TECHNICAL DESCRIPTION

MSL
Multi-beam
Safety Light Barriers

SICK

Contents

Caution sign
Non-observance can cause dangerous situations

Application hint
Technical hints for correct and efficient application

Approvals

EU Europe

EU-sample test by:

TÜV Rheinland
Am Grauen Stein
D-51105 Köln
Test number BB 9511541 01
E 9512741 E 01

QUALITY SYSTEM

certified by DQS according to
DIN EN ISO 9001 Reg.-No. 462-03

CE

1 General

Multi-beam safety light barriers from SICK are contactless protection installations. They are 2part through beam configurations, consisting of a sender and receiver unit and are suitable for access control and danger zone protection applications.

The MSL fulfils the pr EN 50 100 (pr EN 61 496) requirements, safety category 4. In that it is a self monitoring, contactless protection installation.

The devices were conceived for industrial applications and benefit from the following advantages:

- Proven know-how in the most up-to-date technology
- No mechanically wearing parts
- Adventageous dimensions
- Stable modular construction
- Universal application possibilities
- Simple installation

1.1 Features

Special features of the MSL multi-beam safety light barrier are listed below:

- Integrated evaluation with state-of-the-art electronics and especially developed ICs (ASICs)
- Actively monitored semiconductor outputs
- Conductor monitoring
- Pluggable terminal chamber with PG screws or different device connectors
- Short response time (20 ms)
- Large signal reserve (factor 2)
- Optical synchronisation of sender and receiver units
- Multiple safeguarding by means of corner mirrors and columns
- Compliant with pr EN 50 100 (pr EN 61 496) regulations
- EU sample test
- Operating modes:
  Electronic Device Monitoring (EDM)
  Restart Inhibit
- Muting as a supplementary module

2 Safety instructions

The device can only fulfil its safety function when it is used correctly; this applies to both "safe", i. e. error-proof, connection and accurate positioning.

- The MSL multi-beam safety light barrier complies with the safety regulations of: safety class 4 according to pr EN 50 100.

2.1 Areas of use of the device

The MSL multi-beam safety light barrier is used to guard access to hazardous areas on machinery or plant. The devices are fixed across the access area at the necessary safety distance from the danger point and send a Stop signal to the machine or plant when at least one beam of light is interrupted.

The following information is applicable for practical application purposes:

Maximum scanning range	20 m or 70 m
Minimum resolution	73 mm
Maximum beam gap	500 mm
Minimum number of beams	2
Maximum number of beams	35
Minimum housing length	370 mm
Maximum housing length	1800 mm

The MSL multi-beam safety light barrier consists of two components:

- MSLS sender unit and
- MSLE receiver unit

Both work with at least 2 and at most 35 light beams. Between the two units, the individual beams of light create a protective field defined by the number of beams and their spacing.

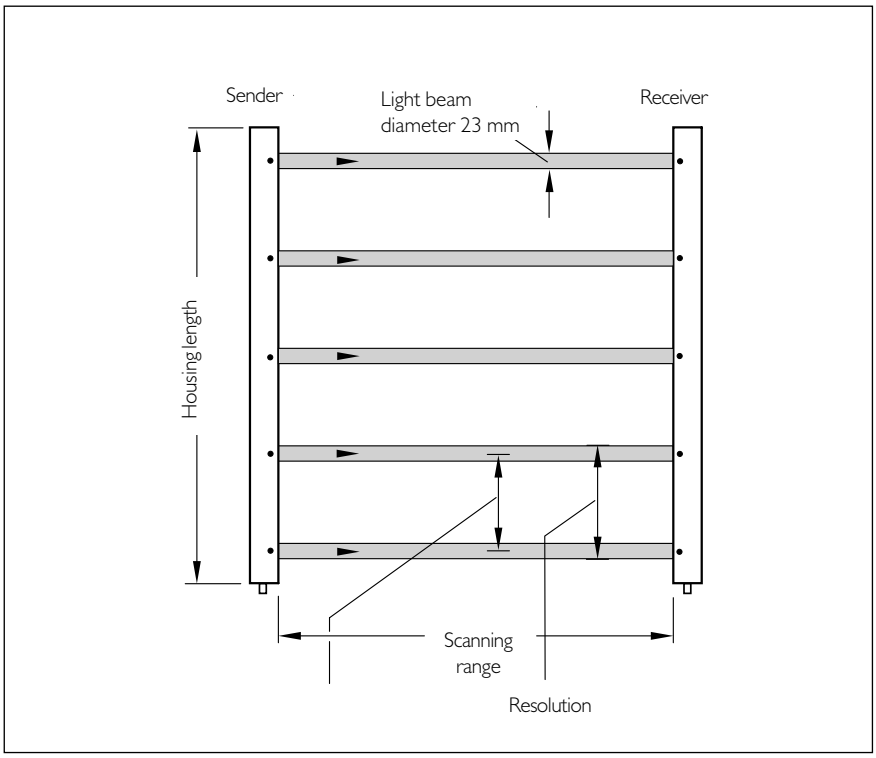


Fig. 1: System construction of the MSL multi-beam safety light barrier

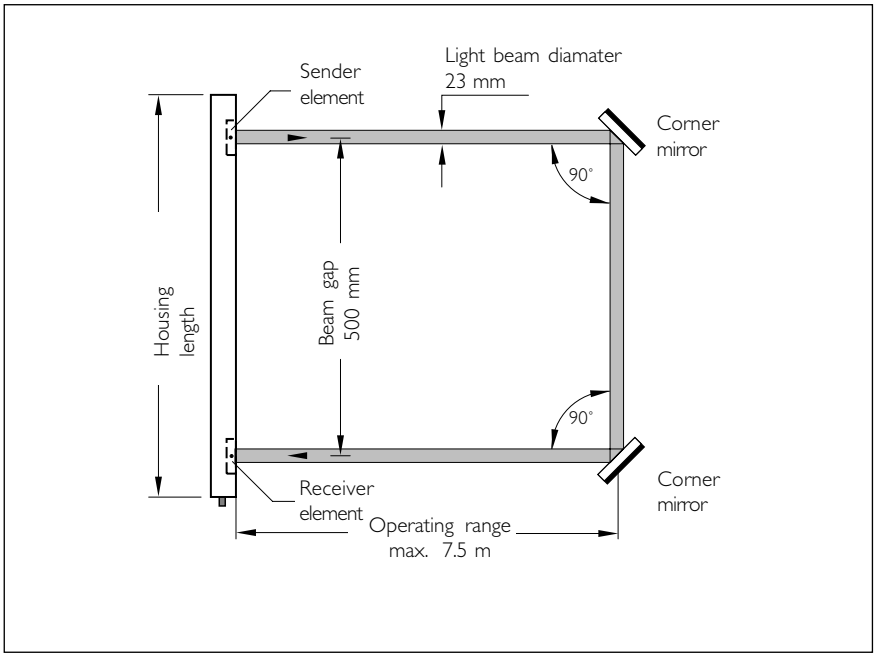


Fig. 2: System construction of the MSLZ safety light barrier

The position of the light beams is indicated by a marking on the housing.

Synchronisation between sender unit and receiver unit is achieved optically, by means of a pre-defined encoded sequence, thus eliminating the need for galvanic connection between sender and receiver.

The MSLZ variant

The MSLZ light barrier, like the MSL is a contactless protection installation – but with one passive side and one active side (*fig. 2*). It is suitable for access control and danger zone protection with a passive mirror side, and a maximum distance of 7.5 m. The MSLZ fulfils the pr EN 50 100 (pr EN 61 496) regulations, safety category 4.

The active side contains the sender and receiver elements with a beam gap of 500 mm (*fig. 2*). The passive side is realised with corner mirrors. The following key specifications are valid for the MSLZ:

Distance:		
Active/passive side	max.	7.5 m
Beam gap		500 mm

2.2 Intended use of the device

The MSL multibeam safety light barrier may only be used as specified in section *2.1, Areas of use of the device*. If it is used in any other way, or if it is modified in any way – including during installation and mounting – SICK AG shall not be held liable for any warranty claims arising.

2.3 General safety instructions and precautions

1 Installation, commissioning, use and routine technical checking of the non-contact safety device is subject to national and international regulations and standards, in particular:

- Regulations derived from the Machinery Directive 98/37 EC
- Regulations derived from the Use of Equipment Directive 89/665 EEC
- Relevant safety regulations
- Applicable accident prevention regulations and safety rules.

The manufacturers and users of the machinery on which our safety devices are used are solely responsible for ascertaining all applicable safety standards and regulations from the competent authorities and for ensuring compliance with those standards and regulations.

2 **Furthermore,** the instructions laid down – and **in particular the test requirements** (see *Testing*) set out in this *Technical Description* and in the *Operating Instructions* (including instructions relating to use, mounting, installation and integration into the machine control system) – must be followed.

3 The tests must be performed by **qualified experts** or by **authorized and competent personnel** and must be documented in such a way as to be verifiable at any time.

4 The Operating Instructions must be made available to **the employee** (operator) of the machine on which our safety device is used. The employee must be instructed **by qualified experts.**

5 The test protocol according to the use of the non-contact safety device is printed at the end of this *Technical Description*. Acceptance testing is performed on the basis of that protocol.

2.4 Safety instructions

2.4.1 Pre-commissioning tests

- The pre-commissioning tests confirm compliance with the safety requirements set out in the national and international regulations and standards, in particular the regulations derived from the Machinery Directive and the Directive governing Use of Equipment (EC Certificate of Conformity).
- Test effectiveness of the safety device on the machine in all operating modes programmable on the machine according to the checklist (at the end of this *Technical Description*).
- The personnel operating the machine protected by the safety device must be instructed by qualified experts. This instruction is the responsibility of the machine operating company.

2.4.2 Regular testing of the safety device by experts

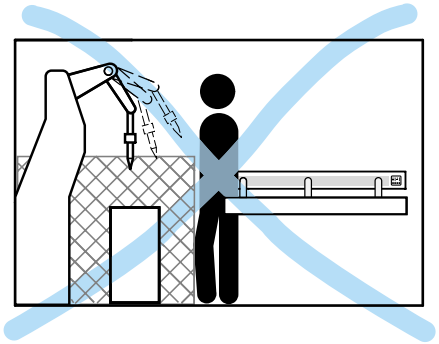
- Test according to national and international regulations and standards at the intervals specified. These tests should reveal modifications or manipulations of the safety device relative to the initial commissioning status.
- The tests are performed on the basis of the checklist (at the end of this *Technical Description*) in the event of major modifications to the machine or safety device, as well as after resetting or repair in the event of damage to the housing, front screen, etc.

2.4.3 Daily testing

Test by supervising personnel of the operating company prior to each work shift.

MSL with "Number of beams" indication on rating plate (vertical mounting)
Test by full coverage of at least one beam of light. The red LED on the receiver unit / MSLZ must light up.

MSL with "Resolution" indication on rating plate (horizontal mounting)
Test of the correct distance between the horizontally mounted photoelectric safety switch and the mechanical limit of the machine. To perform the test, get close up the machine (*fig.*). Only the red LED may light up.



3 Function

Both sender and receiver units are supplied with a voltage of 24 V DC. The sender unit contains the sender module, which transmits the infra-red, encoded light impulses.

3.1 Status indicator

The respective operating states are indicated by indicators on the sender and receiver unit of the MSL (*fig. 3*).

3.2 Diagnosis elements

The LEDs on the sender and the receiver (or on the MSLZ) are also used for diagnosis of the respective operating status. See *Table 1* for senders **up to serial number 9652xxx** and senders **from serial number 9701xxx** (table 2).

3.3 Diagnosis aids

The indicators on the sender and receiver unit enable rapid troubleshooting for the Service department.

