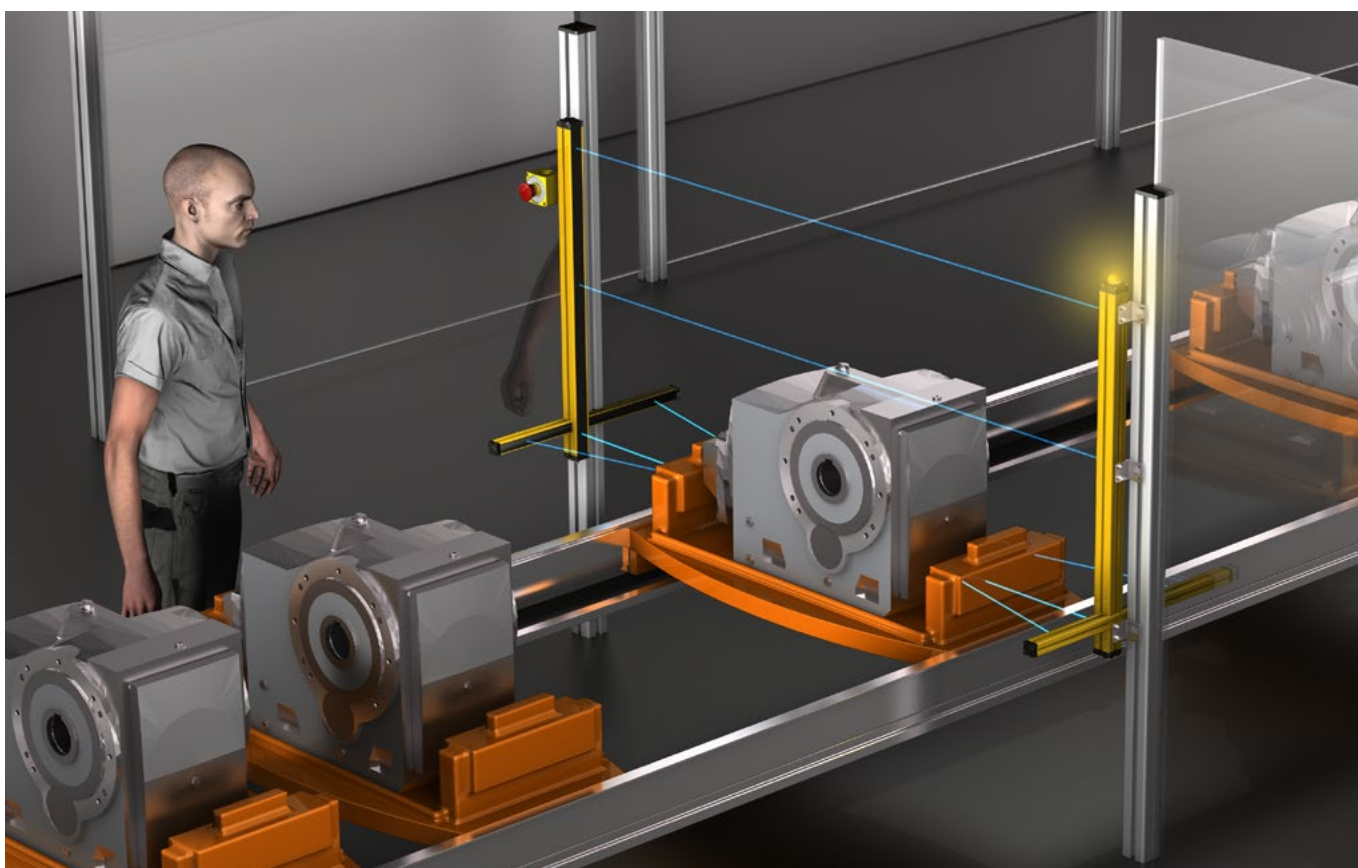


SENSORS
IMAGE PROCESSING AND
IDENTIFICATION SYSTEMS
SAFETY TECHNOLOGY
LIGHTING
ACCESSORIES

Opto-electronic safety sensors

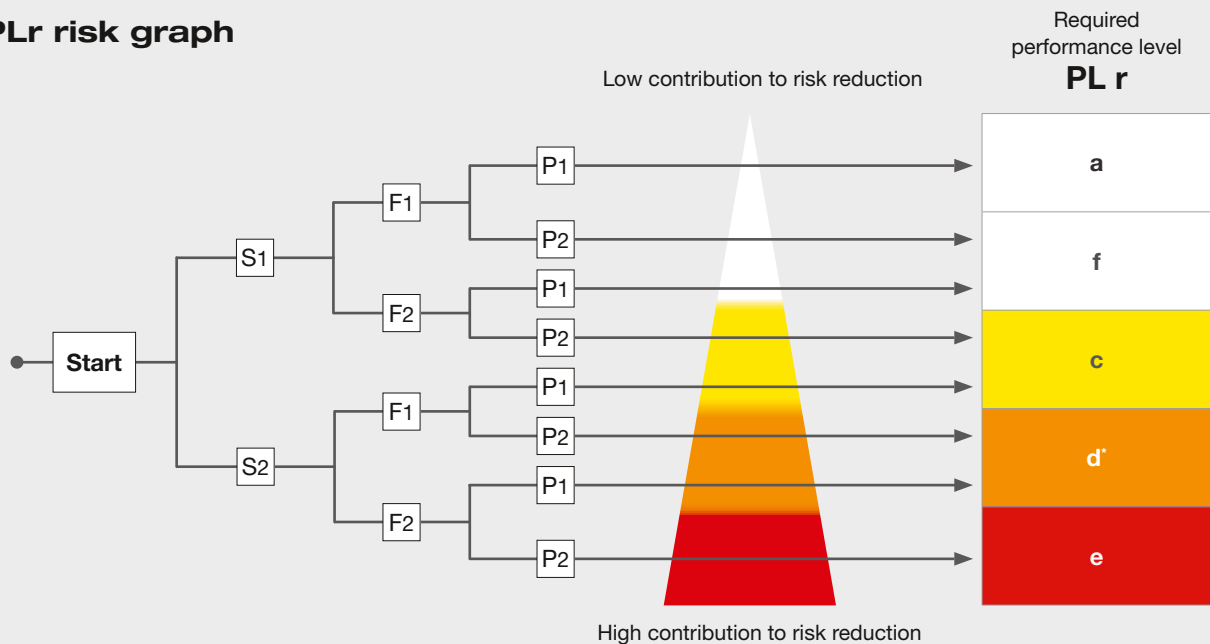


Our opto-electronic safety sensors are used as electro-sensitive protective equipment where danger zones and hazard areas must be reliably and cost-efficiently safeguarded. The large product range also includes robust and resilient variants for technical safety integration up to the highest level of safety.



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MA.../MZ Muting Arms	174

PLr risk graph



* If a required performance level PL **d** is necessary, light barriers with a **Type 4** safety level must be used!

S Injury severity level

- S1** Minor injury (usually reversible)
- S2** Serious injury (usually irreversible) or death

F Frequency and/or duration of the exposure to the hazard

- F1** Seldom/short
- F2** Continuous/prolonged

P Possibility of hazard prevention or limitation of harm

- P1** Possible under certain conditions
- P2** Virtually impossible

→ **Note:** The PLr values are entirely "hierarchical". PLr(e) provides the largest and PLr(a) provides the smallest contribution for risk reduction.

