SCHMERSAL
safety control

EN Operating instructions. . . . . .pages 1 to 16
Translation of the original operating instructions

FR Vous trouverez la version actuelle du mode d'emploi dans votre langue nationale officielle sur l'Internet, www.schmersal.net.

ES Encontrará el manual de instrucciones actual en su idioma oficial de la UE en nuestra página de Internet www.schmersal.net.

NL U vindt de huidige versie van de gebruikshandleiding in uw officiële landstaal op het Internet, www.schmersal.net.

IT Il manuale d'istruzioni aggiornato nella vostra lingua (lingua ufficiale UE) è scaricabile in Internet all'indirizzo www.schmersal.net.

JP EU公用語で書かれた最新の取扱説明書は,インターネッ (www.schmersal.net) からダウンロードできます。

Content

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 machinery or plant.

X.000 / v.A. / 03.2011 / BZ-Nr. 53501-1V900 / Teile-Nr. 1214163-EN / Ausgabe C

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 electro-sensitive device 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 inadequate or improper use or manipulations of the safety switchgear, personal hazards or damage to machinery or plant components cannot be excluded. The relevant requirements of the standards EN ISO 13855 (successor of EN 999) & EN ISO 13857 must be observed.

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 Ordering code

This operating instructions manual applies to the following types:

SLC 420-E/R①-②-RFB-③④

No.	Option	Description
①	xxxx	Protection field heights in mm available lengths: 0170, 0250, 0330, 0410, 0490, 0570, 0650, 0730, 0810, 0890, 0970, 1050, 1130, 1210, 1290, 1370, 1450, 1530*, 1610*, 1690*, 1770*
②	14, 30, 50	Resolution 14, 30, 50 mm
③		Range 0.3 m ... 7 m** only for resolution 14 mm Range 0.3 m ... 10 m* only for resolution 30 mm and 50 mm
	H	Range 0.3 m ... 18 m, High Range**only for resolution 30 mm
④	M	Master function
	S***	Slave function

Note

*** Protection field heights from 170 to 650 mm

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.

2.2 Special versions

For special versions, which are not listed in the order code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.

2.3 Scope of delivery and accessories

2.3.1 Accessories included in delivery

Mounting kit MS-1030

The kit comprises 4 rotating mounting angles and 16 mounting screws for fixing to the end caps.

Test rod PLS

The test rod is used for testing the protection field.

2.3.2 Optional accessories

Centre fixing MS-1051

Consisting of 2 steel angles, 4 fixing screws and 4 T-slot nuts

Connecting cable for transmitter

Item number	Designation	Description	Length
1207741	KA-0804	Female connector M12, 4-pole	5 m
1207742	KA-0805	Female connector M12, 4-pole	10 m
1207743	KA-0808	Female connector M12, 4-pole	20 m

Connecting cable for receiver

Item number	Designation	Description	Length
1207728	KA-0904	Female connector M12, 8-pole	5 m
1207729	KA-0905	Female connector M12, 8-pole	10 m
1207730	KA-0908	Female connector M12, 8-pole	20 m

Junction cable for cascaded systems

Item number	Designation	Description	Length
1207744	KA-0810	Female connector for emitter M12, 4-pole	800 mm
1207749	KA-0901	Female connector for receiver M12, 8-pole	800 mm

BUS converter NSR-0801

Converter for parametrization and diagnostics. Detailled information can be found in the operating instructions manual of the NSR-0801. Included in delivery: integrated connecting cable, PC-software USB 2.0 connection (L x W x H, 122 x 60 x 35 mm), indications of measurements without cable

MSD4 Vibration damper
Kit comprising: 8 vibration dampers 15 x 20 mm, 8x M5 socket head cap screws, 8 spring washers.

The MSD4 vibration damper kit must be used for damping vibrations and oscillations on the SLC 420. For applications with higher mechanical stresses, e.g. presses, punching machines, we recommend the MSD4 kit. In this way, the availability of the SLC 420 is increased.

2.4 Destination and use

The SLC 420 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.

2.5 Technical data

Standards:	EN 61496-1; CLC/TS 61496-2; EN ISO 13849; EN 62061
Material of the enclosure:	aluminium
Number of beams:	2 … 144 beams
Protection field heights:	
- Resolution 14 mm	170 mm - 1450 mm, (170, 250, 330, 410, 490...),
- Resolution 30 mm	170 mm- 1770 mm, (170, 250, 330, 410, 490...),
- Resolution 50 mm	170 mm- 1770 mm, (170, 250, 330, 410, 490...)
Detection ability for test bodies:	14 mm, 30 mm, 50 mm
Range of the protection field:	0,3 … 7,0 m; (Resolution 14 mm), 0,3 … 10,0 m; (Resolution 30, 50 mm), 0,3 … 18,0 m; (Resolution 30 mm High range)
Response time:	1 - 48 L = 10 ms, 49 - 144 L = 20 ms without beam coding A, 1 - 48 L = 15 ms, 49 - 144 L = 27 ms with beam coding A
Rated operating voltage:	24 VDC ±10% (PELV) supply unit to EN 60204 (power drop > 20 ms)
Operating current:	400 mA max. + 0.5 A (OSSD load + output signal quality load)
Wave length of the sensor:	880 nm
Safety outputs (OSSD1, OSSD2):	2 x PNP-type semi-conductor, short-circuit proof
Switching voltage HIGH[1]:	15 … 28,8 V
Switching voltage LOW[1]:	0 … 2 V
Switching current:	0 … 500 mA
Leakage current[2]:	1 mA
Load capacity:	2 µF
Load inductance:	2 H
Admissible conduction resistance between OSSD and load:	2.5 Ω
Supply cable:	1 Ω
Contactor control (EDM)	
Input voltage HIGH (inactive):	17 … 29 V
Input voltage LOW (active):	0 … 2,5 V
Input current HIGH:	3 … 10 mA
Input current LOW:	0 … 2 mA
Input restart interlock (manual reset)	
Input voltage HIGH (active):	17 … 29 V
Input voltage LOW (inactive):	0 … 2,5 V
Input current HIGH:	3 … 10 mA
Input current LOW:	0 … 3 mA
Function:	Protective mode, start and restart interlock, contactor control, Beam blanking fixed and floating, cascaded version

Signal times

Contactor control:	50 … 500 ms, einstellbar
Restart interlock (manual reset):	50 ms … 1,0 s, signal transmission in case of trailing edge
Start interlock:	250 … 1500 ms, adjustable
LED indications transmitter:	Transmitting, status
LED indications receiver:	OSSD ON, OSSD OFF, restart, signal reception, blanking, multifunction
Connection:	Stand alone, M12 connector plug with metal thread, Receiver 8-pole, Emitter 4-pole, Cascading: M12 connector plug with metal thread, id. to stand-alone
Ambient temperature:	−10° C … + 50° C
Storage temperature:	−25° C … + 70° C
Interface:	Diagnostics and function setting
Protection class:	IP67 (IEC 60529)
Resistance to vibrations:	10 … 55 Hz to IEC 60068-2-6
Resistance to shock:	10 g; 16 ms; to IEC 60068-2-29
Year of construction:	as of 2010 version 1.0

[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.