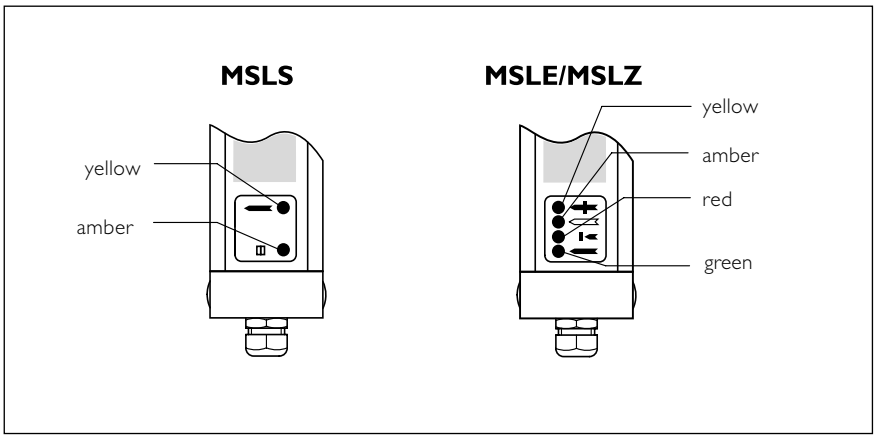


Fig. 3: Indicators on the sender and receiver unit of the MSL multi-beam photoelectric safety switch

Sender unit

≤ 9 652 xxx / ≥ 9 701 xxx

LEDs amber	LEDs yellow	Function/cause
●	◑	Operating voltage applied
◑	●	Sender active
●	○	MCC test; lockout
●	◑	Operating voltage applied
☀ 8/s	☀ 8/s	Lockout: sender
●	☀ 1/s	MCC test
●	●	Sender active, range 15 - 70 m
●	○	Sender active, range 0,5 - 20 m

○ LED off ● LED illuminated ☀ LED flashing ◑ LED no influence

Tab. 1: LEDs on the sender: up to serial number 9 652 xxx, and from serial number 9 701 xxx

Receiver unit

LEDs green	LEDs red	LEDs amber	LEDs yellow	Function / cause
●	○	◑	○	Light beam free and outputs active
○	●	◑		Light beam broken an outputs inactive
○	●	◑	☀ 1/s	Actuate command unit
○	●	☀ 2/s	☀ 2/s	Lockout
◑	◑	●	◑	Contamination

○ LED off ● LED illuminated ☀ LED flashing ◑ LED no influence

Tab. 2: Indicators on the receiver unit or on the MSLZ

4 Applications and application requirements

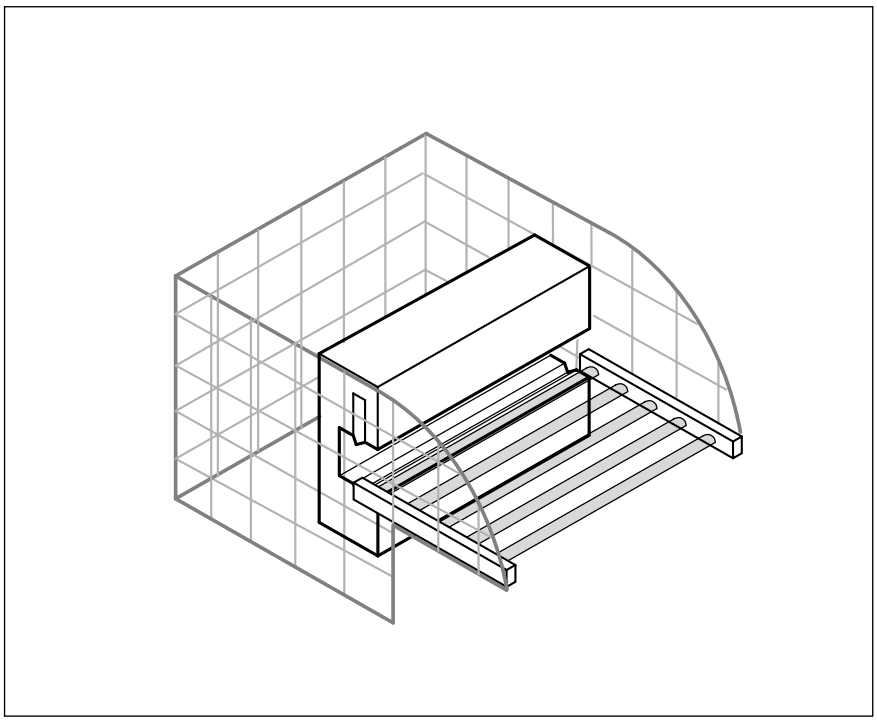


Fig. 4: Access guarding with 5-beam MSL multi-beam photoelectric safety switch

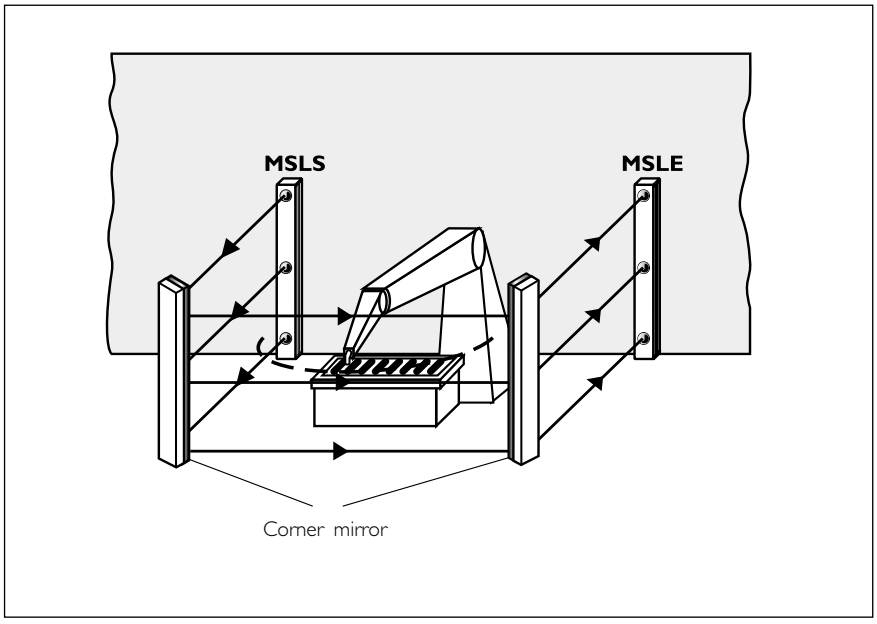


Fig. 5: Tri-beam MSL multi-beam safety light barrier for safeguarding access to a robot.

4.1 Applications

The MSL multi-beam safety light barrier can be used for safeguarding access to dangerous areas and for danger zone protection.

Typical areas of application are:

- Hazardous zone guarding (*fig. 4*)
- Access control for processing areas (*fig. 5*), cutting and stacking machines, palleting areas and paving machines.

4.2 Application requirements

The protective functions of the MSL can only be used when the following conditions are satisfied:

- It must be possible to control the machine or installation electrically.
- It must be possible to halt hazardous machine movement.
- The MSL must be so installed that entry into the danger zone must interrupt one or more of the light beams.

An absolutely safe switch-off can only then be assured if the light beam diameter of 23 mm is fully covered.

Release can only be achieved by unlocking the restart inhibit with the help of a restart switch.

The restart switch must be placed such that it cannot be pressed from inside the danger zone.

The MSL should be mounted such that upon interruption of the light beam, the dangerous location can only be reached if the dangerous condition of the machine has been neutralised. The requirement for this is that there is a safety distance between the light beams and the nearest point of danger.

This safety distance is defined as per EN 999 (see *5.2 Safety distance for dangerous zones*).

Persons situated inside the danger zone, but outside the protection field are not recognised. It must therefore be ensured that a dangerous condition is only possible when there is nobody present in the danger zone.

The relevant legal and government regulations are to be complied with for the implementation of protection installations. These regulations vary, depending on areas of application.

4.3 Corner mirrors and columns

When the MSL is used in conjunction with one or two corner mirrors, 2 or 3 sides can be protected respectively (*fig. 6*). Use of mirrors reduce the scanning range e. g. for a device with normal scanning range of 70 m the range is reduced to

approx. 61 m for 2 mirrors approx. 42 m for 4 mirrors

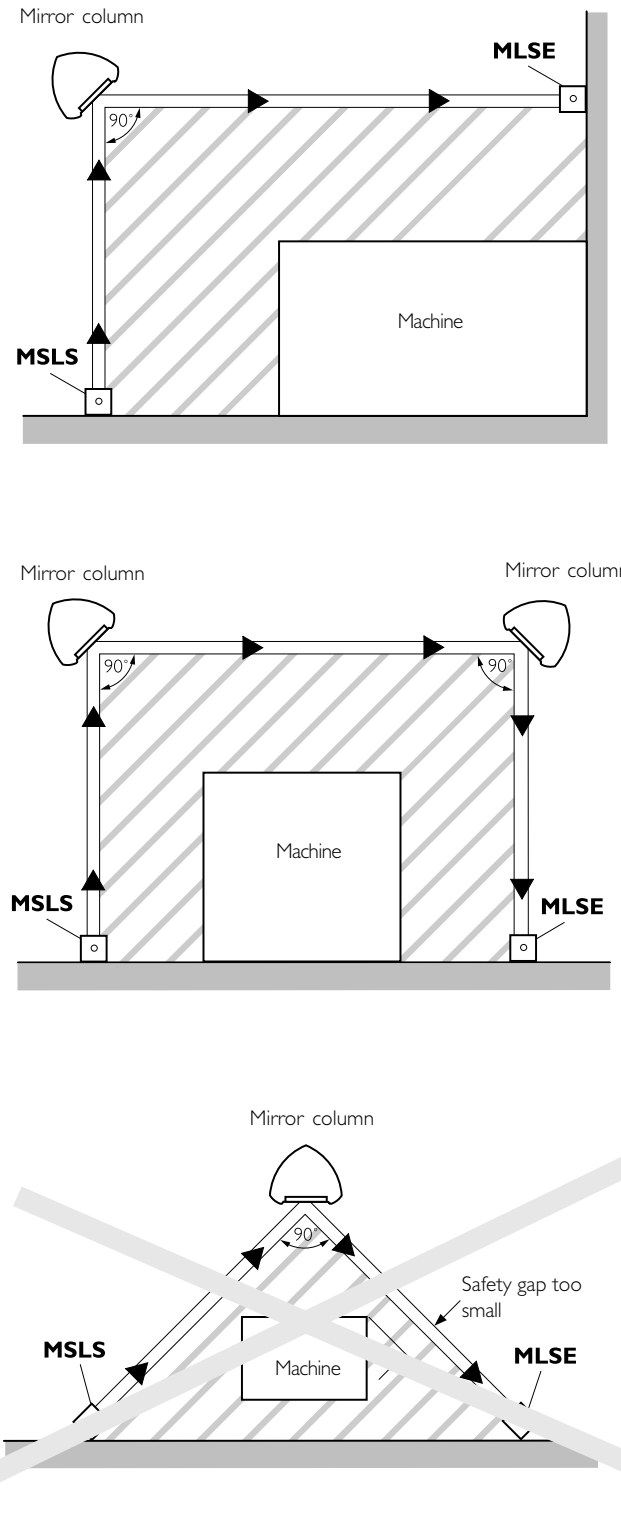


Fig. 6: Multi-sided access control to danger zones with MSL multi-beam safety light barrier.

5 Mechanical installation

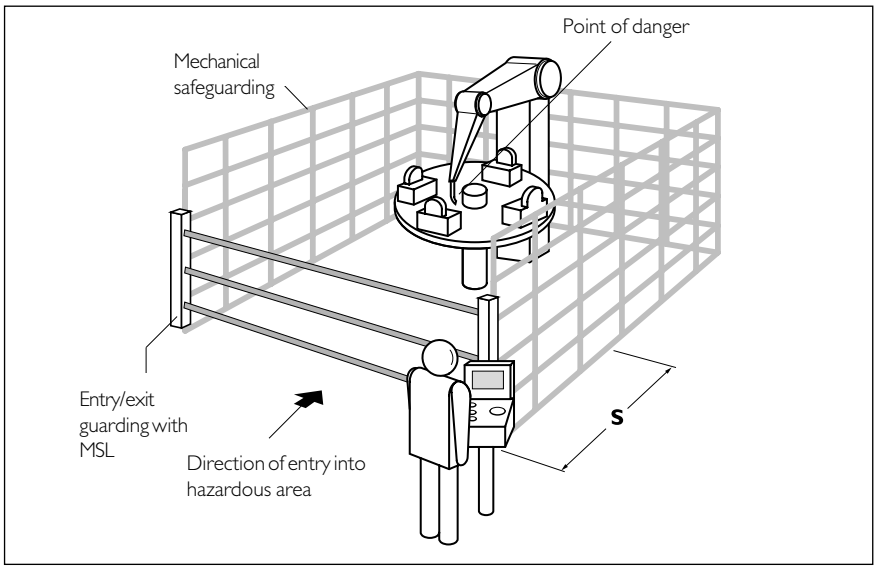


Fig. 7: Safety distance and height of the point of danger for multi-beam vertical access protection

5.1 General

The MSL can be fitted in any required position. The devices are to be mounted such that the danger zone can only be reached by interrupting at least one light beam. The choice of the MSL type, number of beams and beam gaps are determined by the requirements of the respective machine and specifications of the relevant regulation body.

