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Sicherheitstechnik · Safety Technology

Produktkatalog · Product Catalogue

140222 v2.5

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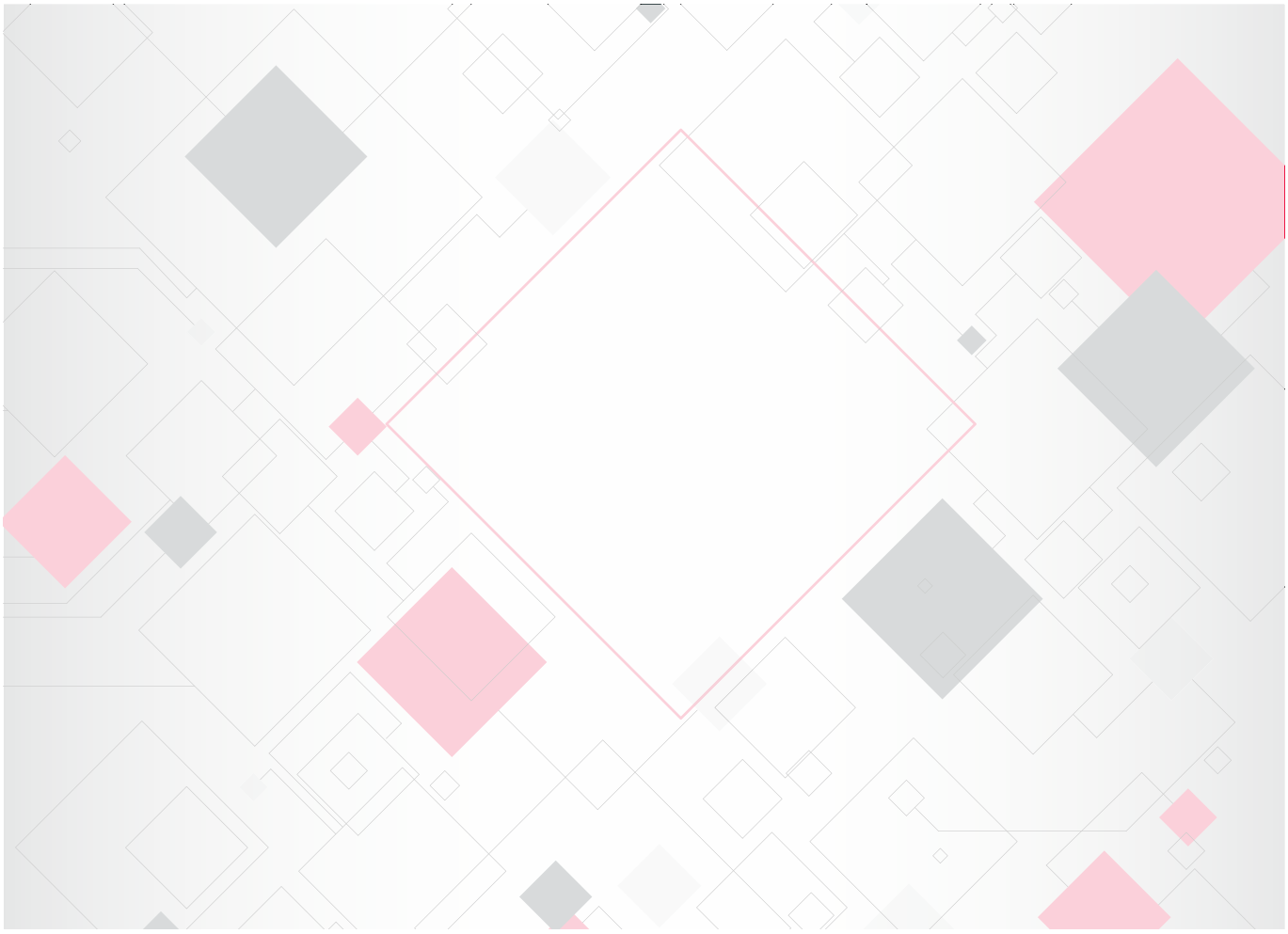

General

EN | Product information

Mayser GmbH & Co. KG
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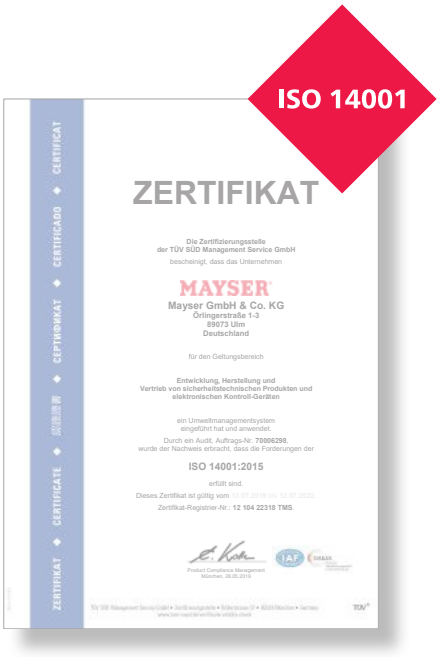
Quality management

In addition to the important role played by our employees, another key ingredient of our success is the quality of our products. We want our customers to be excited about our products and solutions. To achieve this, we offer intensive support, critically examine the requirements of our customers and generate new ideas.

In addition, Mayser strives for continuous improvement of quality – both in production and in development. In this way, we can ensure that all products, systems and solutions fulfil the relevant quality standards and comply with the applicable standards and directives. This is also backed up by our certifications.

We are certified by **TÜV SÜD Management Service GmbH** for the areas of

- the development, construction and sale of safety technology products and electronic monitoring devices in accordance with **ISO 9001** and **ISO 14001**
- the development and construction of anti-pinch protection systems and seat occupancy detectors – and their components – for the automotive industry in accordance with **IATF 16949**



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Certificates

Tip:
Detailed versions of all the certificates can be found in the Downloads area of our website at www.mayser.com.

Further details can be found in the certificates: Please click on the desired certificate.

Quality management

Quality management system	Certificate No.
According to ISO 9001:2015	12 100 22318 TMS
According to IATF 16949:2016	12 111 22318 TMS

Environmental management

Environmental management system	Certificate No.
According to ISO 14001:2015	12 104 22318 TMS

Safety edges

Safety edges	Certificate No.
SK SP 37	44 205 13043610 *
SK SP 57	44 205 13043611 *
SK SP 67	44 205 13043612 *
SK SP 87	44 205 13043614 *
SK SP according to CSA C22.2 No. 247	UL-CA-L496132-21-41508102-1
SK SP according to UL 325	UL-US-L496132-11-41508102-1
SL NC II	IFA 2001029 *

Miniature safety edges

Miniature safety edge	Certificate No.
EKS and SE 1 TPE according to UL 325	20180912-E496132

Control units

Control unit	Certificate No.
SG-EFS 104/4L	44 205 15176904
SG-EFS 104/4L according to UL 508	20150327-E471221
SG-EFS 104/2W	44 205 13127902
SG-RS 309-2	44 205 13043613
RB3 system: T868 + R868	44 207 13749706

* EC type examination certificates apply exclusively to the combinations of sensor and control unit specified therein.

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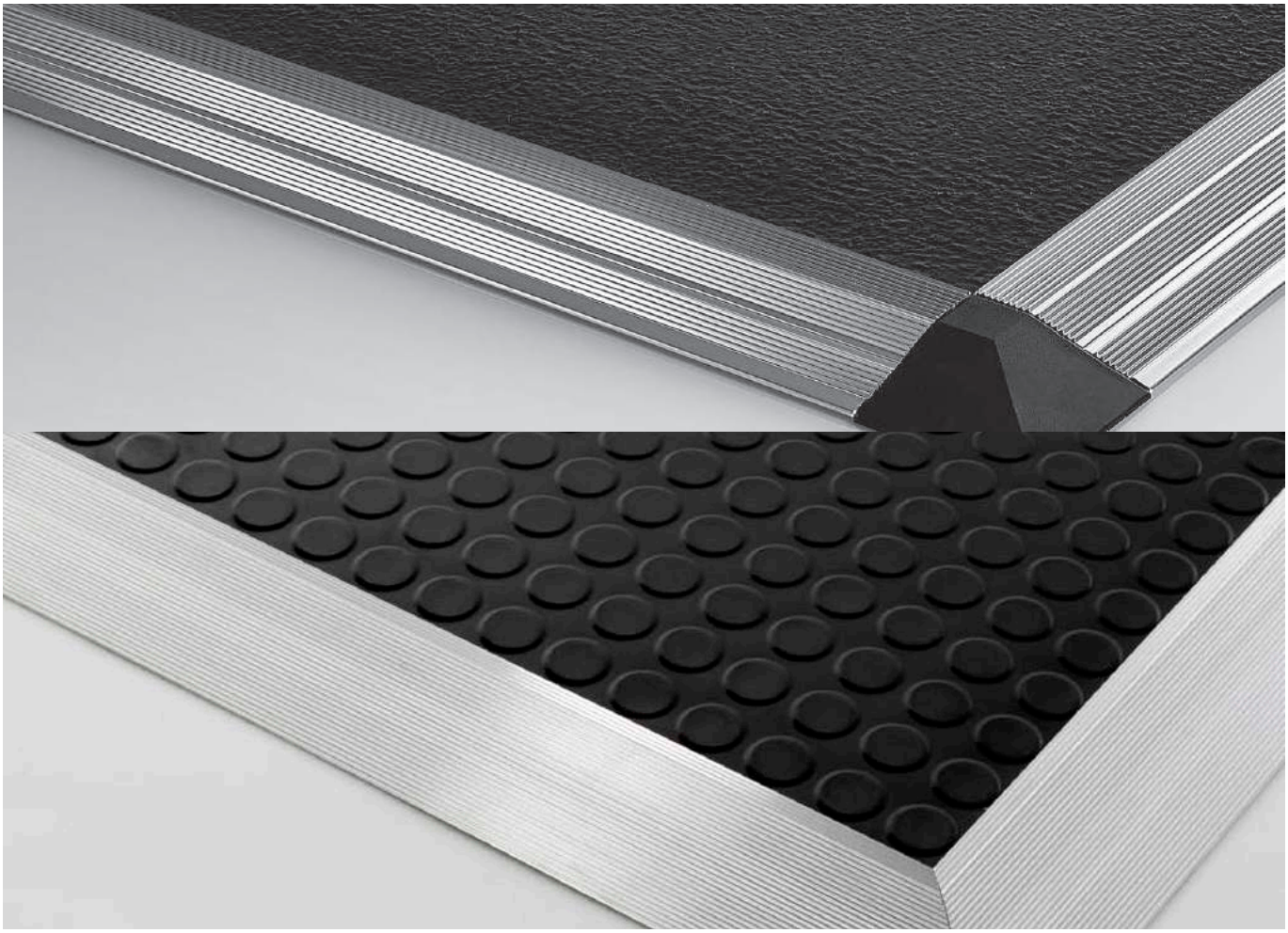

Safety mats SM and SM11

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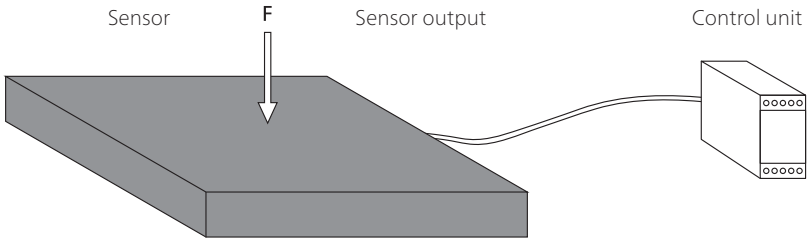
Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

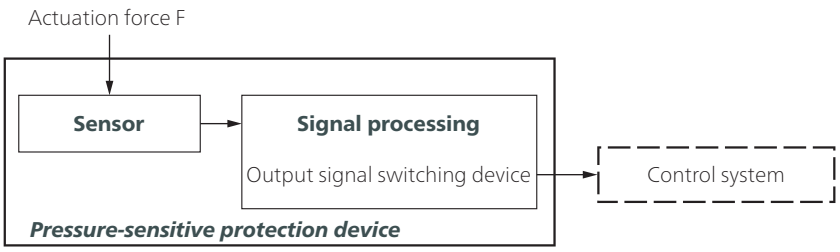


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuation area is deformed locally.

Signal processing

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the forwarding control system and which transmits safety output signals such as STOP.

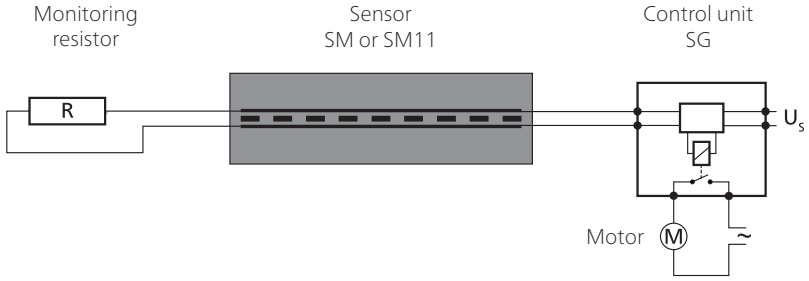


Tip: Terms are defined in ISO 13856-1 Section 3.

Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP65 is the standard for safety mats.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…
- Is it necessary to detect people who weigh < 35 kg?

Operation principle of 2-wire technology



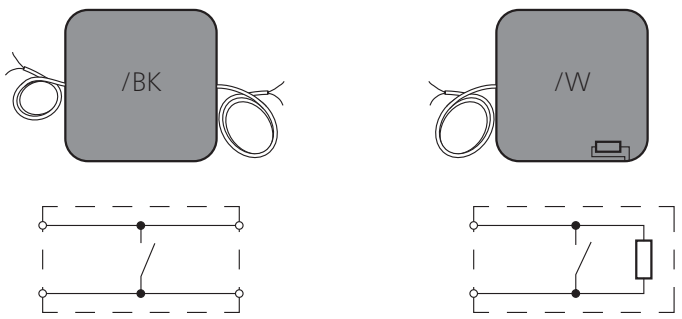
The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

Types

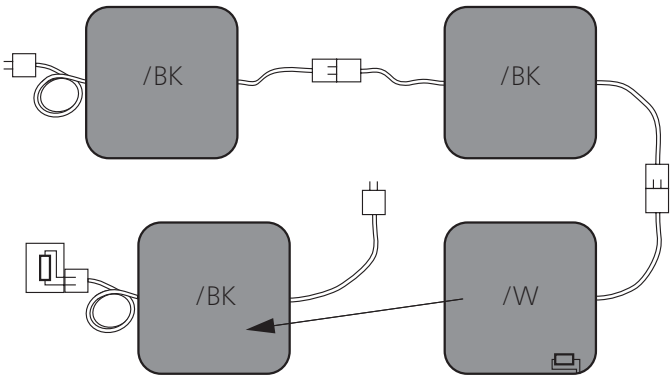
/BK With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor

/W With an integrated monitoring resistor for use as an end sensor



Subject to technical modifications.

Sensor combination

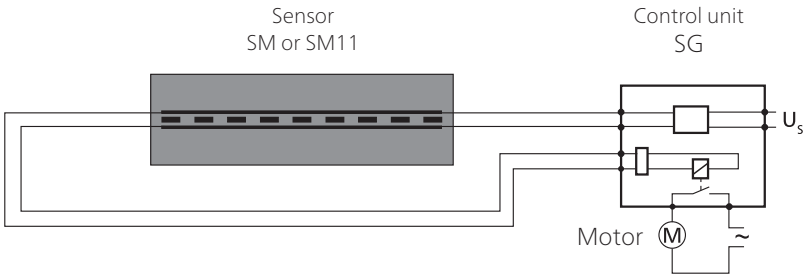


Version with external resistor, therefore no variety of models

Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety mats can be combined to create an overall surface of any size and shape

Operation principle of 4-wire technology



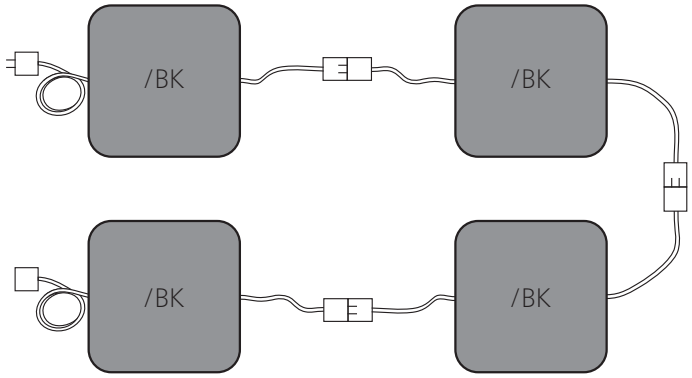
The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

/BK With cables on both sides for use as a through sensor

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety mats can be combined to create an overall surface of any size and shape

Subject to technical modifications.

Safety

Intended use

A safety mat detects a person standing on it or who steps onto it. It is a flat protection device that is capable of monitoring when somebody is present. Its task is to prevent possible hazardous situations that could affect someone within a danger zone.
Typical areas of application are moving parts on machines and systems.
Safe operation of a safety mat depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

Tip: This is illustrated clearly by Figures B.1 and B.2 in ISO 13856-1.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 10 /BK-type sensors can be connected to one control unit.
- No more than 9 /BK-type sensors and 1 /W-type sensor can be connected to one control unit.
- Max. system size: 15 m^2
  = max. quantity × max. sensor size

Exclusions

Sensors are not suitable for:

- Detecting people who weigh less than 20 kg
- Driving on with industrial trucks

Sensor combinations are not suitable for:

- Detecting people who weigh less than 35 kg

Selecting the appropriate product line

The size and shape of safety mats can be customised to create a bespoke solution. SM safety mats are highly resistant to environmental influences and normal chemical influences.
If your sensor requirements are lower, our SM11 or SM8 safety mat products may be right for you.

Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts in the case of pressure-sensitive protection devices according to ISO 13856. In this case, no characteristic values of the sensor whatsoever are included when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety mat system (pressure-sensitive protection device) as a whole.

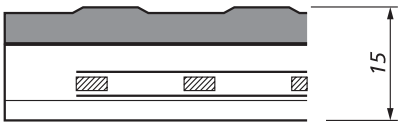
Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard. After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

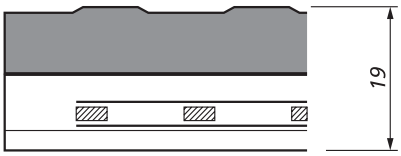
Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design

Design of the SM

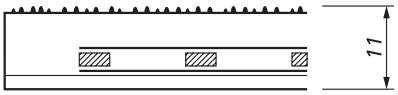


SM with GM1
Moulded onto a plastic plate.
The rubber studded covering provides the necessary non-slip properties and ensures mechanical protection.



SM with GM5
Moulded onto a plastic plate.
The high-strength rubber studded covering provides the necessary non-slip properties and ensures a high level of mechanical protection.

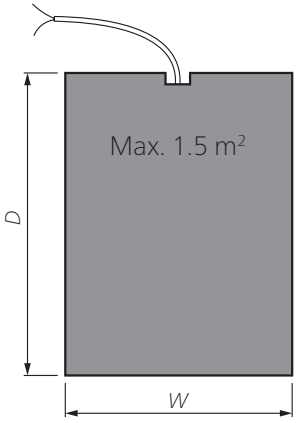
Design of the SM11



SM11
Moulded onto a plastic plate.
The surface texture provides the necessary non-slip properties and ensures mechanical protection.

Available sizes

Sensors are available up to a max. size of 1.5 m^2.
The side lengths must be within a range of 200 to 3000 mm.



W: Width (broad side)
D: Depth (long side)

$W \times D \leq 1.5\ m^2$

The cable exit can be on the broad or long side.

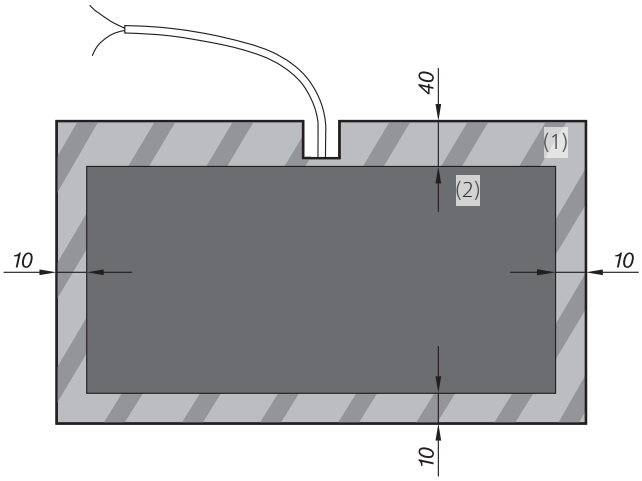
According to ISO 13855, the minimum depth to the danger zone must be taken into account (see chapter *Calculation of the necessary actuation area*).
The non-sensitive edges must be taken into account (see chapter *Effective actuation area*).

Subject to technical modifications.

Effective actuation area

A non-sensitive edge (1) surrounds the effective actuation area (2):

- 40 mm = on the cable exit side
- 10 mm = on the remaining sides



Sensor combinations

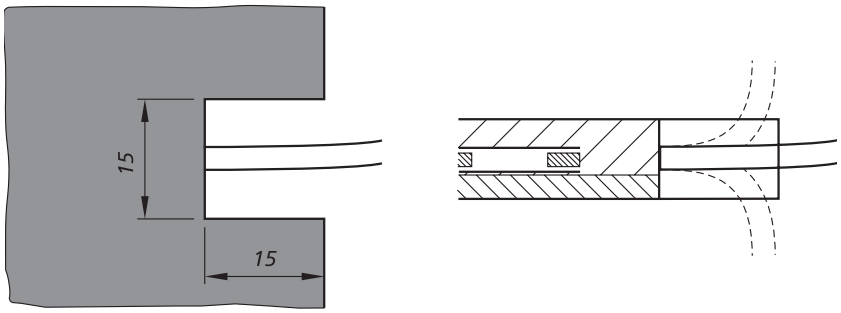
When sensor combinations are used, only the sides with 10 mm edges should be placed next to one another.

Connection

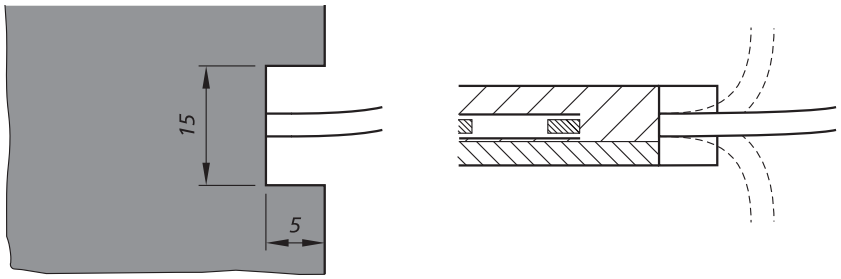
Cable exit

The multifunction cut-out also allows the cable to be laid so that it exits upwards or downwards.
The cable exit is located in the middle of the side.

SM cable exit



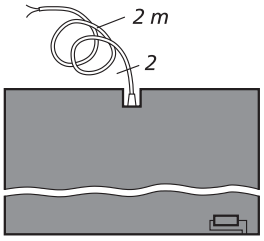
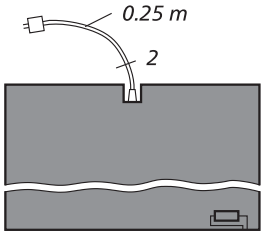
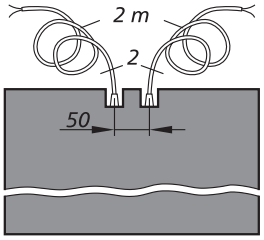
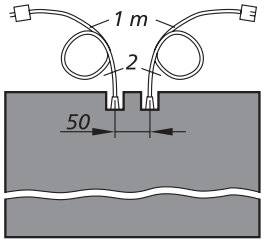
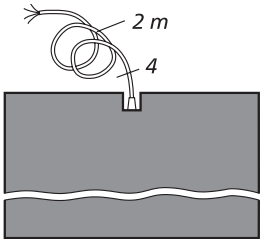
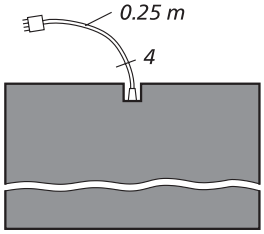
SM11 cable exit



Cable connection

- Standard cable lengths
  L = 2.0 m
- Maximum total cable length to the control unit
  L_{max} = 100 m

Subject to technical modifications.

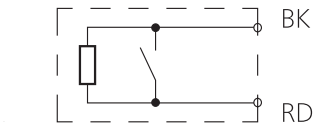
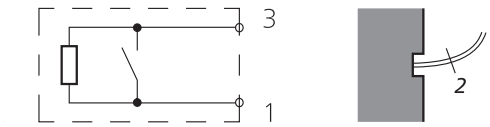
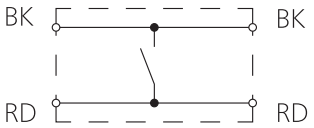
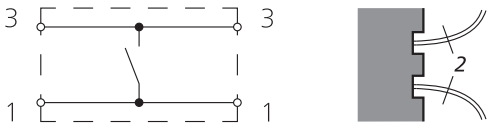
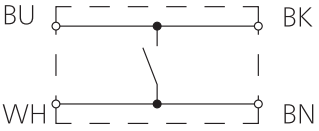
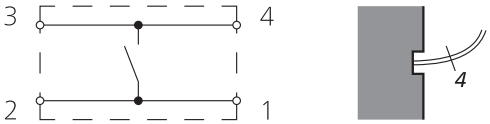
Without plug (standard)	With plug (M8)
• Suitable for universal use • Variable cable length	• Service-friendly • Easy assembly • Secure connection • Watertight plug connection
/W-type sensor with 1 line	
	
• As an individual /W-type sensor or a /W-type end sensor • Integrated resistor • 1 two-wire cable	
/BK-type sensor with 2 lines	
	
• As a /BK-type through sensor • Without resistor • 2 two-wire cables	
/BK-type sensor with 1 line	
	
• As a /BK-type through sensor • Without resistor • 1 four-wire cable	

Subject to technical modifications.

Wire colours

Colour coding

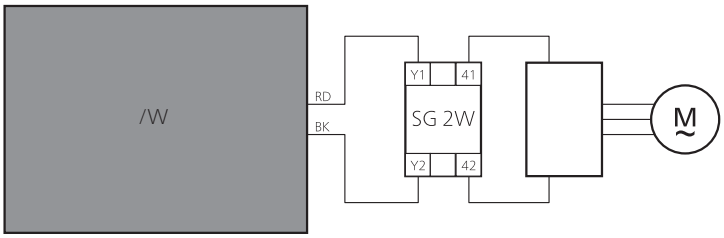
BK	Black
BN	Brown
BU	Blue
RD	Red
WH	White

Without plug (standard)	With plug (M8)
	
/W-type sensor with 1 line	
	
/BK-type sensor with 2 lines	
	
/BK-type sensor with 1 line	
	

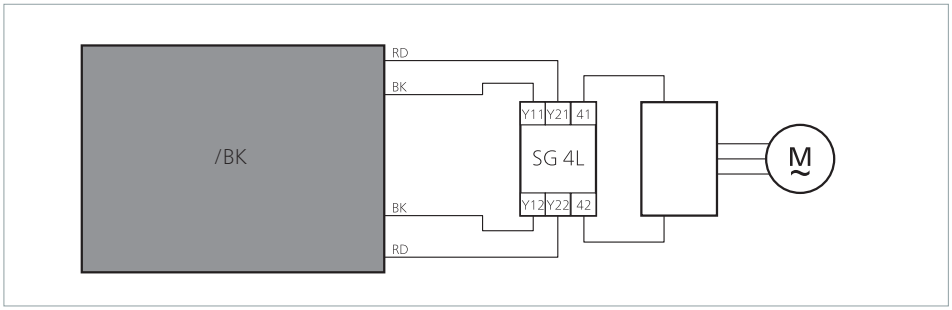
Connection examples

Key:

SG 2W	Evaluation with 2-wire technology
SG 4L	Evaluation with 4-wire technology



Subject to technical modifications.



Sensor surface

Sensor surface of the SM

The rubber studded covering is glued in place at the factory. It provides the necessary non-slip properties and ensures mechanical protection.

GM1
Black covering with circular studs
Yellow covering with circular studs
Material: NBR
Thickness: 4.5 mm $^{\pm 0.5}$
Max. size: 1.0 m × 10 m
1.2 m × 10 m

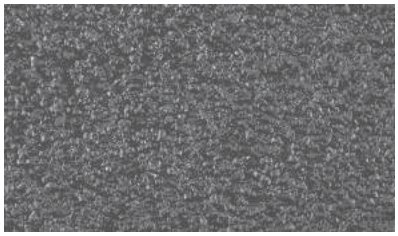
GM5
Green covering with circular studs
With high mechanical strength
Material: NBR
Thickness: 9 mm $^{\pm 0.5}$
Max. size: 1.2 m × 10 m

Subject to technical modifications.

Sensor surface of the SM11

The rough surface texture is applied at the factory. It provides the necessary non-slip properties and ensures mechanical protection.

Surface texture
Grey
Material: PUR
Thickness: 1.0 mm



Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having:

- A rubber studded covering that is bonded face to face with the sensor (SM only)
- An undamaged surface (SM and SM11)

Physical resistance

	NBR (SM)	PUR (SM11)
DIN 53516: Abrasion	120 mg	< 150 mg
DIN 4102: Fire behaviour	B2	B2
Alternating climate stress conditions	+	+
UV resistance	+	+

Explanation of symbols:
+ = resistant

Subject to technical modifications.

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

Explanation of symbols:

+ = resistant
± = resistant to a certain extent
– = not resistant

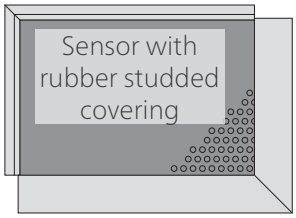
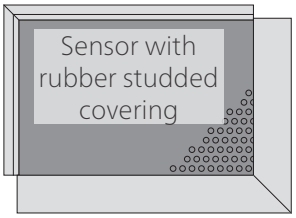
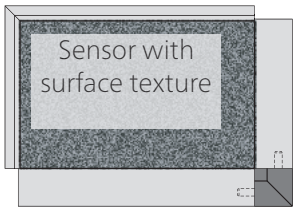
Material	NBR (SM)	PUR (SM11)
Acetone	+	–
Ammonia	+	+
Brake fluid	±	
Cutting emulsion	±	+
Acetic acid	±	
Greases	+	–
Caustic potash solution	+	
Cooling lubricant	+	±
Metal working oil	+	+
Methyl alcohol	±	–
Sodium hydroxide	+	
Cellulose thinner	±	–
Hydrochloric acid 10%	+	±
Suds	+	
Spirit (ethyl alcohol)	+	–
Water	+	+
Petroleum ether / petrol	+	–
Citric acid	+	
Drawing compound	±	–

Subject to technical modifications.

Mounting

The sensors must be mounted immediately in front of the danger zone. They must be fixed in place using ramp edges, Z-profiles or cable conduits (optional), which must be screwed to the floor. Ramp edges are required on the access sides to minimise the risk of tripping.

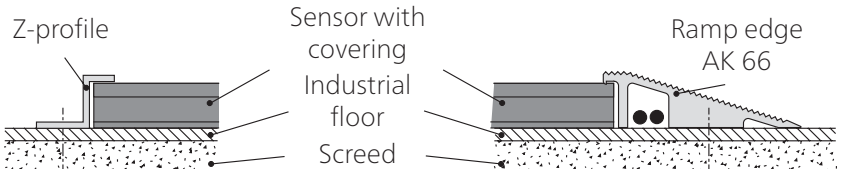
Overview of fixing materials

SM with GM1	SM with GM5	SM11
Overall height 15 mm	Overall height 19 mm	Overall height 11 mm
Z-profile (machine side)	Z/1-profile (machine side)	Z/2-profile or AP 45 cable conduit (machine side)
		
Ramp edge AK 66 or AK 105 (access side)	Ramp edge AK 105/1 (access side)	Ramp edge AK 56 (access side)
Other fixing materials		
Sealing plug	–	Outer corner connector E1 AK 56
		Connecting wedge Vk AK 56
		Inner corner connector E2 AK 56

Subject to technical modifications.

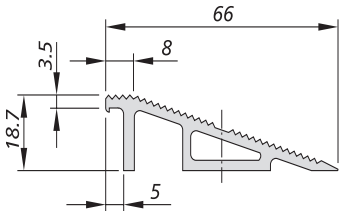
Fixing the SM with GM1

Ramp edge AK 66 with Z-profile



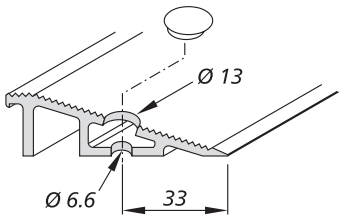
- Not suitable for plug-in cable connections
- Cable conduit for max. 2 cables

Aluminium ramp edge AK 66
- 1-piece with cable conduit
- For sensor combinations with up to 2 sensors
- Sensor without plug
- Aluminium ramp edge for sensors with GM1
- Rod 3 m (7500053), rod 6 m (1000008) or fixed length

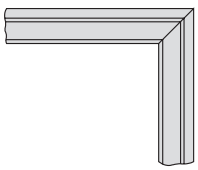


Stepped hole for AK 66
- For fixing aluminium ramp edge AK 66

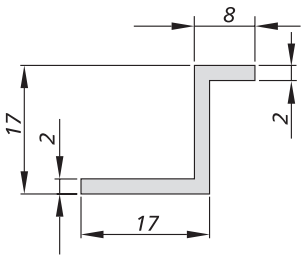
Sealing plug
- Seals the stepped hole (1000615)



Mitre cut
- For corner connections

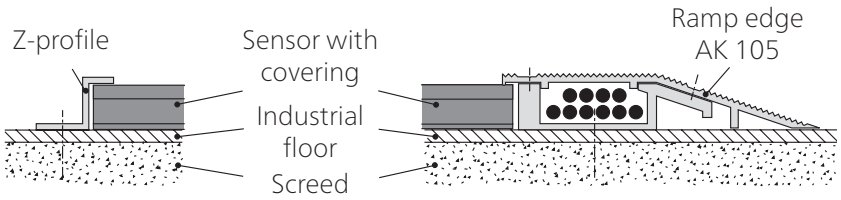


Aluminium Z-profile
- Edging at the machine or wall side
- Aluminium Z-profile for sensors with GM1
- Aluminium Z-profile: Rod 3 m (7500054), rod 6 m (1000011) or fixed length



Subject to technical modifications.

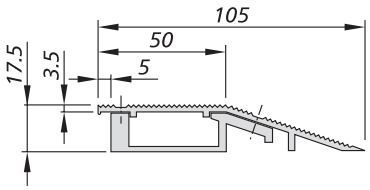
Ramp edge AK 105 with Z-profile



- Suitable for plug-in cable connections
- Cable conduit for max. 10 cables

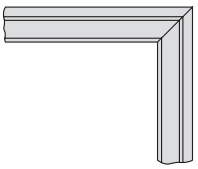
Aluminium ramp edge AK 105

- 2-piece with cable conduit
- For sensor combinations
- Sensors with or without plugs
- Aluminium ramp edge AK 105 for sensors with GM1
- Aluminium ramp edge AK 105:
  Rod 3 m upper and lower sections (7500052),
  rod 6 m upper section (1000009),
  rod 6 m lower section (1000010),
  or fixed length



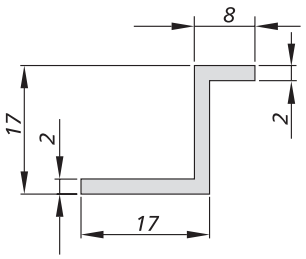
Mitre cut

- For corner connections



Aluminium Z-profile

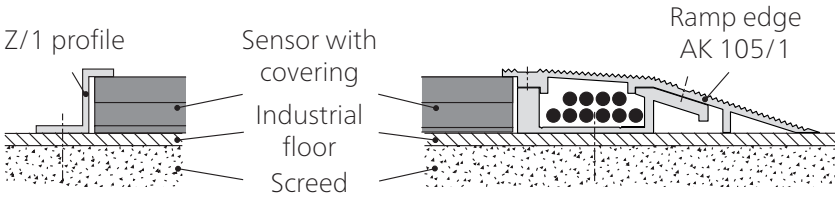
- Edging at the machine or wall side
- Aluminium Z-profile for sensors with GM1
- Aluminium Z-profile:
  Rod 3 m (7500054),
  rod 6 m (1000011)
  or fixed length



Subject to technical modifications.

Fixing the SM with GM5

Ramp edge AK 105/1 with Z/1-profile

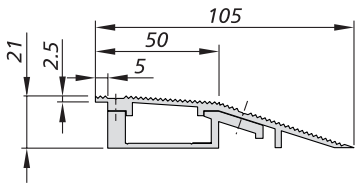


- Suitable for plug-in cable connections
- Cable conduit for max. 10 cables

Ramp edge AK 105/1 and Z/1-profile only suitable for sensors with GM5.

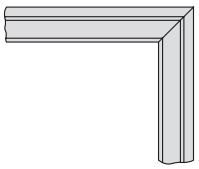
Aluminium ramp edge AK 105/1

- 2-piece with cable conduit
- For sensor combinations
- Sensors with or without plugs
- Aluminium ramp edge AK 105/1 for sensors with GM5
- Aluminium ramp edge AK 105/1:
  Rod 3 m upper and lower sections (7500224),
  rod 6 m upper section (1000992),
  rod 6 m lower section (1000010),
  or fixed length



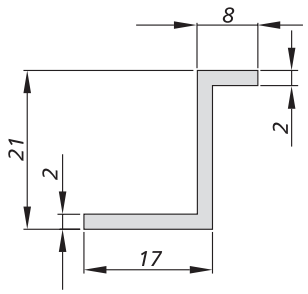
Mitre cut

- For corner connections



Aluminium Z/1-profile

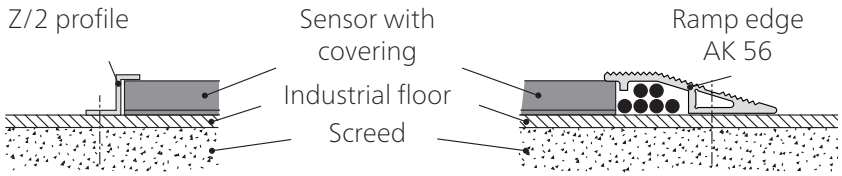
- Edging at the machine or wall side
- Aluminium Z/1-profile for sensors with GM5
- Aluminium Z/1-profile:
  Rod 3 m (7500738),
  rod 6 m (1001478)
  or fixed length



Subject to technical modifications.

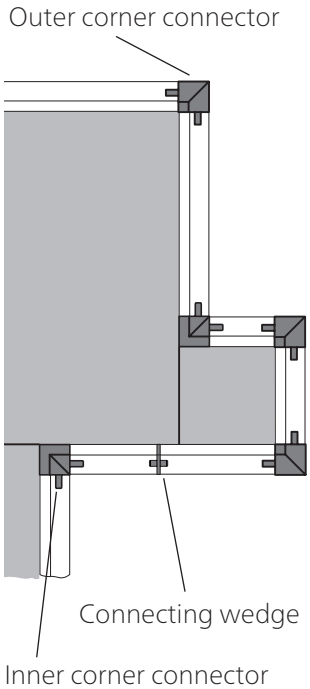
Fixing the SM11

Ramp edge AK 56 with Z/2-profile

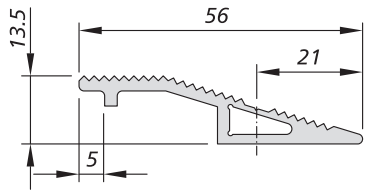


- Not suitable for plug-in cable connections
- Cable conduit for max. 6 cables

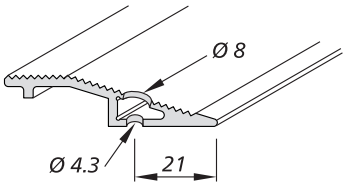
Example:



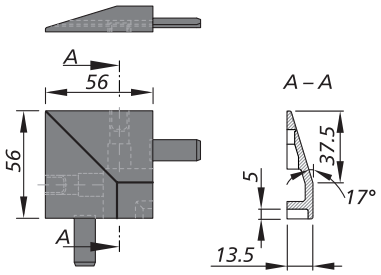
Aluminium ramp edge AK 56
- 1-piece with cable conduit
- For sensor combinations
- Sensors with or without plugs
- Rod 3 m (7501014), rod 6 m (1002684) or fixed length



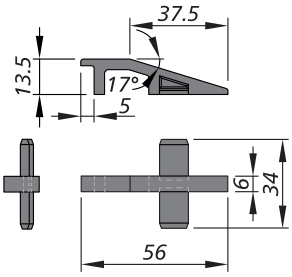
Stepped hole for AK 56
- For fixing ramp edge AK 56



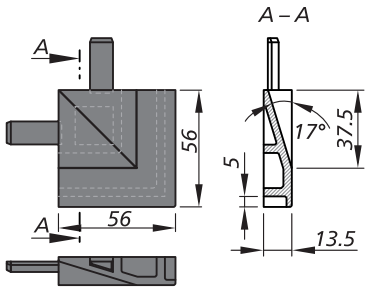
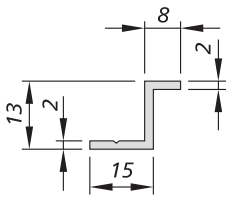
Outer corner connector E1 AK 56
- For connecting the corners of ramp edge AK 56
- Material: Black plastic (1002751)



Connecting wedge Vk AK 56
- For connecting several ramp edges AK 56 lengthwise
- Material: Black plastic (1002996)

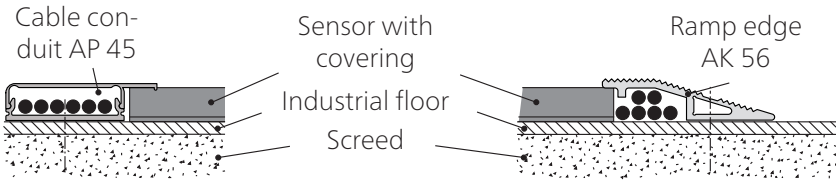


Subject to technical modifications.

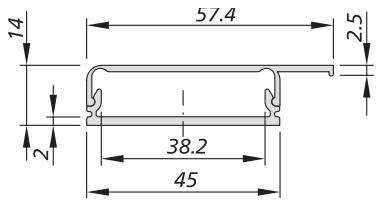
Inner corner connector E2 AK 56 • For connecting the corners of ramp edge AK 56 • Material: Black plastic (1002752)	
Aluminium Z/2-profile • Edging at the machine or wall side • Rod 3 m (7500385), rod 6 m (1001666) or fixed length	

Optional: Ramp edge AK 56 with cable conduit AP 45

Instead of using a Z/2 profile, you can also use cable conduit AP 45 to fix the sensor in place.



- Cable conduit AP 45 instead of Z/2-profile
- Suitable for plug-in cable connections
- Cable conduit for max. 6 cables

Aluminium cable conduit AP 45 • 2-piece cable conduit • For sensor combinations • Sensors with or without plugs • Upper section is clipped into lower section • Rod 3 m upper section (1002546), rod 3 m lower section (1002547) or fixed length upper and lower sections	

Subject to technical modifications.

Calculation of the necessary actuation area

According to ISO 13855, the effective actuation area that is required with reference to the danger zone is calculated using the following formula:

$S = (K \times T) + C$ where: $K = 1600$ mm/s, $T = t_1 + t_2$, $C = 1200$ mm – 0.4H

- S = Minimum distance between the danger zone and the furthest edge of the sensor [mm]
- K = Approximation parameter [mm/s]
- T = Follow-through of the complete system [s]
- t_1 = Response time of the protection device
- t_2 = Stopping time of the machine
- C = Safety margin [mm]
- H = Step height [mm]

With installation at floor level

H = 0; thus:

$S = (1600 \text{ mm/s} \times T) + 1200 \text{ mm}$

With installation on a step

H ≠ 0; thus:

$S = (1600 \text{ mm/s} \times T) + (1200 \text{ mm} - 0.4H)$

Calculation examples

Calculation example 1

A safety mat detects when someone inadvertently accesses the danger zone of an automated movement. The mat is installed at floor level, i.e. H = 0.
The follow-through time of the movement is 300 ms, the response time of the protection device is 18 ms.

$S = (1600 \text{ mm/s} \times (300 \text{ ms} + 18 \text{ ms})) + 1200 \text{ mm}$
$S = (1600 \text{ mm/s} \times 0.318 \text{ s}) + 1200 \text{ mm}$
$S = 509 \text{ mm} + 1200 \text{ mm}$
$S = 1709 \text{ mm}$

Calculation example 2

The same conditions as Example 1, except that there is a step with a height of 150 mm leading up to the danger zone that has to be dealt with.

$S = (1600 \text{ mm/s} \times (300 \text{ ms} + 18 \text{ ms})) + (1200 - (0.4 \times 150)) \text{ mm}$
$S = (1600 \text{ mm/s} \times 0.318 \text{ s}) + (1200 - 60) \text{ mm}$
$S = 509 \text{ mm} + 1140 \text{ mm}$
$S = 1649 \text{ mm}$

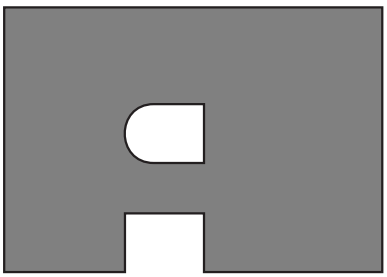
Subject to technical modifications.

Customised designs

Special shapes

e.g. different corner shapes

Different shapes such as circles, circle segments, trapeziums etc.
are possible.



e.g. cut-outs

Mats can be ready-manufactured with cut-outs, e.g. for machine feet, switch cabinets, and so on.

Special versions

Special versions are available for particular ambient conditions, e.g. aggressive substances (fuels, solvents etc.).

Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection
Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting.

Cleaning
If the sensors become dirty, they can be cleaned with a mild cleaning product.

Subject to technical modifications.

Technical data

	Safety mat SM/W or SM11/W with control unit SG-EFS 104/2W	Safety mat SM/BK or SM11/BK with control unit SG-EFS 104/4L	Sensor* SM/W, SM/BK or SM11/W, SM11/BK (without control unit)
Testing basis	ISO 13856-1		
Switching characteristics at v_{test} = 250 mm/s			
Switching operations at 0.1 A	> 4× 10^6		
Actuation forces			
Test piece (cylinder) Ø 11 mm	< 300 N		
Test piece (cylinder) Ø 80 mm	< 300 N		
Test piece (cylinder) Ø 200 mm	< 600 N		
Response time	23 ms	38 ms	8 ms
Safety classifications			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
$MTTF_D$ (pressure-sensitive protection device)	210 a	65 a	–
B_{10D} (sensor)	6× 10^6	6× 10^6	6× 10^6
n_{op} (assumption)	52560/a	52560/a	–
Mechanical operating conditions			
Sensor size	Max. 1.5 m^2		
Side length (min./max.)	200 mm / 3000 mm		
Cable length (min./max.)	10 cm / 100 m		
Static load (up to 8 h)			
SM with GM1	Max. 800 N/cm^2		
SM with GM5	Max. 1200 N/cm^2		
SM11	Max. 800 N/cm^2		
Driving on with industrial trucks	Not suitable		
Weight			
SM with GM1	17.3 kg/m^2		
SM with GM5	23.9 kg/m^2		
SM11	12.0 kg/m^2		
IEC 60529: degree of protection			
Sensor	IP65		
Max. humidity (23 °C)	95% (non-condensing)		
Operating temperature			
Individual sensor	–20 to +55 °C		
Sensor combination	+5 to +55 °C		
Storage temperature	–20 to +55 °C		

	Safety mat SM/W or SM11/W with control unit SG-EFS 104/2W	Safety mat SM/BK or SM11/BK with control unit SG-EFS 104/4L	Sensor* SM/W, SM/BK or SM11/W, SM11/BK (without control unit)
Electrical operating conditions			
Connection cable	Ø 5.0 mm PVC		
	2× 0.5 mm^2	2× 0.5 mm^2 or 4× 0.34 mm^2	2× 0.5 mm^2 or 4× 0.34 mm^2
Sensor	24 V DC / max. 100 mA		
Number of /BK-type sensors	Max. 10 in series		
Dimensional tolerances			
Length dimension	ISO 2768 – c		
Perpendicularity	ISO 2768 – c		

* If you combine sensors with control units and thereby place pressure-sensitive protection devices on the market, you should observe the basic requirements according to ISO 13856.
As well as meeting technical requirements, this also means – in particular – observing any that relate to marking and information for use.
Declarations of Conformity only apply to pressure-sensitive protection devices. In the case of sensors that are going to be used to make pressure-sensitive protection devices, Declarations of Incorporation are issued instead.

Conformity

CE

The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out.

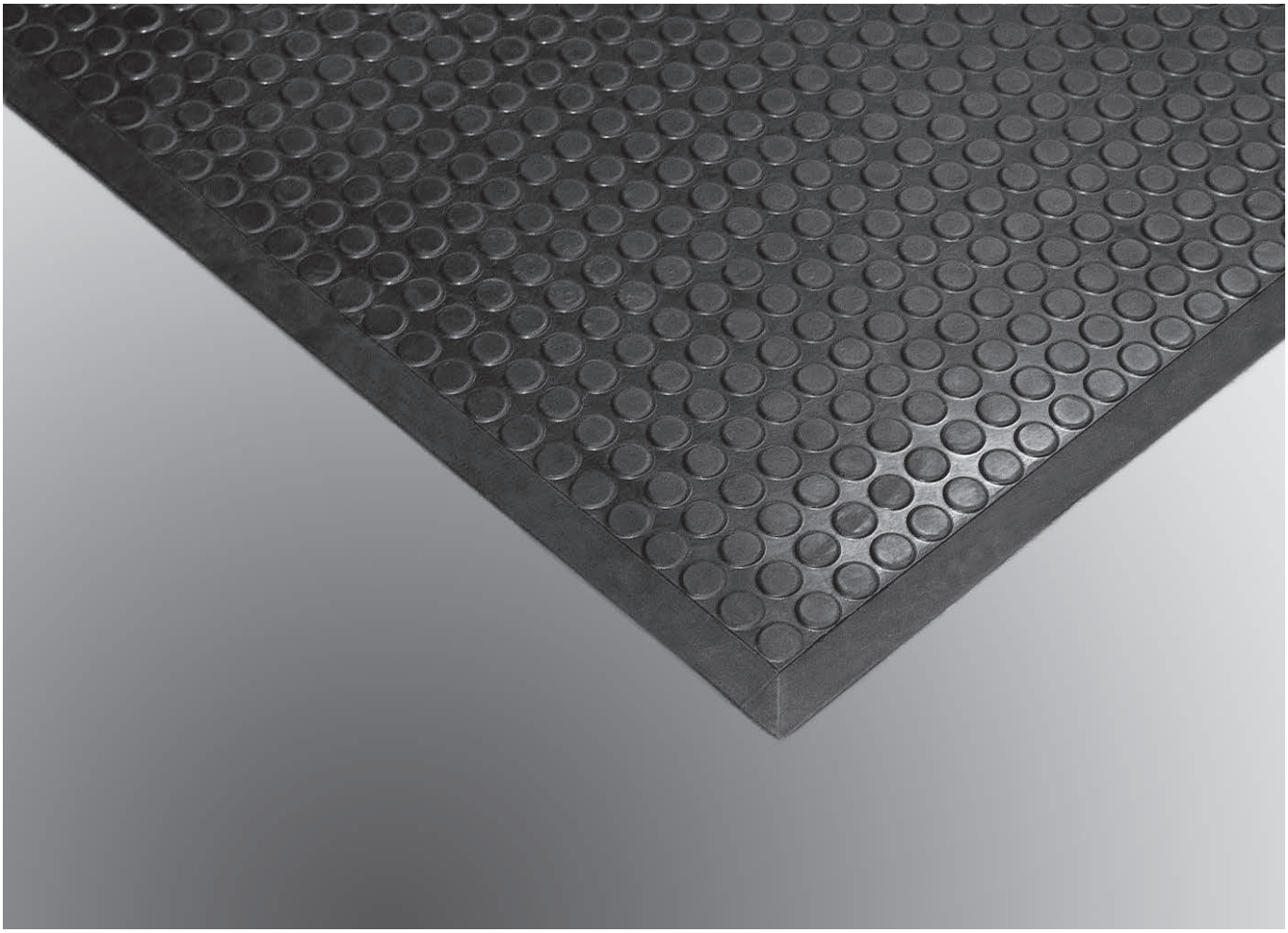
The design type of the pressure-sensitive protection device complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of Machinery)
- 2011/65/EU (RoHS)
- 2014/30/EU (EMC)

The Declaration of Conformity is available in the Downloads section of our website:
www.mayser.com/de/download.

MAYSER®

Innovative by tradition.



Safety mats SM8

EN | Product information

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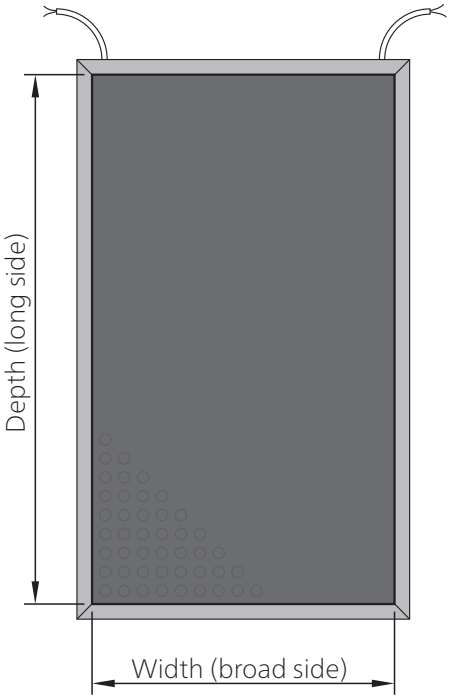
Table of contents

Available sizes

SM8 sensors are only available in fixed sizes:

Part number	SM8/BK	Width × Depth
5006626	SM8/BK	750 × 1000 mm
5006627	SM8/BK	750 × 1250 mm
5006628	SM8/BK	750 × 1500 mm
5006623	SM8/BK	1000 × 1000 mm
5006624	SM8/BK	1000 × 1250 mm
5006625	SM8/BK	1000 × 1500 mm

The dimensions refer solely to the contact surface. An extra 25 mm must be added on each side that has a moulded ramp.



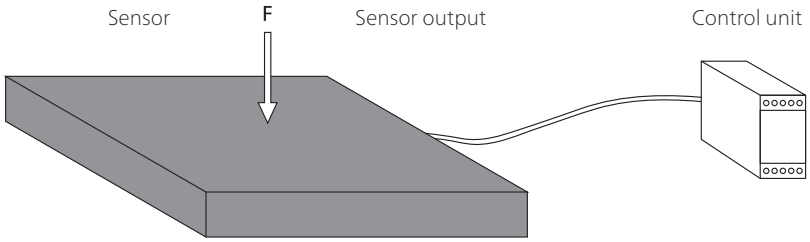
According to ISO 13855, the minimum depth to the danger zone must be taken into account (see chapter *Calculation of the necessary actuation area*). The non-sensitive edges must be taken into account (see chapter *Effective actuation area*).

Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

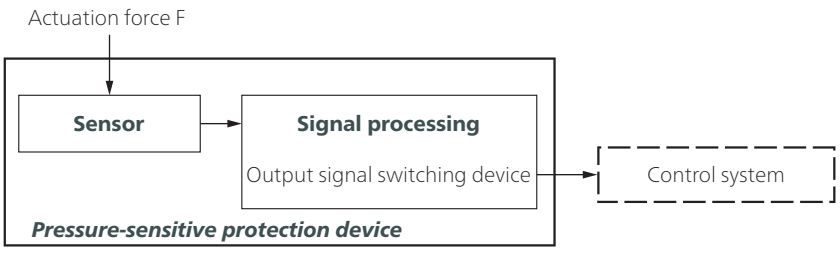


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuation area is deformed locally.

Signal processing

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the forwarding control system and which transmits safety output signals such as STOP.

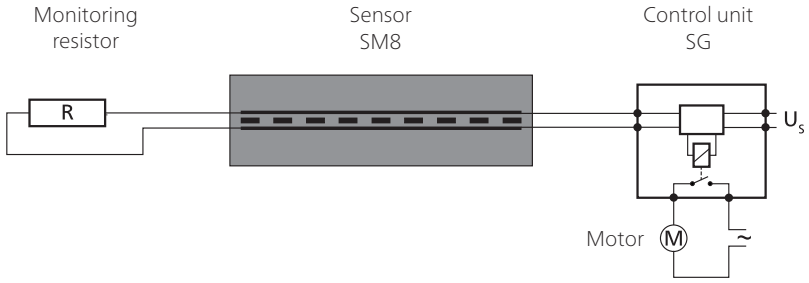


Tip: Terms are defined in ISO 13856-1 Section 3.

Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP65 is the standard for safety mats.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…
- Is it necessary to detect people who weigh < 35 kg?

Operation principle of 2-wire technology

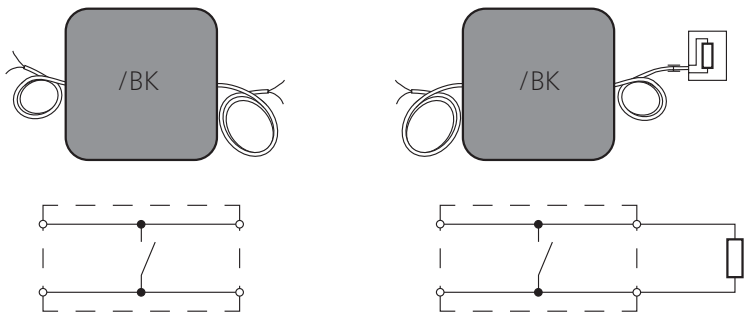


The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

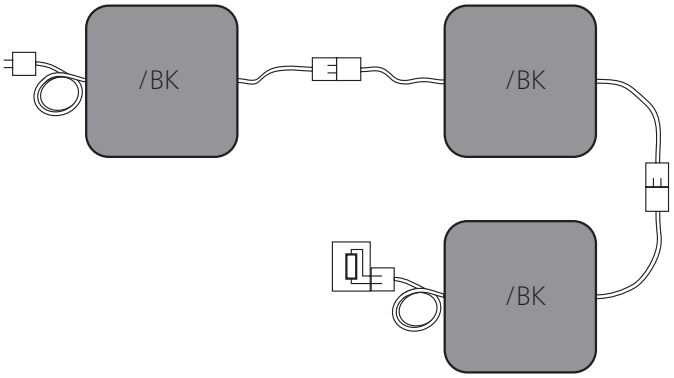
Types

/BK With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor



Subject to technical modifications.

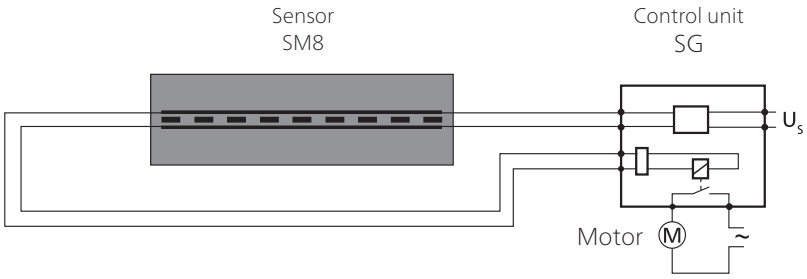
Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety mats can be combined to create an overall surface of any size and shape

Operation principle of 4-wire technology



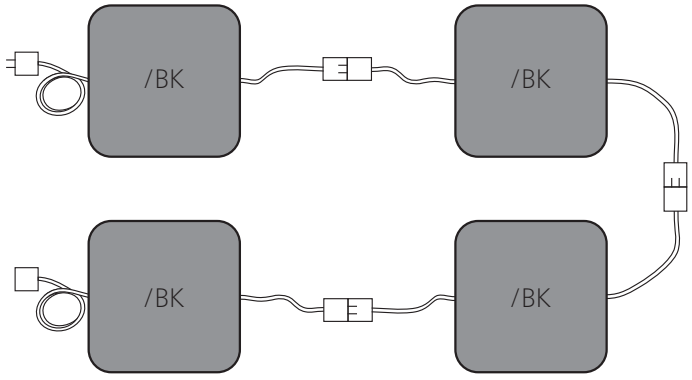
The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

/BK With cables on both sides for use as a through sensor

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety mats can be combined to create an overall surface of any size and shape

Subject to technical modifications.

