



## Safety bumpers SB



EN | Product information

**Mayser GmbH & Co. KG**

Örlinger Strasse 1–3

89073 Ulm

GERMANY

Tel.: +49 731 2061-0

Fax: +49 731 2061-222

E-mail: [info.ulm@mayser.com](mailto:info.ulm@mayser.com)

Website: [www.mayser.com](http://www.mayser.com)

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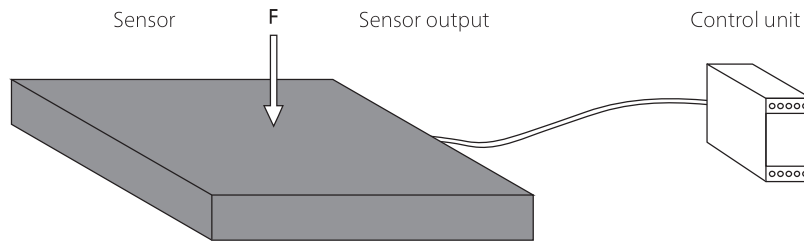
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## Definitions

### 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.

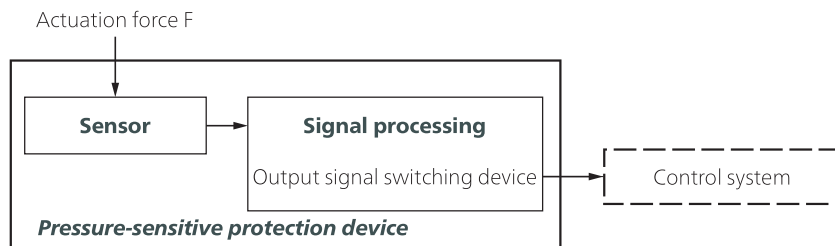


#### Sensor

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 downstream control system and which transmits safety output signals such as STOP.



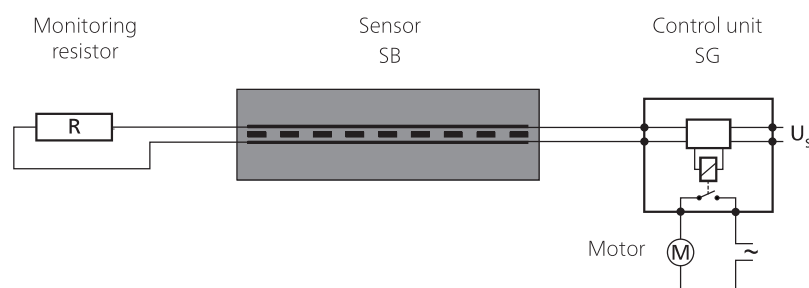
Tip: Terms are defined in ISO 13856-3 Section 3.



## Criteria for selecting the sensor type

- Category according to ISO 13849-1
- Performance level of the pressure-sensitive protection device = at least PL<sub>r</sub>
- Temperature range
- Degree of protection in accordance with IEC 60529:  
IP54 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.

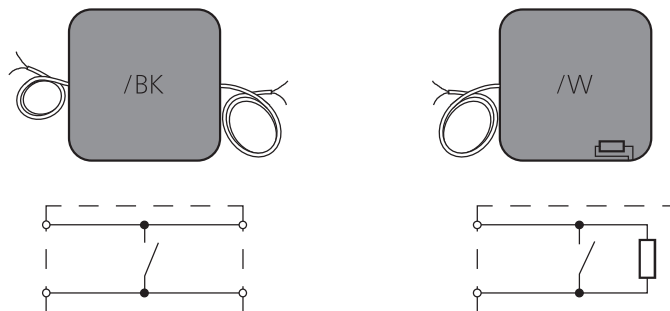
For your safety:

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).

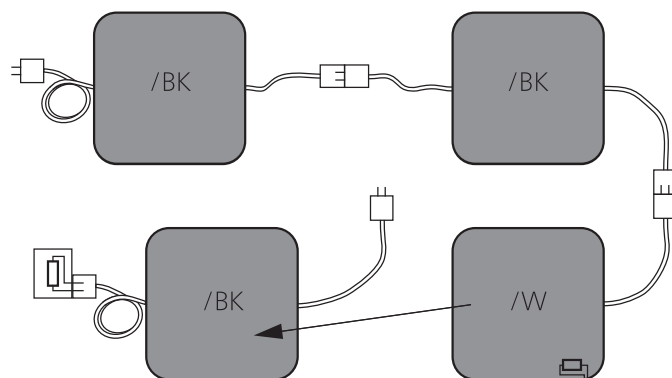
## Types

/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



## Sensor combination

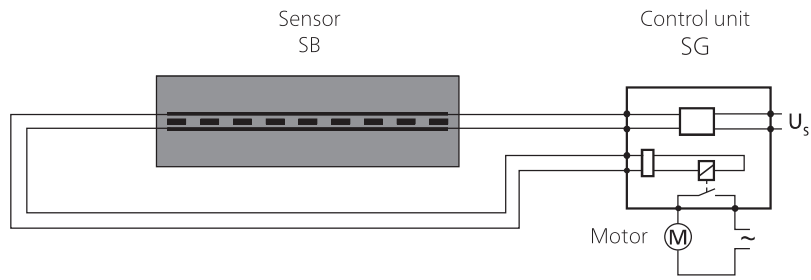


Version with external resistor, therefore  
no variety of models

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:

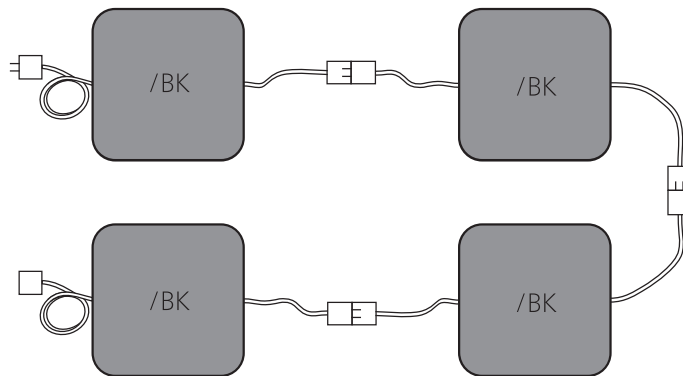
The sensor and connection cables are constantly monitored to ensure they are functioning correctly. Monitoring relies on signal transmission feedback – without a monitoring resistor.

### 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

## Safety

### Intended use

A safety bumper detects a person or part of the body when pressure is applied to the effective actuation area. In most cases it is a linear tripping device and presence detector. 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.

### 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.

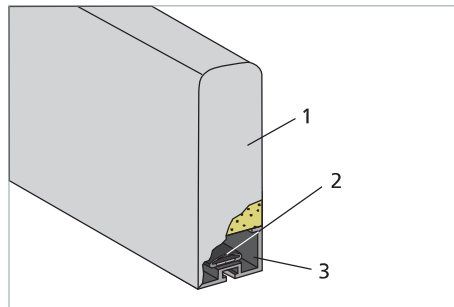
### **Risk and safety assessment**

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

### **Without reset function**

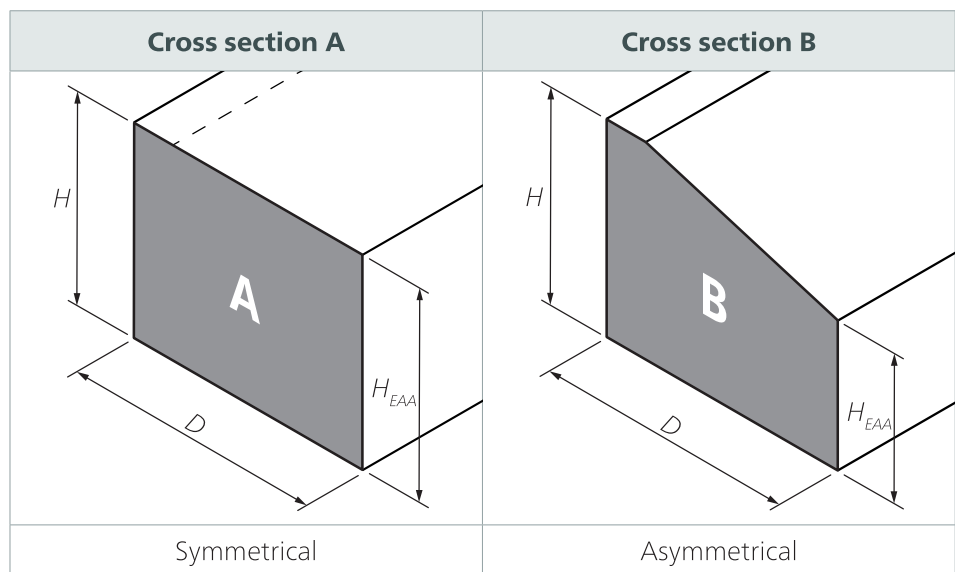
When a protection device without reset function is used (automatic reset), the reset function must be provided in some other way.