When assessing the risk situation, consideration must be made to the possibility of bypassing the protection field by:

- Crawling underneath
- Reaching over the top
- Reaching through two light beams
- Climbing through two light beams

5.2 Safety distance to point of danger, determination of safety distance

A safety distance must be maintained between the protection field and the point of danger. This safety distance should guarantee that the point of danger can only be reached by the time the hazardous motion of the machine has come to rest (*fig. 7*). The safety distance (according to EN 775, 999 and 294) is dependent on:

- The stop time of the machine
- The response time of the protection installation
- The person's speed of approach.

The stop time is a specification of the machine itself.

5.2.1 General formula for the safety distance in accordance with EN 999

The saftey distance S is calculated from the formula

$$S = (K \cdot T) + C$$

S Safety distance in mm
T Stop time of machine plus response time
C Constant for calculated distance in mm
K Speed of approach

5.2.2 Safety distance for multi-beam access control in accordance with EN 999

Several individual beams are used to prevent invasion of the whole body or parts of the body which are larger than the minimum resolution (beam gap + 23 mm beam diameter). The approach speed is taken as 1600 mm/s and C is 850 mm.

The minimum distance to the point of danger is thus:

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

The position of the beams is also to be observed (*table 3*).

Number of beams	Height above reference level (e. g. floor, in mm)	Beam gap in mm
2	400, 900	500
3	300, 700, 1100	400
4	300, 600, 900, 1200	300

Table 3: Number of light beams, height above relevant level and beam gap

5.2.3 Safety gap for horizontal multi-beam danger area guarding according to EN 999

The safety gap for horizontal zone guarding is calculated using the following formula:

S = (1600 mm/s • T) + (1200 mm – 0,4 • H)

H Height of protective field above the reference level, e. g. floor, in mm.

With this configuration, the height (H) of the protective field must not be greater than 1000 mm. During risk assessment, unintentional access by creeping under the light beams must be taken into consideration. The minimum permissible height (H) of the protective field must be calculated as follows:

H = 15 (d – 50 mm)

d Resolution of safety device

The resolution is derived from gap + light beam section.

Example:

Resolution MSL mm	Height H in mm
73 mm	345
93 mm	645

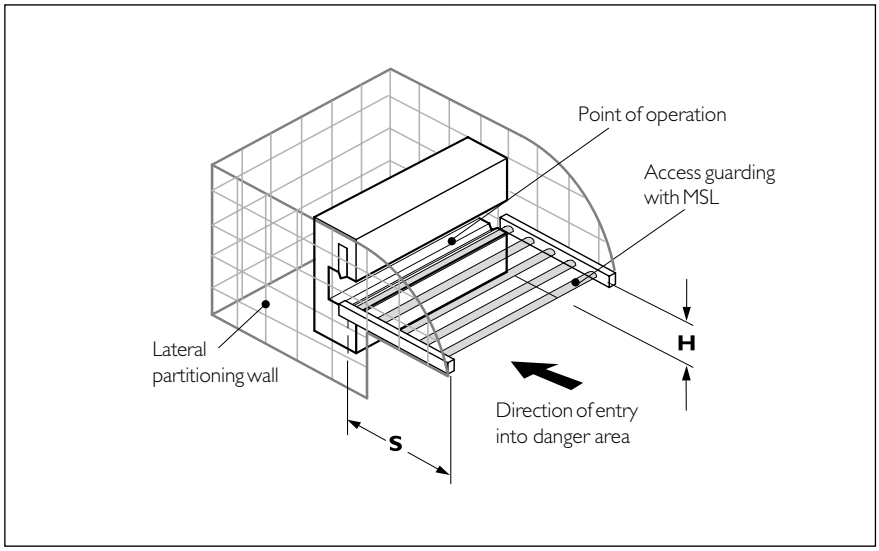


Fig. 8: Safety gap S and height H for hazardous guarding

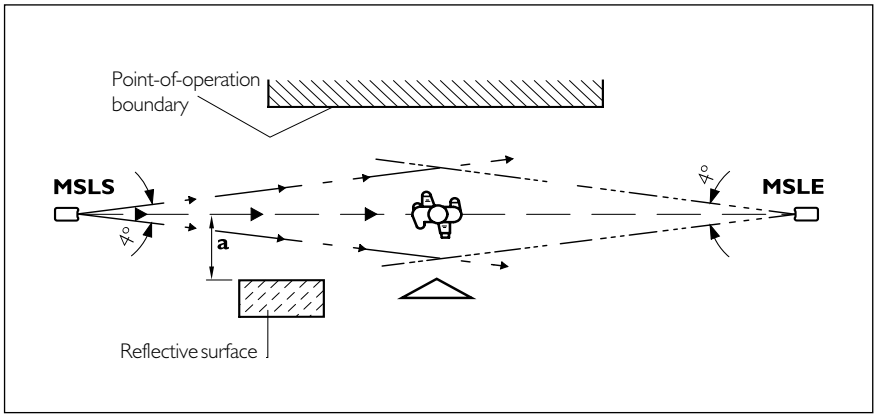


Fig. 9: Correct assembly, correct alignment, no diverted reflection

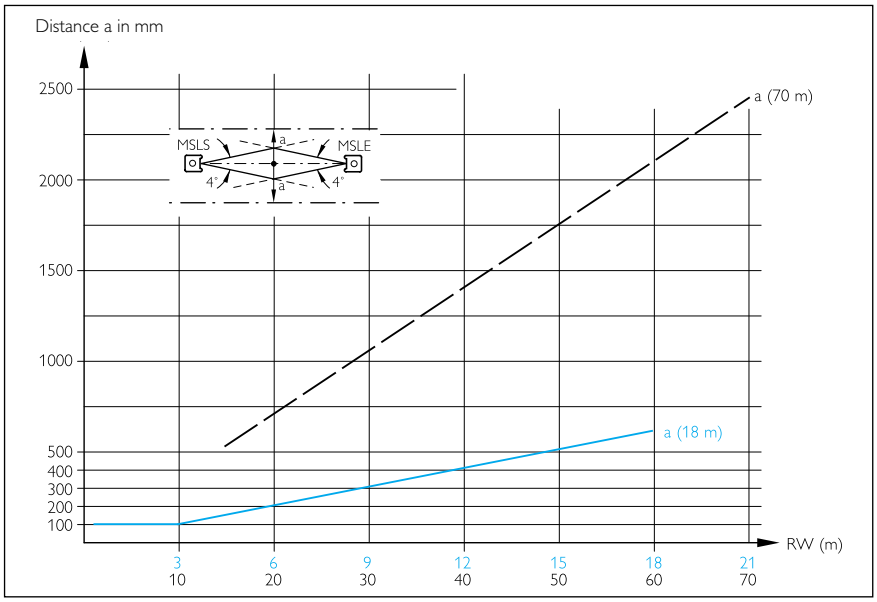


Fig. 10: Necessary safety distance (a) in relation to the distance between sender and receiver units.

5.3 Distance from reflective surface

Reflective surfaces located (placed or fixed) within the sender and receiver range, may cause reflection and thus prevent an obstacle from being reliably detected.
For this reason, a minimum distance "a" from reflective surfaces to the optical axis (linear connection between MSLS and MSLE) must be maintained (see *fig. 9*). The distance "a" is dependent on the distance between the sender and receiver (*fig. 10*).

5.4 Multiple safeguarding

If two MSL units are used per guarding system, it must be ensured that the two units cannot influence each other. Since the light beams diverge, their cross-section becomes greater as the distance between the MSLS and the MSLE increases. The light beams from the sender unit may only be received by its accompanying receiver unit. To eliminate any muttual influence, it must be ensured that they are positioned correctly during installation (*fig. 11 and 12*).

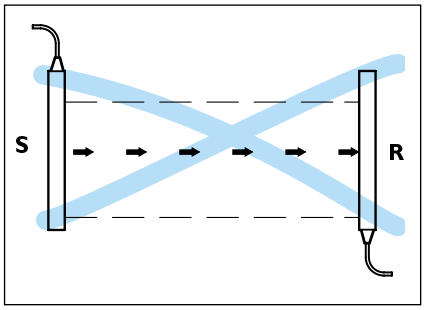


Fig. 11: The sender and receiver must be installed in the same direction, installation rotated by 180° is not permitted.

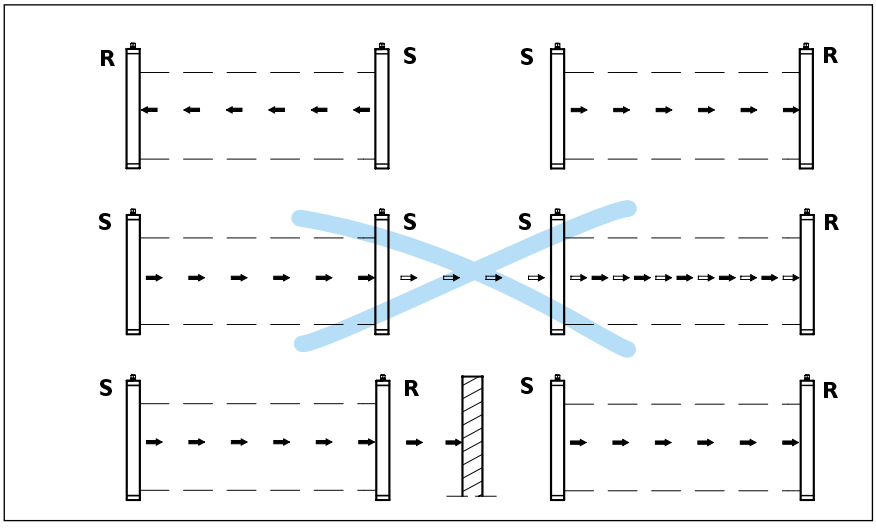


Fig 12. Installation of two MSL systems in series: with different beam directions (above), with wall between two systems (below)

5.5 Mechanical fixing

In the basic kit, 4 slider nuts with M5 Thread are provided for both sender unit and receiver unit. These slider nuts are fastened into the slot on the side of the housing. Either rigid, hinged or shock absorbing mounting brackets are available as optional accessories (*fig. 13*).

The rigid bracket can be used where no large mechanical tolerances need to be compensated for. The hinged bracket allows for ± 2° horizontal adjustment of the sensor. In addition to this, the bracket can be used in conjunction with shock absorbers to reduce the vibrational forces. The brackets are fastened to the sender and receiver units by means of slider nuts in the housing.

To prevent shifting of the light barrier, the bracket must be fastened at 20 - 30 mm (60 mm on the terminal chamber side) from the end caps.