Safety

Intended use

A safety mat detects a person standing on it or who steps onto it. It is a flat protection device that is capable of monitoring when somebody is present. Its purpose is to prevent possible hazardous situations for personnel within a danger zone.
Typical areas of application are moving parts on machines and systems.
Safe operation of a safety mat depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

Tip: This is illustrated clearly by Figures B.1 and B.2 in ISO 13856-1.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 10 /BK-type sensors can be connected to one control unit.
- Max. system size: 15 m^2
  = max. quantity × max. sensor size

Exclusions

Sensors are not suitable for:

- Detecting walking aids
- Detecting people who weigh less than 20 kg
- Driving on with industrial trucks

Sensor combinations are not suitable for:

- Detecting people who weigh less than 35 kg

Selecting the appropriate product line

Sensors from our SM8 line of safety mat products are only available in a rectangular shape. The surface is resistant to external influences and normal chemical influences to a degree.
If your sensor requirements are higher, only our SM safety mat products will be able to meet them.

Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

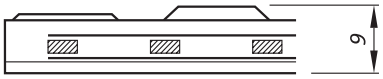
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts in the case of pressure-sensitive protection devices according to ISO 13856. In this case, no characteristic values of the sensor whatsoever are included when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety mat system (pressure-sensitive protection device) as a whole.

Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard. After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design

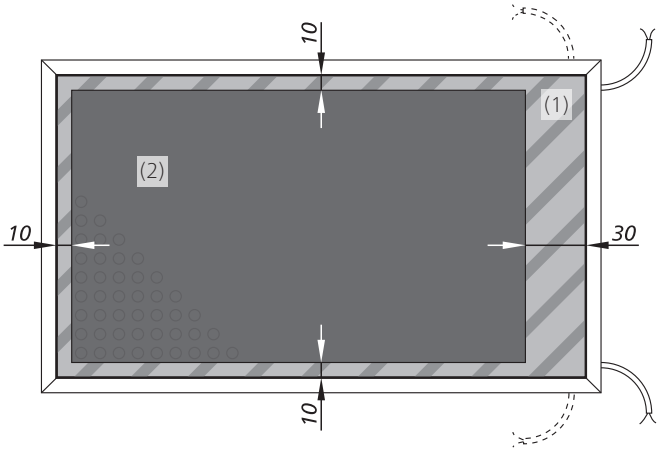


SM8
Moulded onto a plastic plate.
The surface texture provides the necessary non-slip properties and ensures mechanical protection.

Effective actuation area

A non-sensitive edge (1) surrounds the effective actuation area (2):

- 30 mm = on the cable exit side
- 10 mm = on the remaining sides



The ramps running around the sides are discounted when considering the effective actuation area.

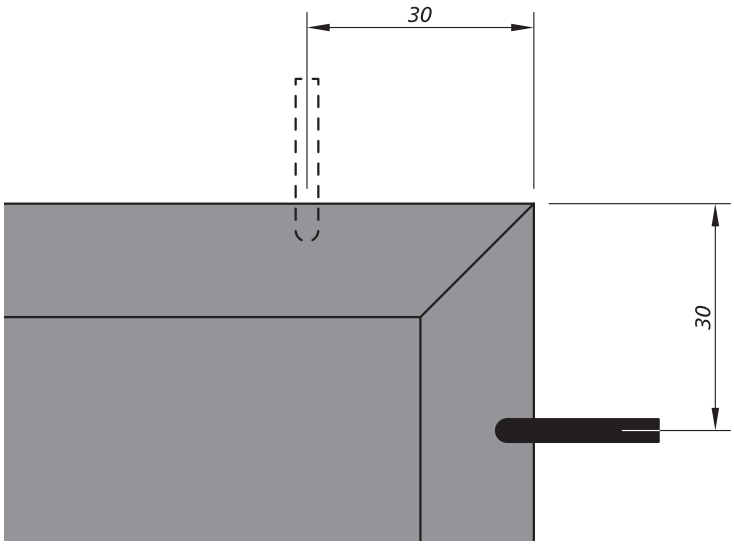
Sensor combinations
When sensor combinations are used, only the sides with 10 mm edges should be placed next to one another.
The integrated ramps must be removed from these sides before combining the sensors.

Subject to technical modifications.

Connection

Cable exits

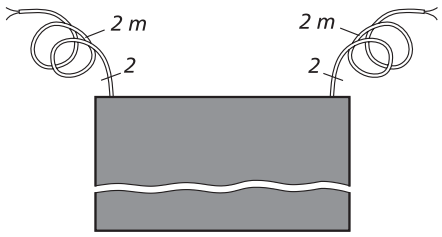
The cables are located at two corners.
Two cable exits are available at each corner and you can either use the one on the broad side (width) or the one on the long side (depth). The required cable exit must be cut out on site at the designated point on the mat.



Cable connection

- Standard cable lengths
  L = 2.0 m
- Maximum total cable length to the control unit
  L_{max} = 100 m

/BK-type sensor with 2 lines



- As a /BK-type through sensor
- Without resistor
- 2 two-wire cables

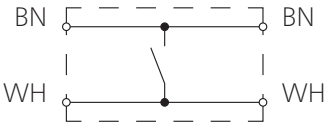
Subject to technical modifications.

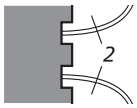
Wire colours

/BK-type sensor with 2 lines

Colour coding

BN	Brown
WH	White

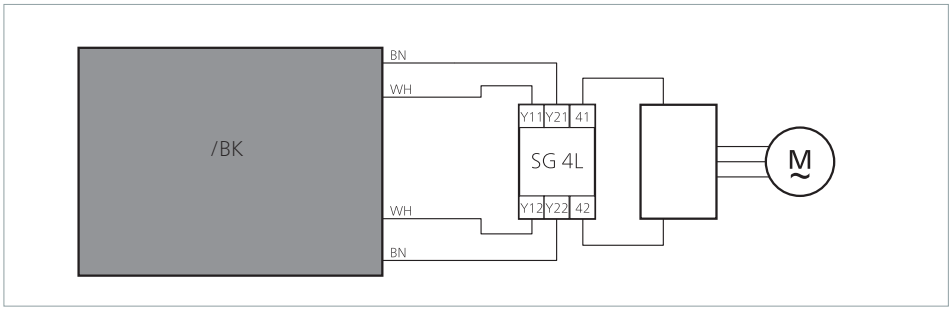




Connection example

Key:

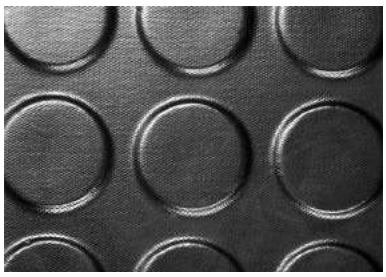
SG 4L Evaluation with 4-wire technology



Subject to technical modifications.

Sensor surface

The rubber surface structure is created at the factory during moulding. It provides the necessary non-slip properties and ensures mechanical protection. No further sensor cover is required.



Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having an undamaged surface.

Physical resistance

	PUR
DIN 53516: Abrasion	120 mg
DIN 4102: Fire behaviour	B2
Alternating climate stress conditions	+
UV resistance	+

Explanation of symbols:
+ = resistant

Subject to technical modifications.

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

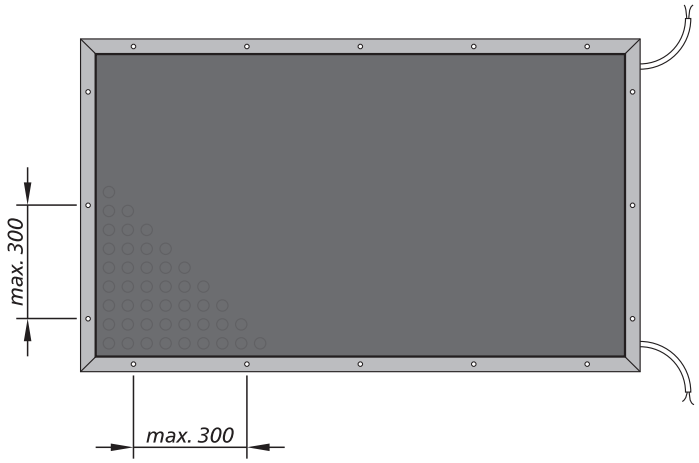
Explanation of symbols:
+ = resistant
± = resistant to a certain extent
– = not resistant

Material	PUR
Acetone	–
Formic acid 5%	+
Ammonia	+
ATF (automatic transmission fluid)	+
DOT 4 brake fluid	–
Cutting emulsion	+
Demineralised water	+
Diesel	±
Acetic acid 10%	+
Ethanol	–
Greases	–
Hydraulic oil	+
Caustic potash solution 10%	+
Saline solution 5%	+
Cooling lubricant	±
Metal working oil	+
Methanol	–
Mineral oil	+
Caustic soda 10%	±
Cellulose thinner	–
Hydrochloric acid 10%	±
Brine 10%	+
Suds 5%	+
Spirit (ethyl alcohol)	–
Universal thinner	–
Water	+
Petroleum ether / petrol	–
Citric acid 10%	+
Drawing compound	–

Subject to technical modifications.

Mounting

To minimise the risk of tripping, the sensor has integrated ramps all the way round the edges. No separate ramp edges are required.



The sensor must be fixed to the floor using flat-head screws with a diameter of at least 5 mm (recommended: 6 x 50 mm flat-head screws). These parts are not supplied as standard. The screws must be spaced no further than 300 mm apart.

Calculation of the necessary actuation area

S = Minimum distance between the danger zone and the furthest edge of the sensor [mm]
K = Approximation parameter [mm/s]
T = Follow-through of the complete system [s]
t_1 = Response time of the protection device
t_2 = Stopping time of the machine
C = Safety margin [mm]
H = Step height [mm]

According to ISO 13855, the effective actuation area that is required with reference to the danger zone is calculated using the following formula:

$S = (K \times T) + C$ where: $K = 1600$ mm/s
$T = t_1 + t_2$
$C = 1200$ mm – 0.4H

With installation at floor level

H = 0; thus:
$S = (1600 \text{ mm/s} \times T) + 1200 \text{ mm}$

With installation on a step

$H \neq 0$; thus:
$S = (1600 \text{ mm/s} \times T) + (1200 \text{ mm} - 0.4H)$

Subject to technical modifications.

Calculation examples

Calculation example 1
A safety mat detects when someone inadvertently accesses the danger zone of an automated movement. The mat is installed at floor level, i.e. H = 0.
The follow-through time of the movement is 140 ms, the response time of the protection device is 38 ms.

S = (1600 mm/s × (140 ms + 38 ms)) + 1200 mm
S = (1600 mm/s × 0.178 s) + 1200 mm
S = 285 mm + 1200 mm
S = 1485 mm

Calculation example 2
The same conditions as Example 1, except that there is a step with a height of 150 mm leading up to the danger zone that has to be dealt with.

S = (1600 mm/s × (140 ms + 38 ms)) + (1200 – (0.4×150)) mm
S = (1600 mm/s × 0.178 s) + (1200 – 60) mm
S = 285 mm + 1140 mm
S = 1425 mm

Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection
Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting.

Cleaning
If the sensors become dirty, they can be cleaned with a mild cleaning product.

Technical data

	Safety mat SM8/BK with control unit SG-EFS 104/4L	**Sensor* SM8/BK** (without control unit)
Testing basis	ISO 13856-1	
Switching characteristics at v_{test} = 250 mm/s		
Switching operations at 0.1 A	> 4 × 10^6	
Actuation forces		
Test piece (cylinder) Ø 80 mm	< 300 N	
Test piece (cylinder) Ø 200 mm	< 600 N	
Response time	DC 38 ms / AC 58 ms	8 ms
Safety classifications		
ISO 13856: reset function	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 1
$MTTF_D$ (pressure-sensitive protection device)	65 a	–
B_{10D} (sensor)	6 × 10^6	6 × 10^6
n_{op} (assumption)	52560/a	–
Mechanical operating conditions		
Sensor size	Max. 1.5 m^2	
Cable length (min./max.)	10 cm / 100 m	
Static load (up to 8 h)	Max. 800 N/cm^2	
Driving on with industrial trucks	Not suitable	
Weight	13.0 kg/m^2	
IEC 60529: degree of protection		
Sensor	IP65	
Max. humidity (23 °C)	95% (non-condensing)	
Operating temperature		
Individual sensor	–25 to +55 °C	
Sensor combination	+5 to +55 °C	
Storage temperature	–25 to +55 °C	
Electrical operating conditions		
Connection cable	Ø 3.8 mm PVC 2 × 0.25 mm^2	
Sensor	24 V DC / max. 100 mA	
Number of /BK-type sensors	Max. 10 in series	
Dimensional tolerances		
Length dimension	ISO 2768 – c	
Perpendicularity	ISO 2768 – c	

* If you combine sensors with control units and thereby place pressure-sensitive protection devices on the market, you should observe the basic requirements according to ISO 13856.
As well as meeting technical requirements, this also means – in particular – observing any that relate to marking and information for use.
Declarations of Conformity only apply to pressure-sensitive protection devices. In the case of sensors that are going to be used to make pressure-sensitive protection devices, Declarations of Incorporation are issued instead.

Conformity

CE

The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out.

The design type of the pressure-sensitive protection device complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of Machinery)
- 2011/65/EU (RoHS)
- 2014/30/EU (EMC)

The Declaration of Conformity is available in the Downloads section of our website:
www.mayser.com/de/download.

MAYSER®

Innovative by tradition.

SP DIY sensor profiles

EN | Product information

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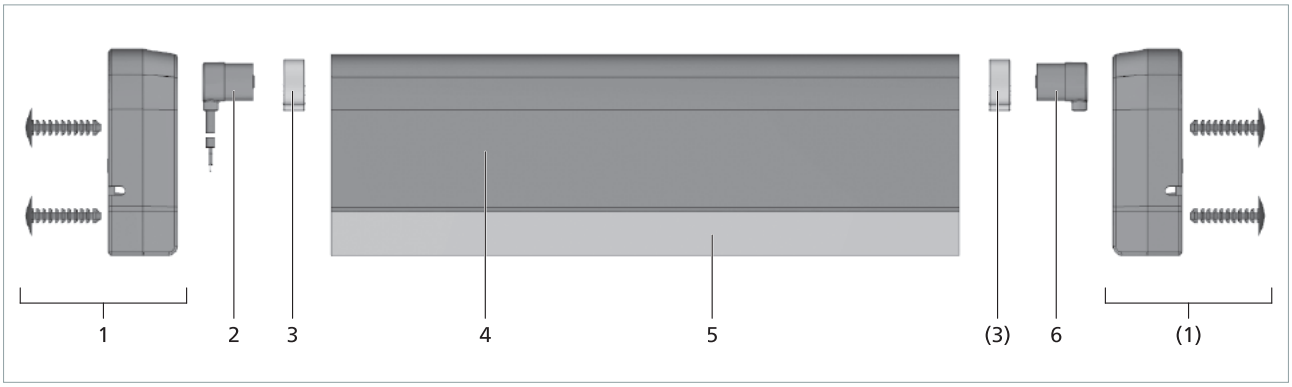
Overview

Contact profile – Sensor profile

The semi-finished contact profile (No. 4) is cut to length and assembled with the other components. This results in a functioning product called a sensor profile.



Nos. 2, 3 and 6 are identical for all sensor profiles.

No. 2	Closing plug with 2.5 m cable	7502873
No. 3	Ear clamp	1005684
No. 6	Closing plug with resistor	7502875

Alternatives for No. 2:

Closing plug with 5.0 m cable	7503774
Closing plug with 10 m cable	7503775

Sensor profile	No. 1 Set of end caps	No. 4 Contact profile		No. 5 Aluminium profile	
SP 17-3 without end caps	1005786	SP 17-3	7503461	C 15	1000016
SP 37-1 without end caps	1000606	SP 37-1	7502853	C 25	1000004
SP 37-1 with end caps	7503008	SP 37-1	7502853	C 25	1000004
SP 37-2 with end caps	7503988	SP 37-2	7503318	C 26	1004330
SP 37L-2 with end caps	7503988	SP 37L-2	7504192	C 26	1004330
SP 37-3 with end caps	7503505 (7503654)	SP 37-3	7503343	C 25	1000004
SP 57-2 with end caps	7503603	SP 57-2	7503055	C 30	1005844
SP 57L-2 with end caps	7503603	SP 57L-2	7503412	C 30	1005844

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Subject to technical modifications.

Sensor profile	No. 1 Set of end caps	No. 4 Contact profile		No. 5 Aluminium profile	
SP 57-3 with end caps	7503618	SP 57-3	7503521	C 35	1000006
SP 57-4 with end caps	7503618	SP 57-4	7503633	C 35	1000006
SP 57L-4 with end caps	7503618	SP 57L-4	7503711	C 35	1000006
SP 67-2 with end caps	7503655	SP 67-2	7503285	C 30	1005844
SP 87-2 with end caps	7504118	SP 87-2	7503722	C 36	1003848

Materials list

Part No.	Designation	PU
7503461	Contact profile SP 17-3 TPE	80 m
7502853	Contact profile SP 37-1 TPE	30 m
7503318	Contact profile SP 37-2 TPE	30 m
7504192	Contact profile SP 37L-2 TPE	30 m
7503343	Contact profile SP 37-3 TPE "black"	30 m
7503534	Contact profile SP 37-3 TPE "red"	30 m
7503055	Contact profile SP 57-2 TPE	30 m
7503412	Contact profile SP 57L-2 TPE	30 m
7503521	Contact profile SP 57-3 TPE	25 m
7503633	Contact profile SP 57-4 TPE	25 m
7503711	Contact profile SP 57L-4 TPE	25 m
7503285	Contact profile SP 67-2 TPE	30 m
7503722	Contact profile SP 87-2 TPE	25 m
7502875	Closing plug with 8k2 resistor	10 pcs.
7502873	Closing plug with 2.5 m PUR cable, angled 90°	10 pcs.
7503774	Closing plug with 5.0 m PUR cable, angled 90°	10 pcs.
7503775	Closing plug with 10 m PUR cable, angled 90°	10 pcs.
7503708	Closing plug without resistor	10 pcs.
1005684	Ear clamp for closing plug	20 pcs.
1005786	Countersunk tapping screw 3.5 x 25 for SP 17-3	20 pcs.
7503008	Set of end caps for SP 37-1: 2 end caps, 2 fixing stoppers and 2 screws 3.9 × 25	10 pcs.
7503988	Set of end caps for SP 37(L)-2: 2 end caps and 4 pine tree clips	10 pcs.

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Subject to technical modifications.

Part No.	Designation	PU
7503505	Set of end caps for SP 37-3 "black": 2 end caps and 2 pine tree clips	10 pcs.
7503654	Set of end caps for SP 37-3 "red": 2 end caps and 2 pine tree clips	10 pcs.
7503603	Set of end caps for SP 57(L)-2 with clips: 2 end caps and 4 pine tree clips	10 pcs.
7503618	Set of end caps for SP 57-3 and SP 57(L)-4: 2 end caps and 6 pine tree clips	10 pcs.
7503655	Set of end caps for SP 67-2: 2 end caps and 4 pine tree clips	10 pcs.
7504118	Set of end caps for SP 87-2: 2 end caps and 8 pine tree clips	10 pcs.
1000016	Aluminium profile C 15	6 m
1000854	Aluminium profile C 25M, upper section	6 m
1000855	Aluminium profile C 25M, lower section	6 m
1000829	Aluminium profile C 25L	6 m
1000012	Aluminium profile C 25S	6 m
1000004	Aluminium profile C 25	6 m
1004626	Aluminium profile C 26M, upper section	6 m
1004627	Aluminium profile C 26M, lower section	6 m
1004330	Aluminium profile C 26, perforated	6 m
1005844	Aluminium profile C 30	6 m
1001398	Aluminium profile C 35M, upper section	6 m
1001399	Aluminium profile C 35M, lower section	6 m
1000013	Aluminium profile C 35S	6 m
1000006	Aluminium profile C 35	6 m
1004629	Aluminium profile C 36M, upper section	6 m
1004630	Aluminium profile C 36M, lower section	6 m
1003849	Aluminium profile C 36L, perforated	6 m
1003850	Aluminium profile C 36S, perforated	6 m
1003848	Aluminium profile C 36, perforated	6 m
1001223	End stopper for C 25M, for SP without end caps	1 pc.
1000606	End stopper for C 25 or C 25S, for SP without end caps	1 pc.
1005906	Section cutter, cutting length 87 mm	1 pc.
7502868	Assembly aid SH3	1 pc.
1005741	Notching pliers Knipex 7742115	1 pc.
1005729	Vice-grip pliers, Knipex System Oetiker 1099	1 pc.

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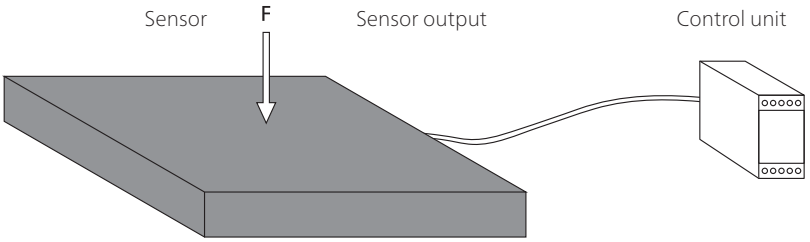
Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

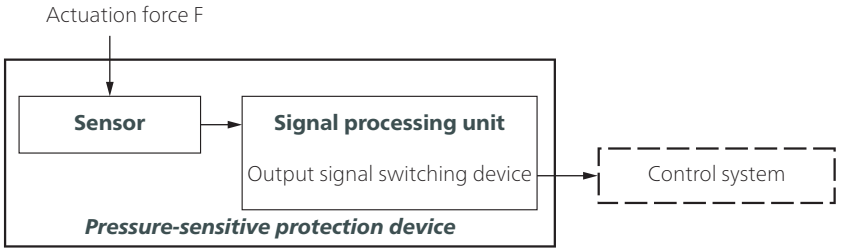


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuating surface is deformed locally.

Signal processing unit

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the forwarding control system and which transmits safety output signals such as STOP.



Tip: Terms are defined in ISO 13856-2 Section 3.

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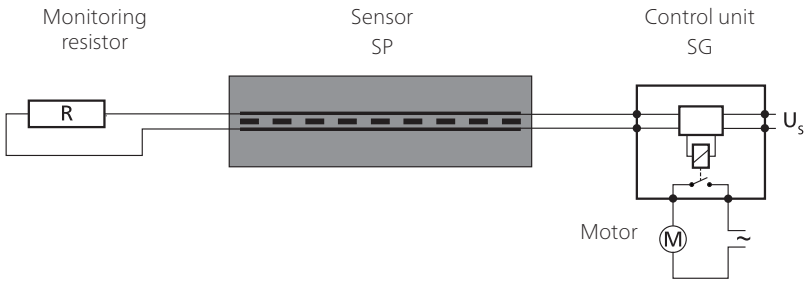
Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP67 is the standard for safety edges.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…
- Finger detection necessary?

Operation principle of 2-wire technology

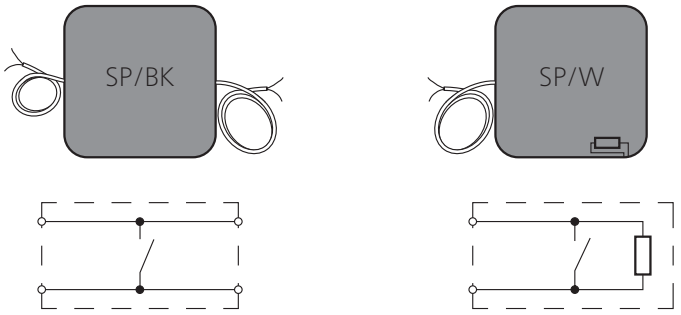


The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

Types

SP/BK	With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor
SP/W	With an integrated monitoring resistor for use as an end sensor



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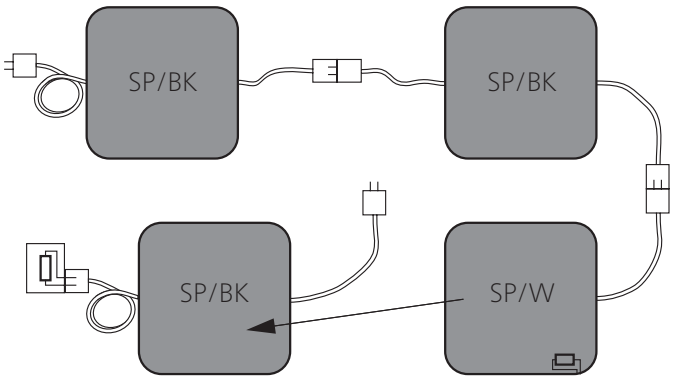
Subject to technical modifications.

Sensor combination

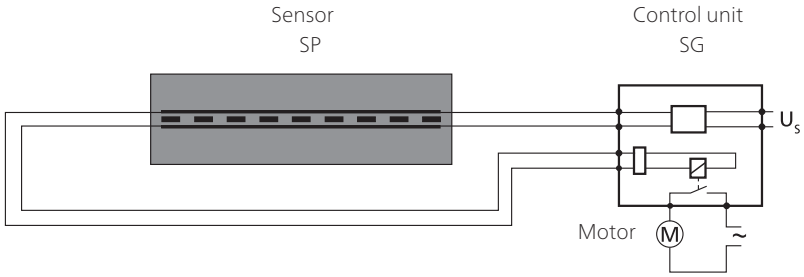


Version with external resistor, therefore no variety of models

Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

Operation principle of 4-wire technology



The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

SP/BK With cables on both sides for use as a through sensor

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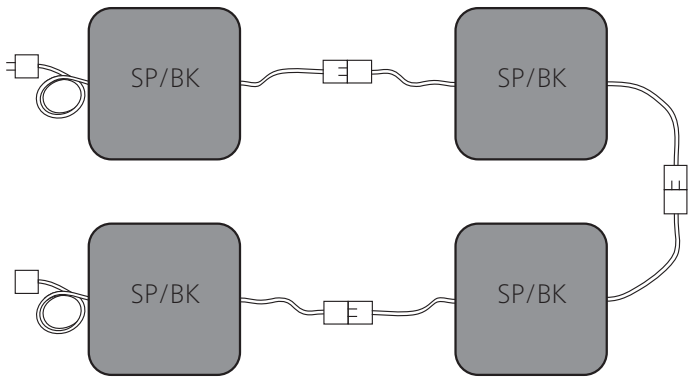
Subject to technical modifications.

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

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Safety

Intended use

A safety edge detects a person or part of the body when pressure is applied to the effective actuation area. It is a linear tripping device. Its task is to prevent possible hazardous situations that could affect someone within a danger zone, such as shearing and pinching edges.
Typical areas of application are door and gate systems, moving parts on machines, platforms and lifting devices.
Safe operation of a safety edge depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

For additional application guidelines, please refer to ISO 13856-2 Annex E.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 5 /BK-type sensors can be connected to one control unit.
- No more than 4 /BK-type sensors and 1 /W-type sensor can be connected to one control unit.

Exclusions

The sensors are not suitable for:

- performing a sealing function. Constant actuation of sensors can result in permanent damage.
  Exception: The L version with an attached lip seal.
  The lip seal can be in full contact with the closing edge, which allows it to repel wind and water.

Selecting the appropriate product line

If you opt for our line of SP DIY sensor profiles that have to be assembled with tools, the maximum class of protection that can be achieved is IP68 and IPX8 (20 weeks). If a class of protection of IP67 or IPX8 (13 days) is sufficient for your application, we recommend using our line of SP DIY sensor profiles for **toolless** self-assembly instead.

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Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

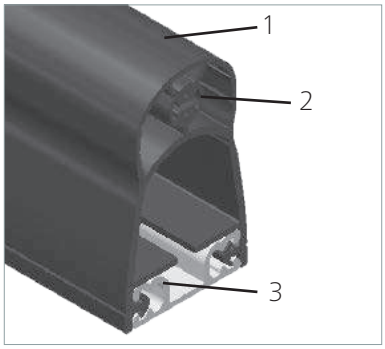
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts by pressure-sensitive equipment according to ISO 13856. In this case, the diagnostic coverage (DC) is not calculated or taken into account when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety edge system (pressure-sensitive protection device) as a whole.

Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard. After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design



The SP sensor profile consists of one sensor (1 to 3)
(1) SP contact profile with
(2) integrated normally open switching element,
(3) aluminium profile and an evaluating control unit SG.

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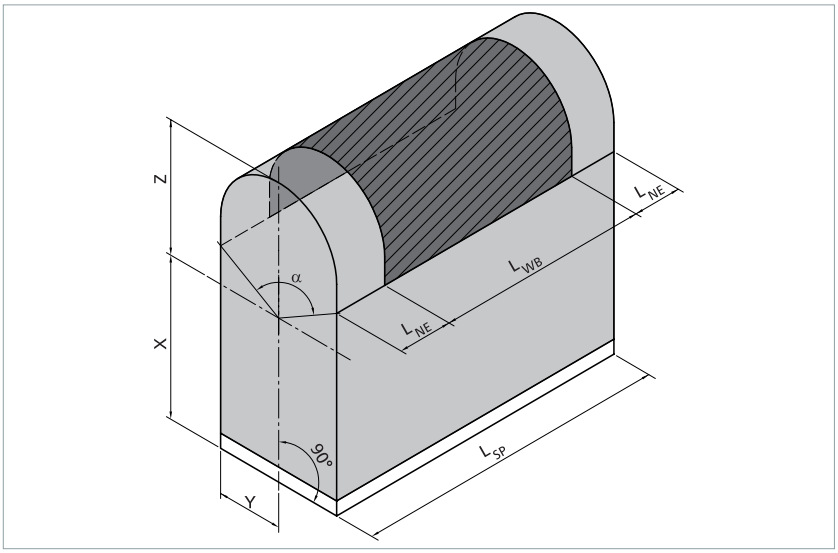
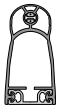
Effective actuation area

The parameters X, Y, Z, L_{WB} and the angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$$L_{WB} = L_{SP} - 2 \times L_{NE}$$

Parameters:
L_{WB} = effective actuation length
L_{SP} = total length of sensor profile
L_{NE} = non-sensitive length at end of sensor profile
α = effective actuation angle



	SP 17-3 [1]	SP 37-1	SP 37(L)-2	SP 37-3	SP 57(L)-2	SP 57-3	SP 57(L)-4	SP 67-2	SP 87-2
									
Incl.	C 15	C 25	C 26	C 25	C 30	C 35	C 35	C 30	C 36
α	90°	100°	100°	100°	90°	90°	90°	90°	90°
L_{NE}	60 mm	20 mm	20 mm	20 mm	10 mm [2]	10 mm [2]	10 mm [2]	20 mm [2]	10 mm [2]
Y	6.7 mm	12.5 mm	13 mm	12.5 mm	17 mm	17.5 mm	17.5 mm	17 mm	18.1 mm
X	15.3 mm	28.5 mm	30 mm	29 mm	44 mm	52 mm	52 mm	57.3 mm	72 mm
Z	5 mm	9 mm	9 mm [3]	9 mm	12 mm [3]	12 mm	12 mm [3]	10 mm	15 mm
X + Z	20.3 mm	37.5 mm	39 mm [3]	38 mm	56 mm [3]	64 mm	64 mm [3]	67.3 mm	87 mm

[1] without end cap [2] with finger protection [3] without lip

Installation position

The installation position can be selected as required, i.e. all installation positions from A to D as per ISO 13856-2 are possible.

Subject to technical modifications.

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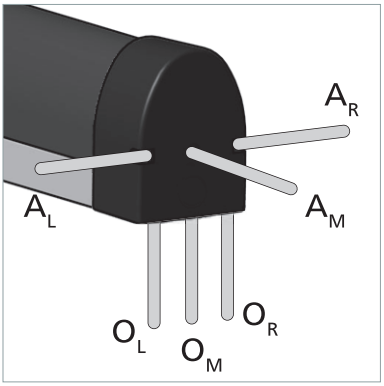
Connection

Cable exits

Depending on the end cap, the following cable exits are available.

A_L = axial left
A_M = axial middle
A_R = axial right
O_L = orthogonal left
O_M = orthogonal middle
O_R = orthogonal right



Orientation		Cable exit					
Lateral exit		A_L		A_R			
Axial exit			A_M				
90° exit					O_L	O_M	O_R
Combination							
Contact profile	Set of end caps						
SP 17-3	–					●	
SP 37-1	7503008	●		●	●		●
SP 37(L)-2	7503988	●	●	●		●	
SP 37-3 black	7503505	●		●	●		●
SP 37-3 red	7503654	●		●	●		●
SP 57(L)-2	7503062	●	●	●		●	
	7503603	●	●	●		●	
SP 57-3	7503618	●	●	●		●	
SP 57(L)-4	7503796	●	●	●	●		●
SP 67-2	7503655	●	●	●		●	
SP 87-2	7504118	●	●	●		●	

● = possible

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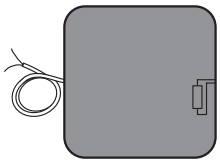
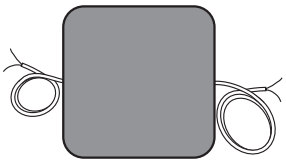
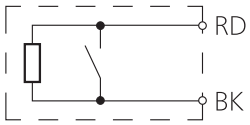
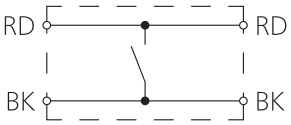
Subject to technical modifications.

Cable connection

- Standard cable lengths
  L = 2.5 m / 5.0 m / 10 m
- Maximum total cable length to the control unit
  L_{max} = 100 m

/W-type sensor with 1 line	/BK-type sensor with 2 lines
• As an individual /W-type sensor or a /W-type end sensor • Integrated resistor • 1 two-wire cable	• As a /BK-type through sensor • Without resistor • 2 two-wire cables
	

Wire colours

/W-type sensor with 1 line	/BK-type sensor with 2 lines
	

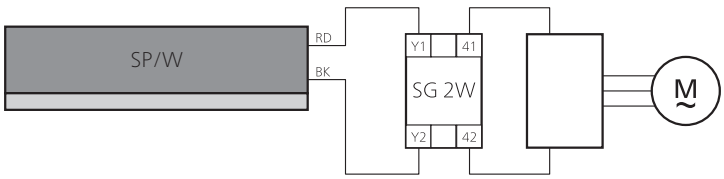
Colour coding

BK	Black
RD	Red

Connection examples

Key:

SG 2W	evaluation with 2-wire technology
SG 4L	evaluation with 4-wire technology



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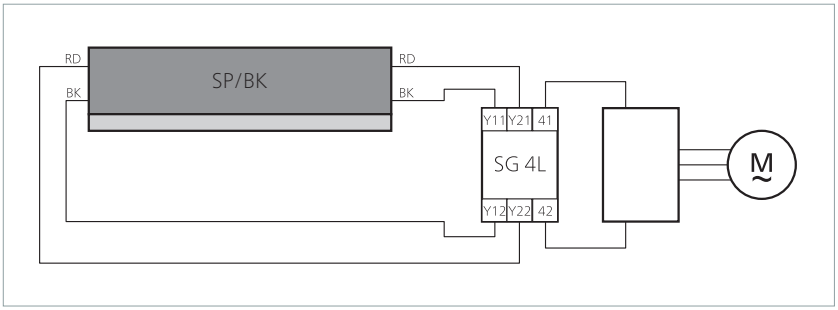
Subject to technical modifications.



Sensor surface

Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having an undamaged surface.

Physical resistance

	TPE
UV resistance	Yes

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

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Explanation of symbols:

+ = resistant
± = resistant to a certain extent
- = not resistant

Material	TPE
Acetone	-
Formic acid	-
Armor All	+
Car shampoo	+
Petrol	-
Brake fluid	+
Buraton	+
Butanol	-
Sodium hypochlorite	-
Disinfectant 1%	+
Diesel	-
Acetic acid 10%	-
Ethanol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Anti-frost agent	+
Skin cream	+
Incidin	+
Incidin Plus	+
Cooling lubricant	-
Plastic cleaner	+
Lyso FD 10	+
Metal working oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5%	+
Spirit (ethyl alcohol)	+
Terralin	+
Centring oil	-

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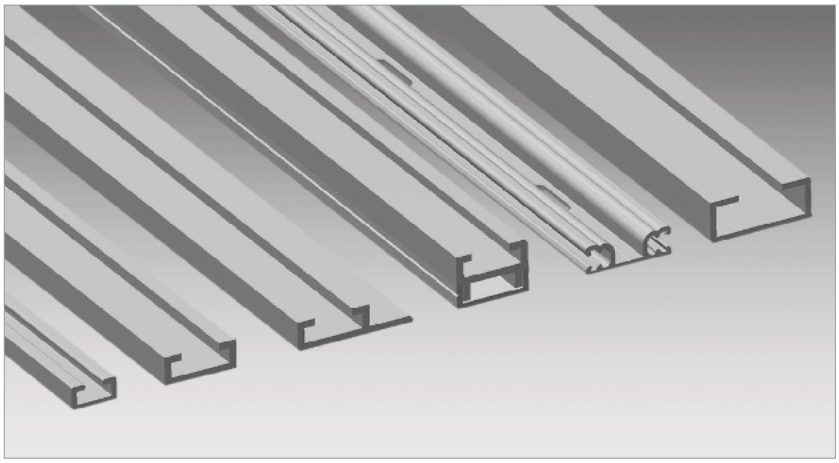
Subject to technical modifications.

Mounting

The sensors are mounted directly onto the main and secondary closing edges that present a danger. They are fixed using special aluminium profiles. The profiles are fastened with screws or rivets.



Material properties

- AlMgSi0.5 F22
- Wall thickness at least
  2.0 mm
  C 15: at least 1.7 mm
  C 30: at least 1.5 mm
- Extruded
- Hot hardened
- Tolerances as per EN 755-9

Aluminium profiles: Overview of combinations

Sensor profile foot		C 15	C 25 C 25M C 25S C 25L	C 26 C 26M	C 30	C 35 C 35M C 35S	C 36 C 36M C 36S C 36L
Snap-in foot (middle)	…-1	–	SP 37-1	–	–	–	–
Clip bars (outside)	…-2	–	–	SP 37(L)-2	SP 57(L)-2 SP 67-2	–	SP 87-2
T-foot (middle)	…-3	SP 17-3	SP 37-3	–	–	SP 57-3	–
T-foot narrow (middle)	…-4	–	–	–	–	SP 57(L)-4	–

Subject to technical modifications.

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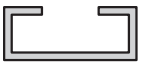
Aluminium profiles: Mounting types

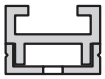
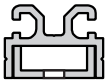
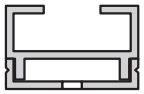
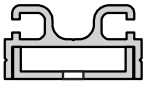
Standard profile

First the aluminium profile must be mounted onto the closing edge and then the sensor profile clipped into the aluminium profile.

C 15	C 25	C 26	C 30	C 35	C 36
					

Two-part profile, type M

For convenient assembly and disassembly. The sensor profile is clipped into the upper section and the upper section inserted into the installed lower section and fastened.

–	C 25M	C 26M	C 35M	C 36M
				

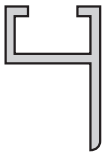
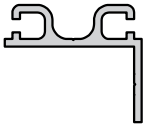
Flange profile, type S

Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

–	C 25S	–	C 35S	C 36S
				

Angle profile, type L

If the closing edge should or must not have assembly holes, this "round-the-corner" solution is suitable. Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

–	C 25L	–	–	C 36L
				

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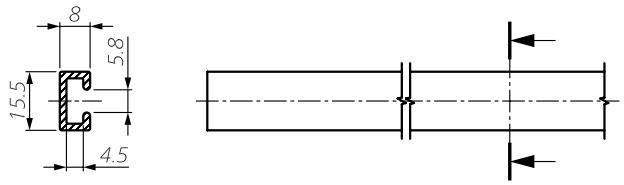
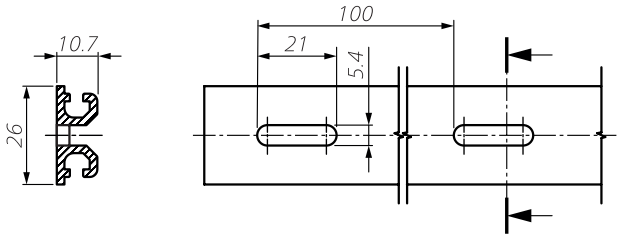
Aluminium profiles: Dimensions

Standard profile 1:2

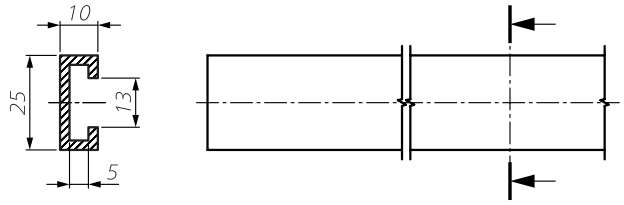
C 15



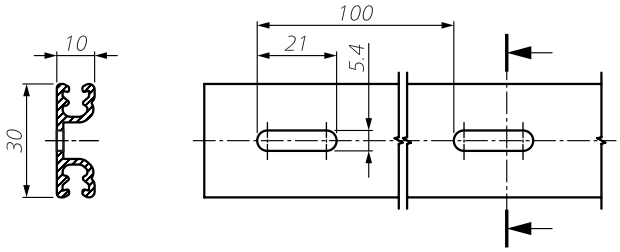
C 26



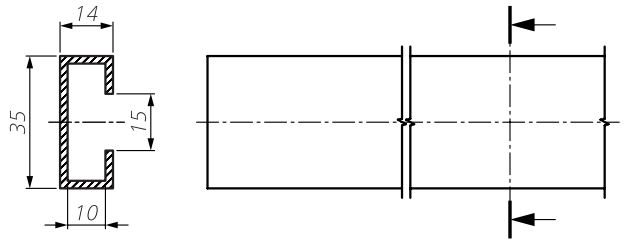
C 25



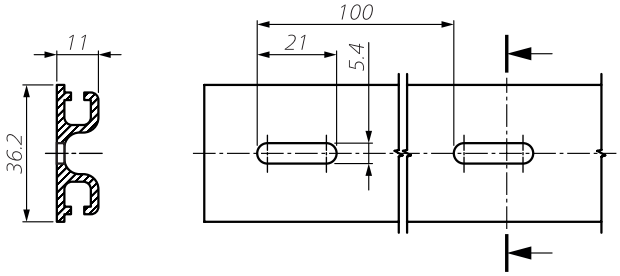
C 30



C 35

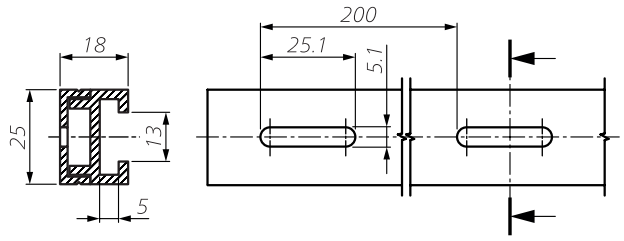


C 36

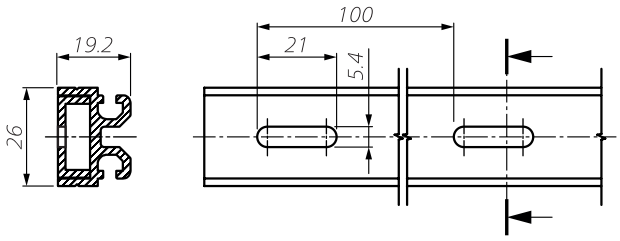


Two-part profile, type M 1:2

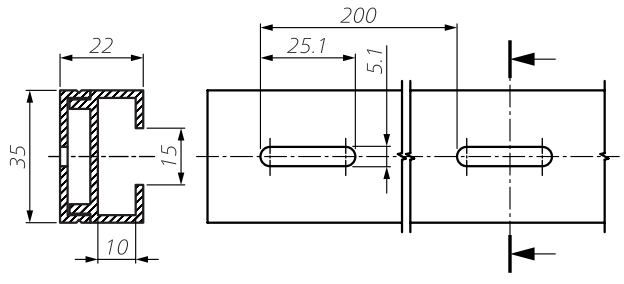
C 25M



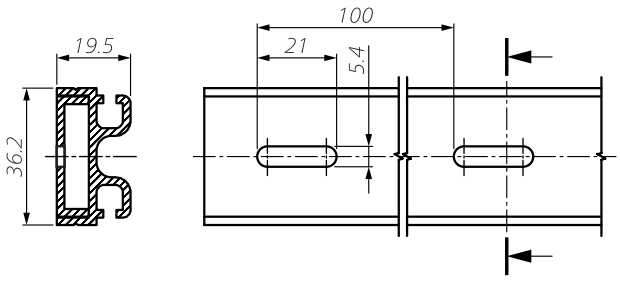
C 26M



C 35M



C 36M



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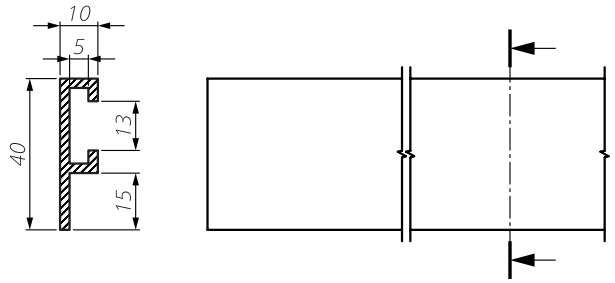
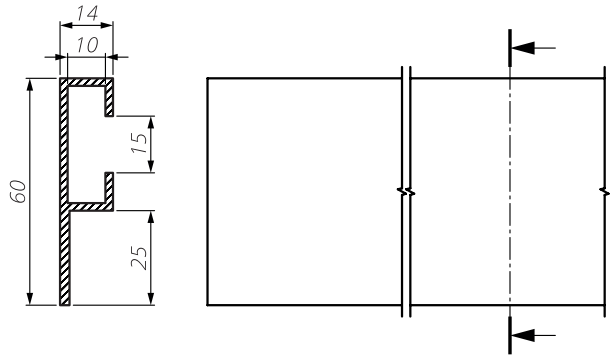
Flange profile, type S 1:2

C 25S

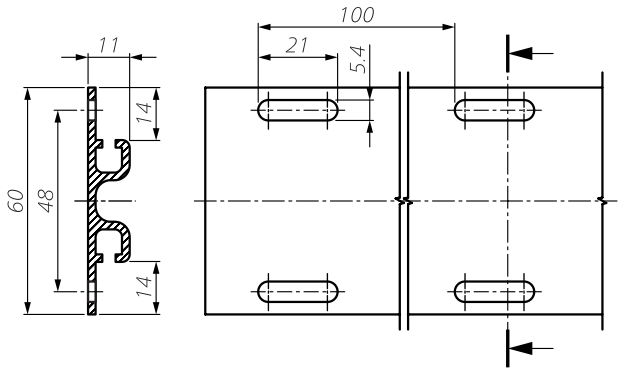


–

C 35S

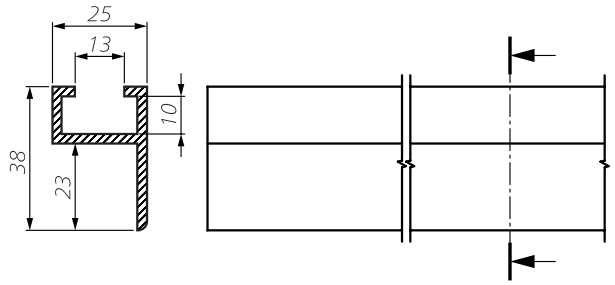


C 36S

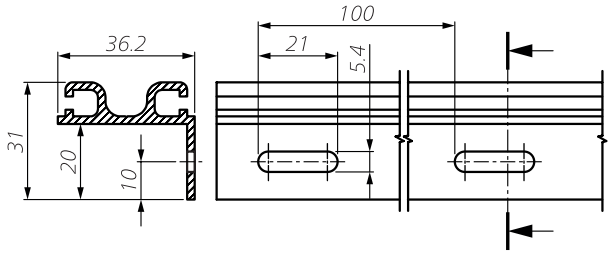


Angle profile, type L 1:2

C 25L



C 36L



131221 v3.12-RiA

Subject to technical modifications.

SP: Making the right selection

Calculation for selection of the safety edge height

s_1 = Stopping distance of the dangerous movement [mm]
v = Velocity of the dangerous movement [mm/s]
T = Follow-through time of the complete system [s]
t_1 = Safety edge response time
t_2 = Stopping time of the machine
s = Minimum overtravel distance of the safety edge to ensure that the stipulated limit forces are not exceeded [mm]
C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected.

The stopping distance of the dangerous movement is calculated using the following formula:

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

In accordance with ISO 13856-2, the minimum overtravel distance of the safety edge is calculated using the following formula:

$s = s_1 \times C$ where: $C = 1.2$

A suitable safety edge profile can now be selected based on the result. For details of the overtravel distances for safety edge profiles, see chapter *Technical data*.

Calculation examples

Calculation example 1

The dangerous movement on your machine has a velocity of v = 10 mm/s and can be brought to a standstill within t_2 = 200 ms. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore, the sensor profile SP 37-1 TPE could be sufficient. The response time of the safety edge (SP 37-1 TPE + control unit*) is t_1 = 600 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 10$ mm/s $\times$ (0.6 s + 0.2 s)
$s_1 = 1/2 \times 10$ mm/s $\times$ 0.8 s = 4.0 mm

$s = s_1 \times C$ where: $C = 1.2$
s = 4.0 mm $\times$ 1.2 **= 4.8 mm**

The safety edge must have a minimum overtravel distance of s = 4.8 mm. The selected SP 37-1 TPE has an overtravel distance of at least 9.2 mm. This is more than the required 4.8 mm.
Result: The SP 37-1 TPE is **suitable** for this case.

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Subject to technical modifications.

* Assumption: Typical reaction time of a control unit = 20 ms

Calculation example 2

The same conditions apply as in calculation example 1 with the exception of the velocity of the dangerous movement. This is now v = 200 mm/s. The response time of the safety edge (SP 37-1 TPE + control unit*) is t_1 = 55 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 200$ mm/s $\times$ (0.055 s + 0.2 s)

s_1 = 1/2 × 200 mm/s × 0.255 s = 25.5 mm

$s = s_1 \times C$ where: C = 1.2

s = 25.5 mm × 1.2 **= 30.6 mm**

The safety edge must have a minimum overtravel distance of s = 30.6 mm. The selected SP 37-1 TPE has an overtravel distance of at least 3.8 mm. This is less than the required 30.6 mm.

Result: The SP 37-1 TPE is **not suitable** for this case.

Calculation example 3

The same conditions apply as in calculation example 2. Instead of SP 37-1 EPDM, the SP 67-1 TPE is selected. The response time of the safety edge (SP 67-2 TPE + control unit*) is t_1 = 72 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 200$ mm/s $\times$ (0.072 s + 0.2 s)

s_1 = 1/2 × 200 mm/s × 0.272 s = 27.2 mm

$s = s_1 \times C$ where: C = 1.2

s = 27.2 mm × 1.2 **= 32.6 mm**

The safety edge must have a minimum overtravel distance of s = 32.6 mm. The selected SP 67-2 TPE has an overtravel distance of at least 36.5 mm. This is more than the required 32.6 mm.

Result: The SP 67-2 TPE is **suitable** for this case.

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* Assumption: Typical reaction time of a control unit = 20 ms

Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection

Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting

Cleaning

If the sensors become dirty, they can be cleaned with a mild cleaning product.

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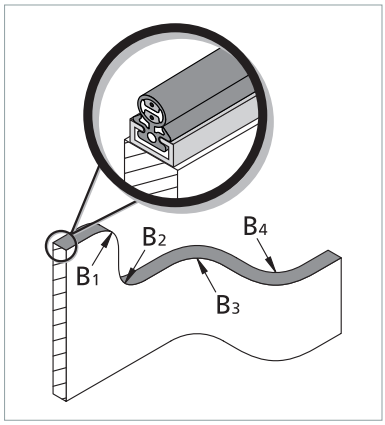
Technical data

SK SP 17-3 TPE

Sensor profile (without control unit)	SK SP/W 17-3 TPE or SK SP/BK 17-3 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 10 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	1.5 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 80 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	200 / 200 / 50 / 50 mm
Operating velocity	
(min. / max.)	10 mm/s / 10 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 17-3
without aluminium profile	0.12 kg/m
with aluminium profile C 15	0.28 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



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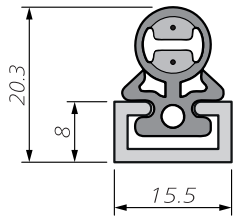
Dimensions and distances

SP 17-3 TPE (1:1)



Dimensional tolerances according to ISO 3302 E2/L2

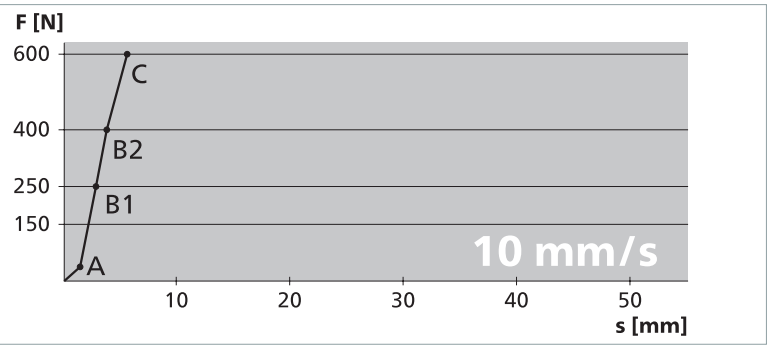
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

All the data given here has been verified by Mayser GmbH & Co. KG.

Test velocity	**10 mm/s**
Actuation force	38 N
Response time	140 ms
Actuation distance (A)	1.4 mm
Overtravel distance	
up to 250 N (B1)	1.4 mm
up to 400 N (B2)	2.3 mm
up to 600 N (C)	4.1 mm
Total deformation	5.5 mm

Force-distance ratios



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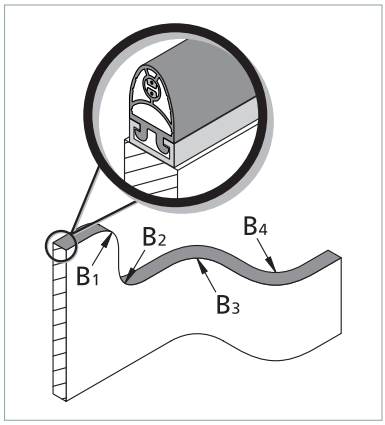
Technical data

SK SP 37-1 TPE

Sensor profile (without control unit)	SK SP/W 37-1 TPE or SK SP/BK 37-1 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 37-1
without aluminium profile	0.33 kg/m
with aluminium profile C 25	0.64 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

Bend radii:



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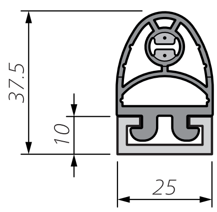
Dimensions and distances

SP 37-1 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

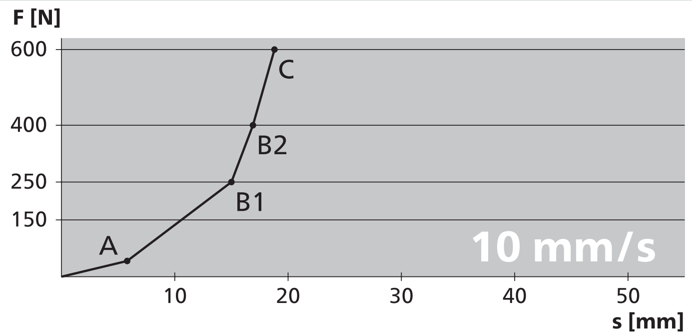
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without channel

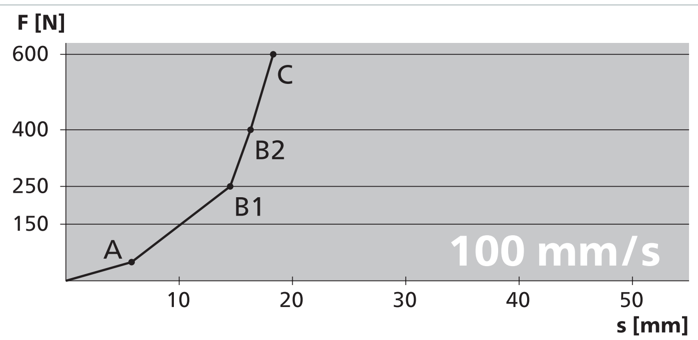
All data stated here is documented in EC type examination certificates.

Force-distance ratios

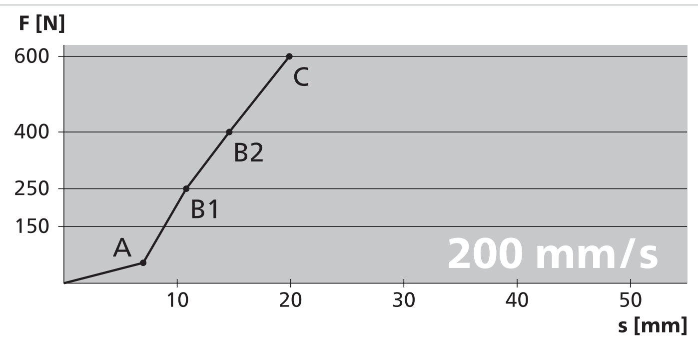
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



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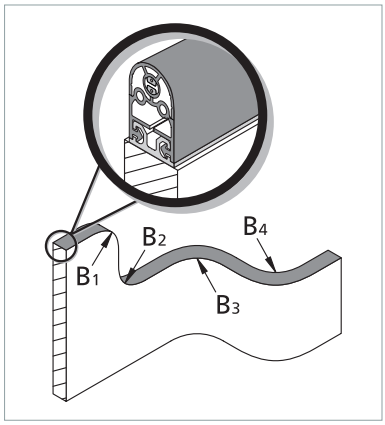
Technical data

SK SP 37(L)-2 TPE

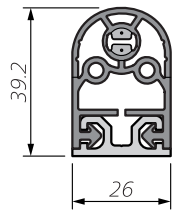
Sensor profile (without control unit)	SK SP/W 37(L)-2 TPE or SK SP/BK 37(L)-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 37-2** **SP 37L-2**
without aluminium profile	0.36 kg/m 0.41 kg/m
with aluminium profile C 26	0.69 kg/m 0.74 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

Bend radii:



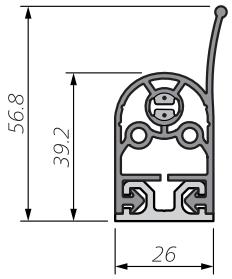
Dimensions and distances

SP 37-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 37L-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

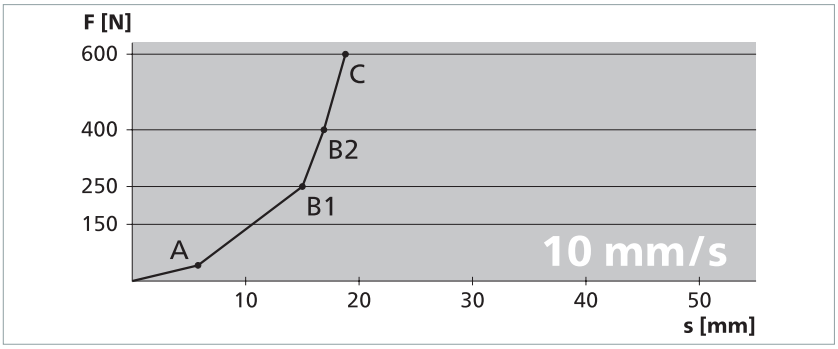
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

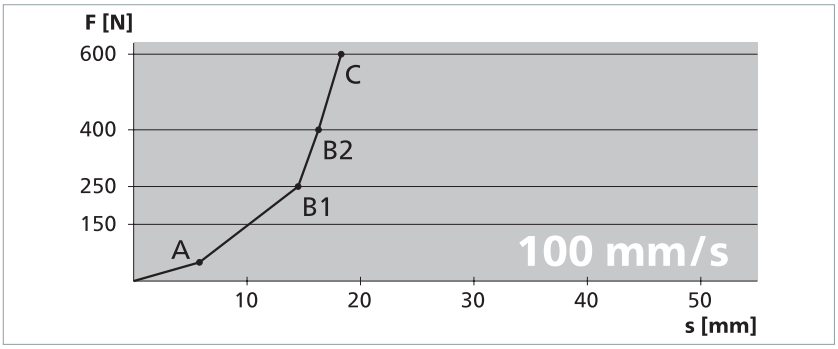
All data stated here is documented in EC type examination certificates.