**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.

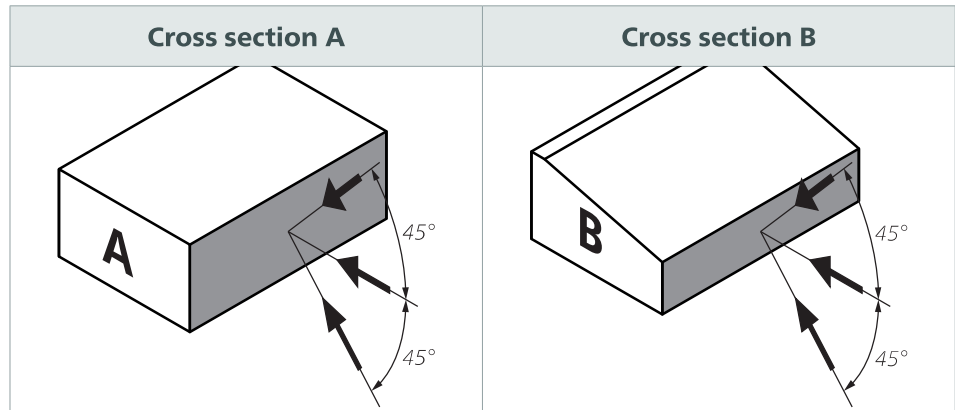
**Cross sections**



**Cross section and aluminium mounting plate combinations**

Cross section	A	B	B
Aluminium mounting plate	C 40	C 100	C 150
Height H	40 mm	100 mm	150 mm
	Height of effective actuation area $H_{EAA}$		
Depth T = 100 mm	40 mm	–	–
Depth T = 150 mm	–	78 mm	–
Depth T = 200 mm	–	70 mm	–
Depth T = 250 mm	–	61 mm	–
Depth T = 300 mm	–	–	102 mm
Depth T = 400 mm	–	–	84 mm

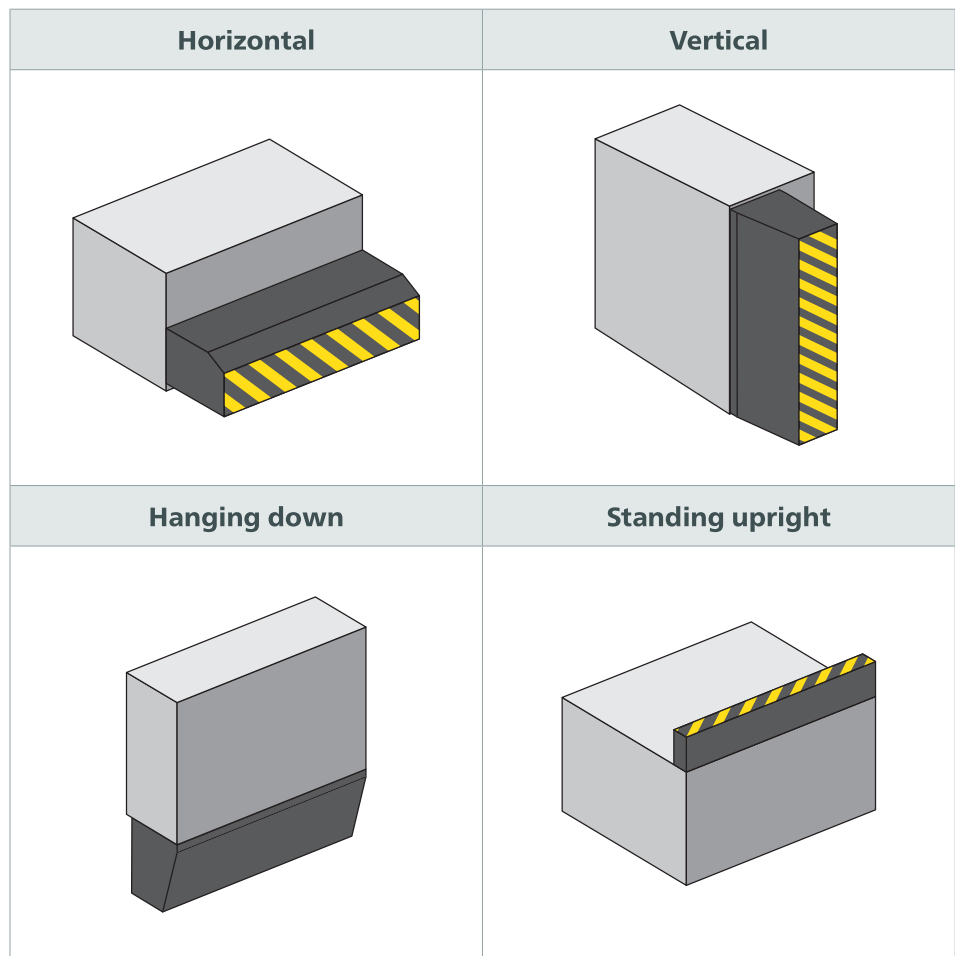
## Effective actuation area



## Installation position

The installation position can be selected as required, i.e. all installation positions necessitated by the application are possible.

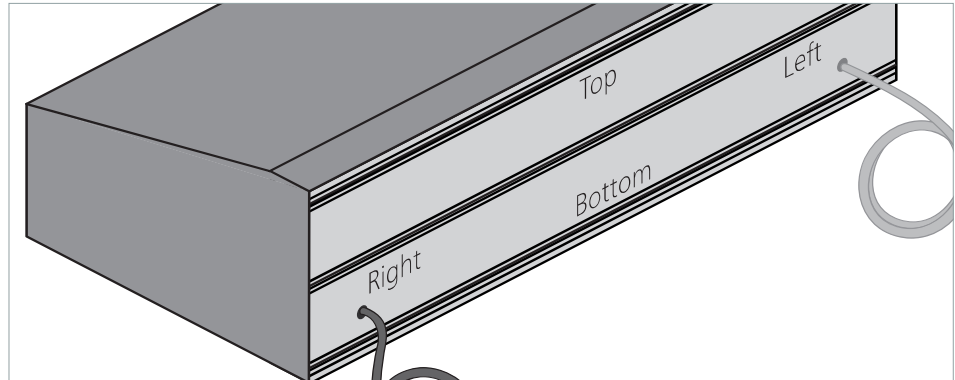
The preferred installation positions are:





**Connection**

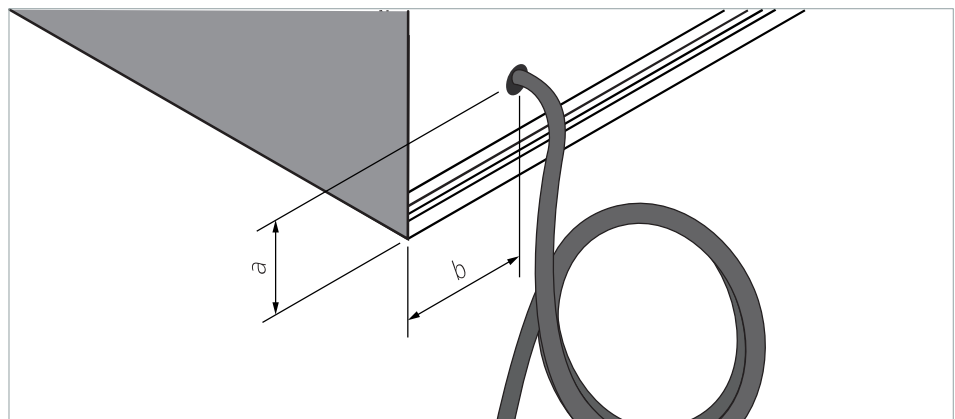
**Cable exits**



	<b>SB/W</b>	<b>SB/BK</b>
Bottom right	●	●
Bottom centre	○	○
Bottom left	○	●
Top right	○	○
Top centre	○	○
Top left	○	○

● = standard    ○ = optional

Standard cable exit: position



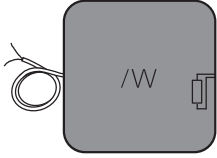
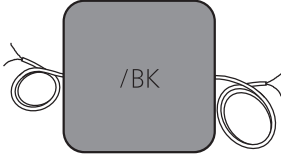
<b>Aluminium mounting plate</b>	<b>C 40</b>	<b>C 100</b>	<b>C 150</b>
a	7 mm	40 mm	50 mm
b	50 mm	50 mm	50 mm

Other cable exits can be provided on request.

*Subject to technical modifications.*

## Cable connection

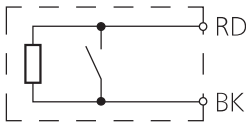
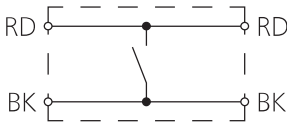
- Standard cable lengths  
L = 2.0 m
- Maximum total cable length to the control unit  
L<sub>max</sub> = 100 m
- Cable ends: stripped wires  
Optional: cable ends available with plug and coupling

<b>/W-type sensor with 1 line</b>	<b>/BK-type sensor with 2 lines</b>
<ul style="list-style-type: none"> <li>• As an individual /W-type sensor or a /W-type end sensor</li> <li>• Integrated resistor</li> <li>• 1 two-wire cable</li> </ul>	<ul style="list-style-type: none"> <li>• As a /BK-type through sensor</li> <li>• Without resistor</li> <li>• 2 two-wire cables</li> </ul>
	