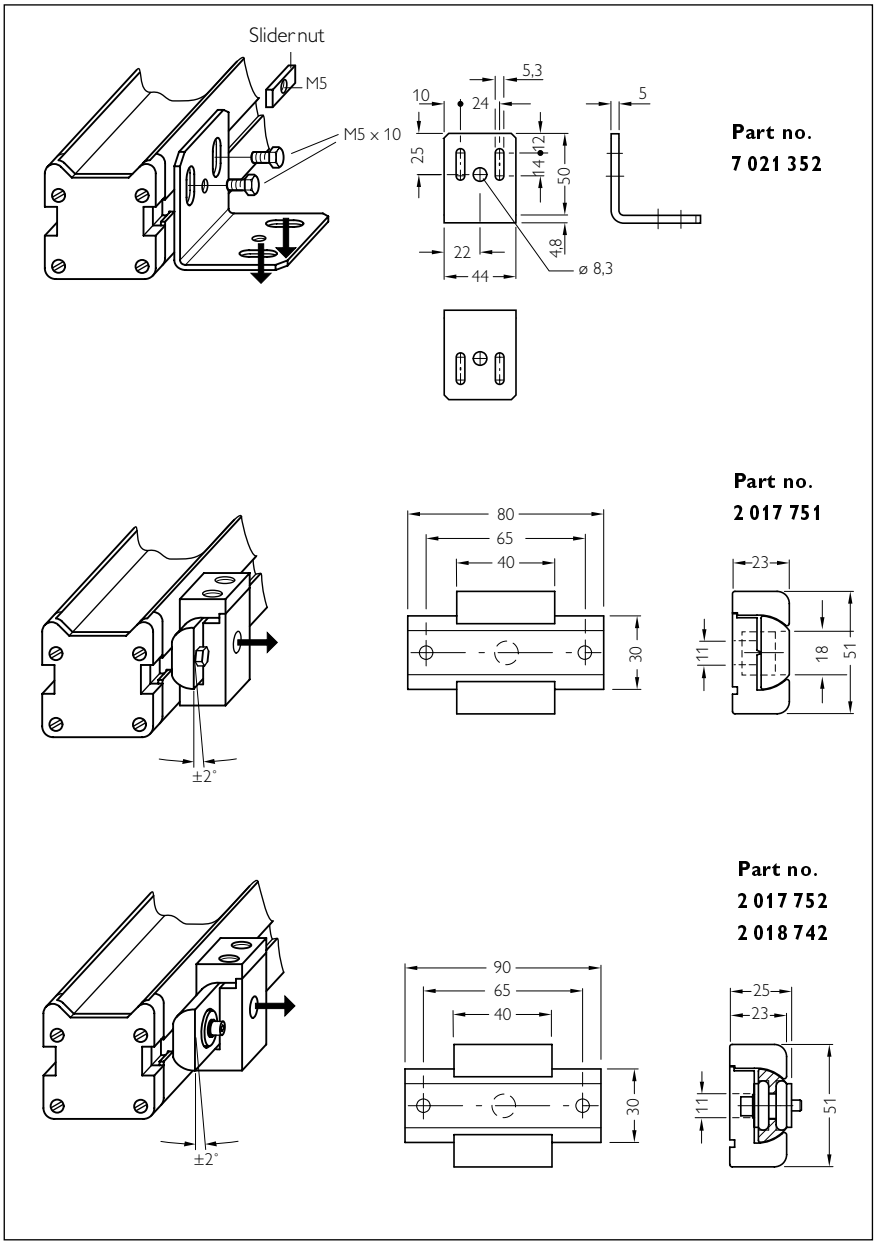


Fig. 13: Mechanical options for MSL (from top to bottom): Rigid bracket, hinged bracket and bracket with shock absorber.