Force-distance ratios

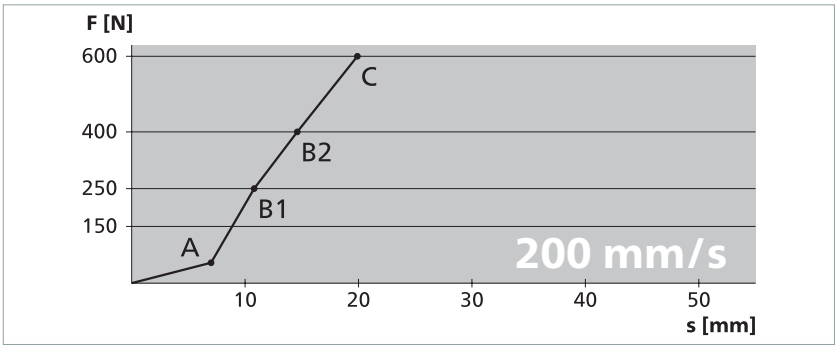
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



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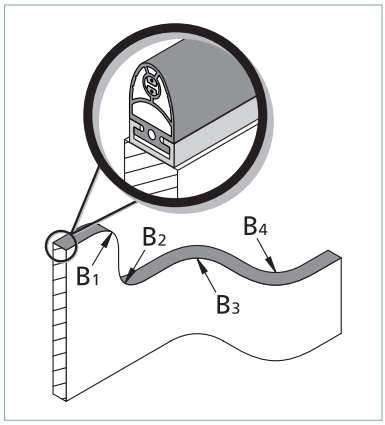
Technical data

SK SP 37-3 TPE

Sensor profile (without control unit)	SK SP/W 37-3 TPE or SK SP/BK 37-3 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 37-3
without aluminium profile	0.34 kg/m
with aluminium profile C 25	0.66 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

Bend radii:



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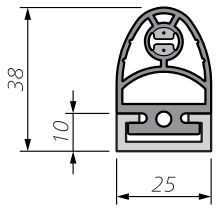
Dimensions and distances

SP 37-3 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

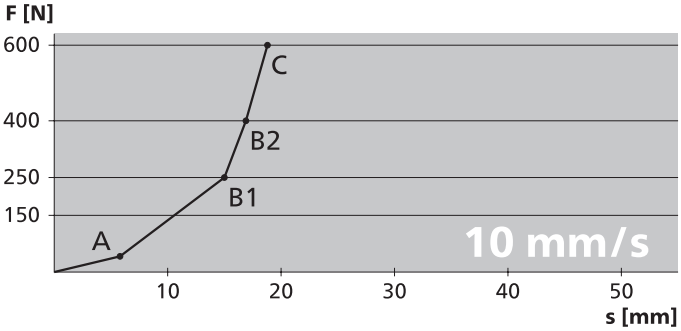
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

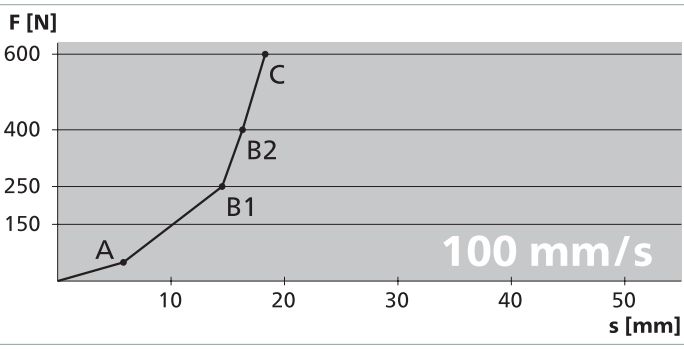
All data stated here is documented in EC type examination certificates.

Force-distance ratios

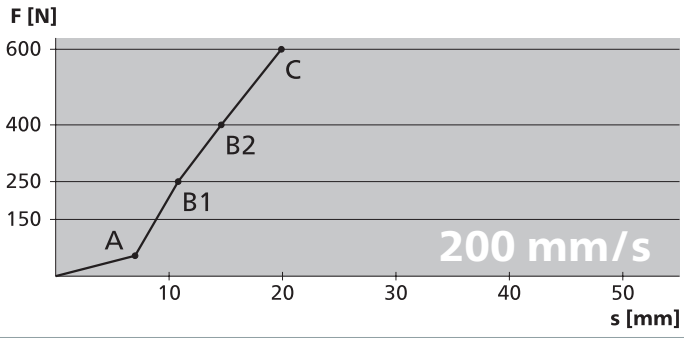
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



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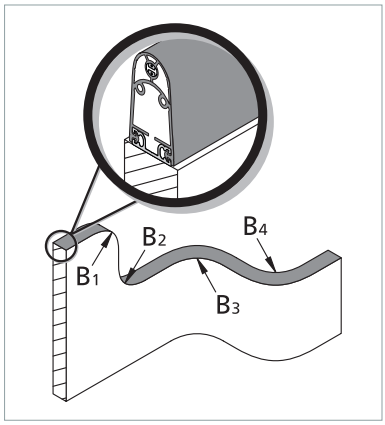
Technical data

SK SP 57(L)-2 TPE

Sensor profile (without control unit)	SK SP/W 57(L)-2 TPE or SK SP/BK 57(L)-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 57-2** **SP 57L-2**
without aluminium profile	0.44 kg/m 0.47 kg/m
with aluminium profile C 30	0.74 kg/m 0.77 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

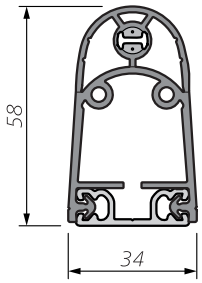
Bend radii:



131221 v3.12-RiA

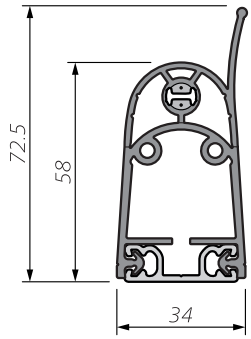
Dimensions and distances

SP 57-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 57L-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

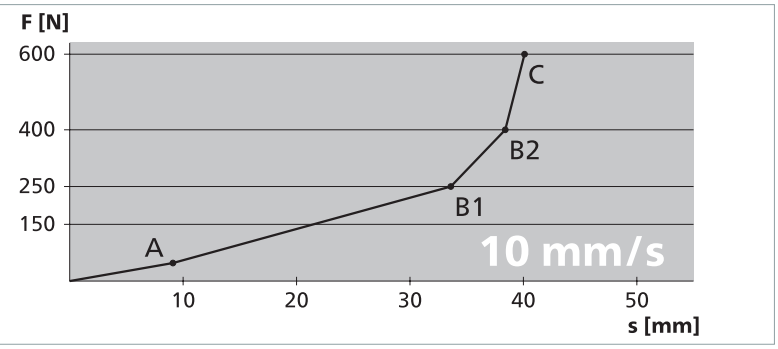
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

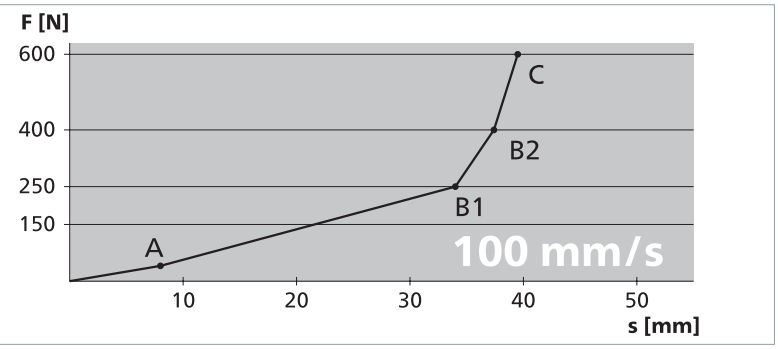
All data stated here is documented in EC type examination certificates.

Force-distance ratios

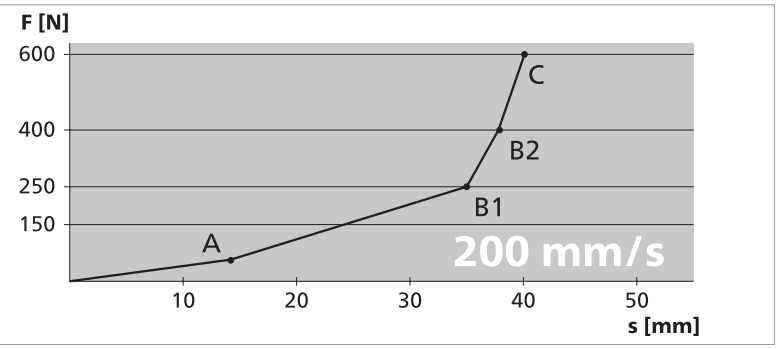
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



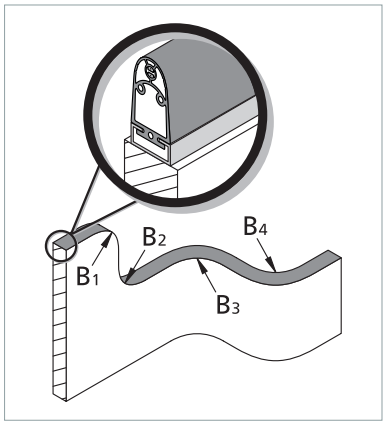
131221 v3.12-RiA

Technical data

SK SP 57-3 TPE

Sensor profile (without control unit)	SK SP/W 57-3 TPE or SK SP/BK 57-3 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 57-3
without aluminium profile	0.60 kg/m
with aluminium profile C 35	1.00 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

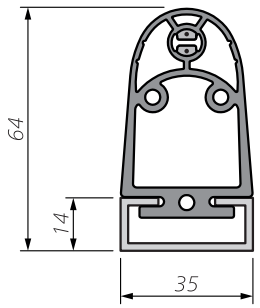
Bend radii:



131221 v3.12-RiA

Dimensions and distances

SP 57-3 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

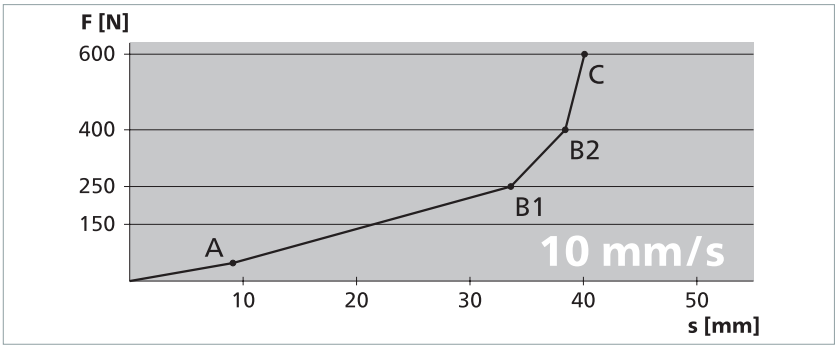
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

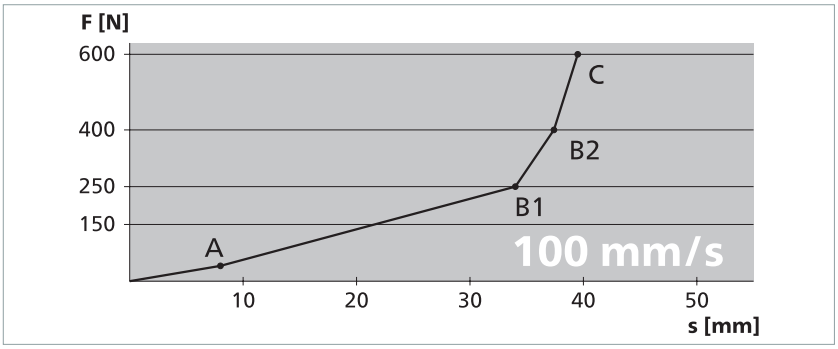
All data stated here is documented in EC type examination certificates.

Force-distance ratios

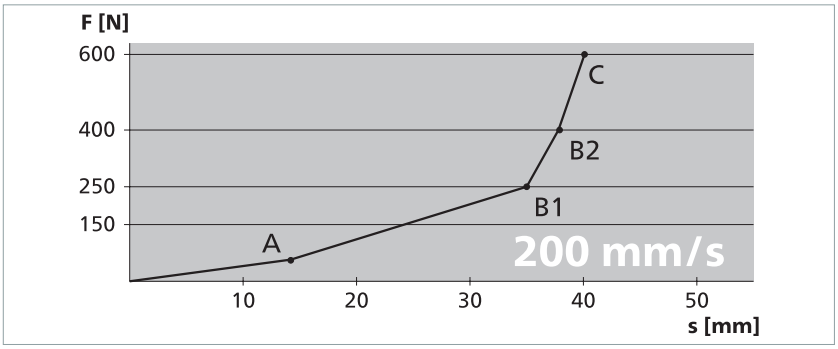
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



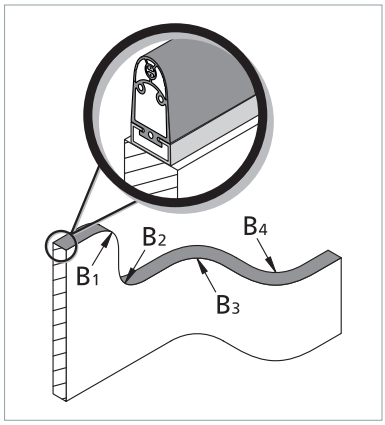
131221 v3.12-RiA

Technical data

SK SP 57(L)-4 TPE

Sensor profile (without control unit)	SK SP/W 57(L)-4 TPE or SK SP/BK 57(L)-4 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 57-4** **SP 57L-4**
without aluminium profile	0.58 kg/m 0.62 kg/m
with aluminium profile C 35	0.99 kg/m 1.03 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

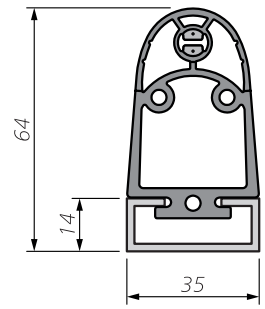
Bend radii:



131221 v3.12-RiA

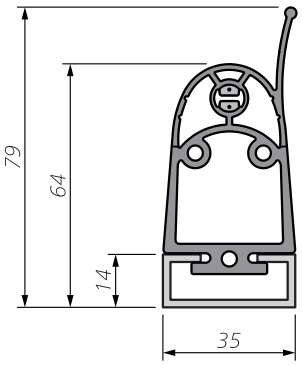
Dimensions and distances

SP 57-4 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 57L-4 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

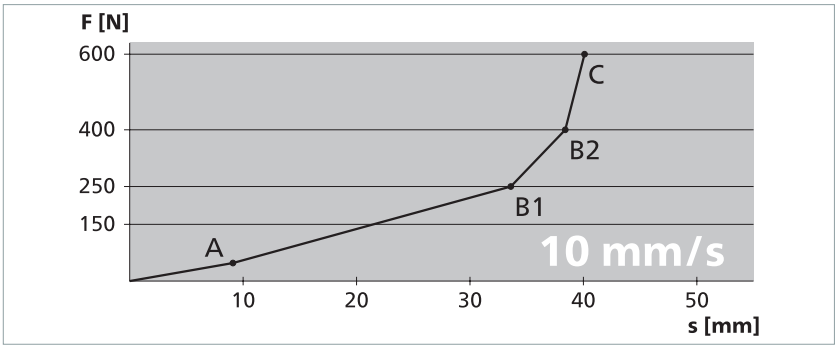
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

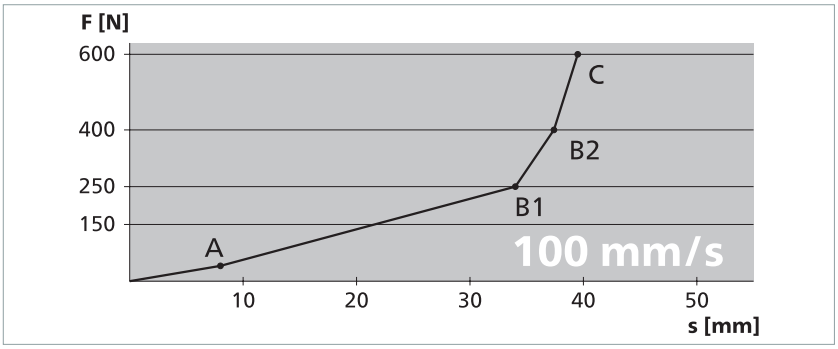
All data stated here is documented in EC type examination certificates.

Force-distance ratios

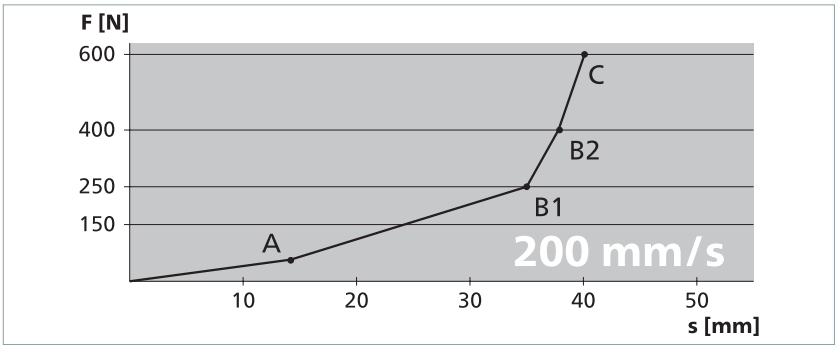
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



131221 v3.12-RiA

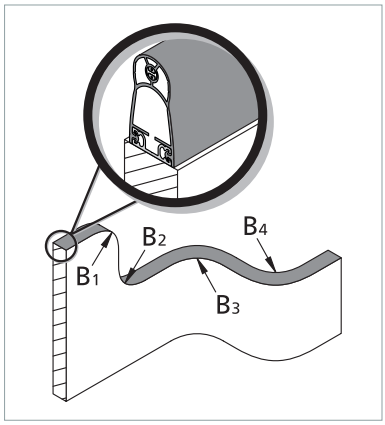
MAYSER®

Technical data

SK SP 67-2 TPE

Sensor profile (without control unit)	SK SP/W 67-2 TPE or SK SP/BK 67-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	11 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	± 45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 67-2
without aluminium profile	0.49 kg/m
with aluminium profile C 30	0.79 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

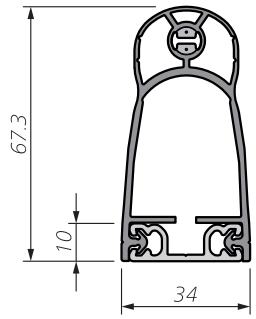
Bend radii:



131221 v3.12-RiA

Dimensions and distances

SP 67-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

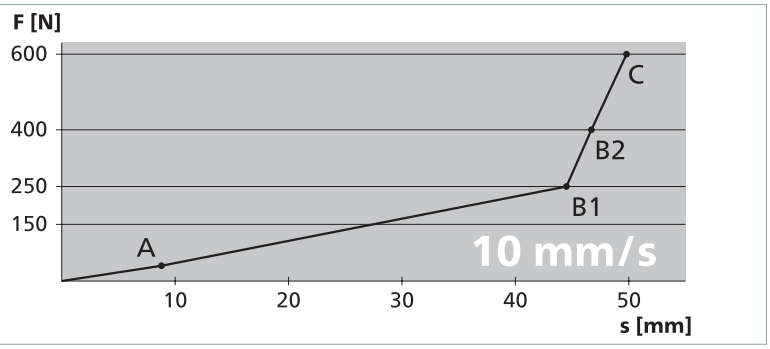
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

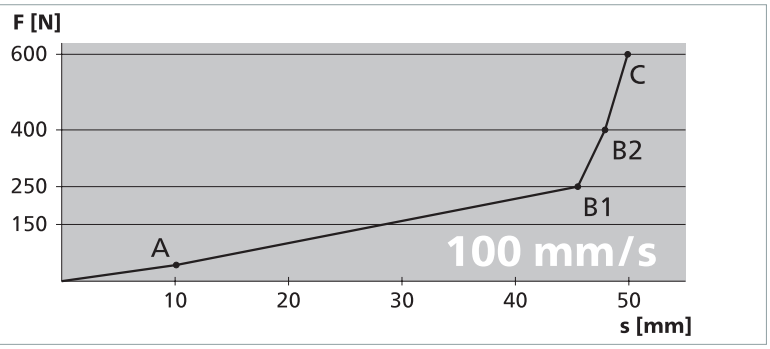
All data stated here is documented in EC type examination certificates.

Force-distance ratios

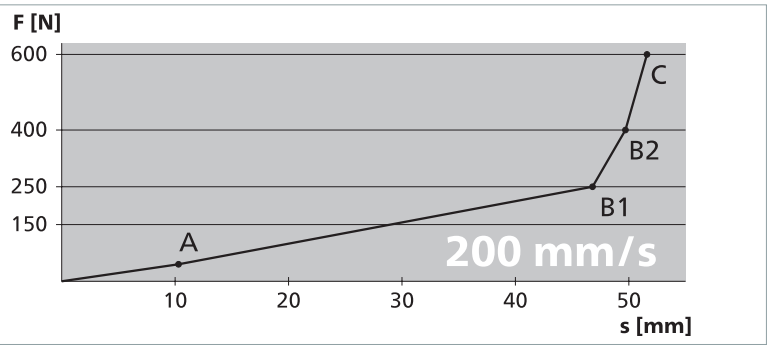
Test velocity	**10 mm/s**
Actuation force	41 N
Response time	880 ms
Actuation distance (A)	8.8 mm
Overtravel distance	
up to 250 N (B1)	35.7 mm
up to 400 N (B2)	37.9 mm
up to 600 N (C)	41 mm
Total deformation	49.8 mm



Test velocity	**100 mm/s**
Actuation force	43 N
Response time	101 ms
Actuation distance (A)	10.1 mm
Overtravel distance	
up to 250 N (B1)	35.4 mm
up to 400 N (B2)	37.8 mm
up to 600 N (C)	39.8 mm
Total deformation	49.9 mm



Test velocity	**200 mm/s**
Actuation force	45 N
Response time	51.5 ms
Actuation distance (A)	10.3 mm
Overtravel distance	
up to 250 N (B1)	36.5 mm
up to 400 N (B2)	39.4 mm
up to 600 N (C)	41.3 mm
Total deformation	51.6 mm



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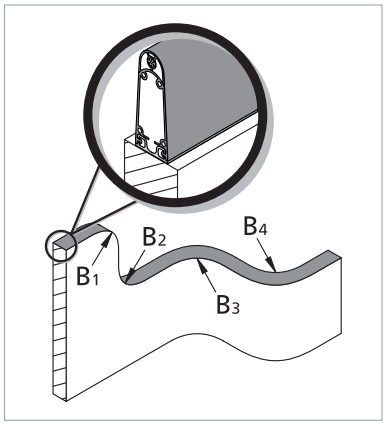
MAYSER®

Technical data

SK SP 87-2 TPE

Sensor profile (without control unit)	SK SP/W 87-2 TPE or SK SP/BK 87-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	9 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	± 45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP68
SP in water: 9 cm bottom edge	IPX8: 20 weeks
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 87-2
without aluminium profile	0.64 kg/m
with aluminium profile C 36	1.06 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



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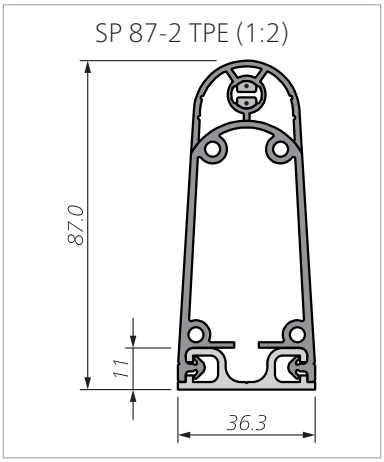
Dimensions and distances



Dimensional tolerances according to ISO 3302 E2/L2

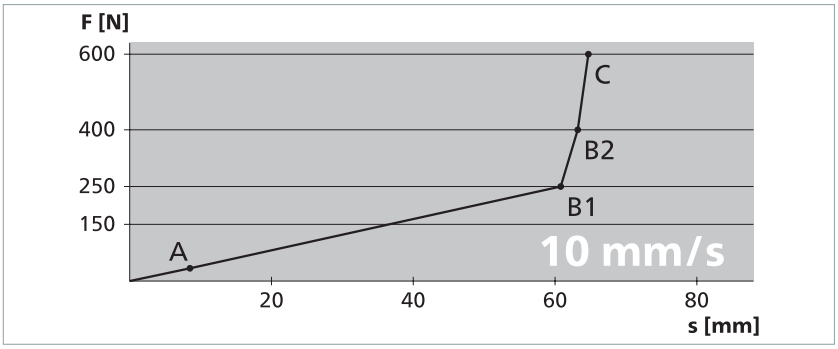
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

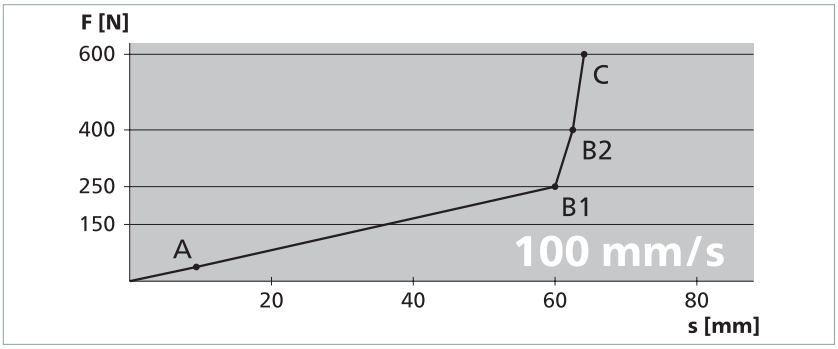
All data stated here is documented in EC type examination certificates.

Force-distance ratios

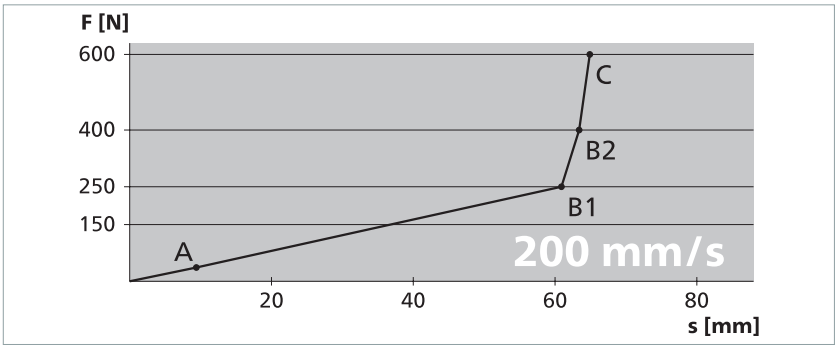
Test velocity	**10 mm/s**
Actuation force	34 N
Response time	850 ms
Actuation distance (A)	8.5 mm
Overtravel distance	
up to 250 N (B1)	52.3 mm
up to 400 N (B2)	54.7 mm
up to 600 N (C)	56.2 mm
Total deformation	64.7 mm



Test velocity	**100 mm/s**
Actuation force	38 N
Response time	81 ms
Actuation distance (A)	8.1 mm
Overtravel distance	
up to 250 N (B1)	51.9 mm
up to 400 N (B2)	54.4 mm
up to 600 N (C)	56.0 mm
Total deformation	64.1 mm



Test velocity	**200 mm/s**
Actuation force	37 N
Response time	47 ms
Actuation distance (A)	9.4 mm
Overtravel distance	
up to 250 N (B1)	51.5 mm
up to 400 N (B2)	54.0 mm
up to 600 N (C)	55.5 mm
Total deformation	64.9 mm



131221 v3.12-RiA

Marking

If you combine sensors with control units and thereby place pressure-sensitive protection devices on the market, you should observe the basic requirements according to ISO 13856.
As well as meeting technical requirements, this also means – in particular – observing any that relate to marking and information for use.

Conformity

EC type examination

The product was tested by an independent institute.
There is an EC type examination certificate to confirm conformity.
The EC type examination certificate is stored in the Downloads section of our website: www.mayser.com.

UL certification

The design type of the product conforms to the basic requirements of UL certification:

- UL 325

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MAYSER®

Innovative by tradition.

SP DIY sensor profiles for toolless self-assembly

EN | Product information

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MAYSER®

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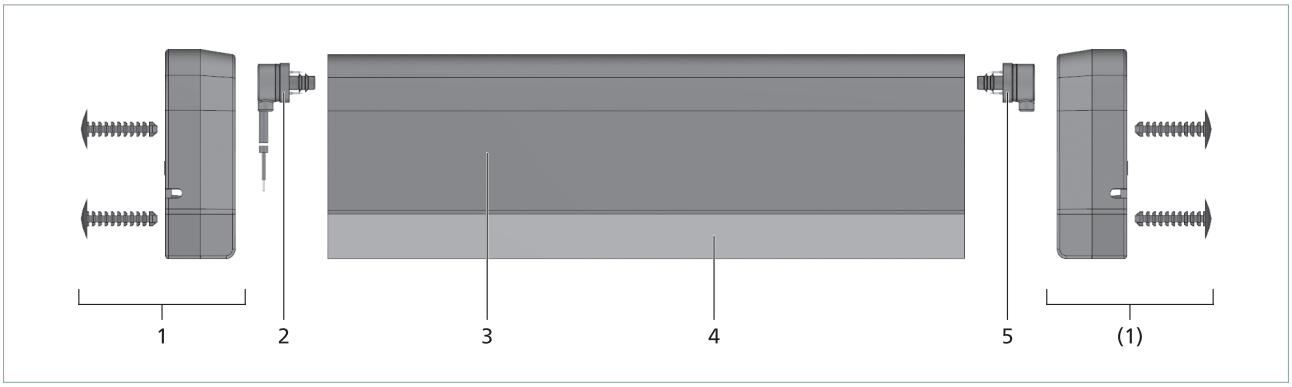
021222 v1.04-RiA

Overview

Contact profile – Sensor profile
The semi-finished contact profile (No. 3) is cut to length and assembled with the other components. This results in a functioning product called a sensor profile.



Nos. 2 and 5 are identical for all sensor profiles.

No. 2	Closing plug with 2.5 m cable	7504038
No. 5	Closing plug with resistor	7504039

Alternatives for No. 2:

Closing plug with 5.0 m cable	7504103
Closing plug with 10 m cable	7504102

Sensor profile	No. 1 Set of end caps	No. 3 Contact profile		No. 4 Aluminium profile	
SP 17-3 without end caps	1005786	SP 17-3	7503461	C 15	1000016
SP 37-1 without end caps	1000606	SP 37-1	7502853	C 25	1000004
SP 37-1 with end caps	7503008	SP 37-1	7502853	C 25	1000004
SP 37-2 with end caps	7503988	SP 37-2	7503318	C 26	1004330
SP 37L-2 with end caps	7503988	SP 37L-2	7504192	C 26	1004330
SP 37-3 with end caps	7503505 (7503654)	SP 37-3	7503343	C 25	1000004
SP 57-2 with end caps	7503603	SP 57-2	7503055	C 30	1005844
SP 57L-2 with end caps	7503603	SP 57L-2	7503412	C 30	1005844
SP 57-3 with end caps	7503618	SP 57-3	7503521	C 35	1000006

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Subject to technical modifications.

Sensor profile	No. 1 Set of end caps	No. 3 Contact profile		No. 4 Aluminium profile	
SP 57-4 with end caps	7503618	SP 57-4	7503633	C 35	1000006
SP 57L-4 with end caps	7503618	SP 57L-4	7503711	C 35	1000006
SP 67-2 with end caps	7503655	SP 67-2	7503285	C 30	1005844
SP 87-2 with end caps	7504118	SP 87-2	7503722	C 36	1003848

Materials list

Part No.	Designation	Packing unit
7503461	Contact profile SP 17-3 TPE	80 m
7502853	Contact profile SP 37-1 TPE	30 m
7503318	Contact profile SP 37-2 TPE	30 m
7504192	Contact profile SP 37L-2 TPE	30 m
7503343	Contact profile SP 37-3 TPE “black”	30 m
7503534	Contact profile SP 37-3 TPE “red”	30 m
7503055	Contact profile SP 57-2 TPE	30 m
7503412	Contact profile SP 57L-2 TPE	30 m
7503521	Contact profile SP 57-3 TPE	25 m
7503633	Contact profile SP 57-4 TPE	25 m
7503711	Contact profile SP 57L-4 TPE	25 m
7503285	Contact profile SP 67-2 TPE	30 m
7503722	Contact profile SP 87-2 TPE	25 m
7504039	Closing plug with resistor 8k2	10 pcs.
7504038	Closing plug with 2.5 m PUR cable, angled 90°	10 pcs.
7504103	Closing plug with 5.0 m PUR cable, angled 90°	10 pcs.
7504102	Closing plug with 10 m PUR cable, angled 90°	10 pcs.
7504101	Closing plug without resistor	10 pcs.
1005786	Countersunk tapping screw 3.5 x 25 for SP 17-3	20 pcs.
7503008	Set of end caps for SP 37-1: 2 end caps, 2 fixing stoppers and 2 screws 3.9 × 25	10 pcs.
7503988	Set of end caps for SP 37(L)-2: 2 end caps and 4 pine tree clips	10 pcs.

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Subject to technical modifications.

Part No.	Designation	Packing unit
7503505	Set of end caps for SP 37-3 “black”: 2 end caps and 2 pine tree clips	10 pcs.
7503654	Set of end caps for SP 37-3 “red”: 2 end caps and 2 pine tree clips	10 pcs.
7503603	Set of end caps for SP 57(L)-2 with clips: 2 end caps and 4 pine tree clips	10 pcs.
7503618	Set of end caps for SP 57-3 and SP 57(L)-4: 2 end caps and 6 pine tree clips	10 pcs.
7503655	Set of end caps for SP 67-2: 2 end caps and 4 pine tree clips	10 pcs.
7504118	Set of end caps for SP 87-2: 2 end caps and 8 pine tree clips	10 pcs.
1000016	Aluminium profile C 15	6 m
1000854	Aluminium profile C 25M, upper section	6 m
1000855	Aluminium profile C 25M, lower section	6 m
1000829	Aluminium profile C 25L	6 m
1000012	Aluminium profile C 25S	6 m
1000004	Aluminium profile C 25	6 m
1004626	Aluminium profile C 26M, upper section	6 m
1004627	Aluminium profile C 26M, lower section	6 m
1004330	Aluminium profile C 26, perforated	6 m
1005844	Aluminium profile C 30	6 m
1001398	Aluminium profile C 35M, upper section	6 m
1001399	Aluminium profile C 35M, lower section	6 m
1000013	Aluminium profile C 35S	6 m
1000006	Aluminium profile C 35	6 m
1004629	Aluminium profile C 36M, upper section	6 m
1004630	Aluminium profile C 36M, lower section	6 m
1003849	Aluminium profile C 36L, perforated	6 m
1003850	Aluminium profile C 36S, perforated	6 m
1003848	Aluminium profile C 36, perforated	6 m
1001223	End stopper for C 25M, for SP without end caps	1 pc.
1000606	End stopper for C 25 or C 25S, for SP without end caps	1 pc.
1005906	Section cutter, cutting length 87 mm	1 pc.

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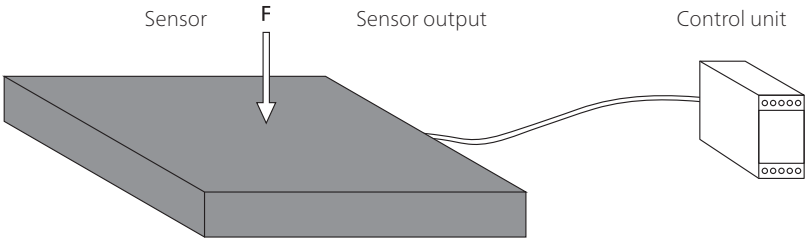
Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

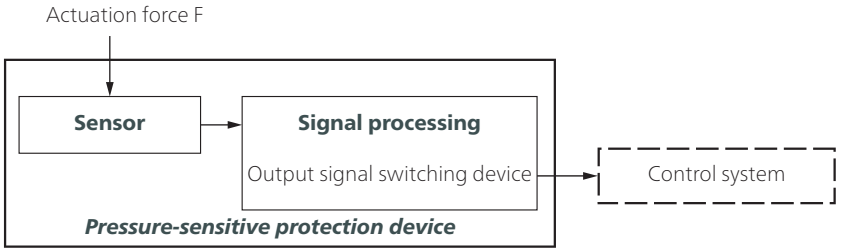


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuating surface is deformed locally.

Signal processing

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the forwarding control system and which transmits safety output signals such as STOP.



Tip: Terms are defined in ISO 13856-2 Section 3.

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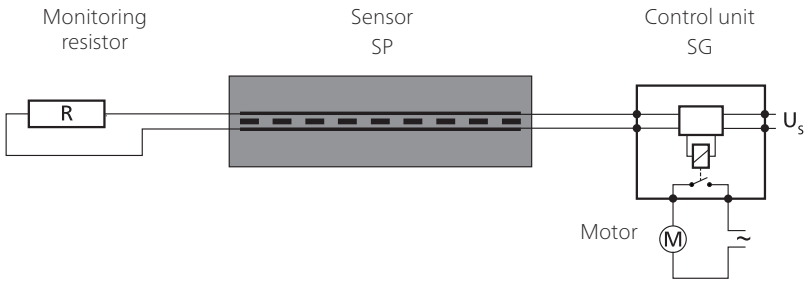
Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of Protection in accordance with IEC 60529:
  IP67 is the standard for safety edges.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…
- Finger detection necessary?

Operation principle of 2-wire technology

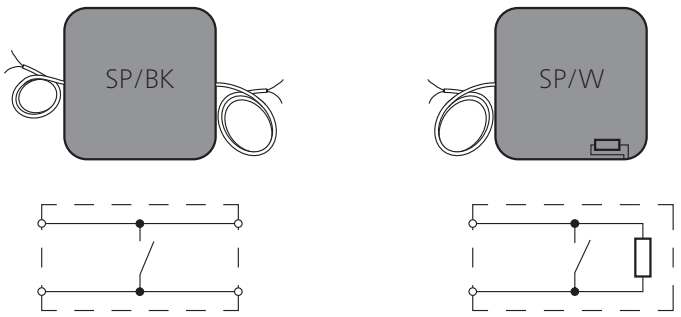


The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

Types

SP/BK	With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor
SP/W	With an integrated monitoring resistor for use as an end sensor



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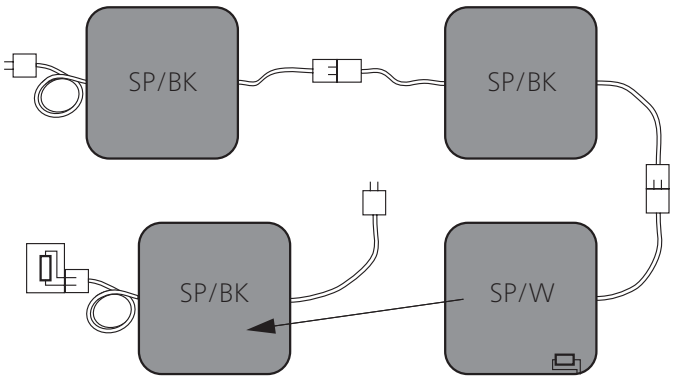
Subject to technical modifications.

Sensor combination

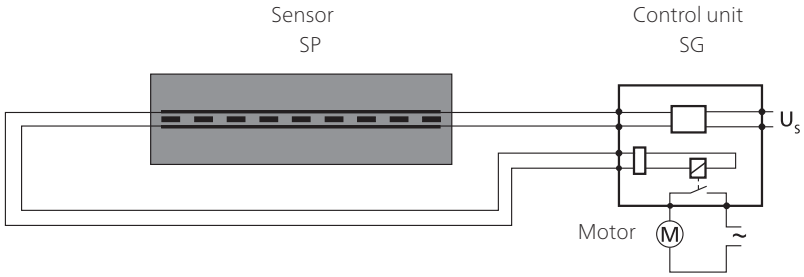


Version with external resistor, therefore no variety of models

Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

Operation principle of 4-wire technology



The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connecting cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

SP/BK With cables on both sides for use as a through sensor

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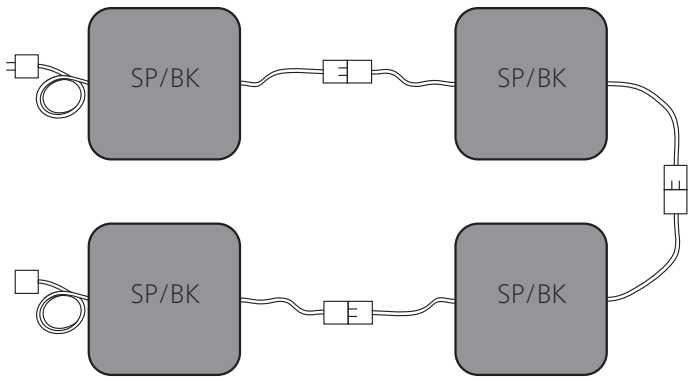
Subject to technical modifications.

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

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Safety

Intended use

A safety edge detects a person or part of the body when pressure is applied to the effective actuation area. It is a linear tripping device. Its task is to prevent possible hazardous situations that could affect someone within a danger zone, such as shearing and pinching edges.
Typical areas of application are door and gate systems, moving parts on machines, platforms and lifting devices.
Safe operation of a safety edge depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

For additional application guidelines, please refer to
ISO 13856-2 Annex E.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 5 /BK-type sensors can be connected to one control unit.
- No more than 4 /BK-type sensors and 1 /W-type sensor can be connected to one control unit.

Exclusions

The sensors are not suitable for:

- performing a sealing function. Constant actuation of sensors can result in permanent damage.
  Exception: The L version with an attached lip seal.
  The lip seal can be in full contact with the closing edge, which allows it to repel wind and water.

Selecting the appropriate product line

If you opt for our line of SP DIY sensor profiles for toolless self-assembly, the maximum class of protection that can be achieved is IP67 and IPX8 (13 days). If a higher protection class of IP68 or IPX8 (20 weeks) is required for your application, we recommend using our line of SP DIY sensor profiles for **assembly with tools** instead.

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Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

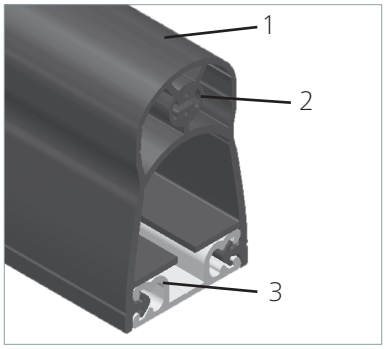
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts by pressure-sensitive equipment according to ISO 13856. In this case, the diagnostic coverage (DC) is not calculated or taken into account when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety edge system (pressure-sensitive protection device) as a whole.

Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard. After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design



The SP sensor profile consists of one sensor (1 to 3)
(1) SP contact profile with
(2) integrated normally open switching element,
(3) aluminium profile and an evaluating control unit SG.

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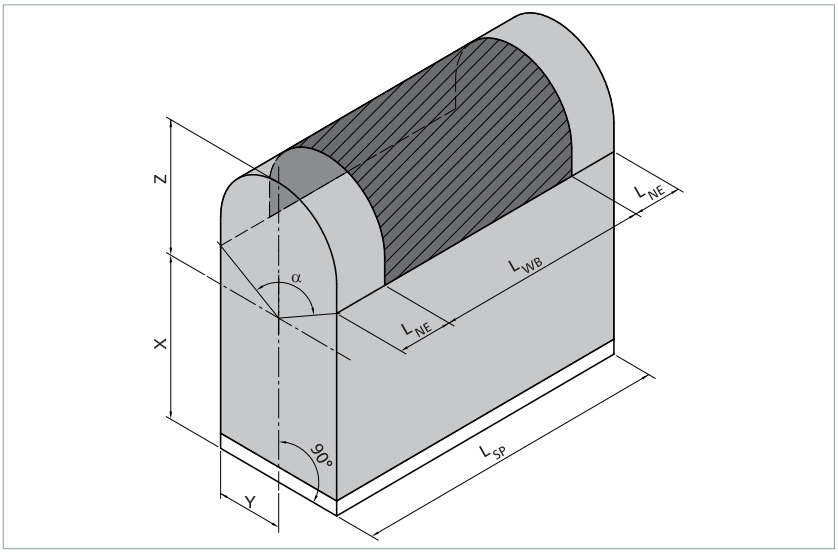
Subject to technical modifications.

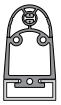
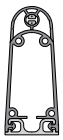
Effective actuation area

The parameters X, Y, Z, L_{WB} and the angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$$L_{WB} = L_{SP} - 2 \times L_{NE}$$



Parameters:
L_{WB} = effective actuation length
L_{SP} = total length of sensor profile
L_{NE} = non-sensitive length at end of sensor profile
α = effective actuation angle

	SP 17-3 [1]	SP 37-1	SP 37(L)-2	SP 37-3	SP 57(L)-2	SP 57-3	SP 57(L)-4	SP 67-2	SP 87-2
									
Incl.	C 15	C 25	C 26	C 25	C 30	C 35	C 35	C 30	C 36
α	90°	100°	100°	100°	90°	90°	90°	90°	90°
L_{NE}	60 mm	20 mm	20 mm	20 mm	10 mm [2]	10 mm [2]	10 mm [2]	20 mm [2]	10 mm [2]
Y	6.7 mm	12.5 mm	13 mm	12.5 mm	17 mm	17.5 mm	17.5 mm	17 mm	18.1 mm
X	15.3 mm	28.5 mm	30 mm	29 mm	44 mm	52 mm	52 mm	57.3 mm	72 mm
Z	5 mm	9 mm	9 mm [3]	9 mm	12 mm [3]	12 mm	12 mm [3]	10 mm	15 mm
X + Z	20.3 mm	37.5 mm	39 mm [3]	38 mm	56 mm [3]	64 mm	64 mm [3]	67.3 mm	87 mm

[1] without end cap [2] with finger protection [3] without lip

Installation position

The installation position can be selected as required, i.e. all installation positions from A to D as per ISO 13856-2 are possible.

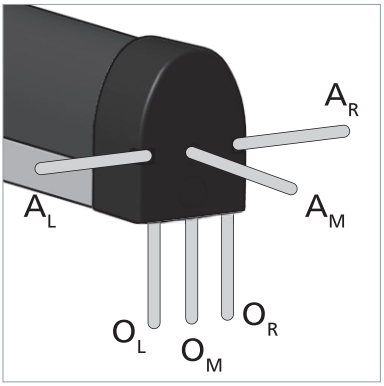
Subject to technical modifications.

Connection

Cable exits

Depending on the end cap, the following cable exits are available.

A_L = axial left
A_M = axial middle
A_R = axial right
O_L = orthogonal left
O_M = orthogonal middle
O_R = orthogonal right



Orientation		Cable exit					
Lateral exit		A_L		A_R			
Axial exit			A_M				
90° exit					O_L	O_M	O_R
Combination							
Contact profile	Set of end caps						
SP 17-3	–					●	
SP 37-1	7503008	●		●	●		●
SP 37(L)-2	7503988	●	●	●		●	
SP 37-3 black	7503505	●		●	●		●
SP 37-3 red	7503654	●		●	●		●
SP 57(L)-2	7503062	●	●	●		●	
	7503603	●	●	●		●	
SP 57-3	7503618	●	●	●		●	
SP 57(L)-4	7503796	●	●	●	●		●
SP 67-2	7503655	●	●	●		●	
SP 87-2	7504118	●	●	●		●	

● = possible

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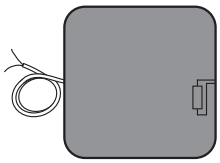
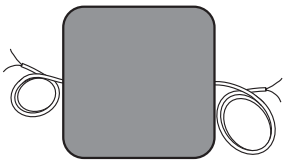
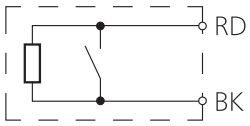
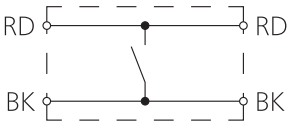
Subject to technical modifications.

Cable connection

- Standard cable lengths
  L = 2.5 m / 5.0 m / 10 m
- Maximum total cable length to the control unit
  L_{max} = 100 m

/W-type sensor with 1 line	/BK-type sensor with 2 lines
• As an individual /W-type sensor or a /W-type end sensor • Integrated resistor • 1 two-wire cable	• As a /BK-type through sensor • Without resistor • 2 two-wire cables
	

Wire colours

/W-type sensor with 1 line	/BK-type sensor with 2 lines
	

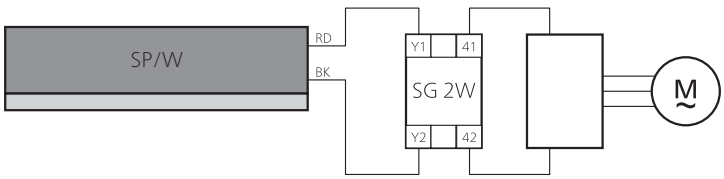
Colour coding

BK	Black
RD	Red

Connection examples

Key:

SG 2W	evaluation with 2-wire technology
SG 4L	evaluation with 4-wire technology



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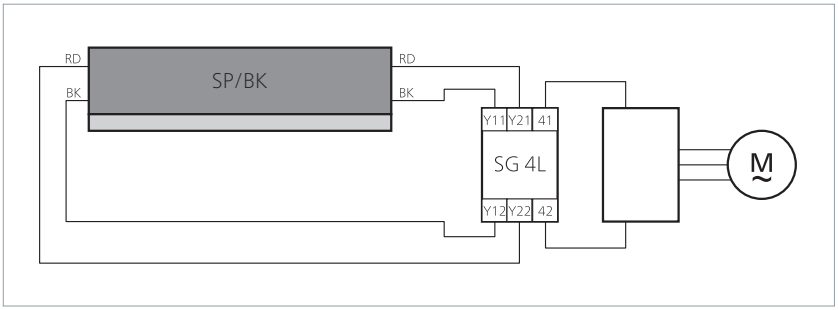
Subject to technical modifications.



Sensor surface

Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having an undamaged surface.

Physical resistance

	TPE
UV resistance	Yes

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

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Explanation of symbols:

+ = resistant
± = resistant to a certain extent
- = not resistant

Material	TPE
Acetone	-
Formic acid	-
Armor All	+
Car shampoo	+
Petrol	-
Brake fluid	+
Buraton	+
Butanol	-
Sodium hypochlorite	-
Disinfectant 1%	+
Diesel	-
Acetic acid 10%	-
Ethanol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Anti-frost agent	+
Skin cream	+
Incidin	+
Incidin Plus	+
Cooling lubricant	-
Plastic cleaner	+
Lyso FD 10	+
Metal working oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5%	+
Spirit (ethyl alcohol)	+
Terralin	+
Centring oil	-

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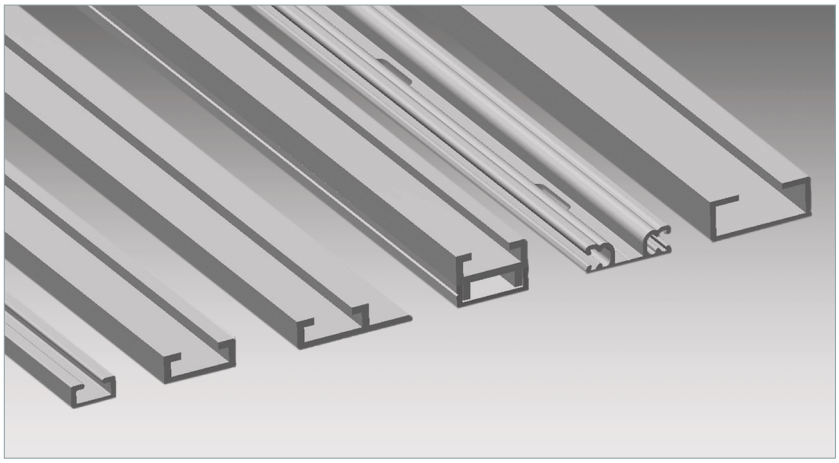
Subject to technical modifications.

Mounting

The sensors are mounted directly onto the main and secondary closing edges that present a danger. They are fixed using special aluminium profiles. The profiles are fastened with screws or rivets.



Material properties

- AlMgSi0.5 F22
- Wall thickness at least
  2.0 mm
  C 15: at least 1.7 mm
  C 30: at least 1.5 mm
- Extruded
- Hot hardened
- Tolerances as per EN 755-9

Aluminium profiles: Overview of combinations

Sensor profile foot		C 15	C 25 C 25M C 25S C 25L	C 26 C 26M	C 30	C 35 C 35M C 35S	C 36 C 36M C 36S C 36L
Snap-in foot (middle)	…-1 	–	SP 37-1	–	–	–	–
Clip bars (outside)	…-2 	–	–	SP 37(L)-2	SP 57(L)-2 SP 67-2	–	SP 87-2
T-foot (middle)	…-3 	SP 17-3	SP 37-3	–	–	SP 57-3	–
T-foot narrow (middle)	…-4 	–	–	–	–	SP 57(L)-4	–

Subject to technical modifications.

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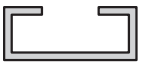
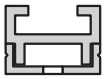
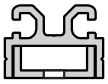
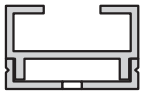
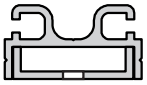
Aluminium profiles: Mounting types

Standard profile
First the aluminium profile must be mounted onto the closing edge and then the sensor profile clipped into the aluminium profile.

C 15	C 25	C 26	C 30	C 35	C 36
					

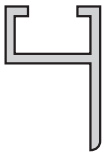
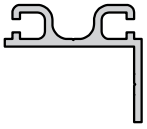
Two-part profile, type M
For convenient assembly and disassembly. The sensor profile is clipped into the upper section and the upper section inserted into the installed lower section and fastened.

–	C 25M	C 26M	C 35M	C 36M
				

Flange profile, type S
Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

–	C 25S	–	C 35S	C 36S
				

Angle profile, type L
If the closing edge should or must not have assembly holes, this "round-the-corner" solution is suitable. Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

–	C 25L	–	–	C 36L
				

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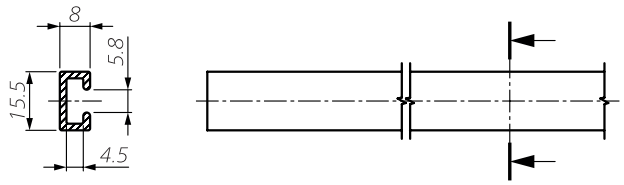
Subject to technical modifications.

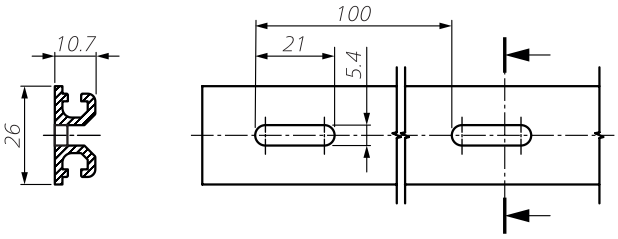
Aluminium profiles: Dimensions

Standard profile 1:2

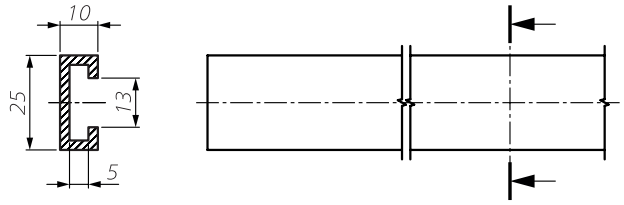
C 15



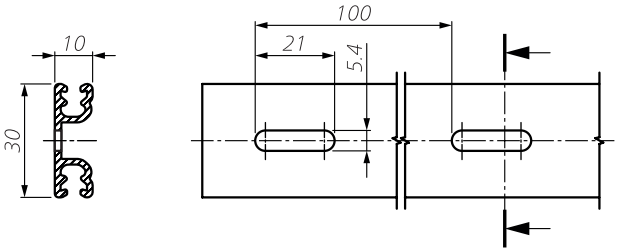
C 26



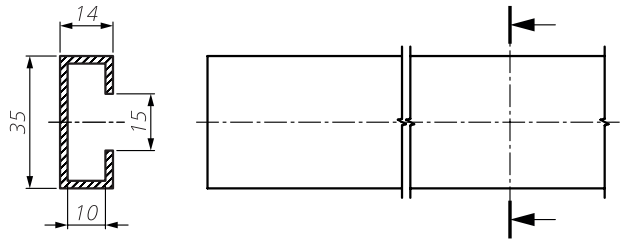
C 25



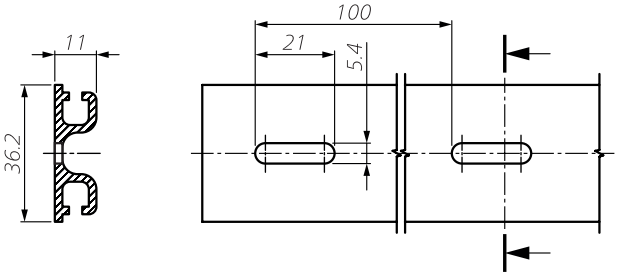
C 30



C 35

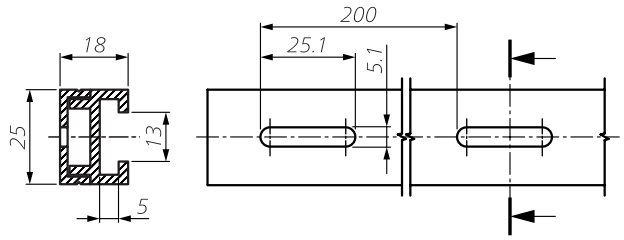


C 36

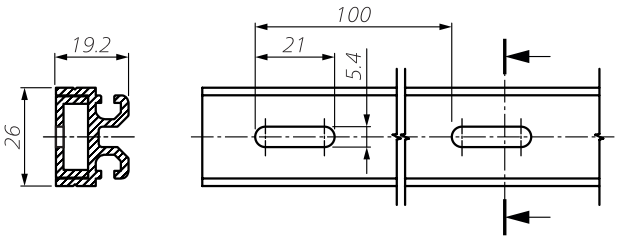


Two-part profile, type M 1:2

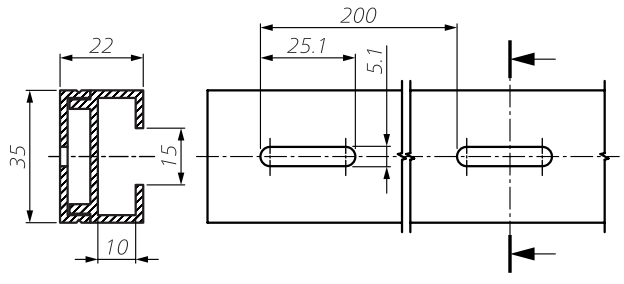
C 25M



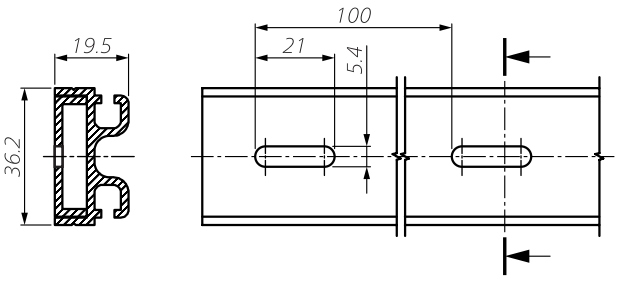
C 26M



C 35M



C 36M



Subject to technical modifications.