## Wire colours

### Colour coding

BK Black  
RD Red

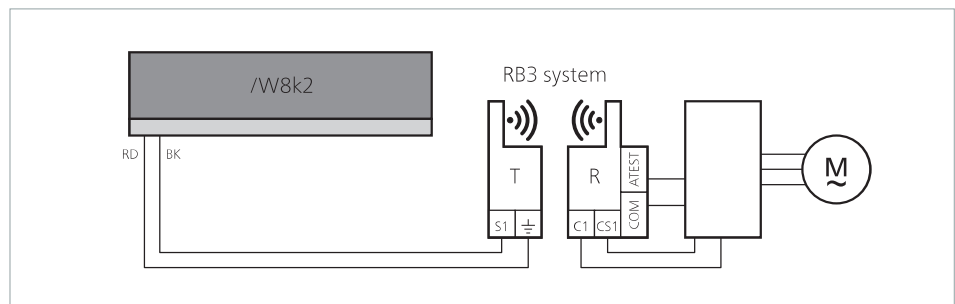
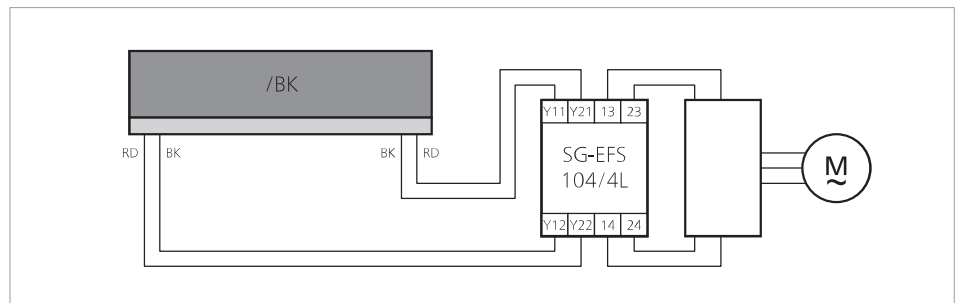
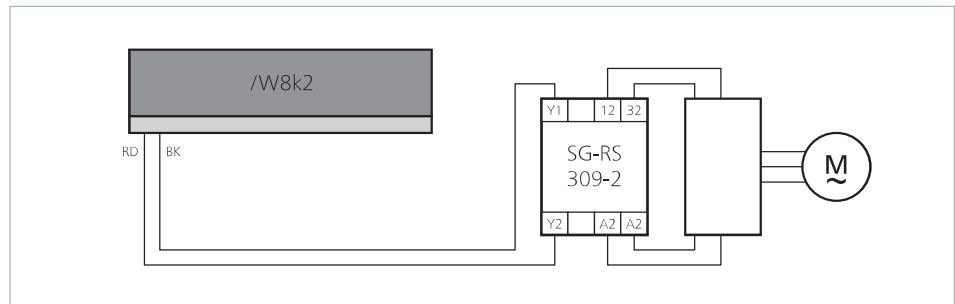
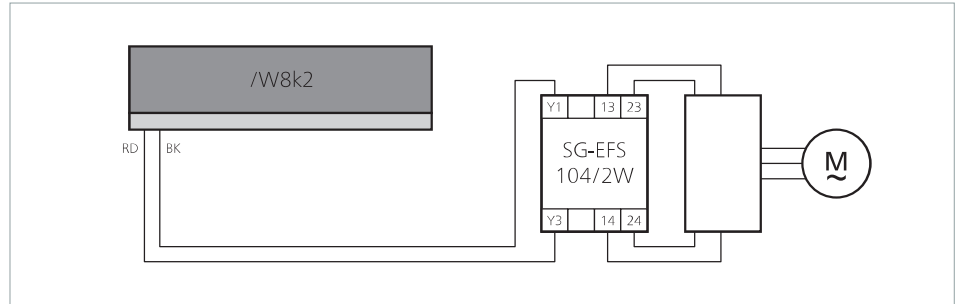
<b>/W-type sensor with 1 line</b>	<b>/BK-type sensor with 2 lines</b>
	

## Connection examples

Key:  
 /W8k2 Sensor for 2-wire technology with resistor 8k2  
 /BK Sensor for 4-wire technology  
 M Motor

### Colour coding

BK Black  
 RD Red



## Sensor surface

The sensor surface is a sleeve that mechanically protects the foam body and the internal parts. The sleeve also prevents dirt and moisture from penetrating the sensor (IP54).

## PES (polyester sleeve)

### Areas of application:

- Indoors
- Outdoors with additional sealing
- Heavy mechanical loads

### Colour:

Standard:

- Plain yellow
- Plain black
- Black and yellow stripes

Optional:

- "No entry" symbol



## PUR (skin)

### Areas of application:

- For dry indoor environments
- Normal mechanical loads
- Tight-fitting skin around foam

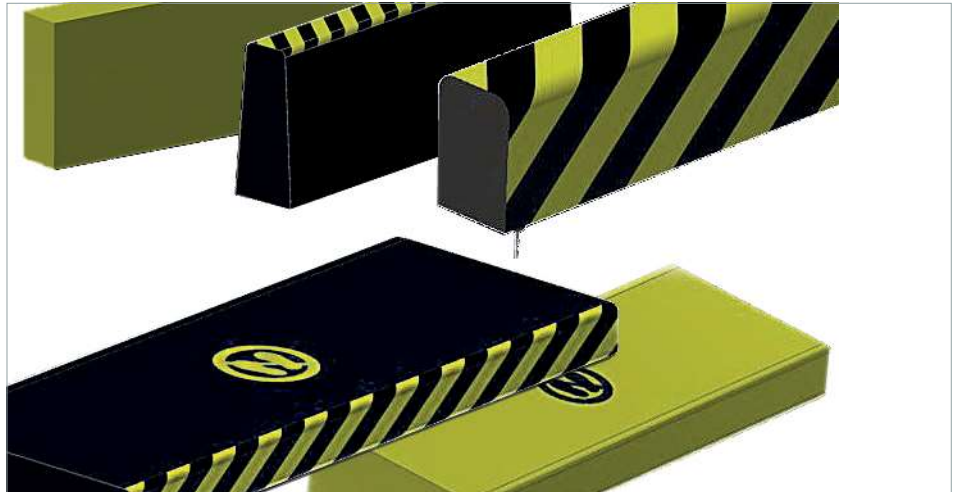
### Colour:

Standard:

- Plain yellow
- Plain black
- Black and yellow stripes

Optional:

- "No entry" symbol



## Synthetic leather

### Areas of application:

- For environments with high aesthetic requirements

### Colour:

Standard:

- Plain yellow
- Plain black
- Black and yellow stripes

Optional:

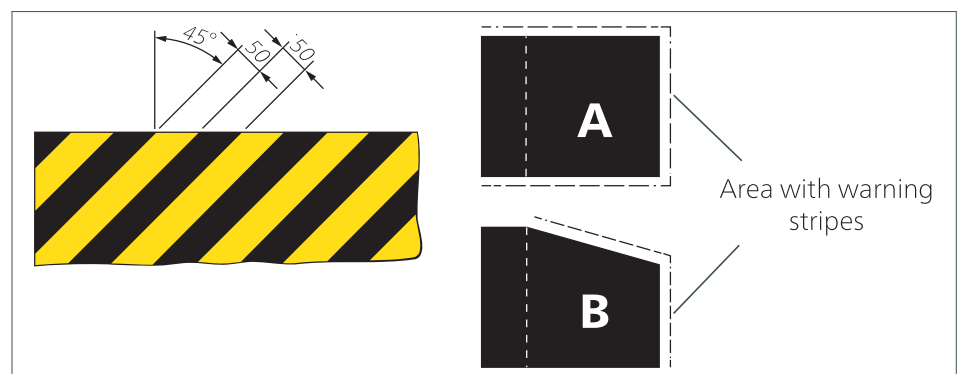
- "No entry" symbol

## Optional sleeves

- Extreme PES in yellow or black, or with black and yellow stripes (for use outdoors)
- Welding protection sleeve in silver (good resistance to flying sparks and hot swarf)
- Theatre fabric, black
- PUR in another RAL colour (on request)

## Warning stripes

Black and yellow warning stripes are only available with the following materials: PES, PUR, synthetic leather and extreme PES.



*Subject to technical modifications.*

## Resistance

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

### Physical resistance

	PES	PUR
UV resistance	Yes	Yes
Impregnation (fluorocarbons) Water, oil and dirt-repellent	Yes	No

### Chemical resistance

The sensor is resistant to a certain extent 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:

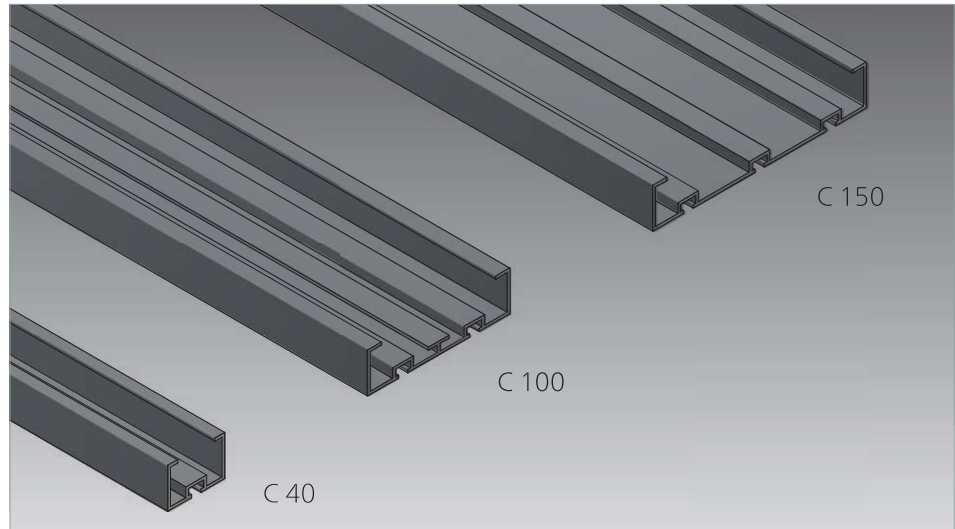
- + = resistant
- ± = resistant to a certain extent
- = not resistant

	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	+	+	+	+

## 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 sliding blocks, 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
- Hot hardened
- Wall thickness: at least 2.0 mm, extruded
- Tolerances in accordance with EN 755-9

