Optoelectronic safety systems for the protection of man and machine
Product information
Schmersal offers its customers a comprehensive range of products for optoelectronic safeguarding of hazardous areas. The company has a large program of active optoelectronic protective devices ("AOPD"), ranging from light barriers, light grids and light curtains with different functions (e.g. blanking, muting, cascading) up to laser scanners. A large range of accessories, e.g. deflecting mirrors, mounting brackets etc. helps the user fitting and using the AOPD on his specific application.

This brochure contains a brief introduction of the individual optoelectronic product families as well as the main accessories for the AOPD systems of the Schmersal Group.

The technical data of the individual devices are completed with wiring examples, e.g. in combination with safety-monitoring modules or for integration in the AS-i Safety at Work System. Appropriate components can be wired into a complete safety system.

Descriptions of technical correlations, details on external control units, installation or operating instructions or similar have been provided to the best of our knowledge. However, this does not mean that any warranted characteristics or other properties under liability law may be assumed which extend beyond the “General Terms of Delivery of Products and Services of the Electrical Industry”. We trust that you will understand that the user must check our information and recommendations before using our equipment.

Subject to technical modifications and errors.
The field of automation is subject to a permanent and innovative change of products and applications. The focus is on increasing the productivity and realising a smooth-running production process with a minimum of human interventions on machinery and systems. The ideal, a fully automatic and totally safe machine however will always remain a dream, though the robots used in production plants already are a big step towards this aim.

Human intervention and knowledge will always be required for the commissioning, monitoring and maintenance of modern industrial systems. Man however is not infallible and ignorance or lack of information, thoughtlessness or negligence often leads to damages.

For these reasons, harmonised standards, i.e. the Machinery Directive EC 98/37/EC and other regulations, were implemented at European level. These standards aim at detecting and constructively avoiding all possible risks and hazards during the planning and project phase of machines and systems. Safety components must be used to minimise or eliminate the residual risks.

In this way, manufacturers and users are making equivalent efforts to set up an optimal process flow, which offers the highest possible protection to the operating staff. The challenge for all manufacturers of safety components is to design efficient and safe product solutions for mechanical engineers. Flaps and doors are the simplest means of access to the machine.

Safety fences are not suitable for production processes requiring the material to be transported into the working area by means of conveyor belts, as it does not allow for an ergonomic and optimal work sequence. A “virtual safety guard” in the form of an active optoelectronic device (AOPD), e.g. a safety light curtain, is a perfect solution, offering both an optimal protection of human life and uninterrupted production process.
Typical applications:

- Power-driven machines
- Power-driven presses in metalworking, plastics, leather, stone working and rubber processing industry
- Folding presses and attachments
- Filter presses
- Punching machines in leather, textile and plastics processing
- Robots stations and welding booths
- Printing and injection moulding machines
- Transport engineering
- Pallet loaders and palletizers
- Materials handling and storage technology
- and so on

Depending on the application, the AOPD are used for danger point, danger zone and perimeter guarding. The user can choose from a large range of different optoelectronic safety solutions e.g. light barriers, light grids, light curtains and laser scanners.
Design and operating principle

Optoelectronic

Safety light barriers

The safety light barrier systems of the SLB range are active optoelectronic protective devices (AOPD) fulfilling the Control Category 2 or 4 in accordance with EN 954-1 or EN 61496. These systems are used as entry guards on hazardous zones, danger points and entrances. They protect human life without restricting the production flow.

Typical applications for safety light barriers are on robots, automatic-processing plants, transfer lines, rack storages and pallet loaders.

The entire safety light barrier system includes a light emitter, a light receiver and a safety-monitoring module. The safety-monitoring module evaluates the signals of the emitter.

If the light beam is interrupted, a signal is emitted to bring the dangerous movement of the machine to standstill.

The protection field is defined by the height and width of the protection field. The protected height is the range between the first and last infrared light beam of a light curtain. The protected width or operating range is the distance between the transmitter and receiver unit.

For an accurate detection of objects with different sizes in the hazardous area, the user can choose between light grids and light curtains with different resolutions. Here, the following rule applies: the smaller the distance between two adjacent light beams, the more accurate the detection sensitivity of the AOPD.

For the detection of body parts, a distinction is made between finger, hand and body protection.

EN 999 or EN 294 sets the biometric data for finger protection to 14 mm, for hand detection to 40 mm, for leg detection up to 70 mm and for body detection to over 70 mm.

Safety light grids with 2, 3 or 4 individual beams are generally used to detect the penetration of the entire human body. Safety light curtains are multiple beam systems (> 5 individual beams) and can also detect smaller objects in case of intrusion into the protected field. The maintenance-free safety light curtains and light grids can be smoothly fitted using an M12 connector and have a diagnostic LED indication for status messages.

Depending on the type of safety light curtain or light grid used, the components have an integrated evaluation with start/restart interlock and contactor monitoring. Additional functions such as blanking, muting and cascading of the light curtains are available as well.

These functions are simply configured in the AOPD through the contact configuration (no configuration software required). The SLC and SLG product series therefore offer a maximum of flexibility for safeguarding different danger points.

Safety light grids / light curtains

The safety light curtains and safety light grids of the SLC and SLG meet the requirements of Control Category 2 or 4 to EN 954-1 and Type 2 or Type 4 to EN 61496.

They safeguard danger points and hazardous areas on different applications, e.g. presses, robot stations, injection moulding machines, pallet machines, etc.

In these active optoelectronic protective devices (AOPD), the emitter and receiver are fitted in two separate enclosures. An invisible infrared signal is sent from the emitter and evaluated by the receiver. If the light beam is interrupted by an object or a person, a stop signal is emitted to bring the machine to standstill.

The protection field is defined by the height and width of the protection field. The protected height is the range between the first and last infrared light beam of a light curtain. The protected width or operating range is the distance between the transmitter and receiver unit.

For an accurate detection of objects with different sizes in the hazardous area, the user can choose between light grids and light curtains with different resolutions. Here, the following rule applies: the smaller the distance between two adjacent light beams, the more accurate the detection sensitivity of the AOPD.

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These functions are simply configured in the AOPD through the contact configuration (no configuration software required). The SLC and SLG product series therefore offer a maximum of flexibility for safeguarding different danger points.
Safety laser scanner

The safety laser scanners of the LS series are used for protection of man on machines, where dangerous movements can occur. It is used for the horizontal and vertical protection of hazardous zones in front of or in stations and plants, e.g. tube-bending machines, industrial robots, feed points and automated guided vehicle systems (AGV’s).

The safety laser scanners of the LS 30 series emit harmless, invisible laser beams. These beams are deflected through a rotating mirror, thus enabling the scanner to monitor semicircular areas. If the laser beam detects an object (person or object) in the sensing range, the emitter registers the reflected light and calculates the time between the emission and the reception of the light. The internal evaluation uses the light propagation time and the corresponding angle information to calculate the exact position of the object in the monitored area.

In this monitored area, different warning and protection fields can be defined by means of the software. The protection field must be adapted to the hazardous area of the machine concerned. If a person enters the warning field, the system indicates this intrusion, however without switching-off the machine. If a person enters the protection field, he or she is recognised by the laser scanner and the hazardous movement will be switched off.

The resolution of the LS 30 is adjustable from 30, 40, 50, 70 to 150 mm.

Important conditions for the use of optoelectronic safety devices:

In order to choose the appropriate active optoelectronic protective device (AOPD) such as light barriers, light curtains/grids and laser scanners and to use them correctly, both the requirements of the standards (EN 61496, EN 999, EN 294, C standards etc.) and product-specific features (detection sensitivity, range, etc.) must be taken into account. AOPD’s can be used, provided that:

- the dangerous movement can be stopped at all times and that it is ensured that the danger point can only be reached after the movement has come to standstill,
- the run-out time of the machine and all safety components is known,
- no objects (work pieces, sparks, liquids, etc.) can be ejected,
- the AOPD meet the requirements of Type 2 or Type 4 acc. to EN 61496,
- the danger point can only be reached by passing through the protected field of the AOPD,
- reaching over, under or through the protected field is impossible,
- the start or restart command devices are fitted in such a way that the entire hazardous area is completely visible from the outside and that it cannot be activated from outside the hazardous area,
- and the safety distance is calculated and constructively applied in accordance with EN 999.

The effectiveness of the safety guard corresponds to the risk assessment, which was carried out during the planning and design phase, taking all important boundary conditions, e.g. environment, machine and function.
Safety distances for light curtains

Between the interruption of a light beam and the standstill of the machine, a certain time expires. The safety light grid or light curtain must be sized and installed such that a stop would be signalled and the hazard ceased prior to a person or a body member accessing the hazard.

The standard EN 999 provides the user with detailed information about the calculation of the minimum safety distances. These include the following important influencing factors:

- run-out time of the entire system, taking the different reaction times of the individual systems into account (e.g. machine, safety-monitoring module, AOPD etc.)
- capacity of the AOPD to detect body parts (fingers, hand and entire human body)
- set-up of the safety guard in normal condition (vertical fitting), parallel condition (horizontal fitting) or at an arbitrary angle in front of the safety guard and
- the speed at which the protection field is approached.

For the calculation of the minimum safety distance $S$ to the hazardous area, EN 999 presents the following general formula:

$$ S = K \times T + C $$

Where:

- $S$ the safety distance to the danger point (mm)
- $K$ the approach speed of the body or the body part (mm/s)
- $T$ the entire reaction time of the system(s) (including the machine’s run-out time, the reaction time of the safety guard and the safety-monitoring module etc.)
- $C$ additional distance (mm) in front of the safety guard

Normal approach for light curtains:
(resolution: max. 40 mm)

The minimum safety distance $S$ is calculated in the following way:

$$ S = 2000 \times T + 8 \times (D - 14) $$

($D = \text{resolution}$).

This formula applies to safety distances up to 500 mm. The minimum safety distance $S_{\text{min}}$ may not be less than 100 mm. If the calculation produces a distance larger than 500 mm for $S$, the calculation can be repeated with a lower approach speed:

$$ S = 1600 \times T + 8 \times (D - 14) $$

In this case, $S_{\text{min}}$ may not be less than 500 mm.

If the danger point of the machine is accessible from the top because of its particular construction, the height $H$ of the topmost beam of the light barrier must be at least 1800 mm above the base $G$ of the machine.

Normal approach for light curtains:
(resolution: from 40 mm up to max. 70mm)

The minimum safety distance $S$ is calculated in the following way:

$$ S = 1600 \times T + 850 $$

The height of the topmost light beam must be at least 900 mm, the height of the lowermost light beam maximum 300 mm above the bottom (for the protection of children younger than 14: 200 mm)
Normal approach for light grids:
(resolution: > 70 mm)

The minimum safety distance $S$ is calculated using the following formula:

$$ S = 1600 T + 850 $$

For safety guards with multiple beams, height $H$ (mm) above the reference floor of the individual beams must be applied in the following way:

<table>
<thead>
<tr>
<th>Number of beams</th>
<th>Height above the reference floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>400, 900</td>
</tr>
<tr>
<td>3</td>
<td>300, 700, 1100</td>
</tr>
<tr>
<td>4</td>
<td>300, 600, 900, 1200</td>
</tr>
</tbody>
</table>

When using light curtains or light grids, particular attention must be paid to the tampering possibilities of the safety guard and to the mechanical risks (e.g. crushing, shearing, cutting, ejection).

Horizontal approach for light curtains/grids
(resolution: > 50 mm)

The minimum safety distance $S$ is calculated using the following formula:

$$ S = 1600 T + 1200 - 0.4 H $$

Here, $S_{\text{min}}$ is 850 mm. The lowest authorised height $H$ depends on the resolution $D$ of the light curtain:

$$ H = 15 (D-50) $$

For this type of safety guard, the maximum height $H$ is 1000 mm.

