



SCHMERSAL

Version 2.0



Operating instructions. pages 1 to 16
Original

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1. About this document


1.1 Function
This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety switchgear. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.


1.2 Target group: authorised qualified personnel
All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used

 **Information, hint, note:**
This symbol is used for identifying useful additional information.

 **Caution:** Failure to comply with this warning notice could lead to failures or malfunctions.
Warning: Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use

The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety switchgear must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions

The user must observe the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.



Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: www.schmersal.net.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.



The entire concept of the control system, in which the safety component is integrated, must be validated to EN ISO 13849-2.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

Additional measures could be required to ensure that the system does not present a dangerous breakdown, when other forms of light beams are available in a special application (e.g. use of wireless control devices on cranes, radiation of welding sparks or effects of stroboscopic lights).

1.6 Warning about misuse



In case of improper use or manipulation of the safety switchgear, personal hazards or damages to machinery or plant components cannot be excluded when safety switchgear is used. The relevant requirements of the standards EN ISO 13855 & EN ISO 13857 must be observed.



Only if the information described in this operating instructions manual are realised correctly, the safety function and therefore the compliance with the Machinery Directive is maintained.

1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden; the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

2. Product description

2.1 Destination and use

The SLG440 is a non-contact, self-testing safety guard, which is used for the protection of hazardous points, hazardous areas and machine accesses. If one or more light beams are interrupted, the hazardous movement must be stopped.



The user must evaluate and design the safety chain in accordance with the relevant standards and the required safety level.

2.2 Ordering code

This operating instructions manual applies to the following types:

SLG440-ER-①-②

No.	Option	Description
①	0500-02	Distance between outermost beams: 500 mm, 2-beam
	0800-03	800 mm, 3-beam
	0900-04	900 mm, 4-beam
②	01	Integrated status indication*, range 0.3 ... 12 m
	H1	Integrated status indication*, range 3.0 ... 20 m

* = integrated status indication (option)

2.3 Special versions

For special versions, which are not listed in the order code, these specifications apply accordingly, provided that they correspond to the standard version.

2.4 Scope of delivery and accessories

2.4.1 Accessories included in delivery

Mounting kit MS-1100

The kit comprises 4 rotating mounting angles and 8 mounting screws for fixing to the end caps.

2.4.2 Optional accessories

Centre support MS-1110

Consisting of 2 steel brackets and 4 spacers

Connecting cable for transmitter

Item No	Designation	Description	Length
101207741	KA-0804	Female connector M12, 4-pole	5 m
101207742	KA-0805	Female connector M12, 4-pole	10 m
101207743	KA-0808	Female connector M12, 4-pole	20 m

Connecting cable for Receiver

Item No	Designation	Description	Length
101207728	KA-0904	Female connector M12, 8-pole	5 m
101207729	KA-0905	Female connector M12, 8-pole	10 m
101207730	KA-0908	Female connector M12, 8-pole	20 m

Adapter cable for parameter setting

Item No	Designation	Description	Length
101217615	KA-0974	Y-distributor with command device	1 m

Test rod PLS

The test rod is used for testing the protection field.

MSD4 Vibration damper

Kit consists of: 8 vibration dampers 15 x 20 mm, 8 M5 cylinder head screws with hexagon socket, 8 spring washers. Mounting using MS-1100.

The MSD4 vibration damper kit is recommend to be used for damping vibrations and oscillations on the SLG440. For applications with higher mechanical stresses, e.g. presses, punching machines, we recommend the MSD4 kit. In this way, the availability of the SLG440 is increased.

Spacer MSD5

The kit consists of 2 spacers. The spacers must be used in case of vibrations.

Integrated status indication

The SLG440 series is also available with integrated status indication (red/yellow/green) installed onto the receiver. (See ordering code)

2.5 Technical data

Standards: EN 61496-1; EN 61496-2;
EN ISO 13849; EN 62061

Material of the enclosure:	Aluminium
Protection field heights:	500 mm, 800 mm, 900 mm
Detection ability for test bodies:	2 beams with resolution 500 mm *3 3 beams with resolution 400 mm *3 4 beams with resolution 300 mm *3

Range of the protection field:	
- Standard	0.3 ... 12 m
- Height range (H)	3.0 ... 20 m

Response time:	
- Beam coding (normal)	2 - 4 beams = 10 ms
- Beam coding A	2 - 4 beams = 15 ms

Rated operating voltage:	24 VDC \pm 10% (PELV) supply unit I_{max} 2.0 A, to EN 60204 (power drop \leq 20 ms)
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Rated operating current:	250 mA max. + 2 x 0.25 A each OSSD
Wavelength of the infrared radiation:	880 nm

Transmitter, infrared emitted radiation

- to DIN EN 12198-1:	Category 0
- to DIN EN 62471:	free group

Safety outputs

OSSD1, OSSD2:	2 x short-circuit proof PNP semi-conductor outputs
Test impulse cycle OSSD:	750 ms
Test impulse length:	100 μ s
Switching voltage HIGH ¹ :	15 ... 26.4 V
Switching voltage LOW ¹ :	0 ... 2 V
Switching current each OSSD:	0 ... 250 mA
Leakage current ² :	1 mA
Load capacity:	0 ... 2.2 μ F
Load inductance ⁴ :	0 ... 2 H
Admissible conduction resistance between OSSD and load:	2.5 Ω
Admissible conduction resistance of the supply cable:	1.5 Ω

Contact control (EDM)

Input voltage HIGH (inactive):	11 ... 30 V
Input voltage LOW (active):	0 ... 2.0 V
Input current HIGH:	3 ... 10 mA
Input current LOW:	0 ... 2 mA

Input release restart interlock/restart interlock 2

Input voltage HIGH (active):	11 ... 30 V
Input voltage LOW (inactive):	0 ... 2.0 V
Input current HIGH:	3 ... 10 mA
Input current LOW:	0 ... 3 mA

Functions:	automatic mode, restart interlock, double reset, contactor control, beam blanking fixed and floating, beam coding A
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Signal times

Contact control:	max. 500 ms
Restart interlock (manual reset):	50 ms ... 1.5 s, signal transmission in case of trailing edge
LED indications transmitter:	transmitting, status
LED indications receiver:	OSSD ON, OSSD OFF, restart, signal reception, blanking, information
Connection:	M12 connector plug with metal thread, receiver 8-pole, transmitter 4-pole
Ambient temperature:	-25° C ... + 50° C; at -25° C: Reduction of range by -10%
Storage temperature:	-25° C ... + 70° C
Interface:	Diagnostics and function setting
Protection class:	IP67 (IEC 60529)
Resistance to vibration:	10 ... 55 Hz to IEC 60068-2-6
Resistance to shock:	10 g, 16 ms, to IEC 60028-2-29
Year of construction:	as of 2014 version 2.0

¹⁾ To IEC 61131-2

²⁾ In case of failure, the leakage current at the most flows to the OSSD cable. The downstream control element must recognise this state as LOW. A safety PLC must detect this state.

