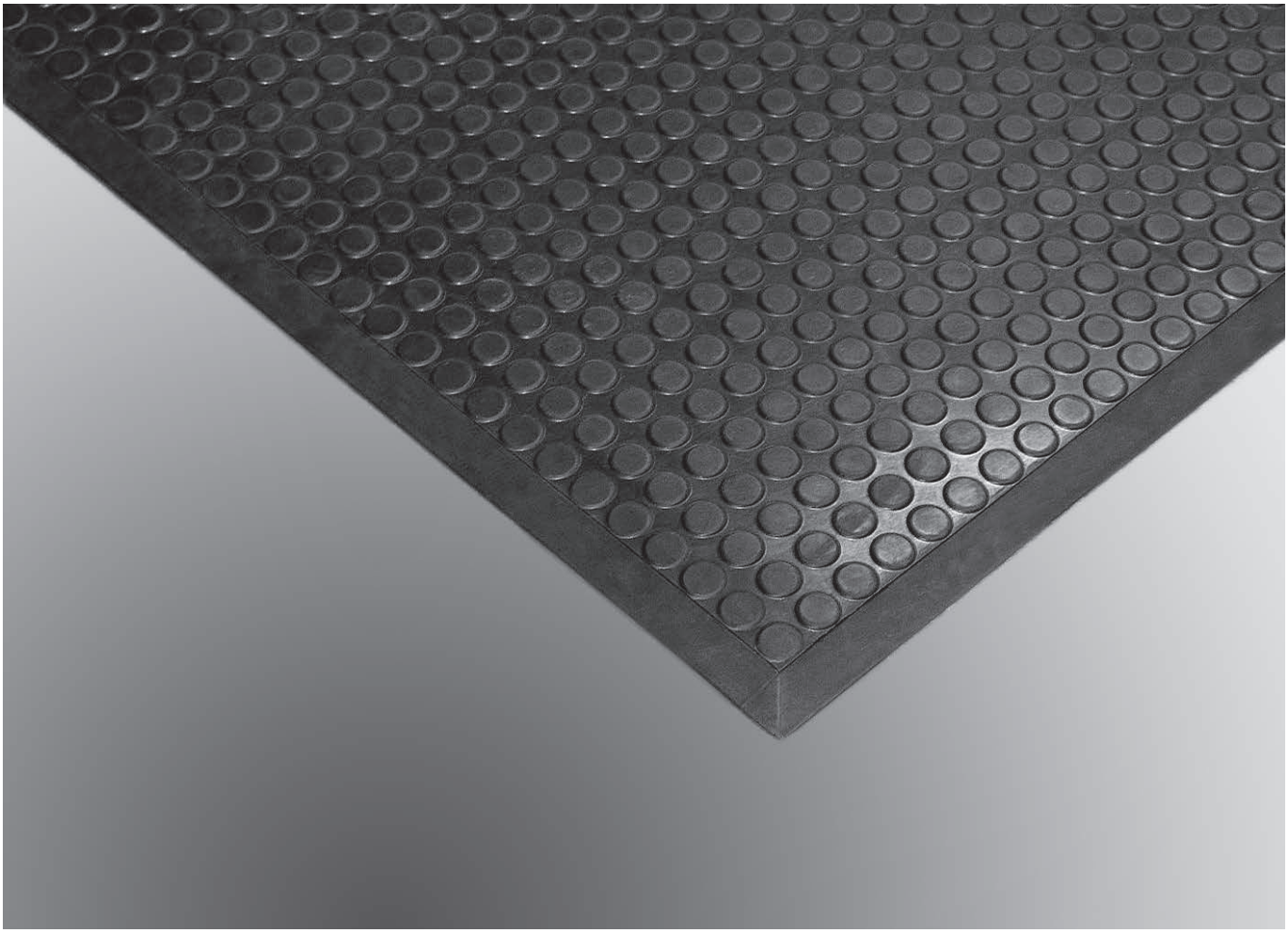
MAYSER®

Innovative by tradition.