Directives and standards for PL e

Safety light curtains / grids

Type 4 / Type 4 in accordance with IEC/TS 61496-2
SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061

PL e – Cat. 4 in accordance with ISO 13849-1

Corresponds to the following directives and standards:

- **2006/42/EG** „Machinery Directive“
- **2014/30/EU** „EMC Directive / Directive relating to electromagnetic compatibility“
- **2014/35/EU** „Low Voltage Directive“
- **2011/65/EU** „RoHS Directive“
- **IEC/EN 61496-1** Edition 2.1, **IEC/TS 61496-2** Edition 2 „Electro-sensitive protective equipment“
- **EN ISO 13849-1** „Safety of machinery – Safety-related parts of control systems – General principles for design“
- **IEC/EN 62061 ed. 1 ; am1** „Sof machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems“
- **IEC 61508-1, -2, -3, -4 ed.2** „Functional safety of safety-related electrical, electronic and programmable electronic systems“
- **EN 50178: 1997** „Electronic equipment for use in power installations“
- **EN 55022: 2010** „Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement“
- **EN 61000-6-2: 2005** „Electromagnetic compatibility (EMV) - Part 6-2: Generic standards – Immunity for industrial environments“
- **UL (C+US)** for Canada and the USA
- **ANSI / UL 1998** „Safety software in programmable components“

Safety level

TYPE 4

SIL 3 – SILCL 3
PL e – Cat. 4



SELECTION GUIDE FOR SAFETY LIGHT CURTAINS/GRIDS

It is helpful to divide the application of safety light curtains / grids into four groups:



Detection of a finger



Detection of a body in the danger zone



Detection of a finger



Detection of a body during access control

 Finger protection	SLB4-...	SLI4-...
Light barrier type	Light curtain	
Safety level	Type 4 SIL 3 – SILCL 3 PL e – Cat. 4	
Resolution	14 mm	
Protective field height	160 - 1,810 mm	
Maximum range	6 m	
Start / restart interlock integrated	-	✓
EDM integrated	-	✓
Master/slave versions	-	✓ (Slave / Slave 2)

 Hand protection	SLB4-...	SLBH4-...	SLI4-...	SLIH4-...	SLM4-...
Light barrier type	Light curtain				Light curtain with muting lamp
Safety level	Type 4 SIL 3 – SILCL 3 PL e – Cat. 4				
Resolution	20 - 30 - 40 mm				30 mm
Protective field height	160 - 1,810 mm				310 - 2,260 mm
Maximum range	12 m	20 m	12 m	20 m	12 m
Start / restart interlock integrated	-	-	✓	✓	✓
EDM integrated	-	-	✓	✓	✓
Master/slave versions	-	-	✓ (Slave / Slave 2)	-	-

 Body protection	SLB4-...	SLBH4-...	SLI4-...	SLIH4-...
Light barrier type	Light curtain			
Safety level	Type 4 SIL 3 – SILCL 3 PL e – Cat. 4			
Resolution	50 - 90 mm			
Protective field height	160 - 1,810 mm			
Maximum range	12 m	20 m	12 m	20 m
Start / restart interlock integrated	-	-	✓	✓
EDM integrated	-	-	✓	✓
Master/slave versions	-	-	✓ (Slave / Slave 2)	-

 Access control	SLB4-xB	SLBH4-xB	SLI4-xB	SLIH4-xB	SLM4-...
Light barrier type	Light grids				Light grid with muting lamp
Safety level	Type 4 SIL 3 – SILCL 3 PL e – Cat. 4				
Number of beams	2 - 3 - 4				
Beam separation (axis distance)	300 - 400 - 500 mm				
Protective field height	510 - 810 - 910 mm				-
Maximum range	12 m	20 m	12 m	20 m	12 m
Start / restart interlock integrated	-	-	✓	✓	✓
EDM integrated	-	-	✓	✓	✓
Master/slave versions	-	-	✓ (Slave / Slave 2)	-	-

Glossary

Start / restart interlock:

Locking function when the machine is started or restarted (manual confirmation required).

EDM- External Device Monitoring:

Monitoring of the external switch protection devices using a feedback input.

Master/slave:

Two or three light curtains / grids can be switched in series;
all outputs are managed by only one light curtain/grid (master).

SL-4 SAFETY LIGHT CURTAINS/GRIDS, TYPE 4

With safety level type 4, these safety light curtains / grids cover the highest safety level for finger, hand and body protection or in access control. The compact, slim devices can also be installed in confined space conditions. The master/slave variants as well as a version with integrated control function (EDM) are available as options.



Technical data (typ.)	+20°C, 24 VDC
Safety level	Type 4 in accordance with IEC/TS 61496-2 SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061 PL e – Cat. 4 in accordance with ISO 13849-1
Profile cross section	28x30mm
Safety outputs	PNP (2x), 400mA, 24V DC
LED displays	Self-diagnostics Status
Start / restart	Automatic
Service voltage	19.2 to 28.8V DC
Master connection	M12, 5-pin M12, 8-pin (receiver) (SLB... and SLI...)
Length of connection cable	max. 100m unshielded
Ambient temperature	-20 to +55 °C
Protection class	IP 65 + IP 67
Protection class	III, operation on protective low voltage
Housing material	Aluminum
Window material	Polycarbonate
Mounting	Rear side, T-groove, or by the use of adjustable brackets SFB E180 (optional)

Resolution / beam separation							Number of beams							Protective field height (mm)							Total height (mm)							Response time (ms)							Connection cable (optionally available)							Product description						
SL-4 Safety Light Curtain / Grid														SLB4							SLBH4							SLI4							SLIH4													
Special feature														For external safety functions														Integrated safety functions																				
Range														up to 6 m														up to 6 m																				
	Finger protection 14 mm	15	160	213	4	Transmitter CD...	SLB4-151		SLI4-151 ¹⁾																																							
		30	310	363	5.5		SLB4-301		SLI4-301 ¹⁾																																							
		45	460	513	7.5		SLB4-451		SLI4-451 ¹⁾																																							
		60	610	663	9		SLB4-601		SLI4-601 ¹⁾																																							
		75	760	813	11		SLB4-751		SLI4-751 ¹⁾																																							
		90	910	963	13		SLB4-901		SLI4-901 ¹⁾																																							
		105	1,060	1,113	14.5	Receiver CD... / SLI... : C8D	SLB4-1051		SLI4-1051 ¹⁾																																							
		120	1,210	1,263	16.5		SLB4-1201		SLI4-1201 ¹⁾																																							
		135	1,360	1,413	18		SLB4-1351		SLI4-1351 ¹⁾																																							
		150	1,510	1,563	20		SLB4-1501		SLI4-1501 ¹⁾																																							
		165	1,660	1,713	22		SLB4-1651		SLI4-1651 ¹⁾																																							
		180	1,810	1,886	23.5		SLB4-1801		SLI4-1801 ¹⁾																																							

¹⁾ see "Note", page 168

Resolution / beam separation											
Number of beams											
Protective field height (mm)											
Total height (mm)											
Response time (ms)											
Connection cable (optionally available)											
Product description											
SL-4 Safety Light Curtain /Grid											
SLB4											
SLBH4											
SLI4											
SLIH4											
Special feature											
For external safety functions											
Integrated safety functions											
Range											
up to 12 m											
up to 20 m											
up to 12 m											
up to 20 m											
	Hand protection 20mm	15	160	213	4	Transmitter CD ...	Receiver CD ... / C8D				
		30	310	363	5.5						
		45	460	513	7.5						
		60	610	663	9						
		75	760	813	11						
		90	910	963	13						
		105	1,060	1,113	14.5						
		120	1,210	1,263	16.5						
		135	1,360	1,413	18						
		150	1,510	1,563	20						
		165	1,660	1,713	22						
		180	1,810	1,886	23.5						
Range											
up to 12 m											
up to 20 m											
up to 12 m											
up to 20 m											
	Hand protection 30mm	8	160	213	4	Transmitter CD ...	Receiver CD ... / C8D	SLB4-153		SLI4-153 ¹⁾	
		13	260	313	5			SLB4-253		SLI4-253 ¹⁾	
		16	310	363	5.4			SLB4-303		SLI4-303 ¹⁾	
		23	460	513	7.5			SLB4-453		SLI4-453 ¹⁾	
		31	610	663	9			SLB4-603		SLI4-603 ¹⁾	
		38	760	813	10.5			SLB4-753		SLI4-753 ¹⁾	
		46	910	963	12.5			SLB4-903		SLI4-903 ¹⁾	
		53	1,060	1,113	14			SLB4-1053		SLI4-1053 ¹⁾	
		61	1,210	1,263	15.5			SLB4-1203		SLI4-1203 ¹⁾	
		68	1,360	1,413	17			SLB4-1353		SLI4-1353 ¹⁾	
		76	1,510	1,563	19			SLB4-1503		SLI4-1503 ¹⁾	
		88	1,660	1,713	20.5			SLB4-1653		SLI4-1653 ¹⁾	
91	1,810	1,886	22	SLB4-1803		SLI4-1803 ¹⁾					
Range											
up to 12 m											
up to 20 m											
up to 12 m											
up to 20 m											
	Hand protection 30mm	8	160	213	3	Transmitter CD ...	Receiver CD ... / C8D				
		16	310	363	4						
		23	460	513	5						
		31	610	663	6						
		38	760	813	6.5						
		46	910	963	7.5						
		53	1,060	1,113	8.5						
		61	1,210	1,263	9.5						
		68	1,360	1,413	10						
		76	1,510	1,563	11						
		88	1,660	1,713	12						
		91	1,810	1,886	13						