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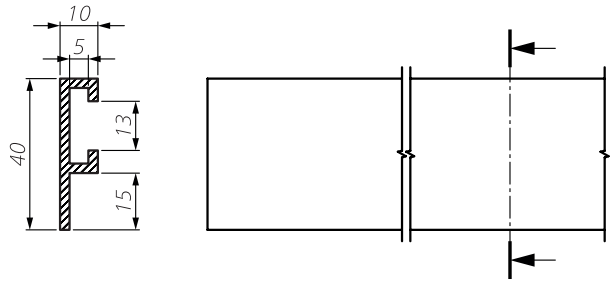
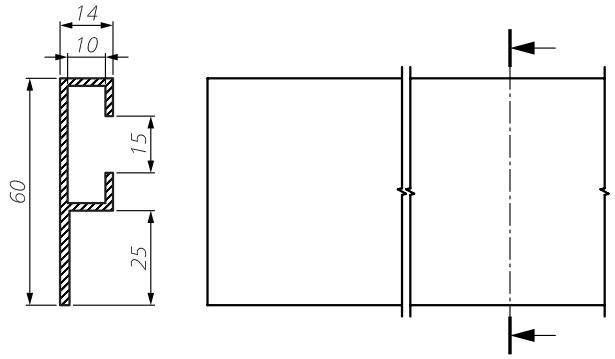
Flange profile, type S — 1:2

C 25S

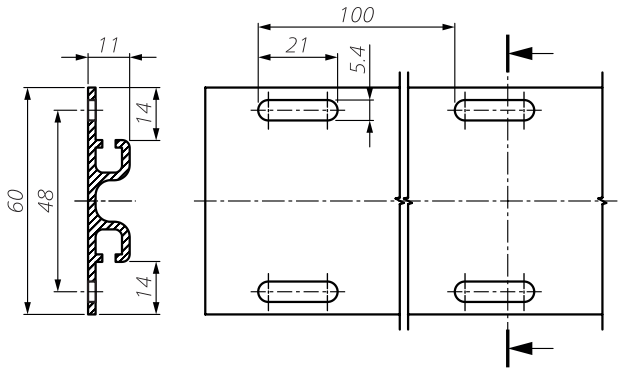


–

C 35S

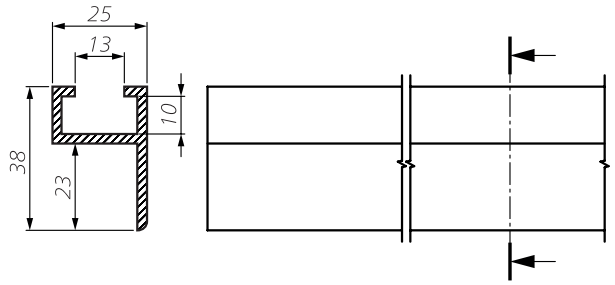


C 36S

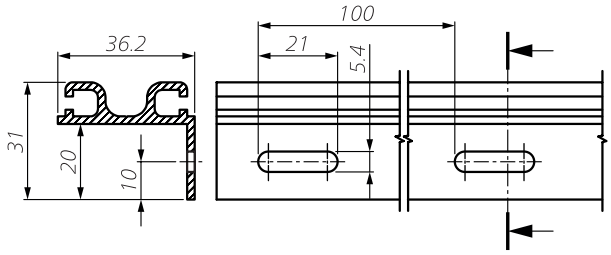


Angle profile, type L — 1:2

C 25L



C 36L



021222 v1.04-RiA

Subject to technical modifications.

SP: Making the right selection

Calculation for selection of the safety edge height

s_1 = Stopping distance of the dangerous movement [mm]
v = Velocity of the dangerous movement [mm/s]
T = Follow-through time of the complete system [s]
t_1 = Safety edge response time
t_2 = Stopping time of the machine
s = Minimum overtravel distance of the safety edge to ensure that the stipulated limit forces are not exceeded [mm]
C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected.

The stopping distance of the dangerous movement is calculated using the following formula:

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

In accordance with ISO 13856-2, the minimum overtravel distance of the safety edge is calculated using the following formula:

$s = s_1 \times C$ where: $C = 1.2$

A suitable safety edge profile can now be selected based on the result. For details of the overtravel distances for safety edge profiles, see chapter *Technical data*.

Calculation examples

Calculation example 1

The dangerous movement on your machine has a velocity of v = 10 mm/s and can be brought to a standstill within t_2 = 200 ms. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore, the sensor profile SP 37-1 TPE could be sufficient. The response time of the safety edge (SP 37-1 TPE + control unit*) is t_1 = 600 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 10$ mm/s $\times$ (0.6 s + 0.2 s)
$\mathbf{s_1 = 1/2 \times 10}$ mm/s $\times 0.8$ s **= 4.0 mm**

$s = s_1 \times C$ where: $C = 1.2$
s = 4.0 mm $\times$ 1.2 **= 4.8 mm**

The safety edge must have a minimum overtravel distance of s = 4.8 mm. The selected SP 37-1 TPE has an overtravel distance of at least 9.2 mm. This is more than the required 4.8 mm.
Result: The SP 37-1 TPE is **suitable** for this case.

021222 v1.04-RiA

Subject to technical modifications.

* Assumption: Typical reaction time of a control unit = 20 ms

Calculation example 2

The same conditions apply as in calculation example 1 with the exception of the velocity of the dangerous movement. This is now v = 200 mm/s. The response time of the safety edge (SP 37-1 TPE + control unit*) is t_1 = 55 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 200$ mm/s $\times$ (0.055 s + 0.2 s)

s_1 = 1/2 × 200 mm/s × 0.255 s = 25.5 mm

$s = s_1 \times C$ where: C = 1.2

s = 25.5 mm × 1.2 **= 30.6 mm**

The safety edge must have a minimum overtravel distance of s = 30.6 mm. The selected SP 37-1 TPE has an overtravel distance of at least 3.8 mm. This is less than the required 30.6 mm.

Result: The SP 37-1 TPE is **not suitable** for this case.

Calculation example 3

The same conditions apply as in calculation example 2. Instead of SP 37-1 EPDM, the SP 67-1 TPE is selected. The response time of the safety edge (SP 67-2 TPE + control unit*) is t_1 = 72 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 200$ mm/s $\times$ (0.072 s + 0.2 s)

s_1 = 1/2 × 200 mm/s × 0.272 s = 27.2 mm

$s = s_1 \times C$ where: C = 1.2

s = 27.2 mm × 1.2 **= 32.6 mm**

The safety edge must have a minimum overtravel distance of s = 32.6 mm. The selected SP 67-2 TPE has an overtravel distance of at least 36.5 mm. This is more than the required 32.6 mm.

Result: The SP 67-2 TPE is **suitable** for this case.

021222 v1.04-RiA

Subject to technical modifications.

* Assumption: Typical reaction time of a control unit = 20 ms

Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection

Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting.

Cleaning

If the sensors become dirty, they can be cleaned with a mild cleaning product.

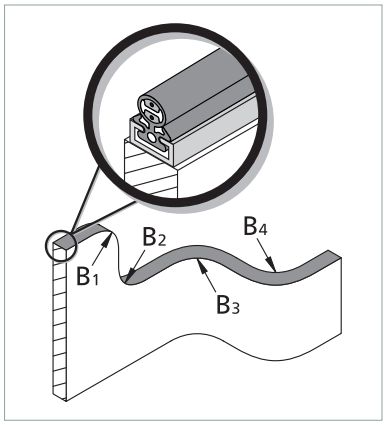
021222 v1.04-RiA

Technical data

SK SP 17-3 TPE

Sensor profile (without control unit)	**SK SP/W 17-3 TPE or SK SP/BK 17-3 TPE**
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 10 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	1.5 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 80 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	200 / 200 / 50 / 50 mm
Operating velocity	
(min. / max.)	10 mm/s / 10 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 17-3
without aluminium profile	0.12 kg/m
with aluminium profile C 15	0.28 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

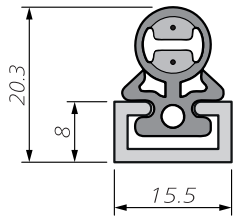
Bend radii:



021222 v1.04-RiA

Dimensions and distances

SP 17-3 TPE (1:1)



Dimensional tolerances according to ISO 3302 E2/L2

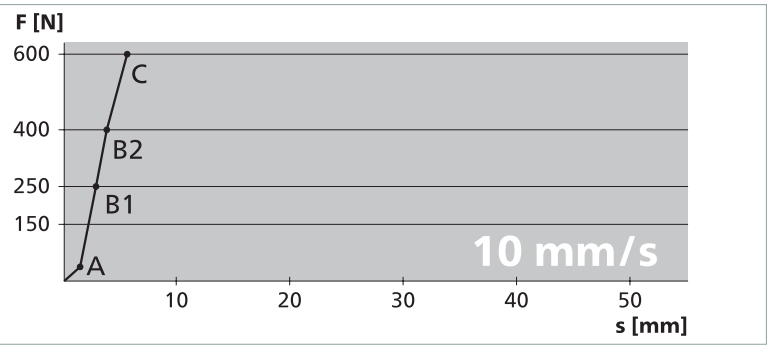
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

All the data given here has been verified by Mayser GmbH & Co. KG.

Test velocity	**10 mm/s**
Actuation force	38 N
Response time	140 ms
Actuation distance (A)	1.4 mm
Overtravel distance	
up to 250 N (B1)	1.4 mm
up to 400 N (B2)	2.3 mm
up to 600 N (C)	4.1 mm
Total deformation	5.5 mm

Force-distance ratios



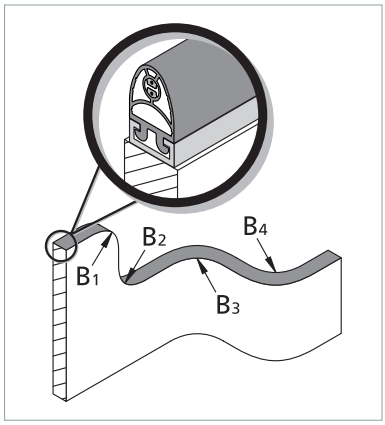
021222 v1.04-RiA

Technical data

SK SP 37-1 TPE

Sensor profile (without control unit)	SK SP/W 37-1 TPE or SK SP/BK 37-1 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 37-1
without aluminium profile	0.33 kg/m
with aluminium profile C 25	0.64 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

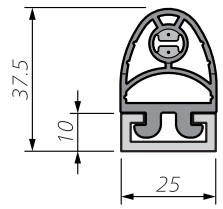
Bend radii:



021222 v1.04-RiA

Dimensions and distances

SP 37-1 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

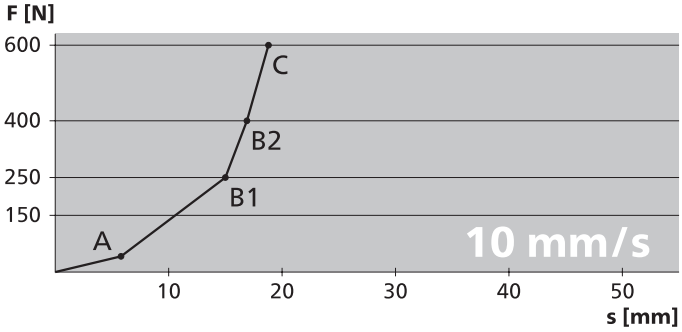
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

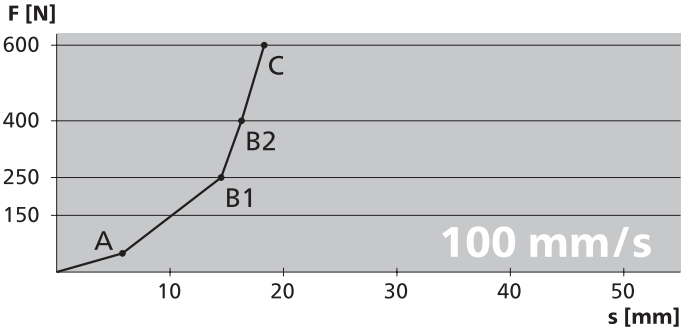
All data stated here is documented in EC type examination certificates.

Force-distance ratios

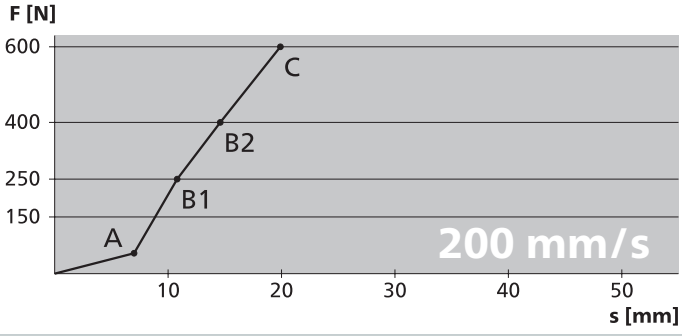
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



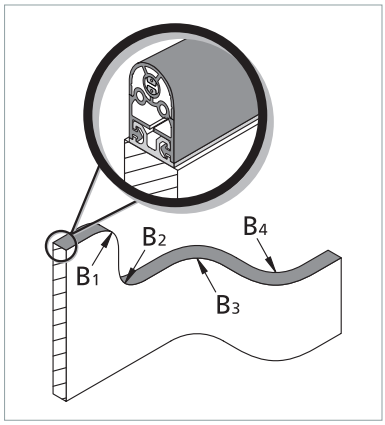
021222 v1.04-RiA

Technical data

SK SP 37(L)-2 TPE

Sensor profile (without control unit)	SK SP/W 37(L)-2 TPE or SK SP/BK 37(L)-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 37-2** **SP 37L-2**
without aluminium profile	0.36 kg/m 0.41 kg/m
with aluminium profile C 26	0.69 kg/m 0.74 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

Bend radii:



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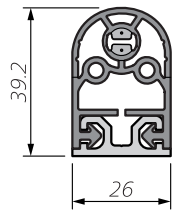
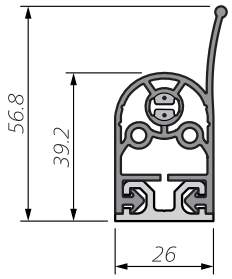
Dimensions and distances

SP 37-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 37L-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

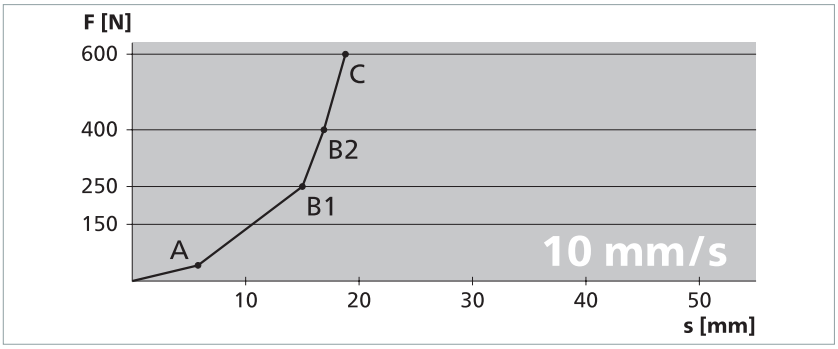
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

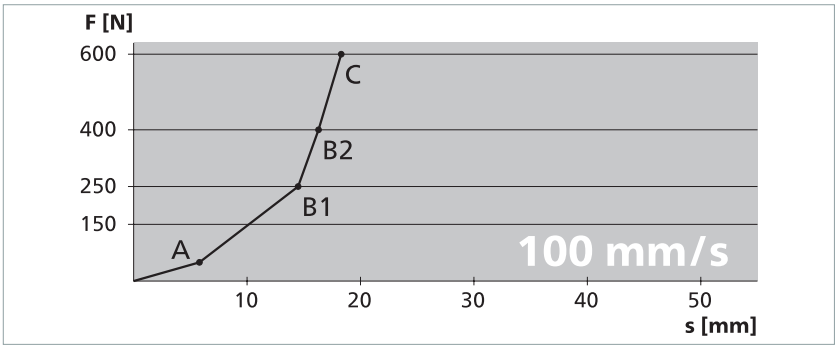
All data stated here is documented in EC type examination certificates.

Force-distance ratios

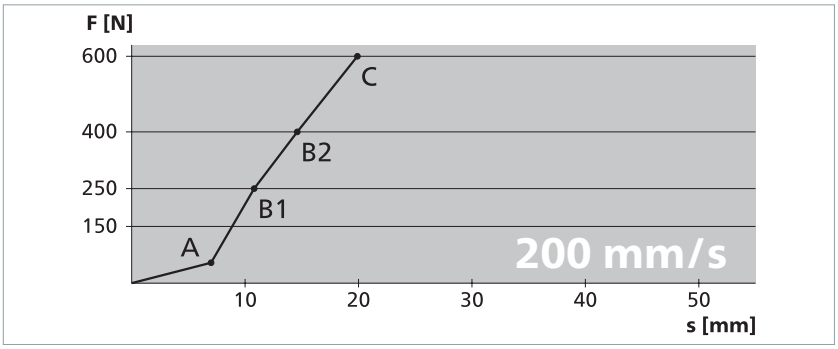
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



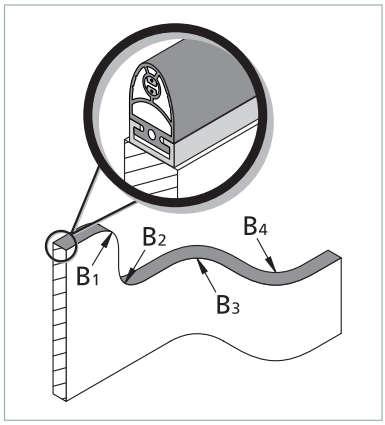
021222 v1.04-RiA

Technical data

SK SP 37-3 TPE

Sensor profile (without control unit)	SK SP/W 37-3 TPE or SK SP/BK 37-3 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±50°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	500 / 500 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 37-3
without aluminium profile	0.34 kg/m
with aluminium profile C 25	0.66 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



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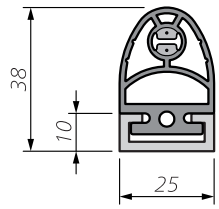
Dimensions and distances

SP 37-3 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

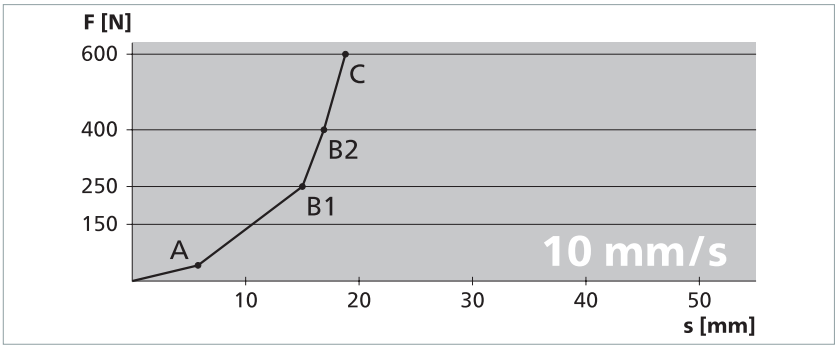
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

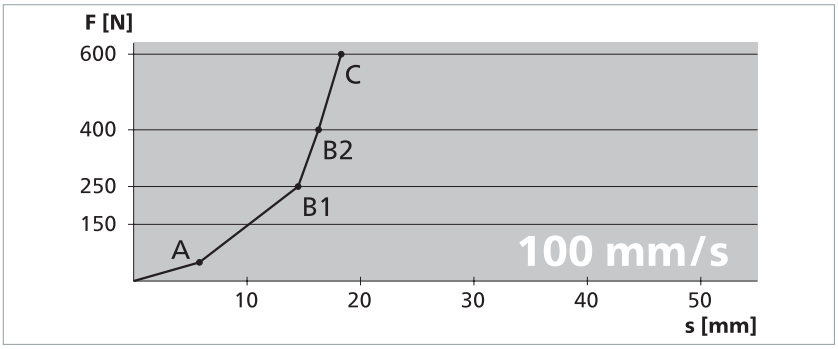
All data stated here is documented in EC type examination certificates.

Force-distance ratios

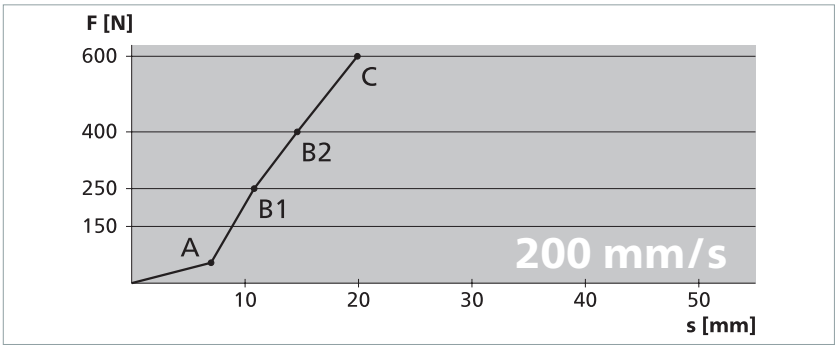
Test velocity	**10 mm/s**
Actuation force	42 N
Response time	580 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	9.2 mm
up to 400 N (B2)	11.1 mm
up to 600 N (C)	13.0 mm
Total deformation	18.8 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	58 ms
Actuation distance (A)	5.8 mm
Overtravel distance	
up to 250 N (B1)	8.7 mm
up to 400 N (B2)	10.5 mm
up to 600 N (C)	12.5 mm
Total deformation	18.3 mm



Test velocity	**200 mm/s**
Actuation force	54 N
Response time	35 ms
Actuation distance (A)	7.0 mm
Overtravel distance	
up to 250 N (B1)	3.8 mm
up to 400 N (B2)	7.6 mm
up to 600 N (C)	12.9 mm
Total deformation	19.9 mm



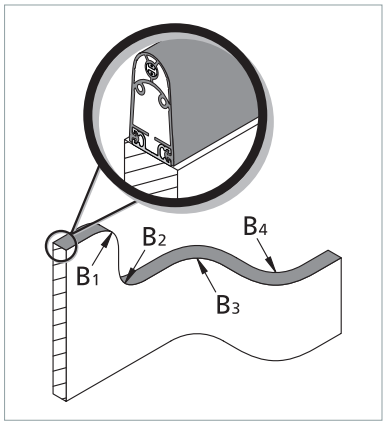
021222 v1.04-RiA

Technical data

SK SP 57(L)-2 TPE

Sensor profile (without control unit)	SK SP/W 57(L)-2 TPE or SK SP/BK 57(L)-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 57-2** **SP 57L-2**
without aluminium profile	0.44 kg/m 0.47 kg/m
with aluminium profile C 30	0.74 kg/m 0.77 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

Bend radii:



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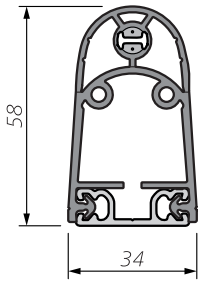
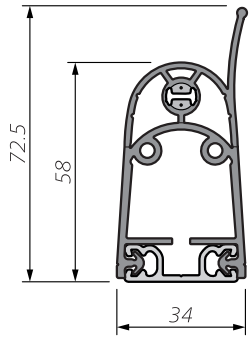
Dimensions and distances

SP 57-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 57L-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

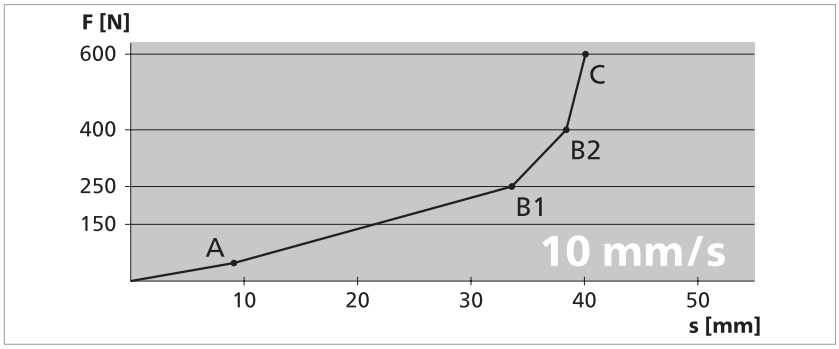
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

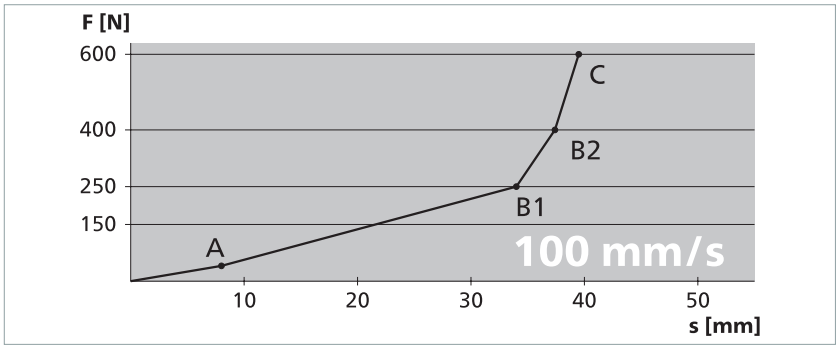
All data stated here is documented in EC type examination certificates.

Force-distance ratios

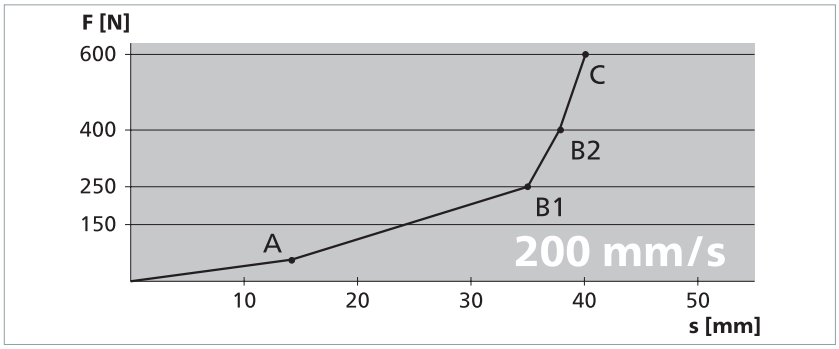
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



021222 v1.04-RiA

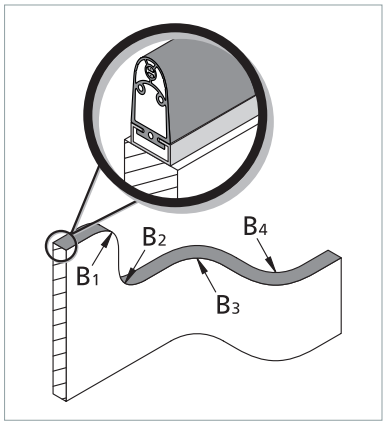
MAYSER®

Technical data

SK SP 57-3 TPE

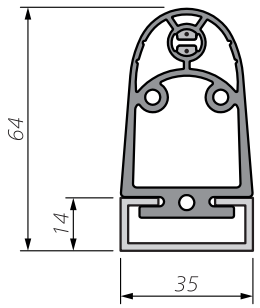
Sensor profile (without control unit)	SK SP/W 57-3 TPE or SK SP/BK 57-3 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 57-3
without aluminium profile	0.60 kg/m
with aluminium profile C 35	1.00 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



Dimensions and distances

SP 57-3 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

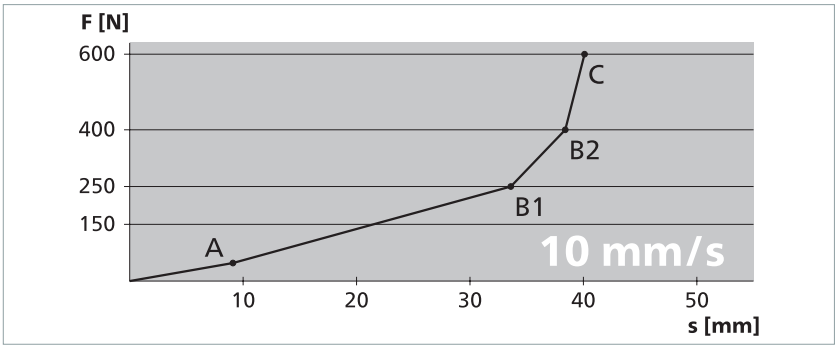
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

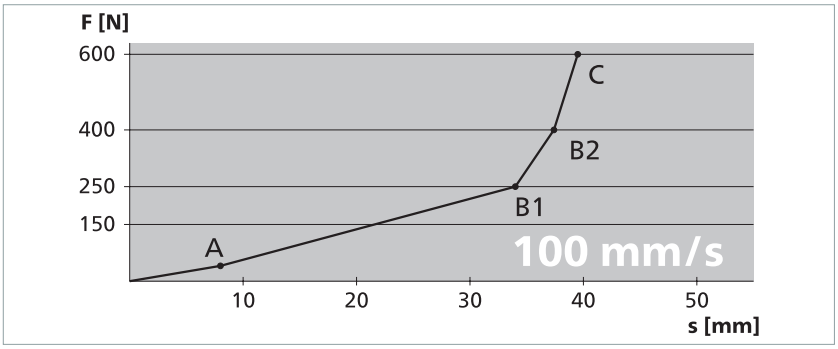
All data stated here is documented in EC type examination certificates.

Force-distance ratios

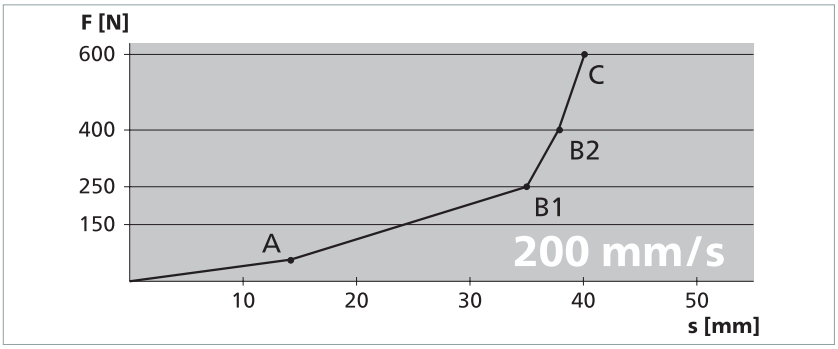
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



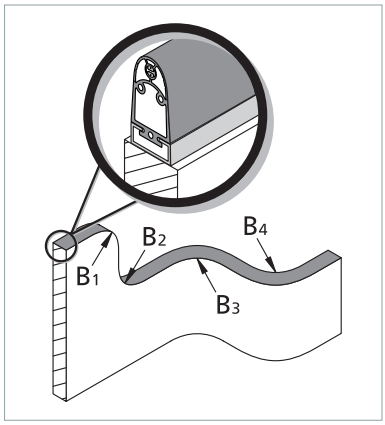
021222 v1.04-RiA

Technical data

SK SP 57(L)-4 TPE

Sensor profile (without control unit)	SK SP/W 57(L)-4 TPE or SK SP/BK 57(L)-4 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	**SP 57-4** **SP 57L-4**
without aluminium profile	0.58 kg/m 0.62 kg/m
with aluminium profile C 35	0.99 kg/m 1.03 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²

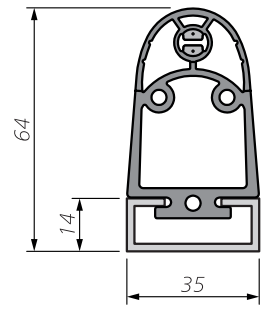
Bend radii:



021222 v1.04-RiA

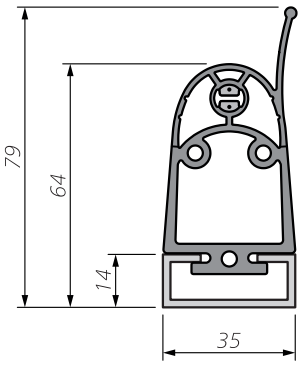
Dimensions and distances

SP 57-4 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

SP 57L-4 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

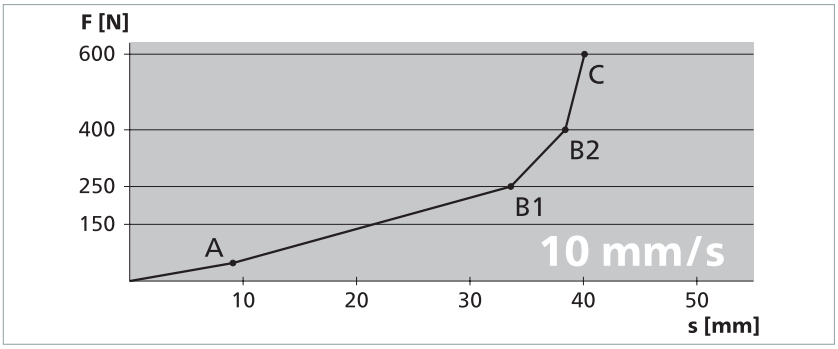
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit
- Lip not taken into account

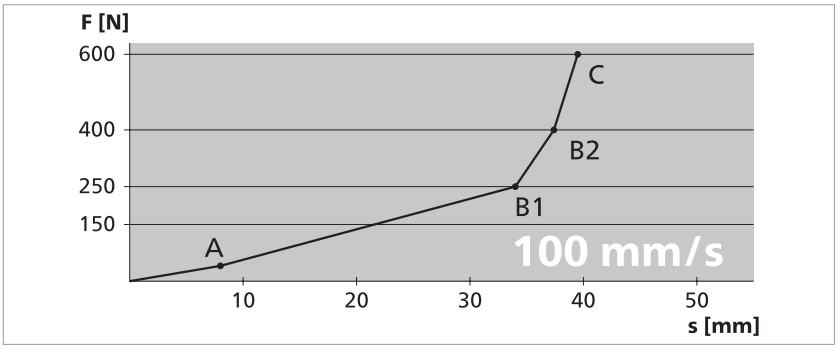
All data stated here is documented in EC type examination certificates.

Force-distance ratios

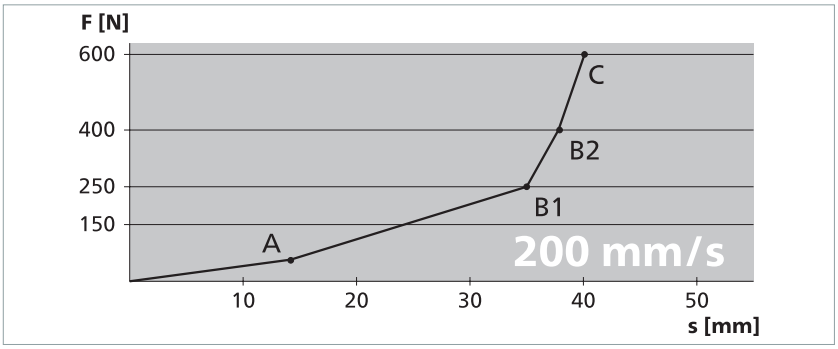
Test velocity	**10 mm/s**
Actuation force	48 N
Response time	910 ms
Actuation distance (A)	9.1 mm
Overtravel distance	
up to 250 N (B1)	24.5 mm
up to 400 N (B2)	29.3 mm
up to 600 N (C)	31.0 mm
Total deformation	40.1 mm



Test velocity	**100 mm/s**
Actuation force	41 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
up to 250 N (B1)	26.0 mm
up to 400 N (B2)	29.4 mm
up to 600 N (C)	31.5 mm
Total deformation	39.5 mm



Test velocity	**200 mm/s**
Actuation force	58 N
Response time	71 ms
Actuation distance (A)	14.2 mm
Overtravel distance	
up to 250 N (B1)	20.8 mm
up to 400 N (B2)	23.7 mm
up to 600 N (C)	25.9 mm
Total deformation	40.1 mm



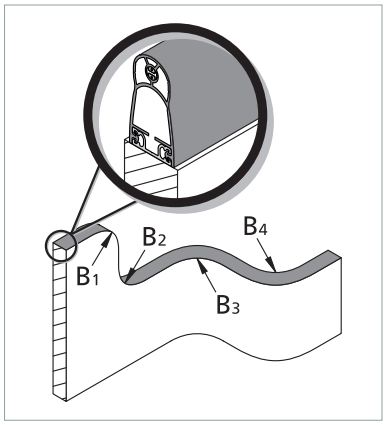
021222 v1.04-RiA

Technical data

SK SP 67-2 TPE

Sensor profile (without control unit)	SK SP/W 67-2 TPE or SK SP/BK 67-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	11 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	± 45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 30 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 67-2
without aluminium profile	0.49 kg/m
with aluminium profile C 30	0.79 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



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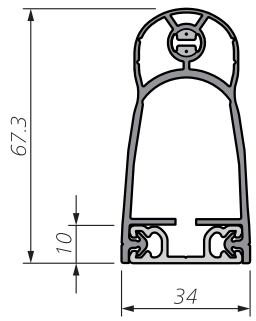
Dimensions and distances

SP 67-2 TPE (1:2)



Dimensional tolerances according to ISO 3302 E2/L2

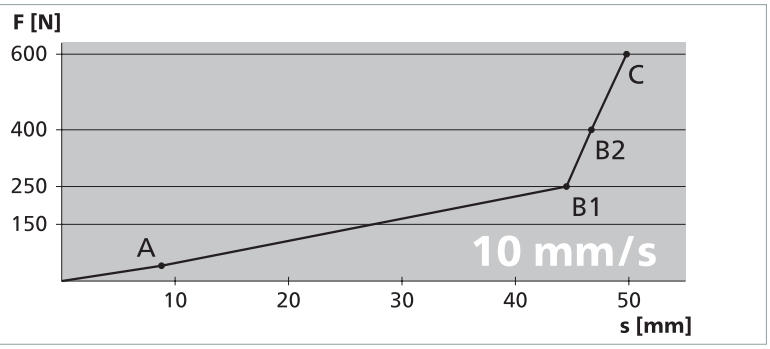
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

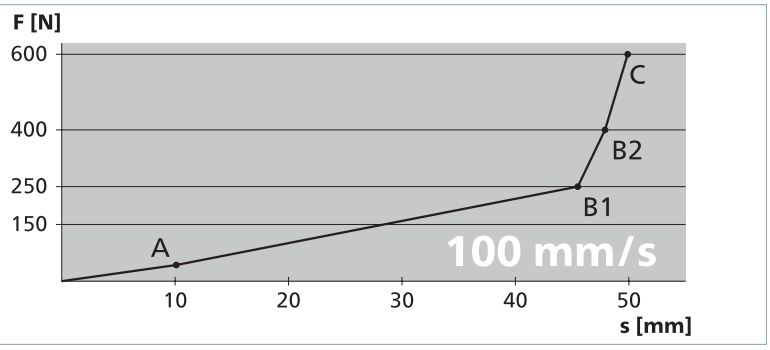
All data stated here is documented in EC type examination certificates.

Force-distance ratios

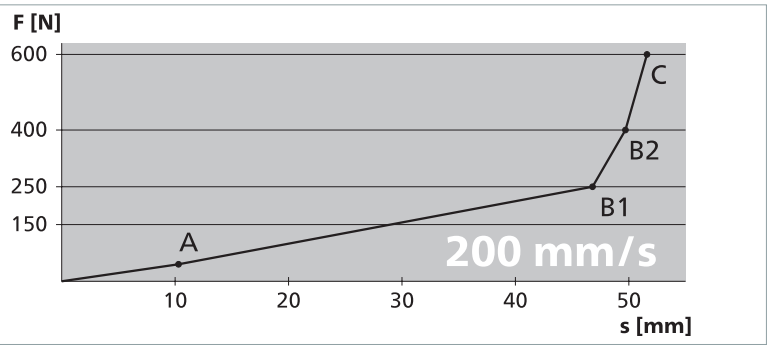
Test velocity	**10 mm/s**
Actuation force	41 N
Response time	880 ms
Actuation distance (A)	8.8 mm
Overtravel distance	
up to 250 N (B1)	35.7 mm
up to 400 N (B2)	37.9 mm
up to 600 N (C)	41 mm
Total deformation	49.8 mm



Test velocity	**100 mm/s**
Actuation force	43 N
Response time	101 ms
Actuation distance (A)	10.1 mm
Overtravel distance	
up to 250 N (B1)	35.4 mm
up to 400 N (B2)	37.8 mm
up to 600 N (C)	39.8 mm
Total deformation	49.9 mm



Test velocity	**200 mm/s**
Actuation force	45 N
Response time	51.5 ms
Actuation distance (A)	10.3 mm
Overtravel distance	
up to 250 N (B1)	36.5 mm
up to 400 N (B2)	39.4 mm
up to 600 N (C)	41.3 mm
Total deformation	51.6 mm



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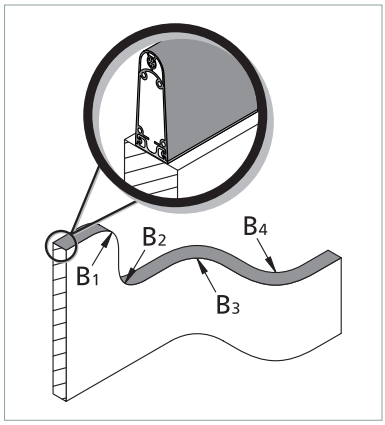
Technical data

SK SP 87-2 TPE

Sensor profile (without control unit)	SK SP/W 87-2 TPE or SK SP/BK 87-2 TPE
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (rod) Ø 20 mm	< 50 N
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	9 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	± 45°
Finger detection	Yes
Safety classifications	
ISO 13849-1: B_{10D}	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	10 cm / 25 m
Cable length (min./max.)	10 cm / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	1000 / 1000 / 200 / 200 mm
Operating velocity	
(min. / max.)	10 mm/s / 200 mm/s
Max. load capacity (impulse)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: Degree of protection	IP67
SP in water: 9 cm bottom edge	IPX8: 13 days
Operating temperature	–25 to +55 °C
short-term (15 min)	–40 to +80 °C
Storage temperature	–40 to +80 °C
Weight	SP 87-2
without aluminium profile	0.64 kg/m
with aluminium profile C 36	1.06 kg/m
Electrical operating conditions	
Terminal resistance	8k2 ±1%
Nominal output (max.)	250 mW
Contact transition resistance	< 400 ohms (per sensor)
Number of BK-type sensors	Max. 5 in series
Switching voltage (max.)	DC 24 V
Switching current (min./max.)	1 mA / 10 mA
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2

Bend radii:



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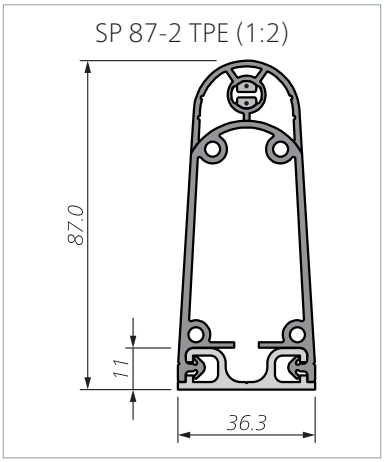
Dimensions and distances



Dimensional tolerances according to ISO 3302 E2/L2

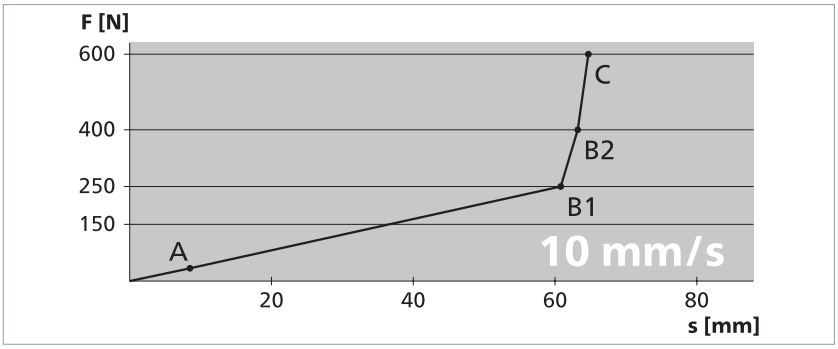
Test conditions according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

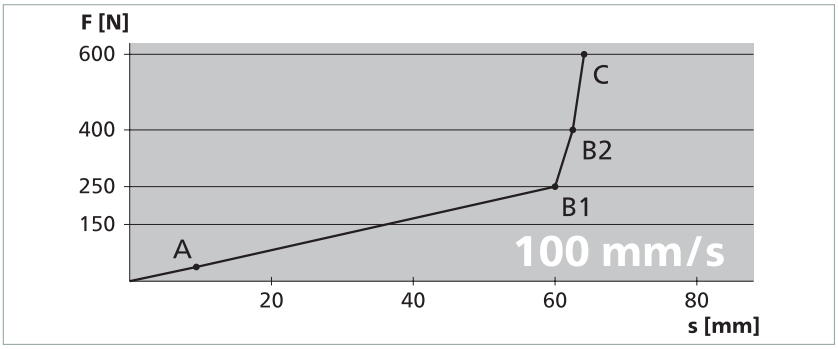
All data stated here is documented in EC type examination certificates.

Force-distance ratios

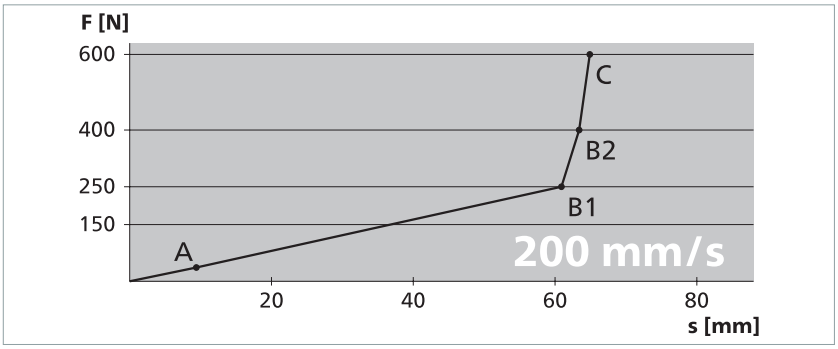
Test velocity	**10 mm/s**
Actuation force	34 N
Response time	850 ms
Actuation distance (A)	8.5 mm
Overtravel distance	
up to 250 N (B1)	52.3 mm
up to 400 N (B2)	54.7 mm
up to 600 N (C)	56.2 mm
Total deformation	64.7 mm



Test velocity	**100 mm/s**
Actuation force	38 N
Response time	81 ms
Actuation distance (A)	8.1 mm
Overtravel distance	
up to 250 N (B1)	51.9 mm
up to 400 N (B2)	54.4 mm
up to 600 N (C)	56.0 mm
Total deformation	64.1 mm



Test velocity	**200 mm/s**
Actuation force	37 N
Response time	47 ms
Actuation distance (A)	9.4 mm
Overtravel distance	
up to 250 N (B1)	51.5 mm
up to 400 N (B2)	54.0 mm
up to 600 N (C)	55.5 mm
Total deformation	64.9 mm



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Marking

If you combine sensors with control units and thereby place pressure-sensitive protection devices on the market, you should observe the basic requirements according to ISO 13856.
As well as meeting technical requirements, this also means – in particular – observing any that relate to marking and information for use.

Conformity

EC type examination

The product has been tested by an independent institute.
There is an EC type examination certificate to confirm conformity.
The EC type examination certificate is stored in the Downloads section of our website: www.mayser.com.

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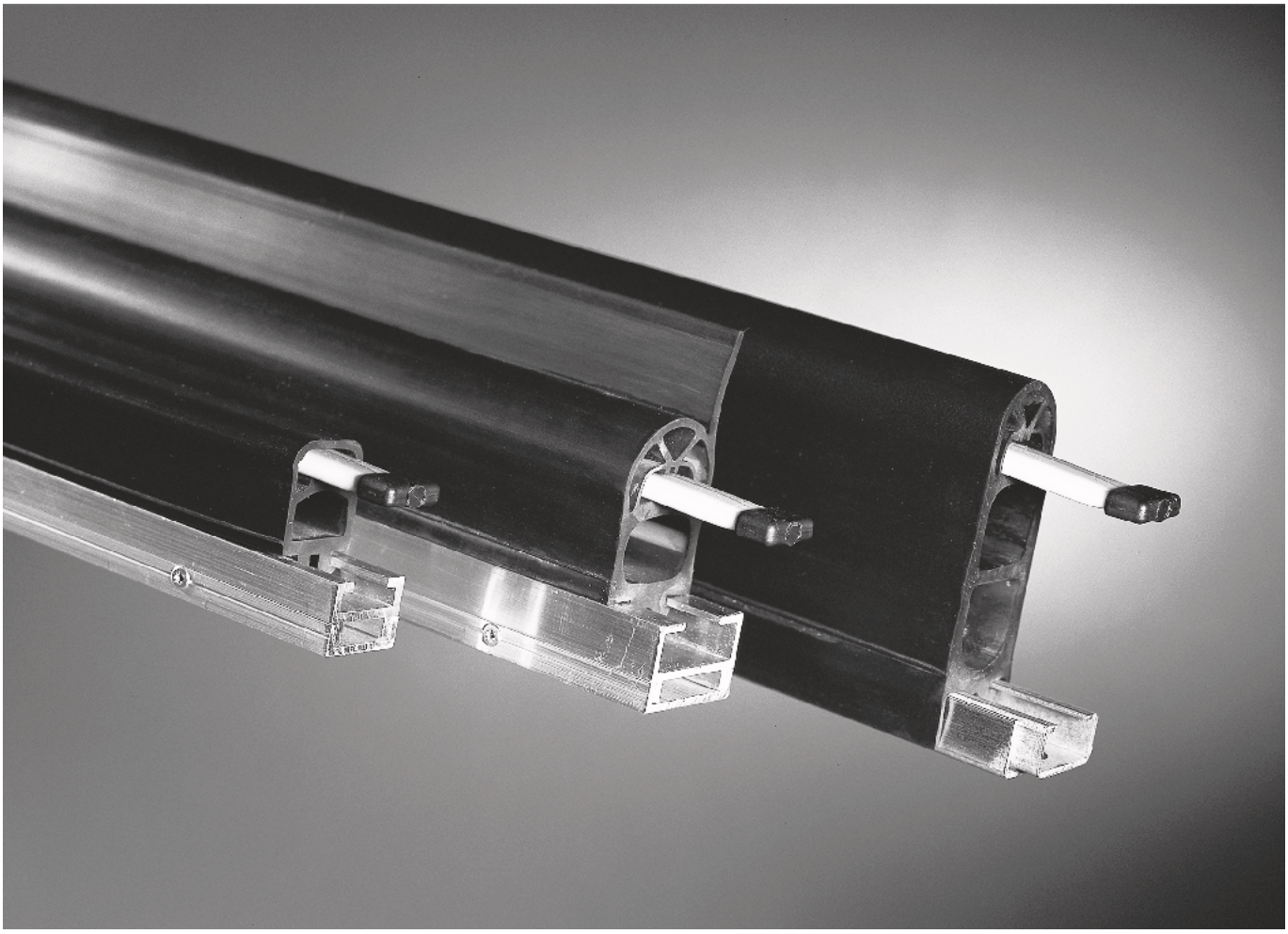

Safety edges SL

EN | Product information

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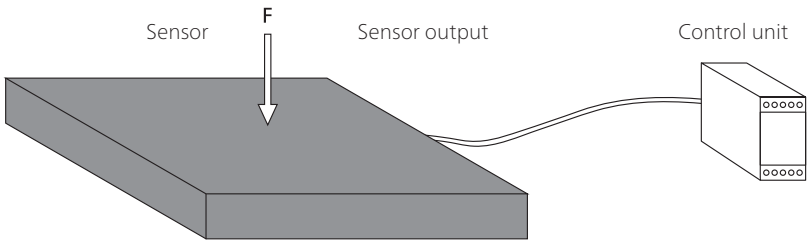
Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

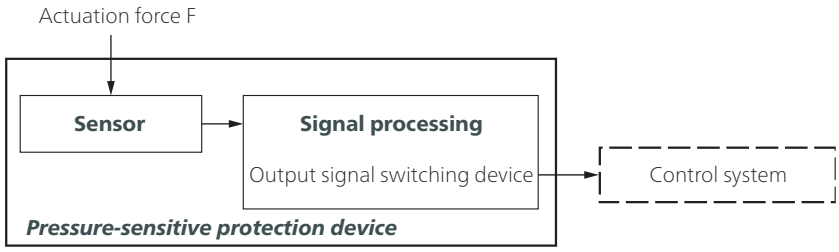


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuation area is deformed locally.

Signal processing

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the forwarding control system and which transmits safety output signals such as STOP.



Tip: Terms are defined in ISO 13856-2 Section 3.

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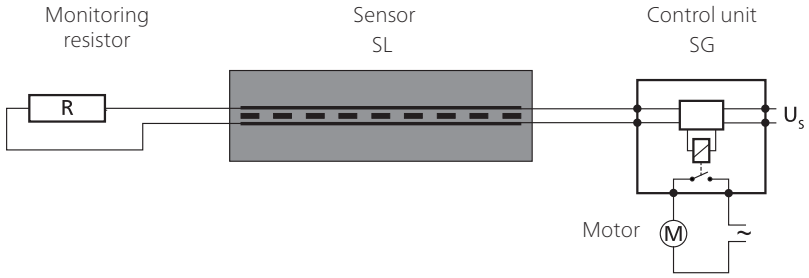
Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP67 is standard for safety edges.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…
- Finger detection necessary?

Tip: For further sensor selection criteria, see ISO 13856-2 Annex C and Annex E.

Operation principle of 2-wire technology



The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

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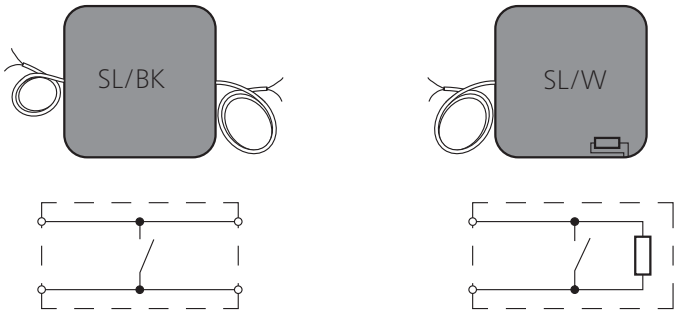
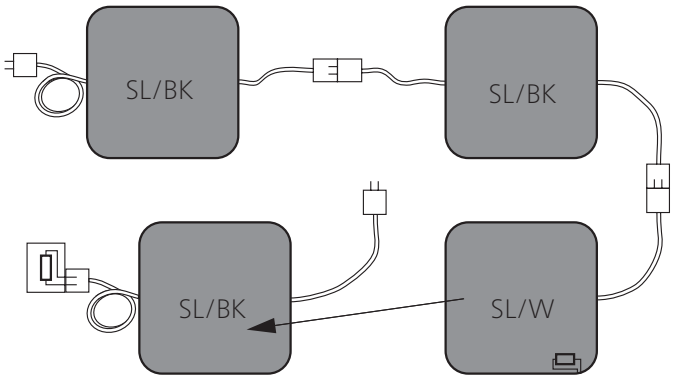
Types

SL/BK — With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor

SL/W — With an integrated monitoring resistor for use as an end sensor



Sensor combination



Version with external resistor, therefore no variety of models

Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edges can be combined to achieve custom lengths and angles

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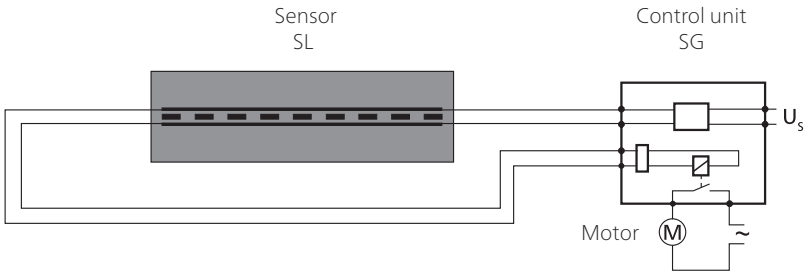
Subject to technical modifications.

Operation principle of 4-wire technology



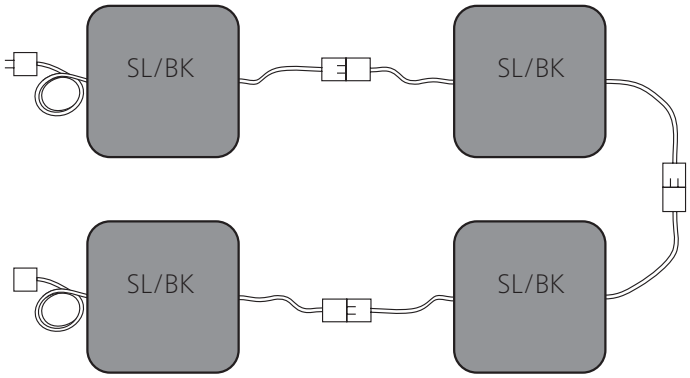
The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

SL/BK With cables on both sides for use as a through sensor

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edges can be combined to achieve custom lengths and angles

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Subject to technical modifications.

Safety

Intended use

A safety edge detects a person or part of the body when pressure is applied to the effective actuation area. It is a linear tripping device. Its purpose is to prevent possible hazardous situations that could affect someone within a danger zone, such as shearing and pinching edges. Typical areas of application are door and gate systems, and moving parts on machines, platforms and lifting devices.
Safe operation of a safety edge depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

For additional application guidance, please refer to ISO 13856-2 Annex E.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 10 /BK-type sensors can be connected to one control unit.
- No more than 9 /BK-type sensors and 1 /W-type sensor can be connected to one control unit.

Exclusions

The sensors are not suitable for:

- Detecting fingers.
- Performing a sealing function. Constant actuation of sensors can result in permanent damage.
  Exception: The L version with an attached lip seal.
  The lip seal can be in full contact with the closing edge, which allows it to repel wind and water.

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Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

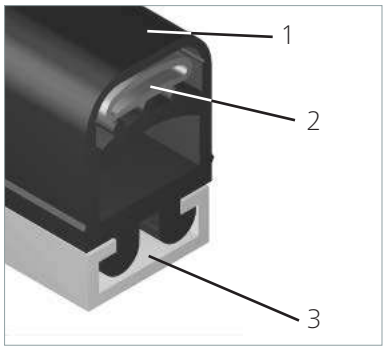
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts in the case of pressure-sensitive protection devices according to ISO 13856. In this case, the diagnostic coverage (DC) is not calculated or taken into account when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety edge system (pressure-sensitive protection device) as a whole.

Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard.
After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design



The safety edge SL consists of a sensor (1 to 3) –
(1) rubber profile GP,
(2) switch element,
(3) aluminium profile –
and an evaluating control unit SG.

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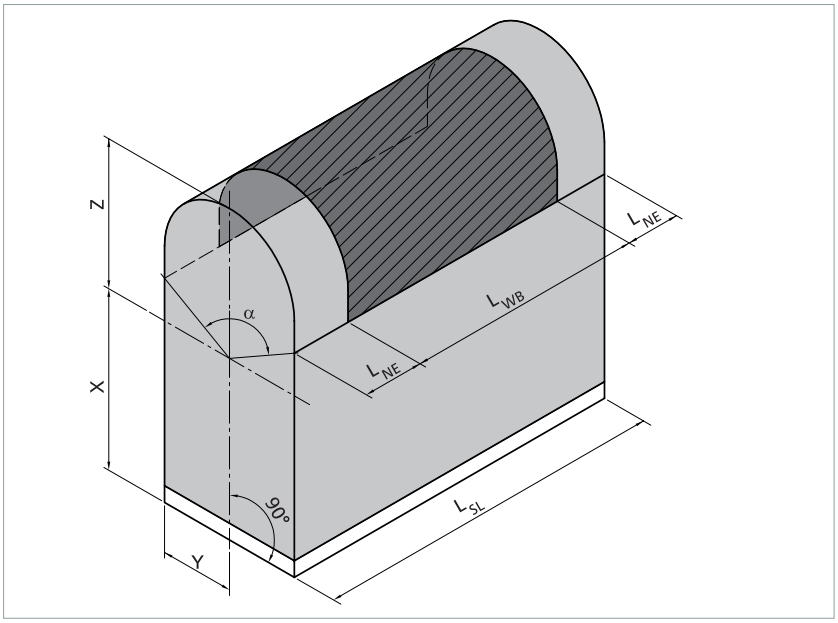
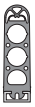
Effective actuation area

The parameters X, Y, Z, L_{WB} and the angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$$L_{WB} = L_{SL} - 2 \times L_{NE}$$

Parameters:
L_{WB} = effective actuation length
L_{SL} = overall length of safety edge
L_{NE} = non-sensitive length at the end of the safety edge
α = effective actuation angle



	GP 15-1	GP 22-1	GP 39-1	GP 39L-1	GP 50(L)-1	GP 60-1	GP 120-1
							
Aluminium profile	C 15	C 25	C 25	C 25	C 35	C 35	C 35
α	70°	70°	110°	120°	90°	110°	120°
L_{NE}	35 mm	35 mm	35 mm	35 mm	35 mm	35 mm	35 mm
Y	9.5 mm	12.5 mm	13 mm	14.5 mm	17.5 mm	18 mm	18 mm
X	14 mm	15 mm	33 mm	33 mm	40.5 mm	54.5 mm	110 mm
Z	7 mm	9 mm	7 mm	7 mm	21.5 mm	21.5 mm	19 mm
X + Z	21 mm	24 mm	40 mm	40 mm	62 mm	76 mm	129 mm

At 70°, the effective actuation angle α of GP 15-1 and GP 22-1 falls below the requirements of ISO 13856-2 and EN 12978.