5.6 Mounting the mirror columns

Column 400

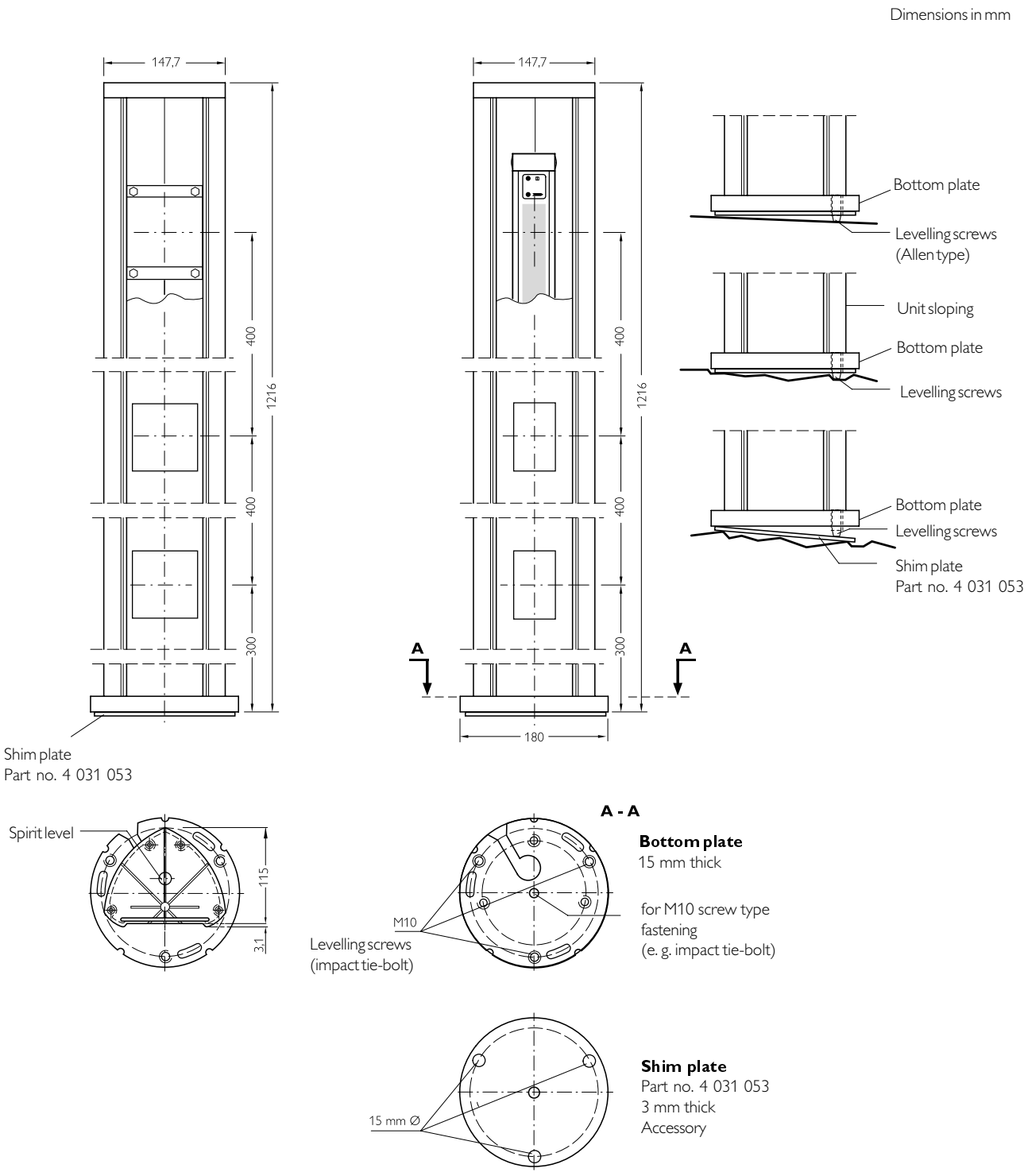


Fig. 14: Column 400: left – mirror column, right – device column

Column 500

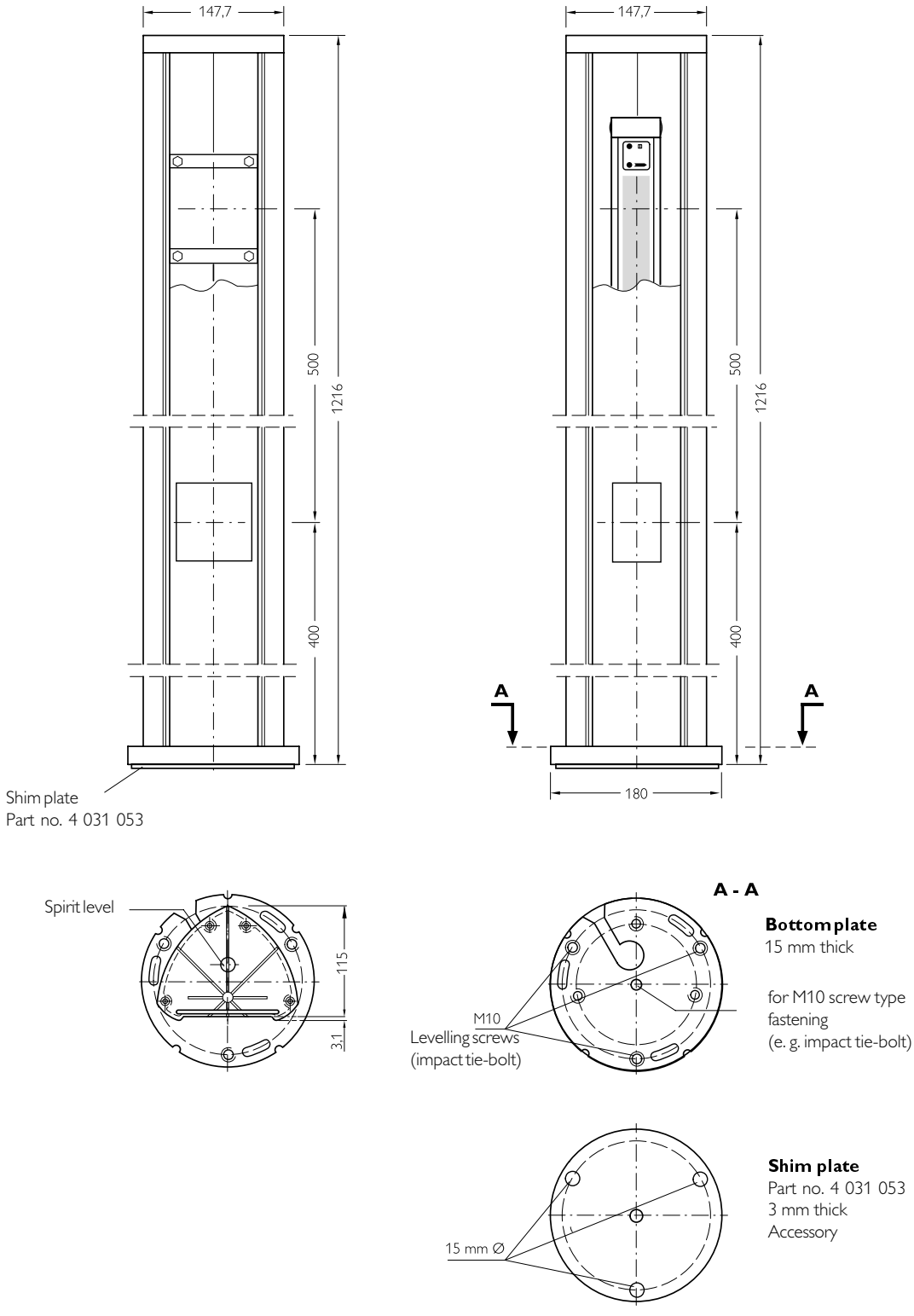


Fig. 15: Column 500: left – mirror column, right – device column

5.7 Corner mirror

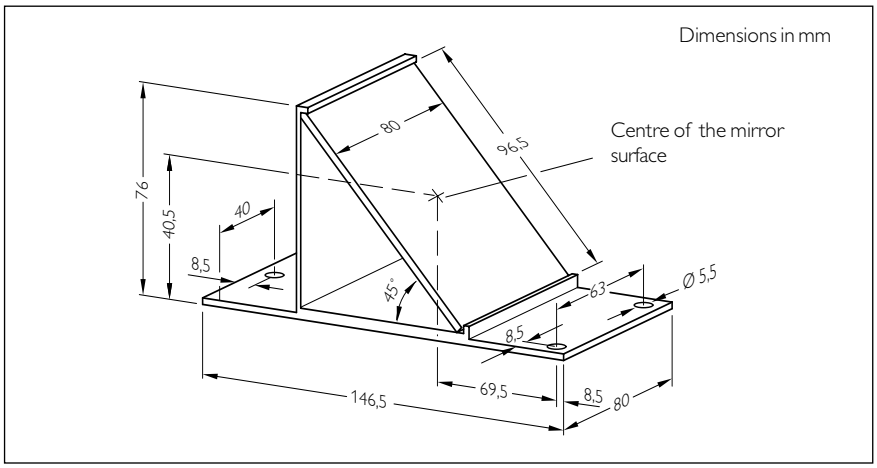
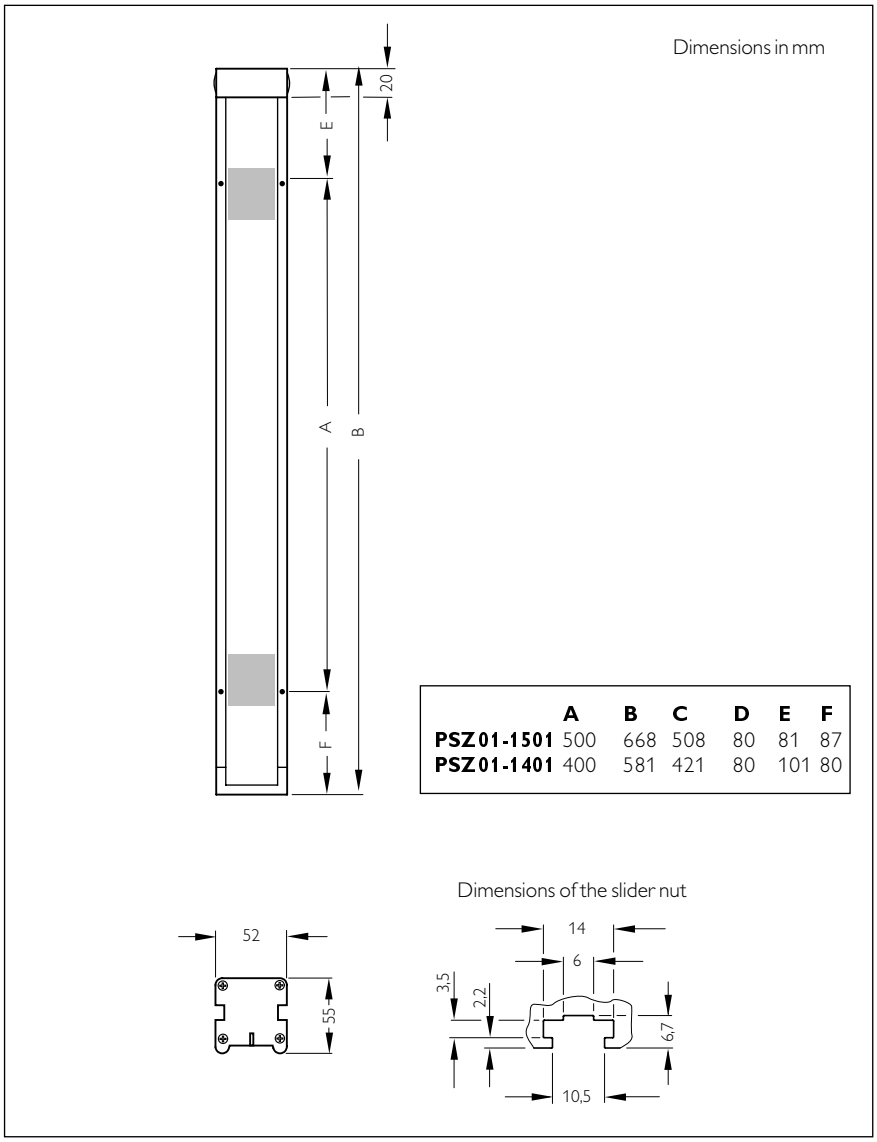


Fig. 16: Dimensions of the PSK 45 corner mirror



	A	B	C	D	E	F
PSZ01-1501	500	668	508	80	81	87
PSZ01-1401	400	581	421	80	101	80

Fig. 17: Dimensions of the PSZ corner mirror

The PSK 45 corner mirror (*fig. 16*) is not suitable for column mounting. The part number 5 306 053 contains an assembly kit.
The PSZ corner mirror is espacially suited to the MSLZ as a passive side (*fig. 17*). The mirrors are housed in the MSLZ housing profile. The PSZ offers the following advantages:

- Mirror does not have to be cleaned (IP 65 enclosure)
- Easy to adjust
- Tolerant to small adjustment errors

6 Operating modes

In the case of MSL multi-beam photoelectric safety switches, it is possible to select different operating modes at the device (depending on requirements).

6.1 Self configuration

If you wish to configure the device yourself, SICK offers training to provide the necessary know-how.

6.2 Restart inhibit (restart switch)

- **Without restart inhibit:** When the protective field has been broken and released again, the protective field is automatically reactivated to be actuated (e. g. start button), and the MC can continue its hazardous motion once the beam path is free. In this case, the restart inhibit must be an element of the MC's control system.
- **With restart inhibit:** When the protective field has been broken and released again, then outputs are only reactivated after a command unit has been actuated. The MC can then continue its hazardous motion once the light beam is free.

6.3 External device monitoring (EDM)

External device monitoring is a safety function which checks to ensure that the contacts and relays directly connected to the outputs are functioning correctly.

Deselecting external device monitoring

- If a reliable PLC is used
- If external device monitoring is used in the machine control system

Electrical connection of the receiver unit and the exact functional principle are described in *7.3.3 External device monitoring input*.

The voltage supply must be disconnected when the operating mode is changed.

6.4 Muting with additional MSM module

Transporting material to the production site without interrupting operating procedures is a problem often faced in automatic production processes.
The photoelectric safety switch is not able to distinguish between material and personnel.
The muting circuit with its external sensors as additional module is a solution to this problem. Muting briefly deactivates the protective field provided by the photoelectric switch to allow objects to be transported into the danger area.
The interaction of the photoelectric light switch, the muting sensors, and the muting controller in the additional module enable the system to make a simple distinction between personnel and transported objects, and this in turn ensures safety.

Detailed functional and connection information can be found in the *Technical description MSM*.

7 Electrical installation

7.1 General

Connecting the MSL components is easy. The sender and receiver units are connected directly to the machine control unit. An additional evaluation unit is not necessary.

The exact cabling requirements are listed in chapter *9, Technical specifications.*

The machine control unit has a 5-wire connection to the sender unit and an 8-wire connection to the receiver unit.

The maximum cross section of a conductor is 1.5 mm^2 solid or 1 mm^2 sleeved. Both components have a plugggable terminal block in the terminal chamber. Alternatively, the terminal chamber can be provided with a pre-prepared connector insert.
Both components are supplied with a voltage of 24 V DC ± 20 %. The operating voltage is connected between + 24 V and 0 V.

In accordance with EN 60 204, the external voltage supply must be able to bridge a short drop-out 20 ms (U_{min} = 18 V). Suitable power supplies are available from SICK as optional accessories (Siemens 6 EW 1 family).

Electrical connection work may only be carried out in a voltage free condition.

7.2 Sender unit

The electrical connection diagram of the sender unit is shown in *fig. 18*.

7.2.1 MCC – test input

The test procedure enables an inspection of the switching elements. The sender unit is switched off for this process. A break contact from the machine control unit is applied to the test input (MCC = machine control contact). The test procedure is triggered when the break contact is open for at least 100 ms (*fig. 19*). The testing must be carried out at time when there is no hazardous machine motion.

The test input may only be used to check any connected switching elements.

If the test is unsuccessful, the machine must receive a switch-off signal from the machine control unit.

7.2.2 Scanning range of the sender unit

The connection diagram for sender unit with scanning range 15 to 70 m is shown in *fig. 20*.

A short circuit bridge is to be applied between contacts 5 and 6 in the terminal block (when using a PG screw type) or in the cable socket (when using Interconnectron connectors).

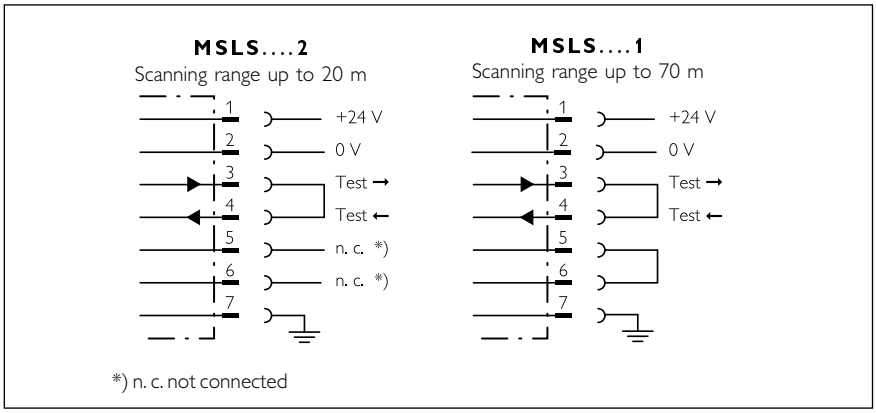


Fig. 18: Connection diagram for the sender unit: Left, scanning range up to 20 m, right, scanning range up to 70 m.

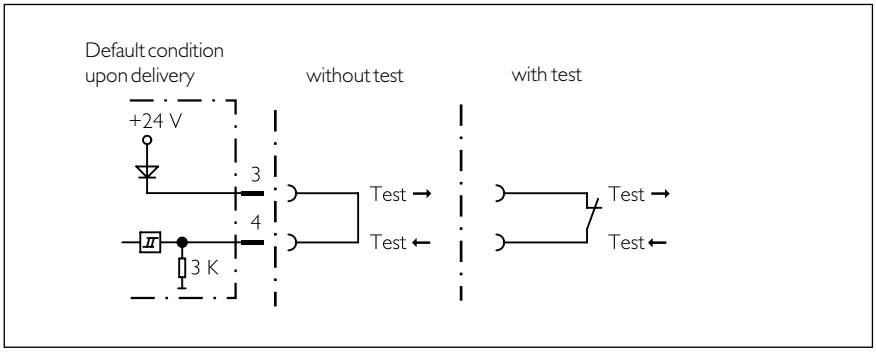


Fig. 19: Testing the MSL with the MCC – test input

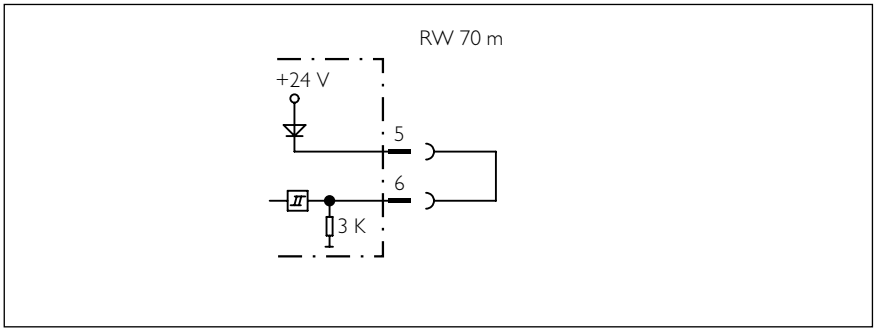


Fig. 20: Conversion of the MSL for 70 m scanning range.

7.3 Receiver unit

The electrical connection diagram of the receiver unit and the MSLZ is shown in *fig. 21*.

7.3.1 Switching outputs

Both outputs OSSD 1 and OSSD 2 are actively monitored, short-circuit proof PNP semiconductor outputs. The outputs can be loaded with a maximum of 0.5 A and are not floating, but are referenced to 0 V. For unobstructed light beams, both outputs are active HIGH. The output voltage U_a of both channels is dependent on the supply voltage U_v and the switched load, and is at least

$U_a \geq U_V - 3\ V$

Note
Connection of the receiver outputs OSSD 1 and OSSD 2 (fig. 23)

- An additional supply voltage must not be applied to the outputs
- Both output signals must be processed separately. They must not be connected in series or parallel

7.3.2 Output: Contamination warning (OWS)

The contamination warning output (OWS = Output Weak Signal) is a short-circuit proof PNP semi-conductor output which is active (HIGH) for an unobstructed but weak light beam (*fig. 22*). This output is not floating but is referenced to 0 V.

The OWS outputs of several MSLs can be connected together to *one* signal receptor or a PLC input. Parallel switching of several MSL contamination warning is possible ("wired OR").

The maximum output current is 100 mA.