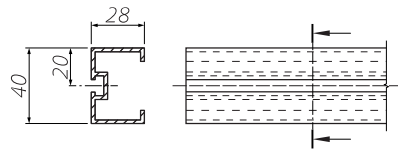
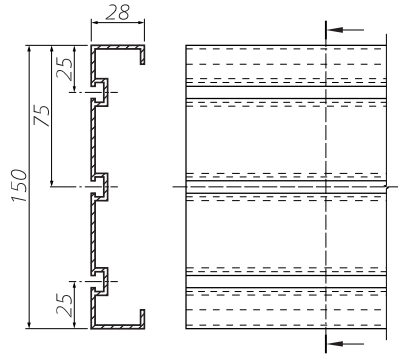
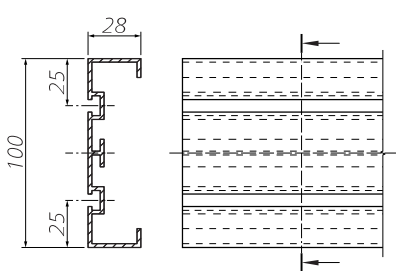
## Aluminium mounting plates: Fixing types

### Standard profile

C 40	C 100	C 150

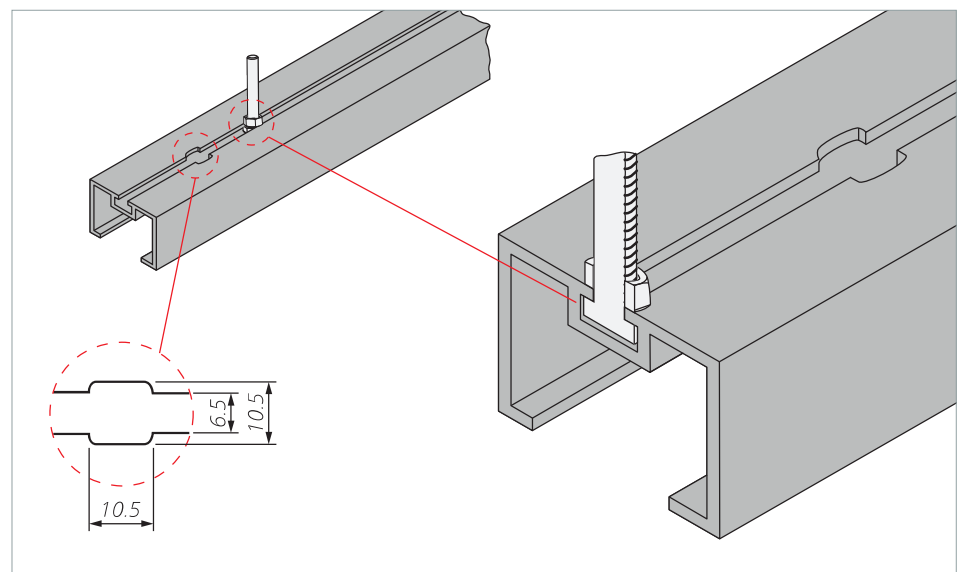


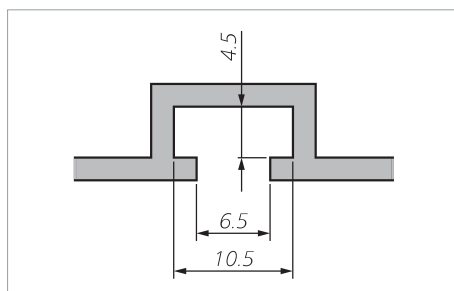
## Aluminium mounting plates: Dimensions

Standard profile		1:4
C 40		C 100
C 150		

## Fixing groove

The fixing grooves are only accessible through the groove openings. Access from the side is blocked by the sleeve.



**Dimensions and quantities**

	Quantity
C 40	1×
C 100	2×
C 150	3×

Standard: fixed using low-profile M5 sliding block for 6 mm groove, flat-head M6 hexagon bolt or M6 thin 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:

$s_1$  = Stopping distance of the dangerous movement [ mm ]

$$s_1 = 1/2 \times v \times T$$

where:  $T = t_1 + t_2$

$v$  = Velocity of the dangerous movement [ mm/s ]

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:  $C = 1.2$

$T$  = Follow-through time of the complete system [ s ]

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*.

$t_1$  = 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 your machine with a width of 1.5 m has a velocity of  $v = 10$  mm/s and can be brought to a standstill within  $t_2 = 0.25$  s. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore, the safety bumper STB 1500 × 40 × 100 could be sufficient. The safety bumper response time (STB + control unit\*) is  $t_1 = 1180$  ms.

$$s_1 = 1/2 \times v \times T$$

where:  $T = t_1 + t_2$

$$s_1 = 1/2 \times 10 \text{ mm/s} \times (1.18 \text{ s} + 0.25 \text{ s})$$

$$s_1 = 1/2 \times 10 \text{ mm/s} \times 1.43 \text{ s} = \mathbf{7.2 \text{ mm}}$$

$$s = s_1 \times C$$

where:  $C = 1.2$

$$s = 7.2 \text{ mm} \times 1.2 = \mathbf{9 \text{ mm}}$$

The safety bumper must have a minimum overtravel distance of  $s = 9$  mm. The selected safety bumper STB 1500 × 40 × 100 has an overtravel distance of at least 57.3 mm. This is more than the required 9 mm.

**Result:** The STB 1500 × 40 × 100 mm 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  $v = 200 \text{ m/s}$  and  $t_2 = 0.5 \text{ s}$ . The safety bumper response time (STB + control unit\*) is  $t_1 = 95 \text{ ms}$ .

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$
$$s_1 = 1/2 \times 200 \text{ mm/s} \times (0.095 \text{ s} + 0.5 \text{ s})$$
$$s_1 = 1/2 \times 200 \text{ mm/s} \times 0.595 \text{ s} = \mathbf{60 \text{ mm}}$$

$$s = s_1 \times C \quad \text{where: } C = 1.2$$
$$s = 60 \text{ mm} \times 1.2 = \mathbf{72 \text{ mm}}$$

The safety bumper must have a minimum overtravel distance of  $s = 72 \text{ mm}$ . The selected safety bumper STB 1500 × 40 × 100 has an overtravel distance of at least 57.3 mm. This is less than the required 72 mm.

**Result:** The STB 1500 × 40 × 100 is **not suitable** for this case.

**Calculation example 3**

The same conditions apply as in calculation example 2. Instead of the safety bumper STB 1500 × 40 × 100, a safety bumper STB 1500 × 100 × 200 is selected. The safety bumper response time (STB + control unit\*) is  $t_1 = 108 \text{ ms}$ .

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$
$$s_1 = 1/2 \times 200 \text{ mm/s} \times (0.108 \text{ s} + 0.5 \text{ s})$$
$$s_1 = 1/2 \times 200 \text{ mm/s} \times 0.608 \text{ s} = \mathbf{61 \text{ mm}}$$

$$s = s_1 \times C \quad \text{where: } C = 1.2$$
$$s = 61 \text{ mm} \times 1.2 = \mathbf{74 \text{ mm}}$$

The safety bumper must have a minimum overtravel distance of  $s = 74 \text{ mm}$ . The selected safety bumper STB 1500 × 100 × 200 has an overtravel distance of at least 147 mm. This is more than the required 74 mm.

**Result:** The STB 1500 × 100 × 200 is **suitable** for this case.

## Customised designs

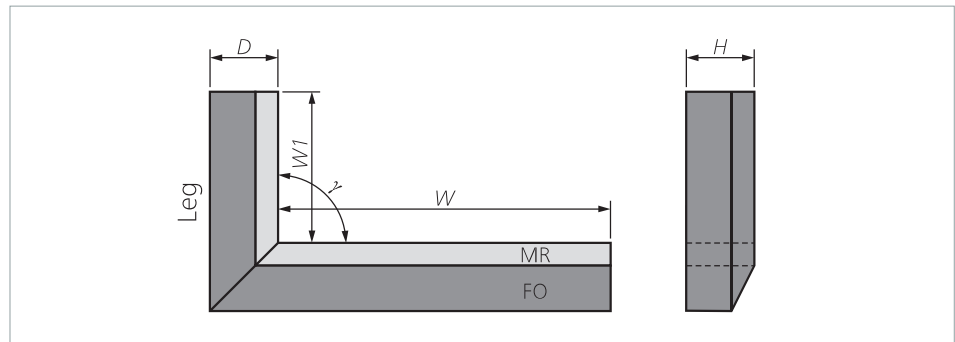
In addition to the standard range, special solutions are also possible, such as:

### L shape

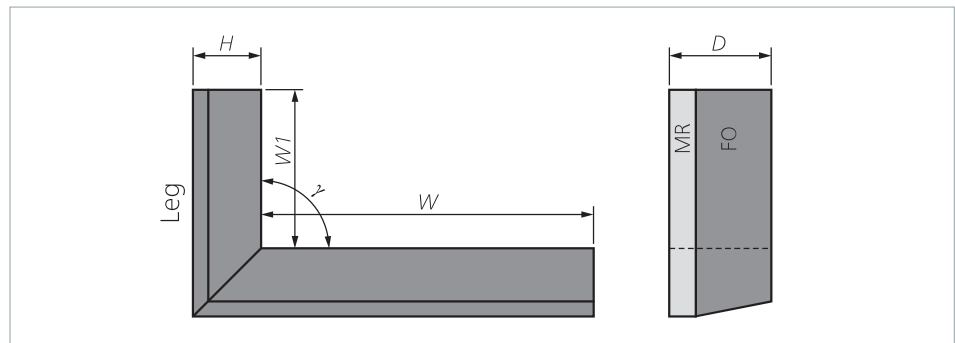
- Depth (D) is the same in the case of W and W1
- Leg angle  $\gamma$  : 90°/120°/135°/150°

