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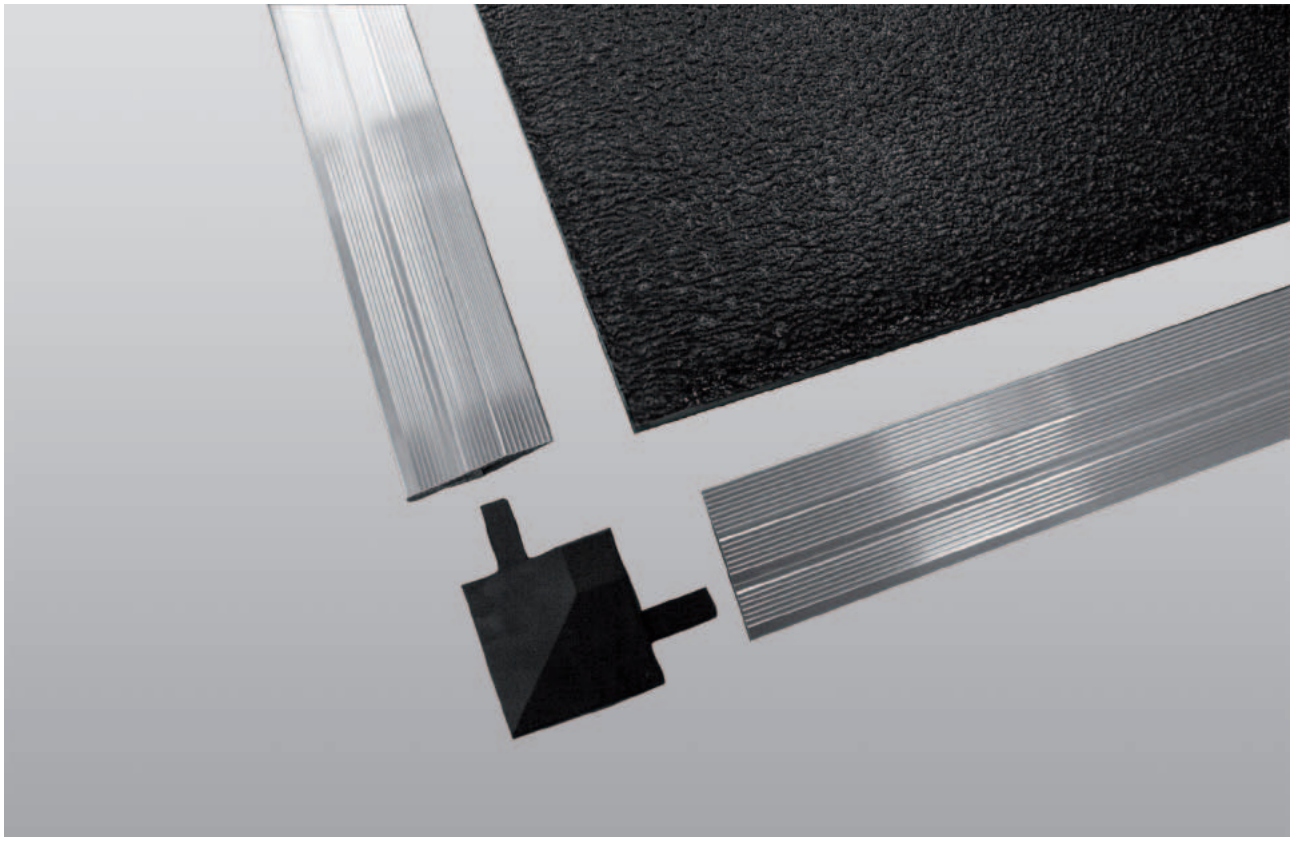
Product information



Safety Mats SM11

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Contents

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.

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Definitions

See Definitions and Operation Principles in chapter 1 of the catalogue.

Intended use

A safety mat detects a person that is standing on or stepping onto it. It is a protective device covering a certain area and monitoring the presence of a person on it as a safety function. Its purpose is to prevent possible hazardous situations for personnel within a danger zone.
Typical applications are in the area of moving units on machines and plants.
Safe operation of a safety mat depends entirely on

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

Tipp
See Annex B of ISO 13856-1 and Annex B of EN 1760-1, especially Figures B.1 and B.2.

Limits

- max. 10 sensors on one Control Unit
- System size max. 15 m^2
  = max. number × max. sensor size

Exclusions

An individual sensor is not suitable for detecting people weighing under 20 kg.
Sensor combinations are not suitable for detecting people weighing under 35 kg.
Sensors are also not suitable for driving over with forklifts.