³⁾ resolution = beam distance + beam diameter 10 mm

⁴⁾ The load induction generates an induced voltage during the switch-off, which compromises the downstream components (spark quenching element).

2.6 Response time (reaction time)

The response time depends on the number of light beams and the beam coding A.

Beams [Number]	Beam distance [mm]	Response time [ms]	Response time with beam coding A [ms]	Weight [kg]
2	500	10	15	0.90
3	400	10	15	1.35
4	300	10	15	1.50

2.7 Safety classification

Standards:	EN ISO 13849-1, EN 62061
PL:	up to e
Control category:	up to 4
PFH value:	5.14×10^{-9} / h
SIL:	up to 3
Service life:	20 years

2.8 Functions

The system consists of a receiver and a transmitter. For the described functions, no further switching elements are required. The diagnostic and function selection takes place with a command device (key release), refer to the chapter on parameterisation.

The system has the following features:

- Protective mode automatic (automatic start after release of the protection zone)
- Restart Interlock (manual reset)
- Double acknowledgement/reset
- Contactor control (EDM)
- Beam coding A
- Blanking of movable objects

Factory setting

The system features many functions without needing any additional devices. The following table gives an overview of the possible functions and the factory settings configuration.

Function	Factory setting	Configuration
Protective mode, automatic	not active	External wiring
Restart interlock (manual reset)	not active	External wiring
Double acknowledgement/reset	not active	with command device
Blanking of moving objects	not active	with command device
Contactor control (EDM)	not active	with command device
Beam coding A	not active	with command device

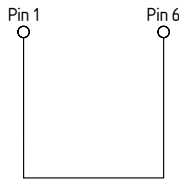
i By default neither the restart interlock (manual reset) nor the protective mode is active. One of both operating modes must be wired in order to enable the OSSD outputs. If no operating mode is selected, the following message is shown: **Status indication E1 + LED OSSD OFF (red)**

2.8.1 Protective mode / Automatic

The protective mode switches the OSSD outputs to the ON state (protection field not interrupted), without external release of a switching device.

Wiring of the receiver

Jumper connection pin 1 with pin 6



This operating mode generates an automatic restart of the machine if the protection field is not interrupted.

i A 24 VDC H-signal at the input of pin 1 leads to a restart of the system. If the 24 VDC H-signal is still present at pin 1 after the self-test, the system switches to setting mode, see chapter "Setting mode".

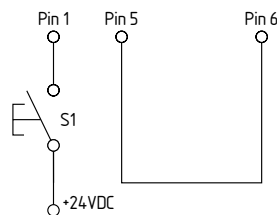
! This operating mode may only be chosen in conjunction with the restart interlock (manual reset) of the machine. This operating mode must not be chosen, when persons can step behind the protection field.

2.8.2 Restart Interlock (operation)

The restart interlock (manual reset) prevents an automatic enabling of the outputs (OSSD's ON state) after switch-on of the operating voltage or an interruption of the protection field. The system switches the outputs only to ON state, when an external command device (restart button) generates an enabling signal at the restart input (receiver).

Wiring of the receiver

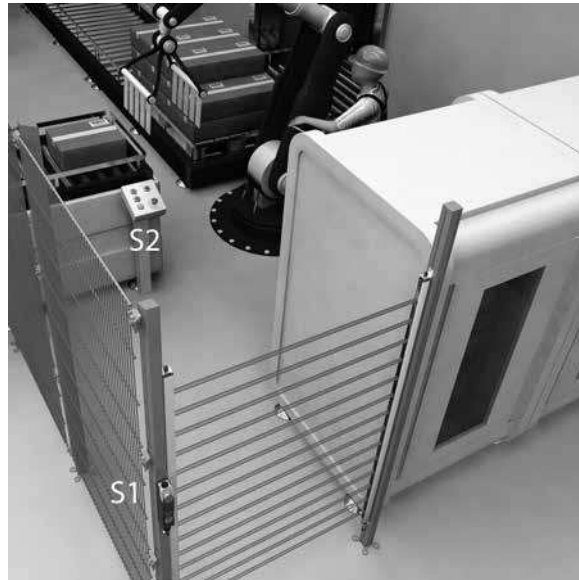
- Jumper connection pin 5 with pin 6
- Command device (enabling button) at pin 1



The command devices (enabling button) must be installed outside of the hazardous area. The operator must have a clear view on the hazardous area when actuating the enabling button.

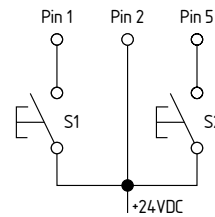
2.8.3 Restart interlock with double acknowledgement/reset

In applications with access monitoring, a complete overview of the hazardous areas is often not possible; despite that, a reset of the command device for the restart interlock outside of the hazardous area by third parties is at all times enabled, although possible persons/operators are in the invisible area. This hazardous situation can be avoided by means of a double reset, i.e. integration of two command devices inside and outside the hazardous area.



Wiring of the receiver

- Command device S1 at pin 1
- Command device S2 at pin 5
- Pin 6, no signal (input open)



Specification

The operating mode is available, when the parameter setting - double reset is activated (P 5). See chapter Parameter setting.

Sequence for enabling:

- 1) Actuate command device inside of the hazardous area (S2) and leave the hazardous area
- 2) Go through protected field or interrupt at least one beam, then release protected field
- 3) Actuate the command device outside of the hazardous area (S1)

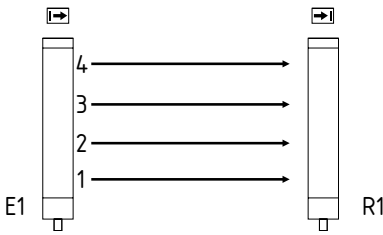
Command device S1 can be reset (acknowledged) within a timeframe of 2 to 60 seconds after the actuation of S2. If the order or the time requirement is not respected, the process must be repeated.

Signalling: LED restart (yellow)

Status	Note
On	Release of S2 (restart interlock 2) waiting for signal
Flashing	Release of S1 (restart interlock) waiting for signal

2.8.4 Blanking of moving objects

The SLG440 can blank movable objects in the protection field.



The moving blanking range is authorised for individual beams in case of obstacles, taking the protective function into account.

The function enables an arbitrary floating blanking of partial areas in the protection field. The first beam, which is located immediately behind the diagnostic window, cannot be blanked.

This function allows for an interruption of maximum 1 light beam without the outputs being disabled in case of material movement in the protection field, e.g. ejection of material or process-controlled material movement.

The operating mode is only available, when the parameter setting P 3 is activated. See chapter Parameter setting.



- The variable blanking of one beam is not authorised with the 2-beam SLG440!
- The blanking of one beam at the most in the SLG440 3-beam version or the SLG440 4-beam version is authorised, provided that the protective function is taken into account.
- The restart interlock (manual reset) function of the safety light grid or the machine must be activated.
- The protection field must be checked with a test rod by a qualified person after the configuration.
- The standard IEC/TS 62046 includes information, which describes possibly required additional measures to prevent a person from reaching a hazard through the beam blanking of a protection field.