#### Horizontal

MR = mounting plate  
FO = foam



#### Vertical



#### Possible installation positions

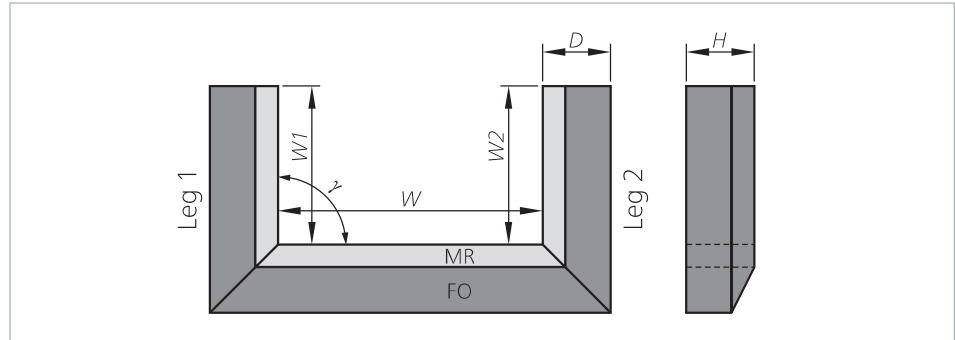
	L shape
Horizontal	●
Vertical	●
Hanging down	●
Standing upright	●

## U shape

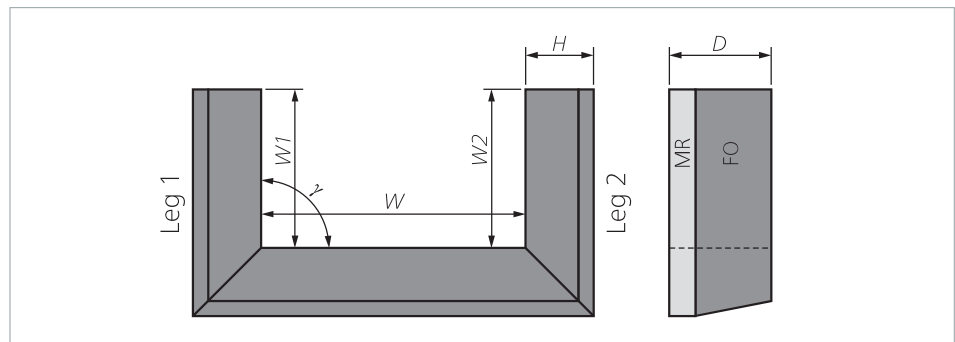
- Depth (D) is the same in the case of W, W1 and W2
- Leg angle  $\gamma$  : 90°/120°/135°/150°

### Horizontal

MR = mounting plate  
FO = foam



### Vertical

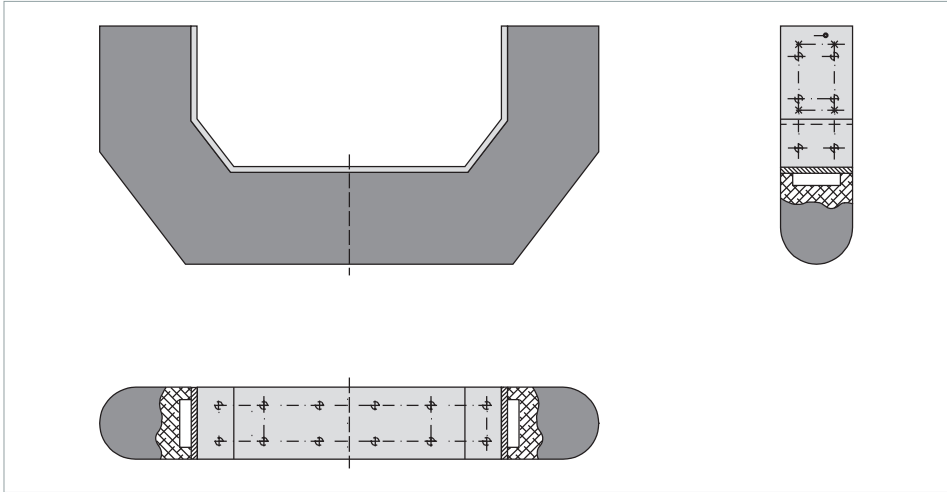


### Possible installation positions

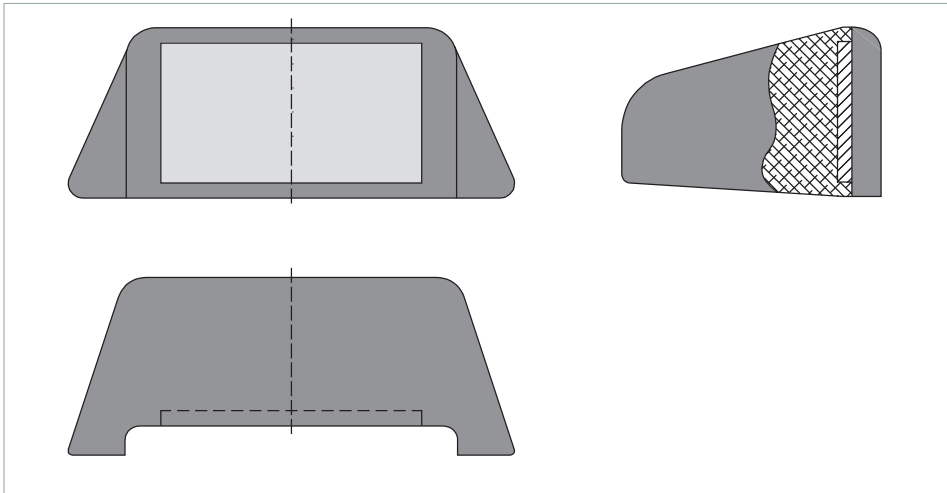
	U shape
Horizontal	●
Vertical	●
Hanging down	●
Standing upright	●

### Additional options

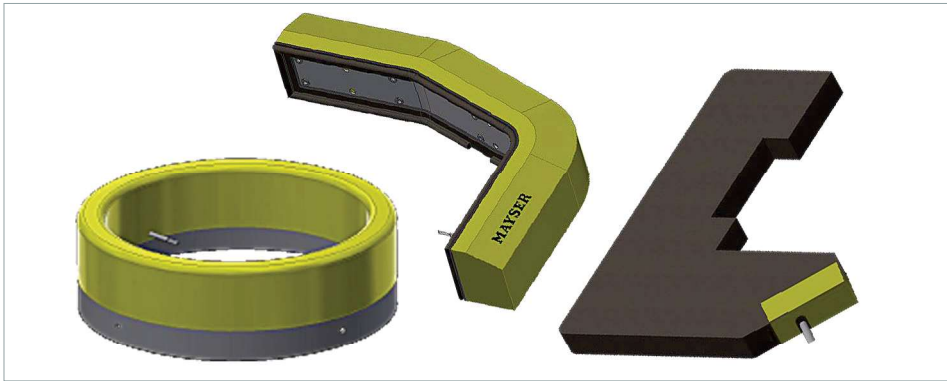
#### Extended U shape



#### Trapezium shape



#### Additional shapes



*Subject to technical modifications.*



## 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 fixing.

### Cleaning

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

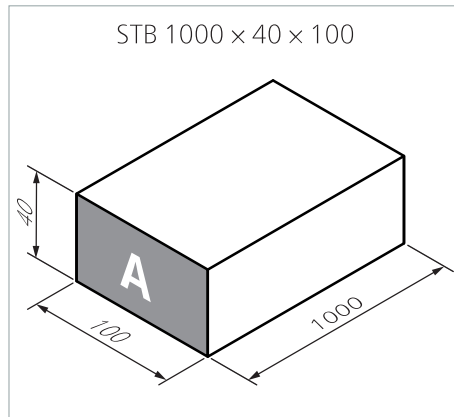
**Technical data**

**STB 1000 × 40 × 100 PES**

Cross section A 1000 × 40 × 100 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>
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	135 ms	150 ms	120 ms
Actuation distance	14 mm	15 mm	12 mm
Overtravel distance	54 mm	53 mm	56 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	0.99 kg/m (without control unit)		0.99 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA		24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

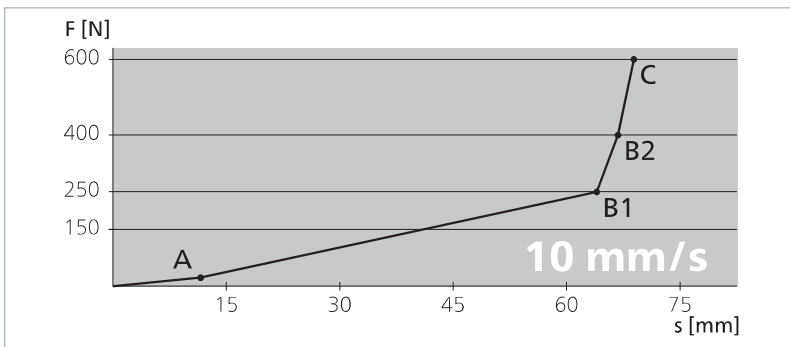
### Test conditions

according to ISO 13856-3

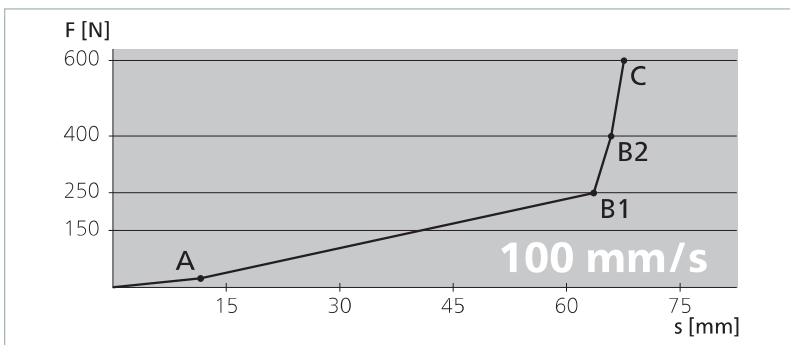
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