Program selection

Sensors in the SM11 Safety Mat programme are only available in rectangular shape. The surface is resistant to a certain extent to environmental influences and normal chemical influences.
If you have higher requirements of the sensors, please ask for our customised SM programme.

ATTENTION
The categories according to EN 954-1 for safety mats and safety panels on machines are stated in type-C standards.

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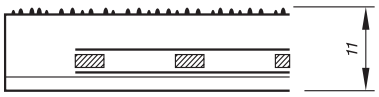
Subject to technical modifications.

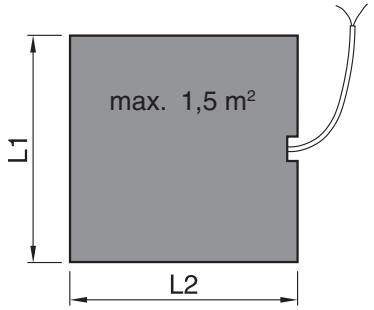
Design



Standard version
moulded onto a plastic plate;
fitted in the factory with a
non-slip structured surface
non-slip category: R9
Degree of protection: IP65

Available sizes

Sensors are available exclusively in rectangular shape up to a size of max.1.5 m².
The side lengths must be within a range of 200 to 3,000 mm.



L1: cable side
L2: not cable side

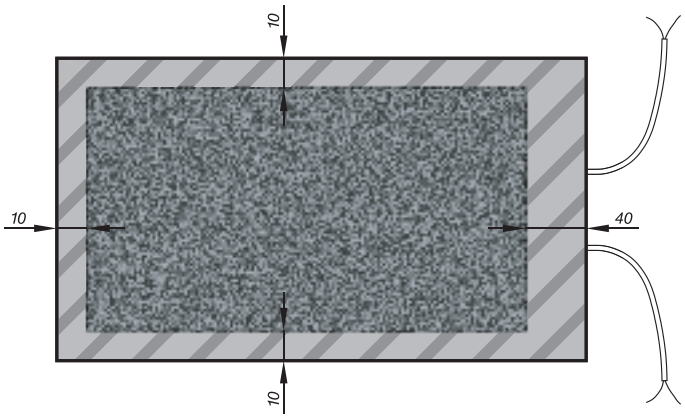
$L1 \times L2 \leq 1{,}5\ m^2$

The cable exit can be on the wide or the narrow side.

Non-sensitive zone along edges

The surrounding area of a sensor which does not have a sensing function:

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



Note
Where several sensors form one contact area only the sides with 10 mm edges should lie next to one another.

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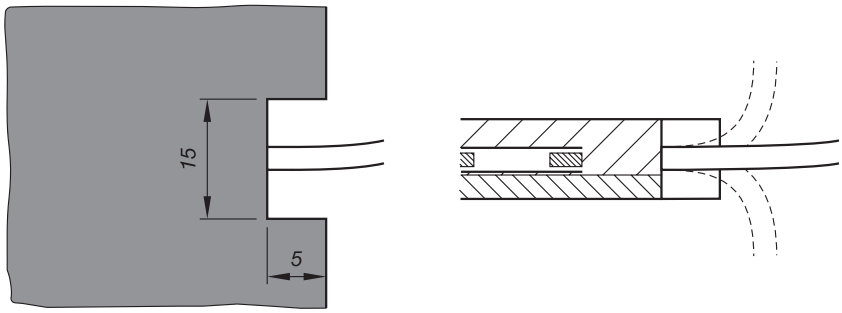
Connection

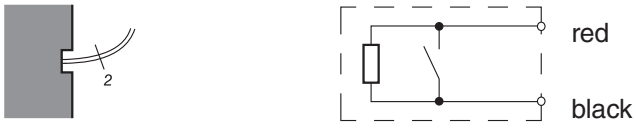
Cable exit

The multifunctional cutout also allows the cable to be laid upwards or downwards.

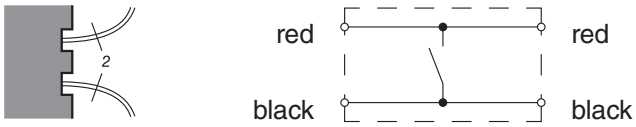


Wire colours

Safety Mat SM11/W



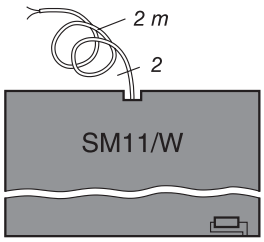
Safety Mat SM11/BK with 2 cables



Cable connection

Without plug (standard)

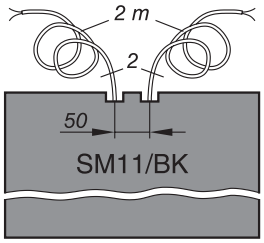
- Universally applicable
- Variable cable length



- Individual sensor SM11/W or end sensor SM11/W
- Integrated resistor
- 2-wire cable (Ø 5 mm; 2× 0.5 mm² Cu)

ATTENTION
The maximum overall cable length up to signal processing is 200 m.