2.8.5 Contactor control (EDM)

The contactor control monitors the controlled switching elements (auxiliary contacts of the contactors) of both outputs. This monitoring is realised after each interruption of the protection field and prior to the restart (enabling) of the outputs. In this way, malfunctions of the contactors are detected, e.g. contact welding or contact spring breakage. If the light curtain detects a malfunction of the switching elements, the outputs are locked.

After elimination of the error, a power reset is required.

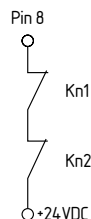


The contactor control is not activated upon delivery. The function is activated in parameter setting mode (P 4).

Connection EDM

Wiring of the receiver

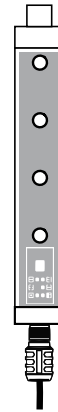
- Kn1, Kn2 = auxiliary contact of the last switching relay



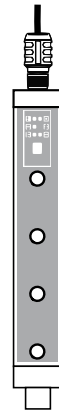
The auxiliary contacts must only be connected, when the function is activated!

2.8.6 Rotating the display through 180 degrees

The orientation of the 7 segment display can be rotated through 180 degrees via the software option. This ensures that the display remains readable in rotated mounting positions of the AOPD.



Parameter P 7 –
Display normal orientation



Parameter P 7 A
Display rotated

2.9 Self-test

The system performs a complete self-test and safety test within 2 seconds after the operating voltage has been switched on. If the protection field is free, the system switches to the ON condition (automatic mode). In case of an error, the outputs at the receiver do not switch to the ON state. An error message is emitted in the form of an error code. For more information, refer to chapter Fault diagnosis.

During operation, the system executes a cyclic self-test. Safety-relevant faults are detected within the reaction time and cause the outputs to be switched off and an error code to be emitted.

2.10 Beam coding A

The preset beam coding of the safety light grid must be adjusted, when systems operating in each other's vicinity and a set-up as shown in the image below (no interference) is impossible. When supplied, the beam coding A is **not active**. A receiver with activated beam coding A can distinguish the beams of the transmitter with the same beam coding, which are destined to this particular receiver, from foreign beams.

If adjacent systems are operated without beam coding A, the user is at risk.

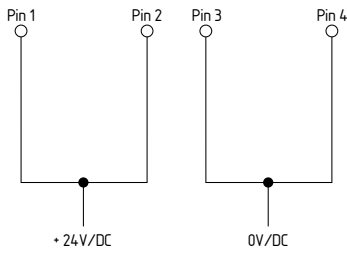


- The beam coding A avoids mutual interference of adjacent systems.
- The beam coding A is permanently shown by the transmitter and the receiver by means of flashing LED's (refer to LED status information).
- The beam coding A must be set for **each sensor** (receiver and transmitter) individually.
- The function at the receiver is activated in parameter setting mode (P 6).

Transmitter parameter setting

Wiring of the transmitter

- Jumper connection pin 1 with pin 2
- Jumper connection pin 3 with pin 4



The response time of the system is increased when beam coding A is used. To this end, the safety distance must be adjusted. Refer to chapter: Response time.

2.11 Parameter setting

The parameter setting of the SLG440 enables the individual adjustment of the desired functionality to the application.

Parameter display (7-segment display)

- A = parameter active
- = parameter not active
- S. = save the current configuration
- C. = delete the current configuration, new configuration = factory setting
- n = unavailable (unauthorised setting, refer to Parameter setting information)
- d. = diagnostic/setting mode

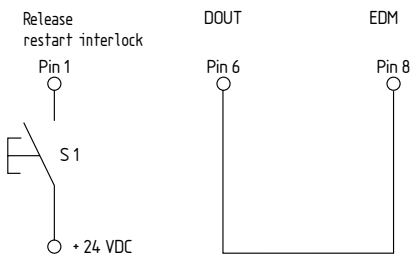
Parameter selection

Selection, change and acceptance of the parameters by means of the command device pushbutton S1:

- Switch to parameter setting Px briefly press the button 0.1 ... 1.5 sec.
- Change parameter setting Px press button 2.5 ... 6 sec.
- Save S. / Factory setting C. press button 2.5 ... 6 sec.

Procedure

- 1) For the parameter setting, the receiver must be isolated from the operating voltage. In de-energised condition, the following jumper connection and the pushbutton S1 must be connected.



Wiring of the receiver

- Jumper connection from DOUT (Pin 6) to EDM (Pin 8)
 - Connection of the command device pushbutton S1 (+24 VDC) on Pin 1 (restart interlock)
 - Possible jumper connections from Pin 5 to Pin 6 or Pin 1 to Pin 6 must be removed. If the EDM function was activated, the auxiliary contact of Pin 8 must be removed.
- 2) The receiver switches to parameter setting mode when the operating voltage is switched on.

The operating status is signalled in the following way

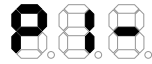


7- segment display

- LED OSSD ON (red) active
- LED OSSD OFF (green) active

Parameter setting

- 1) When S1 is briefly pressed, the display shows **repeatedly**



- (Parameter P 1 not active, factory setting)

- 2) Select the desired parameter by means of command device S1 (briefly press the button)
- 3) Select the desired parameter by means of the command device (press the button for a long time)
 1. Push button (approx. 2.5 seconds) → - flashes (parameter not active)
 2. Enable button when → A static (parameter active)
- 4) Save the new configuration with the parameter Save S. (push the button for a long)
 1. Actuate button (approx. 2.5 seconds) → S. flashes
 2. Enable button when → S. static
 3. Automatic restart → "segment circulation" then P is displayed (saving operation successful)

If no restart takes place (S.), the saving operation has not been successful (i.e. the parameter changes have not been saved). The procedure 4 (1 to 3) must be repeated.

All parameters can be reset to the factory setting using parameter C. (clear/delete).

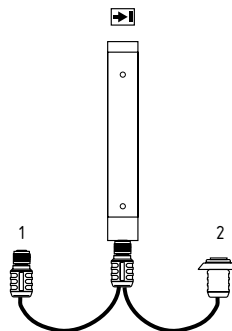
- 1) Press the button approx. 2.5 seconds → C. flashes
- 2) Enable the button when → C. static
- 3) Automatic restart → "Segment circulation", then P is displayed (all parameters have been deleted)

Return to normal operating mode

1. Switch off the operating voltage at the receiver
2. Remove jumper connection at the receiver DOUT (Pin 6) and EDM (Pin 8).
3. Select the desired operating mode (jumper connections)
4. Switch operating voltage on

Adapter cable for parameter setting

If the wiring for the parameter setting of the receiver is not accessible, the KA-0974 adapter cable can be used as an alternative. The adapter cable is connected between the connecting cable and the cable connector of the receiver. The parameters are set by means of the command device (pushbutton), as described in the parameter setting. After the parameters have been set, the KA-0974 is removed and the connecting cable is connected to the receiver.