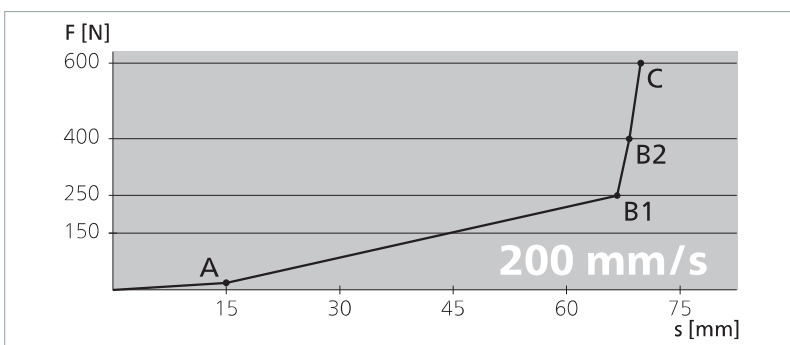
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	22.5 N
Response time	1160 ms
Actuation distance (A)	11.6 mm
Overtravel distance	
up to 250 N (B1)	52.4 mm
up to 400 N (B2)	55.2 mm
up to 600 N (C)	57.3 mm
Total deformation	68.9 mm



Test velocity	<b>100 mm/s</b>
Actuation force	23.6 N
Response time	116 ms
Actuation distance (A)	11.6 mm
Overtravel distance	
up to 250 N (B1)	52.0 mm
up to 400 N (B2)	54.3 mm
up to 600 N (C)	56.0 mm
Total deformation	67.6 mm



Test velocity	<b>200 mm/s</b>
Actuation force	18.7 N
Response time	75 ms
Actuation distance (A)	15.0 mm
Overtravel distance	
up to 250 N (B1)	51.7 mm
up to 400 N (B2)	53.3 mm
up to 600 N (C)	54.8 mm
Total deformation	69.8 mm

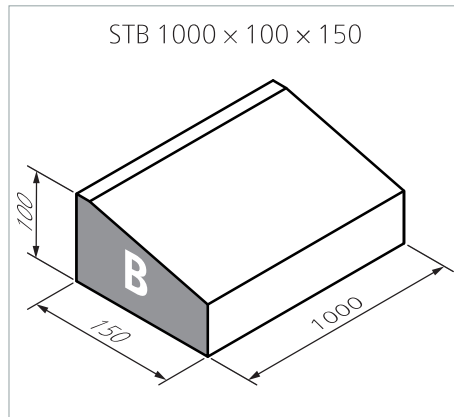
**Technical data**

**STB 1000 × 100 × 150 PES**

Cross section B 1000 × 100 × 150 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> $1 \times 10^5$	> $1 \times 10^5$	> $1 \times 10^5$
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	155 ms	170 ms	140 ms
Actuation distance	16 mm	17 mm	14 mm
Overtravel distance	98 mm	97 mm	100 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	$6 \times 10^6$	$6 \times 10^6$	$6 \times 10^6$
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	1.76 kg/m (without control unit)		1.76 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA		24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

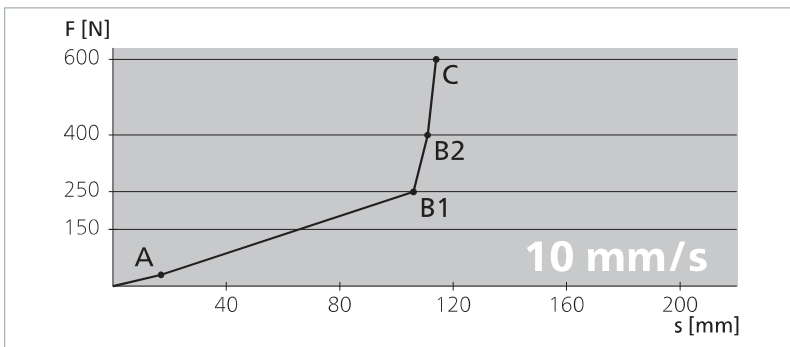
### Test conditions

according to ISO 13856-3

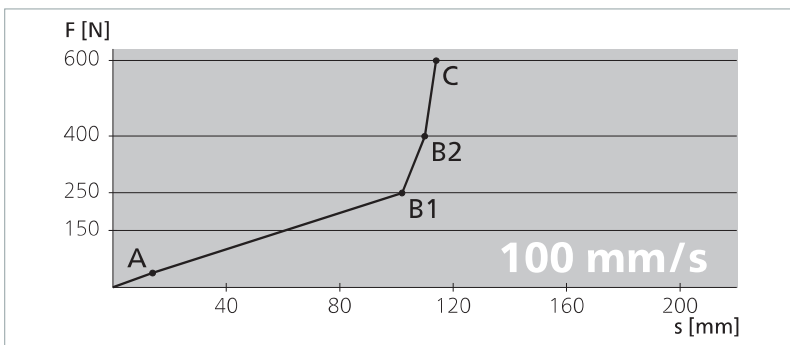
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

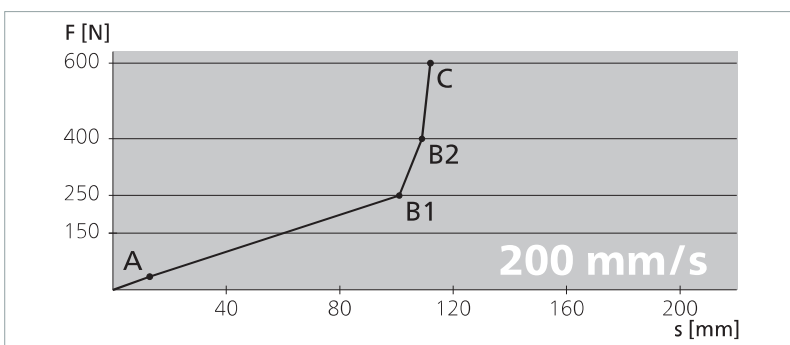
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	30 N
Response time	1700 ms
Actuation distance (A)	17 mm
Overtravel distance	
up to 250 N (B1)	89 mm
up to 400 N (B2)	94 mm
up to 600 N (C)	97 mm
Total deformation	114 mm



Test velocity	<b>100 mm/s</b>
Actuation force	38 N
Response time	140 ms
Actuation distance (A)	14 mm
Overtravel distance	
up to 250 N (B1)	88 mm
up to 400 N (B2)	96 mm
up to 600 N (C)	100 mm
Total deformation	114 mm



Test velocity	<b>200 mm/s</b>
Actuation force	35 N
Response time	65 ms
Actuation distance (A)	13 mm
Overtravel distance	
up to 250 N (B1)	88 mm
up to 400 N (B2)	96 mm
up to 600 N (C)	99 mm
Total deformation	112 mm

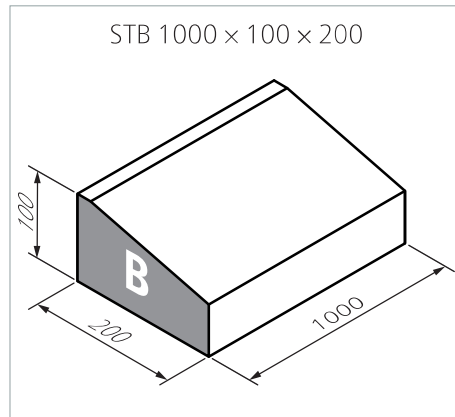
**Technical data**

**STB 1000 × 100 × 200 PES**

Cross section B 1000 × 100 × 200 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> $1 \times 10^5$	> $1 \times 10^5$	> $1 \times 10^5$
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	175 ms	190 ms	160 ms
Actuation distance	18 mm	19 mm	16 mm
Overtravel distance	140 mm	139 mm	142 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	$6 \times 10^6$	$6 \times 10^6$	$6 \times 10^6$
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	1.86 kg/m (without control unit)		1.86 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA	24 V DC / max. 10 mA	24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