¹⁾ see "Note", page 168

Resolution / beam separation												Number of beams												Protective field height (mm)												Total height (mm)												Response time (ms)												Connection cable (optionally available)												Product description											
SL-4 Safety Light Curtain / Grid																								SLB4						SLBH4						SLI4						SLIH4																																									
Special feature																								For external safety functions												Integrated safety functions																																															
Range																								up to 12 m						up to 20 m						up to 12 m						up to 20 m																																									
	Hand protection 40mm	6	160	213	3.5	Transmitter CD ...	SLB4-154												SLI4-154 ¹⁾																																																																
		8	260	313	4		SLB4-254												SLI4-254 ¹⁾																																																																
		11	310	363	4.5		SLB4-304												SLI4-304 ¹⁾																																																																
		16	460	513	5.5		SLB4-454												SLI4-454 ¹⁾																																																																
		21	610	663	7		SLB4-604												SLI4-604 ¹⁾																																																																
		26	760	813	8		SLB4-754												SLI4-754 ¹⁾																																																																
		31	910	963	9		SLB4-904												SLI4-904 ¹⁾																																																																
		36	1,060	1,113	10		Receiver CD ... / C8D	SLB4-1054												SLI4-1054 ¹⁾																																																															
		41	1,210	1,263	11			SLB4-1204												SLI4-1204 ¹⁾																																																															
		46	1,360	1,413	12.5			SLB4-1354												SLI4-1354 ¹⁾																																																															
		51	1,510	1,563	13.5			SLB4-1504												SLI4-1504 ¹⁾																																																															
		56	1,660	1,713	14.5			SLB4-1654												SLI4-1654 ¹⁾																																																															
		61	1,810	1,886	15.5			SLB4-1804												SLI4-1804 ¹⁾																																																															
Range																								up to 12 m						up to 20 m						up to 12 m						up to 20 m																																									
	Hand protection 40mm	6	160	213	3	Transmitter CD ...							SLBH4-154												SLIH4-154 ¹⁾																																																										
		11	310	363	3.5								SLBH4-304												SLIH4-304 ¹⁾																																																										
		16	460	513	4								SLBH4-454												SLIH4-454 ¹⁾																																																										
		21	610	663	4.5								SLBH4-604												SLIH4-604 ¹⁾																																																										
		26	760	813	5								SLBH4-754												SLIH4-754 ¹⁾																																																										
		31	910	963	6								SLBH4-904												SLIH4-904 ¹⁾																																																										
		36	1,060	1,113	6.5								SLBH4-1054												SLIH4-1054 ¹⁾																																																										
		41	1,210	1,263	7								SLBH4-1204												SLIH4-1204 ¹⁾																																																										
		46	1,360	1,413	7.5								SLBH4-1354												SLIH4-1354 ¹⁾																																																										
		51	1,510	1,563	8								SLBH4-1504												SLIH4-1504 ¹⁾																																																										
		56	1,660	1,713	8.5								SLBH4-1654												SLIH4-1654 ¹⁾																																																										
		61	1,810	1,886	9.5								SLBH4-1804												SLIH4-1804 ¹⁾																																																										

Resolution / beam separation											
Number of beams											
Protective field height (mm)											
Total height (mm)											
Response time (ms)											
Connection cable (optionally available)											
Product description											
SL-4 Safety Light Curtain /Grid											
SLB4											
SLBH4											
SLI4											
SLIH4											
Special feature											
For external safety functions											
Integrated safety functions											
Range											
	Hand protection 50 mm	4	160	213	3	Transmitter CD ...	SLB4-155		SLI4-155 ¹⁾		
		8	310	363	4		SLB4-305		SLI4-305 ¹⁾		
		12	460	513	4.5		SLB4-455		SLI4-455 ¹⁾		
		16	610	663	5.5		SLB4-605		SLI4-605 ¹⁾		
		20	760	813	6.5		SLB4-755		SLI4-755 ¹⁾		
		24	910	963	7.5		SLB4-905		SLI4-905 ¹⁾		
		28	1,060	1,113	8.5		SLB4-1055		SLI4-1055 ¹⁾		
		32	1,210	1,263	9		SLB4-1205		SLI4-1205 ¹⁾		
		36	1,360	1,413	10		SLB4-1355		SLI4-1355 ¹⁾		
		40	1,510	1,563	11		SLB4-1505		SLI4-1505 ¹⁾		
		44	1,660	1,713	12		SLB4-1655		SLI4-1655 ¹⁾		
		48	1,810	1,886	13		SLB4-1805		SLI4-1805 ¹⁾		
Range											
	Hand protection 50 mm	4	160	213	2.5	Transmitter CD ...		SLBH4-155		SLIH4-155 ¹⁾	
		8	310	363	3			SLBH4-305		SLIH4-305 ¹⁾	
		12	460	513	3.5			SLBH4-455		SLIH4-455 ¹⁾	
		16	610	663	4			SLBH4-605		SLIH4-605 ¹⁾	
		20	760	813	4.5			SLBH4-755		SLIH4-755 ¹⁾	
		24	910	963	5			SLBH4-905		SLIH4-905 ¹⁾	
		28	1,060	1,113	5.5			SLBH4-1055		SLIH4-1055 ¹⁾	
		32	1,210	1,263	6			SLBH4-1205		SLIH4-1205 ¹⁾	
		36	1,360	1,413	6.5			SLBH4-1355		SLIH4-1355 ¹⁾	
		40	1,510	1,563	7			SLBH4-1505		SLIH4-1505 ¹⁾	
		44	1,660	1,713	7			SLBH4-1655		SLIH4-1655 ¹⁾	
		48	1,810	1,886	8			SLBH4-1805		SLIH4-1805 ¹⁾	
Range											
	Body protection 90 mm	4	310	363	3	Transmitter CD ...	SLB4-309		SLI4-309 ¹⁾		
		6	460	513	3.5		SLB4-459		SLI4-459 ¹⁾		
		8	610	663	4		SLB4-609		SLI4-609 ¹⁾		
		10	760	813	4.5		SLB4-759		SLI4-759 ¹⁾		
		12	910	963	5		SLB4-909		SLI4-909 ¹⁾		
		14	1,060	1,113	5.5		SLB4-1059		SLI4-1059 ¹⁾		
		16	1,210	1,263	5.5		SLB4-1209		SLI4-1209 ¹⁾		
		18	1360	1,413	6		SLB4-1359		SLI4-1359 ¹⁾		
		20	1,510	1,563	6.5		SLB4-1509		SLI4-1509 ¹⁾		
		22	1,660	1,713	7		SLB4-1659		SLI4-1659 ¹⁾		
		24	1,810	1,886	7.5		SLB4-1809		SLI4-1809 ¹⁾		