2.6 Response time (reaction time)

Standard version
The response time depends on the hight of the protected field, the resolution, the number of light beams and the beam coding.

Resolution 14 mm				
Protection field height [mm]	Beams [Number]	Response time [ms]	Response time with beam coding A [ms]	Weight [kg]
170	16	10	15	0.9
250	24	10	15	1.2
330	32	10	15	1.5
410	40	10	15	1.8
490	48	10	15	2.0
570	56	20	27	2.3
650	64	20	27	2.5
730	72	20	27	2.8
810	80	20	27	3.1
890	88	20	27	3.4
970	96	20	27	3.6
1050	104	20	27	3.9
1130	112	20	27	4.2
1210	120	20	27	4.5
1290	128	20	27	4.7
1370	136	20	27	5.0
1450	144	20	27	5.2

Resolution 30 mm				
Protection field height [mm]	Beams [Number]	Response time [ms]	Response time with beam coding A [ms]	Weight [kg]
170	8	10	15	0.9
250	12	10	15	1.2
330	16	10	15	1.5
410	20	10	15	1.8
490	24	10	15	2.0
570	28	10	15	2.3
650	32	10	15	2.5
730	36	10	15	2.8
810	40	10	15	3.1
890	44	10	15	3.4
970	48	10	15	3.6
1050	52	20	27	3.9
1130	56	20	27	4.2
1210	60	20	27	4.5
1290	64	20	27	4.7
1370	68	20	27	5.0
1450	72	20	27	5.2
1530	76	20	27	5.5
1610	80	20	27	5.8
1690	84	20	27	6.1
1770	88	20	27	6.3

Resolution 50 mm				
Protection field height [mm]	Beams [Number]	Response time [ms]	Response time with beam coding A [ms]	Weight [kg]
170	4	10	15	0.9
250	6	10	15	1.2
330	8	10	15	1.5
410	10	10	15	1.8
490	12	10	15	2.0
570	14	10	15	2.3
650	16	10	15	2.5
730	18	10	15	2.8
810	20	10	15	3.1
890	22	10	15	3.4
970	24	10	15	3.6
1050	26	10	15	3.9
1130	28	10	15	4.2
1210	30	10	15	4.5
1290	32	10	15	4.7
1370	34	10	15	5.0
1450	36	10	15	5.2
1530	38	10	15	5.5
1610	40	10	15	5.8
1690	42	10	15	6.1
1770	44	10	15	6.3

Master / Slave version

In cascaded systems, the response time is registered on the type plate of the corresponding master system. The response time for cascaded systems can be found in the following table:

Master Number of beams	Slave Number of beams	Response time [ms]
> 48	< 48	30
> 48	> 48	37
< 48	> 48	37
< 48	< 48	20
Base system:	without beam coding A	
Extension:	with beam coding A	

2.7 Effective resolution

The effective resolution in case of activated blanking of floating beams can be found in the following table:

Blanked beams	Physical resolution	Effective resolution
1	14	24
2	14	34
3	14	44
4	14	54
5	14	64
6	14	74
7	14	84
8	14	94

Blanked beams	Physical resolution	Effective resolution
1	30	45
2	30	65
3	30	85
4	30	105

Blanked beams	Physical resolution	Effective resolution
1	50	85
2	50	125
3	50	165
4	50	205

2.8 Safety classification

Standards:	EN ISO 13849-1, EN 62061
PL:	up to e
Control category:	up to 4
PFH value:	7.42 x 10^{-9} / h
SIL:	up to 3
Service life:	20 years

2.9 Functions

The system consists of a receiver and a transmitter. For the described functions, no further switching elements are required. For the diagnostics and function selection, a user-friendly PC-software is offered as accessory.
For the connection to a PC, the NSR-0801 BUS converter is required (not included in delivery).

The system has the following features:
• Protective mode (automatic start after release of the protected field)
• Start interlock
• Restart interlock (manual reset)
• Contactor control EDM
• Beam coding
• Blanking of fixed protection field areas
• Blanking of movable protection field areas
• Cascading

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	not active	External wiring
Restart interlock (manual reset)	not active	External wiring
Blanking fixed/variable	not active	With BUS converter NSR-0801 and PC-software
Contactor control (EDM)	not active	With BUS converter NSR-0801 and PC-software
Start interlock	not active	With BUS converter NSR-0801 and PC-software
Beam coding	not active	With BUS converter NSR-0801 and PC-software

2.9.1 Protective mode

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

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

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

2.9.2 Restart interlock (manual reset)

The restart interlock 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).

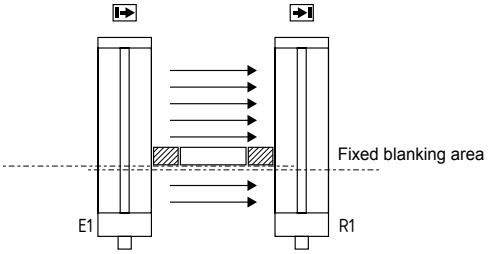
The command devices (enabling button) must be installed outside of the hazardous area. The operator must have a clear view on the hazardous area when actuating the enabling button.

In supply condition, the restart interlock (manual reset) neither the protective mode is active. You must choose one of both operating modes to enable the OSSD outputs. If no type of protection is selected, you will obtain the following signalisation through the LED status indication in the receiver:
LED OSSD OFF (red) + LED restart (yellow) flashing

2.9.3 Fixed blanking

The SLC 420 can blank stationary parts in the protection field.