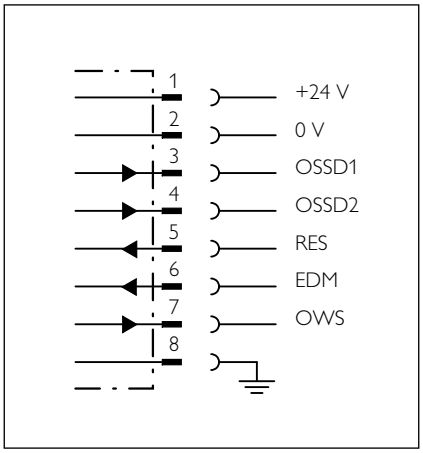


Fig. 21: Wiring diagram of the receiver unit or MSLZ

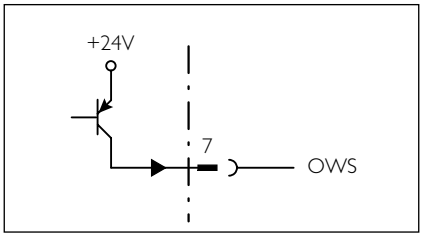


Fig. 22: The contamination warning output

	Voltage at output (standard implementation)
Light barrier contaminated	+ 24 V
Light barrier not contaminated	0 V

7.3.3 Input: External Device Monitoring (EDM)

The EDM monitors the switching elements (e. g. contacters) which are driven by the sensor outputs. The EDM is activated whenever the light beam is interrupted before the machine restarts and its consequent hazardous motion. The outputs of the light barrier and switching elements are active HIGH for an uninterrupted light beam.
When operating with EDM the switching element contacts to be monitored are connected to the EDM input (*fig. 23*).
EDM expects the contacts to be in their rest position (+ 24 V) and only then enables the outputs OSSD 1 and OSSD 2 (active HIGH for uninterrupted light beam).
Electrically, this means that both break contacts (k 1, k 2) must close when the switching elements (K 1, K 2) reach their rest position due to an interrupted light beam.

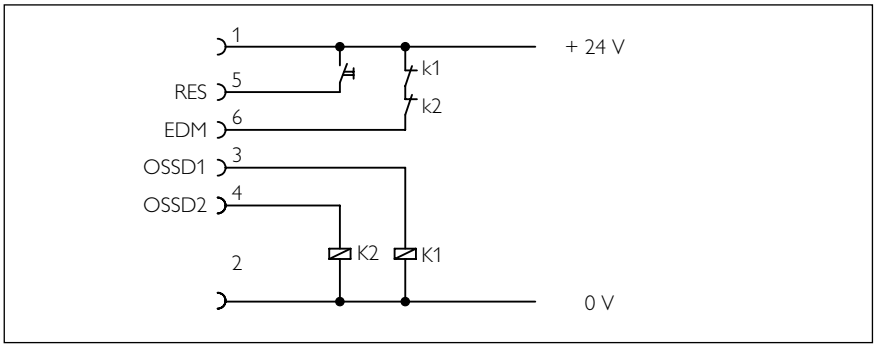


Fig. 23: Schematic for restart switch and contacts with EDM

The EDM switches the OSSDs off again ...
... if no reaction from the switching elements is determined within 300 ms (dynamic EDM).
The contacts k 1 and k 2 must then be off. If this is not the case, the outputs switch off again and the red LED on the receiver unit lights up.
When operating with Restart Inhibit, it is necessary to press the Restart Inhibit button (yellow LED flashes).
When operating without Restart Inhibit, the light beam must be interrupted and enabled. The request to do this is indicated by the continuously lit yellow LED on the receiver unit.

7.3.4 Input: Restart switch (RES)

When operating with restart inhibit (*chapter 6.2*), a make contact is connected between + 24 V and the restart switch input (*fig. 24*).
If the light beam is unobstructed, the yellow LED on the receiver flashes to indicate that the Restart switch must be activated. After the restart switch has been pressed and then released again, the sensor switches the outputs OSSD 1 and OSSD 2 high (active), and the green LED on the receiver lights up.

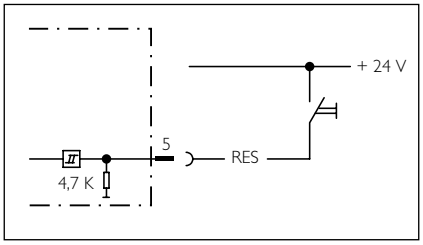


Fig. 24: Connection of the restart switch to the receiver unit or to the MSLZ

7.4 Example circuits

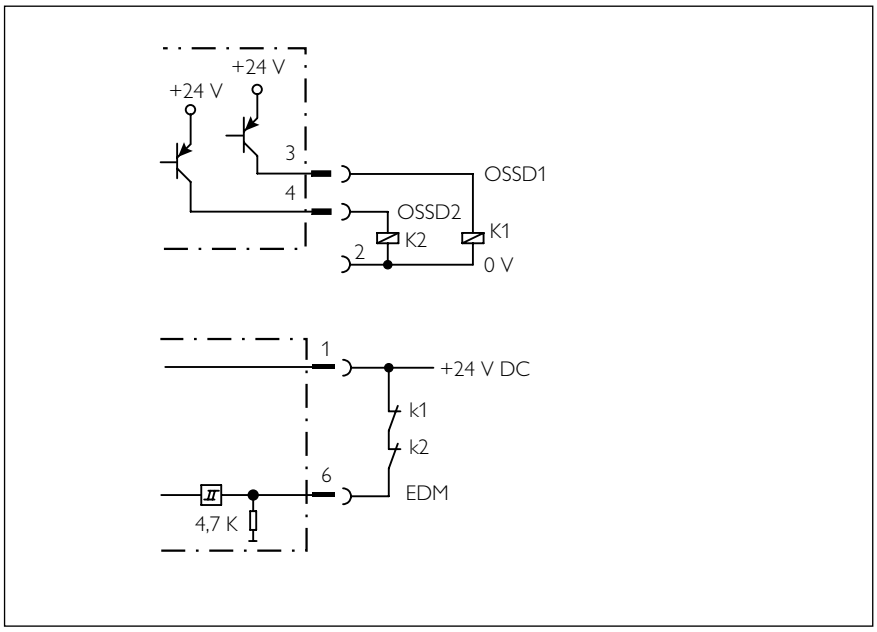


Fig. 25: Connection of the contacts with EDM

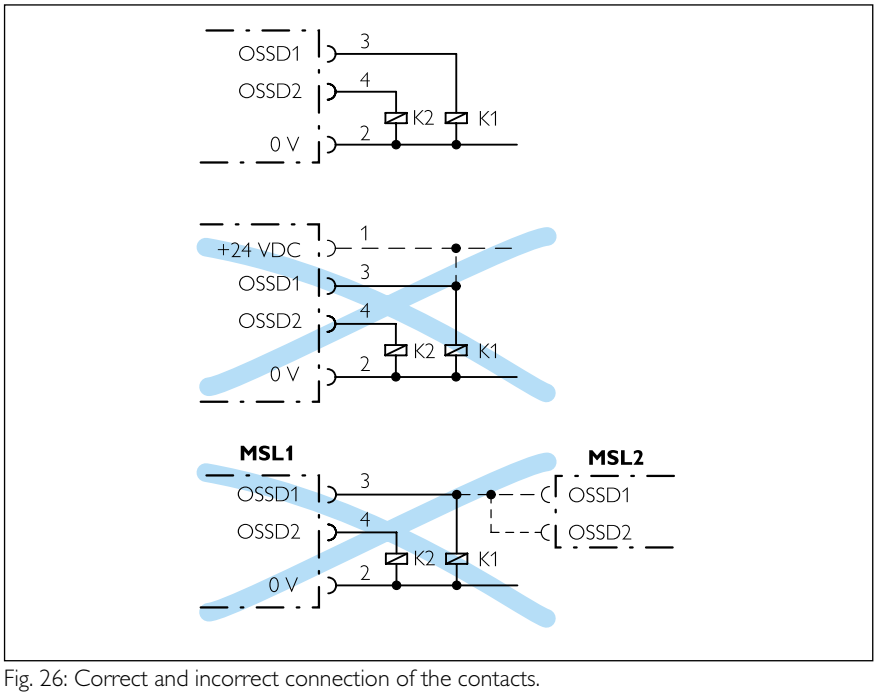


Fig. 26: Correct and incorrect connection of the contacts.

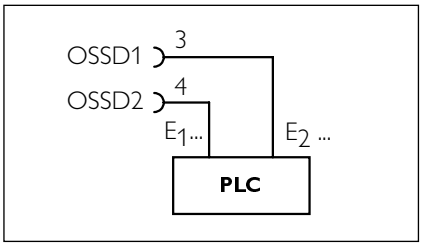
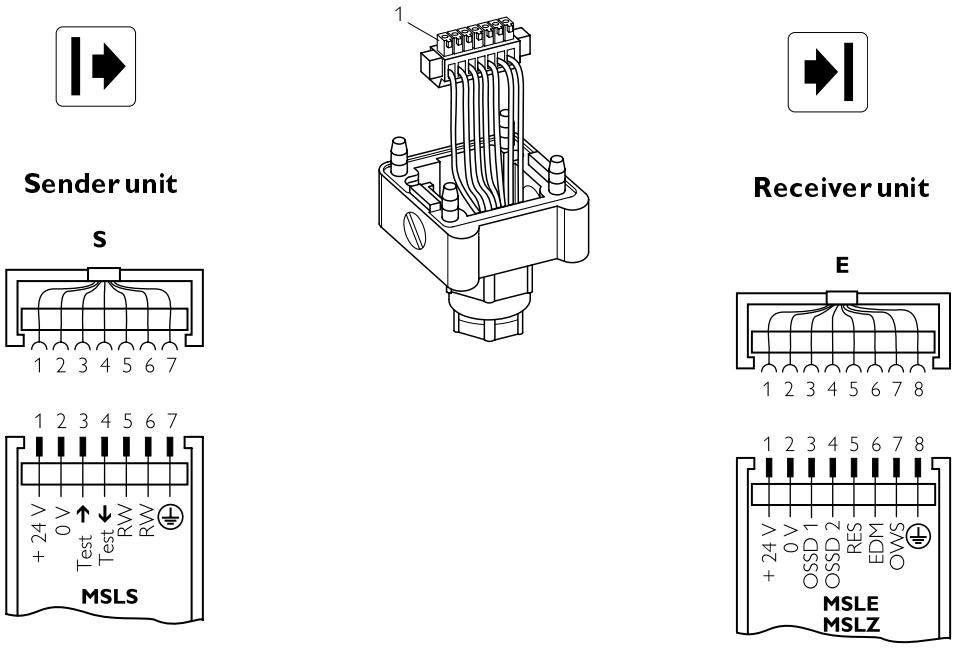


Fig. 27: Two-channel connection of the receiver unit or MSLZ to a safe PLC.

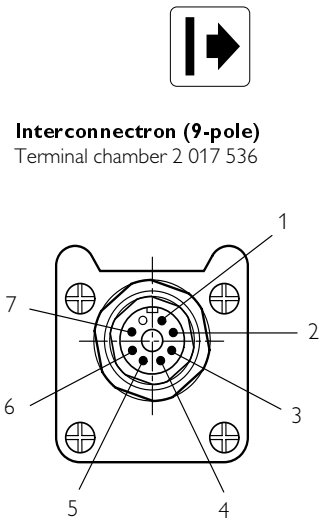
8 Connector diagrams

Connector pin-outs

Connection terminal



Interconnectron

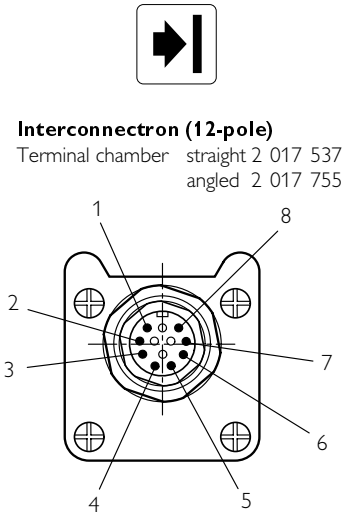


Interconnectron (9-pole)
Terminal chamber 2 017 536

Cable socket (crimp type)
6 008 440

Pin	Function
1	+ 24 V
2	0 V
3	Test →
4	Test ←
5	Scanning range
6	Scanning range
7	PE

Pin	Function
1	+ 24 V
2	0 V
3	OSSD 1
4	OSSD 2
5	RES
6	EDM
7	OWS
8	PE



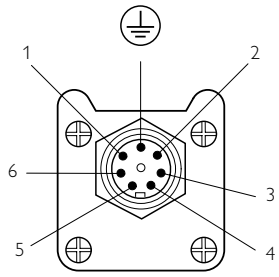
Interconnectron (12-pole)
Terminal chamber straight 2 017 537
angled 2 017 755

Cable socket (crimp type)
6 008 441

⚠ When using Interconnectron connectors, only use safe, VDE 551 approved power supplies.