Key

- 1 = Connecting cable Receiver
- 2 = Command device pushbutton for release

Table Parameter setting

No.	Parameter	Status	Note
P 1	not available	n.	not available
P 2	not available	n.	not available
P 3	Floating blanking 1 light beam	– = not active 1 = 1 beam	Blanking of one beam, only for resolution 300 mm and 400 mm
P 4	Contact control/ EDM	– = not active A = Active	The auxiliary (NC) contacts are monitored
P 5	Double acknowledgement with command device restart interlock N° 2	– = not active A = Active	Operating mode "Protective mode with double reset" restart n° 2"
P 6	Beam coding A (alternative)	– = not active A = Active	Activating upon mutual interference of identical systems
P 7	Rotating the display through 180 degrees	– = not active A = Active	The orientation of the 7 segment display can be turned through 180 degrees
S.	Save	S.	Press button S1 to save changes (2.5 ...6.0 sec.)
C.	Clear/delete	C.	Press button S1 to save factory setting (2.5 ...6.0 sec.)
d.	Diagnostic/ setting mode	d.	Switch to setting mode



P 1 and P 2 - not available!
P 6 - Beam coding A must also be set at the transmitter, refer to chapter Beam coding A

3. Mounting

3.1 General conditions

The following guidelines are provided as preventive warning notices to ensure a safe and appropriate handling. These guidelines are an essential part of the safety instructions and therefore must always be observed and respected.



- The SLG must not be used on machines, which can be stopped electrically in case of emergency.
- The safety distance between the SLG and a hazardous machine movement must always be observed and respected.
- Additional mechanical safety guards must be installed so that the operator has to pass by the protection field to reach the hazardous machine parts.
- The SLG must be installed so that the personnel always must be within the detection zone when operating the machine. An incorrect installation can lead to serious injuries.
- Never connect the outputs to +24VDC. If the outputs are wired to +24VDC, they are in ON state, as a result of which they are unable to stop a hazardous situation occurring on the application/machine.
- The safety inspections must be conducted regularly.
- The SLG must not be exposed to inflammable or explosive gasses.
- The connecting cables must be connected in accordance with the installation instructions.
- The fixing screws of the end caps and the mounting angle must be firmly tightened.

3.2 Protection field and approach

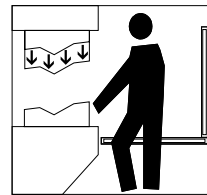
The protection field of the SLG consists only of the individual beams with a distance of 300, 400 or 500 mm. Additional protective devices must ensure that hazardous machine components can only be reached after passing through the protection field.

The SLG must be installed so that personnel are always located within the detection zone of the safety device when operating the hazardous machine parts to be secure.

Correct installation

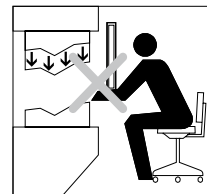


Hazardous machine parts can only be reached after passing through the protection field.

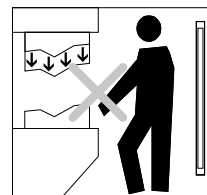


The presence of staff members between the protection field and hazardous machine parts must be prevented/avoided (protection against stepping over).

Unauthorised installation



Hazardous machine parts can be reached without passing through the protection field.



The presence of staff members between the protection field and hazardous machine parts is enabled.

3.3 Alignment of the sensors

Procedure:

1. Transmitter and receiver must be fitted parallel to each other and at the same height.
2. Choose the operating mode "Automatic" (see chapter Protective mode/automatic) and switch the operating voltage on.
3. The 7-segment display in the receiver shows the current signal quality/fine setting (signalling, see chapter "set-up mode") for 30 seconds. Rotate the transmitter and then the receiver towards each other until you have the best possible signal strength of 3 horizontal bars (7 segment display) (note that 2 horizontal bars is sufficient). Fix this position using the screws to the mounting angle. If the set-up is not possible within 30 seconds, change to set-up mode (see chapter "set-up mode"). The set-up mode leads to the best possible positioning of the sensors through the basic setting (position of the first and last beam) and the optimisation of with the fine setting (total signal).

Status indication of the LED

OSSD ON (green) is active, signal strength (orange) is not active.

3.4 Setting mode

Setting tool with 7-segment display



The function supports the best possible alignment between transmitter and receiver. The indication shows the signal strength of the different receivers while the safety outputs are switched off. It setting) as well as the best possible orientation of all beams (find adjustment).

Activating setting mode

After the system start, a signal impulse (H signal 24 VDC) must be present at the input restart interlock (pin 1) of the receiver for at least 2.0 seconds (pushbutton/enabling).

The 7 segment display starts with the default setting (vertical bar). The sensors are aligned in parallel and at the same height until both segments have reached a signal strength of 50% to 100%.

With a signal impulse on the input release (pin 1) you can change between default setting and fine adjustment as long as the signal strength is at 50% of the default setting (vertical bar).

After the setting of the sensors, the setting mode can be terminated by the presence of a HI-signal at pin 1 for at least 2.5 seconds (max. 6 seconds) and the actuation of the enabling button or by a voltage reset at the receiver (+UB).

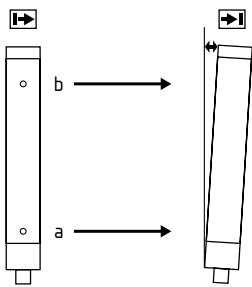
Status display

The signal strength is also shown on the display in the diagnostic window by yellow light pulses to the status light. The better the alignment, the higher the frequency of the light pulses. The alignment is correct when the light pulses switch over to continuous light.

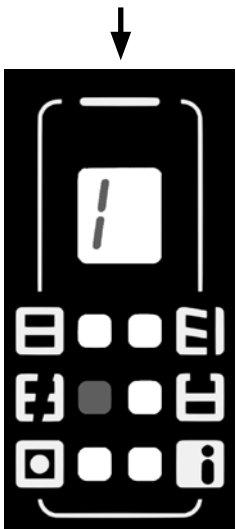
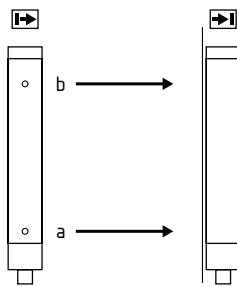
If there is no optical synchronisation between the transmitter and the receiver, a light pulse is emitted every three seconds. The setting mode is ended by a system start (+UB OFF/ON).

Alignment

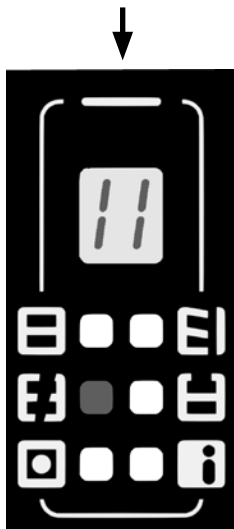
Receiver not parallel



Both sensors parallel



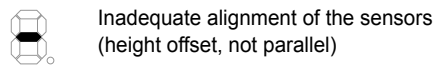
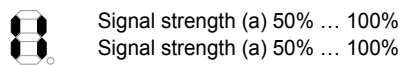
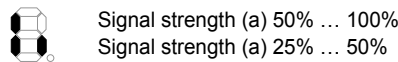
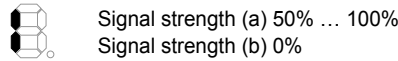
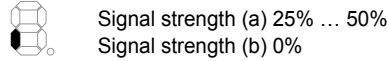
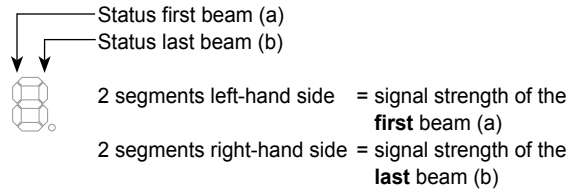
Beam (a) = receive signal OK
Beam (b) = no receive signal



Beam (a) and beam (b)
= receive signals OK

Indication basic setting

The signal strength is displayed per beam with two segments for the first (a) and the last (b) beam.