Multiple protection field areas can be blanked. If small changes are made within the fixed blanking area, each time 1 beam can be additionnally blanked to increase the tolerance. Refer to the chapter Variable blanking



The range of the fixed blanking can be arbitrarily chosen in the protection field.
The first beam line, which realises the optical synchronisation and is located immediately behind the diagnostic window, cannot be blanked.

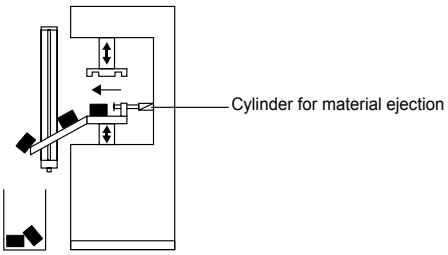
The area of the fixed blanking must not be modified after the teach-in process. Any change of the area or removal of the part from the protection field will be detected by the system. As a result, the outputs are disabled (locked). This locking can be neutralised by executing a new teach-in process in accordance with the actual beam interruptions.

The function is activated by means of the NSR-0801 BUS converter and a PC or laptop. The activation of the function is signaled by the LED blanking flashing in the diagnostic window of the receiver.

- The remaining lateral areas must be protected against intrusion by means of mechanical covers.
- The lateral covers must be fixed with the object.
- Partial covers are not authorised.
- After the fixed blanking, the protection field must be tested by means of the test rod.
- The restart interlock function of the safety light curtain or the machine must be activated.

2.9.4 Floating blanking

The SLC 420 can blank movable parts in the protection field.



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.

The SLC 420 can blank one or more beams in the protection field. A combination of fixed and variable blanking is possible.

This function allows for an interruption of the protection height without the outputs being disabled in case of material movement in the protection field, e.g. material ejection or process-controlled material movement. This extension of the object detection increases the resolution. In this way, the physical resolution changes into an effective resolution. This effective resolution must be used to calculate the safety distance. This effective resolution must be used to calculate the safety distance. Use formula (2) to calculate the safety distance with the effective resolution if a maximum of 1 light beams are blanked; use formula (2) indicated in the "Safety distance" chapter if more than 3 light beams are blanked.
The number of beams to be blanked is limited by the software.

In a system with a 14 mm physical resolution, the effective resolution is increased to 2 mm in case of a variable blanking of 34 beams. The effective resolution must be registered permanently and clearly visible onto the label affixed to the receiver.

The function is activated by means of the NSR-0801 BUS converter and a PC or laptop. The activation of the function is signaled by the LED blanking flashing in the diagnostic window of the receiver.

Perform a new calculation of the safety distance with the effective resolution. Adjust the safety distance in accordance with your calculation!

The standard IEC/TS 62046 includes information, which describes possibly required additional measures to prevent a person from reaching a hazard through the blanking areas of a protection field.

2.9.5 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 relays are detected, e.g. contact welding or contact spring breakage. If the light curtain detects a malfunctioning of the switching elements, the outputs are locked, i.e. after elimination of the failure, a Power Reset is required. **The auxiliary contacts must only be connected, when the function is activated!**
After fault rectification, the operating voltage must be once switched off and back on (power reset).

The contactor control is not activated upon delivery. This function is activated by means of the NSR-0801 BUS converter and a PC or laptop.

Activation of the contactor control (EDM) without software
The contactor control can be activated without PC software as of firmware version 1.23, by means of cable bridges (refer to wiring diagram).

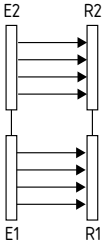
2.9.6 Start interlock
The start interlock prevents an automatic start of the machine when the supply voltage is switched on. After enabling of the start interlock - by the one-time interruption of the protection field -, this protective function is deactivated until the next power reset.

The start interlock is not activated upon delivery. This function is activated by means of the NSR-0801 BUS converter and a PC or laptop.

2.10 Testing
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 not interrupted, the system switches to the ON condition. In case of an error, the outputs at the receiver do not switch to the ON state. The LED OSSD OFF starts flashing, thus emitting an error message. Further indications can be found in the chapter Fault diagnostic.

During operation, the system continuously executes a self-test. Safety-relevant faults are detected within the cycle time and cause the outputs to be switched off.

2.11 Cascading
The SLC 420 (master version) can be extended with an additional light curtain (slave) for applications with protection against stepping behind or for different monitoring ranges.

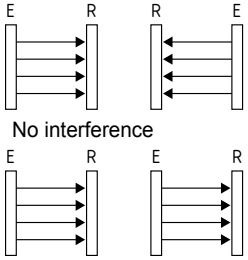


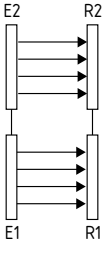
Legend
E1 = transmitter (Master) without beam coding A
E2 = transmitter (Slave) with beam coding A
R1 = receiver (Master) without beam coding A
R2 = receiver (Slave) with beam coding A

- A cascaded system features the same system properties as a basic system (stand-alone).
- The cascading is possible up to max. 144 lines. The resolution (14 mm/30 mm/50 mm) can be arbitrarily chosen between the master and slave.
- The connection of the master to the slave is realised with the pre-wired cable KA-0810 (transmitter) and KA-0901 (receiver).

2.12 Beam coding
The beam coding of the safety light curtain 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 is not active. With beam coding A, a receiver can distinguish the beams of the transmitter with the same beam coding, which are destined to this particular receiver, from foreign beams. The beam coding A must be set for each sensor (receiver and transmitter) individually. The function is activated by means of the NSR-0801 BUS converter and a PC or laptop.

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





- The beam coding increases the safety and avoids mutual interference of adjacent systems.
- The beam coding increases the immunity against optical interference (e.g. sun light, welding sparks).
- The beam coding A is activated in the extension (cascading) (supply condition).
- 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 response time of the system is increased when beam coding A is used. To this end, the safety distance must be adjusted to the hazardous movement. Refer to chapter Response time.

3. Mounting

3.1 General conditions

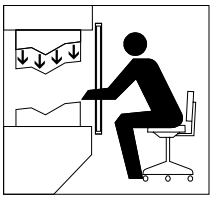
The following guidelines are provided as a preventative warning notice to ensure safe and appropriate handling. These guidelines are an essential part of the safety instructions and therefore must always be observed and respected.