Harting

Harting R 15 (7-pole + PE)
Terminal chamber
straight 2 018 549
angled 2 019 081



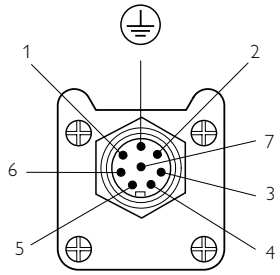
Pin	Function
1	+ 24 V
2	0 V
3	Test ➔
4	Test ←
5	Scanning range
6	Scanning range
⏚	PE

Cable socket (crimp type)
Cable diameter 11 - 15 mm 6 011 105

Cable socket (crimp type)
Cable diameter 15 - 20.5 mm 6 011 058

Harting R 15 (7-pole + PE)
Terminal chamber
straight 2 018 550
angled 2 018 551

Pin	Function
1	+ 24 V
2	0 V
3	OSSD 1
4	OSSD 2
5	RES
6	EDM
7	OWS
⏚	PE

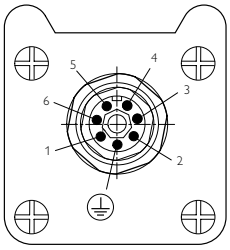


Cable socket (crimp type)
Cable diameter 11 - 15 mm 6 011 105

Cable socket (crimp type)
Cable diameter 15 - 20.5 mm 6 011 058

Hirschmann

Hirschmann (6-pole + PE)
Terminal chamber 7 021 354

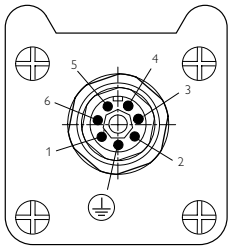


Pin	Function
1	+ 24 V
2	0 V
3	Test ➔
4	Test ←
5	Scanning range
6	Scanning range
⏚	PE

Cable socket, crimp
straight 6 006 612
angled 6 006 613

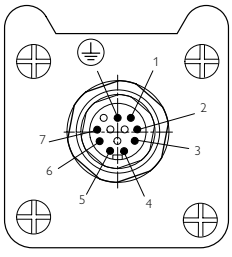
Pin	Function
1	+ 24 V
2	0 V
3	OSSD 1
4	OSSD 2
5	RES
6	EDM
⏚	PE

Hirschmann (6-pole + PE)
Terminal chamber 2 018 539



Cable socket, crimp
straight 6 006 612
angled 6 006 613

Hirschmann (11-pole + PE)
Terminal chamber 2 018 584

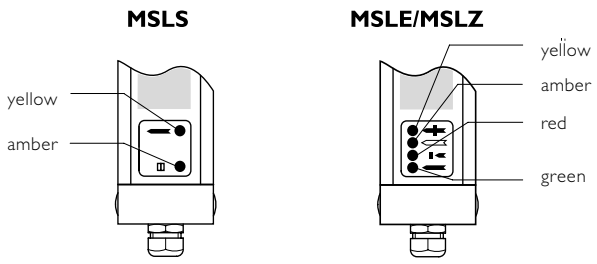


Pin	Function
1	+ 24 V
2	0 V
3	OSSD 1
4	OSSD 2
5	RES
6	EDM
7	OWS
⏚	PE

Cable socket, crimp
straight 6 020 757
angled 6 020 758

The Hirschmann connector may be mounted in the end cap in any desired position. The connector insert can only be rotated however, in 30° steps (after loosening the nut). Together with the same adjustability in the angled cable socket, this results in a 15° adjustability.

9 Diagnosis elements



Note:
There are two LED functions of the sender unit:

- up to serial number 9 652 xxx and
- from serial number 9 701 xxx

	LEDs	Cause	Test and remedy
	green red amber yellow		
Sender unit up to 9652xxxx	– – ○ ○	No power	Check voltage
	– – ● ○	Sender inactive Open circuit between terminals 3 and 4 (test contact) Device in LOCKOUT (fault condition)	Change MSLS Check passage Operating voltage OFF/ON Replace MSLS or contact SICK Service
Sender unit from 9652xxxx	– – ○ ○	No supply voltage	Check voltage
	– – ☀ 8/s ☀ 8/s	Device in lockout	Operating voltage OFF/ON Replace MSLS or contact SICK Service
	– – ● ☀ 1/s	Break between terminal 3 and 4 (test contact)	Check continuity
LEDs on sender unit must light up: Receiver unit	○ ○ ○ ○	No supply voltage at MSLE/MSLZ	Check voltage at MSLE/MSLZ Replace MSLE or contact SICK Service
	○ ● ◑ ○ (no light received)	System misaligned Receiver unit MSLE/MSLZ faulty Test input MSLS interrupted	Realign MSLE and MSLS Change MSLE/MSLZ Check testing
	◑ ◑ ● ◑	System or corner mirror misaligned Front screen of MSLE/MSLS/MSLZ and/or corner mirror dirty	Realign system or corner mirror Clean front screen and/or corner mirror
	○ ● ○ ☀	Exit window and/or corner mirror dirty	Clean front screen and/or corner mirror
	○ ● ☀ ☀	Device in LOCKOUT EDM contacts not operating	Operating voltage ON/OFF, if the green LED still remains unlit, change MSLE/MSLZ or contact SICK Service Check NC relay k 1 and k 2
	○ ● ○ ○	24 V DC permanently supplied at RES input during operation	Check RES Operating voltage OFF/ON

○ LED off ● LED illuminated ☀ LED flashing ◑ LED no influence

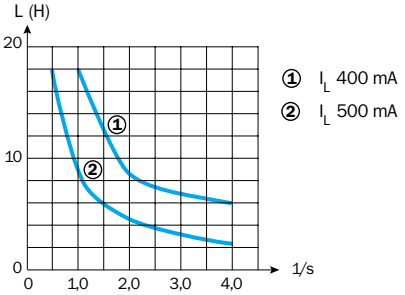
10 Technical specifications

	min.	typ.	max.
General system data			
Operating range (depending on type)			
Sender/Receiver	0,5 m		20 m
	15 m		70 m
MSLZ	0 m		7.5 m
Beam gap	50 mm		500 mm
Resolution (type-dependent)	73 mm		
Protection class	I		
Enclosure rating	IP 65		
Supply voltage U_V	19.2 V	24 V	28.8 V
Ripple [1])			2.5 V_{SS}
Voltage if power fails (20 ms)	18 V		
Synchronization		optical, without separate synchronization cable	
On-transition time			
After applying the supply voltage of receiver and sender		1.5 s	
Sender Unit			
Test output		U_V – 1.4 V	
Test input			
Input resistance (HIGH)	2.4 kΩ (in relation to 0 V)		
Sender, active	0 V		5 V
Sender, active	17.8 V		U_V
Reaction time on test		90 ms	100 ms
NC contact opening time	100 ms		
Wave length		880 nm	
Power consumption			7 W
Weight (for MSLS 03-140)		3.14 kg	
Receiver unit			
Supply connections (OSSD)	2 PNP semiconductors, short-circuit protected [2]), crossed connection-monitored		
Switching voltage HIGH (U_{eff})	U_V – 3 V		U_V
Switching current	5 mA		500 mA
Leakage current [3])			2.4 mA
Load capacity			2.2 µF
Load inductance L [4])			2.2 H
Switching frequency			4/s
Test impulse data [5])			
Test impulse width	70 µs	140 µs	160 µs
Test impulse rate	1 ms	9 ms	10 ms
Permissible cable resistance between unit and load [6])			2.5 Ω
Response time			20 ms
Switch-on time after break in light-beam release		30 ms	420 ms
Power consumption			5 W

Voltage in DC • Reference point for measured values: equipment plug

	min.	typ.	max.
External contact monitoring input			
Input resistance	2.5 kΩ (in relation to 0 V)		
Working position at	18.5 V		U_V
Rest position at	0 V		5 V
Permissible release time of contactors	no restriction		
Permissible response time of contactors			300 ms
Reset input			
Input resistance (HIGH)	2.5 kΩ (in relation to 0 V)		
Reset operated at	18.5 V		U_V
Reset released	0 V		12 V
Duration of command unit operation	50 ms		
Contamination signalling output open collector	not short-circuit-proof		
Output current			100 mA
Weight (MSLE 03-140)		3.14 kg	
Connection	Plug-in terminal chamber		
Max. conductor cross section			1 mm² with sleeve 1.5 mm² without sleeve
Cable length	Dependent on load, power supply unit and wire cross-section. The technical specifications must be observed.		
(from 10 m to 70 m)	shielded		
Operating data			
Operating mode (type-dependent)	with restart inhibit and external contact monitoring		
Safety category	Type 4		
Tested to	pr EN 50 100 Part 1 and 2		
Ambient operating temperature	0 °C		+ 55 °C
Storage temperature	– 25 °C		+ 70 °C
Air humidity (non-condensing)	15 %		95 %
Vibration resistance	5 g, 10 ... 55 Hz to IEC 68-2-6		
Shock resistance	10 g, 16 ms to IEC 68-2-29		
Dimensions	see *Dimensional drawings, Chapter 10*		

⚠ [1]) The voltage must not exceed or fall below the limit values.
[2]) Applies for voltages between U_V and 0 V.
⚠ [3]) In the case of an error (interruption of the 0 V cable) the outputs behaves like a resistor > 13 kΩ after U_V. The downstream control element must identify this state as LOW.
[4]) With a low switching frequency ([1]/s) the max. permissible load inductance L is higher.

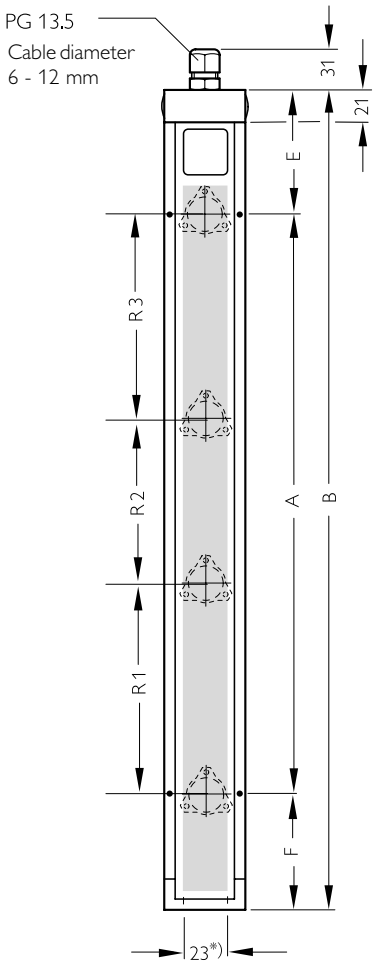


[5]) In the active state, the outputs are tested in a cycle (switch LOW briefly). When selecting the downstream control elements ensure that the test impulses with the parameters listed above donot lead to a shutdown.
⚠ [6]) The individual conductor resistor to the downstream control element must be limited to this value so that a crossed connection between the outputs can be identified. (EN 60 204 *Electrical Equip. of Machines, Part 1: General Requirements* must be observed.)