Indication fine adjustment

The fine adjustment is displayed by means of up to 3 segments (crossbars) for the best possible signal strength of all beams.



Best possible signal strength



Signal strength for normal operation OK



- Signal strength is sufficient, if one or more beams in the protection zone are covered (object blanking)
- Signal strength insufficient, when no beams are covered



The availability of the system is also assured if due to soiling or operation at nominal range the best possible signal strength (3 segments) is not reached.

3.5 Safety distance

The safety distance is the minimum distance between the SLG440 and the hazardous point, which must be observed in order to ensure that the hazardous point can only be reached after the hazardous movement has come to standstill.



The protection using individual beams must be chosen so that bodies or body parts larger than the selected resolution (beam distance + beam diameter 10 mm) of the SLG440 are detected.

Calculation of the safety distance to EN ISO 13855 & EN ISO 13857

The safety distance depends on the following elements:

- Stopping time of the machine (calculation by run-on time measurement)
- Response time of the machine and the safety light grid and the downstream relay (entire safety guard)
- Approach speed
- Resolution of the safety light grid

Calculation of the safety distance for the multi-beam light grid

$$S = (1600 \text{ mm/s} \cdot T) + 850 \text{ mm}$$

S = Safety distance [mm]

T = Total reaction time (machine stopping time, reaction time of the safety guard, relays, etc.)

K = Approach speed 1600 mm/s

C = Safety supplement 850 mm

Example

Reaction time of the SLG440 = 10 ms

Stopping time of the machine T = 170 ms

$$S = 1600 \text{ mm/s} \cdot (170 \text{ ms} + 10 \text{ ms}) + 850 \text{ mm}$$

$$S = 1138 \text{ mm}$$

The following mounting heights must be observed:

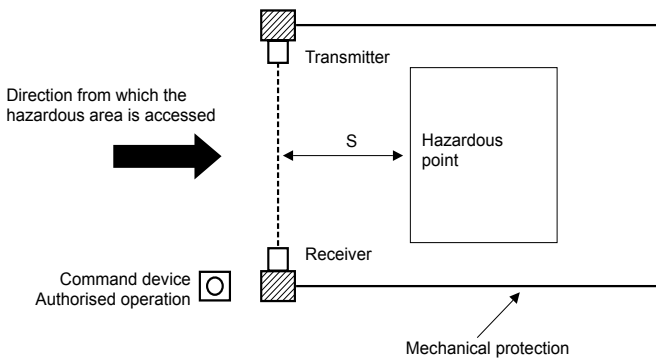
Number of beams	Mounting height above reference floor in mm
2	400, 900
3	300, 700, 1100
4	300, 600, 900, 1200

The formulae and calculation examples are related to the vertical set-up (refer to drawing) of the safety light grid with regard to the hazardous point. Please observe the applicable harmonised EN standards and possible applicable national regulations.



The safety distance between the safety light grid and the hazardous point must always be respected and observed. If a person reaches the hazardous point before the hazardous movement has come to a standstill, he/she is exposed to serious injuries.

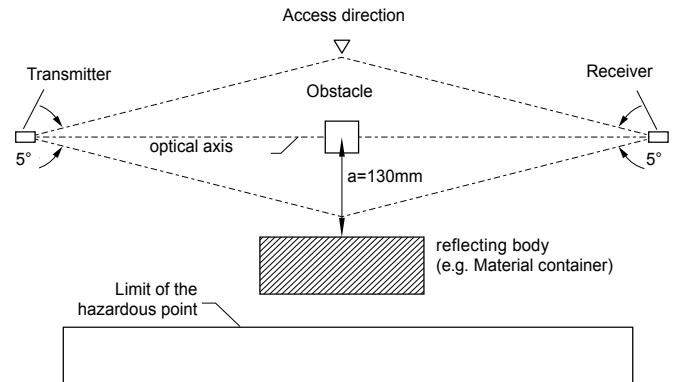
Safety distance to the hazardous area



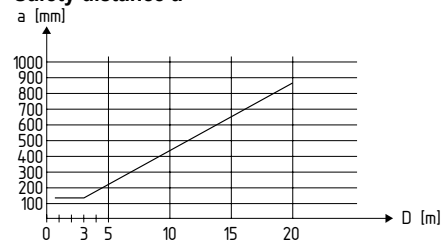
To calculate the minimum distances of the safety guards with regards to the hazardous point, the EN ISO 13855 and EN ISO 13857 must be observed. If an overlap of the protection field is possible, take care with the calculation of the safety distance referring to additional CRO according to the table A1 as per norm EN ISO 13855.

3.5.1 Minimum distance to reflecting surfaces

During the installation, the effects of reflecting surfaces must be taken into account. In case of an incorrect installation, interruptions of the protection field could possibly not be detected, which could lead to serious injuries. The hereafter-specified minimum distances with regard to reflecting surfaces (metal walls, floors, ceilings or parts) must be imperatively observed.



Safety distance a



Calculate the minimum distance to reflecting surfaces as a function of the distance with an aperture angles of $\pm 2.5^\circ$ degrees or use the value from the table below:

Distance between transmitter and receiver L [m]	Minimum distance a [mm]
0.2 ... 3.0	130
4	175
5	220
7	310
10	440
12	530

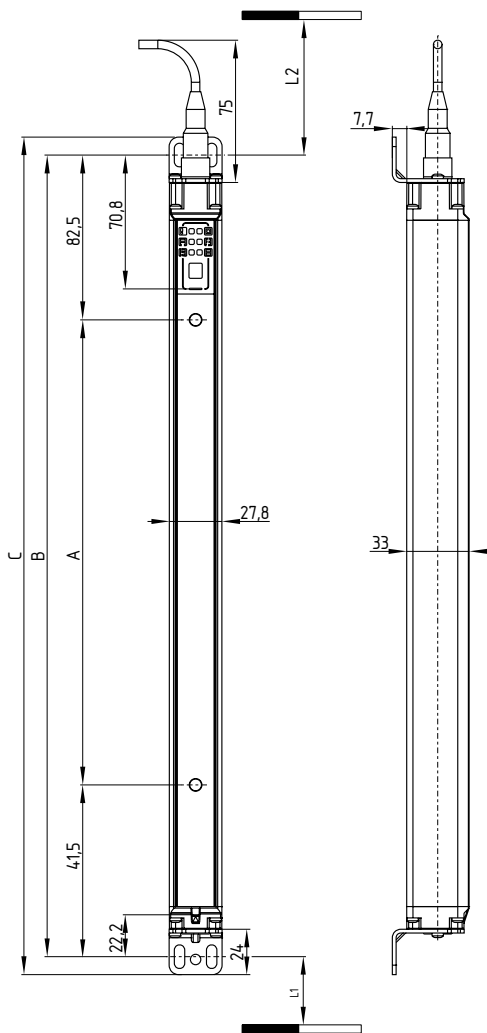
$$\text{Formula: } a = \tan 2.5^\circ \times L \text{ [mm]}$$

a = Minimum distance to reflecting surfaces

L = Distance between transmitter and receiver

3.6 Dimensions transmitter and receiver

All measurements in mm.