¹⁾ see "Note", page 168

Resolution / beam separation							Number of beams							Protective field height (mm)							Total height (mm)							Response time (ms)							Connection cable (optionally available)							Product description						
SL-4 Safety Light Curtain/Grid														SLB4							SLBH4							SLI4							SLIH4													
Special feature														For external safety functions							Integrated safety functions																											
Range														up to 12 m							up to 20 m							up to 12 m							up to 20 m													
	Body protection 90 mm	4	310	363	2.5	Transmitter CD ... Receiver CD ... / C8D								SLBH4-309							SLIH4-309 ¹⁾																											
		6	460	513	3									SLBH4-459							SLIH4-459 ¹⁾																											
		8	610	663	3									SLBH4-609							SLIH4-609 ¹⁾																											
		10	760	813	3.5									SLBH4-759							SLIH4-759 ¹⁾																											
		12	910	963	3.5									SLBH4-909							SLIH4-909 ¹⁾																											
		14	1,060	1,113	3.5									SLBH4-1059							SLIH4-1059 ¹⁾																											
		16	1,210	1,263	4									SLBH4-1209							SLIH4-1209 ¹⁾																											
		18	1,360	1,413	4									SLBH4-1359							SLIH4-1359 ¹⁾																											
		20	1,510	1,563	4.5									SLBH4-1509							SLIH4-1509 ¹⁾																											
		22	1,660	1,713	4.5									SLBH4-1659							SLIH4-1659 ¹⁾																											
		24	1,810	1,886	5									SLBH4-1809							SLIH4-1809 ¹⁾																											
Range														up to 12 m							up to 20 m							up to 12 m							up to 20 m													
	500	2	510	653	2.5	Transmitter CD ... Receiver CD ... / SLI... : C8D	SLB4-2B														SLI4-2B ¹⁾																											
	400	3	810	953	3		SLB4-3B														SLI4-3B ¹⁾																											
	300	4	910	1,053	3		SLB4-4B														SLI4-4B ¹⁾																											
	500	2	510	653	2.5	Transmitter CD ... Receiver CD ... / SLI... : C8D								SLBH4-2B														SLIH4-2B ¹⁾																				
	400	3	810	953	2.5									SLBH4-3B														SLIH4-3B ¹⁾																				
	300	4	910	1,053	2.5									SLBH4-4B														SLIH4-4B ¹⁾																				

¹⁾ see "Note", page 168**Note**¹⁾ Light curtains / grids are also available as a variant in a protective housing.

SLI ... -WTF (IP 69K)

SLI ... -WTHF (IP 69K, heated)

SL-4 Master/slave models with integrated control functions

Technical data (typ.)	+20 °C, 24 VDC
Safety level	Type 4 in accordance with IEC/TS 61496-2 SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061 PL e – Cat. 4 in accordance with ISO 13849-1
Profile cross section	28x30mm
Safety outputs (master)	PNP (2x), 400 mA, 24 V DC
LED displays	Self-diagnostics Status
Start / restart (master)	Automatic or manual (selectable)
External relay (device) monitoring - EDM (master models)	Feedback input, selectable release
Service voltage	19.2 to 28.8V DC
Master connection	M12, 5-pin (transmitter) M12, 8-pin (receiver)
Master / slave 2 / slave connection	M12, 5-pin (transmitter and receiver)
Length of connection cable	max. 100m unshielded
Length of connection cable	max. 50m unshielded (between master/slave)
Ambient temperature	-20to +55 °C
Protection class	IP 65 + IP 67
Protection class	III, operation on protective low voltage
Housing material	Aluminum
Window material	Polycarbonate
Mounting	Rear side, T-groove, or by the use of adjustable brackets SFB E180 (optional)

		Resolution / beam separation	Number of beams (mm)	Protective field height (mm)	Master / slave 2 (mm)	Slave (mm)	Total height	Conf. range			
									Low Range to (m)	High Range to (m)	Product description
SL-4 Safety Light Curtain / Grid									Master	Slave	Slave 2
	Finger protection 14mm	15	160	-	213	3	6		SLI4-151-M	SLI4-151-S	
		30	310	387	363				SLI4-301-M	SLI4-301-S	SLI4-301-S2
		45	460	537	513				SLI4-451-M	SLI4-451-S	SLI4-451-S2
		60	610	687	663				SLI4-601-M	SLI4-601-S	SLI4-601-S2
		75	760	837	813				SLI4-751-M	SLI4-751-S	SLI4-751-S2
		90	910	987	963				SLI4-901-M	SLI4-901-S	SLI4-901-S2
		105	1,060	1,137	1,113				SLI4-1051-M	SLI4-1051-S	SLI4-1051-S2
		120	1,210	1,287	1,263				SLI4-1201-M	SLI4-1201-S	SLI4-1201-S2
		135	1,360	1,437	1,413				SLI4-1351-M	SLI4-1351-S	SLI4-1351-S2
		150	1,510	1,587	1,563				SLI4-1501-M	SLI4-1501-S	SLI4-1501-S2
		165	1,660	1,737	1,713				SLI4-1651-M	SLI4-1651-S	SLI4-1651-S2
		180	1,810	1,910	1,886				SLI4-1801-M	SLI4-1801-S	SLI4-1801-S2
	Hand protection 30mm	8	160	-	213	4	12			SLI4-153-S	
		13	260	337	313				SLI4-253-M	SLI4-253-S	SLI4-253-S2
		16	310	387	363				SLI4-303-M	SLI4-303-S	SLI4-303-S2
		23	460	537	513				SLI4-453-M	SLI4-453-S	SLI4-453-S2
		31	610	687	663				SLI4-603-M	SLI4-603-S	SLI4-603-S2
		38	760	837	813				SLI4-753-M	SLI4-753-S	SLI4-753-S2
		46	910	987	963				SLI4-903-M	SLI4-903-S	SLI4-903-S2
		53	1,060	1,137	1,113				SLI4-1053-M	SLI4-1053-S	SLI4-1053-S2
		61	1,210	1,287	1,263				SLI4-1203-M	SLI4-1203-S	SLI4-1203-S2
		68	1,360	1,437	1,413				SLI4-1353-M	SLI4-1353-S	SLI4-1353-S2
		76	1,510	1,587	1,563				SLI4-1503-M	SLI4-1503-S	SLI4-1503-S2
		88	1,660	1,737	1,713				SLI4-1653-M	SLI4-1653-S	SLI4-1653-S2
		91	1,810	1,910	1,886				SLI4-1803-M	SLI4-1803-S	SLI4-1803-S2

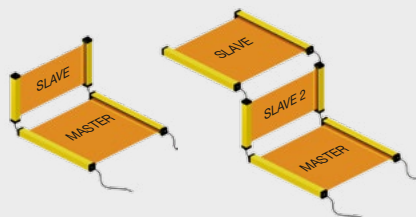
		Total height				Conf. range				
		Resolution / beam separation	Number of beams (mm)	Protective field height (mm)	Master / slave 2 (mm)	Slave (mm)	Low Range to (m)	High Range to (m)	Product description	
SL-4 Safety Light Curtain /Grid								Master	Slave	Slave 2
	Hand protection 40mm	6	160	-	213	4	12		SLI4-154-S	
		8	260	337	313			SLI4-254-M	SLI4-254-S	SLI4-254-S2
		11	310	387	363			SLI4-304-M	SLI4-304-S	SLI4-304-S2
		16	460	537	513			SLI4-454-M	SLI4-454-S	SLI4-454-S2
		21	610	687	663			SLI4-604-M	SLI4-604-S	SLI4-604-S2
		26	760	837	813			SLI4-754-M	SLI4-754-S	SLI4-754-S2
		31	910	987	963			SLI4-904-M	SLI4-904-S	SLI4-904-S2
		36	1,060	1,137	1,113			SLI4-1054-M	SLI4-1054-S	SLI4-1054-S2
		41	1,210	1,287	1,263			SLI4-1204-M	SLI4-1204-S	SLI4-1204-S2
		46	1,360	1,437	1,413			SLI4-1354-M	SLI4-1354-S	SLI4-1354-S2
		51	1,510	1,587	1,563			SLI4-1504-M	SLI4-1504-S	SLI4-1504-S2
		56	1,660	1,737	1,713			SLI4-1654-M	SLI4-1654-S	SLI4-1654-S2
		61	1,810	1,910	1,886			SLI4-1804-M	SLI4-1804-S	SLI4-1804-S2
	Body protection 50mm	4	160	-	213	4	12		SLI4-155-S	
		8	310	387	363			SLI4-305-M	SLI4-305-S	SLI4-305-S2
		12	460	537	513			SLI4-455-M	SLI4-455-S	SLI4-455-S2
		16	610	687	663			SLI4-605-M	SLI4-605-S	SLI4-605-S2
		20	760	837	813			SLI4-755-M	SLI4-755-S	SLI4-755-S2
		24	910	987	963			SLI4-905-M	SLI4-905-S	SLI4-905-S2
		28	1,060	1,137	1,113			SLI4-1055-M	SLI4-1055-S	SLI4-1055-S2
		32	1,210	1,287	1,263			SLI4-1205-M	SLI4-1205-S	SLI4-1205-S2
		36	1,360	1,437	1,413			SLI4-1355-M	SLI4-1355-S	SLI4-1355-S2
		40	1,510	1,587	1,563			SLI4-1505-M	SLI4-1505-S	SLI4-1505-S2
		44	1,660	1,737	1,713			SLI4-1655-M	SLI4-1655-S	SLI4-1655-S2
		48	1,810	1,910	1,886			SLI4-1805-M	SLI4-1805-S	SLI4-1805-S2
	Body protection 90mm	4	310	387	363	4	12	SLI4-309-M	SLI4-309-S	SLI4-309-S2
		6	460	537	513			SLI4-459-M	SLI4-459-S	SLI4-459-S2
		8	610	687	663			SLI4-609-M	SLI4-609-S	SLI4-609-S2
		10	760	837	813			SLI4-759-M	SLI4-759-S	SLI4-759-S2
		12	910	987	963			SLI4-909-M	SLI4-909-S	SLI4-909-S2
		14	1,060	1,137	1,113			SLI4-1059-M	SLI4-1059-S	SLI4-1059-S2
		16	1,210	1,287	1,263			SLI4-1209-M	SLI4-1209-S	SLI4-1209-S2
		18	1,360	1,437	1,413			SLI4-1359-M	SLI4-1359-S	SLI4-1359-S2
		20	1,510	1,587	1,563			SLI4-1509-M	SLI4-1509-S	SLI4-1509-S2
		22	1,660	1,737	1,713			SLI4-1659-M	SLI4-1659-S	SLI4-1659-S2
		24	1,810	1,910	1,886			SLI4-1809-M	SLI4-1809-S	SLI4-1809-S2
		Beams 2-3-4 	500	2	510			677	653	4
400	3		810	977	953	SLI4-3B-M	SLI4-3B-S	SLI4-3B-S2		
300	4		910	1,077	1,053	SLI4-4B-M	SLI4-4B-S	SLI4-4B-S2		