In the risk analysis, special attention must be paid to the prevention of unintentional undetected access from underneath the protection field.

Further calculation examples can be found in DIN EN 999 as well as in the mounting instructions of the SLC/SLG safety sensors.
Modes of operation and functions

Master/Slave cascading
For the SLC/SLG...M/S product series, the master light curtain can be extended with another (slave) light curtain (cascading). In this way, multiple protection fields can be generated. A protection field is created between the emitter and receiver of the master as well as other protection fields between the slave components.

This device cascading provides for a comfortable and efficient protection of contiguous protection fields against reaching over or through the protection field. The slave light curtains are connected to the master by means of an M12 connector.

The master and slave light curtains are available in different sizes and resolutions and allow for almost any combination.

Muting
If goods or objects must be transported in or out of the hazardous area without stopping the machine, the safety light curtain must be automatically and temporarily suspended by the safety-related parts of the control system.

To this end, two or four muting sensors are used to detect whether a person is approaching the hazardous area or a transport system enters or leaves the hazardous area. Suitable muting sensors are light barriers, proximity switches or position switches.

The integrated safety-muting controller of the safety light curtain or light grid monitors and controls the muting process. The safety outputs are not disabled. When the muting function is used, an external muting lamp must be connected to enable the system being activated. Any malfunction of the monitored signal source will cause the OSSD's to be switched off.

Depending on the application, different light curtains with integrated muting function as well as external or internal muting sensors are available. Detailed product information can be found in this brochure from page 33.

Blanking /Floating Blanking
If continuity of the production process is required, a part of the protection field can be blanked without triggering a stop signal.

In this way, objects such as work pieces can be fed or a conveyor belt can be positioned at a fixed position in the protection field.

The integrated floating blanking function of the SLC...B light curtains enables a flexible blanking of up to three adjacent light beams in the protection field of the light curtain.

This function is required to ensure that one, two or three adjacent light beams can be interrupted at an undefined position in the protection field.

In this way, objects such as fixtures or materials with slightly varying heights can be fed through the light curtain without triggering a stop signal. Five different floating blanking functions are available. The distinguishing feature of the different modes is the number of light beams that can be interrupted by an object. In addition to that, it can be defined whether the object may interrupt the protection field permanently or only temporarily. The interrupted light beams can be at any position in the protection field.

Apart from the first infrared light beam (the beam closest to the connector), any light beam can be used for floating blanking.

A complex programming through software and computer or complicated teach-in procedures is not required, as the floating blanking functions are configured in the connector of the AOPD's receiver unit. When floating blanking is applied, the resolution of the light curtain changes. The technical documentation of the different light curtains includes the tables with the effective resolutions D to calculate the minimum safety distance to EN 999.

Further technical product information can be found in this brochure.
More Details

Detailed technical information at:
www.schmersal.com
System features:

- Control Category 2 and 4 acc. to EN 954-1 or acc. to EN 61496, Type 2 and Type 4
- Up to 4 pairs of one-way light barriers can be connected
- Different functions
  - Start/Restart interlock
  - Contactor monitoring
  - Cyclic testing
- Integrated soiling check
- Status and error indication
- Signalling outputs for external indications
- Free of maintenance
- Extremely compact design
- Simple and flexible mounting and adjustment
Safety light barriers

SLB 200

- Control Category 2* to EN 954-1
- Range up to 4 m
- LEDs visible from both sides
- Protection class IP 67

Technical data

- Standards: IEC/EN 61496
- Control Category: 2 *
- Enclosure: ABS
- 10 % GF
- Enclosure dimensions: 31 x 50.5 x 19 mm
- Connection: emitter: 10 cm conductor, M 8 x 1, 3-pole coupler socket
  receiver: 10 cm conductor, M 8 x 1, 4-pole coupler socket
- Max. cable length: 50 m
- Protection class: IP 67 to EN 60529
- Response time: 30 ms *
- Range: 4 m
- Start/Restart interlock: *
- Contactor control: *
- Light emission wavelength: 880 nm
- Safety outputs: *
- Angle of radiation: ±4 °
- Min. size of object: 9 mm Ø
- LED status indication: soiling, switching condition and power on
- Ambient temperature: – 10 °C ... + 55 °C
- Storage and transport temperature: – 20 °C ... + 80 °C

Note

The system components (safety monitoring module, cable, etc.) are not included in the delivery.

System components

SLB 200-C04-1R

- Connector plug M 8 x 1 (with cable)
- Mounting angle BF 31
- Mounting angle BF UNI 1

Ordering details

SLB 200-C04-1R

- Connector plug M 8 x 1
  - emitter:
    - KDE M8-3
    - KDE M8-3-2m
    - KDE M8-3-5m
  - receiver:
    - KDR M8-4
    - KDR M8-4-2m
    - KDR M8-4-5m
- Mounting angles
  - BF 31
- Mounting angles universal
  - BF UNI 1

Note

* (only in combination with SLB 200-C)

Approvals

TUV CE

Ordering details

SLB 200-C04-1R

- Monitoring of safety light barriers
  - refer to page 4-6
- Connector plug M 8 x 1
  - emitter:
    - KDE M8-3
    - KDE M8-3-2m
    - KDE M8-3-5m
  - receiver:
    - KDR M8-4
    - KDR M8-4-2m
    - KDR M8-4-5m
- Mounting angles
  - BF 31
- Mounting angles universal
  - BF UNI 1
Safety light barriers

SLB 400

- Control Category 4* to EN 954-1
- Range up to 15 m
- LED switching conditions display
- Protection class IP 67

Technical data

- Standards: IEC/EN 61496
- Control Category: 4*
- Enclosure: ABS
- Enclosure dimensions: 50 x 50 x 17 mm
- Connection: M 12 x 1, 4-pole coupler socket, can be rotated
- Max. cable length: 100 m
- Protection class: IP 67 to EN 60529
- Response time: 25 ms*
- Range: 15 m
- Start/Restart interlock: *
- Contactor control: *
- Light emission wavelength: 880 nm
- \( U_{n} \): 24 VDC ± 20%
- Safety outputs: *
- Angle of radiation: ± 2°
- Min. size of object: 13 mm Ø
- LED status indication: soiling, switching condition and power on
- Ambient temperature: 0 °C ... + 60 °C
- Storage and transport temperature: – 20 °C ... + 80 °C

* (only in combination with SLB 400-C)

Approvals

Ordering details

<table>
<thead>
<tr>
<th>No.</th>
<th>Replace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E/R</td>
<td>Emitter / Receiver</td>
</tr>
</tbody>
</table>

System components

SLB 400-C10-1R

Connector plug M 12 x 1 (with cable)

Mounting angle BF 50

Mounting angle BF UNI 1

SLB 400-C10-1R

Note

The system components (safety monitoring module, cable, etc.) are not included in the delivery.

Ordering details

Monitoring of safety light barriers refer to page 4-8
Connector plug M 12 x 1
emitter/receiver:
- KD M12-4
- KD M12-4-2m
- KD M12-4-5m
Mounting angles
- BF 50
Mounting angles universal
- BF UNI 1
Safety light barriers

SLB 200-C

- To IEC 61496
- Control Category 2 to EN 954-1, BWS-T
- Up to two pairs of light barrier devices can be connected
- 1 enabling path
- 1 signalling output
- Operating voltage 24 VDC
- Test input
- LED display of switching conditions
- Response time ≤ 30 ms
- Start/Restart interlock can be switched active or inactive
- Contactor monitoring can be switched active or inactive
- Additional cyclic testing
- Co-ordinated for use with SLB 200 R/E safety light barriers

Technical data

| Standards: | IEC/EN 61496-1/-2, EN 954-1 |
| Control category: | 2 |
| Start-up test: | yes |
| Start conditions: | Test button, start-reset button, on/off coding |
| Feedback circuit: | yes |
| Enclosure: | polycarbonate |
| Mounting: | snaps onto standard DIN rail to EN 50022 |
| Connection: | screw terminals |
| Cable section: | max. 4 mm² (incl. conductor ferrules) |
| Protection class: | IP 20 to EN 60529 |
| Ue: | 24 VDC ± 20% |
| Ie: | 180 mA |
| Power consumption: | – |

- Inputs:
  - test input: command device: NC contact
  - release start/restart interlock (start/reset): enable via command device (NO contact), contactor monitoring (NC contacts)

- Outputs:
  - 1 enabling path

- Monitored inputs:
  - max. 2 pairs of light barriers

- Input resistance:
  - –

- Max. cable length:
  - –

- Test and feedback:
  - potential-free contact

- Outputs:
  - 1 enabling path

- Enabling contacts:
  - 1 enabling path

- Utilisation category:
  - AC-15, DC-13

- Ie/Ue:
  - 2 A / 250 VAC, 2 A / 24 VDC

- Contact load capacity:
  - max. 250 VAC, max. 2 A (cos ϕ = 1)

- Switching voltage:
  - max. 250 VAC

- Load current:
  - 8 A

- Max. fuse rating:
  - 4 A gG D-fuse

- Signalling output:
  - 1 transistor output

- Switch-on conditions:
  - test duration: ≤ 150 ms (without relay control)
  - ≤ 450 ms (with relay control)

- Switch-off time:
  - response time (complete sys.): ≤ 30 ms

- Indications:
  - red LED for light barrier interrupted
  - green LED for light barrier free
  - soiling: flashing red/green

- Function display:
  - 4 LEDs

- EMC rating:
  - conforming to EMC Directive

- Max. switching frequency:
  - 10 Hz

- Overvoltage category:
  - II to DIN VDE 0110

- Degree of pollution:
  - 3 to DIN VDE 0110

- Resistance to vibration:
  - 10 ... 55 Hz / amplitude 0.35 mm

- Resistance to shock:
  - 10 g / 16 ms

- Ambient temperature:
  - 0 °C ... + 50 °C

- Storage and transport temperature:
  - – 20 °C ... + 80 °C

- Dimensions:
  - 45 x 84 x 118 mm

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

Approvals

Ordering details

SLB 200-C04-1R

<table>
<thead>
<tr>
<th>No.</th>
<th>Replace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>24 VDC</td>
</tr>
</tbody>
</table>
Safety light barriers

**Note**

- For protection in Control Category 2 to EN 954-1
- Monitoring two pairs of light barrier devices and the power contactor using the SLB 200-C safety monitoring module
- Test push button
  
  The test push button is connected to X13 and X14 in order to carry out a check of the light barrier monitoring function. The terminals X15 and X16 must be bridged.
- The test push button is connected to X13 and X14 in order to carry out a check of the light barrier monitoring function. The terminals X15 and X16 must be bridged.
- The wiring diagram is shown for the de-energised condition.
- Contactor monitoring
  
  To monitor an external contactor, the feedback circuit is connected to X17 and X18. The terminals X19 and X20 must be bridged.
- Start push button
  
  The start push button can be used to start the monitoring of the light barriers for a new start or after an interruption. The terminals X3 and X4 must be bridged.
- It is also possible to connect only one pair of light barrier devices.

**Note**

In order to set for the desired mode of operation and number of light barriers connected, remove the front cover of the safety monitoring module. On delivery, all switches are in position 1.

**Wiring diagram**

The required functions can be selected by means of the internal DIP switches.