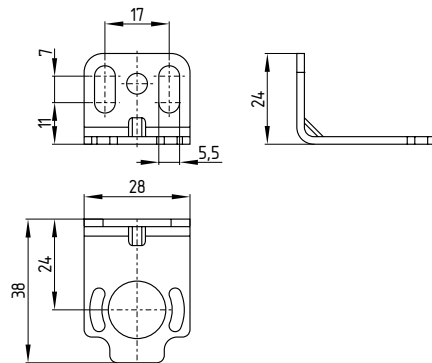


3.7 Fixing

Included in delivery

Mounting kit MS-1100

The mounting kit consists of 4 steel angles and 8 fixing screws.



Type	A Beam distance	B Mounting dimen- sion	C Total length	L1	L2
SLG440-ER-0500-02-XX	500	624	643	358.5	317.5
SLG440-ER-0800-03-XX	400	924	943	258.5	217.5
SLG440-ER-0900-04-XX	300	1024	1043	258.5	217.5

L1 = Mounting distance (mm) between floor and slotted hole centre (short end cap)

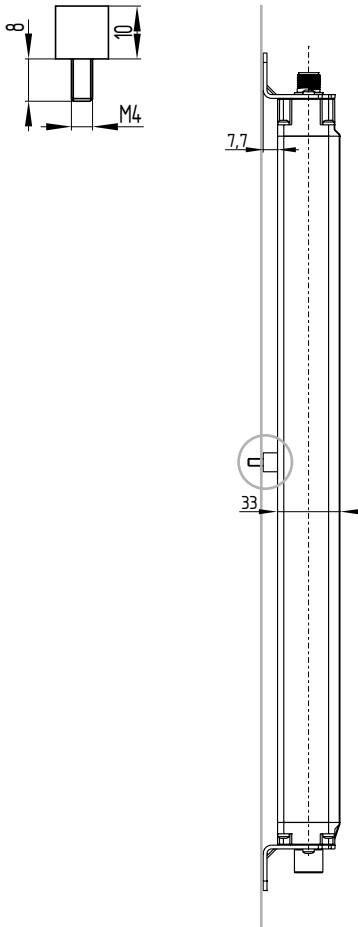
L2 = Mounting distance (mm) between floor and slotted hole centre (diagnostic window)

Overall length Ls (dimension end cap with regard to the cable connection up to the connector M12) of the sensors	
SLG440-ER-0500-02-XX	610 mm
SLG440-ER-0800-03-XX	910 mm
SLG440-ER-0900-04-XX	1010 mm

Optional accessories

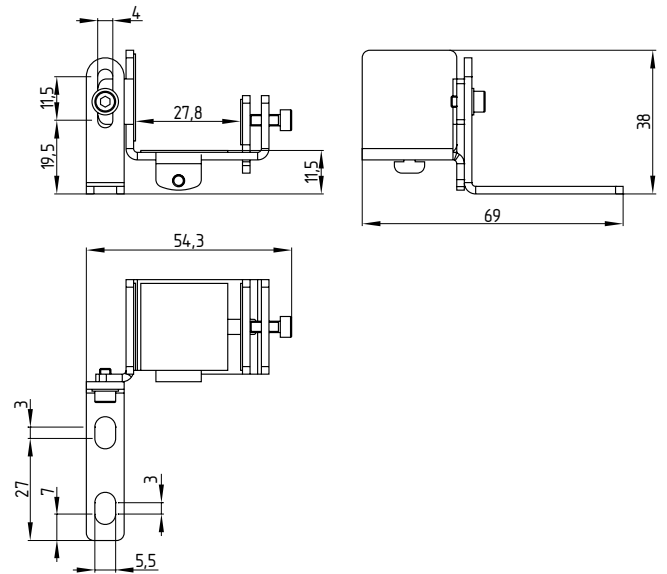
MSD5 spacer

The kit consists of 2 spacers. The spacers must be used in case of vibrations.



Centre support MS-1110

Mounting kit consists of 2 steel angles and 4 spacers for central fixing



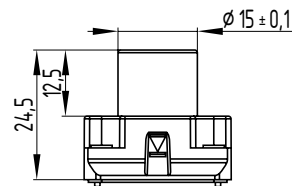
Integrated status indication

The status indication at the receiver indicates the switching condition of the outputs OSSD1 and OSSD2 and the function restart interlock / setup.

Green = outputs H-signal 24V

Red = outputs L-signal 0V

Yellow = setting mode / restart interlock (manual reset)



The integrated status indication **does not** change the mounting dimension B or the overall length C. The overall length of the Ls receiver changes by 10 mm.