Safety mats SM8

EN | Product information

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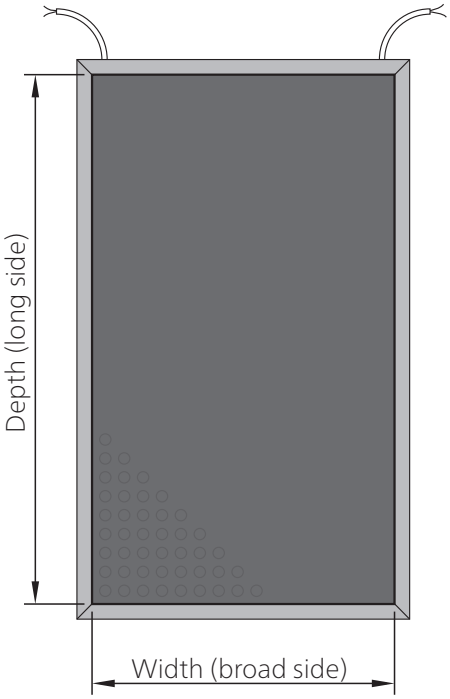
Available sizes

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.



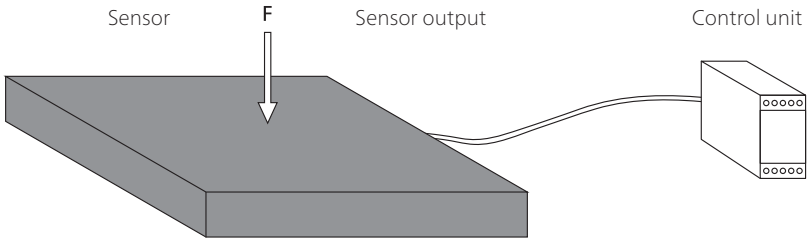
According to ISO 13855, the minimum depth to the danger zone must be taken into account (see chapter *Calculation of the necessary actuation area*). The non-sensitive edges must be taken into account (see chapter *Effective actuation area*).

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.

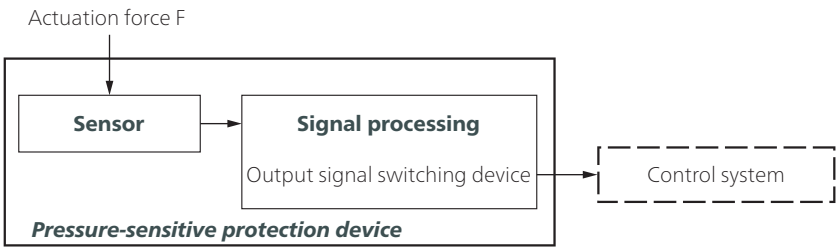


Sensor

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.

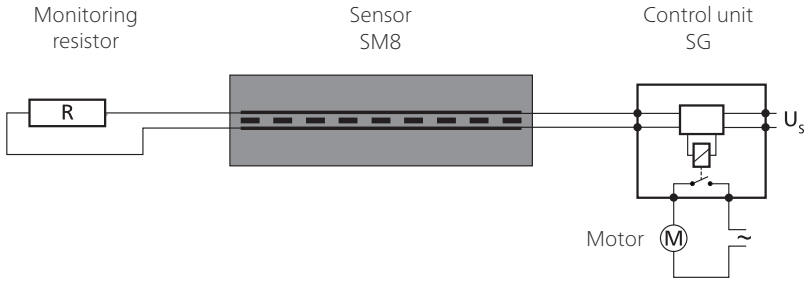


Tip: Terms are defined in ISO 13856-1 Section 3.

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

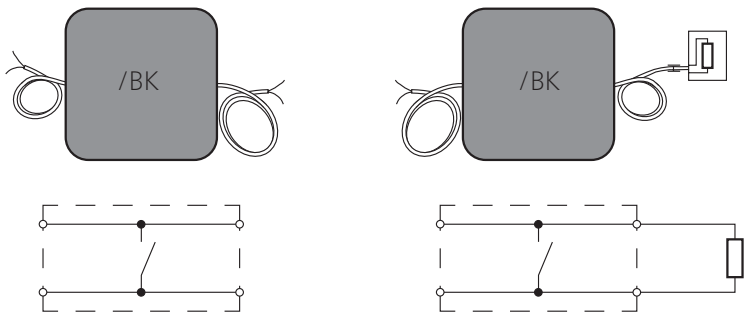


The monitoring resistor must be compatible with the control unit. The standard type is 8k2.

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).