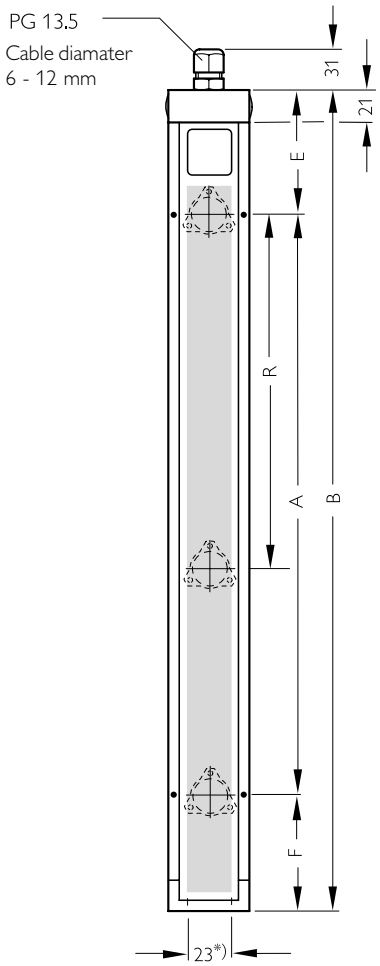
11 Dimensional diagrams

Dimensions in mm

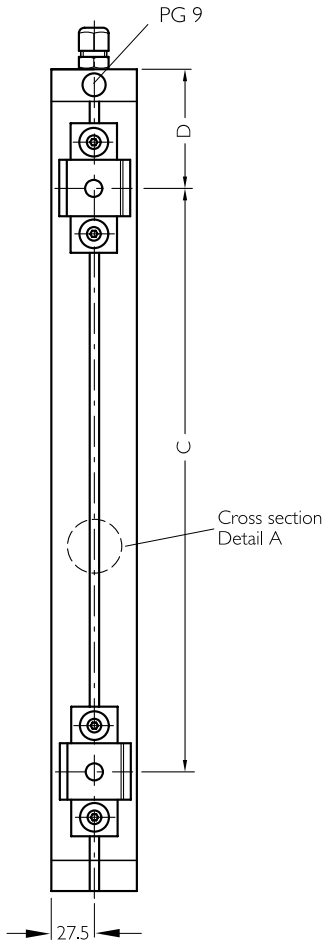
MSLZ

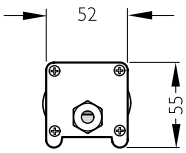


MSL

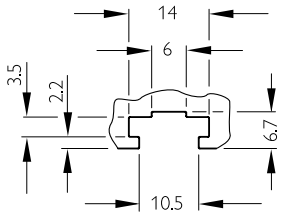


Alternative cable connection
for cable diameter 4 - 8 mm





Detail A



*) With respect to centre of housing

Resolution 93 mm

	A	B	C	D	E	F	R
MSL 20-107	1330	1585	1425	80	107	148	70
MSL 23-107	1540	1736	1576	80	107	89	70

Resolution 73 mm

	A	B	C	D	E	F	R
MSL 14-105	650	835	675	80	107	78	50
MSL 17-105	800	985	825	80	107	78	50
MSL 20-105	950	1135	975	80	107	78	50
MSL 23-105	1100	1285	1125	80	107	78	50
MSL 26-105	1250	1435	1275	80	107	78	50
MSL 29-105	1400	1586	1426	80	107	79	50
MSL 32-105	1550	1736	1576	80	107	79	50
MSL 35-105	1700	1886	1726	80	107	79	50

	A	B	C	D	E	F	R
MSL 02-150	500	684	524	80	107	77	500
MSL 03-122	440	597	437	80	107	50	220
MSL 03-140	800	985	825	80	107	78	400
MSLZ 01-150	500	684	524	80	97	87	500

12 MSL selection table

MSL sender unit

Access guarding

Sender Beams	Beam gap mm	Scanning range m	Type	Part no.
2	500	0,5 ... 20	MSLS 02-15021	1 013 748
2	500	15 ... 70	MSLS 02-15011	1 012 295
3	220	0,5 ... 20	MSLS 03-12221	1 013 749
3	220	15 ... 70	MSLS 03-12211	1 013 763
3	400	0,5 ... 20	MSLS 03-14021	1 013 750
3	400	15 ... 70	MSLS 03-14011	1 013 746

Area guarding

Sender Beams	Resolution mm	Scanning range m	Type	Part no.
20	93	0,5 ... 20	MSLS 20-10721	1 016 067
20	93	15 ... 70	MSLS 20-10711	1 015 702
23	93	0,5 ... 20	MSLS 23-10721	1 015 924
23	93	15 ... 70	MSLS 23-10711	1 015 866
14	73	0,5 ... 20	MSLS 14-10521	1 016 529
14	73	15 ... 70	MSLS 14-10511	1 016 522
17	73	0,5 ... 20	MSLS 17-10521	1 016 530
17	73	15 ... 70	MSLS 17-10511	1 016 523
20	73	0,5 ... 20	MSLS 20-10521	1 016 531
20	73	15 ... 70	MSLS 20-10511	1 016 524
23	73	0,5 ... 20	MSLS 23-10521	1 016 391
23	73	15 ... 70	MSLS 23-10511	1 016 390
26	73	0,5 ... 20	MSLS 26-10521	1 016 532
26	73	15 ... 70	MSLS 26-10511	1 016 525
29	73	0,5 ... 20	MSLS 29-10521	1 016 533
29	73	15 ... 70	MSLS 29-10511	1 016 526
32	73	0,5 ... 20	MSLS 32-10521	1 016 534
32	73	15 ... 70	MSLS 32-10511	1 016 527
35	73	0,5 ... 20	MSLS 35-10521	1 016 535
35	73	15 ... 70	MSLS 35-10511	1 016 528

The part no. of the MSL

- with/without external contact monitoring
- with/without restart inhibit

are available upon request.

Connector system must be ordered separately.
Standard equipment is PG connector.

MSL-Receiver unit and MSLZ ...

... without muting

Access guarding

Receiver Beams	Beam gap mm	with RES and EDM Type	Part no.
2	500	MSLE 02-15011	1 012 296
3	220	MSLE 03-12211	1 013 764
3	400	MSLE 03-14011	1 013 747

MSLZ

Sender-/receiver unit MSLZ

1	500	MSLZ 01-15031	1 013 771

Gap: active/passive side 7.5 m

... with Muting and Override

Access guarding

Receiver Beams	Beam gap	with RES and EDM Type	Part no.
2	500 mm	MSLE 02-15061 A	1 015 701
3	220 mm	MSLE 03-12261 A	1 015 851
3	400 mm	MSLE 03-14061 A	1 015 700

MSLZ

Sender-/receiver unit MSLZ

1	500 mm	MSLZ 01-15021 A	1 015 803

Gap: active/passive side 7.5 m

Area guarding

Receiver Beams	Resolution mm	with RES and EDM Type	Part no.
20	93	MSLE 20-10711	1 015 703
23	93	MSLE 23-10711	1 015 867
14	73	MSLE 14-10511	1 016 536
17	73	MSLE 17-10511	1 016 537
20	73	MSLE 20-10511	1 016 538
23	73	MSLE 23-10511	1 016 392
26	73	MSLE 26-10511	1 016 539
29	73	MSLE 29-10511	1 016 540
32	73	MSLE 32-10511	1 016 541
35	73	MSLE 35-10511	1 016 542

13 Accessory selection table

Type	Designation	Part number
Mounting bracket		
	Sliding nuts (sliding block), pack of 4 *)	2 017 550
	Sliding nuts, additional, single	5 305 719
	Mounting kit 1: Mounting bracket rigid, x4	7 021 352
	Mounting kit 2: Mounting bracket hinged, x4	2 017 751
	Mounting kit 3: Mounting bracket hinged, vibration damped, x4	2 017 752
	Mounting kit 4: Mounting bracket hinged, vibration damped and shock-absorbing, x4	2 018 742
24 V power pack		
	120/230 V AC, 2.5 A	6 010 361
	120/230 V AC, 4 A	6 010 362
Laser alignment aid		
	AR 60	1 015 741
	Adapter AR 60 MSL/FGS, click-on	4 030 282
Connection		
	Terminal chamber with PG cable gland, PG 13.5, side PG 9 (x2)	
	Interconnectron design	
	Equipment plug, crimped, attached to terminal chamber	
	for sender unit (9-pin)	2 017 536
	for receiver unit (12-pin)	2 017 537
	for receiver unit (12-pin), angled **)	2 017 755
	Cable receptacle	
	for sender unit, straight, 9-pin	6 008 440
	for receiver unit, straight,12-pin	6 008 441
	Harting design R 15	
	Equipment plug, crimped, attached to terminal chamber	
	for sender unit, straight	2 018 549
	for receiver unit, straight	2 018 550
	for sender unit, angled	2 019 081
	for receiver unit, angled	2 018 551
	Cable receptacle	
	for sender and receiver unit, for cable dia. 11 - 15 mm	6 011 105
	for sender and receiver unit, for cable dia. 15 - 20.5 mm	6 011 058
	Hirschmann design	
	DIN equipment plug (DIN 43651), attached to terminal chamber	
	for sender unit, 6-pin + PE	7 021 354
	for receiver unit, 6-pin + PE, contamination signalling output not connected	2 018 539
	for receiver unit, 11-pin + PE	2 018 584
	Cable receptacle	
	for receiver unit, straight, 6-pin + PE	6 006 612
	for receiver unit, angled, 6-pin + PE	6 006 613
	for receiver unit, 11-pin + PE, straight, with crimp contacts	6 020 757
	for receiver unit, 11-pin + PE, angled, with crimp contacts	6 020 758

*) Four sliding blocks supplied with each sender and each receiver
**) Specially recommended when using the MSM

The basic specification is highlighted in gray. The connector system must be ordered separately.

Type	Designation	Part number
Auxiliary muting module		
	MSM	1 013 769
	Indicator lamp, incl. 2 m cable, plug, incl. mounting kit with mounting	
	Brackets for attachment to MSM	2 017 768
	Indicator lamp, incl. 10 m cable, with plugs for MSM	2 018 504
	Indicator lamp, LED design, incl. mounting kit and plug for MSM	
	with 2 m cable	2 019 909
	with 10 m cable	2 019 910
	Sensor cable with plug for MSM	
	2 m long	6 010 974
	5 m long	6 010 976
	10 m long	6 008 652
	Sensor cable complete with plug for MSM and cable receptacle for WT 24	
	2 m long	6 008 649
	5 m long	6 008 650
	Sensor cable complete with plug for MSM and cable receptacle for WL 12, WL 14, WL 18, WL 23 and WL 27	
	2 m long	6 021 092
	5 m long	6 021 093
	Angled plug for muting sensor without cable	6 008 651
	Replacement lamp	6 008 654
	Replacement housing	6 008 645
Mounting columns		
	Mirror column 400, fully mounted	1 015 040
	Equipment column 400, with mounting kit	2 018 153
	Mirror column 500, fully mounted	1 015 041
	Equipment column 500, with mounting kit	2 018 154
	Mirror insert complete	2 018 537
	Mirror insert 45°	2 018 547
	Adapter plate for floor fixing	4 031 053
Corner mirrors		
	PSK 45, not suitable for column mounting	5 306 053
	PSZ 01-1501 in MSLZ housing, 500 mm beam gap	1 015 693
	PSZ 01-1401 in MSLZ housing, 400 mm beam gap	1 015 897

SICK

Checklist for machine manufacturer/installer for the installation of Electro Sensitive Protective Equipment (ESPE)

Dependent upon the application, the below listed checks are a minimum when placing an ESPE in operation for the first time.

For reference purposes the list should be retained or stored with the machine documents.

1.	Are the relevant safety standards incorporated into the machine build? Will they satisfy the Regulations?	Yes ☐	No ☐
2.	Are the standards listed in the Declaration of Conformity?	Yes ☐	No ☐
3.	Is the ESPE the correct Type and interfaced to the correct Category?	Yes ☐	No ☐
4.	Is access to the danger zone/point of danger only possible through the ESPE?	Yes ☐	No ☐
5.	Are measures in place to prevent standing between the ESPE and the danger zone? If so, are these measures secured against removal?	Yes ☐	No ☐
6.	Has the overall machine stopping time been checked and documented?	Yes ☐	No ☐
7.	Is the resultant safety distance observed between the danger point and the ESPE?	Yes ☐	No ☐
8.	Is the ESPE correctly fixed and secured against movement after setting in its fixed position?	Yes ☐	No ☐
9.	Are the required protection measures against electric shock in place?	Yes ☐	No ☐
10.	Is the re-set/re-start switch for the ESPE installed and fitted to the correct standard?	Yes ☐	No ☐
11.	Are the OSSDs of the ESPE connected in accordance with the machine circuit diagram?	Yes ☐	No ☐
12.	Have the protective functions been inspected in accordance with the inspection instructions of this document?	Yes ☐	No ☐
13.	Are the protective functions effective in every setting of the operating mode switch?	Yes ☐	No ☐
14.	Are the switching elements controlled by the ESPE, e. g. contactors, valves monitored?	Yes ☐	No ☐
15.	Is the ESPE effective during the entire hazardous state?	Yes ☐	No ☐
16.	Is the hazardous state ended when the ESPE is switched on or off, as well as upon changing operation modes or on switching over to another protective device?	Yes ☐	No ☐
17.	Is the Daily Check Requirement sign positioned in a place visible to the operator?	Yes ☐	No ☐

This checklist does not replace the initial commissioning of regular inspections by qualified personnel.

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