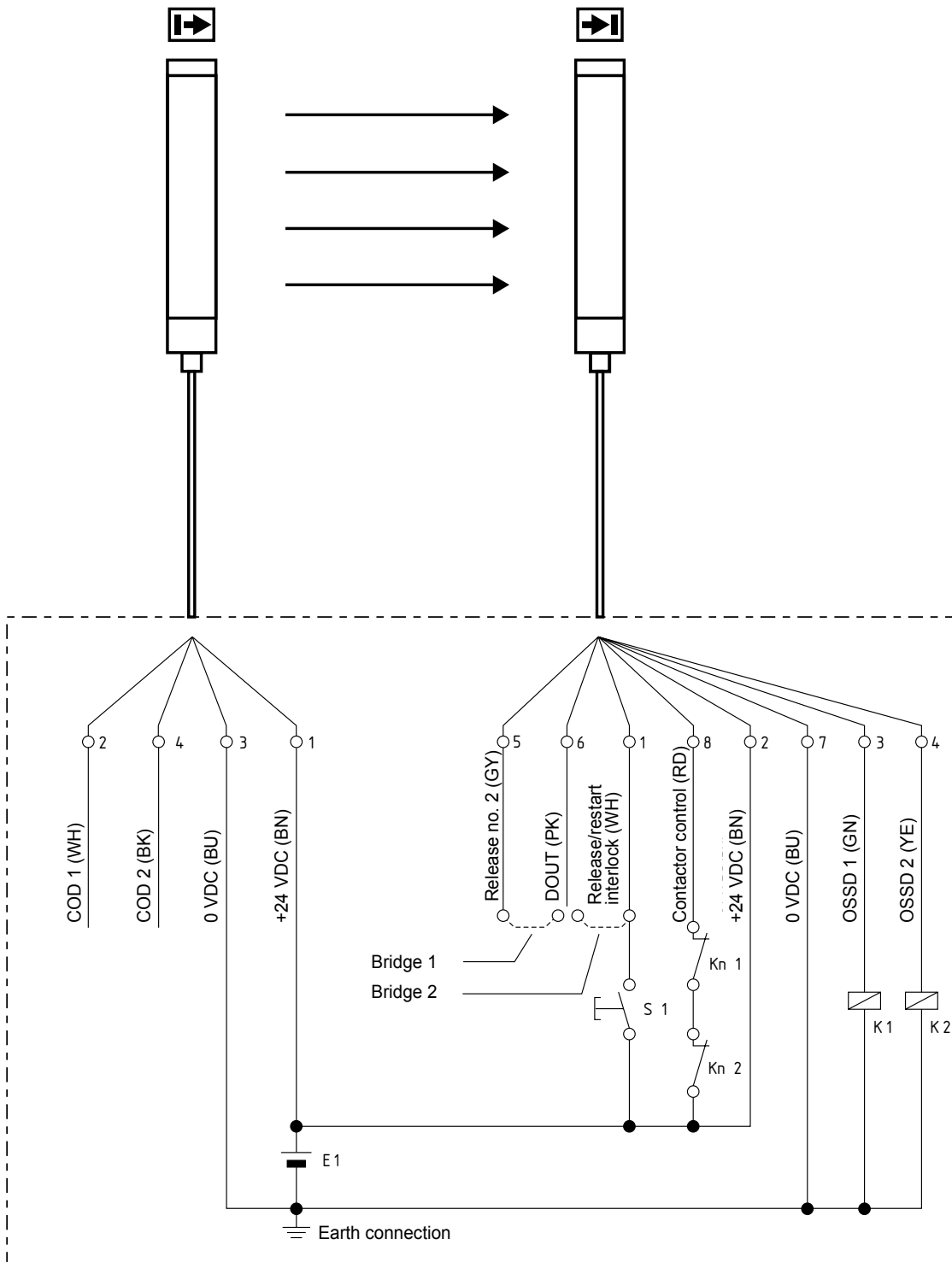
MSD4 Vibration damper

Kit consists of: 8 vibration dampers 15 x 20 mm, 8 M5 cylinder head screws with hexagon socket, 8 spring washers. Mounting using MS-1100.

The MSD4 vibration damper kit is recommend to be used for damping vibrations and oscillations on the SLG440. For applications with higher mechanical stresses, e.g. presses, punching machines, we recommend the MSD4 kit. In this way, the availability of the SLG440 is increased.

4. Electrical connection

4.1 Wiring example



Restart interlock (manual reset) (bridge 1)

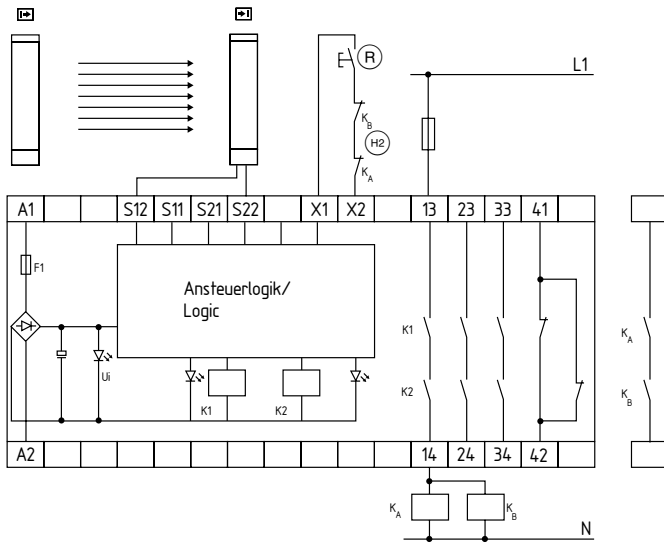
By bridging restart 2 (pin 5) and DOUT (pin 6), the restart interlock (manual reset) is activated. Connect S1 to Pin1

Protective mode / Automatic active (bridge 2)

By bridging DOUT (Pin 6) and enable restart (Pin1), the protective mode is activated. **Don't connect S1.**

- K1, K2 Relay for processing the switching outputs OSSD 1, OSSD 2
- Kn1, Kn2 Auxiliary contacts of the last switching relay (optional) signals at input EDM (Pin 8)
Only to be connected when the contactor control is activated.
- S1 Command device pushbutton for restart (optional)
- E1 Power supply 24 VDC ± 10%

4.2 Wiring example SLG440



Safety monitoring module SRB 301 MC

- Contactor control K_A and K_B at X1/X2
- Command device [®] Restart interlock restart at X1/X2
- OSSD outputs at S12 and S22
- QS-switch = nQS, deactivate cross-wire short detection

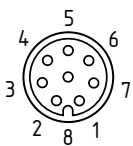
4.3 Connector configuration Receiver, Transmitter & Cable

RECEIVER

SLG: M12 connector / 8 pole

	Designation	Description
	1 WH	Release/restart interlock
	2 BN	24 VDC
	3 GN	OSSD 1
	4 YE	OSSD 2
	5 GY	Restart 2
	6 PK	DOUT
	7 BU	0 VDC
	8 RD	Contactor control

Cable: M12 connector female / 8 pole

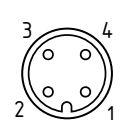


TRANSMITTER

SLG: M12 connector / 4 pole

	Designation	Description
	1 BN	24 VDC
	2 WH	COD 1
	3 BU	0 VDC
	4 BK	COD 2

Cable: M12 connector female / 4 pole



Connect COD 1 / COD 2 only when beam coding A is activated!



The colour codes are only valid for the cable types mentioned below "optional accessories".



For UL evaluated products we do recommend to use the UL style cable 20549.

5. Set-up and maintenance

5.1 Check before start-up

Prior to start-up, the following items must be checked by the responsible person.

Wiring check prior to start-up

1. The voltage supply is a 24V direct current power supply (see technical specifications), which meets the CE Directives, Low Voltage Directives. A power downtime of 20 ms must be bridged.
2. Presence of a voltage supply with correct polarity at the SLG.
3. The connecting cable of the transmitter is correctly connected to the transmitter and the connecting cable of the receiver correctly to the receiver.
4. The double insulation between the light grid output and an external potential is guaranteed.
5. The outputs OSSD1 and OSSD2 are not connected to +24 VDC.
6. The connected switching elements (load) are not connected to +24 VDC.
7. If two or more SLG are used within close range compared to each other, an alternating arrangement must be observed. Any mutual interference of the systems must be prevented.

Switch the SLG on and check the operation in the following way:

The component performs a system test during approx. 2 seconds after the operating voltage has been switched on (indication through 7-segment display). After that, the outputs are enabled, if the protection field is not interrupted. The LED "OSSD ON" at the receiver is on.