- The SLC must not be used on machines, which can be stopped electrically in case of emergency.
- The safety distance between the SLC 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 SLC 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.
- For cascaded systems, the correct combination of transmitters and receivers always must be taken into consideration. An incorrect installation can lead to non-detected areas.
- 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 occuring on the application/machine.
- The safety inspections must be conducted regularly.
- The SLC 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.

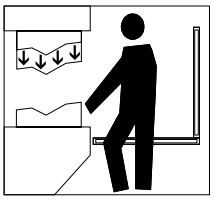
3.2 Protection field and approach

The protection field of the SLC consists of the entire range located between the protection field markings of transmitter and receiver. Additional protective devices must ensure that the operator has to pass by the protection field to reach the hazardous machine parts.
The SLC 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

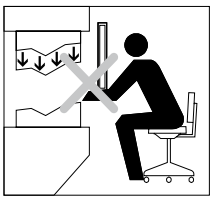


Hazardous machine parts can only be reached after passing through the protection field.

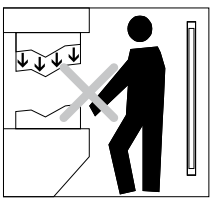


The presence of staff members between the protection field and hazardous machine parts must be prevented/avoided (protection against stepping over).

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

Procedure:

1. The transmitter and the receiver must be fitted parallel to each other and at the same height.
2. Turn the transmitter and monitor the diagnostic window of the receiver. Fix the light curtain, when the LED OSSD ON (green) is on and the LED signal reception (orange) is off.
3. Determine the max. rotating angle to the left and to the right, at which the LED OSSD ON (green) is on and tighten the mounting screws in central position. Make sure that the LED signal reception (orange) is not on or flashing.

3.4 Safety distance

The safety distance is the minimum distance between the protection field of the safety light curtain and the hazardous area. The safety distance must be observed to ensure that the hazardous area cannot be reached before the hazardous movement has come to standstill.

Calculation of the safety distance to EN ISO 13855 (successor of EN 999) and EN ISO 13857

The safety distance depends on the following elements:

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

Safety light curtain SLC 420
The safety distance for resolutions 14 mm up to 40 mm is calculated by means of the following formula:

(1) S = 2000 mm/s * T + 8 (d - 14) [mm]

S = Safety distance [mm]
T = Total reaction time (machine stopping time, reaction time of the safety guard, relays, etc.)
d = Resolution of the safety light curtain

The approach speed is covered with a value of 2000 mm/s

If value S <= 500 mm after the calculation of the safety distance, then use this value.
If value S >= 500 mm, recalculate the distance:

(2) S = 1600 mm/s * T + 8 (d - 14) [mm]

If the new value S > 500 mm, use this value as safety distance.
If the new value S < 500 mm, use a minimum distance of 500 mm.

Example:
Reaction time of the safety light curtain = 10 ms
Resolution of the safety light curtain = 14 mm
Stopping time of the machine = 330 ms

S = 2000 mm/s * (330 ms + 10 ms) + 8(14 mm - 14 mm)
S = 680 mm
S = > 500 mm, therefore new calculation with V = 1600 mm/s
S = 544 mm

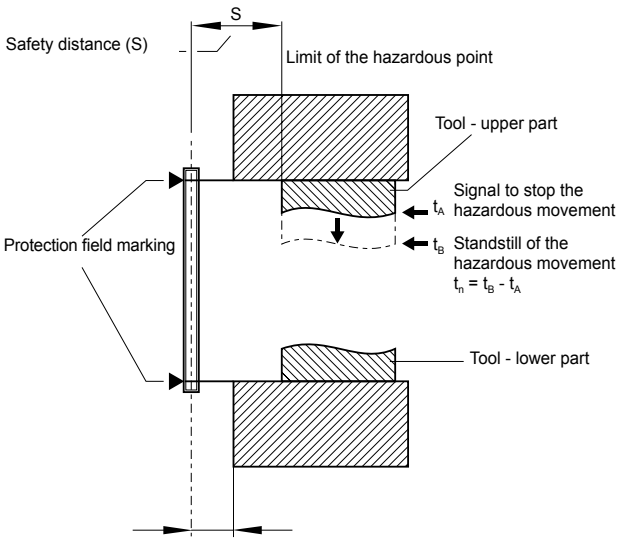
The safety distance for resolution 50 mm is calculated by means of the following formula:

(3) S = (1600 mm/s * T) + 850 mm

S = Safety distance [mm]
T = Stopping time of the machine + reaction time of the safety light curtain
K = Approach speed 1600 mm/s
C = Safety supplement 850 mm

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

Safety distance to the hazardous area

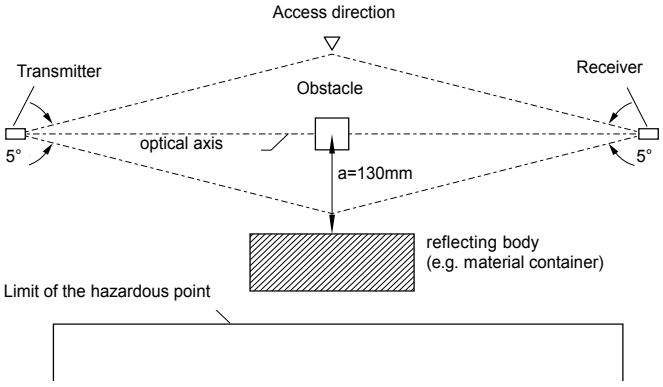


≤ 75 mm = max. distance for protection against stepping over
To prevent persons from stepping over the protection field this dimension must be imperatively respected and observed.

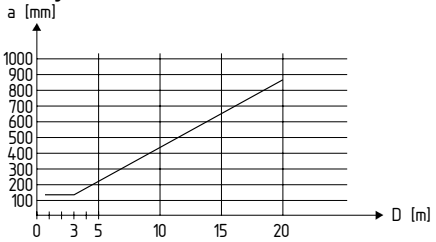
The formulae and calculation examples are related to the vertical set-up (refer to drawing) of the light curtain with regard to the hazardous point. Please observe the applicable harmonised EN standards and possible applicable national regulations.

The successor standards of the EN 999 for calculating the minimum distances of the safety guards with regard to the hazardous point are EN ISO 13855 and EN ISO 13857.