Function of master/slave models

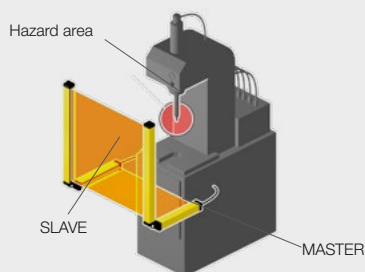
The master/slave model makes it possible to switch up to three light curtains / grids in series and to have combined detection of hands and body, or to simultaneously monitor various sides of the machine. With the following critical advantages:

- Only one pair of safety outputs
- No interference between light barriers installed in adjacent spaces

Examples for series connection of master/slave models

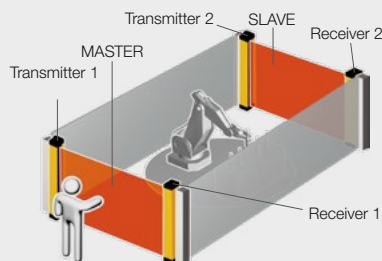


It is possible to connect any master model to any slave model. All electrical connections are designed with 5-pin M12 connectors, with the exception of the master receiver, which requires an 8-pin M12 connector. For the connection between master and slave, cables prefabricated with 2 connectors are available (see page 186).



The master is positioned horizontally for the detection of a body, while the vertical slave takes over the detection of hands. You can also turn the connection and position the master vertically for the protection of hands and the slave horizontally for the detection of the body. The application pictured here is among the most common: Horizontal safety light curtains / grids are used for preventing the operator from going undetected if he or she remains between the vertical light curtain/grid and the dangerous machine when turning it on or restarting it.

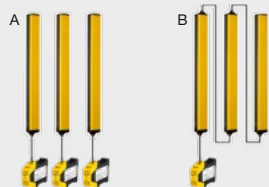
Example of series connection of master/slave models for protecting two sides of a machine



In the case of safety light curtains / grids SLI, a (non-shielded) standard cable is used for the connection between master and slave. It can have a length of up to 50 meters (see page 186).

This property allows for the use of 2 light curtains / grids switched in series, whereby one of them is positioned at the front and the other at the rear side of the machine, with only one connection for the power supply and the control circuit of the machine. Up to 3 safety light curtains / grids switched in series are possible.

Advantage when using master/slave series connections



A schematic of the series connection:
For three standard light curtains / grids, 3 safety modules or 6 relays have to be used and cabled.

B For the master/slave solution with 3 light curtains / grids switched in series, it is possible to use and cable only 1 safety module or 2 relays.

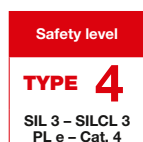
Formulas for calculating the total response time in the case of master/slave series connections SLI4-....:

For a resolution of 14 mm	Master + Slave	$t_{\text{tot}} = [0.06 \times (\text{No.}_{\text{Master}} + \text{No.}_{\text{Slave}}) + 0.9636] \times 2$
	Master + Slave 2 + Slave	$t_{\text{tot}} = [0.06 \times (\text{No.}_{\text{Master}} + \text{No.}_{\text{Slave 2}} + \text{No.}_{\text{Slave}}) + 1.0036] \times 2$
For all other resolutions or beam separations	Master + Slave	$t_{\text{tot}} = [0.11 \times (\text{No.}_{\text{Master}} + \text{No.}_{\text{Slave}}) + 0.9376] \times 2$
	Master + Slave 2 + Slave	$t_{\text{tot}} = [0.11 \times (\text{No.}_{\text{Master}} + \text{No.}_{\text{Slave 2}} + \text{No.}_{\text{Slave}}) + 1.0508] \times 2$

Key t_{tot} = Total response time No. = Number of beams for the selected model

SLM4 – MUTING SAFETY LIGHT CURTAINS/GRIDS, TYPE 4

Type4 Muting SLM4 safety light curtains / grids meet the requirements for the highest safety level Type 4 and permanent personal protection is ensured with unhindered material feed. Additional external muting sensors can be connected to devices with integrated muting function. Ready-to-install muting arms can be added to the modular system.



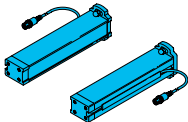
Technical data (typ.)	+20 °C, 24 VDC
Safety level	Type 4 in accordance with TS 61496-2 SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061 PL e – Cat. 4 in accordance with ISO 13849-1
Profile cross section	50x55 mm
Safety outputs	PNP (2x), 400mA, 24 V DC
LED displays	Self-diagnostics Status
Start / restart	Automatic or manual (selectable)
External device (relay) monitoring - EDM	Feedback input, selectable release
Service voltage	19.2 to 28.8 V DC
Connection (transmitter)	M12, 5-pin (main plug) M12, 5-pin (2x, muting sensors)
Connection (receiver)	M12, 12-pin (main plug) M12, 5-pin (2x, muting sensors) M12, 5-pin (muting light SLM4, SLM4O) configuration M12, 5-pin (configuration SLM4PO)
Length of connection cable	max. 100m unshielded
Ambient temperature	-30 to +55 °C
Protection class	IP 65 + IP 67
Protection class	III, operation on protective low voltage
Housing material	Aluminum
Window material	Polycarbonate
Mounting	T-groove (mounting bracket in scope of delivery)

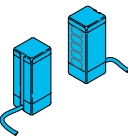
MA.../MZ MUTING ARMS

The muting arms MA .../MZ can be directly mounted on and connected to the safety light grids/curtains SLM4. Multiple muting functions can be implemented thanks to simple hardware wiring. Even perforated objects, such as pallets, can be detected with the MZ multibeam light barriers.