<table>
<thead>
<tr>
<th>Position</th>
<th>DIP switch 1</th>
<th>DIP switch 2</th>
<th>DIP switch 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position 1</td>
<td>With contactor check</td>
<td>With start/restart interlock</td>
<td>Connection of two light barriers connection of one light barrier</td>
</tr>
<tr>
<td>Position 2</td>
<td>Without contactor check</td>
<td>Without start/restart interlock</td>
<td></td>
</tr>
</tbody>
</table>
Safety light barriers

SLB 400-C

- To IEC 61496
- Control Category 4 to EN 954-1, BWS-S
- Cross-wire monitoring
- ISD Integral System Diagnostics
- Operating voltage 24 VDC
- Feedback circuit to monitor external contactors
- Two short-circuit proof additional transistor outputs
- Response time ≤ 30 ms
- Start/Restart interlock can be switched active or inactive
- Contactor monitoring can be switched active or inactive
- Can be coded
- Up to 4 light barrier pairs SLB 400 can be connected

Technical data

- Standards: IEC/EN 61496-1/-2, EN 954-1
- Control category: 4
- Start-up test: yes
- Start conditions: Start-reset button, on/off coding
- Feedback circuit: yes
- Enclosure: glass-fibre reinforced thermoplastic
- Mounting: snaps onto standard DIN rail to EN 50022
- Connection: screw terminals
- Cable section: max. 4 mm² (incl. conductor ferrules)
- Protection class: terminals IP 20, enclosure IP 40 to EN 60529
- Uᵦ: 24 VDC ± 15%
- Iᵦ: 0.3 A without additional transistor outputs
- Power consumption: –
- Inputs: S1, S2
- Monitored inputs: max. 4 pairs of light barriers
- Input resistance: approx. 2 kΩ to ground
- Input signal „1“: 10 ... 30 VDC
- Input signal „0“: 0 ... 2 VDC
- Max. cable length: 100 m of 0.75 mm² conductor
- Outputs: 2 enabling paths
- Enabling contacts: 2 enabling paths
- Utilisation category: AC-15, DC-13
- Iᵦ/Uᵦ: 2 A / 250 VAC, 2 A / 24 VDC
- Contact load capacity: max. 250 VAC, max. 2 A (cos φ = 1)
- Switching voltage: max. 250 VAC
- Load current: max. 2 A
- Switching capacity: max. 500 VA
- Max. fuse rating: 2 A gG D-fuse
- Additional outputs: additional transistor outputs Y1, Y2, Uₑ – 4 V, 100 mA total, short-circuit proof, p-type
- Signalling output: 2 transistor outputs, Y₁ + Y₂ = max. 100 mA, p-type, short-circuit proof
- Switch-on time: –
- Response time: ≤ 25 ms
- Monitoring for synchronism of muting sensors: –
- Indications: ISD
- Function display: 9 LEDs (ISD*)
- EMC rating: conforming to EMC Directive
- Max. switching frequency: 10 Hz
- Overvoltage category: II to DIN VDE 0110
- Degree of pollution: 3 to DIN VDE 0110
- Resistance to vibration: 10 ... 55 Hz / amplitude 0.35 mm, ± 15 %
- Resistance to shock: 30 g / 11 ms
- Ambient temperature: 0 °C ... + 55 °C
- Storage and transport temperature: -25 °C ... + 70 °C
- Dimensions: 99.7 x 75 x 110 mm

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

Approvals

Ordering details

SLB 400-C10-1R

<table>
<thead>
<tr>
<th>No.</th>
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</tr>
</thead>
<tbody>
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<td>1</td>
<td></td>
<td>24 VDC</td>
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</table>
Safety light barriers

Note

- For protection in Control Category 4 to EN 954-1
- Monitoring up to four pairs of light barrier devices and the power contactors using the SLB 400-C safety monitoring module
- The wiring diagram is shown for the de-energised condition.
- Connection of two pairs of safety light barrier devices
  When two pairs of safety light barriers are connected, the terminals X9-X10 and X11-X12 must be bridged.
- Restart push button
  The restart function can be selected by means of the DIP switches. When a start push button is connected to X5 and X6, it must be operated for min. 250 ms and max. 5 s after an interruption of the safety light barriers.

Wiring diagram

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown in the appendix.

ISD

The following faults are registered by the safety monitoring modules and indicated by ISD
- Short-circuit on the connecting leads
- Interruption of the connecting leads
- Failure of the safety relay to pull-in or drop-out
- Fault on the input circuits or the relay control circuits of the safety monitoring module
- Mutual influence between the connected pairs of light barrier device and others on neighbouring systems

Note
Safety light barriers accessories SLB 200 and SLB 400

<table>
<thead>
<tr>
<th>System components</th>
<th>System components</th>
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<tbody>
<tr>
<td><img src="image1" alt="Mirror SLB 200/400 SMA 80" /></td>
<td><img src="image2" alt="Mounting post ST 1250" /></td>
</tr>
<tr>
<td><img src="image3" alt="Mounting angle BF SMA 80-1" /></td>
<td><img src="image4" alt="Floor-stand base STB 1" /></td>
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<tr>
<td><img src="image5" alt="Mounting angle BF SMA 80-2" /></td>
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<tr>
<td><img src="image6" alt="T-slot nut NST 20-8" /></td>
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Ordering details

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<tr>
<th>Mirror</th>
<th>Mounting post ST 1250</th>
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<tr>
<td>Mounting angles for mirror</td>
<td>Floor-stand base STB 1</td>
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<td>SMA 80</td>
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<tr>
<td>BF SMA 80-1</td>
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<td>BF SMA 80-2</td>
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<tr>
<td>T-slot nut NST 20-8</td>
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</tbody>
</table>
System features:

- Control Category 2 and 4 acc. to EN 954-1 or acc. to EN 61496, Type 2 and Type 4
- Different integrated functions:
  - Start/Restart interlock
  - Contactor monitoring
  - Muting
  - Blanking
  - Master/Slave configuration
- Diagnostic display
- Optical synchronisation
- Maintenance-free
- Compact design
- Simple, flexible mounting and adjustment

Safety light grids and safety light curtains
# Safety light grids and safety light curtains

## Selection table:

<table>
<thead>
<tr>
<th>Type</th>
<th>Detection sensitivity (mm)</th>
<th>Protected height (mm)</th>
<th>Range (m)</th>
<th>Contactor monitoring</th>
<th>Start/restart interlock</th>
<th>Master/Slave</th>
<th>Muting</th>
<th>Blanking</th>
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<tbody>
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<td>20-30-40</td>
<td>160 – 1810</td>
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</table>

* X only in combination with safety-monitoring module
* integrated
* Not available
Safety light grids and safety light curtains

**SLC 210**

- Control category Type 2 to IEC/EN 61496-1, -2
- Resolution 20, 30, 40, 50 and 90 mm
- Protection field height from 160 mm to 1810 mm
- 2-, 3- or 4-beam Light grid
- Range from 0 ... 16 m
- Self-test every 0.5 s
- semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**Legend:**
A: Total length (B + 91 mm)
B: Protection field height
C: 85 mm (SLC), 135 mm (SLG)

* only in combination with safety-monitoring module

**Approvals**

<table>
<thead>
<tr>
<th>No.</th>
<th>Replace</th>
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<tr>
<td>2</td>
<td>20, 30</td>
<td>Resolution 20, 30 mm</td>
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<tr>
<td>3</td>
<td>40, 50</td>
<td>Resolution 40, 50 mm</td>
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<td>4</td>
<td>90</td>
<td>Resolution 90 mm</td>
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<td>5</td>
<td>H</td>
<td>Range 6 m</td>
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<tr>
<td>6</td>
<td>Range 1...16 m High Range</td>
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</table>

**Ordering details**

**SLG 210**

- Resolution: 20, 30, 40, 50 and 90 mm
- Protection field height from 160 mm to 1810 mm
- 2-, 3- or 4-beam Light grid
- Range from 0 ... 16 m
- Self-test every 0.5 s
- semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

* only in combination with safety-monitoring module

**Approvals**

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<th>Description</th>
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<td>xxxx</td>
<td>Height of protection field Available lengths: 0160 mm** 0310 mm 0460 mm 0610 mm 0760 mm 0919 mm 1060 mm 1210 mm 1360 mm 1510 mm 1660 mm 1810 mm</td>
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<tr>
<td>2</td>
<td>20, 30</td>
<td>Resolution 20, 30 mm</td>
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<tr>
<td>3</td>
<td>40, 50</td>
<td>Resolution 40, 50 mm</td>
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<td>4</td>
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<td>Resolution 90 mm</td>
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<td>5</td>
<td>H</td>
<td>Range 6 m</td>
</tr>
<tr>
<td>6</td>
<td>Range 1...16 m High Range</td>
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</tr>
</tbody>
</table>

**Ordering details**

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control Category to IEC/EN 61496-1, -2 Type 2
- Enclosure: Aluminium
- Enclosure dimensions: 35 x 45 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole
  - Receiver: connector plug M 12, 5-pole
- Max. cable length: 100 m
- Protection class: IP 65 to EN 60529
- Response time: 5,5 – 28 ms (depends on length and resolution)
- Detection sensitivity
- Resolution: 20, 30, 40, 50 and 90 mm
- Protection field height
  - Resolution 20, 30 mm 160 mm ... 1810 mm
  - Resolution 40, 50 mm 310 mm ... 1810 mm
  - 2-, 3-, 4-beam 510 mm, 810 mm, 910 mm
- Protection field width, range
  - Resolution 20 - 90 mm 0 ... 6 m (Standard), 1 ... 16 (High range)
  - 2-, 3-, 4-beam 0 ... 6 m (Standard), 1 ... 16 (High range)
- Start/Restart interlock: *
- Contactor control: *
- Light emission wavelength: 950 nm (infrared), coded
- U_e: 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current:
  - in case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.
- Power consumption:
  - Emitter 2 W, Receiver 3 W
- Data interface:
  - –
- Status and diagnostics display LED indication
- Ambient temperature: 0 °C ... + 55 ºC
- Storage and transport temperature: – 20 °C ... + 70 ºC

**Ordering details**

**Accessories:**
- Connector plug M 12 x 1 for Emitter/ Receiver KD M12-5-5 m
- Connector plug M 12, 5-pole KD M12-5-5 m
- R = angled connector KD M12-5-R
- S = straight connector KD M12-5-S

**Legend:**
A: Total length (B + 91 mm)
B: Protection field height
C: 85 mm (SLC), 135 mm (SLG)
## Safety light grids and safety light curtains

### SLC 210...RF

- Control category Type 2 to IEC/EN 61496-1, -2
- Resolution 20, 30, 40, 50 and 90 mm
- Protection field height from 160 mm to 1810 mm
- 2-, 3- or 4-beam Light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Range from 0 ... 18 m
- Self-test every 0.5 s
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

### SLG 210...RF

- Legend:
  - A: Total length (B + 91 mm)
  - B: Protection field height
  - C: 85 mm (SLC), 135 mm (SLG)