3.4.1 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 ± 2.5° degrees or use the value from the table below:

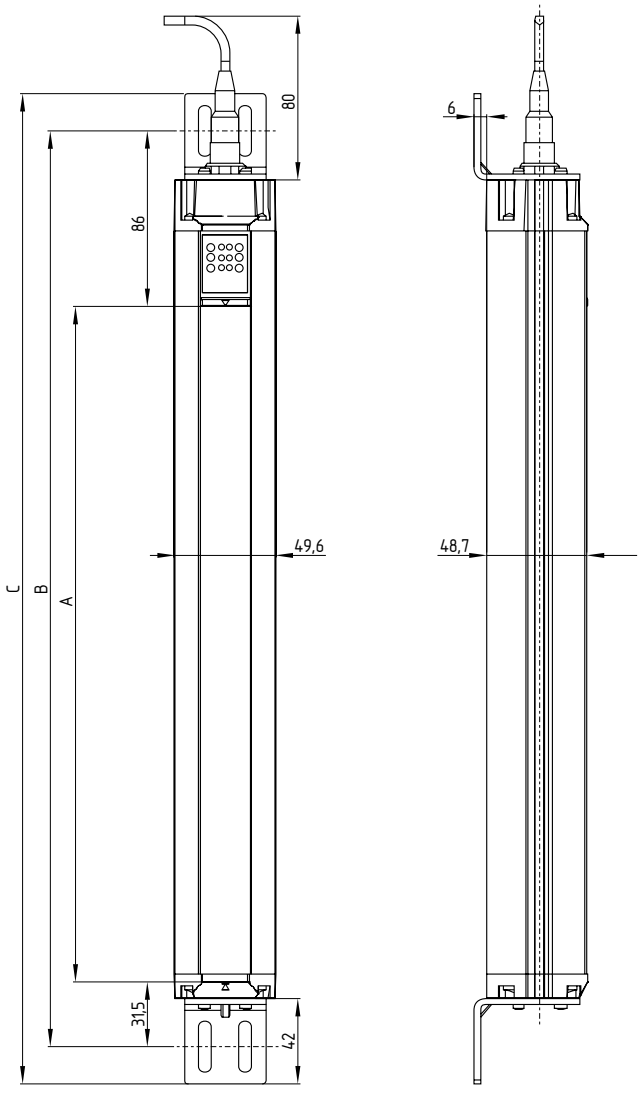
Distance between transmitter and receiver [m]	Minimum distance a [mm]
0.2 … 3.0	130
4	175
5	220
7	310
10	440
15	660

Formula: a = tan 2.5° x L [mm]

a = Minimum distance to reflecting surfaces
L = Distance between transmitter and receiver

3.5 Dimensions

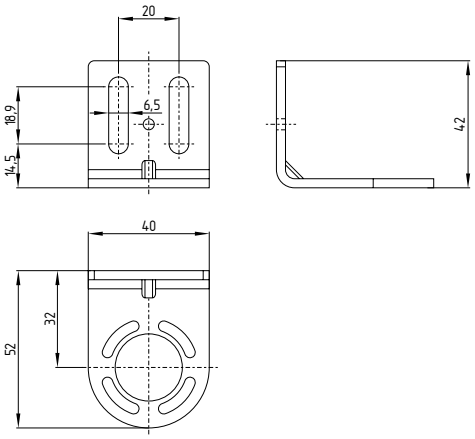
All measurements in mm.



Type	A Protected height	B Mounting dimension	C Total lenght
SLC 420-E/R0170-XX-RFB	170 ± 0.1	288 ± 1	324 ± 1
SLC 420-E/R0250-XX-RFB	250 ± 0.1	368 ± 1	404 ± 1
SLC 420-E/R0330-XX-RFB	330 ± 0.1	448 ± 1	484 ± 1
SLC 420-E/R0410-XX-RFB	410 ± 0.1	528 ± 1	564 ± 1
SLC 420-E/R0490-XX-RFB	490 ± 0.1	608 ± 1	644 ± 1
SLC 420-E/R0570-XX-RFB	570 ± 0.1	688 ± 1	724 ± 1
SLC 420-E/R0650-XX-RFB	650 ± 0.1	768 ± 1	804 ± 1
SLC 420-E/R0730-XX-RFB	730 ± 0.1	848 ± 1	884 ± 1
SLC 420-E/R0810-XX-RFB	810 ± 0.1	928 ± 1	964 ± 1
SLC 420-E/R0890-XX-RFB	890 ± 0.1	1008 ± 1	1044 ± 1
SLC 420-E/R0970-XX-RFB	970 ± 0.1	1088 ± 1	1124 ± 1
SLC 420-E/R1050-XX-RFB	1050 ± 0.1	1168 ± 1	1204 ± 1
SLC 420-E/R1130-XX-RFB	1130 ± 0.1	1248 ± 1	1284 ± 1
SLC 420-E/R1210-XX-RFB	1210 ± 0.1	1328 ± 1	1364 ± 1
SLC 420-E/R1290-XX-RFB	1290 ± 0.1	1408 ± 1	1444 ± 1
SLC 420-E/R1370-XX-RFB	1370 ± 0.1	1488 ± 1	1524 ± 1
SLC 420-E/R1450-XX-RFB	1450 ± 0.1	1568 ± 1	1604 ± 1
SLC 420-E/R1530-XX-RFB	1530 ± 0.1	1648 ± 1	1684 ± 1
SLC 420-E/R1610-XX-RFB	1610 ± 0.1	1728 ± 1	1764 ± 1
SLC 420-E/R1690-XX-RFB	1690 ± 0.1	1808 ± 1	1844 ± 1
SLC 420-E/R1770-XX-RFB	1770 ± 0.1	1888 ± 1	1924 ± 1

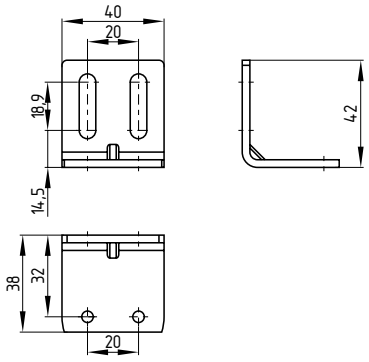
Mounting kit MS-1030

The mounting kit consists of 4 steel angles and 16 fixing screws.