Installation position

The installation position can be selected as required, i.e. all installation positions from A to D as per ISO 13856-2 are possible.

Subject to technical modifications.

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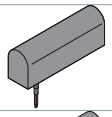
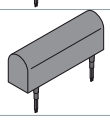
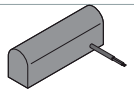
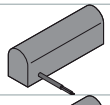
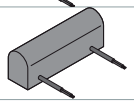
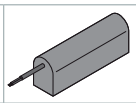
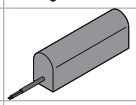
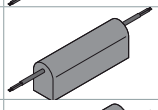
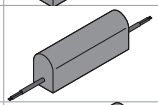
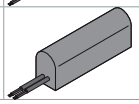
Connection

Cable exits

- With cable sleeves in some cases
- L-type (L) rubber profiles: the rubber lip is always located on the left-hand side when the product is viewed from the end
- Other designs (e.g. shorter non-sensitive ends) available on request

Cable exit (CE)		SL GP					
		15-1	22-1	39 (L)-1	50 (L)-1	60-1	120-1
At the bottom Distance betw. CE & end = 25 mm in each case; versions with cable sleeves							
Version 11: SL/W				●	●	●	●
Version 5: SL/BK				●	●	●	●
At the side Distance betw. CE & end = 25 mm in each case; versions without cable sleeves							
Version 12: SL/W				●	●	●	
Version 13: SL/W				●	●	●	
Version 14: SL/BK				●	●	●	
Axial exit at end Versions without cable sleeves							
Version 9: SL/W		●	●	●	●	●	●
Version 10: SL/W				●	●	●	●
Version 1: SL/BK		●	●	●	●	●	●
Version 3: SL/BK				●	●	●	●
Version 4: SL/BK				●	●	●	●

● = available

Subject to technical modifications.

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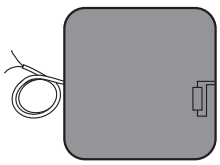
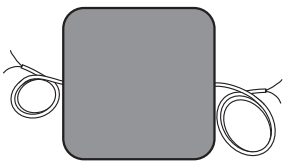
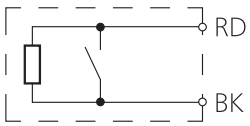
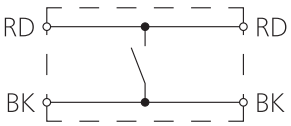
Cable connection

- Standard cable lengths
  L = 2.0 m / 5.0 m / 10 m
- Maximum total cable length to the control unit
  L_{max} = 100 m
- Cable ends: stripped wires
  Option: Cable ends available with plug and coupling

/W-type sensor with 1 line	/BK-type sensor with 2 lines
• As an individual /W-type sensor or a /W-type end sensor • Integrated resistor • Two-wire cables	• As a /BK-type through sensor • Without resistor • 2 two-wire cables
	

Wire colours

/W-type sensor with 1 line	/BK-type sensor with 2 lines
	

Colour coding

BK	Black
RD	Red

Connection examples

Key:

SG 2W	Evaluation with 2-wire technology
SG 4L	Evaluation with 4-wire technology

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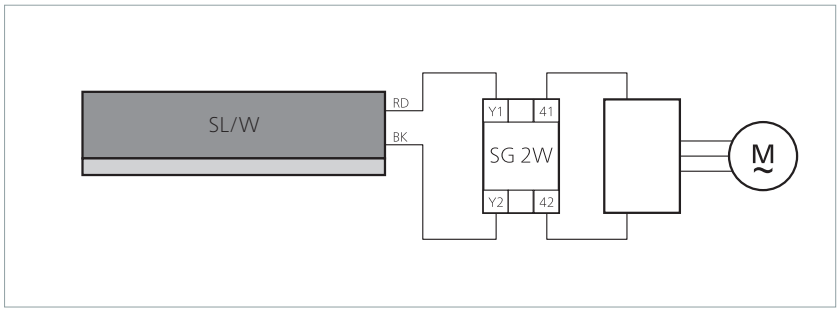
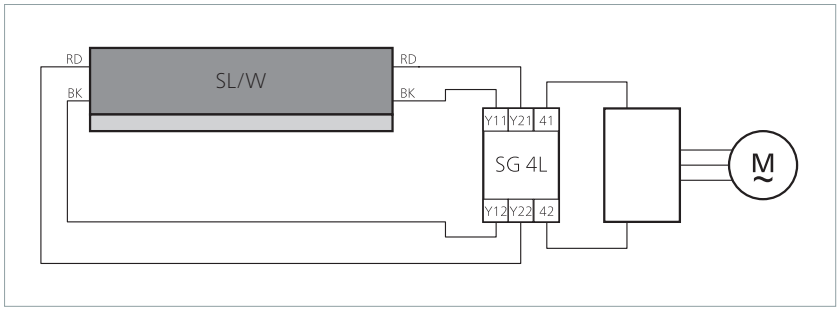
Subject to technical modifications.





Sensor surface

Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having an undamaged surface.

Physical resistance

Rubber profile GP	EPDM	NBR	CR
UV resistance	Yes	Yes	Yes

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

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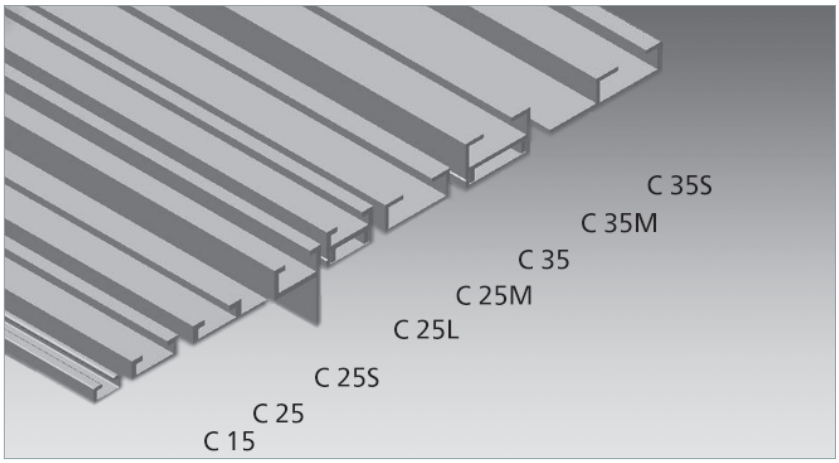
Subject to technical modifications.

Explanation of symbols:
+ = resistant
± = resistant to a certain extent
– = not resistant

Chemical resistance	EPDM	NBR	CR
Acetone	+	±	+
Formic acid	+	+	+
Ammonia	+	+	+
Petrol	–	+	+
Brake fluid	±	±	±
Chloride solutions	+	+	+
Diesel oil	–	+	+
Greases	–	+	+
Household/sanitary cleaners	+	+	+
Isopropanol	+	+	+
Cooling lubricant	–	+	+
Metal working oil	–	+	+
Methanol	+	+	±
Oils	–	+	+
Ozone and weather conditions	+	–	+
Hydrochloric acid 10%	+	+	+
Ethyl alcohol (ethanol)	+	+	+
Carbon tetrachloride	–	+	+
Water and frost	+	–	+
Hydrogen peroxide 10%	+	+	–

Mounting

The sensors are mounted directly onto the main and secondary closing edges that present a danger. They are fixed using special aluminium profiles. The profiles are fastened with screws or rivets.



Material properties

- AlMgSi0.5 F22
- Wall thickness:
  at least 2.0 mm
  C 15: at least 1.7 mm
- Extruded
- Hot hardened
- Tolerances as per EN 755-9

Subject to technical modifications.

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Aluminium profiles:

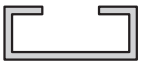
Overview of combinations

Sensor profile foot		C 15	C 25 C 25M C 25S C 25L	C 25 C 25M C 25S C 25L	C 35 C 35M C 35S	C 35 C 35M C 35S	C 35 C 35M C 35S
Snap-in foot (middle)	...-1 	GP 15-1	GP 22-1	GP 39(L)-1	GP 50(L)-1	GP 60-1	GP 120-1

Aluminium profiles: Mounting types

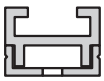
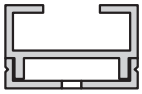
Standard profile

First the aluminium profile must be mounted onto the closing edge and then the sensor profile clipped into the aluminium profile.

C 15	C 25	C 35
		

Two-part profile, type M

For convenient assembly and disassembly. The sensor profile is clipped into the upper section and the upper section inserted into the installed lower section and fastened.

C 25M	C 35M
	

Flange profile, type S

Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

C 25S	C 35S
	

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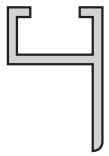
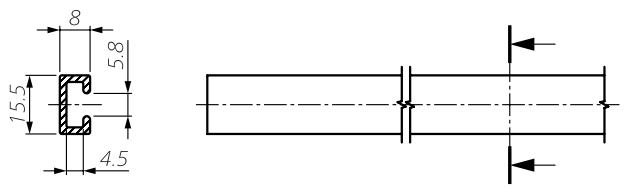
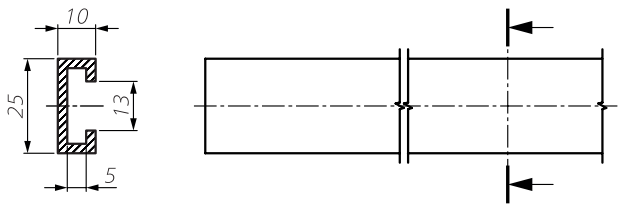
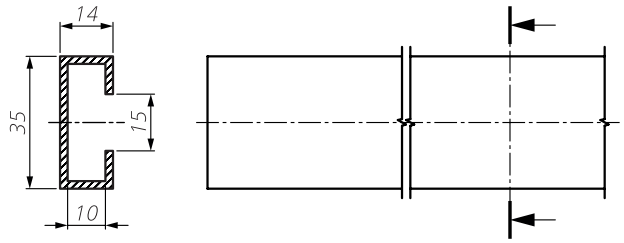
Subject to technical modifications.

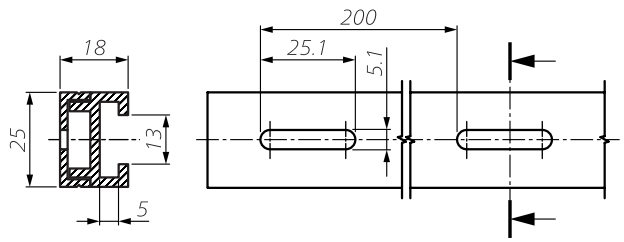
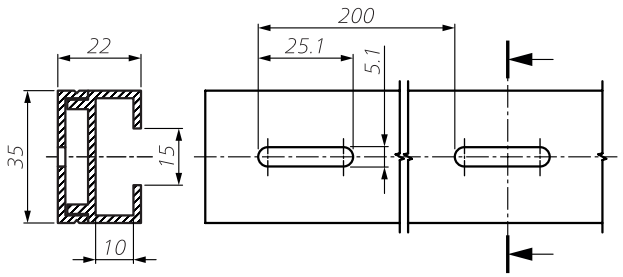
Angle profile, type L

If the closing edge should not or must not have assembly holes, this "round-the-corner" solution is suitable. Final assembly is also possible when the sensor profile is already clipped into the aluminium profile.

C 25L


Aluminium profiles: Dimensions

Standard profile	1:2
C 15	C 25
	
C 35	–
	

Two-part profile, type M	1:2
C 25M	C 35M
	

Subject to technical modifications.

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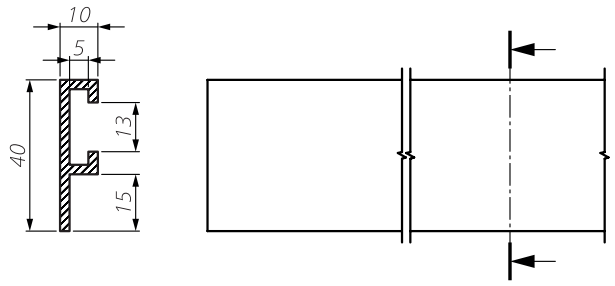
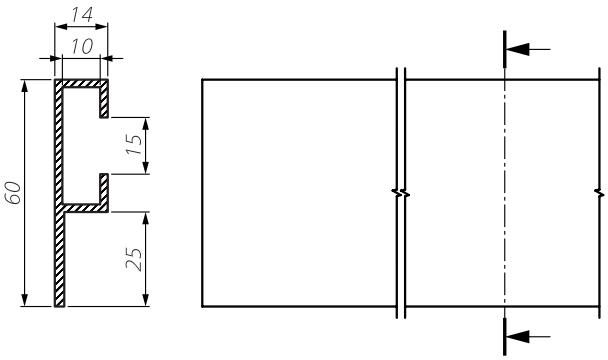
Flange profile, type S 1:2

C 25S

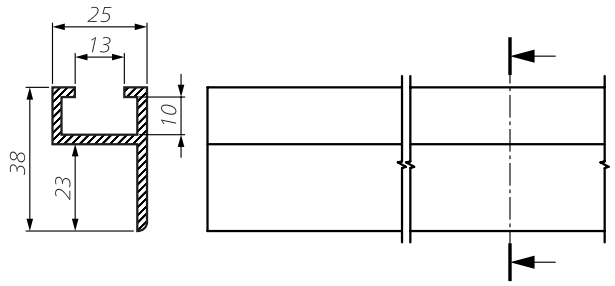


C 35S



Angle profile, type L 1:2

C 25L



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Subject to technical modifications.

SL: Making the right selection

Calculation for selection of the safety edge height

s_1 = Stopping distance of the dangerous movement [mm]
v = Velocity of the dangerous movement [mm/s]
T = Follow-through time of the complete system [s]
t_1 = Safety edge response time
t_2 = Stopping time of the machine
s = Minimum overtravel distance of the safety edge to ensure that the stipulated limit forces are not exceeded [mm]
C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected.

The stopping distance of the dangerous movement is calculated using the following formula:

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

In accordance with ISO 13856-2, the minimum overtravel distance of the safety edge is calculated using the following formula:

$s = s_1 \times C$ where: $C = 1.2$

A suitable safety edge profile can now be selected based on the result. For details of the overtravel distances for safety edge profiles, see chapter *Technical data*.

Calculation examples

Calculation example 1
The dangerous movement on your machine has a velocity of v = 10 mm/s and can be brought to a standstill within t_2 = 190 ms. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore, the normally closed safety edge SL GP 39-1 EPDM might be sufficient. The response time of the safety edge is t_1 = 435 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 10$ mm/s $\times$ (435 ms + 190 ms)
$\mathbf{s_1} = 1/2 \times 10$ mm/s $\times$ 0.625 s = **3.1 mm**

$s = s_1 \times C$ where: $C = 1.2$
s = 3.1 mm $\times$ 1.2 = **3.8 mm**

The safety edge must have a minimum overtravel distance of s = 3.8 mm. The selected SL GP 39-1 EPDM has an overtravel distance of at least 10.9 mm. This is more than the required 3.8 mm.
Result: The SL GP 39-1 EPDM is **suitable** for this case.

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Calculation example 2

The same conditions apply as in calculation example 1 with the exception of the velocity of the dangerous movement. This is now v = 100 mm/s. As a result, the response time of the safety edge is reduced to t_1 = 59 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 100$ mm/s $\times$ (59 ms + 190 ms)

$\mathbf{s_1} = 1/2 \times 100$ mm/s $\times$ 0.249 s = **12.5 mm**

$s = s_1 \times C$ where: C = 1.2

s = 12.5 mm $\times$ 1.2 = **15.0 mm**

The safety edge must have a minimum overtravel distance of s = 15.0 mm. The selected SL GP 39-1 EPDM has an overtravel distance of at least 7.7 mm. This is less than the required 15.0 mm.

Result: The SL GP 39-1 EPDM is **not suitable** for this case.

Calculation example 3

The same conditions as in calculation example 2. Instead of the SL GP 39-1 EPDM, the SL GP 120-1 EPDM is selected. The response time of the safety edge is t_1 = 95 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 100$ mm/s $\times$ (95 ms + 190 ms)

$\mathbf{s_1} = 1/2 \times 100$ mm/s $\times$ 0.285 s **= 14.3 mm**

$s = s_1 \times C$ where: C = 1.2

s = 14.3 mm $\times$ 1.2 = **17.2 mm**

The safety edge must have a minimum overtravel distance of s = 17.2 mm. With a velocity of 100 mm/s, the selected SL GP 120-1 EPDM has an overtravel distance of at least 17.7 mm. This is more than the required 17.2 mm.

Result: The SL GP 120-1 EPDM is **suitable** for this case.

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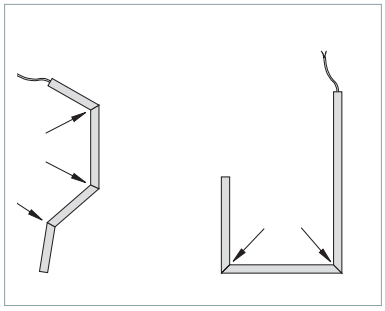
Customised designs

In addition to the standard range, special solutions are also possible, such as:

- Safety edges with sensitive ends
- Resistance to high temperatures:
  short-term (< 15 min) up to +80 °C
  long-term up to +55 °C
  with degree of protection: IP50
- Resistance to low temperatures:
  long-term down to –20 °C
- Angled safety edges with sensitive zones in the corner areas
- Safety edges GP 39-1, GP 50-1, GP 60-1 and GP 120-1 can be supplied with sensitive ends



Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection

Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting.

Cleaning

If the sensors become dirty, they can be cleaned with a mild cleaning product.

290421 v2.01-RiA

Subject to technical modifications.

Technical data

GP 15-1 NBR

Safety edge	**SL/W GP 15-1 NBR with SG-EFS 104/2W**
Testing basis	In accordance with ISO 13856-2
Switching characteristics at v_{test} = 10 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 139 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	2.8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±35°
Response time	295 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	
B_1 / B_2 / B_3 / B_4	Not possible
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	Not possible
Operating velocity	10 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–10 to +50 °C
Storage temperature	–10 to +50 °C
Weight (without / with aluminium profile C 15)	0.14 / 0.28 kg/m
Electrical operating conditions	
Connection cable	Ø 3.8 mm TPU, 2×0.25 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

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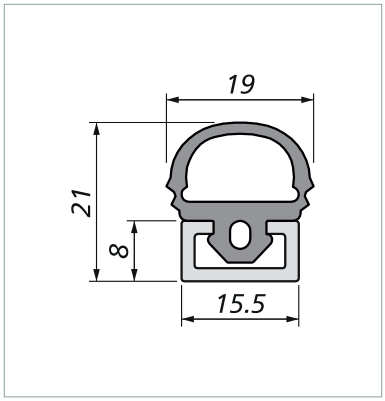
Dimensions and distances

GP 15-1 NBR (1:1)



Dimensional tolerances
according to ISO 3302 E2/L2

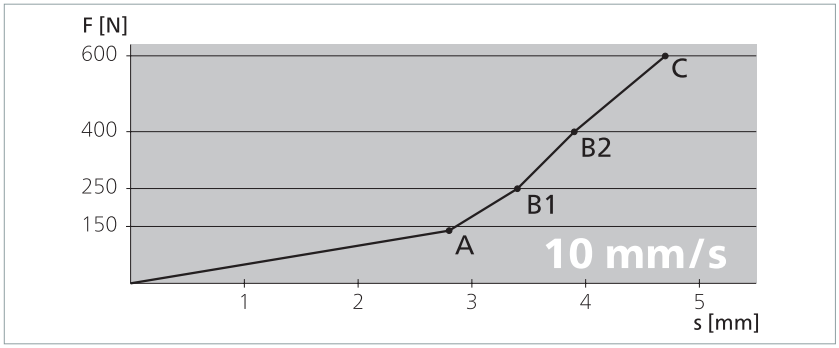
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	139 N
Response time	280 ms
Actuation distance (A)	2.8 mm
Overtravel distance	
Up to 250 N (B1)	0.6 mm
Up to 400 N (B2)	1.1 mm
Up to 600 N (C)	1.9 mm
Total deformation	4.7 mm



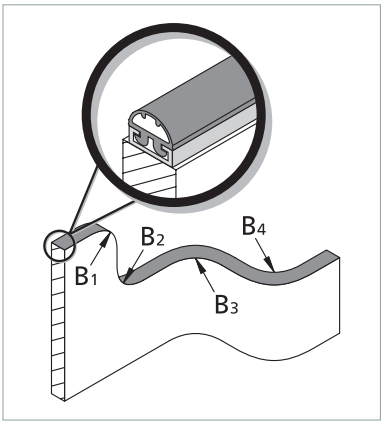
290421 v2.01-RA

Technical data

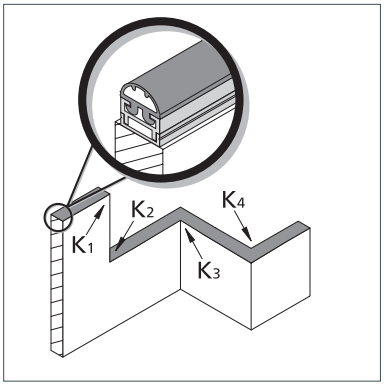
GP 22-1 NBR

Safety edge	SL/W GP 22-1 NBR with SG-EFS 104/2W
Testing basis	In accordance with ISO 13856-2
Switching characteristics at v_{test} = 10 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 60 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	3.1 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±35°
Response time	325 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192a
$MTTF_D$ (sensor)	761a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 25 only
B_1 / B_2 / B_3 / B_4	300 / 350 / 300 / 300 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	25° / 10° / 90° / 90°
Operating velocity	10 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	+5 to +40 °C
Storage temperature	+5 to +40 °C
Weight (without / with aluminium profile C 25)	0.26 / 0.58 kg/m
Electrical operating conditions	
Connection cable	Ø 3.8 mm TPU, 2 × 0.25 mm^2
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



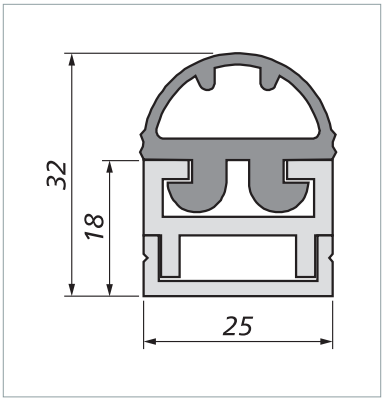
Bend angles:



290421 v2.01-RA

Dimensions and distances

GP 22-1 NBR (1:1)



Dimensional tolerances
according to ISO 3302 E2/L2

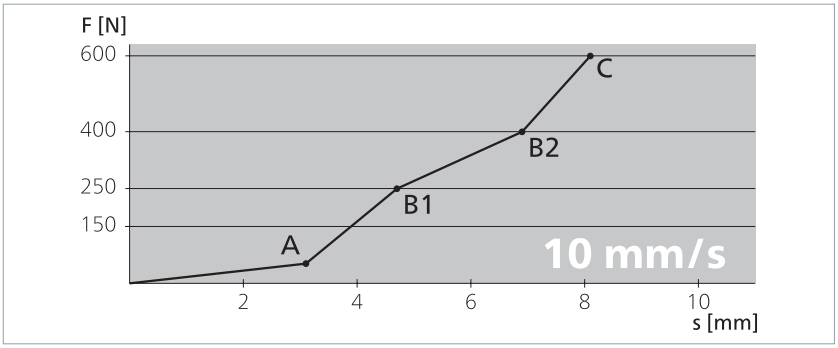
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

All the data given here has been verified by Mayser GmbH & Co. KG.

Test velocity	**10 mm/s**
Actuation force	60 N
Response time	310 ms
Actuation distance (A)	3.1 mm
Overtravel distance	
Up to 250 N (B1)	1.6 mm
Up to 400 N (B2)	3.8 mm
Up to 600 N (C)	5.0 mm
Total deformation	8.1 mm

Force-distance ratios



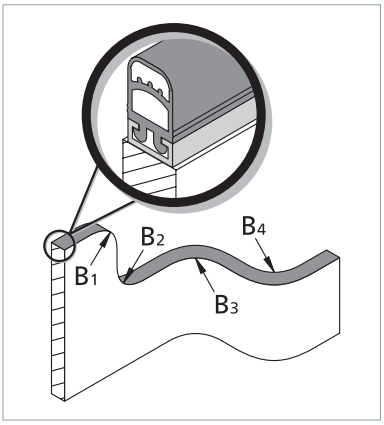
290421 v2.01-RA

Technical data

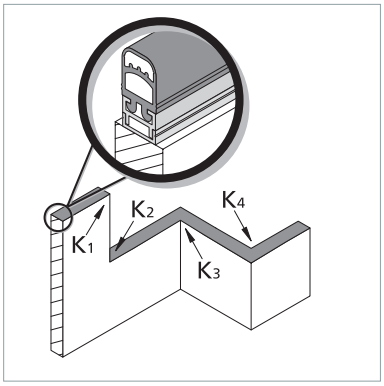
GP 39-1 NBR

Safety edge	SL/W GP 39-1 NBR with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	3.5 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±55°
Response time	50 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 25 only
B_1 / B_2 / B_3 / B_4	300 / 350 / 300 / 300 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	20° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–10 to +50 °C
Storage temperature	–10 to +50 °C
Weight (without / with aluminium profile C 25)	0.51 / 0.83 kg/m
Electrical operating conditions	
Connection cable	Ø 3.8 mm TPU, 2 × 0.25 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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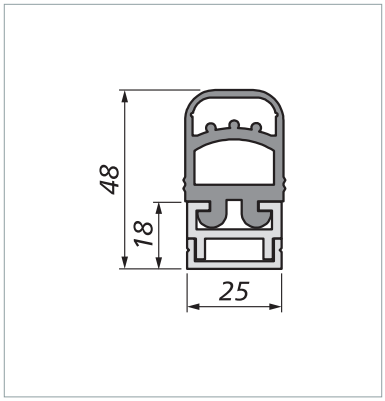
Dimensions and distances

GP 39-1 NBR (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

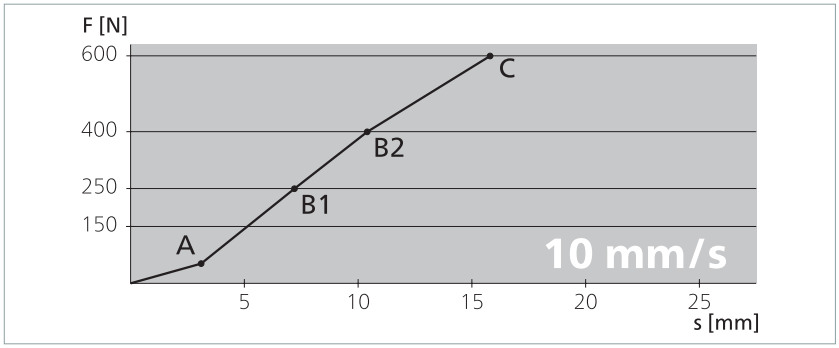
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

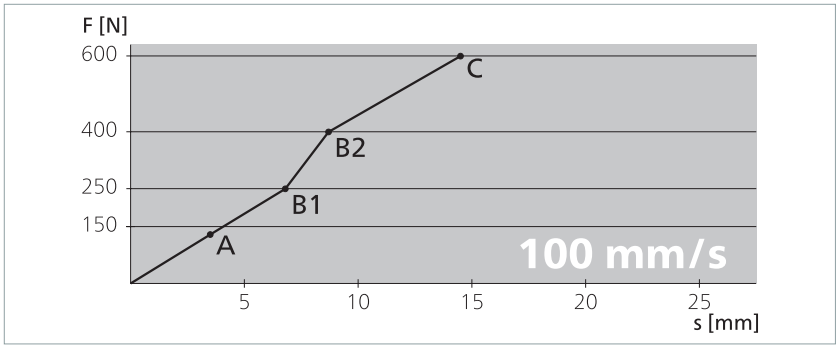
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	52 N
Response time	310 ms
Actuation distance (A)	3.1 mm
Overtravel distance	
Up to 250 N (B1)	4.1 mm
Up to 400 N (B2)	7.3 mm
Up to 600 N (C)	12.7 mm
Total deformation	15.8 mm



Test velocity	**100 mm/s**
Actuation force	129 N
Response time	35 ms
Actuation distance (A)	3.5 mm
Overtravel distance	
Up to 250 N (B1)	3.3 mm
Up to 400 N (B2)	5.2 mm
Up to 600 N (C)	11.0 mm
Total deformation	14.5 mm



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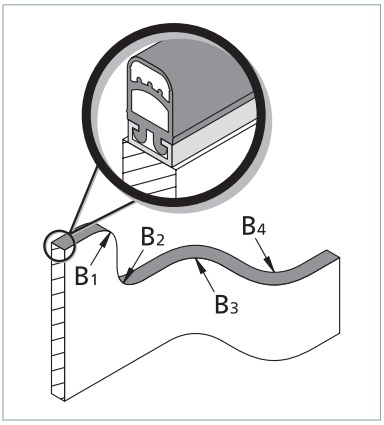
Technical data

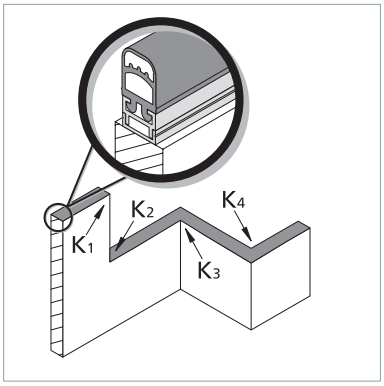
GP 39-1 EPDM

Safety edge	SL/W GP 39-1 EPDM with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	4.4 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±40°
Response time	59 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 25 only
B_1 / B_2 / B_3 / B_4	300 / 350 / 300 / 300 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	20° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–20 to +55 °C
Storage temperature	–20 to +55 °C
Weight (without / with aluminium profile C 25)	0.43 / 0.75 kg/m
Electrical operating conditions	
Connection cable	Ø 3.7 mm TPE, 2×0.22 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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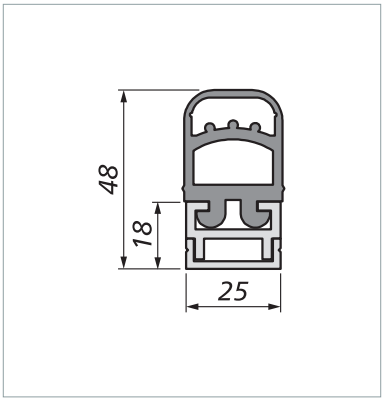
Dimensions and distances

GP 39-1 EPDM (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

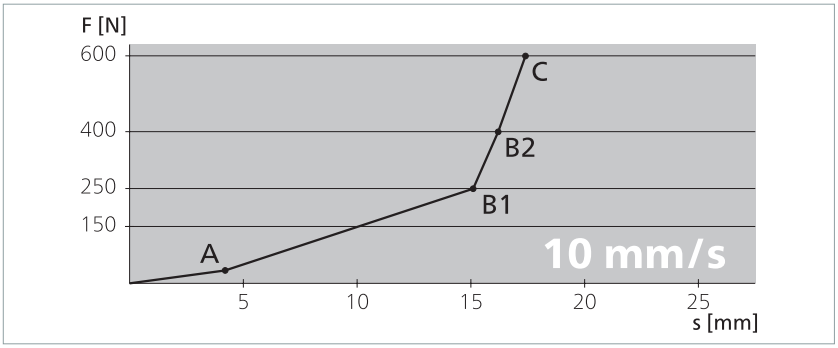
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

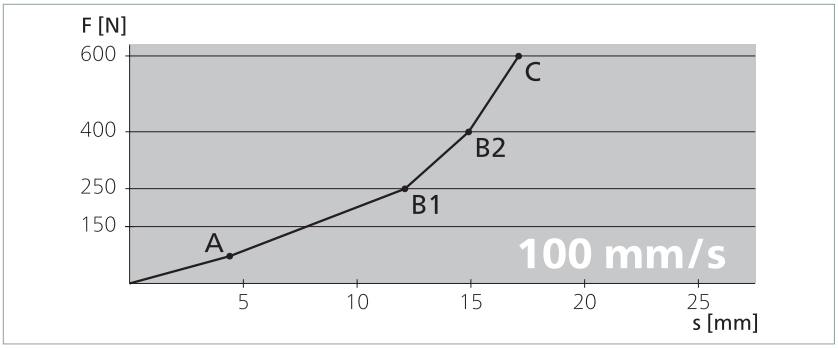
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	34 N
Response time	420 ms
Actuation distance (A)	4.2 mm
Overtravel distance	
Up to 250 N (B1)	10.9 mm
Up to 400 N (B2)	12.0 mm
Up to 600 N (C)	13.2 mm
Total deformation	17.4 mm



Test velocity	**100 mm/s**
Actuation force	72 N
Response time	44 ms
Actuation distance (A)	4.4 mm
Overtravel distance	
Up to 250 N (B1)	7.7 mm
Up to 400 N (B2)	10.5 mm
Up to 600 N (C)	12.7 mm
Total deformation	17.1 mm



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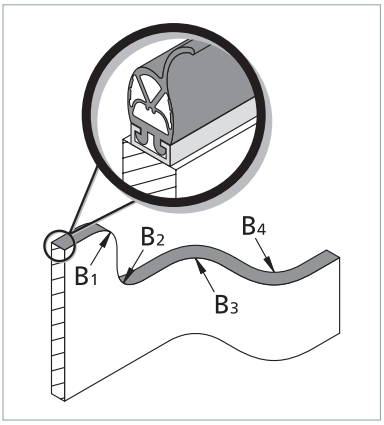
Technical data

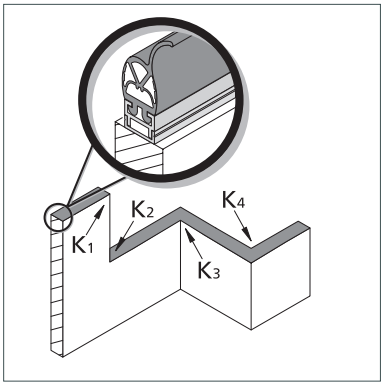
GP 39L-1 EPDM

Safety edge	SL/W GP 39L-1 EPDM with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	18.9 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±60°
Response time	204 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 25 only
B_1 / B_2 / B_3 / B_4	300 / 350 / 300 / 300 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	20° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–20 to +55 °C
Storage temperature	–20 to +55 °C
Weight (without / with aluminium profile C 25)	0.52 / 0.84 kg/m
Electrical operating conditions	
Connection cable	Ø 3.7 mm TPE, 2×0.22 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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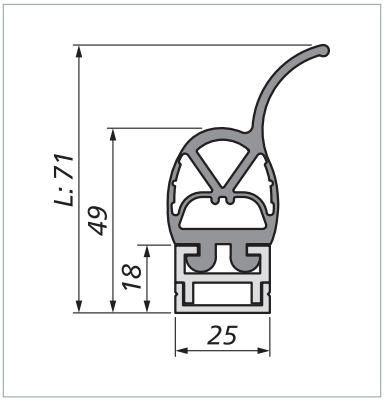
Dimensions and distances

GP 39L-1 EPDM (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

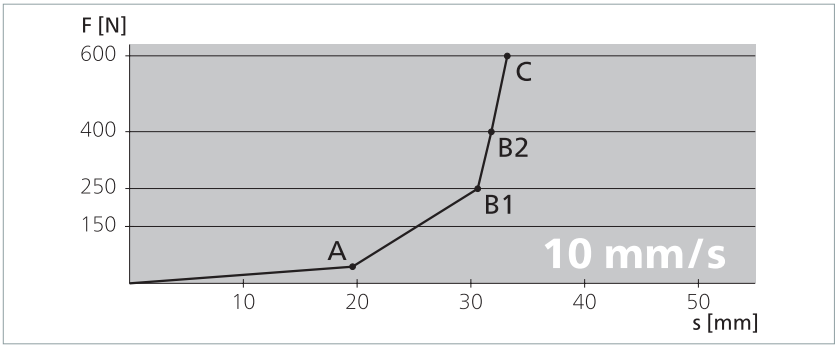
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

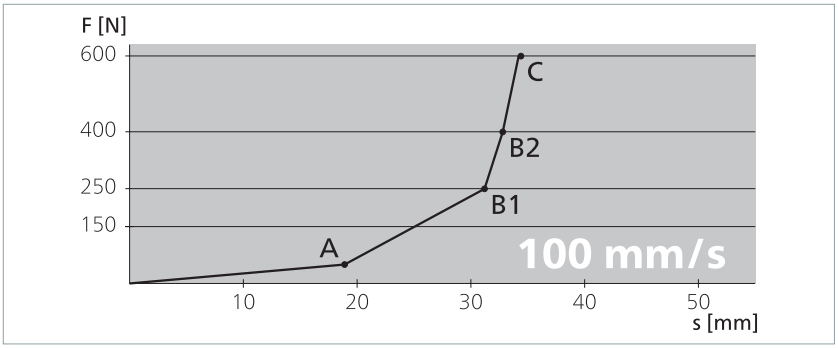
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	44 N
Response time	1960 ms
Actuation distance (A)	19.6 mm
Overtravel distance	
Up to 250 N (B1)	11.0 mm
Up to 400 N (B2)	12.2 mm
Up to 600 N (C)	13.6 mm
Total deformation	33.2 mm



Test velocity	**100 mm/s**
Actuation force	50 N
Response time	189 ms
Actuation distance (A)	18.9 mm
Overtravel distance	
Up to 250 N (B1)	12.3 mm
Up to 400 N (B2)	13.9 mm
Up to 600 N (C)	14.5 mm
Total deformation	34.4 mm



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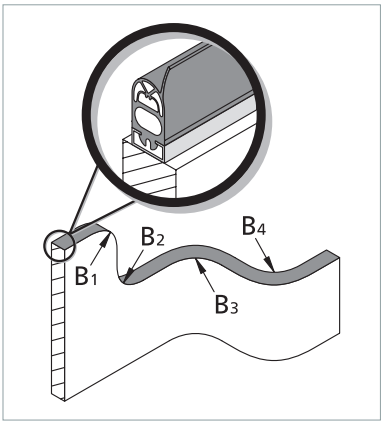
Technical data

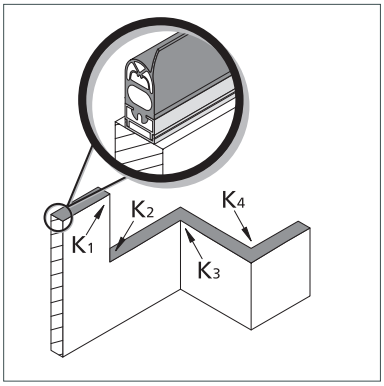
GP 50(L)-1 EPDM

Safety edge	SL/W GP 50(L)-1 EPDM with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	6.3 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Response time	78 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 35 only
B_1 / B_2 / B_3 / B_4	400 / 450 / 550 / 550 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	15° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–20 to +55 °C
Storage temperature	–20 to +55 °C
Weight (without / with aluminium profile C 35)	1.1 / 1.5 kg/m
Electrical operating conditions	
Connection cable	Ø 3.7 mm TPE, 2×0.22 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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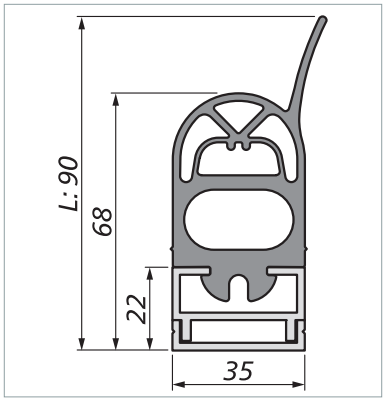
Dimensions and distances

GP 50(L)-1 EPDM (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

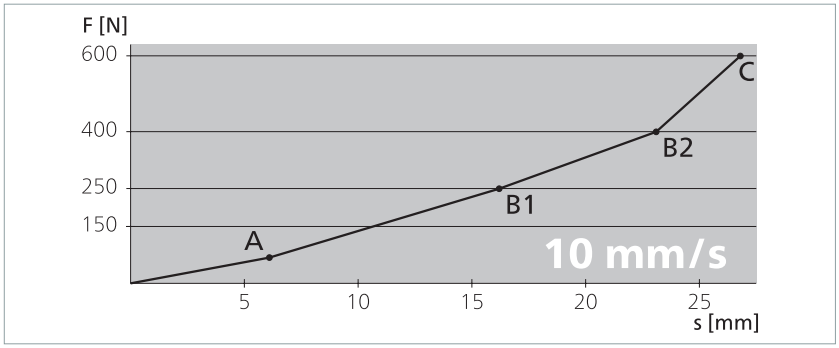
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

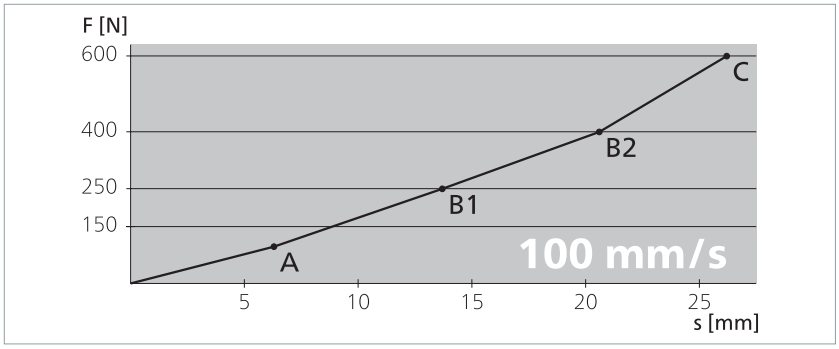
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	68 N
Response time	610 ms
Actuation distance (A)	6.1 mm
Overtravel distance	
Up to 250 N (B1)	10.1 mm
Up to 400 N (B2)	17.0 mm
Up to 600 N (C)	20.7 mm
Total deformation	26.8 mm



Test velocity	**100 mm/s**
Actuation force	97 N
Response time	63 ms
Actuation distance (A)	6.3 mm
Overtravel distance	
Up to 250 N (B1)	7.4 mm
Up to 400 N (B2)	14.3 mm
Up to 600 N (C)	19.9 mm
Total deformation	26.2 mm



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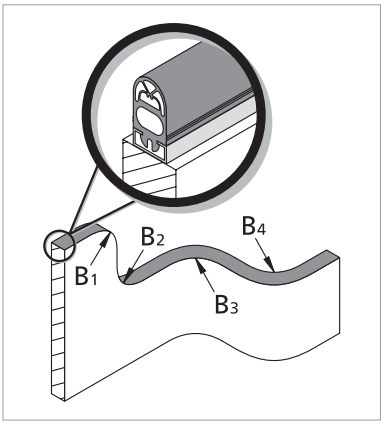
Technical data

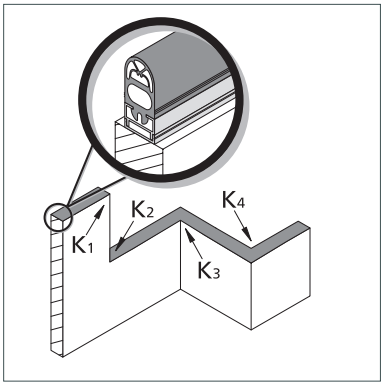
GP 50-1 CR

Safety edge	SL/W GP 50-1 CR with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	4.8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±45°
Response time	63 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 35 only
B_1 / B_2 / B_3 / B_4	400 / 450 / 550 / 550 mm)
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	15° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–20 to +55 °C
Storage temperature	–20 to +55 °C
Weight (without / with aluminium profile C 35)	1.05 / 1.45 kg/m
Electrical operating conditions	
Connection cable	Ø 3.8 mm TPU, 2 × 0.25 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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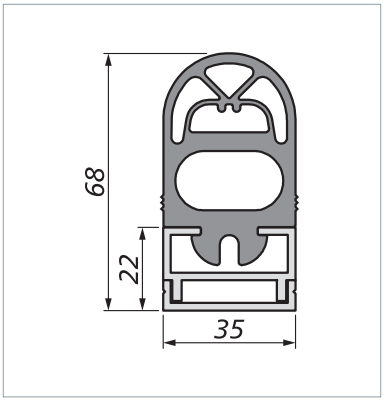
Dimensions and distances

GP 50-1 CR (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

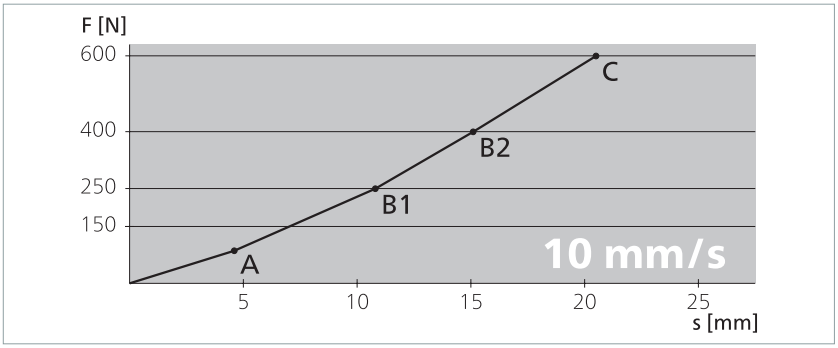
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

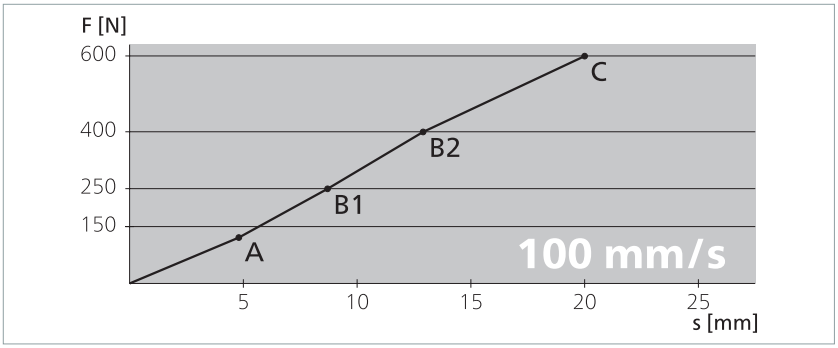
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	86 N
Response time	460 ms
Actuation distance (A)	4.6 mm
Overtravel distance	
Up to 250 N (B1)	6.2 mm
Up to 400 N (B2)	10.5 mm
Up to 600 N (C)	15.9 mm
Total deformation	20.5 mm



Test velocity	**100 mm/s**
Actuation force	121 N
Response time	48 ms
Actuation distance (A)	4.8 mm
Overtravel distance	
Up to 250 N (B1)	3.9 mm
Up to 400 N (B2)	8.1 mm
Up to 600 N (C)	15.2 mm
Total deformation	20.0 mm



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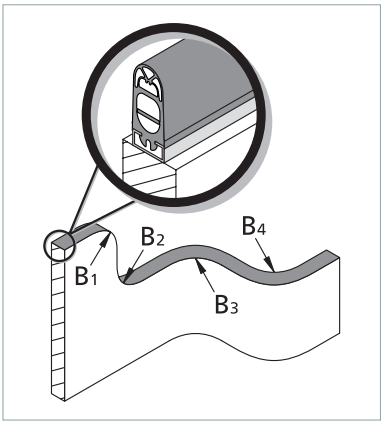
Technical data

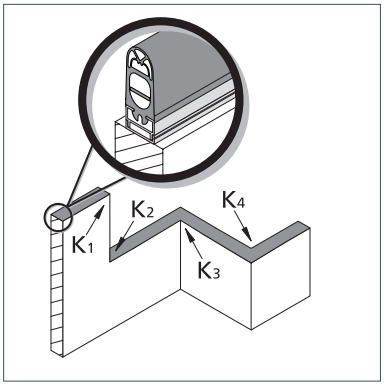
GP 60-1 EPDM

Safety edge	SL/W GP 60-1 EPDM with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	5.5 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±60°
Response time	70 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 35 only
B_1 / B_2 / B_3 / B_4	450 / 550 / 550 / 550 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	15° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–20 to +55 °C
Storage temperature	–20 to +55 °C
Weight (without / with aluminium profile C 35)	1.16 / 1.56 kg/m
Electrical operating conditions	
Connection cable	Ø 3.7 mm TPE, 2×0.22 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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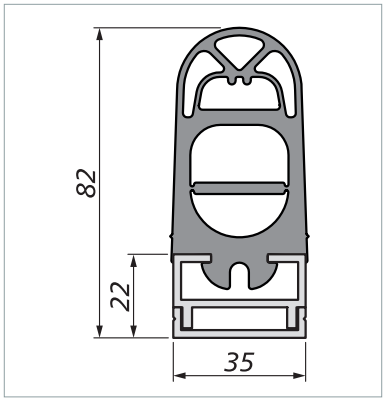
Dimensions and distances

GP 60-1 EPDM (1:2)



Dimensional tolerances
according to ISO 3302 E2/L2

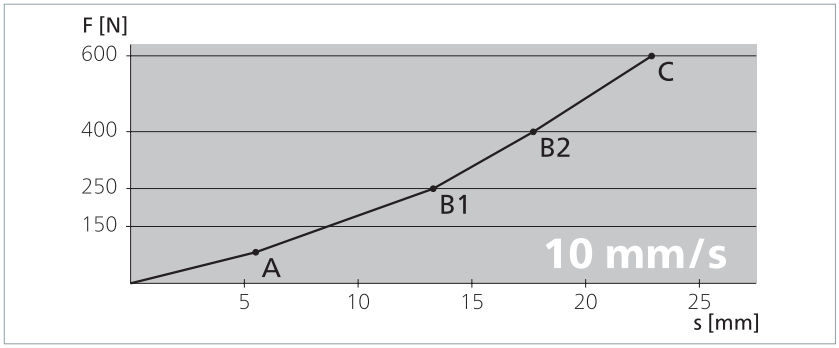
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

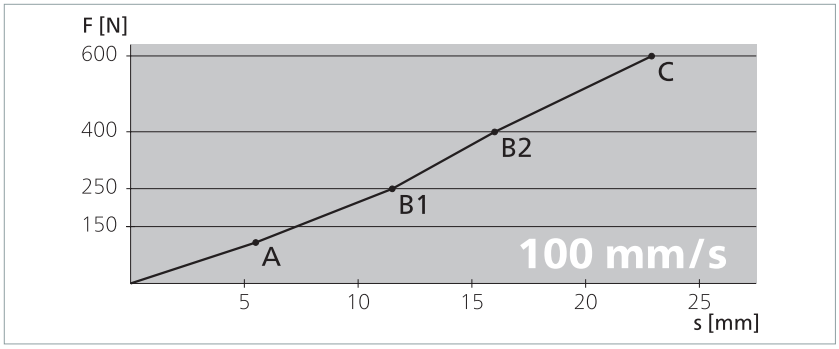
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	82 N
Response time	550 ms
Actuation distance (A)	5.5 mm
Overtravel distance	
Up to 250 N (B1)	7.8 mm
Up to 400 N (B2)	12.2 mm
Up to 600 N (C)	17.4 mm
Total deformation	22.9 mm



Test velocity	**100 mm/s**
Actuation force	108 N
Response time	55 ms
Actuation distance (A)	5.5 mm
Overtravel distance	
Up to 250 N (B1)	6.0 mm
Up to 400 N (B2)	10.5 mm
Up to 600 N (C)	17.3 mm
Total deformation	22.8 mm



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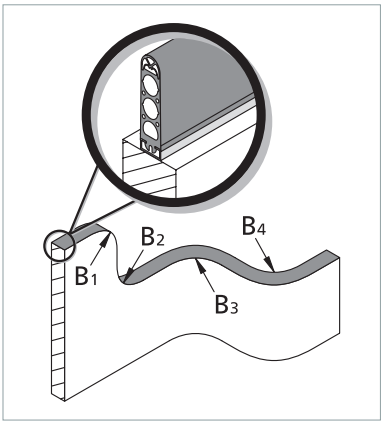
Technical data

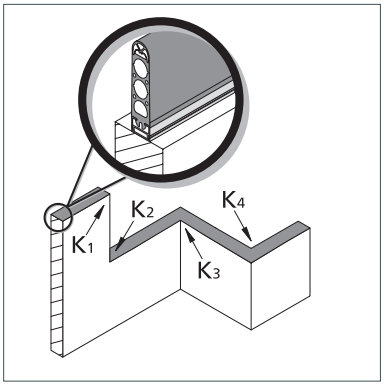
GP 120-1 EPDM

Safety edge	SL/W GP 120-1 EPDM with SG-EFS 104/2W
Testing basis	EN 12978, ISO 13849-1, ISO 13856-2
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	8.0 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	±60°
Response time	95 ms
Finger detection	No
Safety classifications	
ISO 13856: reset function	With/without
ISO 13849-1:2015	Category 3 PL d
$MTTF_D$ (PSPD)	192 a
$MTTF_D$ (sensor)	761 a
B_{10D} (sensor)	4×10^6
n_{op} (assumption)	52,560/a
Mechanical operating conditions	
Sensor length (min./max.)	20 cm / 6 m
Cable length (min./max.)	2.0 m / 100 m
Bend radii, minimum	With C 35 only
B_1 / B_2 / B_3 / B_4	– / – / 550 / 550 mm
Bend angles, maximum	
K_1 / K_2 / K_3 / K_4	15° / 10° / 90° / 90°
Operating velocity	
(min. / max.)	10 mm/s / 100 mm/s
Load capacity (max.)	600 N
Tensile load, cable (max.)	20 N
IEC 60529: degree of protection	IP67
Humidity (max. at 23 °C)	95% (non-condensing)
Operating temperature	–10 to +50 °C
Storage temperature	–10 to +50 °C
Weight (without / with aluminium profile C 35)	2.24 / 2.64 kg/m
Electrical operating conditions	
Connection cable	Ø 3.7 mm TPE, 2×0.22 mm²
Sensor	24 V DC / max. 10 mA
Number of /BK-type sensors	Max. 10 in series

Bend radii:



Bend angles:



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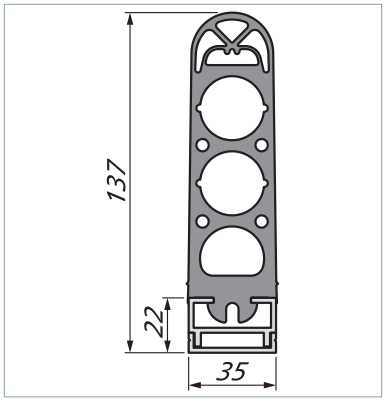
Dimensions and distances

GP 120-1 EPDM (1:3)



Dimensional tolerances
according to ISO 3302 E2/L2

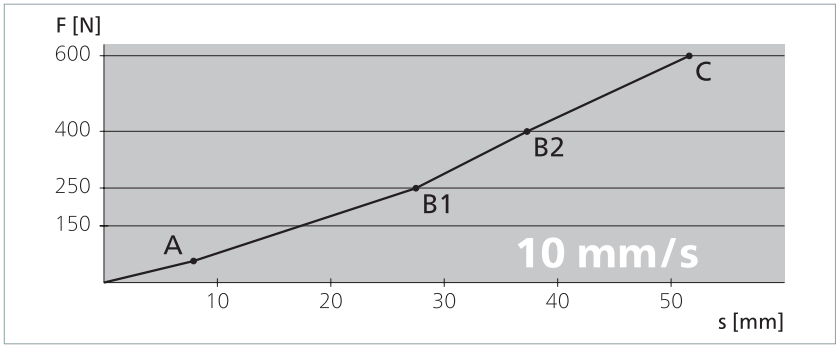
Test conditions
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- Without control unit

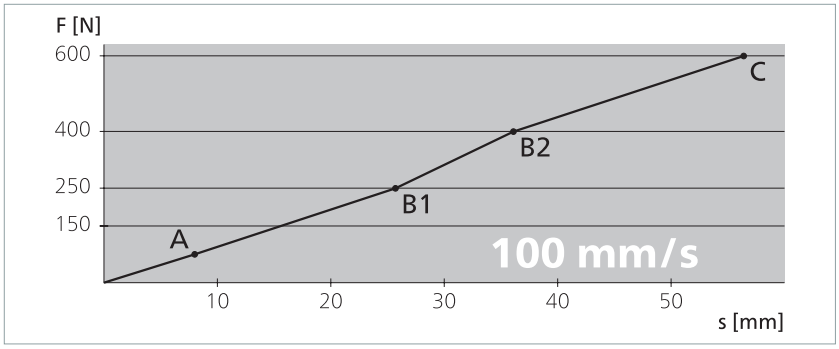
All the data given here has been verified by Mayser GmbH & Co. KG.

Force-distance ratios

Test velocity	**10 mm/s**
Actuation force	57 N
Response time	790 ms
Actuation distance (A)	7.9 mm
Overtravel distance	
Up to 250 N (B1)	19.6 mm
Up to 400 N (B2)	29.4 mm
Up to 600 N (C)	43.7 mm
Total deformation	51.6 mm



Test velocity	**100 mm/s**
Actuation force	75 N
Response time	80 ms
Actuation distance (A)	8.0 mm
Overtravel distance	
Up to 250 N (B1)	17.7 mm
Up to 400 N (B2)	28.1 mm
Up to 600 N (C)	48.4 mm
Total deformation	56.4 mm



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Conformity

The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out.

The design type of the product complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of Machinery)
- 2011/65/EU (RoHS)
- 2014/30/EU (EMC)

The Declaration of Conformity is available in the Downloads section of our website:
www.mayser.com/de/download.

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MAYSER®

Innovative by tradition.

Normally closed safety edges SL NC II

EN | Product information

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Contents

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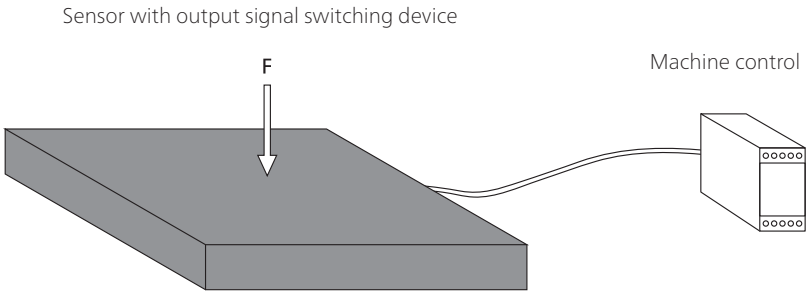
Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of pressure-sensitive sensor(s), signal processing and output signal switching device(s). A pressure-sensitive protection device with switching type NC combines a sensor and an output signal switching device. That means that such a pressure-sensitive protection device can be used without a control unit. The pressure-sensitive protection device is triggered when the sensor is activated.

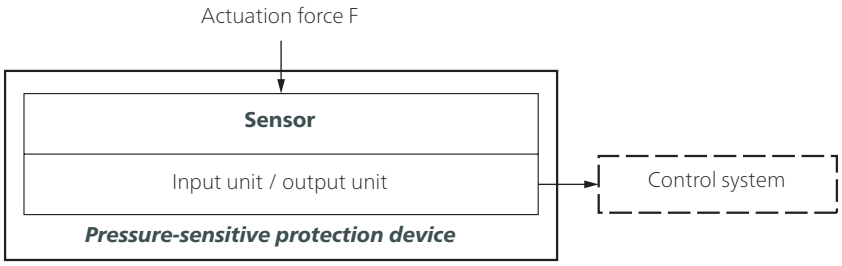


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuating force F is applied. Mayser safety systems have a sensor whereby the actuating surface is deformed locally.

Signal processing

A pressure-sensitive protection device with switching type NC is designed only with an input and output unit for signal processing. The output unit is connected directly to the downstream control.



Tip: Terms are defined in ISO 13856-1, Chapter 3.