### Technical data

<table>
<thead>
<tr>
<th>Standards:</th>
<th>IEC/EN 61496-1/-2</th>
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</thead>
<tbody>
<tr>
<td>Control category to</td>
<td>IEC/EN 61496-1, -2 Type 2</td>
</tr>
<tr>
<td>Enclosure:</td>
<td>Aluminium</td>
</tr>
<tr>
<td>Dimensions:</td>
<td>35 x 45 mm</td>
</tr>
<tr>
<td>Connection:</td>
<td>Emitter: connector plug M 12, 5-pole,</td>
</tr>
<tr>
<td></td>
<td>Receiver: connector plug M 12, 8-pole,</td>
</tr>
<tr>
<td>Max. cable length:</td>
<td>50 m</td>
</tr>
<tr>
<td>Protection class:</td>
<td>IP 65 to EN 60529</td>
</tr>
<tr>
<td>Response time:</td>
<td>5.5 - 28 ms</td>
</tr>
<tr>
<td>(depends on length and resolution)</td>
<td></td>
</tr>
<tr>
<td>Detection sensitivity (Resolution):</td>
<td>20, 30, 40, 50</td>
</tr>
<tr>
<td></td>
<td>and 90 mm</td>
</tr>
<tr>
<td>Protected height:</td>
<td>Resolution 20, 30 mm 160 ... 1810 mm</td>
</tr>
<tr>
<td></td>
<td>Resolution 40, 50, 90 mm 310 ... 1810 mm</td>
</tr>
<tr>
<td>2-, 3-, 4-beam:</td>
<td>510, 810, 910 mm</td>
</tr>
<tr>
<td>Start/Restart interlock:</td>
<td>integrated</td>
</tr>
<tr>
<td>Contactor control:</td>
<td>integrated</td>
</tr>
<tr>
<td>Cascading:</td>
<td>(Master/Slave)</td>
</tr>
<tr>
<td>Light emission:</td>
<td>wavelength: 950 nm (infrared), coded</td>
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<tr>
<td>U_e:</td>
<td>24 VDC ± 20%</td>
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<td>Safety outputs:</td>
<td>2 x PNP, 500 mA</td>
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<tr>
<td>Leakage current*</td>
<td>&lt; 0.3 mA</td>
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<tr>
<td>Power consumption:</td>
<td>Emitter 2 W, Receiver 3 W</td>
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<tr>
<td>Data interface:</td>
<td>–</td>
</tr>
<tr>
<td>Status and diagnostics:</td>
<td>7-segment and LED display</td>
</tr>
<tr>
<td>Ambient temperature:</td>
<td>0 °C ... + 55 °C</td>
</tr>
<tr>
<td>Storage and transport temperature:</td>
<td>– 20 °C ... + 70 °C</td>
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### Approvals

- TÜV
- CE

### Ordering details

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<th>No.</th>
<th>Replace</th>
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<tbody>
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<td>Protected heights (mm)</td>
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<td>0610 mm</td>
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<td>0760 mm</td>
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** only for resolution 20, 30 mm

### Ordering details

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<td>0900-04</td>
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<td>900 mm, 4-beam</td>
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### Ordering details

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<th>Accessories:</th>
<th>Connector plug M 12 x 1 for emitter</th>
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<td>KD M12-5-5 m</td>
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<td>KD M12-5-15 m</td>
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<td>(pre-wiring possible, however without cable)</td>
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<td>KD M12-8-5 m</td>
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<td>KD M12-8-15 m</td>
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* In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.
Safety light grids and safety light curtains

**Technical data**

- **Standards:** IEC/EN 61496-1/-2
- **Control category to IEC/EN 61496-1, -2** Type 2
- **Enclosure:** Aluminium
- **Enclosure dimensions:** 35 x 45 mm
- **Connection:**
  - **Emitter:** connector plug M 12, 5-pole,
  - **Receiver:** connector plug M 12, 8-pole
- **Max. cable length:**
  - Master/Slave: 50 m
  - Protection class: IP 65
- **Response time:** 5.5 - 28 ms
- **Detection sensitivity (Resolution):** 30, 40 and 50 mm
- **Protected height**
  - Resolution 30 mm: 160 ... 1510 mm
  - Resolution 40, 50 mm: 310 ... 1510 mm
- **2-, 3-beam** 510, 810 mm
- **2-, 3-beam** 0 ... 18 m
- **Start/Restart interlock:** integrated
- **Contactor control:** integrated
- **Cascading:** (Master/Slave) possible
- **Light emission wavelength:** 950 nm (infrared), coded
- **U_e:** 24 VDC ± 20%
- **Safety outputs:** 2 x PNP, 500 mA
- **Safety outputs:** < 0.3 mA
- **Power consumption:**
  - Emitter: 2 W
  - Receiver: 3 W
- **Data interface:** –
- **Status and diagnostics:** 7-segment and LED display
- **Ambient temperature:** 0 °C ... + 55 °C
- **Storage and transport temperature:** – 20 °C ... + 70 °C
- **Leakage current:**<sup>1</sup>
- **Power consumption:**
  - Emitter: 2 W
  - Receiver: 3 W
- **Data interface:** –
- **Status and diagnostics:** 7-segment and LED display
- **Ambient temperature:** 0 °C ... + 55 °C
- **Storage and transport temperature:** – 20 °C ... + 70 °C

* In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.

**Ordering details**

- **SLC 210...RFM/S**
  - **No.** Replace Description
  - 1 xxxx Protected heights (mm)
    - Available lengths:
      - 0160 mm 0310 mm
      - 0460 mm 0610 mm
      - 0760 mm 0910 mm
      - 1060 mm 1210 mm
      - 1360 mm 1510 mm
  - 2 30 Resolution 30 mm
  - 40 Resolution 40 mm
  - 50 Resolution 50 mm
  - M Masterfunction
  - S Slavefunction

- **SLG 210...RFM/S**
  - **No.** Replace Description
  - 1 Distance between outermost beams:
    - 0500-02 500 mm, 2-beam
    - 0800-03 800 mm, 3-beam
  - 2 M Master function
  - S Slave function

**Approvals**

- **TUV**

**Legend:**

- A: Total length
- Slave/ Master (B + 91 mm)
- B: Protection field height
- C: 85 mm (SLC), 135 mm (SLG)

**Ordering details**

- **Slave function**
- **Master function**
- **Connector plug M 12 x 1**
- for emitter: KD M12-5-5 m
  - KD M12-5-15 m
- for receiver: KD M12-8-5 m
  - KD M12-8-15 m
- **Connector plug M 12 x 1**
  - (pre-wiring possible, however without cable)
- for Master/ Slave connection: VL M/S-M12-5-0,3 m
  - VL M/S-M12-5-3 m
  - VL M/S-M12-5-5 m
  - VL M/S-M12-5-10 m

**Accessories:**

- **Connector plug M 12 x 1**
  - for emitter: KD M12-5-5 m
  - KD M12-5-15 m
  - (pre-wiring possible, however without cable)
  - R = angled connector KD M12-5-R
  - S = straight connector KD M12-5-S
  - for receiver: KD M12-8-5 m
  - KD M12-8-15 m
  - for Master/ Slave connection: VL M/S-M12-5-0,3 m
  - VL M/S-M12-5-3 m
  - VL M/S-M12-5-5 m
  - VL M/S-M12-5-10 m

**Approvals**

- **TUV**
Safety light grids and safety light curtains

**SLC 210...RFLC**

- Control category Type 2 to IEC/EN 61496-1, -2
- Resolution 30 and 40 mm
- Protection field heights from 160 mm to 1210 mm
- 2-, 3- or 4-beam Light grid
- Range 0 ... 8 m
- Self-test every 0.5 s
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**Legend:**
A: Total length (B + 91 mm)
B: Protection field height
C: 85 mm (SLC), 135 mm (SLG)

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2 Type 2
- Enclosure: Aluminium
- Enclosure dimensions: 45 x 35 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole
  - Receiver: plug M 12, 8-pole
- Max. cable length: 100 m
- Max. cable length: Master/Slave -
- Protection class: IP 65 to EN 60529
- Response time: 2 - 25 ms (depends on length and resolution)
- Detection sensitivity (Resolution): 30 and 40 mm
- Protected height
  - Resolution 20 and 40 mm 160 ... 1210 mm
  - 2-, 3-, 4-beam 510, 810, 910 mm
- Protected width, operating range
  - Resolution 20 and 40 mm 0 ... 8 m (Standard)
  - 2-, 3-, 4-beam 0 ... 8 m (Standard)
- Start/Restart interlock: integrated
- Contactor control: integrated
- Cascading: (Master/Slave) -
- Light emission wavelength: 950 nm (infrared), coded
- $U_e$: 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current**: < 0.3 mA
- Power consumption:
  - Emitter 2 W,
  - Receiver 3 W
- Data interface: –
- Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C ... + 55 °C
- Storage and transport temperature: – 20 °C ... + 70 °C

**Approvals**

**Ordering details**

**SLC 210-E/R-M-RFLC**

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**SLG 210...RFLC**

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<td>0900-05</td>
<td>900 mm, 4-beam</td>
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Mounting brackets and T-slot plugs are included in delivery

* only for resolution 30 mm

**Ordering details**

**Accessories:**
- Connector plug M 12 x 1 for emitter KD M12-5-5 m
- Connector plug M 12 x 1 for receiver KD M12-8-5 m
- (pre-wiring possible, however without cable)
- R = angled connector KD M12-5-R
- S = straight connector KD M12-5-S

**Ordering details**

**SLG 210-E/R-M-RFLC**

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Mounting brackets and T-slot plugs are included in delivery

* only for resolution 30 mm

**Approvals**

**Ordering details**

**SLG 210-E/R-M-RFLC**

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Mounting brackets and T-slot plugs are included in delivery

* only for resolution 30 mm

**Approvals**

**Ordering details**
Safety light grids and safety light curtains

**SLC 410**

- Control category Type 4 to IEC/EN 61496-1, -2
- Resolution 14, 20, 30, 40, 50 and 90 mm
- Protection field heights from 160 mm to 1810 mm
- 2-, 3- or 4-beam Light grid
- Range 0 ... 5 m or 0 ... 18 m
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**SLG 410**

- Resolution 14, 20, 30 mm 160 ... 1810 mm
- Resolution 40, 50, 90 mm 310 ... 910 mm
- 2-, 3-, 4-beam 510, 810, 910 mm

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2 Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 35 x 45 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole
  - Receiver: connector plug M 12, 5-pole
- Max. cable length: 100 m
- Max. cable length: Master/Slave –
- Protection class: IP 65 to EN 60529
- Response time: 6 - 27 ms (depends on length and resolution)
- Detection sensitivity (Resolution):
  - Resolution 14, 20, 30 mm 14, 20, 30, 40, 50 and 90 mm
  - Resolution 40, 50, 90 mm 160 to 1810 mm
  - 2-, 3-, 4-beam 0 ... 18 m
- Protected height
  - Resolution 14, 20, 30 mm 160 ... 1810 mm
  - Resolution 40, 50, 90 mm 310 ... 910 mm
  - 2-, 3-, 4-beam 0 ... 18 m
- Start/Restart interlock:
  - Contactor control: *
- Cascading: (Master/Slave) –
- Light emission wavelength: 950 nm (infrared), coded
- 
**Ordering details**

**SLC 410-E/R**

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**SLG 410-E/R**

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<td>2</td>
<td>Mounting brackets and T-slot plugs are included in delivery</td>
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**Approvals**

- TÜV
- CE

**Accessories:**

- Connector plug M 12 x 1 for emitter/ receiver KD M12-5-5 m
  (pre-wiring possible, however without cable)
- R = angled connector KD M12-5-R
- S = straight connector KD M12-5-S
  (pre-wiring possible)

**Legend:**

- A: Total length (B + 91 mm)
- B: Protection field height
- C: 85 mm (SLC), 135 mm (SLG)

**Legend:**

- A: Total length (B + 91 mm)
- B: Protection field height
- C: 85 mm (SLC), 135 mm (SLG)

* only in combination with safety-monitoring module

**Approvals**

- TÜV
- CE

**Accessories:**

- Connector plug M 12 x 1 for emitter/ receiver KD M12-5-5 m
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- R = angled connector KD M12-5-R
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**Approvals**

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- CE

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**Legend:**

- A: Total length (B + 91 mm)
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**Approvals**

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- CE

**Accessories:**

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**Legend:**

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**Approvals**

- TÜV
- CE

**Accessories:**

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- C: 85 mm (SLC), 135 mm (SLG)

* only in combination with safety-monitoring module

**Approvals**

- TÜV
- CE

**Accessories:**

- Connector plug M 12 x 1 for emitter/ receiver KD M12-5-5 m
  (pre-wiring possible, however without cable)
- R = angled connector KD M12-5-R
- S = straight connector KD M12-5-S
  (pre-wiring possible)
Safety light grids and safety light curtains

**SLC 410...RF**

- Control category Type 4 to IEC/EN 61496-1, -2
- Resolution 14, 20, 30, 40, 50 und 90 mm
- Protection field height from 160 mm to 1810 mm
- 2-, 3-, or 4-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Range 0 ... 5 m or 0 ... 18 m
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**SLG 410...RF**