In case of incorrect functionality, please follow the instructions listed in the chapter Fault diagnostic.

5.2 Maintenance



Do not use the SLG before the next inspection is terminated. An incorrect inspection can lead to serious and mortal injuries.

Conditions

For safety reasons, all inspection results must be archived. The operating principle of the SLG and the machine must be known in order to be able conducting an inspection. If the fitter, the planning technician and the operator are different persons, please make sure that the user has the necessary information at his disposal to be able conduct the maintenance.

5.3 Regular check

A regular visual inspection and functional test, including the following steps, is recommended:

1. The component does not have any visible damages.
2. The optics cover is not scratched or soiled.
3. Hazardous machinery parts can only be accessed by passing through the protection field of the SLG.
4. The staff remains within the detection area, when works are conducted on hazardous machinery parts.
5. The safety distance of the application exceeds the mathematically calculated one.

Operate the machine and check whether the hazardous movement stops under the hereafter-mentioned circumstances.

1. Hazardous machine parts do not move when the protection field is interrupted.
2. The hazardous machine movement is immediately stopped, when the protection field is interrupted with the test rod immediately before the transmitter, immediately before the receiver and in the middle between the transmitter and the receiver.
3. No hazardous machine movement when the test rod is within the protection field.
4. The hazardous machine movement comes to standstill, when the voltage supply of the SLG is switched off.

5.4 Half-yearly inspection

The following items must be checked every six months or when a machine setting is changed.

1. Machine stops or does not inhibit any safety function.
2. No machine modification or connection change, which affects the safety system, has taken place.
3. The outputs of the SLG are correctly connected to the machine.
4. The total response time of the machine does not exceed the response time calculated during the first putting into operation.
5. The cables, the connectors, the caps and the mounting angles are in perfect condition.

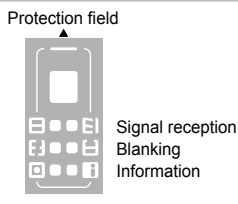
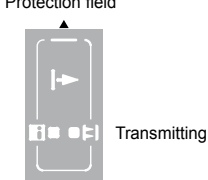
5.5 Cleaning

If the optics cover of the sensors is extremely soiled, the OSSD outputs can be disabled. Clean with a clean, soft cloth with low pressure.

The use of aggressive, abrasive or scratching cleaning agents, which could attack the surface, is prohibited.

6. Diagnostic








6.1 Status information LED

Receiver	Function	LED colour	Description
 <p>OSSD ON OSSD OFF Restart</p> <p>Signal reception Blanking Information</p>	OSSD ON	green	Safety outputs Signal condition ON
	OSSD OFF	red	Safety outputs Signal condition OFF
	Restart	yellow	Input for command device
	Signal reception	orange	Safety-monitoring module of Signal reception
	Blanking	blue	Protection field(s) inactive (blanking)
	Information	yellow-green	Beam coding A
Transmitter	Function	LED colour	Description
 <p>Information</p> <p>Transmitting</p>	Information	green	Function display, Beam coding A
	Transmitting	orange	Transmitter active

Receiver LED	Status LED	Description
OSSD ON	On	Protection field clear
OSSD OFF	On	Protection field interrupted, system or configuration error
	On	Error output refer to Fault diagnostic table
Restart	On	Restart interlock (manual reset) active, signal expected at input restart interlock
Signal reception	ON/flashing	Signal reception too low, check alignment and installation height between transmitter and receiver
		Cleaning the black profile cover
	OFF	Alignment between transmitter and receiver OK, when the OSSD are enabled
Blanking	2 flash	Floating blanking, max. 1 beam
Information	flashing	Beam coding A is active
Transmitter LED	Status LED	Description
Transmitting	On	Standard operation, transmitter active
	flashing	Configuration error
Information	flashing	Beam coding A is active

6.2 Fault diagnostic

The light grid performs an internal self-test after the operating voltage is switched on and the protection field is enabled. When a fault is detected, an error number e.g. E1 is displayed at the receiver. Each fault display is followed by a one-second delay.

Status display	Fault feature	Action
	Wiring error, operating mode not defined (automatic or restart mode)	Check all connections at the receiver, Jumper connection 1 or jumper connection 2 present?
	Supply voltage	UB = 24V/DC+/- 10%, check voltage source and primary voltage, note: after the fault message E2 has been displayed three times, a reset is executed.
	Error output (e), OSSD1 or OSSD2	Check the connections of both outputs, short-circuit of both OSSD, connection to level 0V or 24V, deactivate external (relay) cross-wire short monitoring
	Contact control (EDM)	EDM active: check connections of both NC contacts, EDM not active: check level at Pin 8, open input
	Beam blanking	Check the blanking area(s) of fixed or floating objects with the selected parameter setting, fault elimination - repeat configuration in the parameter setting, possibly adjust P 1, P 2, P 3
	Configuration error in parameter setting	Check parameter setting and save/accept with "S." or delete/reset with "C."
	System error	Restart the system, if E 7 display persists, exchange components

The error display is reset after elimination of the error cause and after the receiver has been switched back on. The error indication displays a 3-digit system error code for every 10th display.

7. Disassembly and disposal

7.1 Disassembly

The safety switchgear must be disassembled in a de-energised condition only.

7.2 Disposal

The safety switchgear must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

8. Appendix

8.1 Contact

Consultancy / Sales



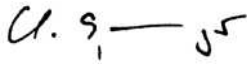
K. A. Schmersal GmbH & Co. KG
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Fax +49 (0) 202 64 74- 100

You will also find detailed information regarding our product variety on our website: www.schmersal.com

Repair handling / shipping

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Am Industriepark 11
D-84453 Mühldorf/ Inn
Phone +49 (0) 8631-18796-0
Fax +49 (0) 8631-18796-1

9. EU Declaration of conformity

EU Declaration of conformity			
Original	Safety Control GmbH Am Industriepark 33 84453 Mühldorf / Inn Germany		
We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.			
Name of the component:	SLC440 SLG440		
Type:	See ordering code		
Description of the component:	Safety light curtain / safety light grid		
Relevant Directives:		Valid up to	Valid as of
		April 19, 2016	April 20, 2016
	Machinery Directive	2006/42/EC	2006/42/EC
	EMC-Directive	2004/108/EC	2014/30/EU
	RoHS-Directive	2011/65/EU	2011/65/EU
Applied standards:	EN 61496-1:2013, EN 61496-2:2013, EN ISO 13849-1:2008 + AC:2009, EN 62061:2005 + A1:2013		
Notified body for the prototype test:	TÜV NORD CERT GmbH Langemarckstr. 20, 45141 Essen ID n°: 0044		
EC-prototype test certificate:	44 205 13144608		
Person authorized for the compilation of the technical documentation:	Oliver Wacker Möddinghofe 30 42279 Wuppertal		
Place and date of issue:	Mühldorf, February 24, 2016		
SLC-SLG440-D-EN			
	Authorised signature Klaus Schuster Managing Director	Authorised signature Christian Spranger Managing Director	



The currently valid declaration of conformity can be downloaded from the internet at www.schmersal.net.



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