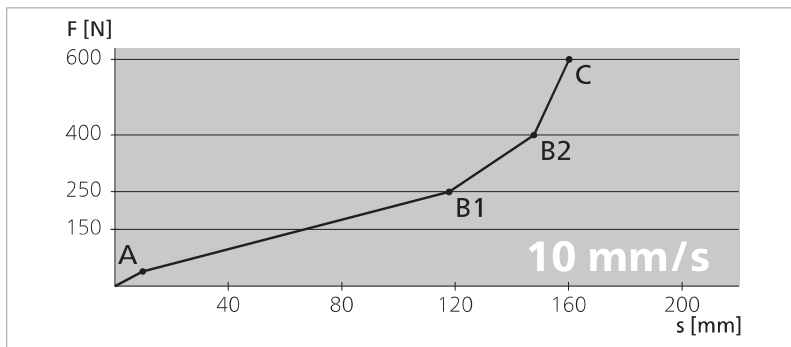
### Test conditions

according to ISO 13856-3

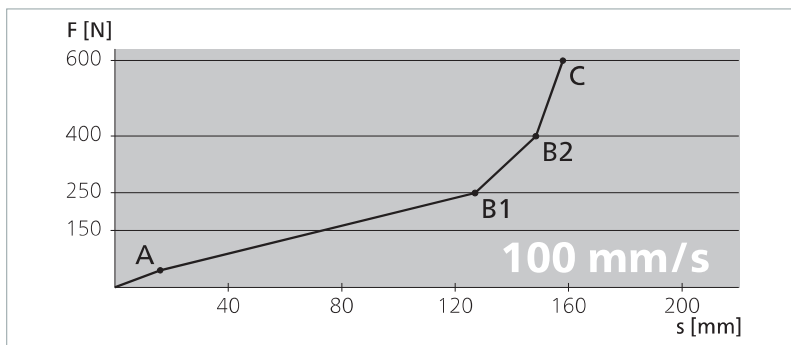
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

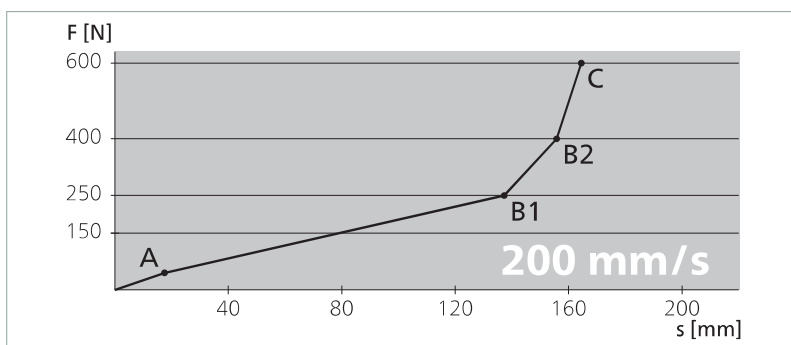
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	39.0 N
Response time	980 ms
Actuation distance (A)	9.8 mm
Overtravel distance	
up to 250 N (B1)	108.1 mm
up to 400 N (B2)	138.0 mm
up to 600 N (C)	150.4 mm
Total deformation	160.2 mm



Test velocity	<b>100 mm/s</b>
Actuation force	44.9 N
Response time	160 ms
Actuation distance (A)	16.0 mm
Overtravel distance	
up to 250 N (B1)	110.0 mm
up to 400 N (B2)	132.5 mm
up to 600 N (C)	142.0 mm
Total deformation	158.0 mm



Test velocity	<b>200 mm/s</b>
Actuation force	44.8 N
Response time	88 ms
Actuation distance (A)	17.5 mm
Overtravel distance	
up to 250 N (B1)	119.8 mm
up to 400 N (B2)	138.3 mm
up to 600 N (C)	147.0 mm
Total deformation	164.5 mm



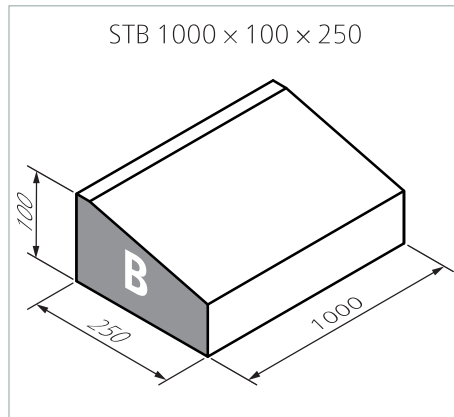
**Technical data**

**STB 1000 × 100 × 250 PES**

Cross section B 1000 × 100 × 250 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>
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	375 ms	390 ms	360 ms
Actuation distance	38 mm	39 mm	36 mm
Overtravel distance	169 mm	168 mm	171 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	1.93 kg/m (without control unit)		1.93 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA		24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

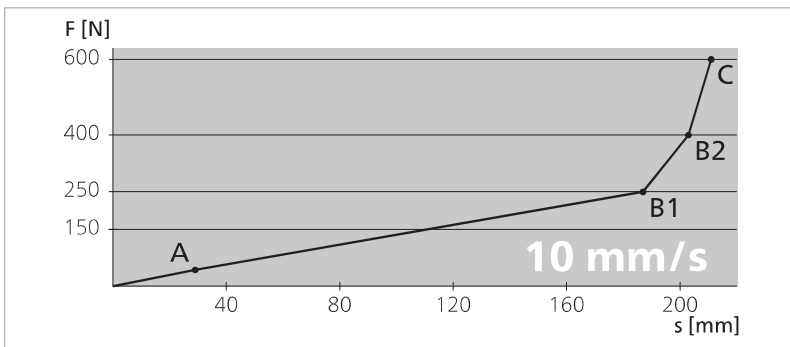
### Test conditions

according to ISO 13856-3

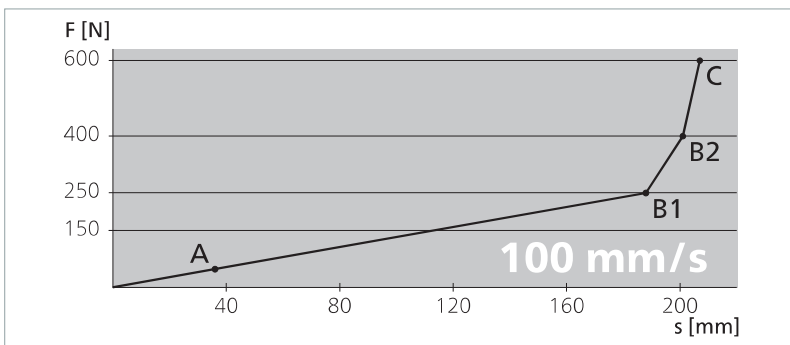
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

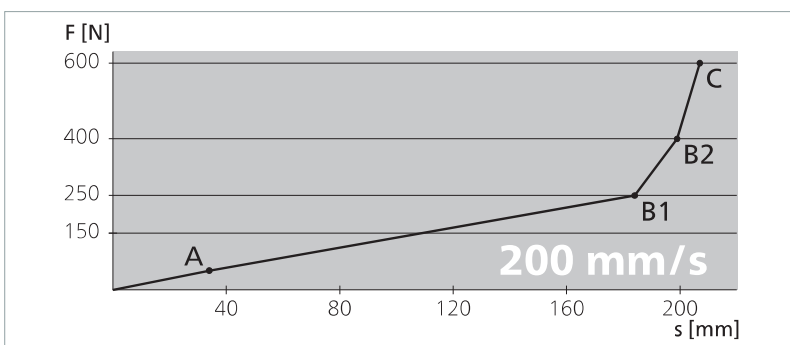
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	43 N
Response time	2900 ms
Actuation distance (A)	29 mm
Overtravel distance	
up to 250 N (B1)	158 mm
up to 400 N (B2)	174 mm
up to 600 N (C)	182 mm
Total deformation	211 mm



Test velocity	<b>100 mm/s</b>
Actuation force	48 N
Response time	360 ms
Actuation distance (A)	36 mm
Overtravel distance	
up to 250 N (B1)	152 mm
up to 400 N (B2)	165 mm
up to 600 N (C)	171 mm
Total deformation	207 mm



Test velocity	<b>200 mm/s</b>
Actuation force	51 N
Response time	170 ms
Actuation distance (A)	34 mm
Overtravel distance	
up to 250 N (B1)	150 mm
up to 400 N (B2)	165 mm
up to 600 N (C)	173 mm
Total deformation	207 mm

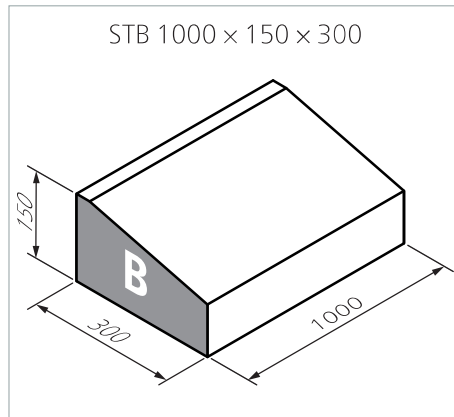
**Technical data**

**STB 1000 × 150 × 300 PES**

Cross section B 1000 × 150 × 300 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>	> 1 × 10 <sup>5</sup>
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	395 ms	410 ms	380 ms
Actuation distance	40 mm	41 mm	38 mm
Overtravel distance	199 mm	198 mm	201 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>	6 × 10 <sup>6</sup>
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	2.50 kg/m (without control unit)		2.50 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA		24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

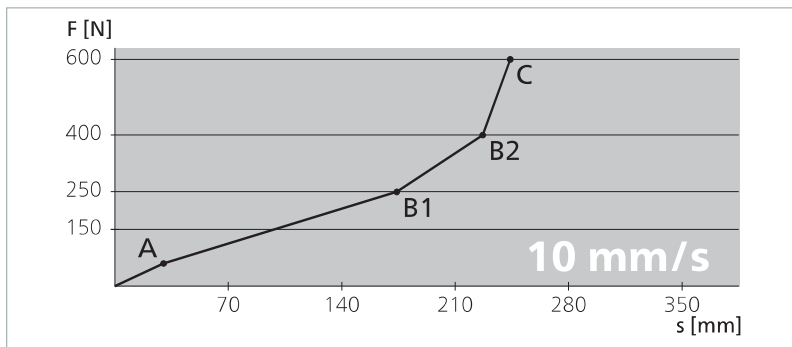
### Test conditions

according to ISO 13856-3

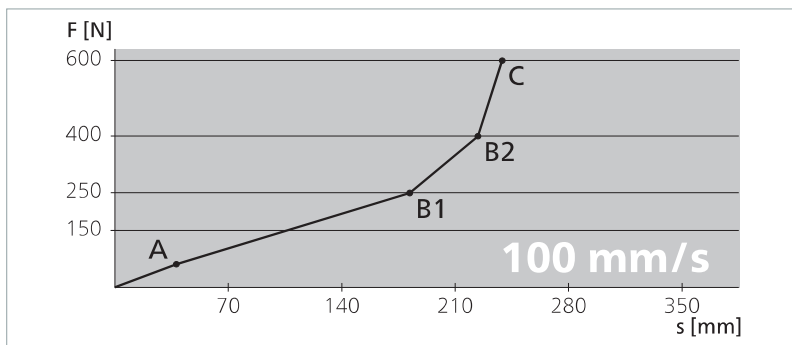
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