- Control category Type 4 to IEC/EN 61496-1, -2
- Resolution 14, 20, 30, 40, 50 und 90 mm
- Protection field height from 160 mm to 1810 mm
- 2-, 3-, or 4-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Range 0 ... 5 m or 0 ... 18 m
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2 Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 45 x 35 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole
  - Receiver: connector plug M 12, 8-pole
- Max. cable length: 100 m
- Max. cable length: Master/Slave –
- Protection class: IP 65 to EN 60529
- Response time: 6 - 27 ms (depends on length and resolution)
- Detection sensitivity (Resolution): 14, 20, 30, 40, 50 and 90 mm
- Protected height:
  - Resolution 14, 20, 30 mm: 160 ... 1810 mm
  - Resolution 40, 50, 90 mm: 310 ... 1810 mm
  - 2-, 3-, 4-beam: 510, 810, 910 mm
- Protected width, operating range:
  - Resolution 14 mm: 0 ... 5 m
  - Resolution 20 bis 90 mm: 0 ... 18 m
  - 2-, 3-, 4-beam: 0 ... 18 m
- Start/Restart interlock: Integrated
- Contactor control: Integrated
- Cascading: (Master/Slave) –
- Light emission wavelength: 950 nm (infrared), coded
- U_e: 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current*: < 0.3 mA
- Power consumption: Emitter 2 W, Receiver 3 W
- Data interface: –
- Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C ... + 55 ºC
- Storage and transport temperature: –20 °C ... + 70 ºC

**Ordering details**

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Legend:
- A: Total length (B + 91 mm)
- B: Protection field height
- C: 85 mm (SLC) 135 mm (SLG)

**Ordering details**

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<td></td>
<td>Mounting brackets and T-slot plugs are included in delivery</td>
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</table>

**Approvals**

- TÜV
- CE

* In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.
Safety light grids and safety light curtains

### Technical data

| Standards: | IEC/EN 61496-1/-2 |
| Control category to IEC/EN 61496-1, -2 | Type 4 |
| Enclosure: | Aluminium |
| Enclosure dimensions: | 35 x 45 mm |
| Connection: |  |
| Emitter: | plug M 12, 5-pole, connector |
| Receiver: | plug M 12, 8-pole |
| Max. cable length: | Master/Slave 50 m |
| Max. cable length: | Master/Slave 50 m |
| Protection class: | IP 65 to EN 60529 |
| Response time: | 3 - 27 ms (depends on length and resolution) |
| Detection sensitivity (Resolution): | |
| Resolution 14, 20, 30 mm | 160 ... 1510 mm |
| Resolution 50 mm | 310 ... 1510 mm |
| 2-, 3-beam | 510, 810 mm |
| Protected width, operating range | |
| Resolution 14 mm | 0 ... 5 m |
| Resolution 20, 30, 50 mm | 0 ... 18 m |
| 2-, 3-beam | 0 ... 18 m |
| Start/Restart interlock: | integrated |
| Contactor control: | integrated |
| Cascading: (Master/Slave) | possible |
| Light emission wavelength: | 950 nm (infrared), coded |
| U_a: | 24 VDC ± 20% |
| Safety outputs: | 2 x PNP, 500 mA |
| Leakage current* | < 0.3 mA |
| Power consumption: | Emitter 2 W, Receiver 3 W |
| Data interface: | – |
| Status and diagnostics: | 7-segment and LED display |
| Ambient temperature: | 0 °C ... + 55 ºC |
| Storage and transport temperature: | – 20 °C ... + 70 ºC |

**In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.**

### Order details

#### SLC 410...RFM/S

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- **Minimum protection field height 310 mm**
- **For resolution 50 mm, minimum protection field height 310 mm**

#### SLG 410...RFM/S

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- **Minimum protection field height 310 mm**
- **For resolution 50 mm, minimum protection field height 310 mm**

### Approvals

![TUV]![CE]

### Note

**Accessories:**
- Connector plug M 12 x 1 for emitter KD M12-5-5 m
- (pre-wiring possible, however without cable)
  - R = angled connector KD M12-5-R
  - S = straight connector KD M12-5-S

- for receiver KD M12-8-5 m
- KD M12-8-15 m

For Master/Slave connection:
- VL M/S-M12-5-0,3 m
- VL M/S-M12-5-3 m
- VL M/S-M12-5-5 m
- VL M/S-M12-5-10 m

---

**Legend:**

- **A:** Total length
- **B:** Slave/ Master (B + 91 mm)
- **C:** Protection field height
- **D:** 85 mm (SLC), 135 mm (SLG)
Safety light grids and safety light curtains

**SLC 410...B**
- Control category Type 4 to IEC/EN 61496-1, -2
- Resolution 14, 20 und 90 mm
- Protection field height from 160 mm to 1810 mm
- Integrated blanking function
- Cascading of Master and slave devices
- Range 0 ... 5 m or 0 ... 18 m
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

*only in combination with safety-monitoring module*  

**SLC 410...BM**

**Technical data**
- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2: Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 35 x 45 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole
  - Receiver: connector plug M 12, 8-pole
- Max. cable length: Master/Slave 50m
- Protection class: IP 65 gem. EN 60529
- Response time: 6 - 27 ms (depends on length and resolution)
- Detection sensitivity (Resolution):
  - Resolution 14 mm: 14, 20 and 90 mm
  - Resolution 90 mm: 140 ... 1810 mm
- Protected width, operating range
  - Resolution 14 mm: 0 ... 5 m
  - Resolution 90 mm: 0 ... 18 m
- Start/Restart interlock: *
- Contactor control: *
- Cascading: (Master/Slave) only for SLC 410...BM
- Blanking function: 5 modes
- Light emission wavelength: 950 nm (infrared), coded
- \( U_{cc} \): 24 VDC ± 20%
- Safety outputs:
  - Emitter: 2 x PNP, 500 mA
  - Receiver: 500 mA
- Leakage current**< 0.3 mA
- Power consumption: Emitter 2 W, Receiver 3 W
- Data interface: –
- Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C ... + 55 °C
- Storage and transport temperature: – 20 °C ... + 70 °C

**Approvals**
- TÜV 
- CE

**Ordering details**

**SLC 410...E/R**

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<tr>
<td>3</td>
<td>M</td>
<td>Master function (for resolution 14 and 20 mm)</td>
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**Note**
- The SLC 410 BM Master can be combined with all slaves of the SLC 410...RFS series.
- Mounting brackets and T-slot plugs are included in delivery
- *** minimum protection field height 610 mm

**Accessories:**
- Connector plug M 12 x 1 for emitter
  - KD M12-5-5 m
  - KD M12-5-15 m
- (pre-wiring possible, however without cable)
- R = angled connector
  - KD M12-5-R
  - KD M12-5-5
- S = straight connector
  - KD M12-8-5 m
  - KD M12-8-15 m
- For Master/Slave connection
  - VL M/S-M12-5-0,3 m
  - VL M/S-M12-5-3 m
  - VL M/S-M12-5-5 m
  - VL M/S-M12-5-10 m

*In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.*
Safety light grids for high operating range

**SLC 412**

- Control category Type 4 to IEC/EN 61496-1, -2
- Resolution 40 mm
- Protection field height from 510 mm to 1210 mm
- 2-, 3-, or 4-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Range 0 ... 16 m or 0 ... 60 m
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

Legend:
- A: Total length (B + 91 mm)
- B: distance of the outermost beams
- C: 85 mm (SLC), 135 mm (SLG)

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2 Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 50 x 60 mm
- Connection:
  - Emitter: plug M 12, 5-pole
  - Receiver: plug M 23, 19-pole
- Max. cable length: 100 m
- Protection class: IP 65, EN 60529
- Response time: 7 – 28.5 ms (depends on length and resolution)
- Detection sensitivity (Resolution): 40 mm
- Protected height
  - Resolution 40 mm 510, 810, 910
  - Resolution 40 mm (H) 610, 910, 1210
  - 2-, 3-, 4-beam (H) 510, 810, 910
- Protected width, operating range
  - Resolution 40 mm 0 ... 16 m (Standard), 0 ... 60 m (High Range)
  - 2-, 3-, 4-beam (H) 0 ... 60 m (High Range)
- Start/Restart interlock: integrated
- Contactor control: integrated
- Light emission wavelength: 950 nm (infrared), coded
- $U_{e}$: 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current**: < 0.3 mA
- Safety outputs: Emitter 2 W, Receiver 3 W
- Data interface:
  - Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C … + 55 ºC
- Storage and transport temperature: –20 °C … + 70 ºC

**Approvals**

**Ordering details**

**SLC 412-E/R]-40-12-H**

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<td>1210 mm</td>
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**SLG 412-E/R]-12-2**

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<td>500 mm, 2-beam</td>
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<td>0900-04</td>
<td>800 mm, 3-beam</td>
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<td>2</td>
<td>H</td>
<td>Range 0 ... 16 m</td>
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<tr>
<td></td>
<td></td>
<td>Range 0 ... 60 m (High Range)</td>
</tr>
</tbody>
</table>

Mounting brackets and T-slot plugs are included in delivery.

**Approvals**

**Accessories:**
- Connector plug M 12 x 1 for emitter
  - KD M12-5-5 m
  - KD M12-5-15 m
- (pre-wiring possible, however without cable)
  - R = angled connector
  - S = straight connector
- for receiver
  - KD M12-8-5 m
  - KD M12-8-15 m

**Note**

- In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.
Safety light grids (retro-reflector)

**SLG 412-P**

- Emitter and receiver in one enclosure
- Control category Type 4 to IEC/EN 61496-1, -2
- Protection field height 510 mm
- 2-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2
- Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 50 x 60 mm
- Connection:
  - Emitter/
  - Receiver: connector
  - plug M 12, 8-pole
- Max. cable length: 100 m
- Protection class: IP 65 to EN 60529
- Response time: 7 ms
- Detection sensitivity (Resolution): –
- Protected height: 2-beam
- 510
- Protected width, operating range:
  - 2-beam: 0 ... 6 m
- Start/Restart interlock: integrated
- Contactor control: integrated
- Light emission wavelength: 950 nm (infrared), coded
- \( U_e \): 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current**: < 0.3 mA
- Power consumption:
  - Emitter 2 W
  - Receiver 3 W
- Data interface: –
- Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C ... + 55 °C
- Storage and transport temperature: – 20 °C ... + 70 °C

**Legend:**

A: Total length
B: Distance of the outermost beams
C: 120 mm

**Approvals**

![TUV](image)

**Ordering details**

SLC 412-P-E/R0500-02-12

**Accessories:**

- Connector plug M 12 x 1 for emitter/receiver
  - KD M12-8-6 m
  - KD M12-8-15 m

**In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.**
Safety light curtain/ light grid with integrated muting function

System features:

- Control Category 4 acc. to EN 954-1 or acc. to IEC 61496, Type 4
- Integrated muting function
- External and internal muting sensors
- Integrated override function
- Diagnostics display
- Optical synchronisation
- Compact design
- Simple, flexible mounting and adjustment
The SLC/SLG 415I is a system for universal use with integrated muting function. The M12 connectors allow a direct connection and flexible positioning of the different muting sensors (e.g. inductive, capacitive or optical sensors). In this way, a safe triggering of the muting function can be obtained for objects of different sizes. The additional integrated override function allows for a controlled restart of the machine to transport the accumulated material out of the protection field after a failure. The safety light curtains/grids with muting function enable a smooth and trouble-free material feeding (input and output), whilst offering a permanent protection of human life.