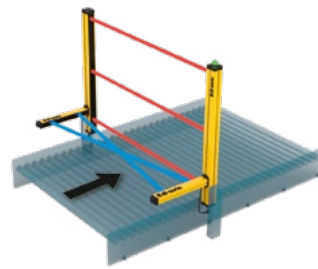
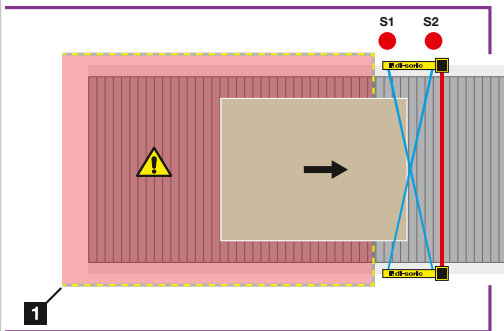


Technical data (typ.)	+20 °C, 24 VDC
Emitted light	Infrared
Service voltage	19.2 to 28.8 V DC
Switching output	pnp, 100 mA, NO
Ambient temperature	-30 to +55 °C

						Operating principle								Adjustment			Product description
	Muting arm design	Number of muting sensors in set	Parallel (P) or Cross-muting (X)	Range (m)	Through-beam sensor	Retroreflective light barrier	Through-beam sensor, 5-beam ¹⁾	Transparent detection, Reduced sensitivity	For high speed belts, with longer muting arms	Safety functions Muting activation	Height adjustable	Rotary position adjustable	IR light				
	L	2	X	1 to 2.5	■					■	■		■	MA-L2X			
	L	2	P	0 to 3.5		■				■	■		■	MA-L2P-TRX			
	L	2	P	0 to 2		■		■		■	■		■	MA-L2P-TRX-G			
	L	2	P	0 to 3.5		■			■	■	■		■	MA-L2P-TRX-V			
	T	2	X	1 to 2.5	■					■	■		■	MA-T2X			
	T	4	P	0 to 3.5		■				■	■		■	MA-T4P-TRX			
	T	4	P	0 to 2		■		■		■	■		■	MA-T4P-TRX-G			
	T	4	P	0 to 3.5		■			■	■	■		■	MA-T4P-TRX-V			
	L	2	X / P	0 to 3.5			■			■	■	■	■	MZ-L2XP			
	L	2	P	0 to 3.5			■		■	■	■	■	■	MZ-L2XP-V			
	T	2	X	0 to 3.5			■			■	■	■	■	MZ-T2X			
	T	4	P	0 to 3.5			■			■	■	■	■	MZ-T4P			
	T	4	P	0 to 3.5			■		■	■	■	■	■	MZ-T4P-V			

	Housing design Size (mm)	Beam separation (mm)	Number of beams	Operating voltage (VDC)	Response time (ms)	Switching output	Protection class	Ambient temperature (°C)	Cable length, plug connector	Product description
	70 x 28 x 30	10	5	24±20%	100	PNP, 100 mA,	IP 65	-30 to 55	0,9m M12, 5-pin	M5-A
	70 x 28 x 30	10	5	24±20%	100	PNP, 100 mA,	IP 65	-30 to 55	0,9m M12, 5-pin	M5-B

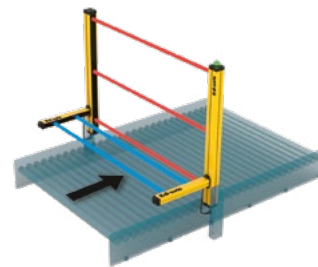
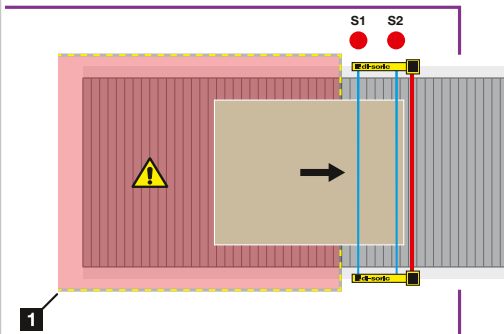
¹⁾ For pallet machines that work with irregular loads and pallets

L2X Muting arms with two crossed muting sensors, material transport out of the danger zone

In this muting mode, the two muting arms are located in front of the vertically mounted safety light barrier, facing the danger zone, and are in front of the hazardous passageway.

This unidirectional mode is used for transporting material out of the danger zone

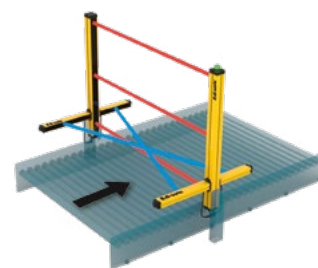
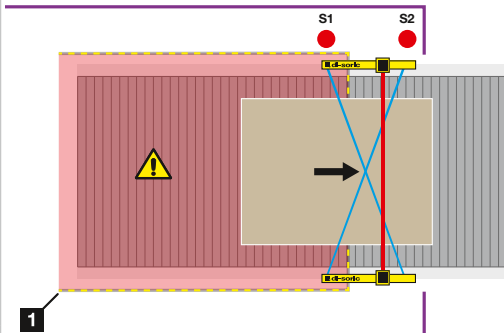
1 = Danger zone

L2P with two crossed muting sensors, material transport out of the danger zone

In this muting mode, sensors 1 and 2 are on the same side of the vertical safety light barrier and are in front of the hazardous passageway.

This unidirectional mode is used for protecting material outputs.

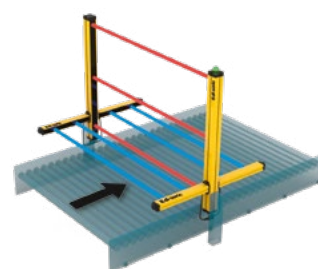
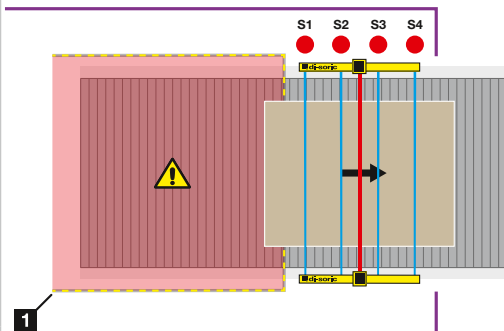
1 = Danger zone

T2X with two crossed muting sensors, material transport into and out of the danger zone

In this muting mode, one sensor (S1) is located on the side of the vertically oriented safety light barrier facing the danger zone. The second sensor (S2) is located on the side facing away from the danger zone.

This bidirectional mode is used for transporting material out of and into the danger zone.

1 = Danger zone

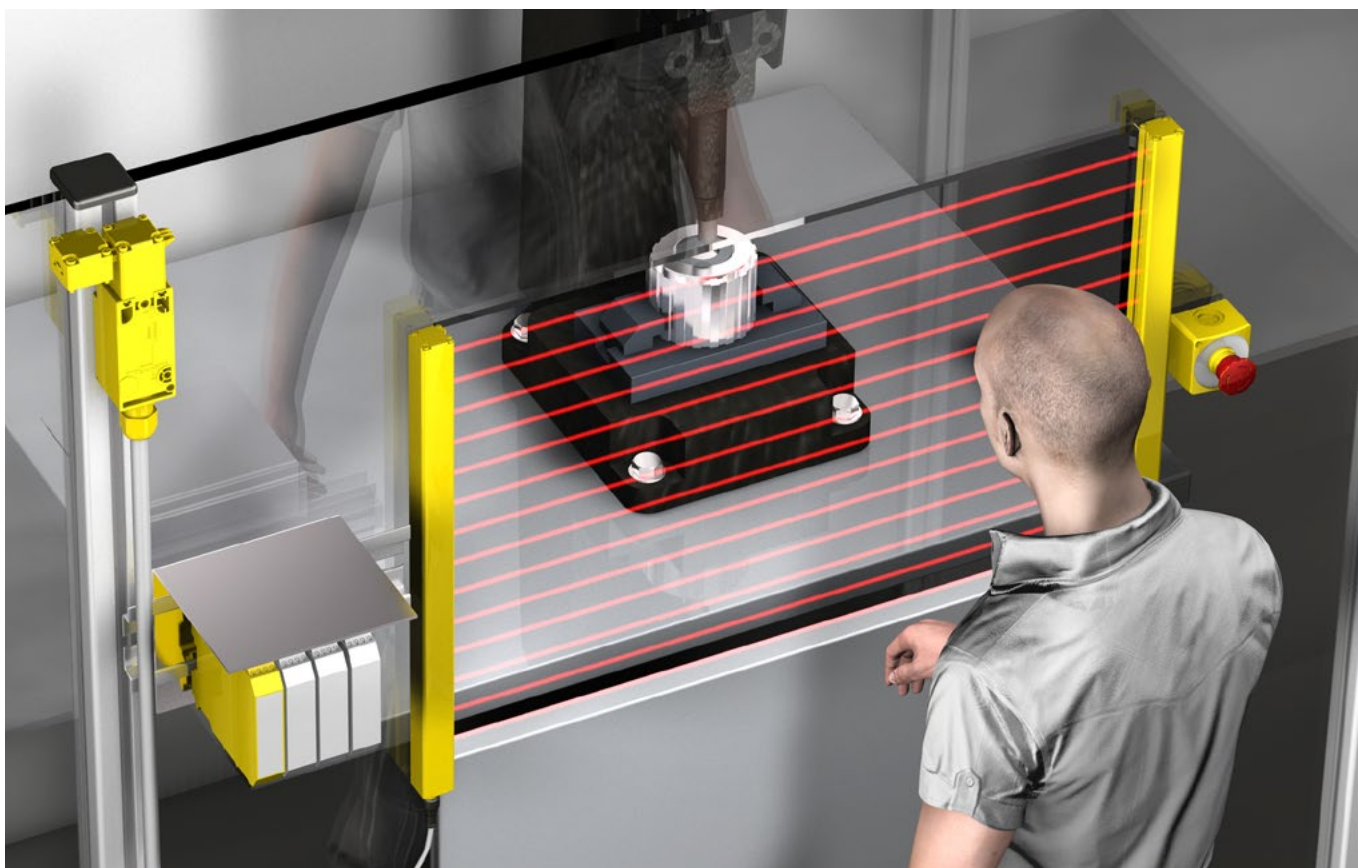
T4P with four parallel muting sensors, material transport into and out of the danger zone