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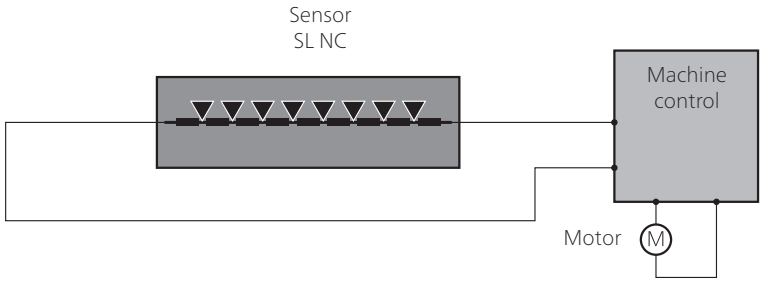
Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP67 is the standard for safety edges.
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use...
- Finger detection necessary?

Tip: For additional sensor selection criteria, please refer to ISO 13856-2 Appendix C and Appendix E.

Operation principle 2-wire-technology

The sensor is designed with integrated **positive break** safety elements in the form of contact chains. A control unit is not necessary, since the NC contact principle provides the output signal directly to the down-stream control.
Optionally, the sensor can also be operated with an emergency stop component or a control unit.



For your safety:
Sensor and connecting cables are constantly monitored for function. This is possible because of signal transmission feedback – without a monitoring resistor.

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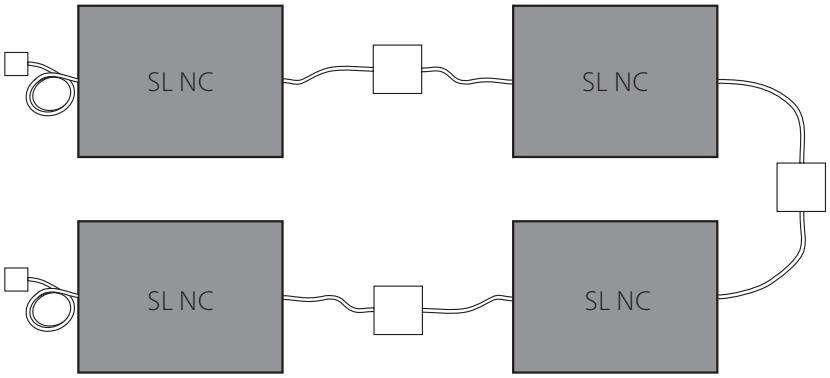
Design

SL NC with two 1-strand cables as a through sensor

Combination of sensors



Combination:

- Connection of more than one sensor
- only one emergency stop component necessary
- Safety edge design with custom lengths and angles

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Safety

Intended use

A safety edge detects a person or part of the body when pressure is applied to the actuation area. It is a linear tripping device. Its task is to avoid possible hazardous situations for a person within a danger zone, such as shearing and pinching edges.
Typical areas of application are door and gate systems, moving parts on machines, platforms and lifting devices.
Safe operation of a safety edge depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance as well as
- correct installation.

For additional application guidelines refer to ISO 13856-2 Annex E.

Due to the design, the visible actuation area is reduced by the non-sensitive edges. What remains is the actual effective actuation area (see chapter *Effective actuation area*).

Limits

A maximum of 10 sensors may be operated in series.
GP 48-2 deviates with respect to the actuation angle from the requirements in ISO 13856-2 and EN 12978; the suitability for doors and gates must be examined on an individual basis.

Exclusions

The sensors are not suitable:

- for detecting fingers
- for areas of application with high levels of vibration
- for performing a sealing function. Continuous actuation can cause permanent damage to sensors.

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Other safety aspects

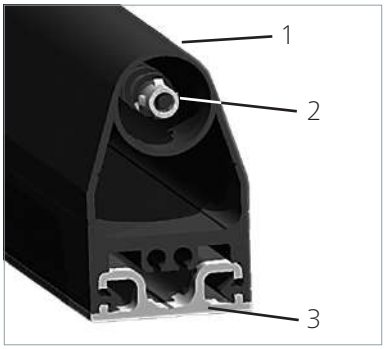
Performance Level (PL)
The PL was determined during a simplified procedure according to ISO 13849-1. Exclusion of error according to ISO 13849-2, Table D.4: Short circuit between two conductors that are permanently installed and protected against external damage. In this case the diagnostic coverage (DC) of the cables is not calculated and is not used in determining the PL. Assuming the control unit has a high $MTTF_D$ value, the entire safety edge system (pressure-sensitive safety device) can achieve the maximum value PL d.

Is the safeguard appropriate?
The PL required for the hazard must be decided by the integrator. This is followed by the choice of safeguard.
Finally, the integrator needs to check whether the category and PL of the safeguard chosen are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine we recommend ISO 12100 „Safety of machinery – general principles for design".

Without reset function
When a safeguard without a reset function is used (automatic reset), the reset function must be made available in some other way.

Design



The Normally closed safety edge SL/NC II consists of
(1) Rubber profile GP,
(2) Contact chain made of connected positive break normally closed contacts and
(3) Aluminium profile C 26 or C 36.

The positive break contact chain simultaneously carries out the functions of the sensor, signal processing and output signal switching device. Therefore, a special control unit is not necessary.

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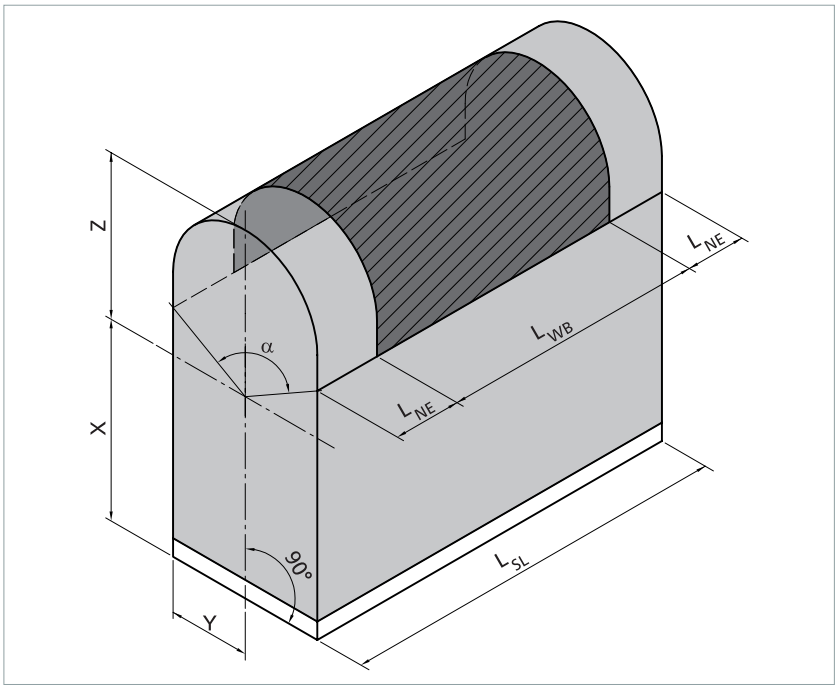
Subject to technical modifications.

Effective actuation area

The parameters X, Y, Z, L_{WB} and the angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$L_{WB} = L_{SL} - 2 \times L_{NE}$



Parameters:
L_{WB} = effective actuation length
L_{SL} = overall length of the safety edge
L_{NE} = non-sensitive length at the end of the safety edge
α = effective actuation angle

SL NC II	GP 48-2	GP 65-2	GP 100-2
α	60°	90°	90°
L_{NE}	50 mm	50 mm	40 mm
X	40 mm	52 mm	85 mm
Y	13 mm	18 mm	18 mm
Z	8 mm	13 mm	14 mm

The effective actuation angle α (60°) for GP 48-2 falls below the requirements of ISO 13856-2 and EN 12978.

Installation position

The installation position can be selected as required, i.e. all installation positions A to D as per ISO 13856-2 are possible.

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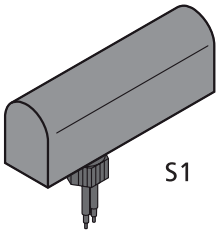
Subject to technical modifications.

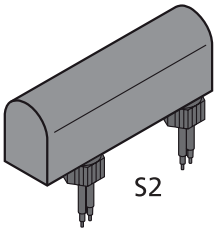
Connection

Cable exits

90° exit
Distance to front end each 60 mm

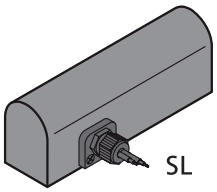


S1: 1 connection

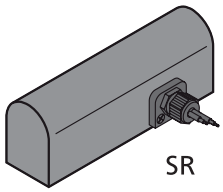


S2: 2 connections

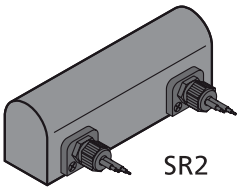
Lateral exit
Distance to front end each 60 mm



SL: lateral exit left

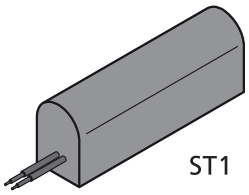


SR: lateral exit right

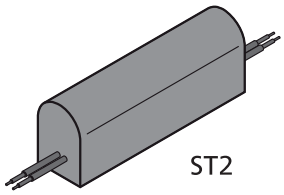


SR2: 2 connections

Axial exit
without PG-screw connection



ST1: Axial exit



ST2: 2 connections

In the case of several sensors connected in sequence, we recommend version S2, SR2 or ST2. These versions provide an additional line in the rubber profile for feedback to the control.

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Subject to technical modifications.

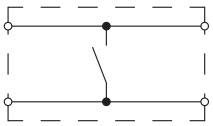
Cable connection

- Cable: Ø 3.3 mm PVC, 1× 0.5 mm²; double insulated, short-circuit-proof, highly flexible
- Cable length depends on the sensor length:
  A cable with a length of 7.5 m is installed in the sensor as standard equipment. Due to internal cable routing from the connections the cable exits, the connection cable length is determined as follows:
  Standard cable length minus sensor length.
  For example, 7.5 m - 6 m = 1.5 m
  Option: can be expanded up to a maximum length of 100 m
- Cable ends: wires stripped
  Option: Cable ends available with plug and coupling

For the wiring between the sensor and the downstream control the cables must be installed permanently and protected against external damage, for example in cable conduits or armoured conduits.
In areas where this is not possible, each cable must be routed in a separate sheath.
This prevents

- line termination and therefore loss of the protective function and
- downgrading of the safety classification.

Wire colours



Colour coding

BK	Black
RD	Red

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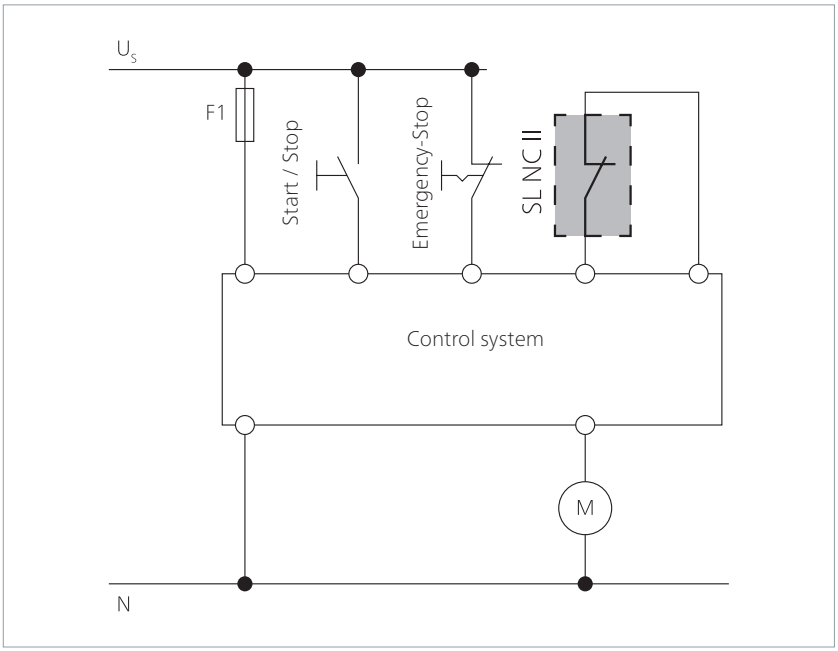
Subject to technical modifications.

Connection examples

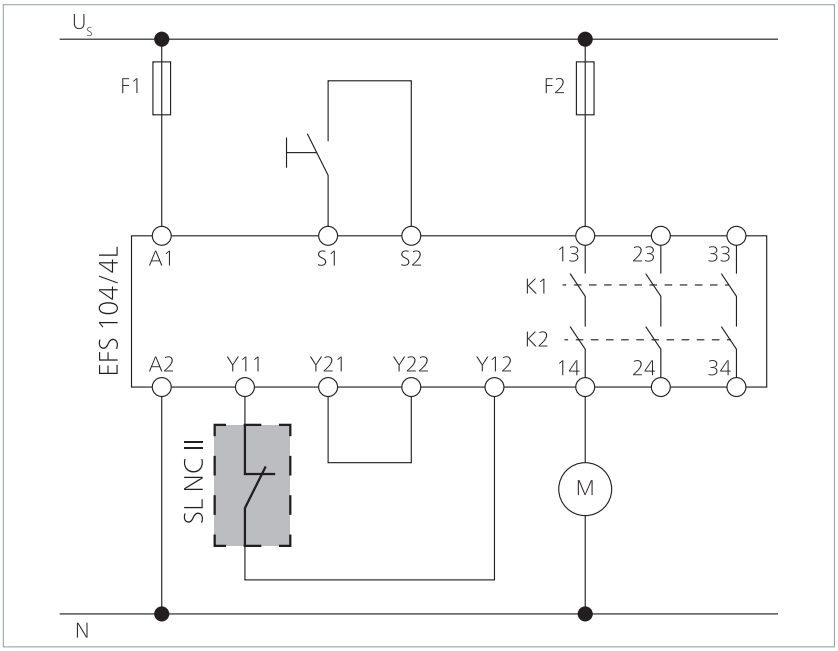
Connection example 1

NC safety edge connected directly to the control. Protective devices in accordance with ISO 13849 1 to PL d are possible, if the control has a performance level of d or higher.



Connection example 2

NC safety edge connected to the Mayser SG-EFS 104/4L control unit. Performance level up to PL d in accordance with ISO 13849-1 is possible.



The NC safety edge and the SG EFS 104/4L sensor are certified to UL 508.

Subject to technical modifications.

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Sensor surface

Physical resistance

Rubber profile GP	EPDM	NBR
Degree of protection (IEC 60529)	IP67	IP67
Hardness per Shore A	65 ±5	70 ±5

Chemical resistance

The sensor is resistant against normal chemical influences such as diluted acids and alkalis as well as alcohol over an exposure period of 24 hrs.

The specifications in the table are the result of tests conducted in our lab at room temperature (+23 °C). The suitability of our products for your special area of application must always be verified with your own practical tests.

Material	EPDM	NBR
Acetone	+	±
Formic acid	+	+
Ammonia	+	+
Petrol	-	+
Brake fl uid	±	±
Chloride solutions	+	+
Diesel oils	-	+
Greases	-	+
Household-/sanitary cleaners	+	+
Isopropyl alcohol	+	+
Cooling lubricant	-	+
Metal working oil	-	+
Methyl alcohol	+	+
Oils	-	+
Ozone and weather conditions	+	-
Hydrochloric acid 10 %	+	+
Spirit (ethyl alcohol)	+	+
Carbon tetrachloride	-	+
Hydrogen peroxide 10 %	+	+
Water and frost	+	-

Explanation of symbols:

+ = resistant
± = resistant to a certain extent
- = not resistant

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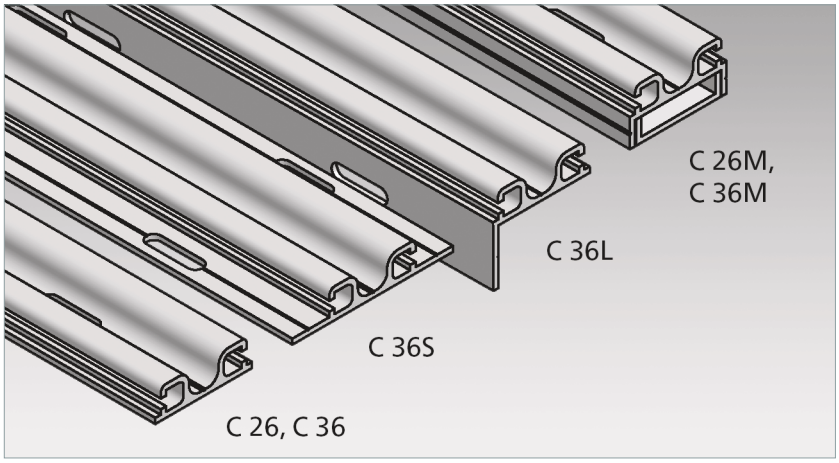
Subject to technical modifications.

Attachment

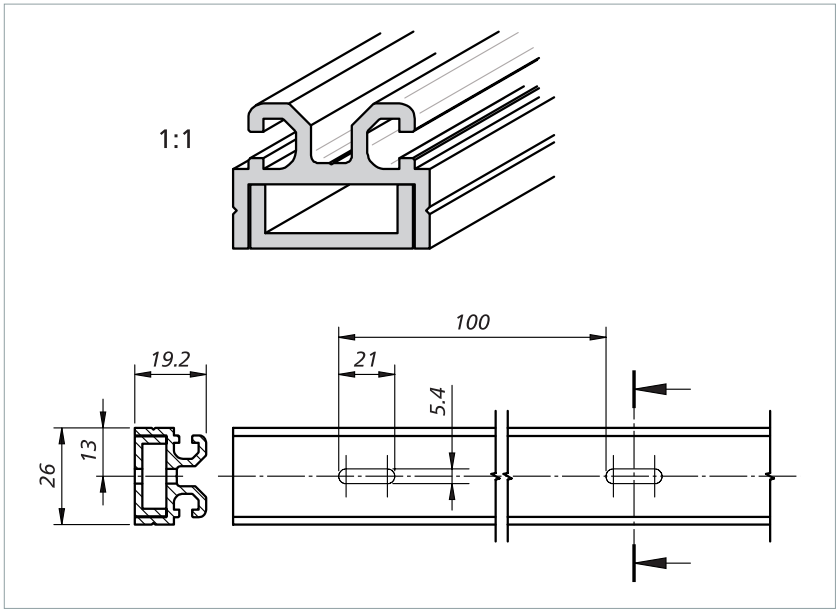
The sensors are mounted directly to the dangerous main and secondary closing edges. The aluminium profiles C 26 and C 36 are used for mounting. The aluminium profiles are mounted with screws M5 or rivets.



Material properties

- AlMgSi0.5 F22
- Wall thickness 2 mm
- Tolerances as per EN 755-9
- extruded
- hot hardened

Aluminium profile C 26M

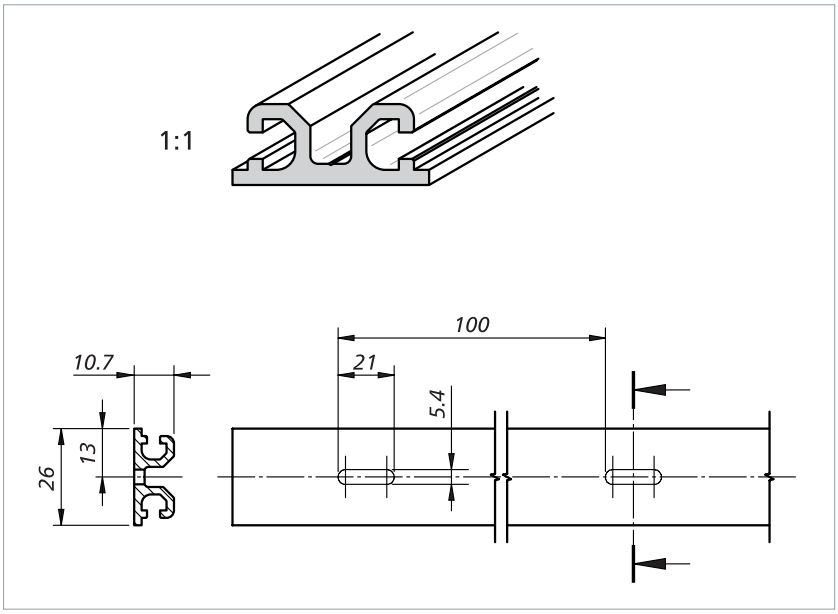


Two-part profile for GP 48-2:
For convenient assembly and disassembly. The rubber profile is clipped into the upper section and the upper section inserted in the installed lower section and fastened.

Subject to technical modifications.

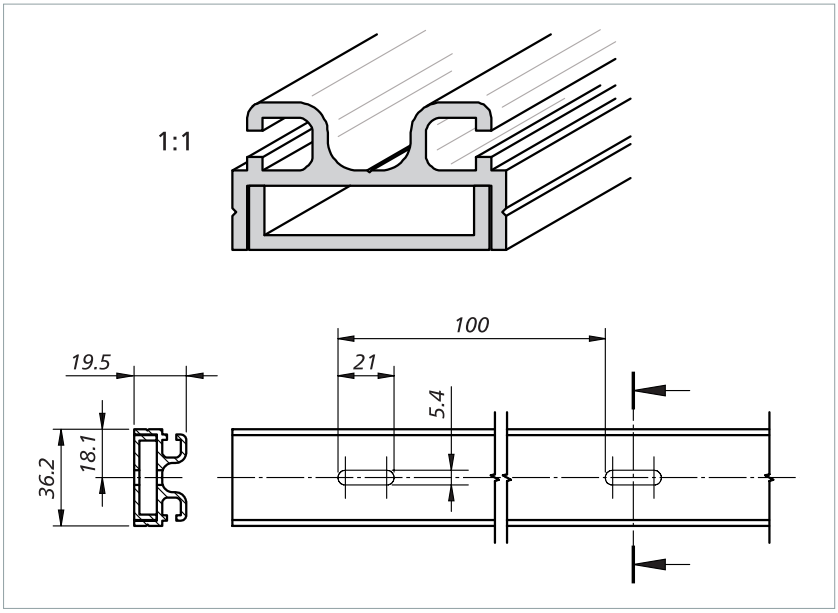
050320 v2.11-RiA

Aluminium profile C 26



Standard profile for GP 48-2:
First the aluminium profile must be mounted to the closing edge and then the rubber profile clipped into the aluminium profile.

Aluminium profile C 36M



Two-part profile for GP 65-2 and GP 100-2:
For convenient assembly and disassembly. The rubber profile is clipped into the upper section and the upper section inserted in the installed lower section and fastened.

Subject to technical modifications.

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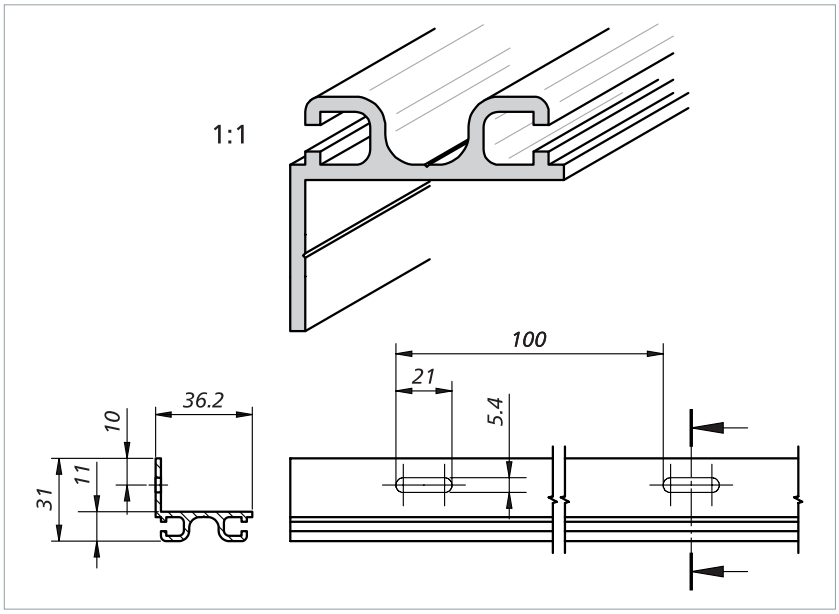
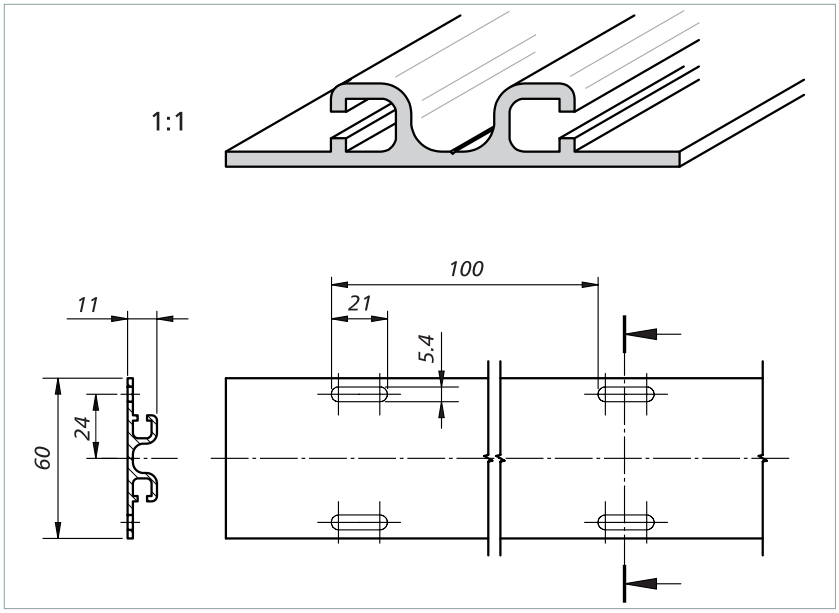
Aluminium profile C 36L



Angle profile for GP 65-2 and GP 100-2:
If the closing edge should or must not have assembly holes, this "round-the-corner" solution is suitable. Final assembly is also possible when the rubber profile is already clipped into the aluminium profile.

Aluminium profile C 36S



Flange profile for GP 65-2 and GP 100-2:
Final assembly is also possible when the rubber profile is already clipped into the aluminium profile.

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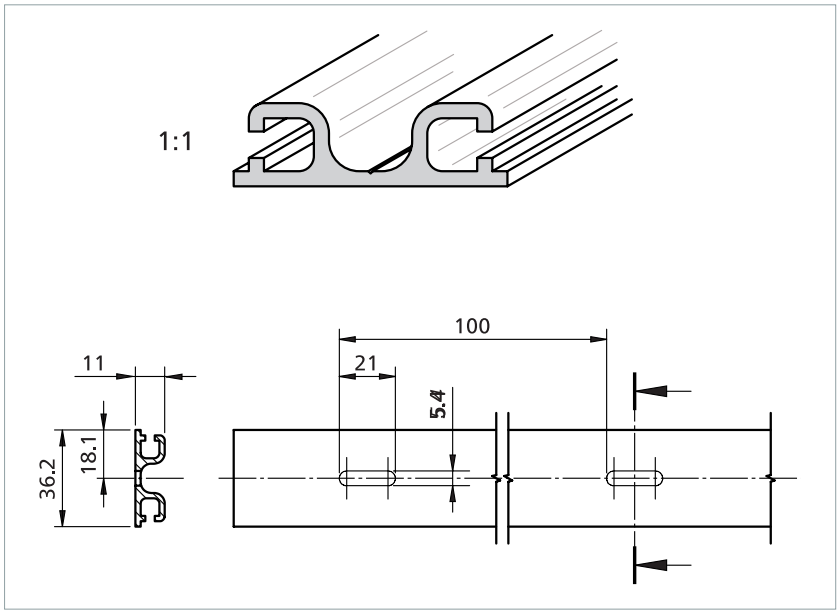
Subject to technical modifications.

Aluminium profile C 36



Standard profile for GP 65-2 and GP 100-2:
First the aluminium profile must be mounted to the closing edge and then the rubber profile clipped into the aluminium profile.

Aluminium profiles: Overview of combinations

Aluminium profiles for		GP 48-2	GP 65-2	GP 100-2
External clip bars	...-2	C 26 C 26M	C 36 C 36M, C 36L, C 36S	C 36 C 36M, C 36L, C 36S

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Subject to technical modifications.

SL NC II: The right selection

Calculation for selection of the safety edge height

s_1 = Stopping distance of the dangerous movement [mm]
v = Velocity of the dangerous movement [mm/s]
T = Follow-through of the complete system [s]
t_1 = Response time safety edge
t_2 = Stopping time of the machine
s = Minimum overtravel distance of the safety edge so that the required limit forces are not exceeded [mm]
C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected

The stopping distance of the dangerous movement is calculated using the following formula:

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

The NC safety edge is a sensor, signal processor and output signal switching device in one (see chapter *Design*). For this reason the response time t_1 of the safety edge = the sensor response time.

In accordance with ISO 13856-2, the minimum overtravel distance of the safety edge is calculated using the following formula:

$s = s_1 \times C$ where: $C = 1.2$

A suitable safety edge profile can now be selected based on the result. Overtravel distances of safety edge profiles: see chapter *Technical data*.

Calculation examples

Example 1
The dangerous movement on your machine has a velocity of v = 10 mm/s and can be brought to a standstill within t_2 = 250 ms. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore the normally closed safety edge SL NC II GP 48-2 NBR could be sufficient. The response time of the safety edge is t_1 = 1300 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 10$ mm/s $\times$ (1300 ms + 250 ms)
$\mathbf{s_1} = 1/2 \times 10$ mm/s $\times$ 1.55 s = **6.55 mm**

$s = s_1 \times C$ where: $C = 1.2$
s = 6.55 mm $\times$ 1.2 = **7.86 mm**

The safety edge must have a minimum overtravel distance of s = 7,9 mm. The selected SL NC II GP 48-2 NBR has an overtravel distance of at least 12.4 mm. This is more than the required 7.9 mm.
Result: The SL NC II GP 48-2 NBR is **suitable** for this case.

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Example 2

The same conditions as in calculation example 1 with the exception of the velocity of the dangerous movement. This is now v = 100 mm/s. This reduces the response time of the safety edge to t_1 = 83 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 100$ mm/s $\times$ (83 ms + 250 ms)

$\mathbf{s_1} = 1/2 \times 100$ mm/s $\times$ 0.333 s = **16.65 mm**

$s = s_1 \times C$ where: C = 1.2

s = 16.65 mm × 1.2 = **19.98 mm**

The safety edge must have a minimum overtravel distance of s = 20 mm. The selected SL NC II GP 48-2 NBR has an overtravel distance of at least 16.8 mm. This is less than the required 20 mm.

Result: The SL NC II GP 48-2 NBR is **not suitable** for this case.

Example 3

The same conditions as in calculation example 2. Instead of SL NC II GP 48-2 NBR the SL NC II GP 100-2 EPDM is selected. The response time of the safety edge is t_1 = 76 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

$s_1 = 1/2 \times 100$ mm/s $\times$ (76 ms + 250 ms)

$\mathbf{s_1} = 1/2 \times 100$ mm/s $\times$ 0.326 s **= 16.3 mm**

$s = s_1 \times C$ where: C = 1.2

s = 16.3 mm × 1.2 = **19.56 mm**

The safety edge must have a minimum overtravel distance of s = 20 mm. The selected SL NC II GP 100-2 EPDM has an overtravel distance of at least 36.8 mm at 100 mm/s. This is more than the required 20 mm.

Result: The SL NC II GP 100-2 EPDM is **suitable** for this case.

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Accessories

Extension kit

For extension of connection cable by customer (contents: double insulated wire, crimp connector and heat-shrinkable sleeves)

Extension kit :	5 m	1003870
Extension kit:	10 m	1003871

Wiring aids

Special resistor:	1k2	1003873
Special resistor:	8k2	1003874

Maintenance and cleaning

The sensors are virtually maintenance-free.

Regular inspection

Depending on the utilisation, sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- damage,
- and correct mounting.

Cleaning

If the sensors become dirty, they can be cleaned with a mild cleaning product.

050320 v2.11-RiA

Subject to technical modifications.

Technical data

GP 48-2 NBR with C 26

Normally closed safety edge SL NC II consisting of sensor and aluminium profile from the profile range C 26.

Testing basis	
ISO 13856-2	
Switching characteristics at v_{test} = 200 mm/s	
Switching operations	>10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	12 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	60°
Response time	60 ms
Finger detection	yes
Safety classifications	
ISO 13856: Reset function	without
ISO 13849-1:2015	Category 3 PL d
B_{10D} (Sensor)	2×10^6
Mechanical operating conditions	
Sensor length (min./max.)	30 cm / 6 m
Cable length (min./max.)	1.5 m / 100 m
Bend radii	not possible
Operating speed	
(min. / max.)	10 mm/s / 200 mm/s
max. load capacity	600 N
IEC 60529: Degree of protection	IP67
Humidity (max. at 23 °C)	95 % (non-condensing)
Operating temperature	+5 to +55 °C
Storage temperature	-20 to +80 °C
Weight	1.0 kg/m
Electrical operating conditions	
Contact transition resistance (max.)	5 Ohm
Number of sensors type BK	max. 10 in series
Switching voltage (PELV) (max.)	48 V DC 48 V AC 50/60 Hz
Protection class	III
Switching current (max.)	20 mA
Contact fuse protection, external	250 mA slow-acting
Connection cable	Ø 3.3 mm PVC 1×0.5 mm²

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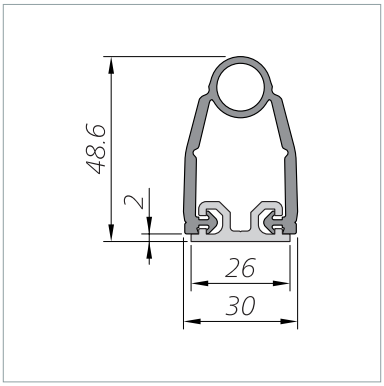
Dimensions and distances

GP 48-2 NBR (1:2)



Dimensional tolerances according to ISO 3302 E2/L2.

Test conditions

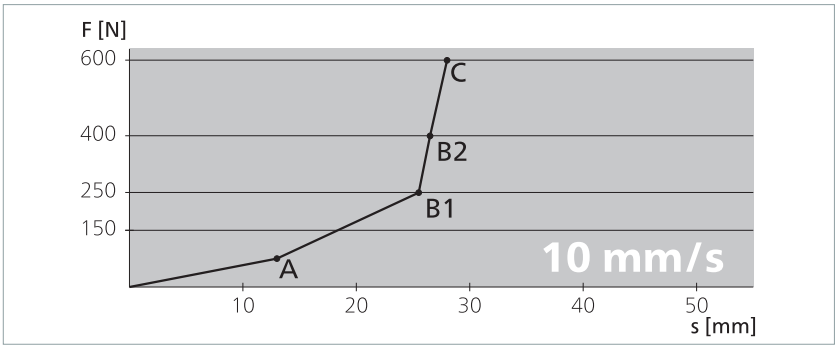
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- without control unit

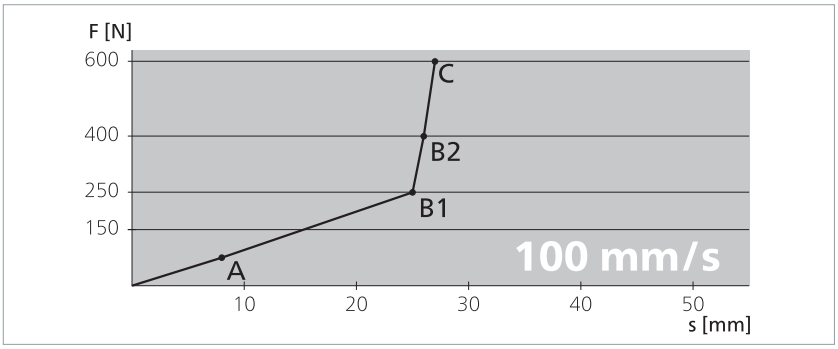
All data stated here is documented in EC design type test certificates.

Force-distance ratios

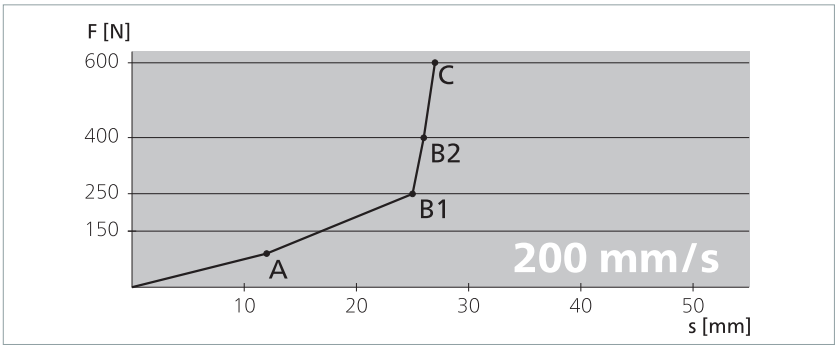
Actuation force	69 N
Response time	1300 ms
Actuation distance (A)	13 mm
Overtravel distance	
up to 250 N (B1)	12.4 mm
up to 400 N (B2)	13.5 mm
up to 600 N (C)	14.9 mm
Total deformation	27.9 mm



Actuation force	71 N
Response time	83 ms
Actuation distance (A)	8.3 mm
Overtravel distance	
up to 250 N (B1)	16.8 mm
up to 400 N (B2)	17.7 mm
up to 600 N (C)	18.9 mm
Total deformation	27.2 mm



Actuation force	71 N
Response time	60 ms
Actuation distance (A)	12 mm
Overtravel distance	
up to 250 N (B1)	13.2 mm
up to 400 N (B2)	14.1 mm
up to 600 N (C)	15.2 mm
Total deformation	27.2 mm



050320 v2.11-RiA

Technical data

GP 48-2 EPDM with C 26

Normally closed safety edge SL NC II consisting of sensor and aluminium profile from the profile range C 26.

Testing basis	
ISO 13856-2	
Switching characteristics at v_{test} = 100 mm/s	
Switching operations	>10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	14.8 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	90°
Response time	148 ms
Finger detection	no
Safety classifications	
ISO 13856: Reset function	without
ISO 13849-1:2015	Category 3 PL d
B_{10D} (Sensor)	2×10^6
Mechanical operating conditions	
Sensor length (min./max.)	30 cm / 6 m
Cable length (min./max.)	1.5 m / 100 m
Bend radii	not possible
Operating speed	
(min. / max.)	10 mm/s / 200 mm/s
max. load capacity	600 N
IEC 60529: Degree of protection	IP67
Humidity (max. at 23 °C)	95 % (non-condensing)
Operating temperature	-10 to +55 °C
Storage temperature	-20 to +80 °C
Weight	1.0 kg/m
Electrical operating conditions	
Contact transition resistance (max.)	5 Ohm
Number of sensors type BK	max. 10 in series
Switching voltage (PELV) (max.)	48 V DC 48 V AC 50/60 Hz
Protection class	III
Switching current (max.)	20 mA
Contact fuse protection, external	250 mA slow-acting
Connection cable	Ø 3.3 mm PVC 1×0.5 mm²

050320 v2.11-RiA

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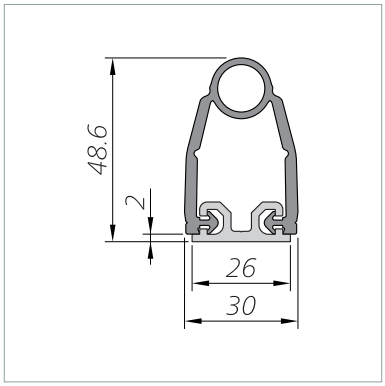
Dimensions and distances

GP 48-2 EPDM (1:2)



Dimensional tolerances according to ISO 3302 E2/L2.

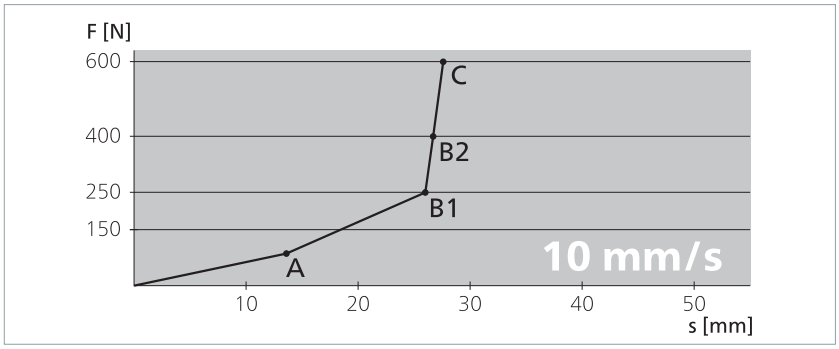
Test conditions

according to ISO 13856-2

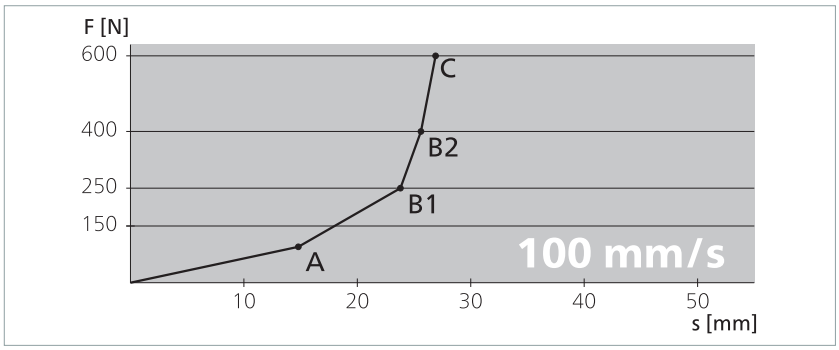
- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- without control unit

Force-distance ratios

Actuation force	86 N
Response time	1440 ms
Actuation distance (A)	14.4 mm
Overtravel distance	
up to 250 N (B1)	11.3 mm
up to 400 N (B2)	12.3 mm
up to 600 N (C)	13.2 mm
Total deformation	27.1 mm



Actuation force	95 N
Response time	148 ms
Actuation distance (A)	14.8 mm
Overtravel distance	
up to 250 N (B1)	10.8 mm
up to 400 N (B2)	11.6 mm
up to 600 N (C)	12.6 mm
Total deformation	26.9 mm



050320 v2.11-RiA

Technical data

GP 65-2 EPDM with C 36

Normally closed safety edge SL NC II consisting of sensor and aluminium profile from the profile range C 36.

Testing basis	
ISO 13856-2	
Switching characteristics at v_{test} = 200 mm/s	
Switching operations	>10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	7 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	90°
Response time	35 ms
Finger detection	no
Safety classifications	
ISO 13856: Reset function	without
ISO 13849-1:2015	Category 3 PL d
B_{10D} (Sensor)	2× 10^6
Mechanical operating conditions	
Sensor length (min./max.)	30 cm / 6 m
Cable length (min./max.)	1.5 m / 100 m
Bend radii	not possible
Operating speed	
(min. / max.)	10 mm/s / 200 mm/s
max. load capacity	600 N
IEC 60529: Degree of protection	IP67
Humidity (max. at 23 °C)	95 % (non-condensing)
Operating temperature	-10 to +55 °C
Storage temperature	-20 to +80 °C
Weight	1.9 kg/m
Electrical operating conditions	
Contact transition resistance (max.)	5 Ohm
Number of sensors type BK	max. 10 in series
Switching voltage (PELV) (max.)	48 V DC 48 V AC 50/60 Hz
Protection class	III
Switching current (max.)	20 mA
Contact fuse protection, external	250 mA slow-acting
Connection cable	Ø 3.3 mm PVC 1× 0.5 mm^2

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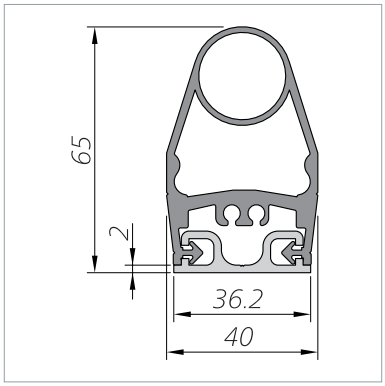
Dimensions and distances

GP 65-2 EPDM (1:2)



Dimensional tolerances according to ISO 3302 E2/L2.

Test conditions

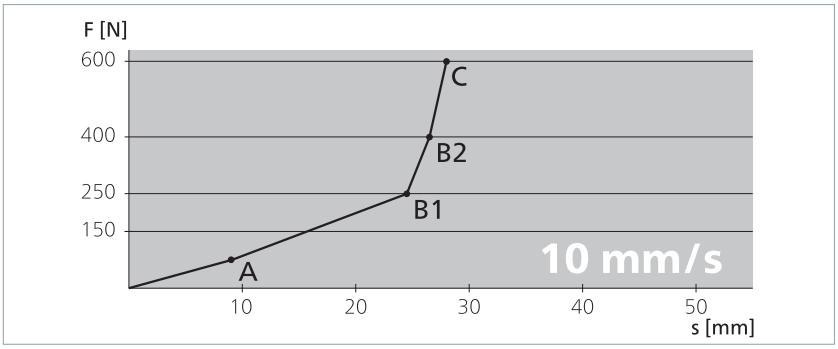
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- without control unit

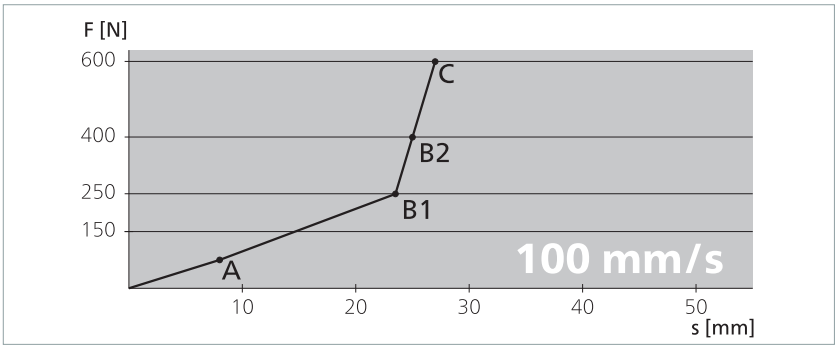
All data stated here is documented in EC design type test certificates.

Force-distance ratios

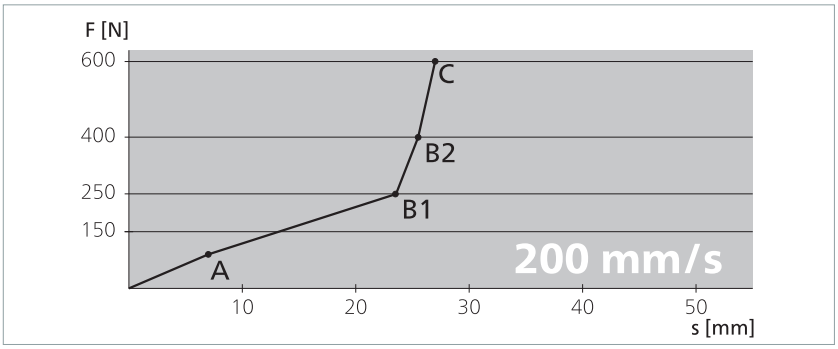
Actuation force	69 N
Response time	890 ms
Actuation distance (A)	8.9 mm
Overtravel distance	
up to 250 N (B1)	15.6 mm
up to 400 N (B2)	17.5 mm
up to 600 N (C)	19.3 mm
Total deformation	28.2 mm



Actuation force	71 N
Response time	80 ms
Actuation distance (A)	8 mm
Overtravel distance	
up to 250 N (B1)	15.5 mm
up to 400 N (B2)	17.3 mm
up to 600 N (C)	19.1 mm
Total deformation	27.1 mm



Actuation force	64 N
Response time	34.5 ms
Actuation distance (A)	6.9 mm
Overtravel distance	
up to 250 N (B1)	16.5 mm
up to 400 N (B2)	18.5 mm
up to 600 N (C)	20 mm
Total deformation	26.9 mm



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Technical data

GP 100-2 EPDM with C 36

Normally closed safety edge SL NC II consisting of sensor and aluminium profile from the profile range C 36.

Testing basis	
ISO 13856-2	
Switching characteristics at v_{test} = 200 mm/s	
Switching operations	>10,000
Actuation force	
Test piece (cylinder) Ø 80 mm	< 150 N
Actuation distance	
Test piece (cylinder) Ø 80 mm	17 mm
Actuation angle	
Test piece (cylinder) Ø 80 mm	90°
Response time	82 ms
Finger detection	no
Safety classifications	
ISO 13856: Reset function	without
ISO 13849-1:2015	Category 3 PL d
B_{10D} (Sensor)	2×10^6
Mechanical operating conditions	
Sensor length (min./max.)	30 cm / 6 m
Cable length (min./max.)	1.5 m / 100 m
Bend radii	not possible
Operating speed	
(min. / max.)	10 mm/s / 200 mm/s
max. load capacity	600 N
IEC 60529: Degree of protection	IP67
Humidity (max. at 23 °C)	95 % (non-condensing)
Operating temperature	-10 to +55 °C
Storage temperature	-20 to +80 °C
Weight	2.1 kg/m
Electrical operating conditions	
Contact transition resistance (max.)	5 Ohm
Number of sensors type BK	max. 10 in series
Switching voltage (PELV) (max.)	48 V DC 48 V AC 50/60 Hz
Protection class	III
Switching current (max.)	20 mA
Contact fuse protection, external	250 mA slow-acting
Connection cable	Ø 3.3 mm PVC 1×0.5 mm²

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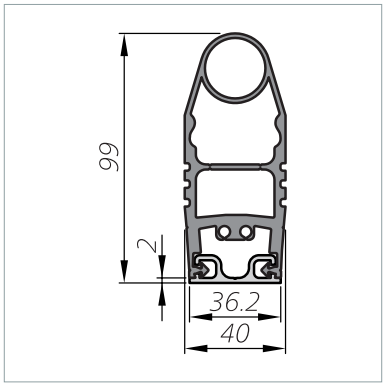
Dimensions and distances

GP 100-2 EPDM (1:3)



Dimensional tolerances according to ISO 3302 E2/L2.

Test conditions

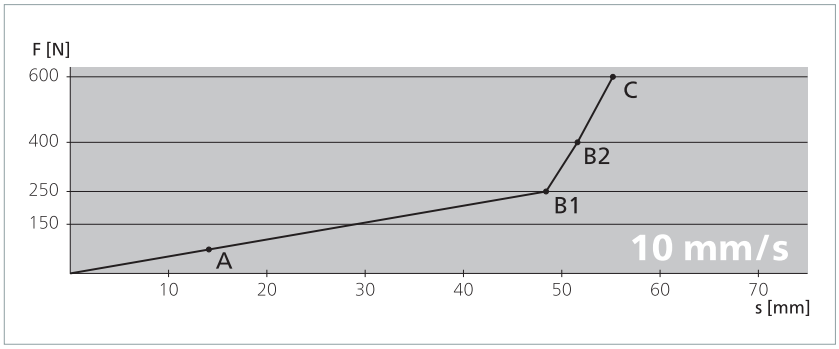
according to ISO 13856-2

- Installation position B
- Temperature +20 °C
- Measurement point c3
- Test sample 1 with Ø 80 mm
- without control unit

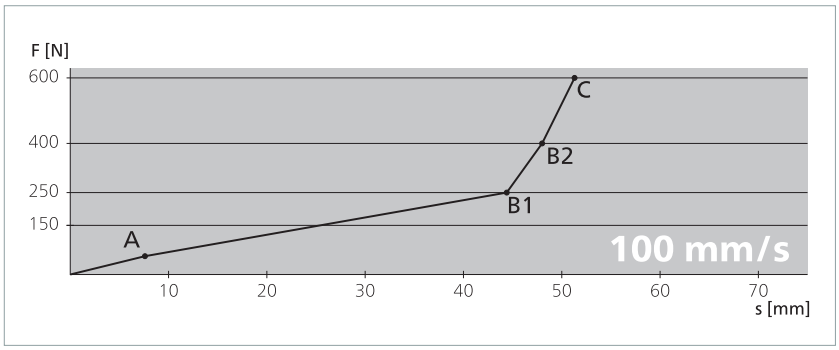
All data stated here is documented in EC design type test certificates.

Force-distance ratios

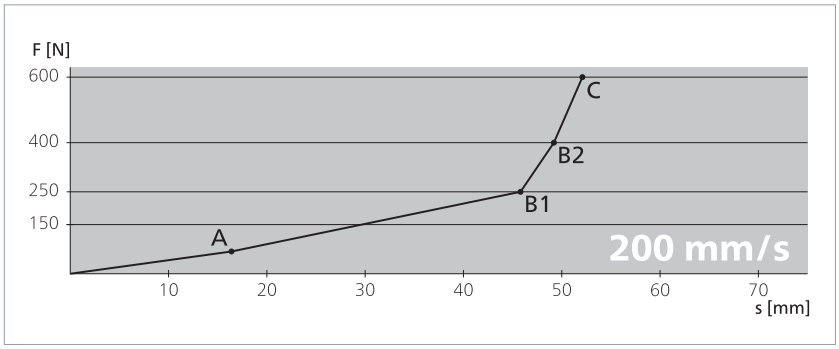
Actuation force	73N
Response time	1410 ms
Actuation distance (A)	14.1 mm
Overtravel distance	
up to 250 N (B1)	34.3 mm
up to 400 N (B2)	37.5 mm
up to 600 N (C)	41.1 mm
Total deformation	55.2 mm



Actuation force	56 N
Response time	76 ms
Actuation distance (A)	7.6 mm
Overtravel distance	
up to 250 N (B1)	36.8 mm
up to 400 N (B2)	40.4 mm
up to 600 N (C)	43.7 mm
Total deformation	51.3 mm



Actuation force	68 N
Response time	82 ms
Actuation distance (A)	16.4 mm
Overtravel distance	
up to 250 N (B1)	29.4 mm
up to 400 N (B2)	32.8 mm
up to 600 N (C)	35.7 mm
Total deformation	52.1 mm



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Conformity

Conformity

The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out.

The design type of the product complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of machinery)
- 2014/30/EU (EMC)

The Declaration of Conformity is available in the download section of the website: www.mayser.com/en/downloads

EC design test

The product was tested by an independent institute.
An EC design type test certificate confirms conformity.
The EC design type test certificate is available in the download section of the website: www.mayser.com/en/downloads

UL certification

Certificates

UL certification	U8V 07 10 31146 006

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Product Information Miniature Safety Edges

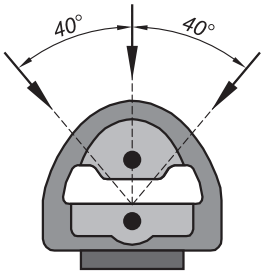
Miniature Safety Edges (EKS) – the "invisible" protection against trapping and nipping

Miniature Safety Edges ...

Tiny dimensions, enormous reliability.
The Miniature Safety Edges are the result of consistent further development and miniaturisation of our Safety Edges which are well known for their reliability in safety applications. Endowed with the same safety and reliability features, the Miniature Safety Edges also have a visual advantage: absolutely tiny and the profile comes in almost any shape and size.

... inside values

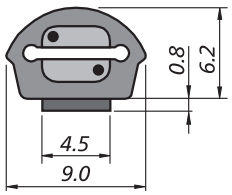
- The heart of the Miniature Safety Edges is the switching chamber which is integrated in the profile. A small amount of pressure to the Miniature Safety Edge suffices to short-circuit two conductive areas which are separated from each other. A sure signal for the evaluating unit connected up.
- Electrically, the Miniature Safety Edge works on the closed circuit principle, i.e. a break in connection is recognized, the danger- bringing movement is brought to a halt.



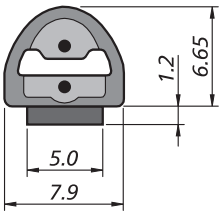
EKS 011

... outside values

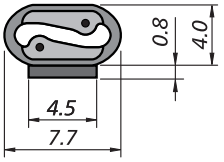
- In addition to the three standard shapes depicted we can also provide customized profiles.
- The design of the Miniature Safety Edge can be practically effortlessly adapted to suit the surroundings.
- The Miniature Safety Edge is in its element in places where only very short overtravel distances are possible.
- Thanks to the minimal dimensions (see to the right) the Miniature Safety Edge can be intregrated into its surroundings in an optimal way.



EKS 002



EKS 011



EKS 026

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Product Information Miniature Safety Edges

Miniature Safety Edges (EKS) – the "invisible" protection against trapping and nipping

... diverse uses

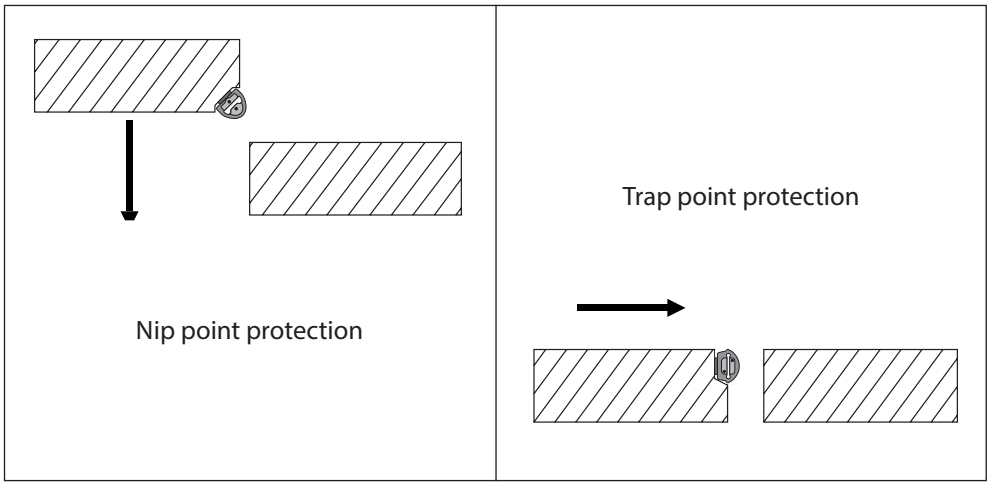
Medical Technology
- Diagnostic equipment
- Radiation apparatus
- Electrically adjustable tables/chairs
- Movable protective hoods
- Rehabilitation equipment (Sports Medicine)

Elevator doors
Bus doors and electric roof lights (finger protection)

Electrically operated screens
- Cash dispensers
- Skylights
- Glass sliding doors

Electrically adjustable furniture
- Computer tables
- Recliners
- Electrically operated writing boards

... sure performance



... technichal details

Distinctive features
- thermoplastic elastomer
- customized TPE-covering
- environment-friendly
- can be recycled

Electrical operating conditions
- max. voltage 24 V DC
- max. current 10 mA

Protection class
- IP65

Operating characteristics
- Response angle: > 90° (depends on shape of profile!)
- Actuating distance: ≤ 1,0 mm
- Actuating force: < 25 N (Test piece: Ø 200 mm)
- Actuating force: < 15 N (Test piece: Ø 4 mm)

Application temperatures
- 40 °C to + 80 °C
(short-time exposure to temperatures up to + 95 °C also possible)

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311018 v1.52

Miniature Safety Edges

(Illustration scale 1:1)

Technical Data

Miniature Safety Edge consisting of sensor type EKS 0XX TPE

1	**Protection class**	**IP65**						
2	**Switching operations**							
	Test piece Ø 10 mm / F=100 N	> 100,000						
3	**Actuating force, actuating distance and response angle**							
3.1	Actuating force	EKS 002			EKS 011		EKS 026	
	v_{test}= 50 mm/min	23 °C	- 25 °C		23 °C	- 25 °C	23 °C	- 25 °C
	Test piece Ø 4 mm	< 10 N	< 15 N		< 15 N	< 30 N	< 10 N	< 20 N
	Test piece Ø 200 mm	< 20 N	< 25 N		< 25 N	< 50 N	< 15 N	< 35 N
3.2	Actuating distance							
	v_{test}= 50 mm/min	23 °C			23 °C		23 °C	
	Test piece Ø 80 mm cyl.	< 1.5 mm			< 2 mm		< 1 mm	
3.3	Response angle	< 60°			< 80°		< 80°	
4	**Mechanical operating and application conditions**							
4.1	Sensor length (min./max.)	70 mm / 150 m			70 mm / 150 m		70 mm / 150 m	
4.2	Bending radii							
	Convex profile curvature	> 50 mm			> 120 mm		> 80 mm	
	Concave profile curvature	> 80 mm			> 150 mm		> 50 mm	
	Across the profile axis	> 120 mm			> 20 mm		> 120 mm	
4.3	Tensile load, cable	max. 60 N			max . 50 N		max. 20 N	
4.4	Working temperature	-25 °C to +80 °C			-25 °C to +80 °C		-25 °C to +80 °C	
	Permissible short term exposure	-40 °C to +100 °C			-40 °C to +100 °C		-40 °C to +100 °C	
5	**Electric operating conditions**							
5.1	End resistor (standard)	1.2 kΩ ±1%			1.2 kΩ ±1%		1.2 kΩ ±1%	
	Performance	max. 250 mW			max. 250 mW		max. 250 mW	
5.2	Transition resistance	< 400 Ω (under load)			< 400 Ω (under load)		< 400 Ω (under load)	
5.3	Electric rating	without end resistor			without end resistor		without end resistor	
	Voltage	max. 24 V DC			max. 24 V DC		max. 24 V DC	
	Current	max. 10 mA			max. 10 mA		max. 10 mA	
		min. 1 mA			min. 1 mA		min. 1 mA	
5.3	Connecting cable	Ø 3.7 mm			Ø 3.4 mm		Ø 1,4 mm per strand	
		2x 0.25 mm²			2x 0.25 mm²		2× 0.35 mm²	
	Class according to IEC 60228	5			6		-	

6 Application using acrylic-foam-adhesive tape

Peel strength	15 N/cm	
Applied to:	using promoter	without promoter
ABS	+	-
Aluminium	+	+
Aluminium, anodised	+	-
Wood: native	-	-
Wood: varnished, veneer or laminated	+	-
PA6	+	-
PA66	+	+
PE, HDPE	-	-
PMMA	+	+
PP	+	-
PS, CAB	-	-
PVC	+	+
SAN	+	-
Steel, stainless steel	+	+

Tests carried out at 23 °C (room temperature).