- Integrated muting function for material transport in 1 or 2 directions
- Connection of 2 or 4 external muting sensors
- Connection of different muting sensors
- Direct connection (M12) of the muting sensors to the SLC/SLG
- Muting controller for crosswise or parallel arrangement of the external sensors
- Adjustable muting time of 30s, 90 min or unlimited
- Integrated override function
- Range up to 16m or 60m
- Optional muting box with integrated muting lamp, restart and override function

The SLG 415L is a safety light grid with integrated muting function. The muting sensors are integrated in the horizontal arms and mechanically and electrically connected to the light grid. This simplifies fitting and positioning of the prepared muting sensors and provides a fault free installation. The additional integrated override function allows for a controlled restart of the machine to transport accumulated material out of the protection field after a failure. The SLG 415L allows for a smooth and trouble-free material output (e.g. on pallet loaders) whilst offering a permanent protection of human life.

- Integrated muting function for transporting material out of the hazardous area
- 2 integrated optical muting sensor blocks
- Muting controller for crosswise and parallel arrangement of the integrated sensors
- Adjustable muting time of 30s or 90min
- Integrated override function
- Range: with crosswise arranged sensors: between 1 – 2.5 m; with parallel arranged sensors: between 0 – 2 m
- Integrated sensors with adjustable height and angle position
- Optional muting box with integrated muting lamp, restart and override function
- Parallel muting sensors with green light for the detection of transparent objects (glass, bottles, film, etc.)
The SLG 415T is a safety light grid with integrated muting function. The muting functions are integrated in two horizontal arms and mechanically and electrically connected to the light grid (right and left). This simplifies fitting and positioning of the muting sensor block and provides for a fault free installation.

The additional integrated override function allows for a controlled restart of the machine to transport accumulated material out of the protection field after a failure. The SLG 415T safety light grid enables a smooth and trouble-free material feeding (input and output), whilst offering a permanent protection of human life.

- Integrated muting function for material transport in 2 directions
- Integrated optical muting sensor blocks
- Muting controller for crosswise and parallel arrangement
- Adjustable muting time of 30s, 90min or unlimited
- Integrated override function
- Range: crosswise arranged sensors: between 1 – 2.5 m; parallel arranged sensors: between 0 – 2 m
- Integrated sensors with adjustable height and angle position
- Optional muting box with integrated muting lamp, restart and override function
- Parallel muting sensors with green light for the detection of transparent objects (glass, bottles, film etc.)
Safety light curtain/ light grid with integrated muting function

**Technical data**

- **Standards:** IEC/EN 61496-1/-2
- **Control category to IEC/EN 61496-1, -2:** Type 4
- **Enclosure:** Aluminium
- **Enclosure dimensions:** 50 x 60 mm
- **Connection:**
  - Emitter: connector plug M 12, 5-pole
  - Receiver: connector plug M 23, 19-pole
  - Muting sensors: 2 x connector plug M 12, 5-pole
- **Max. cable length:** 100 m
- **Protection class:** IP 65 to EN 60529
- **Response time:** 7 – 28.5 ms (depends on length and resolution)

**Detection sensitivity (Resolution):**
- Resolution 30 mm: 310 ... 1210 mm
- Resolution 40, 90 mm: 310 ... 1810 mm
- 2-, 3-, 4-beam: 510, 810, 910 mm
- Resolution 40 (H): 610, 910, 1210 mm

**Protected width, operating range:**
- Resolution 30, 40 mm: 0 ... 16 m (Standard)
- 2-, 3-, 4-beam: 0 ... 16 m (Standard), 0 ... 60 m (High Range)
- Resolution 40 (H): 0 ... 60 m (High Range)

**Start/Restart interlock:** integrated

**Contactor control:** integrated

**Muting and override function:** integrated

**Muting sensors:** 2 or 4 external sensors

- **Light emission wavelength:** 950 nm (infrared), coded
- **U_e:** 24 VDC ± 20%
- **Safety outputs:** 2 x PNP, 500 mA
- **Leakage current:** < 0.3 mA
- **Power consumption:**
  - Emitter: 2 W
  - Receiver: 3 W
- **Data interface:**
  - Status and diagnostics: 7-segment and LED display
- **Ambient temperature:** 0 °C … + 55 °C
- **Storage and transport temperature:** – 20 °C … + 70 °C

**Approvals**

- TÜV
- CE

**Ordering details**

**SLG 415I**

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<td>H**</td>
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<td>Range 0 ...60 m</td>
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<td>High Range</td>
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**SLC 415I**

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<td></td>
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<td>High Range</td>
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**Legend:**

A: Height of the receiver
B: Protection field height
C: 72 mm (SLC), 120 mm (SLG)

**Ordering details**

**SLC 415I-E/R**

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<td>1810 mm</td>
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**SLG 415I-E/R**

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<td>Distance between outermost beams:</td>
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<td>Range 0 ...16 m</td>
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<td></td>
<td>Range 0 ...60 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High Range</td>
</tr>
</tbody>
</table>

**Accessories:**

- Connector plug M 12 x 1 for emitter KD M12-5-3 m
- Connector plug M 12 x 1 for muting sensors KD M12-5-15 m
- Connector plug M 23 x 1 for receiver KD M23-19-3 m
- Connector plug M 23 x 1 for emitting sensor KD M23-19-5 m

**Info:**

- In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.
- Only for resolution 40 mm
- Resolution 40 mm: 310 ... 1810 mm
- 2-, 3-, 4-beam: 510, 810, 910 mm
- Resolution 40 (H): 610, 910, 1210 mm

**Approvals**

- TÜV
- CE
Safety light curtain/ light grid with integrated muting function

**SLG 415L**

- Control category Type 4 to IEC/EN 61496-1, -2
- 2- or 3-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Integrated muting- and override function
- Integrated muting sensors
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**SLG 415L...PB**

- Control category Type 4 to IEC/EN 61496-1, -2
- 2- or 3-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Integrated muting- and override function
- Integrated muting sensors
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

**Technical data**

- Standards: IEC/EN 61496-1/-2
- Control category to IEC/EN 61496-1, -2 Type 4
- Enclosure: Aluminium
- Enclosure dimensions: 50 x 60 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole,
  - Receiver: connector plug M 23, 19-pole,
  - Muting sensors (integrated): 2 x connector plug M 12, 5-pole
- Max. cable length: 100 m
- Protection class: IP 65 to EN 60529
- Response time: 7 – 28.5 ms
  (depends on length and resolution)
- Detection sensitivity (Resolution): –
- Protected height 2,- 3-beam 510, 810
- Mutting-Sensoren, range 2 parallel 0 ... 2,0 m
  (PB = parralel beams)
- 2 crosswise 1 ... 2,5 m
- Start/Restart interlock: integrated
- Contactor control: integrated
- Muting- and override function: integrated
- Light emission wavelength: 950 nm (infrared),
  coded
- $U_e$: 24 VDC ± 20%
- Safety outputs: 2 x PNP, 500 mA
- Leakage current** < 0.3 mA
- Safety outputs: 2 x PNP, 500 mA
- Power consumption:
  - Emitter 2 W,
  - Receiver 3 W
- Data interface: –
- Status and diagnostics: 7-segment and LED display
- Ambient temperature: 0 °C … + 55 ºC
- Storage and transport temperature: – 20 °C … + 70 ºC

**Approvals**

**Ordering details**

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<th>Order</th>
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<td>1</td>
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<td>PB</td>
<td>Muting-Sensors parallel crosswise</td>
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</table>

**Note**

Mounting brackets and T-slot plugs are included in delivery

**Accessories**

- Connector plug M 12 x 1 for emitter: KD M12-5-3 m
- Connector plug M 23 x 1 for receiver: KD M23-19-3 m

**Approvals**

**Ordering details**

<table>
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<th>No.</th>
<th>Order</th>
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<td>KD M12-5-3 m</td>
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<tr>
<td>2</td>
<td>KD M23-19-3 m</td>
<td>straight connector</td>
</tr>
</tbody>
</table>

**Legend**

A: Height of the receiver
C: 72 mm

**Note**

*In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.*
Safety-Light grid

SLG 415T

- Control category Type 4 to IEC/EN 61496-1, -2
- 2-, 3-beam light grid
- Integrated Start/Restart interlock
- Integrated Contactor control
- Integrated muting- und override function
- Integrated muting sensors
- Semiconductor outputs
- Optical synchronisation
- Status display
- Protection class IP 65

Legend:
A: Height of the receiver
C: 72 mm

SLG 415T...PB

Technical data
- Control category to IEC/EN 61496-1, -2
- Enclosure: Aluminium
- Enclosure dimensions: 50 x 60 mm
- Connection:
  - Emitter: connector plug M 12, 5-pole;
  - Receiver: connector plug M 23, 19-pole;
- Muting sensors (integrated):
  - 2 x connector plug M 12, 5-pole
  - Max. cable length: 100 m
- Protection class: IP 65 to EN 60529
- Response time: 7 – 28.5 ms
- (depends on length and resolution)
- Detection sensitivity (Resolution):
  - 510, 810
- Start/Restart interlock:
  - integrated
- Contactor control:
  - integrated
- Muting- and override-function:
  - integrated
- Light emission wavelength: 950 nm (infrared), coded
- $U_e$: 24 VDC ± 20%
- Safety outputs:
  - 2 x PNP, 500 mA
- Leakage current**:
  - < 0.3 mA
- Power consumption:
  - Emitter 2 W, Receiver 3 W
- Data interface:
  - Status and diagnostics: 7-segment and LED display
  - Ambient temperature: 0 °C … + 55 ºC
  - Storage and transport temperature: −20 °C … + 70 ºC
- ** In case of failure (interruption of the 0 V supply) the maximum leakage current is 0.3 mA.

Ordering details

SLG 415T-E/R...-12-

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<tr>
<td>1</td>
<td>Distance between outermost beams:</td>
<td></td>
</tr>
<tr>
<td>0500-02</td>
<td>500 mm, 2-beam</td>
<td></td>
</tr>
<tr>
<td>0800-03</td>
<td>800 mm, 3-beam</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Muting-sensors parallel crosswise</td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mounting brackets and T-slot plugs are included in delivery

Accessories:
- Connector plug M 12 x 1 for emitter
  - KD M12-5-3 m
  - KD M12-5-5 m
  - KD M12-5-15 m
- (pre-wiring possible, however without cable)
- R = angled connector KD M12-5-R
- S = straight connector KD M12-5-S
- Connector plug M 23 x 1 for receiver
  - KD M23-19-3 m
  - KD M23-19-5 m
  - KD M23-19-10 m
  - KD M23-19-15 m
  - KD M23-19-20 m
Accessories for safety light grids/light curtains with integrated muting function

**SLG-MCB**

- Control unit for the SLG415/412 series
- Integrated restart pushbutton
- Integrated muting lamp
- Integrated override key selector switch
- Two safety relay outputs and one signalling contact
- DIP switch to configure the light grid/light curtain
- Plug-in terminal blocks for cable connection
- Possibility to connect an external muting lamp
- Possibility to connect an internal or external feedback loop
- Cable entry for machine connection

**Technical data**

- Enclosure: glass-fibre reinforced thermoplastic
- Fixation: 4 mounting holes
- Connection: M23 or M12 connector, metric thread coupling
- Protection class: Gehäuse IP 66 gem. EN 60529
- \( U_e \): 19 – 30 VDC depending on the connected SLG type
- \( I_e \): > 12 VDC
- Input signal "1": > 12 VDC
- Input signal "0": > 5 VDC
- Max. cable length: 100 m
- Outputs: 2 enabling paths
- Utilisation category: AC-15, DC-13
- Switching voltage: max. 250 VAC
- Load current: max. 2 A (\( \cos = 1 \))
- Switching capacity: max. 500 VA
- Short-circuit protection: 6 A (slow blow)
- Signalling output: 1 relay output (NO contact) for SLG-MCB3/4
- EMC rating: EMC Directive to EN 61496-1
- Overvoltage category: II to DIN VDE 0110
- Ambient temperature: \(-10 \, ^\circ\text{C} \ldots +55 \, ^\circ\text{C}\)
- Storage and transport temperature: \(-10 \, ^\circ\text{C} \ldots +55 \, ^\circ\text{C}\)
- Dimensions: 110 x 180 x 110 mm
- Note: Inductive loads (contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