In this muting mode, two sensors are located on one side of the vertical safety light barrier and two are located on the other side.

This bidirectional mode is used for transporting material out of and into the danger zone.

1 = Danger zone

Reliable control components



di-soric features various secure control components in its product range with which safety sensors can be integrated into work safety solutions. The result is ideal protection with a high degree of machine availability.

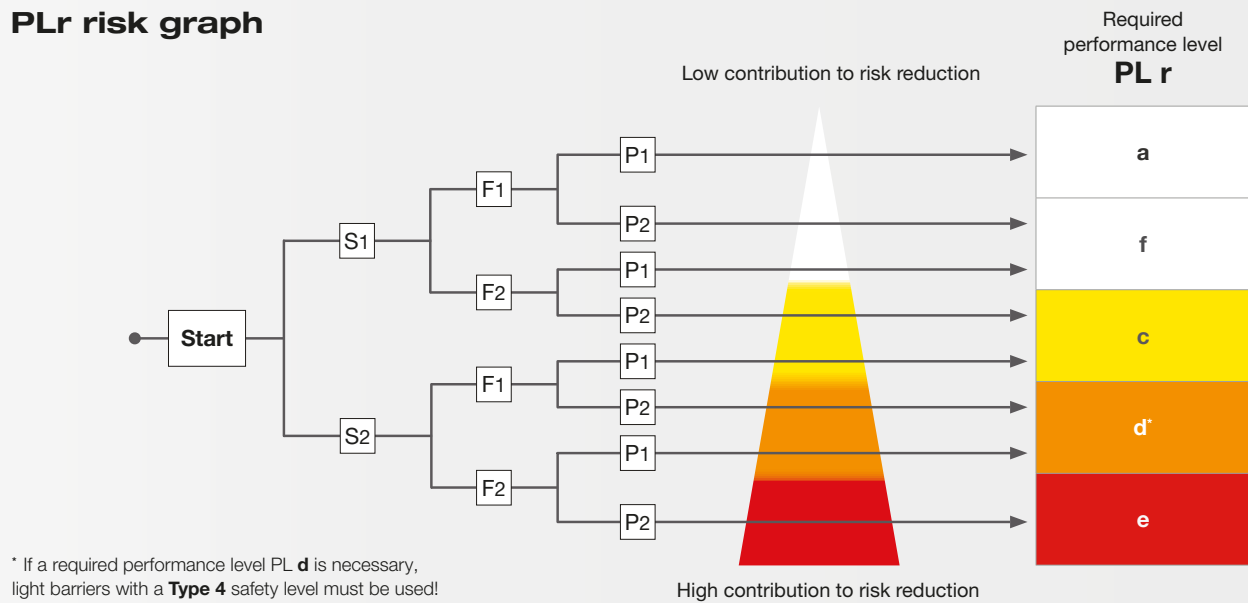


 **di-soric**

SR Safety Relay – Safety Switching Devices 178

MODSI Safety Control System 179

PLr risk graph



S Injury severity level

- S1** Minor injury (usually reversible)
- S2** Serious injury (usually irreversible) or death

F Frequency and/or duration of the exposure to the hazard

- F1** Seldom/short
- F2** Continuous/prolonged

P Possibility of hazard prevention or limitation of harm

- P1** Possible under certain conditions
- P2** Virtually impossible

→ **Note:** The PLr values are entirely „hierarchical“. PLr(e) provides the largest and PLr(a) provides the smallest contribution for risk reduction.

Directives and standards for PL e

MODSI- Modular safety system

Type 4 / Type 4 in accordance with IEC/TS 61496-2

SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061

PL e – Cat. 4 in accordance with ISO 13849-1

Corresponds to the following directives and standards:

- **2006/42/EG** "Machinery Directive"
- **2014/30/EU** "EMC Directive / Directive relating to electromagnetic compatibility"
- **2014/35/EU** "Low Voltage Directive"
- **CEI EN 61131-2** "Programmable controllers, Part 2: Equipment requirements and tests"
- **EN ISO 13849-1** "Safety of machinery - Safety-related parts of control systems - General principles for design"
- **EN ISO 13849-2** "Safety of machinery: Safety-related parts of control systems - Part 2: Validation"
- **IEC/EN 61496-1** "Safety of machinery: Electro-sensitive protective equipment - Part 1: General requirements and tests"
- **IEC/EN 62061** "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- **IEC 61508-1** "Functional safety of safety-related electrical, electronic and programmable electronic control systems - Part 1: General requirements"
- **IEC 61508-2** "Functional safety of safety-related electrical, electronic and programmable electronic control systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems"
- **IEC 61508-3** "Functional safety of safety-related electrical, electronic and programmable electronic control systems - Part 3: Software requirements"
- **IEC 61508-4** "Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and abbreviations"
- **IEC 61784-3** "Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses– General rules and profile definitions"
- **UL (C+US)** for Canada and the USA
- **ANSI / UL 1998** „Safety software in programmable components"

Safety level

TYPE 4

SIL 3 – SILCL 3
PL e – Cat. 4



SR SAFETY RELAY – SAFETY SWITCHING DEVICES

The safety relay / safety switching devices from di-soric make simple integration of individual safety sensors into occupational safety solutions possible. di-soric can optionally also deliver devices with integrated control function (External Device Monitoring - EDM) or with integrated muting function, to which additional external muting sensors can be connected.

Technical data (typ.)	+20 °C, 24 VDC
Reaction time	< 20 ms
Service voltage	19.2 to 28.8 V DC
Connection	to terminal strip
Ambient temperature	0 to +55 °C
Protection class	IP20 for housing IP2X for terminal strip
Mounting	on top-hat rail in accordance with EN 50022-35 standard

	Dimensions (mm)	Integrated muting function	Start / restart ¹⁾ (Automatic or manual (selectable on terminal strip), interlock)	External device (relay) monitoring - EDM (Feedback input, selectable release)	Two-channel inputs for safety light curtains / grids	Outputs safety relay (2 A, 250 VAC)	Status output (PNP (1x), 100 mA, 24 VDC)	Inputs for muting sensors 2x, 24 VDC, PNP, dark-on, NO	Input for muting release 24 VDC, PNP or relay	Product description
	99 x 22.5 x 114.5		■	■	1	NO (2x)	■			SR-1
	99 x 35 x 114.5	■	■	■	1	NO (2x)	■	■	■	SR-M

¹⁾ Reliable control of the Start / Restart command in accordance with the IEC 61496-1 standard




Interface relay for safety light curtains/grids SLI...										
	101 x 35 x 120					NO (2x) NC (1x) ²⁾				SR-0

²⁾ Each NO safety switching output is interrupted twice by the two relays

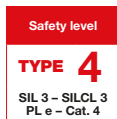




MODSI SAFETY CONTROL SYSTEM

The modular and configurable MODSI safety system can monitor and control various safety equipment in parallel, including safety light curtains / grids, mechanical switches, floor mats, emergency stop switches and two-hand circuits, as well as combinations of these. Using expansion modules, MODSI can be individually adapted to the respective safety requirements.