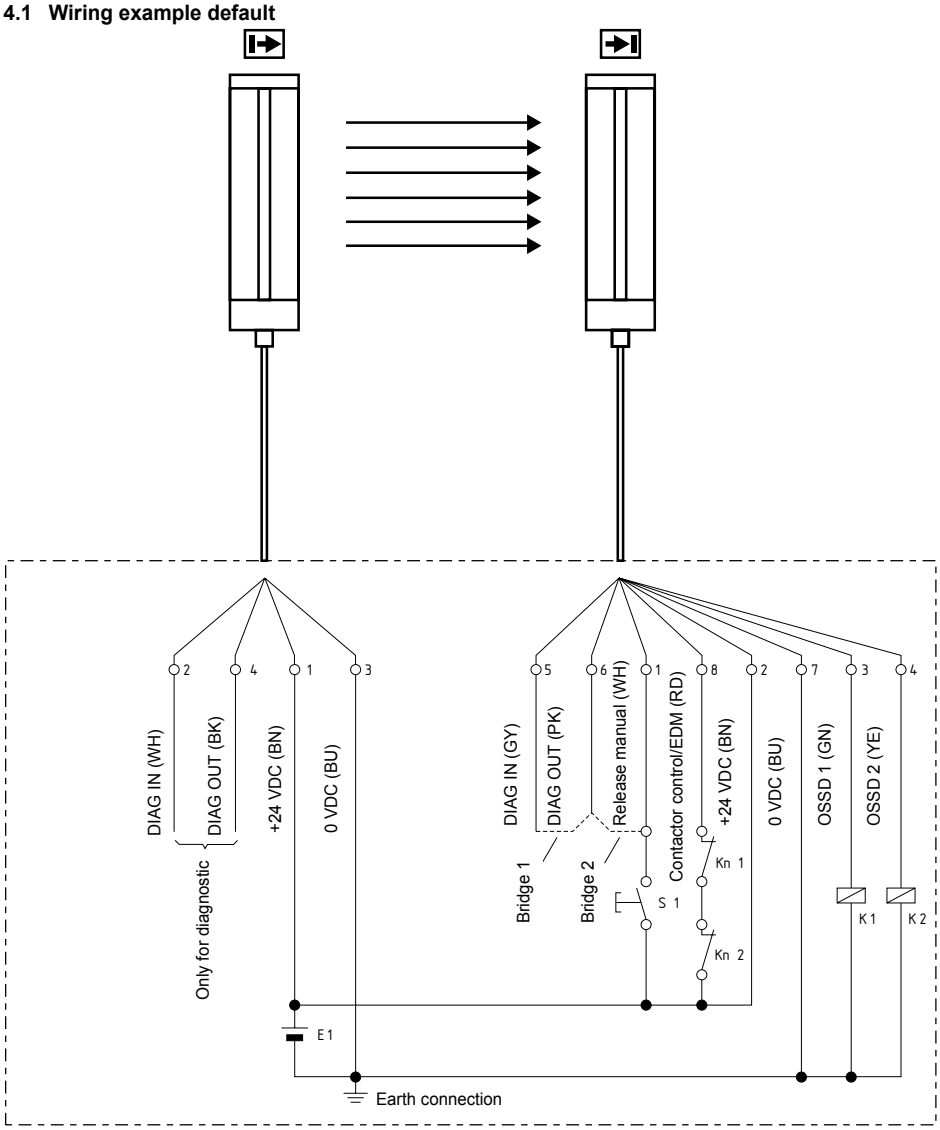
Centre fixing MS-1051 (optional accessory)

Mounting kit consists of 2 steel angles, 4 screws and 4 T-slot nuts for central fixing



4. Electrical connection

4.1 Wiring example default



Restart interlock (manual reset) (bridge 1)
By bridging DIAG IN (pin 5) and DIAG OUT (pin 6), the restart interlock is activated.

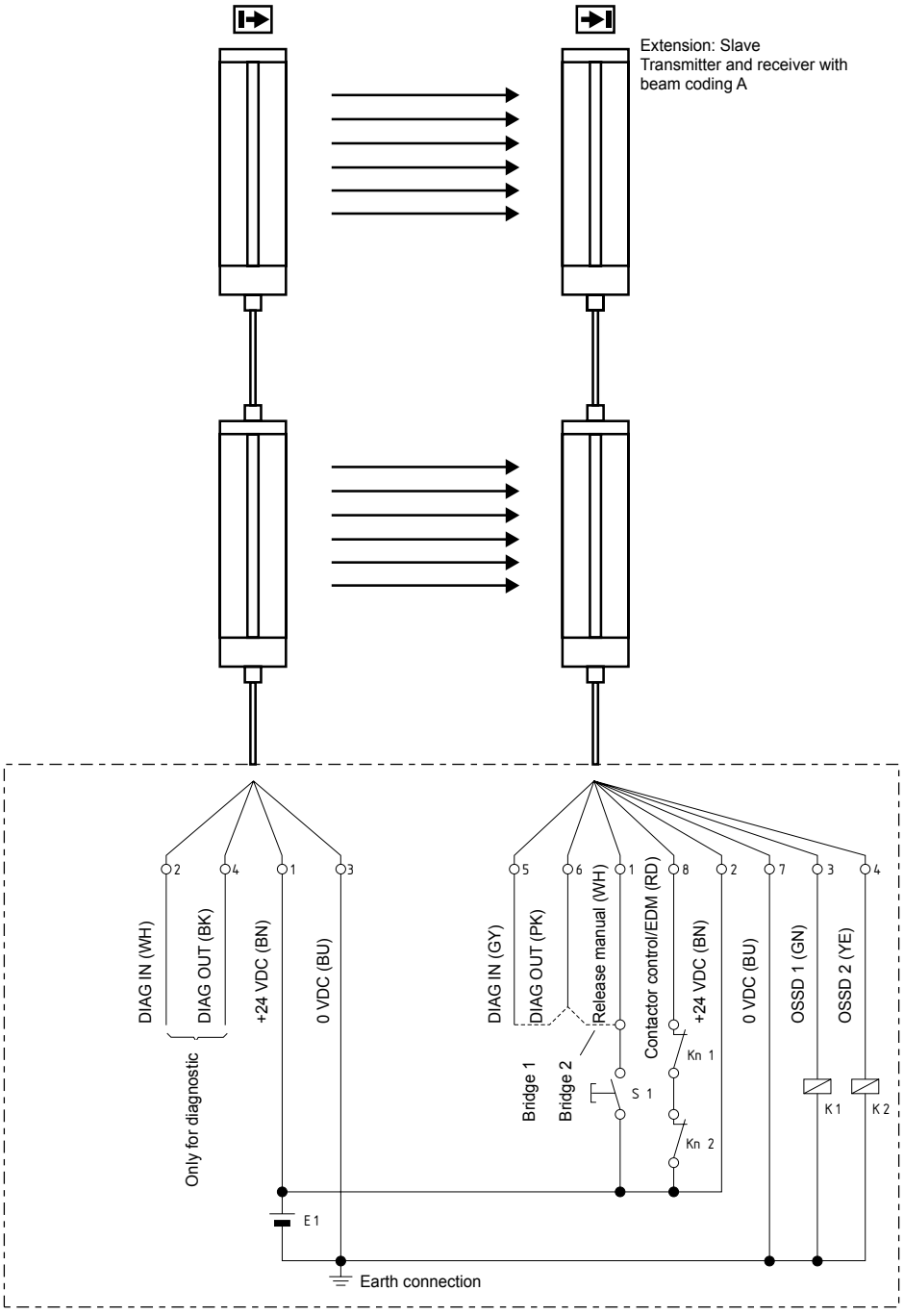
Protective mode (bridge 2)
By bridging DIAG OUT (pin 6) and authorised operation (pin 1), the protective mode is activated. Do not connect S1.