**Ordering details**

<table>
<thead>
<tr>
<th>No.</th>
<th>Replace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Restart pushbutton, key selector switch for override function, muting lamp, 2 safety relays per enabling contact</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Restart pushbutton, 2 safety relays per enabling contact</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Restart pushbutton, key selector switch for override function, muting lamp, 2 safety relays per enabling contact, 1 signalling contact</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Restart pushbutton, 2 safety relays per enabling contact, 1 signalling contact</td>
</tr>
</tbody>
</table>

**Accessories SLG-MCB**

- for emitter - Mutingbox
  - VL MB-M12-19-3 m
  - VL MB-M12-19-5 m
- for receiver - Mutingbox
  - VL MB-M23-19-3 m
  - VL MB-M23-19-5 m
  - VL MB-M23-19-10 m
Safety light grids and curtains – Accessories

**System components**

- Deflecting mirror SMB
- Mounting angle for deflecting mirror BF SMB
- Deflecting mirror ST LGM
- Floor-stand STB LG

**Ordering details**

- Deflecting mirror:
  - Mirror height 250 mm: SMB 250
  - Up to 1900 mm: SMB 1900
  - Other heights available on request
- Mounting angle for deflecting mirror: BF SMB
- Floor-stand (empty enclosure): ST LG
- Floor-stand with integrated deflecting mirror:
  - ST LGM-02: A = 1000 mm
  - ST LGM-03: A = 1200 mm
  - ST LGM-04: A = 1330 mm
  - ST LGM-2000: A = 1970 mm
- Floor-stand base for ST LG/LGM

**Selection table**

<table>
<thead>
<tr>
<th>SLC</th>
<th>SLG</th>
<th>SMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0160</td>
<td></td>
<td>250</td>
</tr>
<tr>
<td>0310</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>0460</td>
<td>2</td>
<td>540</td>
</tr>
<tr>
<td>0610</td>
<td>3</td>
<td>1060</td>
</tr>
<tr>
<td>1060</td>
<td>4</td>
<td>1230</td>
</tr>
<tr>
<td>1210</td>
<td></td>
<td>1400</td>
</tr>
<tr>
<td>1360</td>
<td></td>
<td>1450</td>
</tr>
<tr>
<td>1510</td>
<td></td>
<td>1600</td>
</tr>
<tr>
<td>1660</td>
<td></td>
<td>1750</td>
</tr>
<tr>
<td>1810</td>
<td></td>
<td>1900</td>
</tr>
</tbody>
</table>

**Ordering details**

- Mounting angle (rotating): BFLC-01-D

---

SCHMERSAL
## Safety light grids and –curtains– Accessories

### System components

<table>
<thead>
<tr>
<th>Vibration absorber VA 15-6</th>
<th>Alignment kit LAT SLC-2</th>
<th>Test rods</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Vibration absorber VA 15-6" /></td>
<td><img src="image2" alt="Alignment kit LAT SLC-2" /></td>
<td><img src="image3" alt="Test rods" /></td>
</tr>
</tbody>
</table>

### Ordering details

<table>
<thead>
<tr>
<th>Vibration absorber</th>
<th>Alignment kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA 15-6</td>
<td>LAT SLC-2</td>
</tr>
<tr>
<td>VA 210/410-2</td>
<td>LAT SLC-4</td>
</tr>
<tr>
<td>VA 210/410-3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test rods</th>
</tr>
</thead>
<tbody>
<tr>
<td>With resolution 14 mm</td>
</tr>
<tr>
<td>With resolution 20 mm</td>
</tr>
<tr>
<td>With resolution 30 mm</td>
</tr>
<tr>
<td>With resolution 40 mm</td>
</tr>
<tr>
<td>With resolution 50 mm</td>
</tr>
</tbody>
</table>
Always there for you, the Online Catalogue at: www.schmersal.com
The safety laser scanners of the LS 30 series monitor a surface over an angle of 190° invisibly and without physical contact and are mainly used as hazardous area guards. The zone to be monitored can be individually adjusted to the specific application through the software. The laser scanners of the LS 30 series are basically used if safeguarding the hazardous area by means of conventional means is not possible or requires serious investments, e.g. on tube-bending machines, industrial robots or automatic guided vehicle systems. The safety laser scanners meet the requirements of Control Category 3 acc. to EN 954-1.
Safety laser scanner

**Technical data**

- **Standards:** EN 61496-1/-3
- **Range:**
  - Protection zone: 4 m radius
  - Warning zone: 49 m radius
  - Monitoring area: 49 m
- **Scanning angle:** 190°
- **Angle resolution:**
  - max. 0.25°
  - min. 0.50°
- **Response time:** 60 ms
- **Light source:** laser diode
- **Light emission wavelength:** 905 nm
- **Laser protection class:** 1
- **Configuration:**
  - configuration software SCS
- **Configuration memory:**
  - 24 VDC
- **Outputs:**
  - 2 safe solid state outputs, short-circuit proof
  - 3 not safe signalling outputs
- **Dimensions:** 185 x 155 x 160 mm
- **Weight:** 3.3 kg
- **Connection:** 30 pin system connector
- **Ambient temperature:** – 10 °C … + 50 ºC
- **Protection class:** IP 65 to EN 60529
- **Number of warning zones:** 4
- **Number of protection zones:** 4
- **Serial interface:** RS 232

**System components**

- **Mounting angle**
- **System connector**
- **Connecting cable**
- **Mounting bracket for direct mounting**
  - at the rear on wall or machine.
  - No adjustment facility
  - BF10
- **Bracket only in conjunction with BF10.**
  - Mounting at the rear on wall or machine.
  - BF10
- **Longitudinal and cross-wise adjustment**
  - BF20
  - Bracket only in conjunction with BF10 and BF20. Mounting at the rear or below on wall, floor or machine.
- **BF30**
  - System connector without cable
  - 5 m cable, 13 cores, pre-assembled
  - S0VA-A0000BS01
  - SV00-B1305BS01
- **Verbindungsleitung**
  - Connection cable between the PC and the configuration interface
  - SRS02

**Approvals**

- TÜV
- CE

**Ordering details**

- **LS 30-4015 CAS01**
  - 4 warning and 4 protection zones

The system connector is not included in delivery of the safety laser scanner.
Besides the traditional safety relay controls, Schmersal offers CE-type tested safety controls or other safety-oriented bus systems (e.g. AS-i Safety at Work) for different levels of complexity and combination depths, which provide the user with many visualization and diagnostic possibilities.
Safety-monitoring modules for optoelectronic safety systems

**SCR 1R**

- Suitable for signal processing of outputs connected to potentials (AOPDs), e.g. safety light grids/curtains
- 1 or 2 channel control
- 2 enabling paths, Stop 0
- Reset with edge detection or automatic start
- 2 LEDs to show operating conditions
- Control Category 4 to EN 954-1

## Technical data

| Standards: | IEC/EN 60204-1, EN 954-1, BG-GS-ET-20 |
| Stop category: | 2x Stop 0 |
| Control category: | 4 |
| Start conditions: | Reset button with edge detection, auto start |
| Enclosure: | glass-fibre reinforced thermoplastic |
| Connection: | screw terminals |
| Cable section: | max. 2.5 mm² solid or multi-strand lead (incl. conductor ferrules) |
| \( U_{e} \): | 24 VDC – 15 % / + 20 %, residual ripple max. 10 % |
| \( I_{e} \): | max. 0.10 A |
| Protection class: | terminals IP 20 enclosure IP 40 to EN 60529 |
| Power consumption: | max. 2.6 VA |
| Max. fuse rating: | Internal electronic trip F1, tripping current > 0.6 A, reset after approx. 1 s |
| Monitored inputs: | 1 or 2 channels |
| Drive circuits: | max. 28 VDC |
| Enabling contacts: | 2 enabling paths |
| Utilisation category: | AC-15, DC-13 |
| Switching capacity: | enabling paths: 6 A/230 VAC, 6 A/24 VDC |
| Fuse rating: | enabling paths: 6 A gG D-fuse |
| Max. switching frequency: | 5 Hz |
| Contact material: | AgNi, AgSnO, self-cleaning, positive action |
| Contact resistance: | max. 100 mΩ in new condition |
| Pull-in delay: | \( \leq 330 \text{ ms} / \leq 720 \text{ ms} \) (start button / auto start) |
| Drop-out delay: | \( \leq 20 \text{ ms} \) |
| Air clearances and creepage distances: | DIN VDE 0110-1 (04.97), 4 kV/2 |
| Overvoltage category: | III to DIN VDE 0110 |
| Degree of pollution: | 2 to DIN VDE 0110 |
| Ambient temperature: | \(-25 \degree C \ldots +45 \degree C\) (Derating curve on request) |
| Mechanical life: | 10 million operations |
| Function display: | 2 LEDs |
| Weight: | 190 g |
| Dimensions: | 22.5 x 82 x 98.8 mm |

## Approvals

![CE mark]

## Ordering details

<table>
<thead>
<tr>
<th>SCR 1R</th>
<th>Replace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>24 VDC</td>
</tr>
</tbody>
</table>
Safety-monitoring modules for optoelectronic safety systems

**Note**

- Input level: dual-channel control (Example AOPD, with two OSSDs with external start/restart button).
- The control recognises cable break and earth leakages in the monitoring circuit.
- S1 = electronic fuse
- Relay outputs: Suitable for 2 channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- For a 1-channel control, connect NC contact to Y1/S1 and bridge S1/S2
- Connect potential (p-type) outputs of safety light grids/curtains to S1/S2. The devices must have the same reference potential.
- Automatic start: The automatic start is programmed by connecting the feedback circuit to the terminals X1/X3. If the feedback circuit is not required, establish a bridge

**Wiring diagram**

**LED**

Function indication: The integrated LEDs indicate the following operational states.
- Position relay K1
- Position relay K2

**Note**

The wiring diagram is shown for the de-energised condition.
Safety-monitoring modules for optoelectronic safety systems

**SCR 402R-301**

- Suitable for signal processing of outputs connected to potentials (AOPDs), e.g. safety light grids/curtains
- 1 or 2 channel control
- 3 enabling paths, Stop 0
- 1 indication contact (NC)
- With hybrid fuse
- Reset with edge detection or automatic start
- 4 LEDs to show operating conditions
- Control Category 4 to EN 954-1
- Plug-in screw terminals

---

### Technical data

- **Standards:** IEC/EN 60204-1, EN 954-1, BG-GS-ET-20
- **Stop category:** 3x Stop 0
- **Control category:** 4
- **Start conditions:** Reset button with edge detection, auto start
- **Enclosure:** glass-fibre reinforced thermoplastic, ventilated
- **Connection:** plug-in, screw terminals
- **Cable section:** max. 2.5 mm² solid or multi-strand lead
- **Uᵦᵣ:**
  - 24 VDC –15%/+20%, residual ripple max. 10%
  - 24 VAC –15%/+10%
- **Frequency range:** 50/60 Hz (on AC operational voltage)
- **Iᵦ:** max. 0.08 A
- **Protection class:** terminals IP 20
- **Drive circuits:** S11/S12, S21/S22: max. 28 VDC
- **Enabling contacts:** 3 enabling paths
- **Utilisation category:** AC-15, DC-13
- **Switching capacity:** enabling paths: 6 A/230 VAC, 6 A/24 VDC
- **Max. switching frequency:** 5 Hz
- **Fuse rating:** enabling paths: 6 A gG D-fuse
- **Signalling contacts:** 1 NC contact
- **Switching capacity:** indicating contact: 2 A/24 VDC
- **Contact material:** AgNi, AgSnO, self-cleaning, positive action
- **Contact resistance:** max. 100 mΩ in new condition
- **Pull-in delay:** ≤ 200 ms
- **Drop-out delay:** ≤ 20 ms
- **Air clearances and creepage distances:** DIN VDE 0110-1 (04.97), 4 kV/2
- **Overvoltage category:** III to DIN VDE 0110
- **Degree of pollution:** 2 to DIN VDE 0110
- **Ambient temperature:** –25 °C … + 45 °C (Derating curve on request)
- **Mechanical life:** 10 million operations
- **Function display:** 4 LEDs
- **Weight:** 230 g
- **Dimensions:** 22.5 x 100 x 121 mm

---

### Approvals

UL  CE

### Ordering details

**SCR 402R-301**

<table>
<thead>
<tr>
<th>No.</th>
<th>Replace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td></td>
<td>24 VAC/DC</td>
</tr>
</tbody>
</table>
Safety-monitoring modules for optoelectronic safety systems

**Note**

- **Input level:** dual-channel control (Example AOPD, with two OSSDs with external start/restart button.
- The control recognises cable break and earth leakages in the monitoring circuit.
- $F_1 =$ Hybrid fuse
- $\oplus =$ Feedback circuit
- Relay outputs: Suitable for 2 channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.