Note: check with adhesion tests before serial use whether bonding is possible on the selected installation surface.

Key to symbols:
+ = OK
- = not OK

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Miniature Safety Edges

7 Behaviour in fire

According to DIN 75200 — 40 mm/min
Compliance with — StVZO, TA 29, BMW N601 21.0

8. Dimensions tolerances — length according to DIN ISO 3302 L2
section according to DIN ISO 3302 E2

9. Chemical resistance

Miniature Safety Edge EKS	**TPE**
Material characteristics	
Shore A hardness	55 ±5
Chemical resistance	
Acetone	-
Formic acid	-
Armor All	+
Carwash agent	+
Fuel	-
Brake fluid	±
Buraton	+
Butanol	-
Chlorinated bleaching lye	-
Disinfectant 1 %	+
Diesel	-
Acetic acid 10 %	-
Ethyl alcohol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Antifreeze	+
Skin cream	+
Icidin	+
Incidin	+
Incidin plus	+
Cooling lubricants	-
Plastics cleaning agent	+
Lyso FD 10	+
Metal processing oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5 %	+
Spirit (ethyl alcohol)	+
Terralin	+
UV-resistance	+
Centering oil	-

Tests carried out at 23 °C (room temperature).

Key to symbols
+ = resistant
± = limited resistance
- = not resistant

The data given are results of tests which were carried out in our laboratory to the best of our knowledge and belief. We cannot accept any obligations being deduced from them. You must always test the suitability of our products for your special application purpose under practical conditions.

Subject to technical modifications.

Technical Data

Miniature Safety Edges

Miniature Safety Edge consisting of sensor type EKS 01X TPE

1.	**Protection class**		**IP65**			
2.	**Switching opertions**					
	Test piece Ø 10 mm / F=100 N		> 100.000			
3.	**Actuating force, actuating distance and response angle**					
3.1	Actuating force		EKS 014		EKS 015	
	Test speed v_{test}		50 mm/min		100 mm/min	
	Test temperature		23 °C	-25 °C	23 °C	-25 °C
	Testing basis:					
	74/60/EWG and FMVSS118					
	Test piece	Ø 200 mm	< 25 N	< 50 N	–	–
	Test piece	Ø 4 mm	< 15 N	< 30 N	–	–
	Testing basis:					
	EN 1760-2					
	Test piece 1	Ø 80 mm cyl.	–	–	< 25 N	<110N
	Test piece 3	Ø 20 mm	–	–	< 15 N	< 25 N
3.2	Actuating distance					
	Test speed v_{test}		50 mm/min		100 mm/min	
	Test temperature		23 °C		23 °C	
	Test piece 1	Ø 80 mm cyl.	< 2 mm		2 mm	
3.3	Response angle		< 80°		< 40°	
4.	**Mechanical operating and application conditions**					
4.1	Sensor length (min./max.)		70 mm / 150 m		70 mm / 150 m	
4.2	Bending radii					
	Convex profile curvature		> 120 mm		> 800 mm	
	Concave profile curvature		> 150 mm		> 1000 mm	
	Across the profile axis		> 20 mm		> 200 mm	
4.3	Working temperature		- 40 °C to + 80 °C		- 40 °C to + 80 °C	
	Permissible short term exposure		- 40 °C to +100 °C		- 40 °C to +100 °C	
5.	**Electric operating conditions**					
5.1	End resistor (standard)		1.2 kΩ ±1%		1.2 kΩ ±1%	
	Performance		max. 250 mW		max. 250 mW	
5.2	Transition resistance		< 400 Ω (under load)		< 400 Ω (under load)	
5.3	Electric rating		without end resistor		without end resistor	
	Voltage		max. 24 V DC		max. 24 V DC	
	Current		max. 20 mA		max. 20 mA	
			min. 1 mA		min. 1 mA	
5.4	Connecting cable		Ø 3.4 mm		Ø 3.7 mm	
			2x 0.25 mm²		2x 0.25 mm²	
	Class according to VDE 0295		6		5	
6.	**Application with clip-in foot**					
	Clip-in foot width		3.5 mm		7 mm	
	Al-rail type		C10		C15	
7.	**Dimensions tolerances**		**Length according to ISO 3302 L2**			
			Cross section according to ISO 3302 E2			

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Miniature Safety Edges

8. Chemical resistance

Miniature Safety Edge EKS 01X	TPE
Material characteristics	
Shore A hardness	55 ±5
Chemical resistance	
Acetone	-
Formic caid	-
Armor All	+
Carwash agent	+
Fuel	-
Brake fluid	±
Buraton	+
Butanol	-
Chlorinated bleaching lye	-
Disinfectant 1 %	+
Diesel	-
Acetic acid 10 %	-
Ethyl alcohol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Antifreeze	+
Skin cream	+
Icidin	+
Incidin	+
Incidin plus	+
Cooling lubricants	-
Plastics cleanging agent	+
Lyso FD 10	+
Metal processing oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5 %	+
Spirit (ethyl alcohol)	+
Terralin	+
UV-resistance	+
Centering oil	-

Tests carried out at 23 °C (room temperature).

Key to symbols:
+ = resistant
± = limited resistance
- = not resistant

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Subject to technical modifications.

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220605

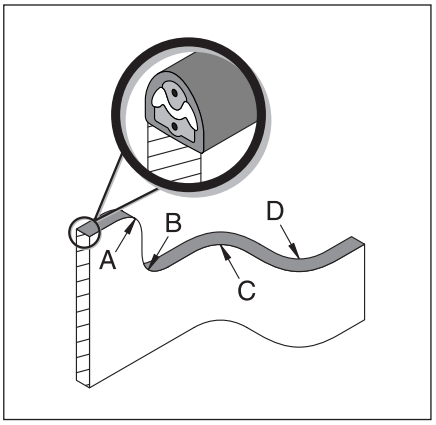
Miniature Safety Edges

Technical Data

Miniature Safety Edge consisting of sensor type EKS 030 TPE

1	**Protection class**	**IP65**	
2	**Switching operations**		
	Test piece Ø 10 mm / F=100 N	> 100 000	
3	**Actuating force, actuating distance and response angle**		
3.1	Actuating force	EKS 030	
	v_{test}= 50 mm/min	23 °C	-25 °C
	Test piece Ø 4 mm	< 15 N	< 25 N
	Test piece Ø 200 mm	< 20 N	< 40 N
3.2	Actuating distance		
	v_{test} = 50 mm/min	23 °C	
	Test piece Ø 80 mm	< 2,0 mm	
3.3	Response angle	< 100°	
4	**Mechanical operating and application conditions**		
4.1	Sensor length (min./max.)	70 mm / 150 m	
4.2	Bending radii, minimum		
	A / B / C / D	70 / 60 / 30 / 30 mm	
4.3	Tensile load, cable	max. 40 N	
4.4	Working temperature	-25 °C to +80 °C	
	Permissible short term exposure	-40 °C to +100 °C	
5	**Electric operating conditions**		
5.1	End resistor (standard)	1.2 kΩ ±1%	
	Performance	max. 250 mW	
5.2	Transition resistance	< 400 Ω (under load)	
5.3	Electric rating	without end resistor	
	Voltage	max. 24 V DC	
	Current	max. 10 mA min. 1 mA	
5.4	Connecting cable	Ø 4.1 mm 2× 0.35 mm²	

Bending radii:



6 Application using acrylic-foam-adhesive tape

Peel strength 15 N/cm

Applied to:	using promoter	without promoter
ABS	+	-
Aluminium	+	+
Aluminium: anodised	+	-
Wood: native	-	-
Wood: varnished, veneer or laminated	+	-
PA6	+	-
PA66	+	+
PE, HDPE	-	-
PMMA	+	+
PP, SAN	+	-
PS, CAB	-	-
PVC	+	+
Steel, stainless steel	+	+

Tests carried out at 23 °C (room temperature).

Note: check with adhesion tests before serial use whether bonding is possible on the selected installation surface.

Key to symbols:
+ = OK
- = not OK

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Miniature Safety Edges

7 Behaviour in fire

According to DIN 75200 — 40 mm/min
Compliance with — StVZO, TA 29, BMW N601 21.0

8 Dimensions tolerances — length according to ISO 3302 L2
section according to ISO 3302 E2

9 Chemical resistance

Miniature Safety Edge EKS	TPE
Material characteristics	
Shore A hardness	52 ±5
Chemical resistance	
Acetone	-
Formic acid	-
Armor All	+
Carwash agent	+
Fuel	-
Brake fluid	±
Buraton	+
Butanol	-
Chlorinated bleaching lye	-
Disinfectant 1 %	+
Diesel	-
Acetic acid 10 %	-
Ethyl alcohol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Antifreeze	+
Skin cream	+
Icidin	+
Incidin	+
Incidin plus	+
Cooling lubricants	-
Plastics cleaning agent	+
Lyso FD 10	+
Metal processing oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5 %	+
Spirit (ethyl alcohol)	+
Terralin	+
UV-resistance	+
Centering oil	-

Tests carried out at 23 °C (room temperature).

Key to symbols:
+ = resistant
± = limited resistance
- = not resistant

The data given are results of tests which were carried out in our laboratory to the best of our knowledge and belief. We cannot accept any obligations being deduced from them. You must always test the suitability of our products for your special application purpose under practical conditions.

Subject to technical modifications.

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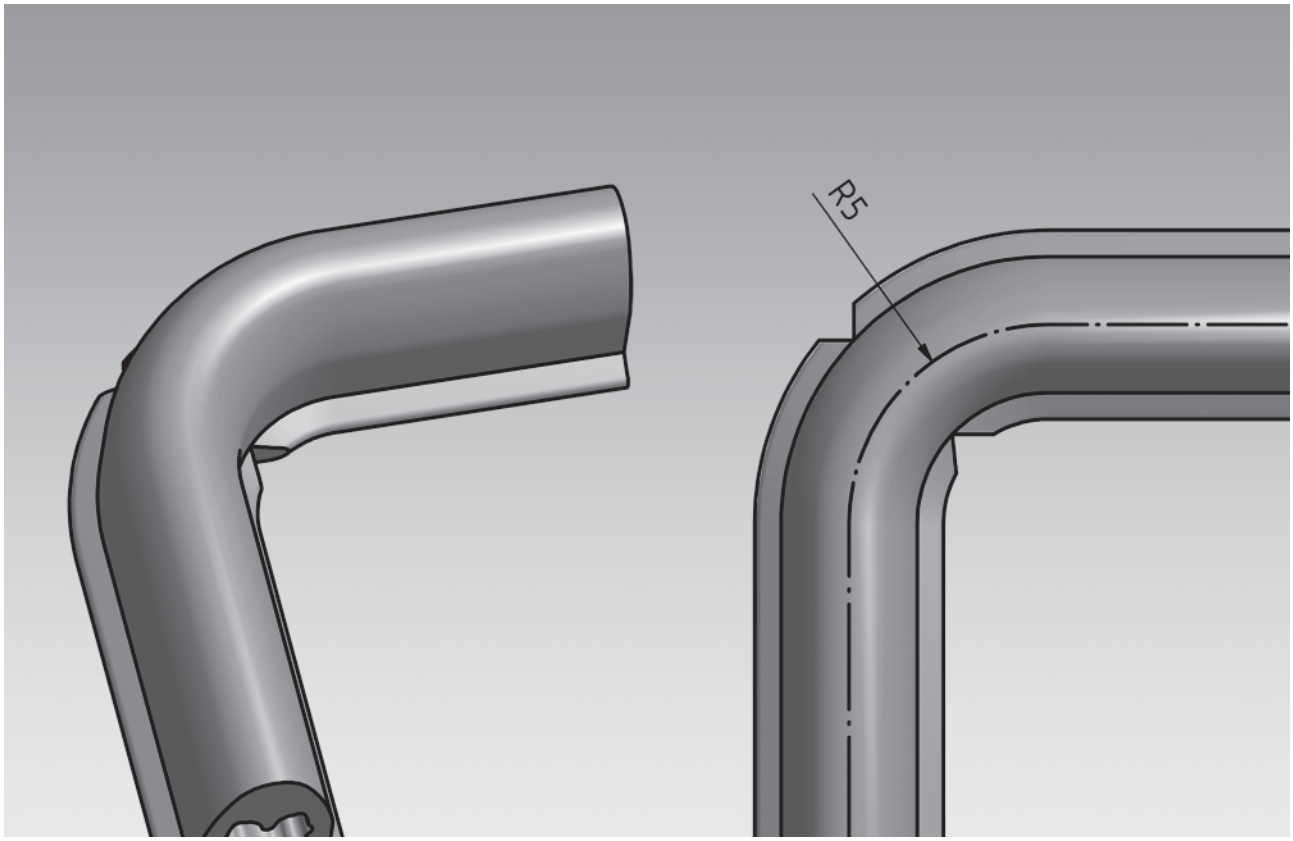
Innovative by tradition.

Product Information



Miniature Safety Edge EKS 038

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MAYSER®

Content

Important information
Read through the product information carefully. It contains important information on operation, safety and maintenance of the product. Retain the product information for later reference.
Always observe the safety instructions on the following pages under **ATTENTION.** Only use the product for the purpose described in the product information.

060217 v1.4c

Definitions

Miniature Safety Edges are sensors for tactile protective devices.
A suitable Control Unit is required for evaluation of the signals.

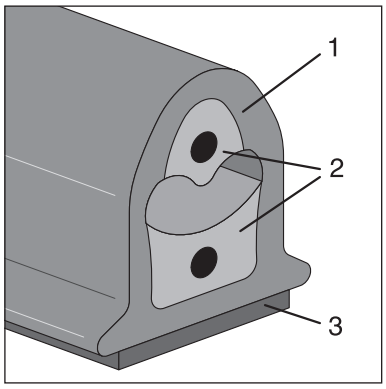
Intended use

A Miniature Safety Edge detects a person or part of the body when pressure is applied to the actuation area. It is part of a linear tripping device. The task of the protective device is to avoid potential hazardous situations for a person within a danger zone such as shearing or pinching edges.
Typical application areas are automatic windows, covers on machines, medical diagnostic equipment and height-adjustable furniture.
Safe operation of a Miniature Safety Edge depends entirely on
- the surface condition of the mounting surface,
- the correct selection of the size and resistance,
- correct installation as well as
- selection of the suitable Control Unit according to ISO 13849-1.

Limits

A maximum of 5 Miniature Safety Edges may be connected to one Control Unit.

Design



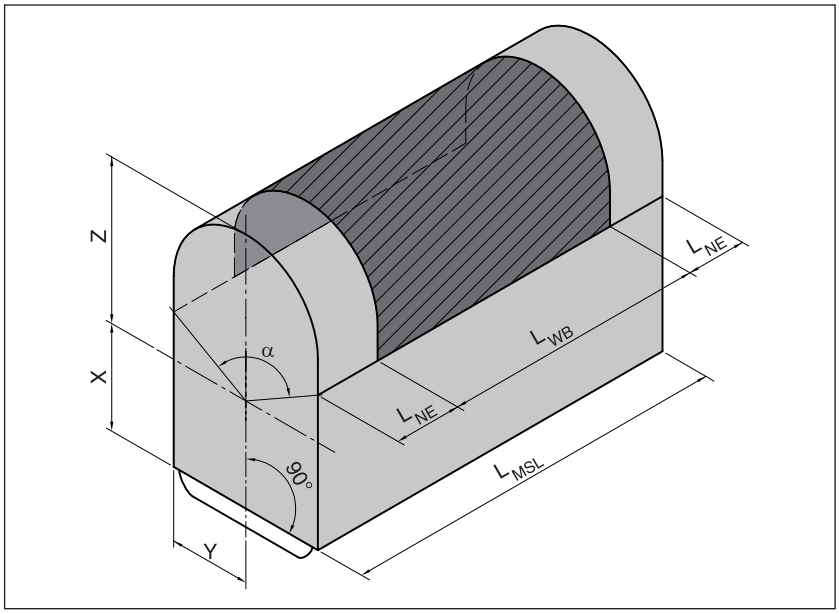
The Miniature Safety Edge EKS 038 consists of
(1) insulating TPE-covering,
(2) conductive contact layers with embedded wires and
(3) self-adhesive acrylic foam on the base of profile.

060217 v1.4c

Effective actuation area

The parameters X, Y, Z, L_{NE} and angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$$L_{WB} = L_{MSL} - 2 \times L_{NE}$$

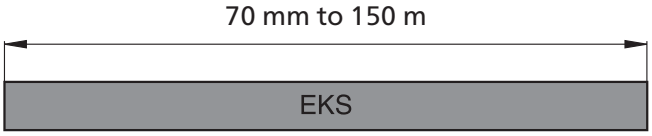


Parameters:

- L_{WB} = effective actuation length
- L_{MSL} = overall length of the Miniature Safety Edge
- L_{NE} = non-sensitive length at the end
- α = effective actuation angle

MSL	EKS 038			
α	60°			
L_{NE}	10 mm			
X	2 mm			
Y	2.65 mm			
Z	2.9 mm			

Available lengths



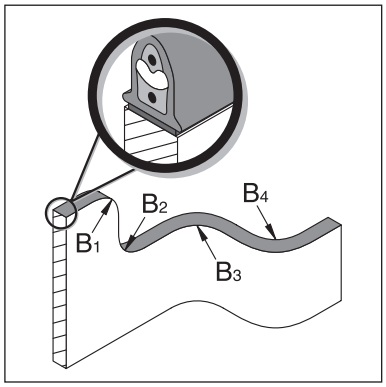
060217 v1.4c

Bend angles and bend radii

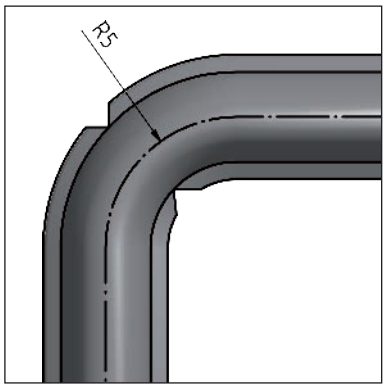
Bend angles

Bend angles are not possible on the Miniature Safety Edge.

Bend radius



Bend radius min.	EKS 038
B_1	500 mm
B_2	300 mm
B_3	15 mm
B_4	15 mm



Small 90° bends can also be implemented: Small bend radii up to 5 mm are possible for B_3 and B_4 with two opposite cuts in the protruding parts of the profile base.

Installation position

The installation position can be selected as required.

CAUTION
No pressure must be exerted on the Miniature Safety Edge in non-operative mode.

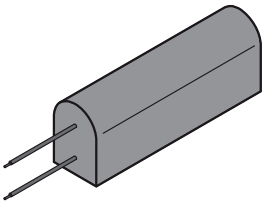
060217 v1.4c

Connection

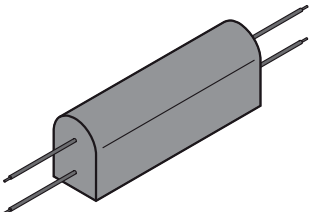
Cable exits

Tip
With more than one sensor connected one behind the other, we recommend the BK versions.

Axial exit



Version: EKS 038/W



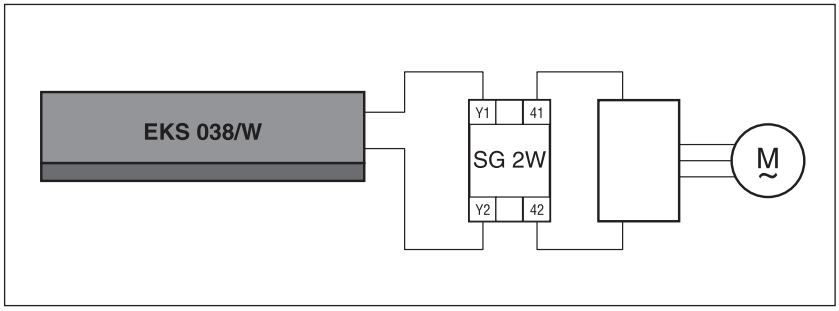
Version: EKS 038/BK

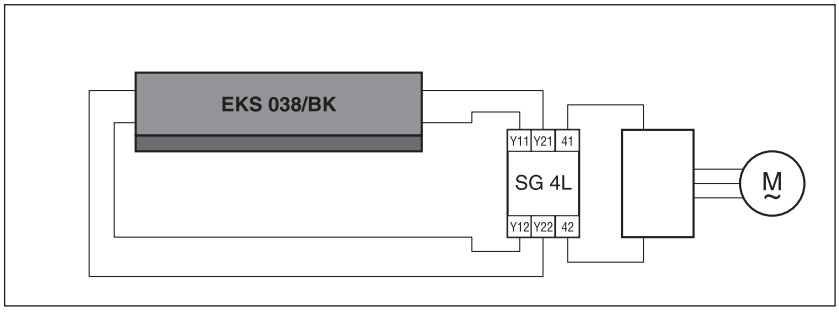
Cable connection

CAUTION
The cables must be laid free of tension.

- Cable: 0.35 mm² per strand, Ø 1.4 mm, black
- Cable length: 2.0 m
  Option: to max. 200 m
- Cable ends: strands stripped
  Option: cable ends available with plug and coupling

Connection example





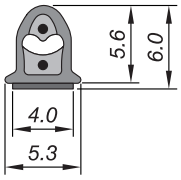
Key:

SG 2W	2-wire-technology evaluation
SG 4L	4-wire-technology evaluation
	Y11, Y12 lower cables; Y21, Y22 upper cables

060217 v1.4c

Profiles

Dimensions and operating paths

EKS 038	
	
Actuation force: < 50 N Actuation distance: < 1.2 mm	

Physical resistance

Miniature Safety Edges EKS	TPE
Degree of protection (IEC 60529)	IP65
Hardness as per Shore A	50 ±5
Behaviour in fire (DIN 75200)	approx. 40 mm/min

060217 v1.4c

Chemical resistance

The Miniature Safety Edge is resistant against normal chemical influences such as diluted acids and alkalis as well as alcohol over an exposure period of 24 hrs.

The values in the table are results of tests carried out in our laboratory to the best of our knowledge and belief. The suitability of our products for your special area of application must always be verified with your own practical tests.

Explanation of symbols:
+ = resistant
± = resistant to a certain extent
- = not resistant

Miniature Safety Edge EKS	TPE
Acetone	-
Formic acid	-
Armor All	+
Car shampoo	+
Buraton	+
Butanol	-
Sodium hypochlorite	-
Disinfectant	+
Acetic acid 10 %	-
Ethanol	+
Ethyl acetate	-
Ethylene glycol	+
Window cleaner	
Alcohol-based	+
Alkaline cleaner	+
Neutral cleaner	+
Greases	±
Volatile softeners	-
Anti-frost agent	+
Skin cream	+
Icidine	+
Incidine	+
Incidine plus	+
Plastic cleaner	+
Lyso FD 10	+
Metal working oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5 %	+
Spirit (ethyl alcohol)	+
Terralin	+
UV-resistance	+
Centring oil	-

Note:
Tests are carried out at room temperature (+23 °C).

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Attachment

Per acrylic-foam adhesive tape

Requirements
For ideal bonding, the bonding surface must be
+ clean
+ dry
+ smooth.

Avoid
- very uneven
- sharp-edged bonding surfaces.

Recommended working temperature: +15 to +25°C.

Note:
Check with adhesion tests before serial use whether bonding is possible on the selected installation surface.

Bonding with ... on ...	with Primer	without Primer
ABS	1	-
Aluminium: natural	1	+
Aluminium: anodised	1 / 3	-
Aluminium: powder-coated	1	-
CAB	-	-
Glass	4 / 5	-
Wood: natural	-	-
Wood: glazed, varnished	2	-
Wood: veneered, light weight building board	2	-
PA6, PA66	3	-
PE, HDPE	-	-
PMMA	1	-
PP	1	-
PS	-	-
PVC	2	-
SAN	1	-
Steel, stainless steel	1 / 3	-

Explanation of symbols:
+ = suitable
- = not suitable
1 = Primer 4298UV
2 = Primer 4297
3 = Multiprimer
4 = Silan Primer
5 = Primer 4299

Note:
Tests are carried out at room temperature (+23 °C).

Preparation
Only applies to bend radii < 15 mm.

1. Measure bend locations and mark on both sides.

2. Carefully cut into both profile sides at the markings, making sure you only cut the projecting part.

CAUTION
Damage to the rest of the TPE-covering renders the Miniature Safety Edge unusable. Dispose of faulty Miniature Safety Edge.

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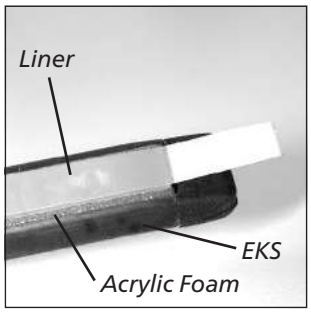
Bonding



1. Clean and degrease bonding surface (e.g. with isopropanol).
2. Apply primer as thinly as possible to complete bonding surface with brush.
3. Air dry primer for approx.10 minutes.
4. Remove 10 to 15 cm of liner from acrylic foam.
5. Place on bonding surface and press on firmly, without any tensile stress.
6. Repeat items 4. and 5. until EKS is completely bonded.
7. Maximum adhesion is achieved after 24 hrs.

Note:
If tensile stress is applied, the EKS can become several millimetres longer.

Tip:
For long straight sections, an extended try square may be useful for alignment.

Installation accessories

Part no.	Designation	Pack. unit
7500462	Primer 4298 type 3M, 125 ml, in can	1 pc.
7501995	Primer 4297 type 3M, 125 ml, in can	1 pc.
1003360	Multiprimer, 250 ml 24-P	1 pc.

ATTENTION
Smaller winding diameters cause separation of the liner and therefore damage to the self-adhesive acrylic foam.

Storage

Correct storage of the Miniature Safety Edge requires a winding diameter of at least 600 mm.

060217 v1.4c

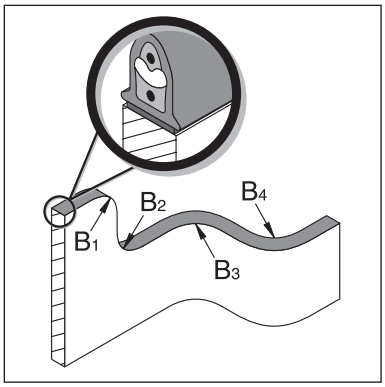
Technical data

Miniature Safety Edge EKS 038 cut-to-size
with resistor (type W) or
without resistor (type BK).

1:1

Switching characteristics at v_{test} = 50 mm/min		
Switching operations	> 1× 10^5	
Actuating force	**+23 °C**	**-25 °C**
Test piece (rod) Ø 4 mm	< 15 N	< 25 N
Test piece (rod) Ø 200 mm	< 35 N	< 50 N
Actuating distance		
Test piece (cylinder) Ø 80 mm	< 1.2 mm	
Actuation angle		
Test piece (cylinder) Ø 80 mm	± 30°	
Safety classifications		
B_{10d} as per ISO 13849-1	2× 10^6	
Mechanical operating conditions		
Sensor length (min./max.)	70 mm / 150 m	
Cable length (min./max.)	2 / 200 m	
Attachment	Using acrylic-foam adhesive	
Peel force	15 N/cm	
Bend radii, minimum		
B_1 / B_2 / B_3 / B_4	500 / 300 / 15 / 15 mm	
IEC 60529: Degree of protection	IP65	
Operating temperature	-25 °C to +80 °C	
short-term (15 min)	-40 °C to +100 °C	
Electrical operating conditions		
Terminal resistance	1k2 ± 5%	
Output	max. 250 mW	
Contact transition resistance	< 400 Ohm (per sensor)	
More than one sensor	max. 5 in series	
Electrical rating		
Voltage	max. 24 V DC	
Current (min./max.)	1 mA / 10 mA	
Connection cable	Ø 1.4 mm per strand 2× 0.35 mm²	
Control Unit (recommendation)		
ISO 13849-1 Cat. 3	SG-EFS 104/2W (type W)	
ISO 13849-1 Cat. 3	SG-EFS 104/4L (type BK)	
Chemical resistance		
The Miniature Safety Edge is resistant against normal chemical influences over a period of exposure of 24 hrs (see p. 8).		
Dimensional tolerances		
Length as per	ISO 3302 L2	
Profile section as per	ISO 3302 E2	

Bend radii:



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MAYSER®

Request for quotation

From:

Fax:

+49 731 2061-222

Company

Department

Name, first name

P. O. Box | Post code | City

Street | Post code | City

Phone | Fax | E-mail

Area of application

(e.g.. window construction, medical technology, machine closing edges, public transport, ...)

⇩ Please keep free! ⇩
For internal use only

Mechanical conditions

EKS _____

❍ Type BK
❍ Type W with resistor _____ kΩ

Length: _____ m
Packing unit: _____ units

Attachment per:
❍ Bonding
❍ Snap-in foot

❑ Angle piece construction: ____ × per EKS

❑ Cable length: ____ m (standard: 2.0 m)

❑ Number of monitoring circuits: ____

❑ SG- _____

Pinching and shearing edges to be protected:
(Diagram incl. mounting possibility and cable routing)

060217 v1.4c

MAYSER®

Innovative by tradition.

DIY Miniature safety edges

EN | Product information

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Contents

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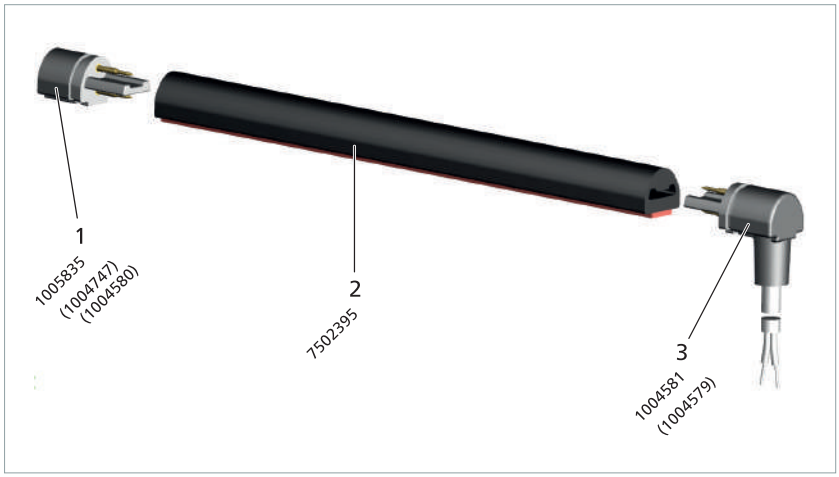
Overview

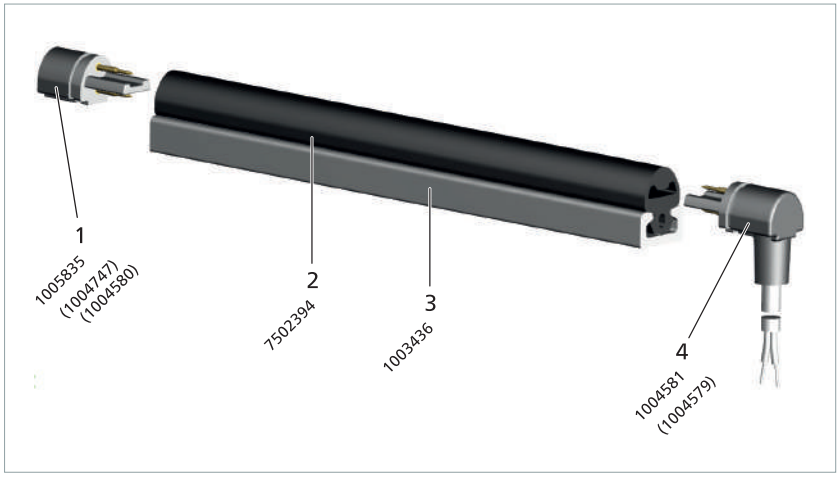
Contact profile – Miniature safety edge

The semi-finished contact profile is cut to length and assembled with the other components. The functioning product is then called a miniature safety edge.



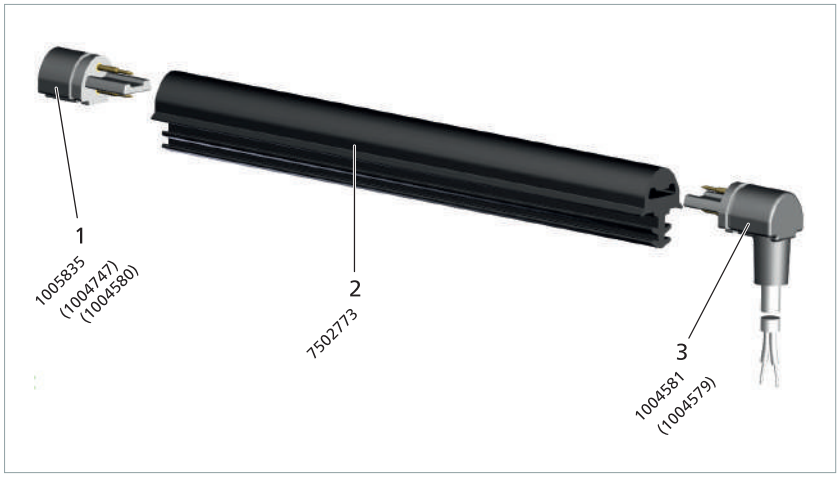
EKS 011 TPE

1 End piece with resistor
2 Contact profile
3 End piece with cable



EKS 014 TPE

1 End piece with resistor
2 Contact profile
3 Aluminium profile
4 End piece with cable



EKS 052 TPE

1 End piece with resistor
2 Contact profile
3 End piece with cable

Subject to technical modifications.

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Materials list

Part No.	Designation	PU
7502395	Contact profile EKS 011 TPE, self-adhesive	50 m
7502394	Contact profile EKS 014 TPE, with snap-in foot	50 m
7502773	Contact profile EKS 052 TPE, with clamp foot	45 m
1004580	End piece with resistor 1k2	50 pc.
1004747	End piece with resistor 2k2	50 pc.
1005835	End piece with resistor 8k2	50 pc.
1004579	End piece with PUR cable 2.5 m, axial	50 pc.
1004581	End piece with PUR cable 2.5 m, angled 90°	50 pc.
1003436	Aluminium profile C 10 for EKS 014 with snap-in foot	6 m
1004988	Scissors with stop	1 pc.
7502412	Assembly aid set	1 pc.
1004987	Special adhesive Contact VA 250 Black, 12 g, for IP64	1 pc.
7501995	Primer 4297 Type 3M, 125 ml, in can	1 pc.

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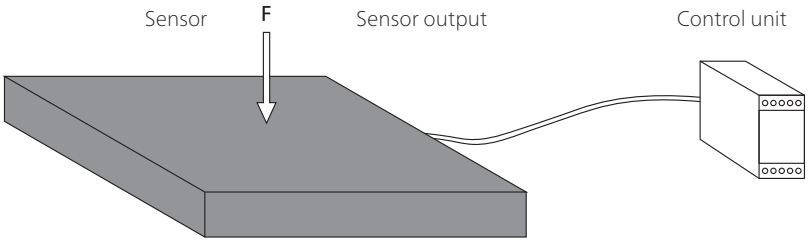
Subject to technical modifications.

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of pressure-sensitive sensor(s), signal processing and output signal switching device(s). The control unit is made up of the signal processing and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

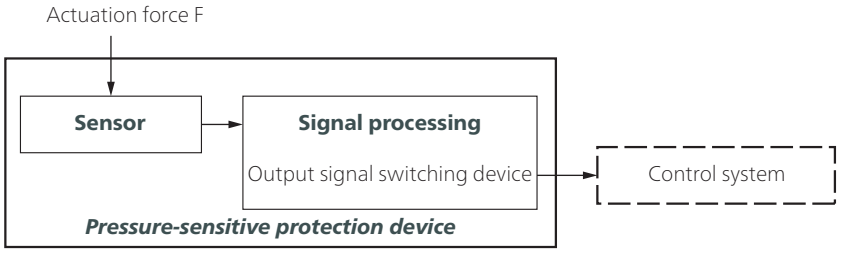


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuating force F is applied. Mayser safety systems have a sensor whereby the actuating surface is deformed locally.

Signal processing

The signal processing is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is that part of the signal processing which is connected to the machine controls and transmits safety output signals such as STOP.



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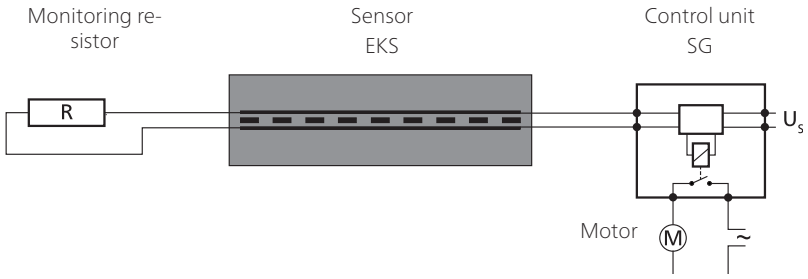
Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP40 is the standard for diy miniature safety edges.
  Higher degree of protection possible with special adhesive (part no.: 1004987).
- Low switching forces
- Minimum overall height

Operation principle 2-wire-technology



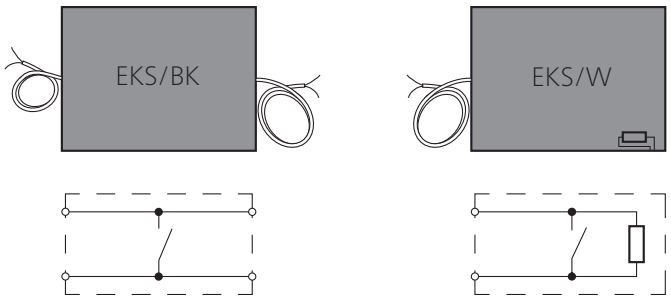
The monitoring resistor must be compatible with the control unit.
Standard value is 8k2.

For your safety:
Sensor and connecting cables are constantly monitored for function.
Monitoring is carried out by controlled bridging of the contact surfaces with a monitoring resistor (closed current principle).

Design

EKS/BK with cables on both sides as a through sensor or as an end sensor with external monitoring resistor

EKS/W as an end sensor with integrated monitoring resistor



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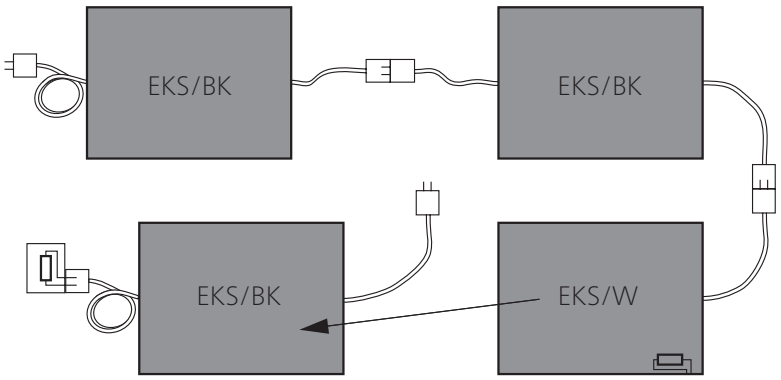
Subject to technical modifications.

Combination of sensors

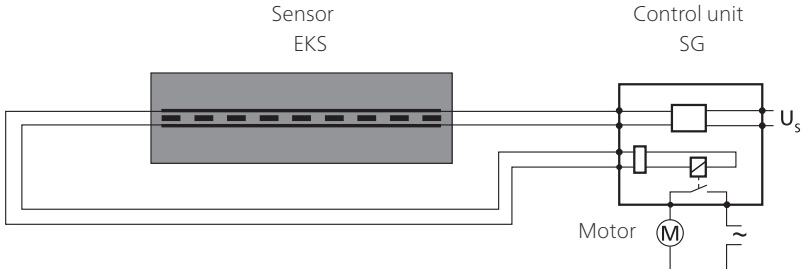


Model with external resistor, thus avoiding variety in type

Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

Operation principle 4-wire-technology

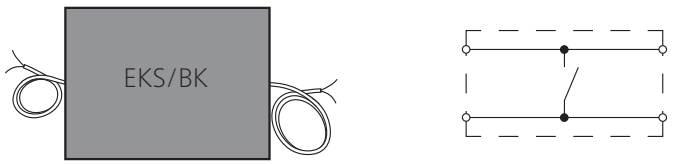


The 4-wire technology can be used only together with control unit SG-EFS 104/4L.

For your safety:
Sensor and connecting cables are constantly monitored for function. This is possible because of signal transmission feedback – without monitoring resistor.

Design

EKS/BK with cables on both sides as a through sensor



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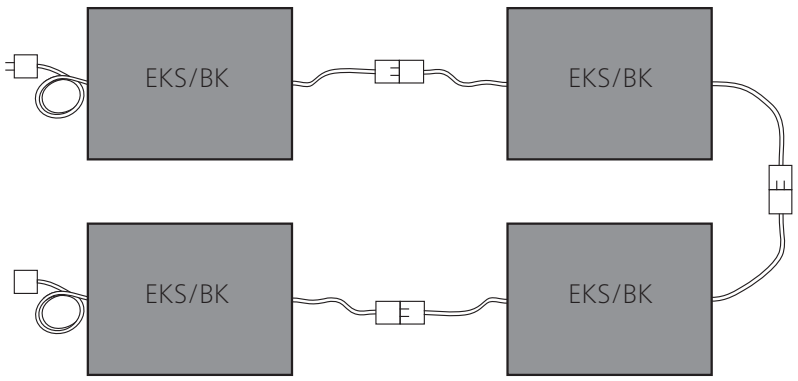
Subject to technical modifications.

Combination of sensors



Combination:

- Connection of more than one sensor
- Only one control unit required
- Safety edge design with custom lengths and angles

Safety

Intended use

A safety edge detects a person or the person's limbs from the pressure exerted on the effective actuation area. It is a linear tripping device. It is designed to prevent potential hazardous situations such as shearing and pinching edges for a person within a danger zone.
Typical areas of use are automated windows and façade systems, automation technology and moving units in medical technology.
The reliable functioning of a safety edge depends on

- the surface condition of the mounting surface,
- the correct choice of EKS profile,
- and proper installation.

Due to the design, the visible actuation area is reduced by the non-sensitive edges. What remains is the actual effective actuation area (see chapter *Effective actuation area*).

Limits

- max. 3 sensors type BK on one control unit
- max. 2 sensors type BK and 1 sensor type W on one control unit

If more sensors are required, please contact Mayser's service department.

060319 v2.01-RiA

Subject to technical modifications.

Exclusions

The sensors are not suitable for performing a sealing function. Constant actuation of sensors can result in permanent damage.

Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit

Performance Level (PL)
Exclusion of error according to ISO 13849-2, Table D.8: Non-closing of contacts in the case of pressure-sensitive safety devices according to ISO 13856. In this case, none of the sensor parameters are used for determining the PL. Assuming the control unit has a high $MTTF_D$ value, the entire miniature safety edge system (pressure-sensitive safety device) can achieve the maximum value PL d.

Is the safeguard appropriate?
The PL required for the hazard must be decided by the integrator. This is followed by the choice of safeguard.
Finally, the integrator needs to check whether the category and PL of the safeguard chosen are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine we recommend ISO 12100 „Safety of machinery – general principles for design".

Without reset function
When a safeguard without reset function is used (automatic reset), the reset function must be made available in some other way.

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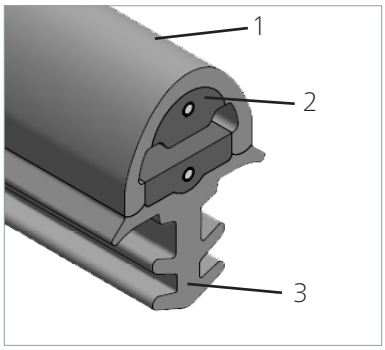
Design



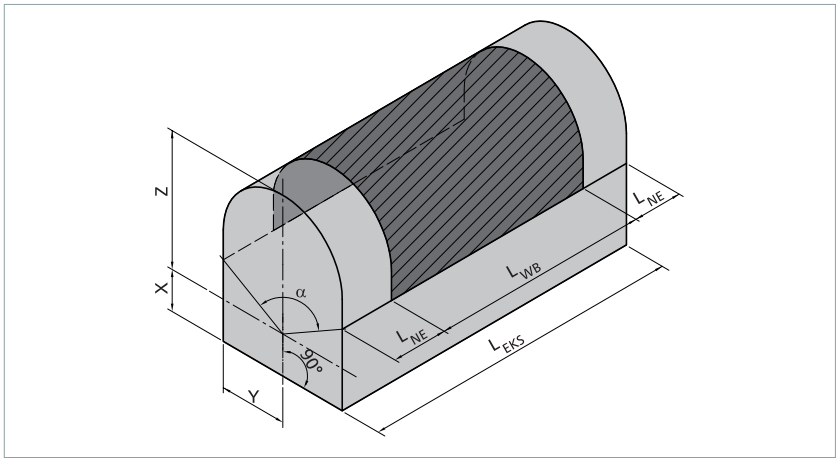
The miniature safety edge consists of
a sensor (1 to 3)
(1) contact profile EKS with
(2) integrated NO contact safety element,
(3) mounting element.

Effective actuation area

The parameters X, Y, Z, L_{NE} and the angle α describe the effective actuation area.
For the effective actuation area, the following applies:

$$L_{WB} = L_{EKS} - 2 \times L_{NE}$$

Parameters:
L_{WB} = effective actuation length
L_{EKS} = total length of miniature safety edge
L_{NE} = non-sensitive length at end of miniature safety edge
α = effective actuation angle



		EKS 011	EKS 014	EKS 052
α		80°	80°	80°
L_{NE}	End piece W	27 mm	27 mm	27 mm
	End piece cable angled 90°	28.5 mm	28.5 mm	28.5 mm
	End piece cable axial	32 mm	32 mm	32 mm
X		2.05 mm	2.3 mm	2.1 mm
Y		3.95 mm	3.9 mm	4.7 mm
Z		4.6 mm	4.5 mm	4.5 mm

Subject to technical modifications.

060319 v2.01-RiA

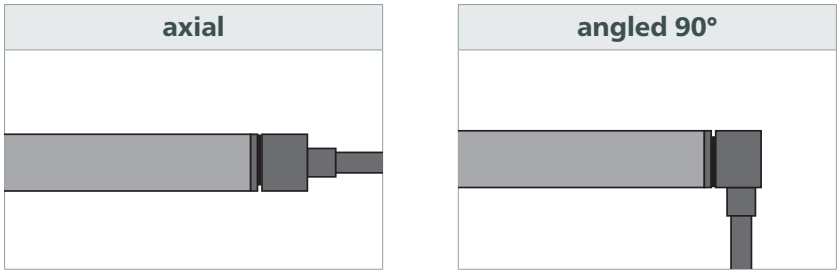
Installation position

The installation position is variable.
In idle state, it must be ensured that no pressure is exerted on the sensors.

Connection

Cable exits

Two cable exits are available: axial and 90° angle.

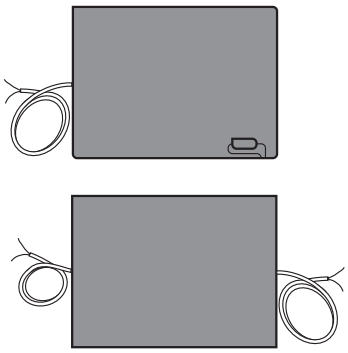


Cable connection

- Standard cable lengths
  L = 2,5 m
- Maximum total cable length to the control unit
  L_{max} = 100 m

Sensor type W

- As a single sensor type W or an end sensor type W
- Integrated resistor
- 2-wire cable (Ø 2.9 mm PUR, 2× 0.25 mm² Cu)



Sensor type BK with 2 lines

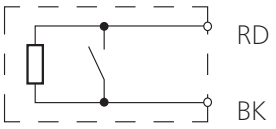
- As a feed-through sensor type BK
- Without resistor
- Two 2-wire cables (Ø 2.9 mm PUR, 2× 0.25 mm² Cu)

060319 v2.01-RiA

Subject to technical modifications.

Wire colours

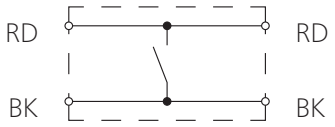
Sensor type W



Colour coding

BK	Black
RD	Red

Sensor type BK with 2 lines



Sensor surface

Physical resistance

Miniature safety edge EKS	TPE
IEC 60529: Degree of protection	IP40
UV-resistance	yes

Higher degree of protection
A special adhesive (part no. 1004987) allows a higher degree of protection up to IP64.

Chemical resistance

The sensor is resistant against normal chemical influences such as diluted acids and alkalis as well as alcohol over an exposure period of 24 hrs.

The specifications in the table are the result of tests conducted in our lab at room temperature (+23 °C). The suitability of our products for your special area of application must always be verified with your own practical tests.

060319 v2.01-RiA

Subject to technical modifications.

Material	TPE
Acetone	-
Formic acid	-
Armor All	+
Car shampoo	+
Petrol	-
Brake fluid	+
Buraton	+
Butanol	-
Sodium hypochlorite	-
Disinfectant 1 %	+
Diesel	-
Acetic acid 10 %	-
Ethanol	+
Ethyl acetate	-
Ethylene glycol	+
Greases	±
Anti-frost agent	+
Skin cream	+
Icidine	+
Incidine	+
Incidine plus	+
Cooling lubricant	-
Plastic cleaner	+
Lyso FD 10	+
Metal working oil	-
Microbac	+
Microbac forte	+
Minutil	+
Saline solution 5 %	+
White spirit (ethyl alcohol)	+
Terralin	+
Centring oil	-

Explanation of symbols:

+ = resistant
± = resistant to a certain extent
- = not resistant

060319 v2.01-RiA

Subject to technical modifications.

Attachment

Three mounting types are available:
- Acrylic foam adhesion
- Snap-in foot
- Clamp foot

The mounting type depends on the selected contact profile.

Mounting type	EKS 011	EKS 014	EKS 052
Acrylic foam adhesion	•	–	–
Snap-in foot	–	•	–
Clamp foot	–	–	•

Per acrylic foam adhesion

The miniature safety edge is equipped with double-sided foam adhesive tape. The double-sided foam adhesive tape (acrylic foam) is already affixed to the bottom side of the contact profile.

With primer
The clean, dry and smooth bonding surface must be treated with primer before the miniature safety edge is mounted.

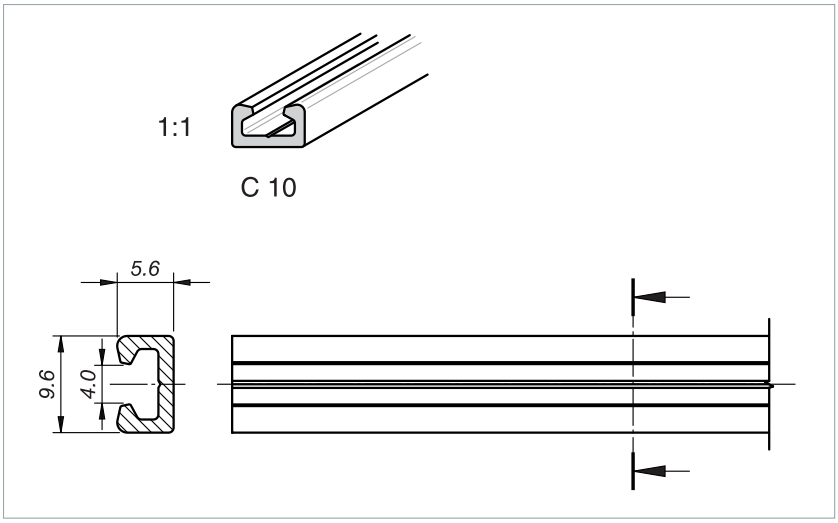
Without primer
Only in the case of uncoated aluminium, the acrylic foam also adheres dependably without primer.

Not suitable
The following materials are not suitable for acrylic foam adhesive tape: CAB, glass, natural wood, PE, HDPE and PS.

060319 v2.01-RiA

Per snap-in foot

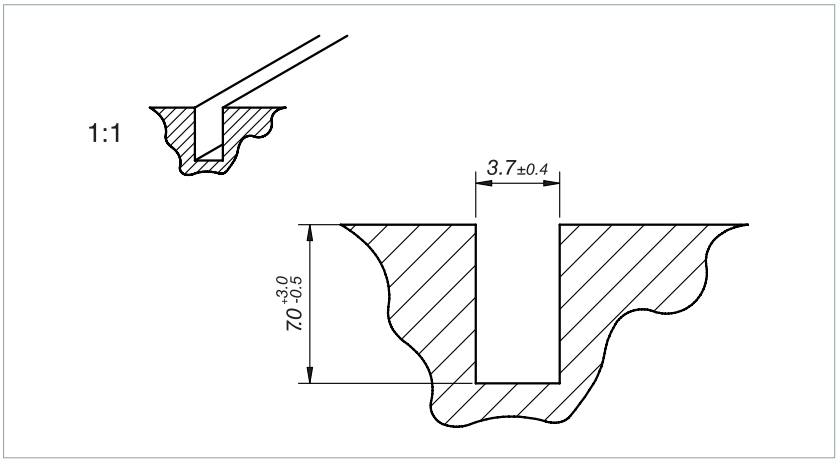
The miniature safety edge is clipped into an aluminium profile.



Aluminium profile C 10
Standard profile for EKS 014:
First the aluminium profile must be mounted onto the closing edge and then the miniature safety edge clipped into the aluminium profile.

Per clamp foot

The miniature safety edge is pressed into a groove.
A precise groove provides for an accurate and lasting fit.



060319 v2.01-RiA

Subject to technical modifications.

Maintenance and cleaning

The sensors are virtually maintenance-free.
The control unit also monitors the sensor.

Regular inspection

Depending on the utilisation, sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- damage,
- and correct mounting.

Cleaning

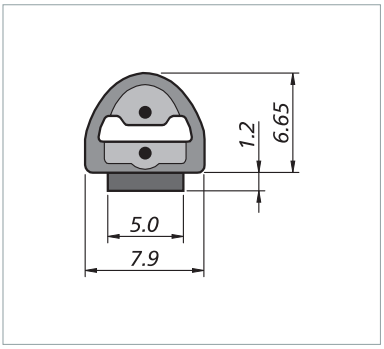
If the sensors become dirty, they can be cleaned with a mild cleaning product.

060319 v2.01-RiA

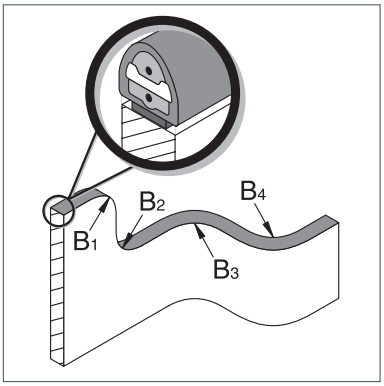
Technical data

SK EKS 011 TPE

Miniature safety edge (without sensor)	**SK EKS/W 011 TPE or SK EKS/BK 011 TPE**	
Test principles	based on ISO 13856-2	
Switching characteristics at v_{test} = 50 mm/s		
Switching operations		
Test piece Ø 10 mm, F = 100 N	> 1× 10^5	
Actuation force	**+23 °C**	**-25 °C**
Test piece Ø 4 mm	< 15 N	< 30 N
Test piece (cylinder) Ø 200 mm	< 25 N	< 50 N
Actuation distance		
Test piece (cylinder) Ø 80 mm	< 2.0 mm	
Actuation angle		
Test piece (cylinder) Ø 80 mm	± 40°	
Finger detection	yes	
Safety classifications		
ISO 13849-1: B_{10D}	2× 10^6	
Mechanical operating conditions		
Sensor length (min./max.)	10 cm / 50 m	
Cable length	2.5 m	
Acrylic foam: Peel force	15 N/cm	
Bend radii (min.): B_1 / B_2 / B_3 / B_4	120 / 150 / 20 / 20 mm	
max. load capacity (signal)	600 N	
Tensile load, cable (max.)	20 N	
IEC 60529: Degree of protection	IP40	
Operating temperature	-25 to +80 °C	
short-term (15 min)	-40 to +100 °C	
Storage temperature	-40 to +80 °C	
DIN 75200: Behaviour in fire	ca. 40 mm/min	
Weight (with Acrylic foam)	43 g/m	
Electrical operating conditions		
Terminal resistance (±1%)	1k2, 2k2 or 8k2	
Rated capacity (max.)	250 mW	
Contact transition resistance	< 400 Ohm (per sensor)	
Number of sensors type BK	max. 3 in series (For more information refer to the chapter *Limits)*	
Switching voltage (max.)	DC 24 V	
Switching current (min. / max.)	1 mA / 10 mA	
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²	
Dimensional tolerances		
Length according to	ISO 3302 L2	
Profile section according to	ISO 3302 E2	



Bend radii:



Higher degree of protection, higher tensile load

A special adhesive (part no. 1004987) allows a higher degree of protection up to IP64 and a tensile load on the cable up to 60 N.

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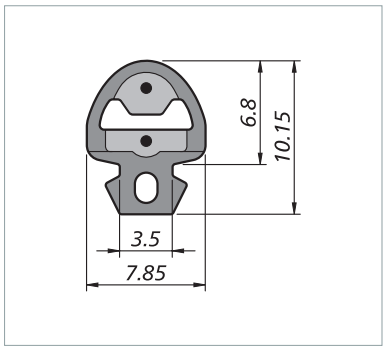
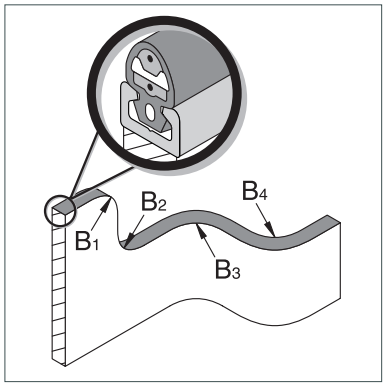
Technical data

SK EKS 014 TPE



Bend radii:



Higher degree of protection, higher tensile load

A special adhesive (part no. 1004987) allows a higher degree of protection up to IP64 and a tensile load on the cable up to 60 N.