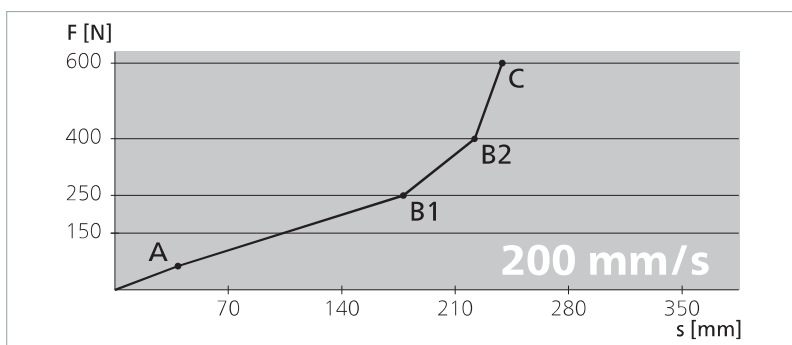
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	60 N
Response time	3000 ms
Actuation distance (A)	30 mm
Overtravel distance	
up to 250 N (B1)	144 mm
up to 400 N (B2)	197 mm
up to 600 N (C)	214 mm
Total deformation	244 mm



Test velocity	<b>100 mm/s</b>
Actuation force	61 N
Response time	380 ms
Actuation distance (A)	38 mm
Overtravel distance	
up to 250 N (B1)	144 mm
up to 400 N (B2)	186 mm
up to 600 N (C)	201 mm
Total deformation	239 mm



Test velocity	<b>200 mm/s</b>
Actuation force	63 N
Response time	195 ms
Actuation distance (A)	39 mm
Overtravel distance	
up to 250 N (B1)	139 mm
up to 400 N (B2)	183 mm
up to 600 N (C)	200 mm
Total deformation	239 mm

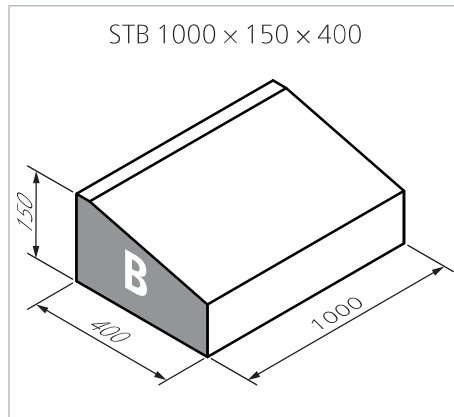
## Technical data

### STB 1000 × 150 × 400 PES

Cross section B 1000 × 150 × 400 mm (W × H × D) PES (polyester sleeve)	Safety bumper STB/W with SG-EFS 104/2W	Safety bumper STB/BK with SG-EFS 104/4L	Sensor* STB/W or STB/BK (without control unit)
Testing basis	EN 12978, ISO 13849-1, ISO 13856-3		ISO 13856-3
<b>Switching characteristics at <math>v_{test} = 100 \text{ mm/s}</math></b>			
Switching operations	> $1 \times 10^5$	> $1 \times 10^5$	> $1 \times 10^5$
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	495 ms	510 ms	480 ms
Actuation distance	50 mm	51 mm	48 mm
Overtravel distance	295 mm	294 mm	297 mm
<b>Safety classifications</b>			
ISO 13856: reset function	With/without	With/without	–
ISO 13849-1:2015	Category 3 PL d	Category 3 PL d	Category 1
MTTF <sub>D</sub> (pressure-sensitive protective device)	257 a	100 a	–
B <sub>10D</sub> (sensor)	$6 \times 10^6$	$6 \times 10^6$	$6 \times 10^6$
n <sub>op</sub> (assumption)	52560/a	52560/a	–
<b>Mechanical operating conditions</b>			
Sensor width	100 to 3000 mm		100 to 3000 mm
Cable length (min./max.)	10 cm / 100 m		10 cm / 100 m
Operating velocity (min. / max.)	10 mm/s / 200 mm/s		10 mm/s / 200 mm/s
Tensile load, cable (max.)	20 N		20 N
IEC 60529: degree of protection			
Sensor	IP54		IP54
Control unit	IP20		–
Operating temperature			
Individual sensor with PES or synthetic leather	–20 to +55 °C		–20 to +55 °C
PUR	+5 to +55 °C		+5 to +55 °C
Weight (incl. aluminium mounting plate)	2.73 kg/m (without control unit)		2.73 kg/m
<b>Electrical operating conditions</b>			
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)
Sensor	24 V DC / max. 10 mA		24 V DC / max. 10 mA

\* See footnote on page 39.

## Dimensions and distances



Dimensional tolerances in accordance with MWN003

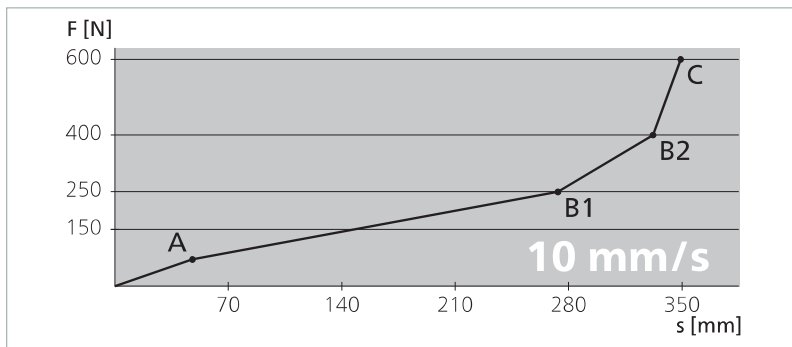
### Test conditions

according to ISO 13856-3

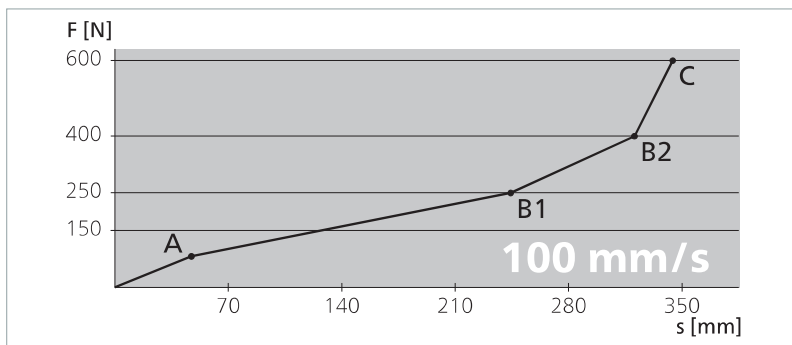
- Installation position C
- Temperature +20 °C
- Measurement point C3
- Test sample 1 with Ø 80 mm
- Without control unit

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

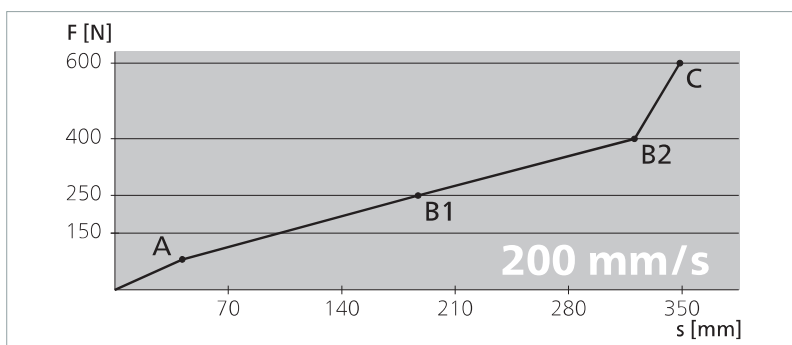
### Force-distance ratios



Test velocity	<b>10 mm/s</b>
Actuation force	71.0 N
Response time	4790 ms
Actuation distance (A)	47.9 mm
Overtravel distance	
up to 250 N (B1)	225.6 mm
up to 400 N (B2)	284.3 mm
up to 600 N (C)	301.3 mm
Total deformation	349.2 mm



Test velocity	<b>100 mm/s</b>
Actuation force	81.9 N
Response time	472 ms
Actuation distance (A)	47.2 mm
Overtravel distance	
up to 250 N (B1)	197.1 mm
up to 400 N (B2)	273.5 mm
up to 600 N (C)	297.1 mm
Total deformation	344.3 mm



Test velocity	<b>200 mm/s</b>
Actuation force	80.6 N
Response time	208 ms
Actuation distance (A)	41.6 mm
Overtravel distance	
up to 250 N (B1)	145.5 mm
up to 400 N (B2)	279.1 mm
up to 600 N (C)	307.1 mm
Total deformation	348.7 mm

## 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](http://www.mayser.com).

\* 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.