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 function is activated
S1: Command device for restart (optional)
E1: Power supply 24 VDC ± 10%

To ensure correct functionality, an operating mode (restart interlock or protective mode) must be selected.

Upon delivery, the "contactor control" function is deactivated. The function is activated by means of the NSR0801 BUS converter and the PC software.

4.2 Wiring example Master/Slave



Restart interlock (manual reset) (bridge 1)
By bridging DIAG IN (pin 5) and DIAG OUT (pin 6), the restart interlock is activated.

Protective mode (bridge 2)
By bridging DIAG OUT (pin 6) and authorised operation (pin 1), the protective mode is activated. Do not 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 function is activated
S1: Command device for restart (optional)
E1: Power supply 24 VDC ± 10%

To ensure correct functionality, an operating mode (restart interlock or protective mode) must be selected.

Upon delivery, the "contactor control" function is deactivated. The function is activated by means of the NSR0801 BUS converter and the PC software.

4.3 Activation of the contactor control (EDM) without software

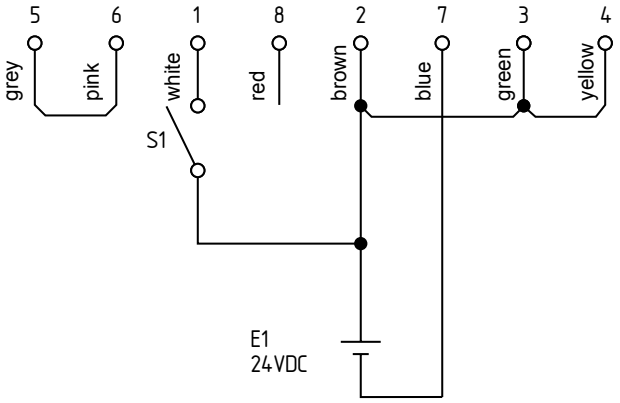
The contactor control can be activated without PC software as of firmware version 1.23 in diagnostic mode by means of cable bridges (refer to wiring diagram).

To activate the EDM function without PC software, proceed in the following way:

Establish the connections in accordance with the wiring diagram, see below, with two cable bridges

Both outputs OSSD1 and OSSD2 of the light curtain must be separated from the machine control.

1) Wire OSSD 1 + 2 to 24 V (pin 2 + 3 + 4)
2) Wire DIAG_IN to DIAG_OUT (pin 5 + 6)
3) Wire S1 or enabling button WA between pin1 and pin2



Execute the parameter assignment according to the following instructions:

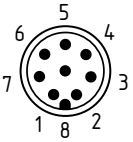
1. Power ON
2. The light curtain detects faults and the EDM programming mode is activated.
3. Red LED flashes for 10 seconds at 2 Hz and blue LED shows during this period of time the current EDM state (supply state: OFF = EDM not active).
4. The EDM programming is realised, when at the same time three impulses are emitted by button S1 at 24V. Impulse duration ON time > 200 ms, OFF time > 200 ms
5. A successful EDM programming is confirmed by the green LED flashing three times (1Hz). During this time, the blue LED shows the new EDM state (ON = EDM active). After that, the OSSD fault mode of the light curtain is activated. The red LED flashes four times. If the EDM programming was not successfull or timed out, the OSSD fault mode of the light curtain is immediately activated. The red LED flashes four times.
6. Power OFF
7. Remove cable bridges PIN 2 + 3 + 4 and if necessary cable bridge PIN 5 + 6
8. Wire OSSD 1 + 2 (pin 3 + 4)
9. Power ON

To reverse the EDM function, repeat the procedure step 2...7. If the programming was not successful, the procedure can also be repeated. The state of the EDM function is shown in diagnostic mode through the blue LED (ON = EDM active).

Both outputs OSSD1 and OSSD2 must be separated from the machine control.
An EDM function, which is deactivated by means of the PC software, can not be activated in this way.

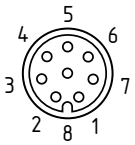
4.4 Connector configuration Receiver, Transmitter & Cable

RECEIVER
SLC: connector
male M12 / 8 pole

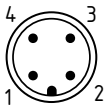


		Signal Designation	Description
1	WH	Restart	Input
2	BN	24 VDC	Power supply
3	GN	OSSD 1	Safety output 1
4	YE	OSSD 2	Safety output 2
5	GY	Diagnostic IN	Input diagnostic data
6	PK	Diagnostic OUT	Output diagnostic data
7	BU	0 VDC	Power supply
8	RD	Contactor control EDM	Input

Cable: Connector
female M12 / 8 pole

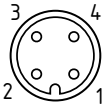


TRANSMITTER
SLC: Connector
male M12 / 4 pol.