Technical data (typ.)	+20°C, 24 VDC
Safety level	TYPE 4 in accordance with IEC/TS 61496-1, -2 SIL 3 – SILCL 3 in accordance with IEC 61508 - IEC 62061 PL e – Cat. 4 in accordance with ISO 13849-1
Service voltage	19.2 to 28.8V DC
Connections	Removable terminal strips, screw contacts
Ambient temperature	-10 to +55 °C
Storage temperature	-10 to +85 °C
Protection class	IP20 for housing, IP2X for terminal strip
Mounting	on top-hat rail in accordance with EN 50022-35 standard
Dimensions - HxLxD	99 x 22.5 x 114.5 mm



MODSI



Compact design



MS-M
Configuration Memory

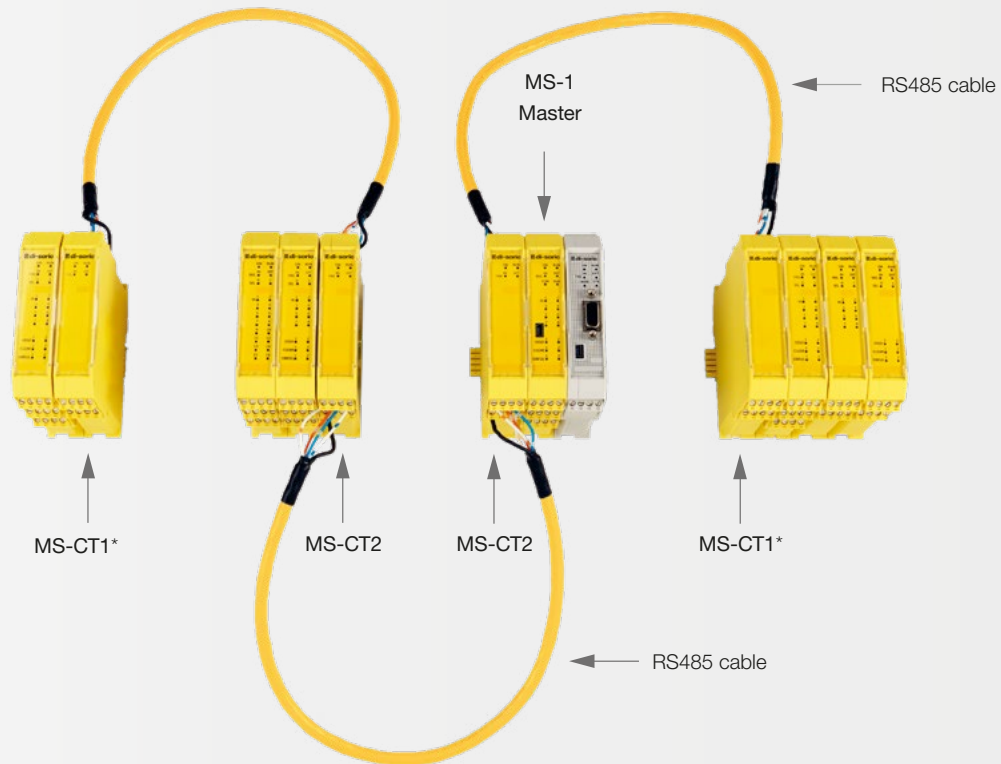


MS-SC
Safety Communication

- Compact design: Design size of each individual module 22.5x99x114.5 mm
- Removable terminal strips, screw contacts
- Can be used with the most common safety sensors
- Data transmission possible over fieldbus systems
- MS-SD - Safety Designer
 - Simple and intuitive software with a graphical user interface
- A large selection of safety functions and logical operators that can be configured using the software (starting on page 51)
- MS-M - Configuration Memory
 - Removable memory card for backing up and transferring configuration data
- MS-SC - Safety Communication
 - Communication between the modules over a 5-way high-speed bus
- Max. 14 expansion modules in addition to the M1 master
- Max. 128 inputs and 16 OSSD safety outputs (pairs)
- Remote maintenance/control of the MS expansion modules is possible over the MS-SC bus (a range of up to 100 m)
- Digital safety inputs that can be programmed individually or in pairs with the option for monitoring using dedicated output signals
- Filters and delays can be programmed separately for each input
- Delays can be programmed for output activation and deactivation
- Independent control of output pairs possible
- Programmable diagnostic output signals
- Easy diagnostics using LED displays on the front side and the bus expansion modules as well as configuration software MS-SD

	USB connection	MS-M card slot	Connection to MS-SC bus	MS-SC connector including Safety inputs	PNP safety outputs, 400 mA OSSD (number of pairs)	PNP signal outputs, 100 mA (programmable)	Test outputs	Safety relay outputs: NO (2x) NC (1x) 6A 250 V AC	NO (4x) NC (2x) 6A 250 V AC	Inputs for start / restart (EDM)	LED display	Product description	
Main module MS-1 for the modular safety system MODSI													
	■	■	■	–	8	2	2	4	–	–	2	Status input/output interference diagnosis	MS-1
Expansion module MS-... for the modular safety system MODSI													
	–	–	■	■	8	2	2	4	–	–	2	Status input/output interference diagnosis	MS-I8-02
	–	–	■	■	8	–	–	4	–	–	–		MS-I8
	–	–	■	■	16	–	–	4	–	–	–		MS-I16
	–	–	■	■	12	–	–	8	–	–	–		MS-I12-T8
	–	–	■	■	–	2	2	–	–	–	2		MS-02
	–	–	■	■	–	4	4	–	–	–	4		MS-04
	–	–	–	–	–	–	–	–	■	–	1	Output status	MS-R2
	–	–	–	–	–	–	–	–	■	–	2		MS-R4
	–	–	■	■	–	–	–	–	–	■	4		MS-OR4
	–	–	■	■	–	–	8	–	–	■	4		MS-OR4-S8
Expansion modules MS-Vx ... for safety speed monitoring													
	–	–	■	■	1 – 4	Inputs: 2 for PNP/NPN inductive proximity switches					Status input Interference diagnosis	MS-V0	
	–	–	■	■		Inputs: 1 TTL incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V1T	
	–	–	■	■		Inputs: 1 HTL incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V1H	
	–	–	■	■		Inputs: 1 sin/cos incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V1S	
	–	–	■	■		Inputs: 1- 2 TTL incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V2T	
	–	–	■	■		Inputs: 1- 2 HTL incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V2H	
	–	–	■	■		Inputs: 1- 2 sin/cos incremental encoder + 1- 2 induct. PNP/NPN proximity switch						MS-V2S	
Expansion modules MS-Bx... for bus diagnosis and data transmission													
	■	–	■	■	Profibus DP - expansion module						Error diagnostics	MS-BP	
	■	–	■	■	DeviceNET - expansion module							MS-BD	
	■	–	■	■	CANopen - expansion module							MS-BC	
	■	–	■	■	Ethernet IP - expansion module							MS-BEI	
	■	–	■	■	EtherCAT - expansion module							MS-BEC	
	■	–	■	■	PROFINET - expansion module							MS-BEP	
	■	–	■	■	Universal Serial Bus - expansion module							MS-BU	
Interface modules MS-CTx for connecting exported expansion modules via the MS-SC Bus													
	–	–	■	■	Interface with 1 connection * (1 input or 1 output)						Output status	MS-CT1	
	–	–	■	■	Interface with 2 connections (1 input and 1 output)							MS-CT2	
Configuration memory for main module													
												MS-M	
Safety communication for main/expansion module													
												MS-SC	

* End or start of the network

Connection variant with MS-CTx**Connection variant with MS-Vx**