- For 1-channel control, connect NC contact to S11/S12 and bridge S12/S22
- Connect potential p-type outputs of safety light grids/curtains to S12/S22. The devices must have the same reference potential.

- **Automatic start:**
  The automatic start is programmed by connecting the feedback circuit to terminals S12/X3. If no feedback circuit is required, establish a bridge.

---

**Wiring diagram**

---

**LED**

**Function display:**
The integrated LEDs indicate the following operational states.
- Position relay $K_1$
- Position relay $K_2$
- Supply voltage $U_B$
- Internal operating voltage $U_i$

---

**Note**

The wiring diagram is shown with guard doors closed and in de-energised condition.
Safety-monitoring modules for optoelectronic safety systems

AZR 311 TL

- Suitable for signal processing of potential-free outputs, e.g. emergency-stop command devices, interlocking equipment etc..
- Suitable for signal processing of outputs connected to potentials (AOPD’s), e.g. safety light grids/curtains
- 1 or 2 channel control
- 4 enabling paths, 1 delayed: 1 ... 30 s
- Acknowledgement output, normally-closed function (potential-free)
- Optionally:
  - Manual reset with edge detection in fail-safe circuit
  - Automatic reset function
- Green LED-indications for relay K2, K3, K4, K5, supply voltage $U_E$ and internal fuse $U_i$
- Control Category 4 to EN 954-1

Technical data

- Standards: IEC/EN 60204-1, EN 954-1, BG-GS-ET-20
- Stop category: 3x Stop 0, 1x Stop 1 (1 ... 30 s delayed)
- Control category: 4
- Start conditions: Start, reset button (trailing edge), autostart
- Enclosure: glass-fibre reinforced thermoplastic
- Connection: self-opening screw terminals
- Cable section: min. 0.6 mm², max. 2.5 mm² solid or multi-strand lead (incl. conductor ferrules)
- $U_E$: 24 VDC – 15 % / + 20 %, residual ripple max. 10%
- $U_i$: 24 VAC – 15 % / + 10 %
- Frequency range: 50/60 Hz (on AC operational voltage)
- $I_E$: max. 0.21 A
- Power consumption: max. 5 W
- Protection class: terminals IP 20
- Standard: enclosure IP 40 to EN 60529
- Start conditions: Start, reset button (trailing edge), autostart
- Control category: 4
- Connectors: 1 or 2 channels
- Feedback circuit: yes
- Drive circuits: S11/S12, S11/S22: max. 28 VDC
- Enabling contacts: 4 enabling paths
- Utilisation category: AC-15, DC-13
- Switching capacity: enabling paths: 6 A/230 VAC, 6 A/24 VDC
- Fuse rating: enabling paths: 6 A gG D-fuse
- Max. switching frequency: 5 Hz
- Auxiliary contacts: 55/66
- Switching capacity: Auxiliary contacts: 2 A/24 VDC
- Contact material: AgNi, AgSnO, self-cleaning, positive action
- Contact resistance: max. 100 mΩ in new condition
- Pull-in delay: $\leq$ 200 ms
- Drop-out delay: $\leq$ 30 ms
- Air clearances and creepage distances: DIN VDE 0110-1 (04.97), 4 kV/2
- Overvoltage category: III to DIN VDE 0110
- Degree of pollution: 2 to DIN VDE 0110
- Ambient temperature: - 25 °C ... + 45 °C (Derating curve on request)
- Mechanical life: 10 million operations
- Function display: 6 LED
- Weight: 280 g
- Dimensions: 45 x 83 x 140 mm

Approvals

Ordering details

AZR 311 TL
Safety-monitoring modules for optoelectronic safety systems

**Note**

- Input level: the example shows a 2-channel control of a guard door monitoring with two position switches, whereof one with positive break, external reset button and feedback circuit.
- The control recognises cable break and earth leakages in the monitoring circuit.
- For one channel operation S12 must be bridged with S22.
- For reset with edge detection T34 must be bridged with T44.
- Relay outputs: Suitable for 2 channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.

**Wiring diagram**

The wiring diagram is shown with guard doors closed and in de-energised condition.

**LED**

**Function display:**
The integrated LEDs indicate the following operating states.
- Position relay K2
- Position relay K3
- Position relay K4
- Position relay K5
- Supply voltage \( U_b \)
- Internal operating voltage \( U_i \)

**Note**

The wiring diagram is shown with guard doors closed and in de-energised condition.
## Technical data

| Standards: | EN 50295, EN 60947-5-1, EN 954-1, EN 61496-1 |
| Enclosure: | glass-fibre reinforced thermoplastic, self-extinguishing |
| AS-Interface connection type: | connector M12 |
| Protection class: | IP 67 to EN 60529 |
| AS-Interface operating voltage: | 26.5 ... 31.6 VDC, via AS-Interface, reverse-polarity proof |
| AS-Interface operating current: | ≤ 50 mA |

| AS-Interface specification: (V 2.1) |
| Profile: | S-0.B |
| IO-Code: | 0x0 |
| ID-Code: | 0xB |
| ID-Code1: | 0xF |
| ID-Code2: | 0xE |

### Inputs:

<table>
<thead>
<tr>
<th>Contact</th>
<th>Status</th>
<th>Data bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 on</td>
<td>D0/D1 = dynamic code transmission</td>
<td></td>
</tr>
<tr>
<td>1 off</td>
<td>D0/D1 = static code &quot;00&quot;</td>
<td></td>
</tr>
<tr>
<td>2 on</td>
<td>D2/D3 = dynamic code transmission</td>
<td></td>
</tr>
<tr>
<td>2 off</td>
<td>D2/D3 = static code &quot;00&quot;</td>
<td></td>
</tr>
</tbody>
</table>

### Outputs:

- A0 ... A3 not used
- Parameter bits: P0 ... P3 not used
- Input module address: default on address 0, programmable via the AS-Interface Master or Hand-held programming device
- Indications: AS-Interface: voltage LED green, communication LED red, OSSD1/2; Enabling status: LED yellow

### Power supply for AOPD:

PELV power supply to IEC 364-4-41

### Reaction time:

≤ 20 ms

### EMC rating:

conforming to EMC Directive

### Ambient temperature:

-25 °C ... + 60 °C

### Storage and transport temperature:

-25 °C ... + 85 °C

## Note


Connector ST1 1: + 24 VDC 2: OSSD 1 3: GND 4: OSSD 2 5: FE (functional earth)

Connector ST2 1: + 24 VDC 2: spare 3: GND 4: spare 5: FE (functional earth)

## Ordering details

AST LC ST-AS

A separate address jack is not available as an option. The addressing must take place via the cable end or the M12 connector.

## Approvals

[Logo: TÜV]  
[Logo: CE]
Safety-monitoring modules for optoelectronic safety systems

**Note**

- The wiring diagram shows an active optoelectronic device (AOPD) (type SLC/SLG) with a safety input module AST LC ST-AS (OptoTube) connected to the AS-i Safety at Work system.

- The Opto-Tube is directly connected to the receiver module (ST1). The AOPD receives its 24 VDC power supply via the second M12-cable connection (ST2).

- The Opto-Tube itself is connected via the M12 connector (ST) to the AS-i network. Beforehand the module has to be programmed with an individual adress (1 - 31).

- The emitter module has be wired up separately as described in its mounting and wiring instruction.

---

**Wiring diagram**

Emitter

Receiver

See note

24 VDC (ST 2)

AS-i (ST)
Definitions and terms:

Start interlock:
A device preventing the automatic release and therefore the automatic machine start when the power supply of the AOPD is switched on or interrupted and switched on again.

AOPD:
The abbreviation of Active Optoelectronic Protective Device.

Resolution:
The resolution or minimum object sensitivity represents the minimum size of an object that is detected in each part of the protection field.

Optoelectronic safety devices:
The here described are optoelectronic safety guards (AOPD), e.g. safety light barriers, safety light curtains and safety light grids as well as laser scanners and their corresponding safety relay modules.

Type 2 acc. to EN 61496-1:
The Type 2 AOPD is a protective device, whose safety function is checked by means of regular tests. These devices must meet the requirements of Control Category 2 acc. to EN 954-1.

Type 4 acc. to EN 61496-1:
The Type 4 AOPD is a protective device, whose safety function is not affected by a failure or error in the system. These devices must meet the requirements of Control Category 4 acc. to EN 954-1.

Blanking:
In this configurable operation mode a safety light curtain blanks out a precisely defined area in the protection field. The operation mode “Blanking” allows objects to be present in the sending area with out deactivating the light curtain safety outputs. “Fixed Blanking” is when a fixed set of adjacent light beams are rendered inactive for the purpose of entering an object and pans into the protective area. “Floating Blanking” is when a set member (one or more) of adjacent beams is allowed to ignore the presence of an object and not deactivating the OSSDs of the light curtain.

Muting:
Muting is a temporary automatic suspension of a safeguarding function by safety-related parts of the control system during otherwise safe conditions in the operation of a machine. The safeguarding function is realized through 2 or 4 muting sensors, which can distinguish between persons and objects. The suspension condition is signalled by means of a muting signal lamp.

OSSD:
Output Signal Switching Device of the AOPD (to EN 61496)

Protection field:
The protection zone is an invisible, two-dimensional light curtain consisting of infrared light beams, installed between the emitter and receiver unit. Depending on the chosen resolution (detection sensitivity) objects of a specific size intruding this light curtain will be detected.

Operating Range:
The operating range is the maximum distance that may exit between the light curtain’s emitter and its receiver.

Protected height:
The protected height is a vertical area between the first and the last infrared light beam of an optoelectronic safety guard. (not the total housing length)

The beginning and the end of this area is marked with symbols on the SLC/SLG’s enclosure.

Restart interlock:
A device preventing the automatic restart of the machine, when the protection field is interrupted during a dangerous machine cycle or when the operating mode of the machine is set or changed.
Since 1996, the information series MRL News appears at irregular intervals. MRL News is intended to provide interesting interpretations and innovations relating to the complicated subject of safety and machinery and machine controls as well as information about standards and directives that are currently under development or revision.

Books on Machine Safety
Safety of machinery and plants is a complex matter. The mechanical engineer must observe numerous directives and standards, which are sometimes still under development or revision. To help you deal with complex subject, Schmersal has published two technical books in which notable authors deal with various aspects of the safety of machines and plants as well as the EC standards and regulations on machine safety: "Safety on machines and engineering plants" and "Protection of human life in practice".