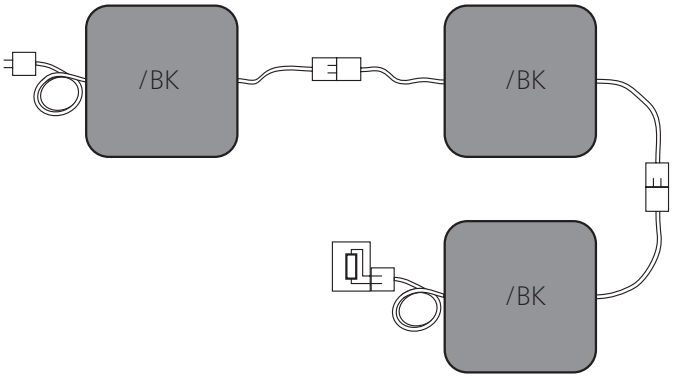
Types

/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.

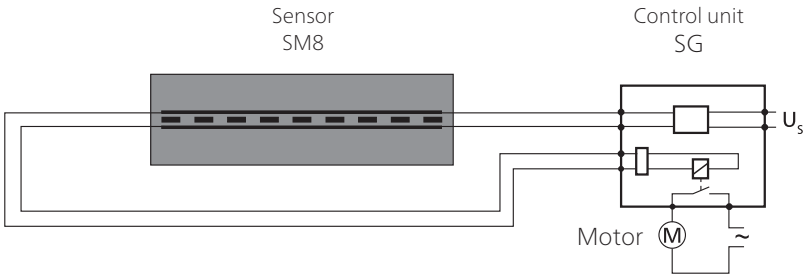
Sensor combination



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



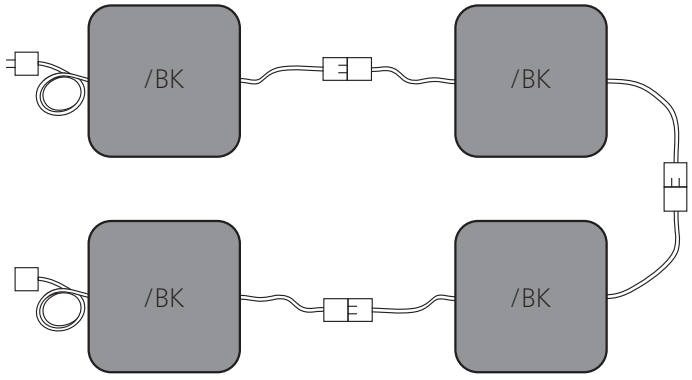
The 4-wire technology can only be used together with control unit SG-EFS 104/4L.

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.

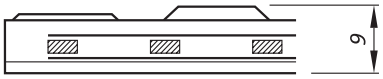
Performance Level (PL)
The PL has been determined using the procedure defined by ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contacts in the case of pressure-sensitive protection devices according to ISO 13856. In this case, no characteristic values of the sensor whatsoever 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

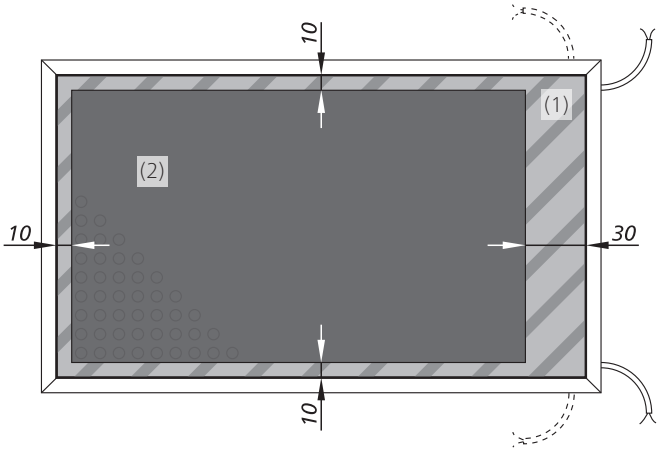


SM8
Moulded onto a plastic plate.
The surface texture provides the necessary non-slip properties and ensures mechanical protection.

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.