Miniature safety edge (without sensor)	**SK EKS/W 014 TPE or SK EKS/BK 014 TPE**	
Test principles	based on ISO 13856-2	
Switching characteristics at v_{test} = 50 mm/s		
Switching operations		
Test piece Ø 10 mm, F = 100 N	> 1× 10^5	
Actuation force	**+23 °C**	**-25 °C**
Test piece Ø 4 mm	< 15 N	< 30 N
Test piece (cylinder) Ø 200 mm	< 25 N	< 50 N
Actuation distance		
Test piece (cylinder) Ø 80 mm	< 2.0 mm	
Actuation angle		
Test piece (cylinder) Ø 80 mm	± 40°	
Finger detection	yes	
Safety classifications		
ISO 13849-1: B_{10D}	2× 10^6	
Mechanical operating conditions		
Sensor length (min./max.)	10 cm / 50 m	
Cable length	2.5 m	
Snap-in foot width	3.5 mm	
Alu-Profil (empfohlen)	C 10	
Bend radii (min.): B_1 / B_2 / B_3 / B_4	120 / 150 / 20 / 20 mm	
max. load capacity (signal)	600 N	
Tensile load, cable (max.)	20 N	
IEC 60529: Degree of protection	IP40	
Operating temperature	-25 to +80 °C	
short-term (15 min)	-40 to +100 °C	
Storage temperature	-40 to +80 °C	
DIN 75200: Behaviour in fire	ca. 40 mm/min	
Weight (without/with Aluuminium profile)	49 g/m / 125 g/m	
Electrical operating conditions		
Terminal resistance (±1%)	1k2, 2k2 or 8k2	
Nennleistung (max.)	250 mW	
Contact transition resistance	< 400 Ohm (per sensor)	
Number of sensors type BK	max. 3 in series (For more information refer to the chapter *Limits)*	
Switching voltage (max.)	DC 24 V	
Switching current (min. / max.)	1 mA / 10 mA	
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm^2	
Dimensional tolerances		
Length according to	ISO 3302 L2	
Profile section according to	ISO 3302 E2	

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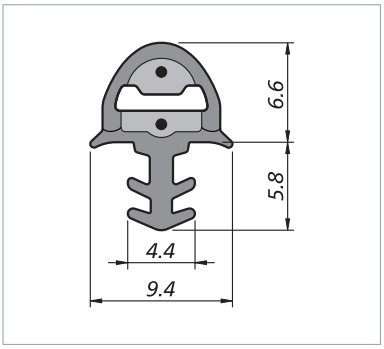
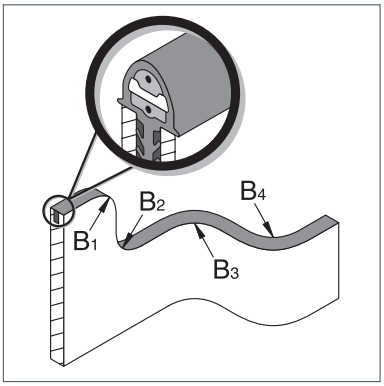
Technical data

SK EKS 052 TPE

Miniature safety edge (without sensor)	**SK EKS/W 052 TPE oder SK EKS/BK 052 TPE**	
Test principles	based on ISO 13856-2	
Switching characteristics at v_{test} = 50 mm/s		
Switching operations		
Test piece Ø 10 mm, F = 100 N	> 1× 10^5	
Actuation force	**+23 °C**	**-25 °C**
Test piece Ø 4 mm	< 15 N	< 30 N
Test piece (cylinder) Ø 200 mm	< 25 N	< 50 N
Actuation distance		
Test piece (cylinder) Ø 80 mm	< 2.0 mm	
Actuation angle		
Test piece (cylinder) Ø 80 mm	± 40°	
Finger detection	yes	
Safety classifications		
ISO 13849-1: B_{10D}	2× 10^6	
Mechanical operating conditions		
Sensor length (min./max.)	10 cm / 45 m	
Cable length	2.5 m	
Groove width for clamp foot	3.7 ±0,4 mm	
Bend radii (min.): B_1 / B_2 / B_3 / B_4	120 / 150 / 20 / 20 mm	
max. load capacity (signal)	600 N	
Tensile load, cable (max.)	20 N	
IEC 60529: Degree of protection	IP40	
Operating temperature	-25 to +80 °C	
short-term (15 min)	-40 to +100 °C	
Storage temperature	-40 to +80 °C	
DIN 75200: Behaviour in fire	ca. 40 mm/min	
Weight	54 g/m	
Electrical operating conditions		
Terminal resistance (±1%)	1k2, 2k2 or 8k2	
Nennleistung (max.)	250 mW	
Contact transition resistance	< 400 Ohm (per sensor)	
Number of sensors type BK	max. 3 in series (For more information refer to the chapter *Limits)*	
Switching voltage (max.)	DC 24 V	
Switching current (min. / max.)	1 mA / 10 mA	
Connection cable	Ø 2.9 mm PUR 2× 0.25 mm²	
Dimensional tolerances		
Length according to	ISO 3302 L2	
Profile section according to	ISO 3302 E2	



Bend radii:



Higher degree of protection, higher tensile load

A special adhesive (part no. 1004987) allows a higher degree of protection up to IP64 and a tensile load on the cable up to 60 N.

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Marking

If you combine sensors with control units and thereby release pressure-sensitive safeguards onto the market, observe the basic regulations in ISO 13856.
Apart from technical requirements, this applies in particular also to marking and information for use.

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MAYSER®

Innovative by tradition.

Safety bumper SB

EN | Product information

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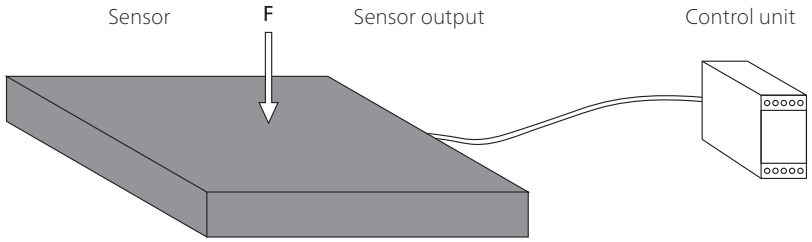
MAYSER®

Table of contents

Definitions

Pressure-sensitive protection device

A pressure-sensitive protection device consists of one or more pressure-sensitive sensors, a signal processing unit, and one or more output signal switching devices. The control unit is made up of the signal processing unit and output signal switching device(s). The pressure-sensitive protection device is triggered when the sensor is activated.

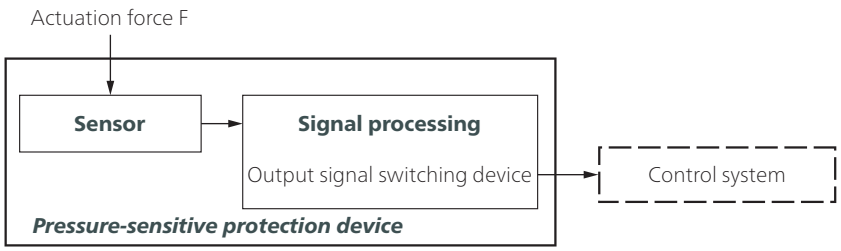


Sensor

The sensor is the part of the pressure-sensitive protection device that generates a signal when the actuation force F is applied. Mayser safety systems feature a sensor whose actuation area is deformed locally.

Signal processing

The signal processing unit is the part of the pressure-sensitive protection device that converts the output signal of the sensor and controls the status of the output signal switching device. The output signal switching device is the part of the signal processing unit which is connected to the downstream control system and which transmits safety output signals such as STOP.

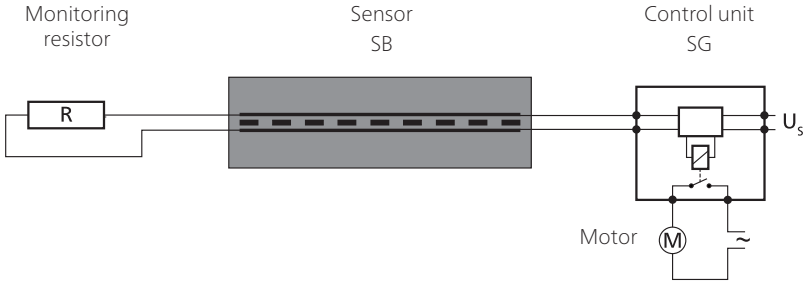


Tip: Terms are defined in ISO 13856-3 Section 3.

Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL_r
- Temperature range
- Degree of protection in accordance with IEC 60529:
  IP53 is standard for safety bumpers (it is important to pay attention to the installation position).
  Higher degrees of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use…

Operation principle of 2-wire technology



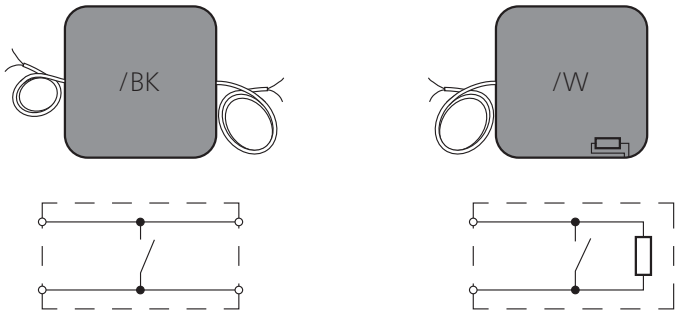
The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

For your safety:
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on controlled bridging of the contact surfaces with a monitoring resistor (closed-circuit principle).

Types

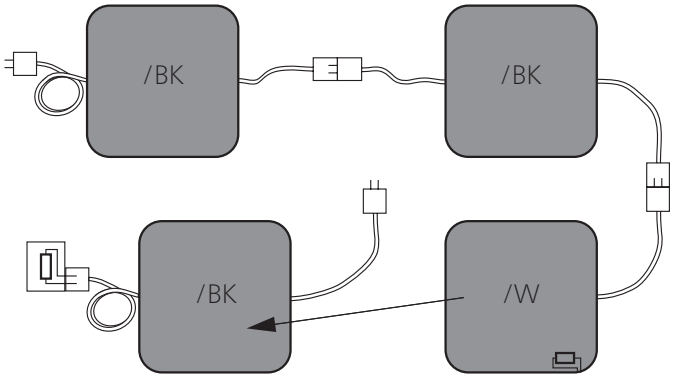
/BK With cables on both sides for use as a through sensor or with an external monitoring resistor for use as an end sensor

/W With an integrated monitoring resistor for use as an end sensor



Subject to technical modifications.

Sensor combination

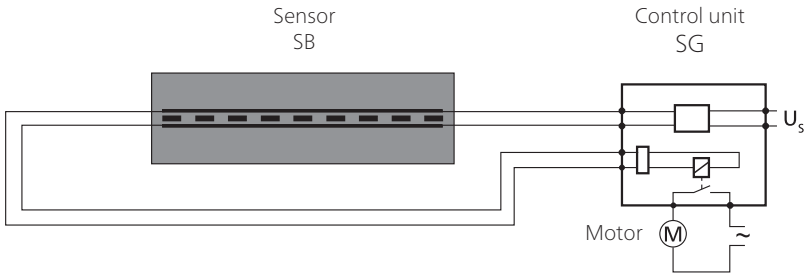


Version with external resistor, therefore no variety of models

Combination:

- Connection of more than one sensor
- Only one control unit required
- Bumper design can be customised in terms of depth and shape

Operation principle of 4-wire technology



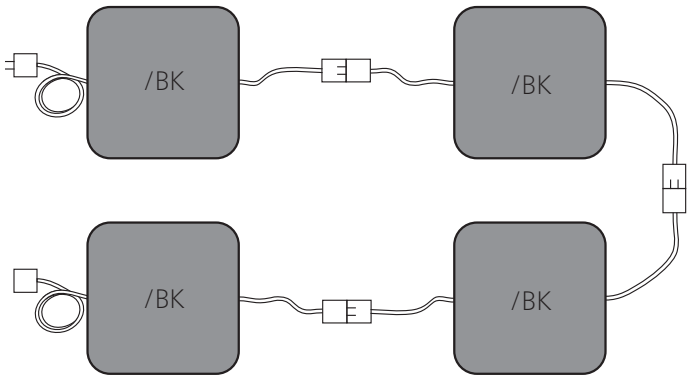
The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

For your safety:
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

Types

/BK With cables on both sides for use as a through sensor

Sensor combination



Combination:

- Connection of more than one sensor
- Only one control unit required
- Bumper design can be customised in terms of depth and shape

Subject to technical modifications.

Safety

Intended use

A safety bumper detects a person or part of the body when pressure is applied to the effective actuation area. It is a linear tripping device. Its purpose is to prevent possible hazardous situations that could affect someone within a danger zone, such as shearing and pinching edges.
Typical areas of application are: AGV systems, hangar doors, aerial platforms and gantry cranes.
Safe operation of a safety bumper depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance rating as well as
- correct installation.

For additional application guidance, please refer to ISO 13856-3 Annex D.

Due to the design, the actuation area is actually smaller than it looks because of the non-sensitive edges. Once these have been allowed for, what remains is the effective actuation area (see chapter *Effective actuation area*).

Limits

- No more than 10 /BK-type sensors can be connected to one control unit.
- No more than 9 /BK-type sensors and 1 /W-type sensor can be connected to one control unit.

Exclusions

The safety bumper is not suitable for:

- Detecting fingers

Other safety aspects

The following safety aspects relate to pressure-sensitive protection devices consisting of a sensor and a control unit.

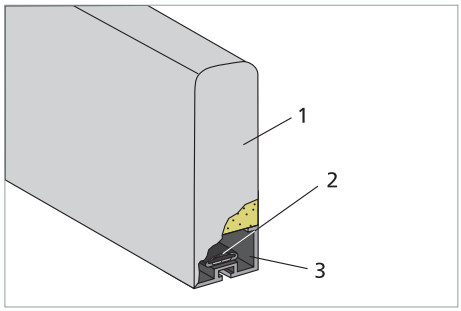
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts in the case of pressure-sensitive protection devices according to ISO 13856. In this case, the diagnostic coverage (DC) is not calculated or taken into account when determining the PL. Assuming a high $MTTF_D$ value for the control unit, a performance level of up to PL d can be achieved by the safety bumper system (pressure-sensitive protection device) as a whole.

Is the protection device suitable?
First, the integrator must decide what PL_r is required for the hazard. After that, they must select the protection device.
Finally, the integrator needs to check whether the category and PL of the selected protection device are appropriate.

Risk and safety assessment
For the risk and safety assessment of your machine, we recommend ISO 12100 "Safety of machinery — General principles for design".

Without reset function
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

Design

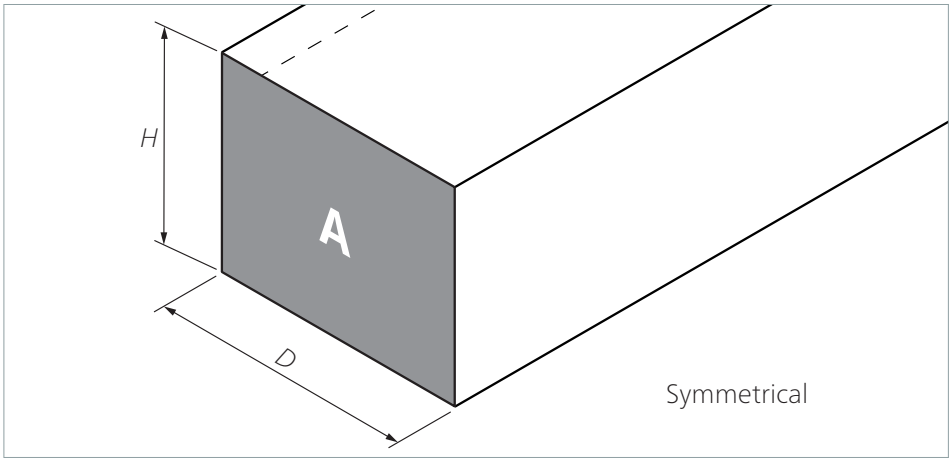


The safety bumper consists of a sensor (1 to 3) –
(1) foam with casing,
(2) switch element,
(3) aluminium mounting plate –
and an evaluating control unit SG.

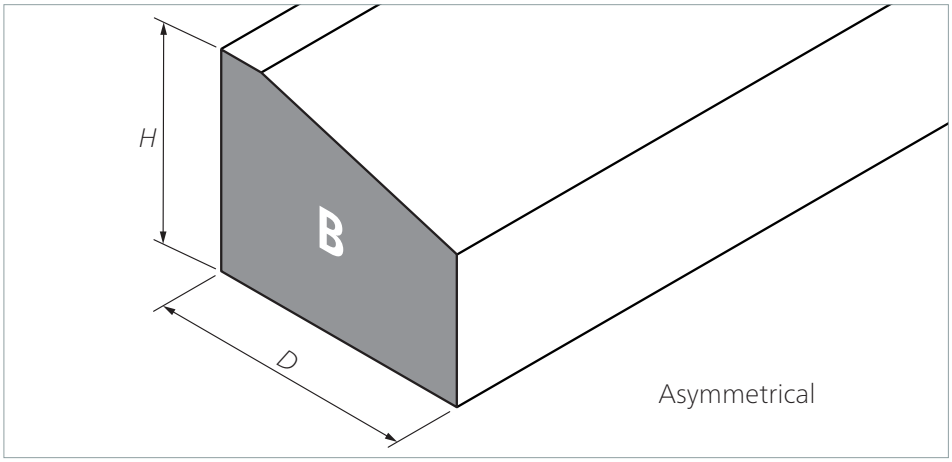
Subject to technical modifications.

Cross sections

Cross section A



Cross section B



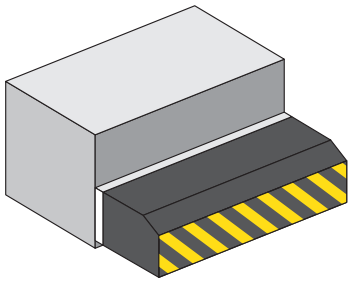
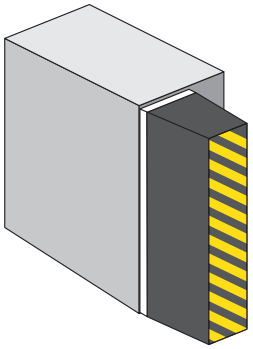
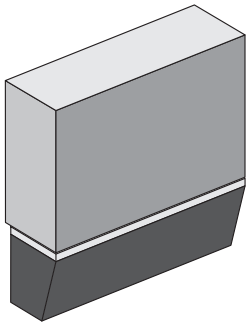
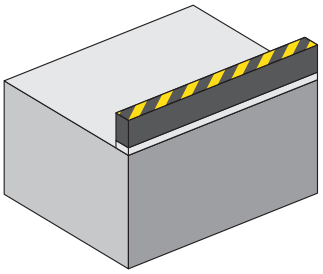
Cross section and aluminium mounting plate combinations

	Alum. mount. pl. C 40	Alum. mount. pl. C 100	Alum. mount. pl. C 150
Cross section A	●		
Cross section B		●	●
Height H	40 mm	100 mm	150 mm
Depth D (max.)	130 mm	250 mm	300 mm

Subject to technical modifications.

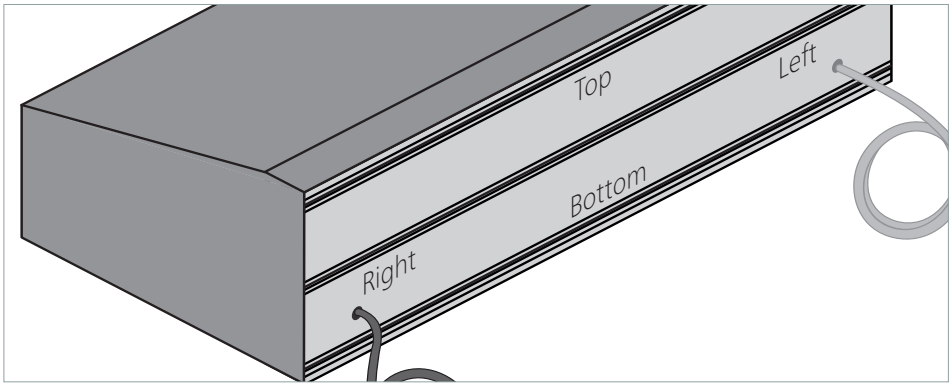
Installation position

The installation position can be selected as required, i.e. all installation positions necessitated by the application are possible.
The preferred installation positions are:

Horizontal	Vertical
	
Hanging down	**Standing upright**
	

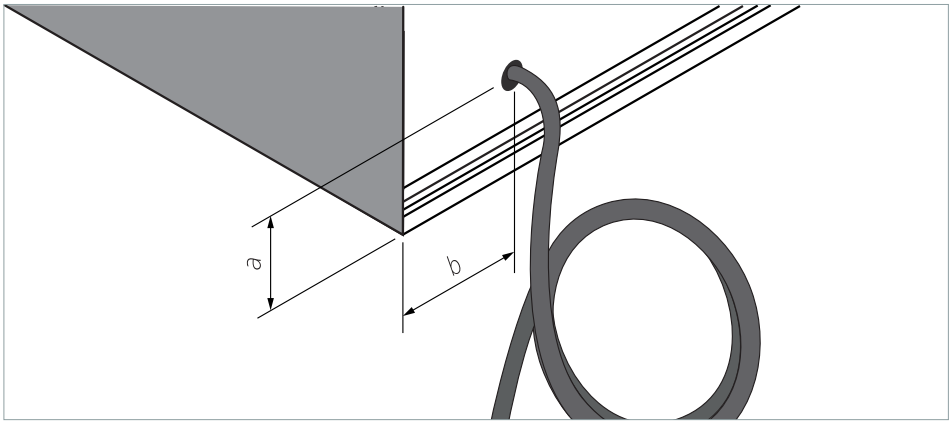
Connection

Cable exits



SB/W: cable exit located on bottom right (standard), optionally on bottom left
SB/BK: cable exits located on bottom right **and** bottom left (standard)

Standard cable exit: position



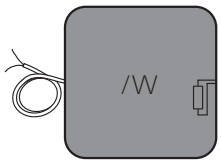
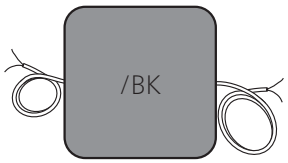
Distance from edges:

	C 40	C 100	C 150	
a	8 mm	25 mm	25 mm	
b	50 mm	50 mm	50 mm	

Other cable exits can be provided on request.

Cable connection

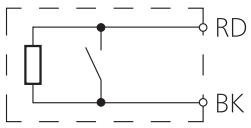
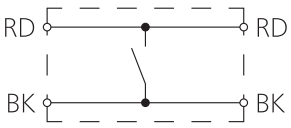
- Standard cable lengths
  L = 2.5 m
- Maximum total cable length to the control unit
  L_{max} = 100 m
- Cable ends: stripped wires
  Optional: cable ends available with plug and coupling

/W-type sensor with 1 line	/BK-type sensor with 2 lines
• As an individual /W-type sensor or a /W-type end sensor • Integrated resistor • 1 two-wire cable	• As a /BK-type through sensor • Without resistor • 2 two-wire cables
	

Wire colours

Colour coding

BK	Black
RD	Red

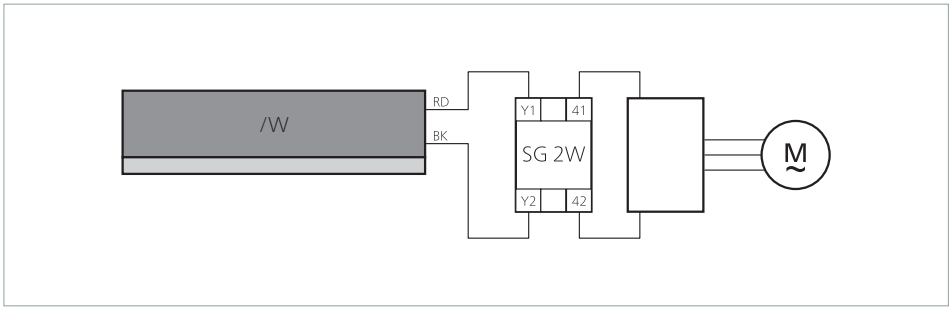
/W-type sensor with 1 line	/BK-type sensor with 2 lines
	

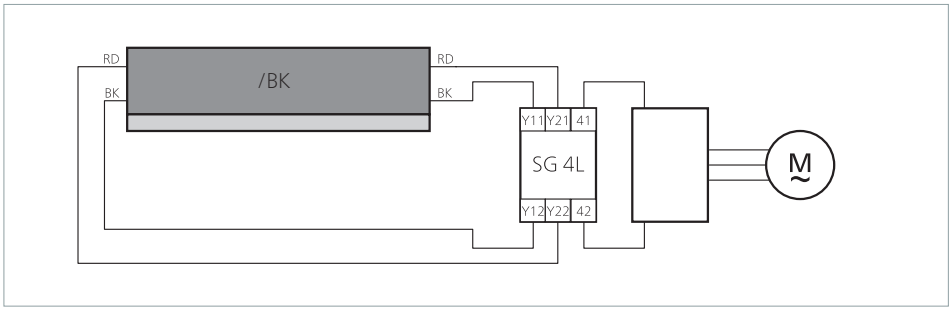
Subject to technical modifications.

Connection examples

Key:

SG 2W	Evaluation with 2-wire technology
SG 4L	Evaluation with 4-wire technology





Subject to technical modifications.

Sensor surface

Each sensor has a sleeve for mechanical protection. This protects the foam structure and inner parts, and prevents the ingress of dirt and moisture.

Polyester sleeve (standard)

Areas of application:

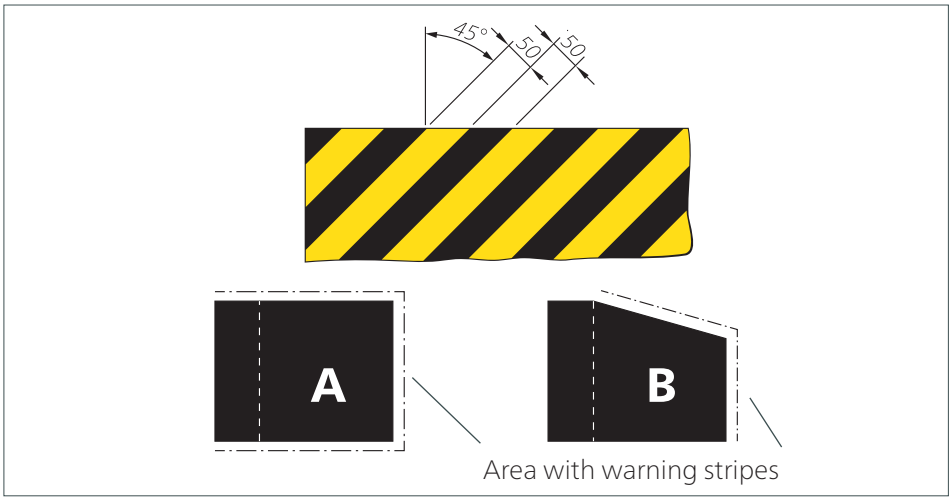
- Indoors
- Outdoors with additional sealing
- Heavy mechanical loads

Colour

- Standard: plain yellow

Optional:

- Black warning stripes
- Red "No entry" symbol



Subject to technical modifications.

Optional sleeves

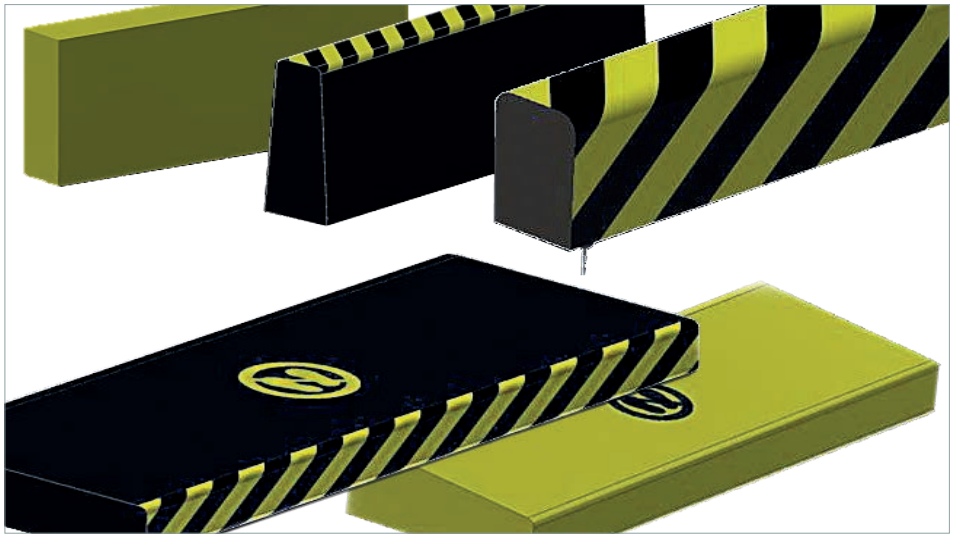
PUR skin

- For dry indoor environments
- Normal mechanical loads
- Tight-fitting skin around foam

Colour:

- Black (similar to RAL 9005)
- Yellow (similar to RAL 1021)
- Black and yellow warning stripes
- Black or yellow "No entry" symbol

Optional: other colours, colour combinations, logos or symbols (including in RAL colours)



Additional sleeve options

- Synthetic leather: for environments with high aesthetic requirements
- Welding protection sleeve: good resistance to flying sparks and hot swarf

Resistance

The resistance ratings listed below (at a room temperature of 23 °C) depend on the sensor having an undamaged surface.

Physical resistance

	PE / PES	PUR
UV resistance	Yes	Yes
Impregnation (fluorocarbons)		
Water, oil and dirt-repellent	Yes	No

Chemical resistance

The sensor is broadly resistant to normal chemical influences such as diluted acids and alkalis, as well as alcohol, over an exposure period of 24 hrs.

The values in the table are the results of tests carried out in our laboratory. You must always conduct your own practical tests to verify that our products are suitable for your specific area of application.

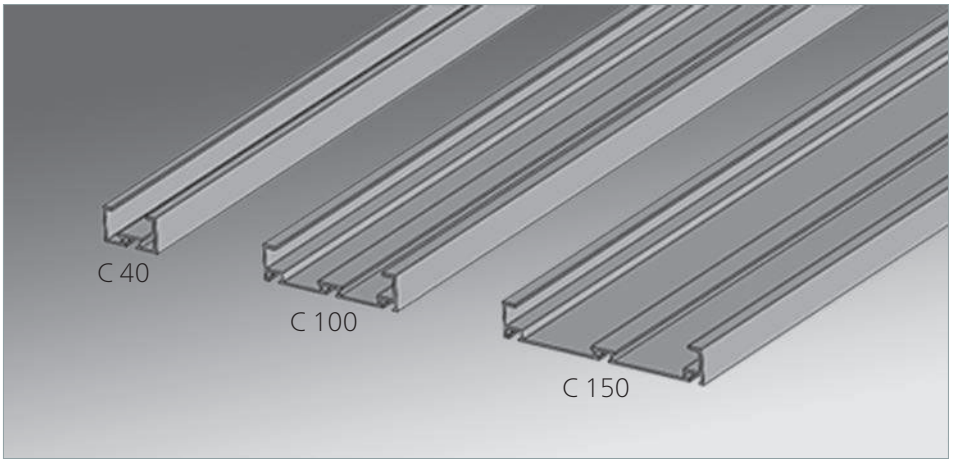
Explanation of symbols:
+ = resistant
± = resistant to a certain extent
– = not resistant

	PE / PES	PUR	Synthetic leather	Welding protection sleeve
Acetone	±	–	–	+
Formic acid 10%	+	+	±	–
Petrol	+	+	–	+
Disinfectant	+	–	–	+
Diesel fuel	+	+	–	+
Acetic acid 10%	+	±	±	–
Ethanol 95%	+	–	–	+
Ethyl acetate	±	–	–	+
Gearbox oil	+	+	–	+
Hydraulic oil	+	+	±	+
Isopropanol	+	+	–	+
Cooling lubricant	+	+	–	+
Tap water	+	+	+	+
Engine oil	+	+	–	+
Sodium hydroxide 10%	–	–	–	–
Sulphuric acid 10%	+	+	±	–
Washing-up liquid	+	+	+	+

Subject to technical modifications.

Fixing

Safety bumper SB products are mounted directly on the impact surfaces that pose a danger. Aluminium mounting plates are used to support them and fix them in place. The aluminium mounting plates can be fixed in place by using T-nuts, hammer nuts, or M6 hexagon bolts in conjunction with the integrated 6 mm groove. The following rule applies: the higher the aluminium mounting plate, the greater the depth (D) possible for the safety bumper.



Material properties

- AlMgSi0.5 F22
- Wall thickness: at least 2.0 mm, extruded
- Hot hardened
- Tolerances as per EN 755-9

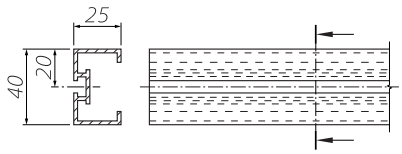
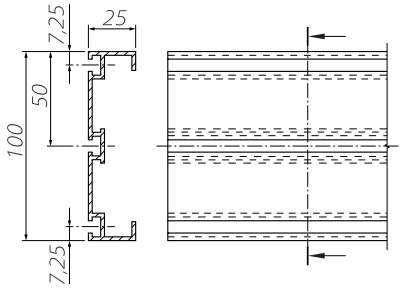
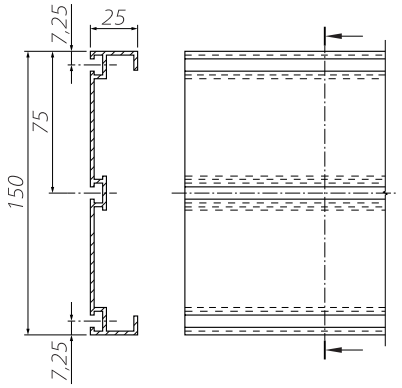
Aluminium mounting plates: Fixing types

Standard profile

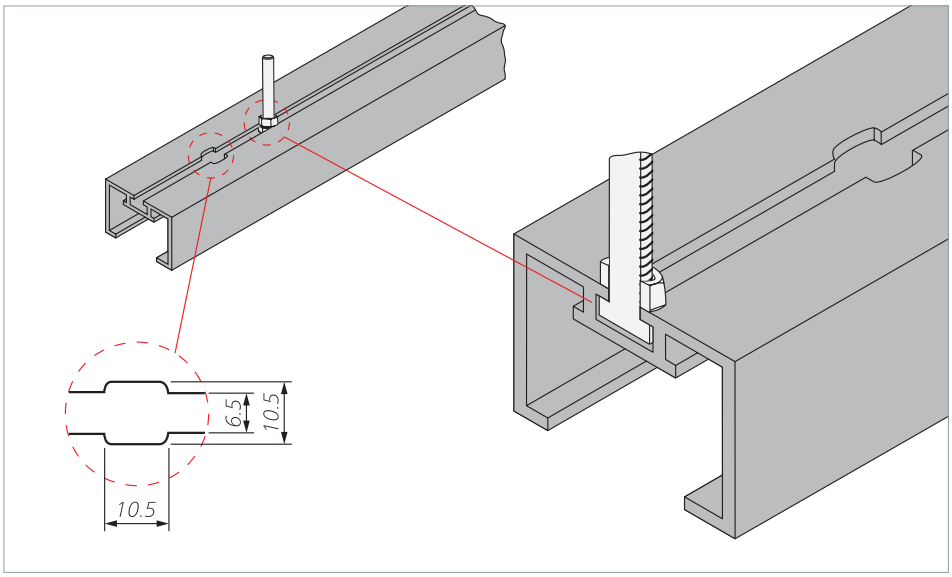
C 40	C 100	C 150
		

Subject to technical modifications.

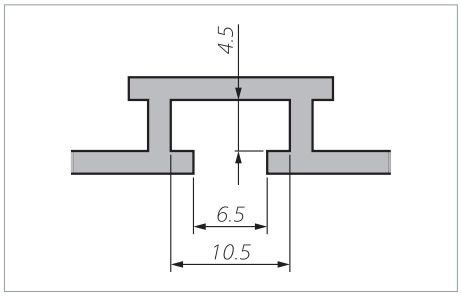
Aluminium mounting plates: Dimensions

Standard profile	1:2
C 40 	C 100 
C 150 	

Fixing groove



Dimensions and quantities



	Quantity
C 40	1×
C 100	3×
C 150	3×

Standard: fixed using T-nut, hammer nut, M6 hexagon bolt or M6 nut.

SB: Making the right selection

Calculation for selecting the safety bumper depth

The stopping distance of the dangerous movement is calculated using the following formula:

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$

In accordance with ISO 13856-3, the minimum overtravel distance of the safety bumper is calculated using the following formula:

$s = s_1 \times C$ where: $C = 1.2$

A suitable safety bumper can now be selected based on the result.
For details of the overtravel distances for safety bumpers, see chapter "Technical data".

- s_1 = Stopping distance of the dangerous movement [mm]
- v = Velocity of the dangerous movement [mm/s]
- T = Follow-through time of the complete system [s]
- t_1 = Safety bumper response time
- t_2 = Stopping time of the machine
- s = Minimum overtravel distance of the safety bumper to ensure that the stipulated limit forces are not exceeded [mm]
- C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected.

Calculation examples

Calculation example 1

The dangerous movement on a 1.5 m wide vehicle has a velocity of v = 0.25 m/s and can be brought to a standstill within t_2 = 1.2 s. The safety bumper response time (sensor + control unit*) is t_1 = 220 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 250$ mm/s $\times$ (0.22 s + 1.2 s)
$\mathbf{s_1} = 1/2 \times 250$ mm/s $\times$ 1.42 s = **178 mm**

$s = s_1 \times C$ where: $C = 1.2$
s = 178 mm $\times$ 1.2 = **213 mm**

The safety bumper must have a minimum overtravel distance of s = 213 mm. A safety bumper with a depth of 250 mm ensures the required overtravel distance.
Result: A safety bumper measuring 1500 × 100 × 250 mm (W × H × D) is **suitable** for this case.

Calculation example 2

The same conditions apply as in calculation example 1 with the exception of the velocity and the stopping time. Instead, these are now v = 0.3 m/s and t_2 = 1.3 s. The safety bumper response time (sensor + control unit*) is t_1 = 220 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 300$ m/s $\times$ (0.22 s + 1.3 s)
$s_1 = 1/2 \times 300$ m/s $\times$ 1.52 s = 228 mm

$s = s_1 \times C$ where: $C = 1.2$
s = 228 mm $\times$ 1.2 = **274 mm**

The safety bumper must have a minimum overtravel distance of s = 274 mm.

* Assumption: Typical reaction time of a control unit = 20 ms

The safety bumper selected in calculation example 1 is unable to provide this minimum overtravel distance.
Result: A safety bumper measuring 1500 × 100 × 250 mm (W × H × D) is **not suitable** for this case.

Calculation example 3
The same conditions apply as in calculation example 2. Instead of the safety bumper measuring 1500 × 100 × 250 mm (W × H × D), a safety bumper measuring 1500 × 150 × 300 mm (W × H × D) is selected. The safety bumper response time (sensor + control unit*) is t_1 = 220 ms.

$s_1 = 1/2 \times v \times T$ where: $T = t_1 + t_2$
$s_1 = 1/2 \times 300$ m/s × (0.22 s + 1.3 s)
$\mathbf{s_1} = 1/2 \times 300$ m/s × 1.52 s = **228 mm**

$s = s_1 \times C$ where: C = 1.2
s = 228 mm × 1.2 = **274 mm**

The safety bumper must have a minimum overtravel distance of s = 274 mm. A safety bumper with a depth of 300 mm ensures the required overtravel distance.
Result: A safety bumper measuring 1500 × 150 × 300 mm (W × H × D) is **suitable** for this case.

* Assumption: Typical reaction time of a control unit = 20 ms

Customised designs

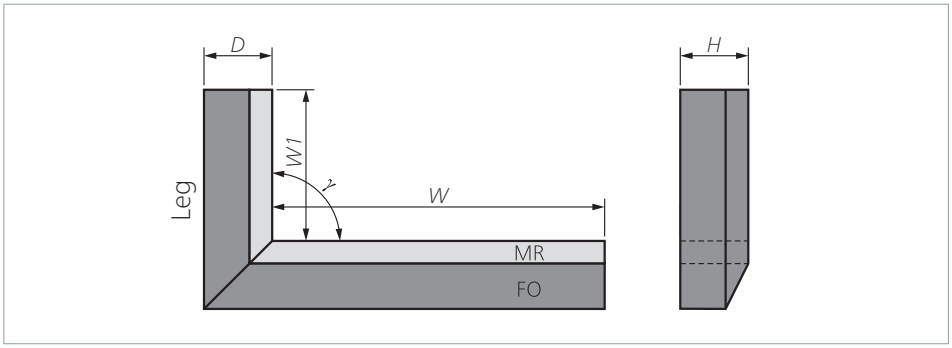
In addition to the standard range, special solutions are also possible, such as:

L shape

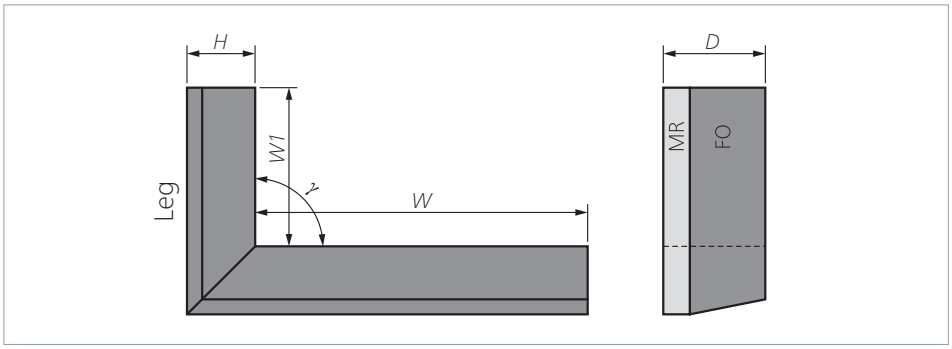
- Depth (D) is the same in the case of W and W1
- Leg angle γ : 90°/120°/135°/150°

Horizontal

MR = mounting plate
FO = foam



Vertical



Possible installation positions

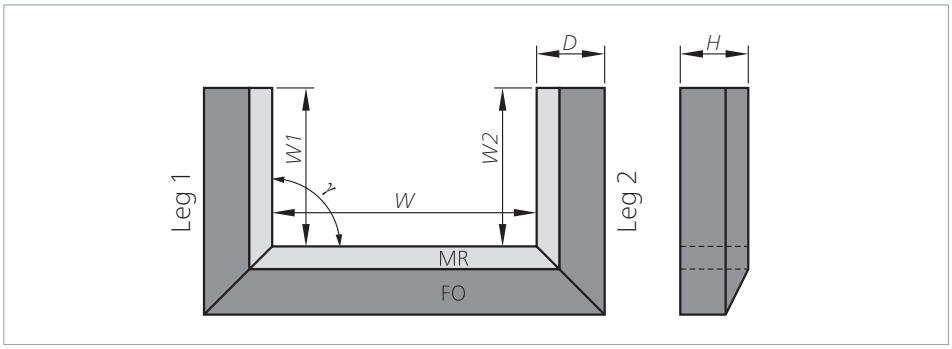
	L shape
Horizontal	●
Vertical	●
Hanging down	●
Standing upright	●

U shape

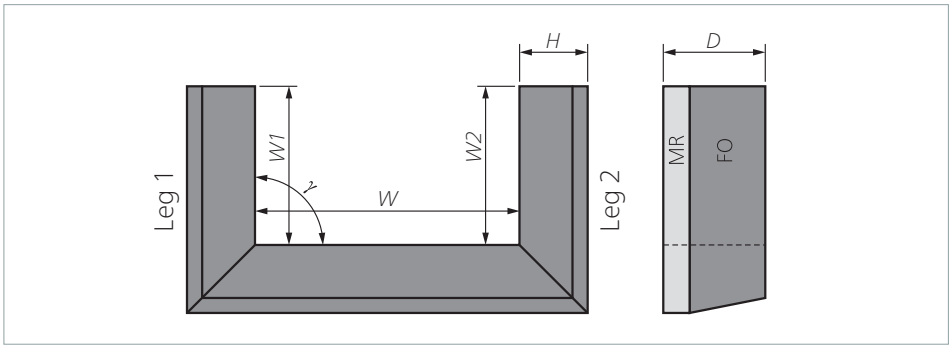
- Depth (D) is the same in the case of W, W1 and W2
- Leg angle γ : 90°/120°/135°/150°

MR = mounting plate
FO = foam

Horizontal



Vertical

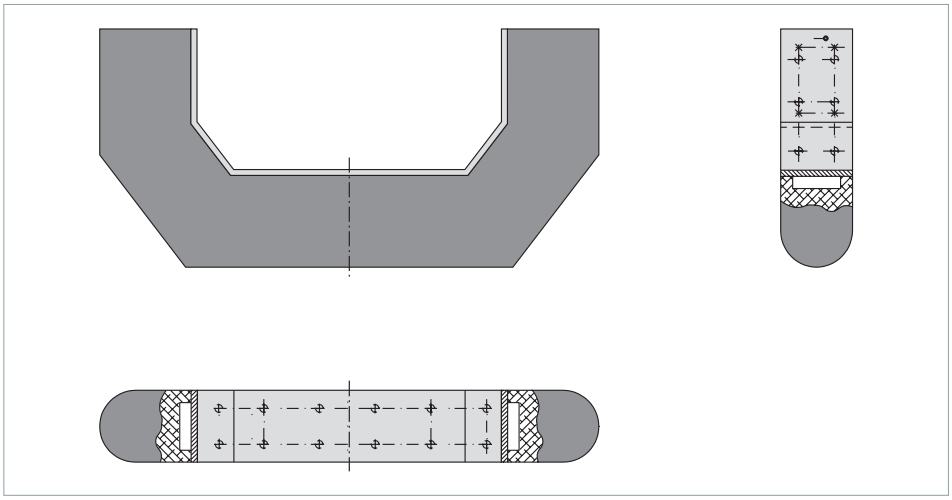


Possible installation positions

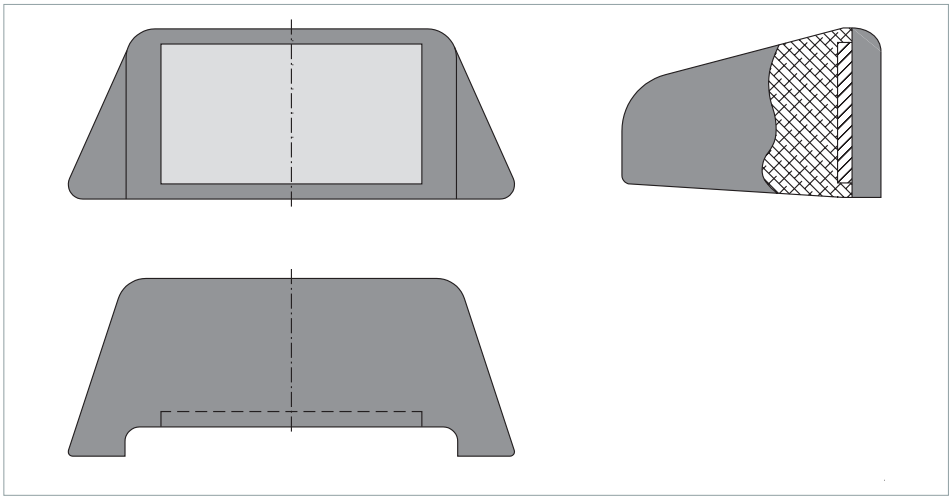
	U shape
Horizontal	●
Vertical	●
Hanging down	●
Standing upright	●

Additional options

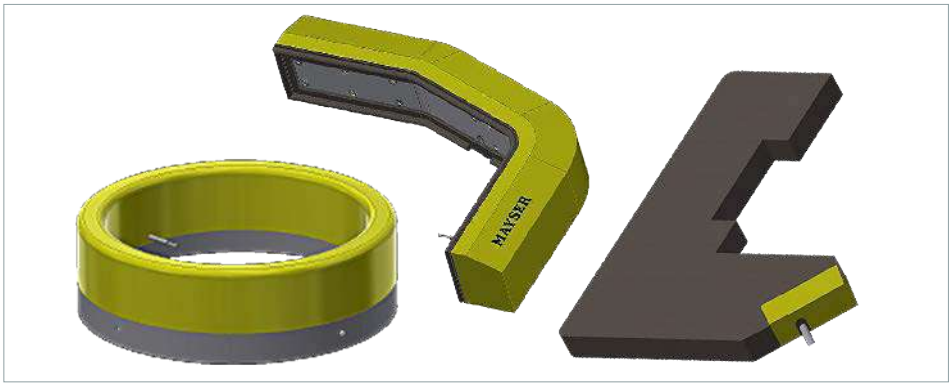
Extended U shape



Trapezium shape



Additional shapes



Other mounting plates

Optional: Customer-specific mounting plates can be provided on request.

Maintenance and cleaning

The sensor is virtually maintenance-free.
The control unit also monitors the sensor at the same time.

Regular inspection

Depending on the operational demands, the sensors must be inspected at regular intervals (at least monthly)

- for proper functioning,
- for damage and
- for correct mounting.

Cleaning

If the sensors become dirty, they can be cleaned with a mild cleaning product.

Technical data

	Safety bumper SB/W with control unit SG-EFS 104/2W	Safety bumper SB/BK with control unit SG-EFS 104/4L	Sensor* SB/W or SB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
Switching characteristics at v_{test} = 100 mm/s			
Switching operations at 0.1 A	> 1× 10^5	> 1× 10^5	> 1× 10^5
Actuation forces			
Test piece (rod) □ 45 mm	< 600 N	< 600 N	< 600 N
Test piece (cylinder) Ø 80 mm	< 150 N	< 150 N	< 150 N
Actuation angle	±45°	±45°	±45°
Response time	215 ms	230 ms	200 ms
Actuation distance	21.5 mm	23 mm	20 mm
Overtravel distance	94.5 mm	93 mm	96 mm
Safety classifications			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
$MTTF_D$ (pressure-sensitive protection device)	257 a	73 a	–
B_{10D} (sensor)	6× 10^6	6× 10^6	6× 10^6
n_{op} (assumption)	52560/a	52560/a	–
Mechanical operating conditions			
Sensor length	100 to 3000 mm		100 to 3000 mm
Sensor depth	70 to 300 mm		70 to 300 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
IEC 60529: degree of protection			
Sensor (outdoors with lip seal)	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor	–20 to +55 °C		–20 to +55 °C
Electrical operating conditions			
Terminal resistance (standard)	8k2 ±1%	–	/W: 8k2 ±1%; /BK: –
Nominal output (max.)	250 mW	–	/W: 250 mW; /BK: –
Contact transition resistance	< 400 ohms (per sensor)		< 400 ohms (per sensor)
Number of sensors	Max. 10 in series (9× /BK + 1× /W)	Max. 10 in series (10× /BK)	Max. 10 in series (9× /BK + 1× /W)
Dimensional tolerances			
Length dimension	General tolerances as per Mayser company standard MWN003		

* If you combine sensors with control units and thereby place pressure-sensitive protection devices on the market, you should observe the basic requirements according to ISO 13856.
As well as meeting technical requirements, this also means – in particular – observing any that relate to marking and information for use.
Declarations of Conformity only apply to pressure-sensitive protection devices. In the case of sensors that are going to be used to make pressure-sensitive protection devices, Declarations of Incorporation are issued instead.

Conformity

The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out.

The design type of the product complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of Machinery)
- 2011/65/EU (RoHS)
- 2014/30/EU (EMC)

The Declaration of Conformity is available in the Downloads section of our website: www.mayser.com/de/download.

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MAYSER®

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Control units SG

EN | Overview

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Type	**SG-EFS 104/4L**	**SG-EFS 104/2W**	**SG-RS 309-2**	**RB3 system**
Safety classification				
ISO 13849-1:2015	Category 3 PL e	Category 3 PL d	Category 3 PL d	Category 2 PL d
ISO 13856: reset function	With/without	With/without	With/without	–
$MTTF_D$	73 a	257 a	937 a	50 a
DC_{avg}	90%	60%	92%	91%
B_{10D} [× 10^6]	0.4	1.8	–	20
Times				
Reaction time	< 30 ms	< 15 ms	< 15 ms	35 ms
Restart time	< 500 ms	< 50 ms	< 150 ms	5 ms
Control unit inputs				
Sensor types	SM, SL, MSL, SB	SM, SL, MSL, SB	SM, SL, MSL, SB	SM, SL, MSL, SB
Monitoring type	4-wire technology	1k2 or 8k2 monitoring resistor	8k2 or 10k monitoring resistor	8k2 monitoring resistor
Monitoring circuits	1	1	2	1
Other inputs				Test signal
Control unit outputs				
Switching channels	1× 3-channel	1× 2-channel	2× 2-channel	2× 2-channel
Switching current (min. / max.)	– / 5 A	– / 4 A	> 0 mA / 100 mA	– mA / 2 A
Switching capacity (max.)	1150 VA / 120 W	1000 VA / 96 W	3.6 W	120 VA / 24 W
Other outputs	1 signal circuit	1 signal circuit, 2 signal outputs	2 signal outputs	1 signal output
Mechanical operating conditions				
Mounting	IEC 60715 mounting rail	IEC 60715 mounting rail	IEC 60715 mounting rail	Wall mounting
IEC 60529: degree of protection	IP20	IP20	IP20	IP65
Operating temperature	–25 to +55 °C	–25 to +55 °C	–40 to +70 °C	–20 to +55 °C
Dimensions (W × H × D)	22.5 × 99 × 114.5 mm	22.5 × 99 × 114.5 mm	17.5 × 99 × 114.5 mm	82 × 190 × 40 mm 60 × 151 × 23 mm
Variants	**SG-EFS 104/4L**	**SG-EFS 104/2W**	**SG-RS 309-2**	**RB3 system**
Part number	1004128	1005196	1006747	1007228 + 1007229
Connecting voltage U_S	24 V AC/DC	24 V AC/DC	24 to 36 V DC	12 to 24 V AC/DC
Power consumption P	< 7 VA / < 3 W	< 4 VA / < 3 W	< 1.5 W	< 0.3 VA / < 0.4 W

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Signal transmission system WLS

EN | Product information

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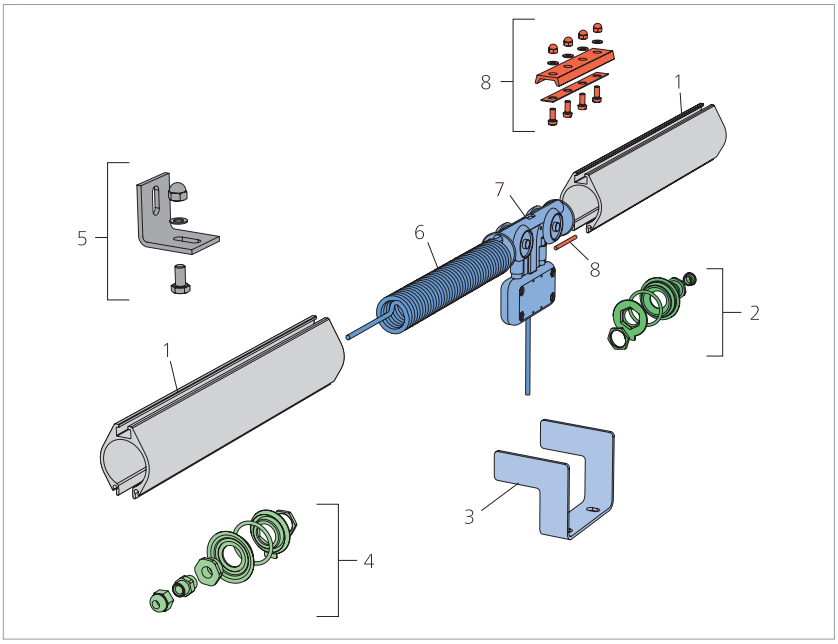
Areas of application

The WLS signal transmission system is used as a protective conduit for cables in doors and gates. When it comes to making danger areas safe, the system is especially suitable for safe transmission of signals between tactile sensors e.g. safety edges and the control module.

Examples:

- Vertical and horizontal gates
- Machine hoods and windows
- Conservatories
- Sun blinds
- Moulding and textile machines

System design



Pos.	Part No.	Designation	Comment
1	10038-06 ... -09	Profile tube WLS	aluminium anodised; 2, 3, 4 and 6 m
2	1003792	WLS-sealing cap	closed
3	1003771	Carrying fork for WLS	
4	1003791	WLS-sealing cap	PG7
6 + 7	75015-13 ... -24	Spiral cable with carriage	4× 0.14 mm²
8	1003802	Tube connector for WLS	stainless steel

Accessories			
5	1003804	Fastening parts for WLS	incl. nuts and screws

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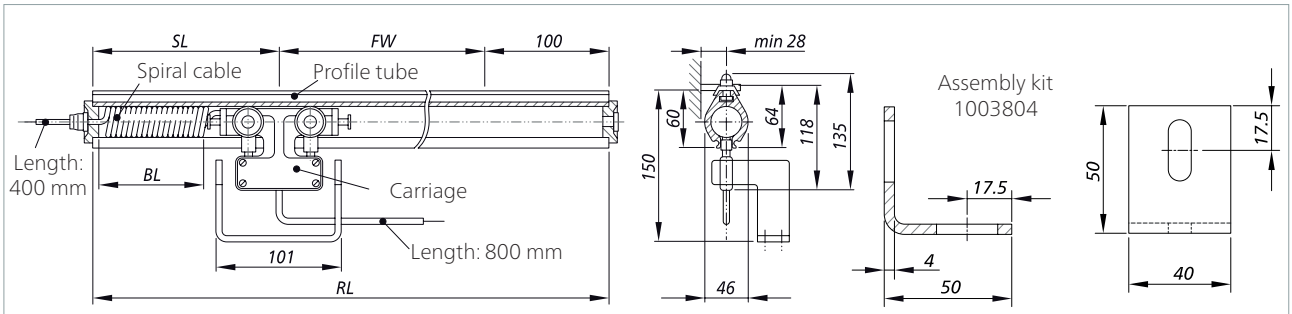
Operation

The system consists of an aluminium profile tube and a specially designed, abrasion-resistant and extremely dimensionally stable spiral cable with carriage. When the carriage is put into motion the cable is stretched inside the profile tube and returns to its original position when the carriage goes back. The system components were designed to co-ordinate with each other and can be used in gates both indoors and outdoors. The WLS is suitable for gates in high-frequency operation.

Dimensions and part numbers



WLS complete	WLS-kit, no profile tube	Spiral cable with carriage	Max. runway	Profile tube length	Storage length	Block length
Part No.	**Part No.**	**Part No.**	**FW [m]**	**RL [m]**	**SL [m]**	**BL [m]**
7501482	7501501	7501513	1.5	2	0.3	0.12
7501483	7501502	7501514	1.6 ... 2.5	3	0.4	0.29
7501484	7501502	7501514	2.6 ... 3.5	4	0.4	0.29
7501485	7501503	7501515	3.6 ... 4.3	5 = 2+3	0.6	0.46
7501486	7501503	7501515	4.4 ... 5.3	6	0.6	0.46
7501487	7501504	7501516	5.4 ... 6.1	7 = 3+4	0.8	0.63
7501488	7501504	7501516	6.2 ... 7.1	8 = 4+4	0.8	0.63
7501489	7501505	7501517	7.2 ... 8.0	9 = 3+6	0.9	0.80
7501490	7501505	7501517	8.1 ... 9.0	10 = 4+6	0.9	0.80
7501491	7501506	7501518	9.1 ... 9.8	11 = 3+4+4	1.05	0.96
7501492	7501506	7501518	9.9 ... 10.8	12 = 6+6	1.05	0.96
7501493	7501506	7501518	10.9 ... 11.8	13 = 3+4+6	1.05	0.96
7501494	7501507	7501519	11.9 ... 12.6	14 = 2+6+6	1.25	1.13
7501495	7501507	7501519	12.7 ... 13.6	15 = 3+6+6	1.25	1.13
7501496	7501508	7501520	13.7 ... 15.3	17 = 2+3+6+6	1.60	1.48
7501497	7501509	7501521	15.4 ... 17.1	19 = 3+4+6+6	1.80	1.65
7501498	7501510	7501522	17.2 ... 19.0	21 = 3+6+6+6	1.90	1.78
7501499	7501511	7501523	19.1 ... 20.9	23 = 2+3+6+6+6	2.00	1.85
7501500	7501512	7501524	21.0 ... 23.5	26 = 2+6+6+6+6	2.40	2.28

Quantity buyers and dealers: please send us your request for quotation.

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Technical data

Cable	special, wear-free, double insulated spiral cable
Number of wires/cross-section	4× 0.14 mm^2
Operating voltage	max. 48 V AC/DC
Max. load (at +25 °C)	max. 1.5 A eff.
Temperature range	-20 to +80 °C
Moving speed	40 m/min
Runway lengths	1.5 m to 23.5 m
System lengths	2.0 m to 26.0 m in fixed lengths: 2, 3, 4 and 6 m
Conduit rail	aluminium, anodized, warp resistant

At a glance

- Robust, simple, proven construction
- Quick and easy installation due to low number of components in modular form
- Maintenance-free
- Short envelope delay to meet the dynamic force and time parameters in accordance with EN 12453 and EN 12445

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