		Signal Designation	Description
1	BN	24 VDC	Power supply
2	WH	Diagnostic IN	Input diagnostic data
3	BU	0 VDC	Power supply
4	BK	Diagnostic OUT	Output diagnostic data

Cable: Connector
female M12 / 4 pole



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

Master/slave systems have the same connector configuration!

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, 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 SLC.
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 curtain 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 SLC 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 SLC 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. After that, the outputs are enabled (if the protection field is not interrupted). The LED "OSSD ON" of 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 SLC 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 SLC 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 SLC.
4. The staff remains within the detection area, when works are conducted on hazardous machinery parts.
5. The safety distance of the application exceed the mathematically calculated one.

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

6. Hazardous machine parts do not move when the protection field is interrupted.
7. 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.
8. No hazardous machine movement when the test rod is within the protection field.
9. The hazardous machine movement comes to standstill, when the voltage supply of the SLC 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 SLC 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.

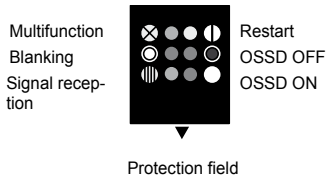
5.5 Cleaning

If the optics cover of the sensors is extremely soiled, the OSSD outputs can be disabled. Clean with a soft cloth without exercising pressure. The use of agressive, abrasive or scratching cleaning agents, which could attack the surface, is prohibited.

6. Diagnostic

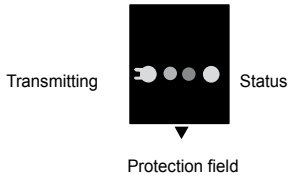
6.1 LED status information

Receiver



Function	LED colour	Description
Multifunction	green	Function display, beam coding
Blanking	blue	Protection field(s) inactive (blanking)
Signal reception	orange	Safety-monitoring module of signal reception
Restart	yellow	Input for command device
OSSD OFF	red	Safety outputs signal condition OFF
OSSD ON	green	Safety outputs signal condition ON

Transmitter



Function	LED colour	Description
Transmitting	orange	Transmitter active
Status	green	Function display, beam coding

Receiver LED	Status LED	Description
OSSD ON	ON	Protection field clear
	Flashing	Diagnostic mode active
OSSD OFF	ON	Protection field interrupted, system or configuration error
	Flashing	Diagnostic mode active, error output refer to Fault diagnostic table
Restart	ON	Start or restart interlock (manual reset) active, signal expected at output WA
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
Blanking	1 flash	Fixed blanking of the protection field(s)
	2 flashes	Floating blanking, max. 1 beam
	3 flashes	Variable blanking, more beams
	4 flashes	Floating (max. 1 beam) and fixed blanking of protection field(s)
	5 flashes	Variable (multiple beams) and fixed blanking of protection field(s)
Multifunction	Flashing	Beam coding A is active

Transmitter		
LED	Status LED	Description
Transmitting	ON	Standard operation, transmitter active
	Flashing	Configuration error
Status	Flashing	Beam coding A is active

6.2 Fault diagnostic

The light curtain performs an internal self-test after the operating voltage is switched on and the protection field is enabled. When a fault is detected, a corresponding flashing pattern is emitted at the receiver through the LED OSSD OFF (red). Every fault emission is followed by a one-second pause.

LED OSSD OFF	Fault feature	Action
OSSD OFF and LED restart continuous flashing	Wiring error for function selection (Restart interlock, automatic mode)	Check connection at the receiver, bridge 1 or bridge 2 must be wired (refer to Wiring)
1 flash	Error at sensor receiver	Replace receiver
2 flashes	Error contactor control OFF	Check connections at contactor control input, refer to Wiring, check wiring of the auxiliary contacts
3 flashes	Error contactor control ON	Check wiring at contactor control input, short-circuit at +UB and mass. Power reset after fault rectification.
4 flashes	Errors at the OSSD outputs	Check the wiring of the outputs, OSSD for short-circuit at +UB and mass
5 flashes	Error configuration data	Check components in case of cascading, check configuration settings by means of the NSR-0801 BUS converter
6 flashes	Error blanking	The receiver has detected blanked beams as beams without interruption, i.e. locking. Check the configuration settings by means of the NSR-0801 BUS converter, repeat the teach process with blanking.

6.3 Extended diagnostic

By means of the optional SLC 420 configuration software and the NSR-0801 BUS converter, an extended diagnostic can be executed. The software provides the status information of the component and can represent the individual light lines. This feature enables an optimal adjustment of the light curtain. The diagnostic mode is signalled by the OSSD ON and OSSD OFF LED's at the receiver. In diagnostic mode, protective mode is disabled, the ODDS outputs being locked. The change from diagnostic mode to protective mode is automatically realised after Power Reset, when the BUS converter is no longer integrated and the connecting cable of the sensor is reconnected.

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
Industrielle Sicherheitsschaltsysteme
Möddinghofe 30
D-42279 Wuppertal
Tel:+49 (0) 202 64 74 -0
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:
Safety Control GmbH
Am Industriepark 11
D-84453 Mühldorf/ Inn
Tel.: +49 (0) 8631-18796-0
Fax: +49 (0) 8631-18796-1

8.2 EC Declaration of conformity

SCHMERSAL safety control

EC Declaration of conformity

Translation of the original declaration of conformity

Safety Control GmbH
Am Industriepark 33
84453 Mühldorf / Inn
Germany

We hereby certify that the hereafter described safety components both in its basic design and construction conform to the applicable European Directives.

Name of the safety component / type:	SLC 420
Description of the safety component:	Safety light curtain
Harmonised EC-Directives:	2006/42/EC EC-Machinery Directive 2004/108/EC EMC-Directive
Applied standards:	EN 61496-1:2004 + A1 2008 CLC/TS 61496-2:2006 EN ISO 13849-1:2008; PL e EN 62061:2005; SIL 3
Person authorised for the compilation of the technical documentation:	Ulrich Loss Möddinghofe 30 42279 Wuppertal
Notified body for the prototype test:	TÜV Nord Cert GmbH Langemarckstr.20 45141 Essen ID n°: 0044
EC-prototype test certificate:	n° 44 205 10 555867 005
Place and date of issue:	Wuppertal, February 1, 2010

Authorised signature
Christian Spranger
Managing Director

Authorised signature
Klaus Schuster
Managing Director

SLC 420-B-EN

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

Safety Control GmbH
Am Industriepark 33
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