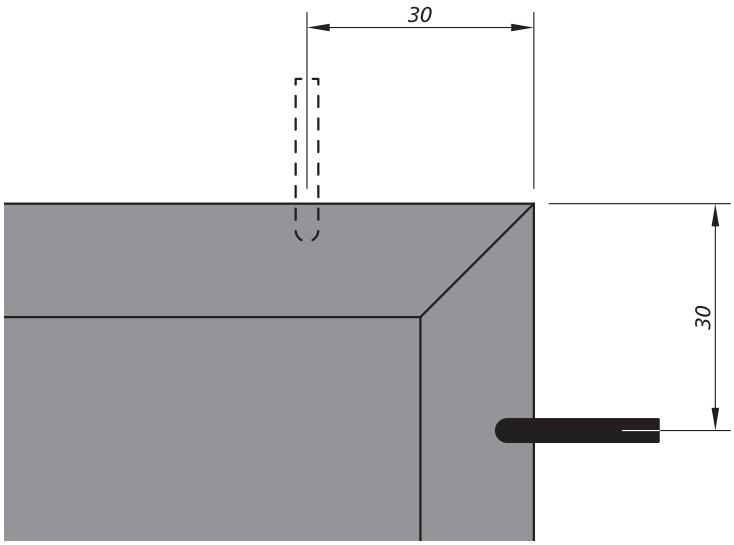
Sensor combinations
When sensor combinations are used, only the sides with 10 mm edges should be placed next to one another.
The integrated ramps must be removed from these sides before combining the sensors.

Subject to technical modifications.

Connection

Cable exits

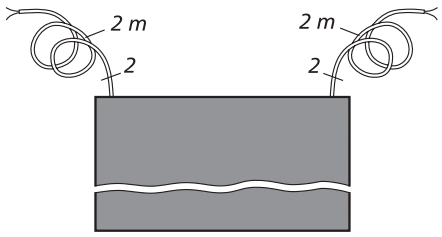
The cables are located at two corners.
Two cable exits are available at each corner and you can either use the one on the broad side (width) or the one on the long side (depth). The required cable exit must be cut out on site at the designated point on the mat.



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

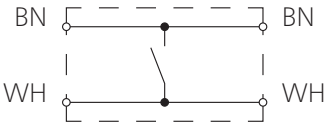
Subject to technical modifications.

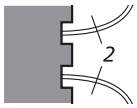
Wire colours

/BK-type sensor with 2 lines

Colour coding

BN	Brown
WH	White

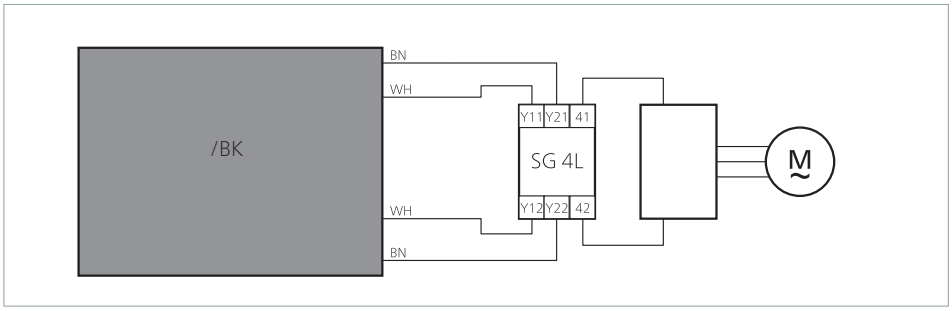




Connection example

Key:

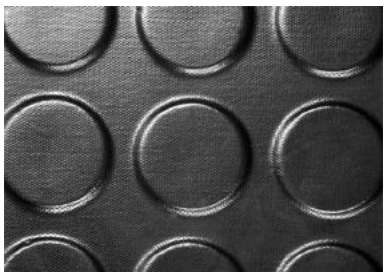
SG 4L Evaluation with 4-wire technology



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.

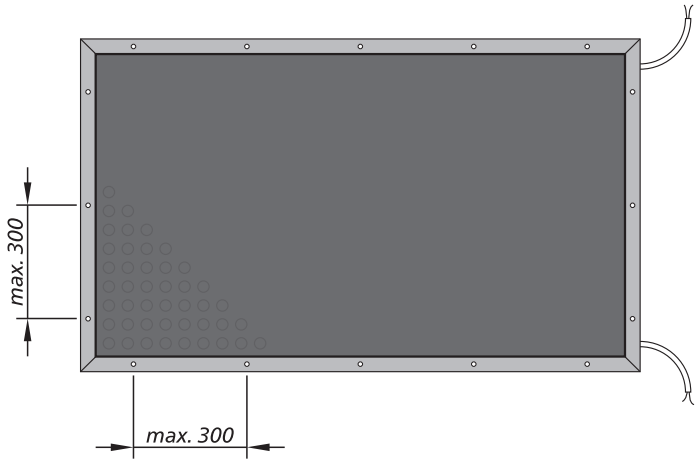
Explanation of symbols:
+ = resistant
± = resistant to a certain extent
– = not resistant

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 ≠ 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

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.