Subject to technical modifications.



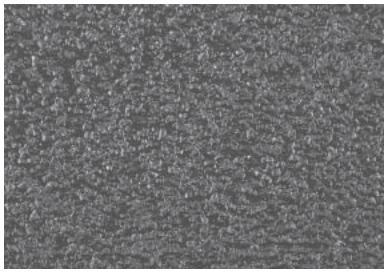
- Feed-through sensor SM11/BK
- Without resistor
- 2 two-wire cables (Ø 5 mm; 2× 0.5 mm² Cu)

Optional with M8 plug (IP67).

Sensor cover

A rough surface provides the necessary non-slip quality and acts as a mechanical protection.
The structured surface is applied in the factory.

Note
Initially there will be slight abrasion in the form of black dust. This does not have any impact on the function.



Resistances

The condition for the resistances listed in the following (at room temperature 23 °C) is a sensor with an undamaged surface.

Physical resistance

Surface topping	PUR
Degree of protection (IEC 60529)	IP65
Hardness as per Shore A	78 +3
Abrasion (DIN 53516)	< 150 mg
Non-Slip (DIN 51130)	R9
Max. load capacity (8 h)	800 N/cm²
Behaviour in fire (DIN 4102)	B2

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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 values in the table are results of tests carried out in our laboratory to the best of our knowledge and belief. Liability cannot be derived from this information. The suitability of our products for your special area of application must always be verified with your own practical tests.

Surface	PUR
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	+
White spirit (ethyl alcohol)	-
UV-resistance	+
Water	+
Petroleum ether / petrol	±
Citric acid	+
Drawing compound	+

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

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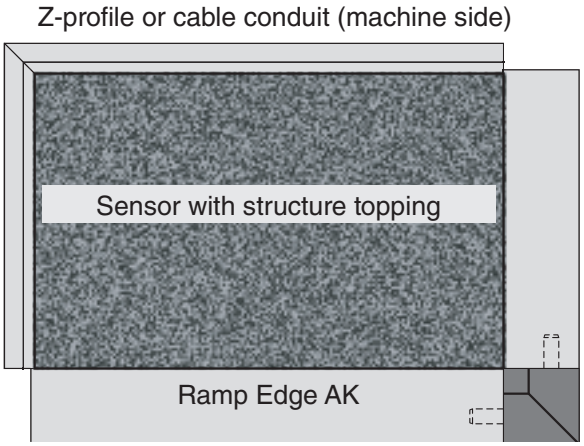
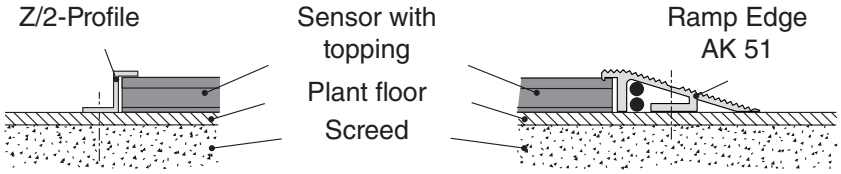
Subject to technical modifications.

Fixing sensors

Ramp Edges can be installed quickly and easily.

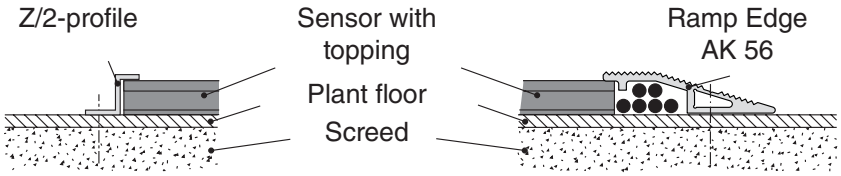


Ramp Edge AK 51



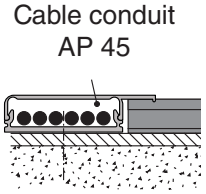
- Not suitable for plug-in cable connections
- Cable conduit for max. 2 cables
- Corner joints are only available with mitre cuts (not suitable for corner connectors and wedge connectors)

Ramp Edge AK 56



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

Cable conduit AP 45



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

Subject to technical modifications.

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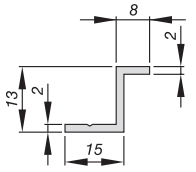
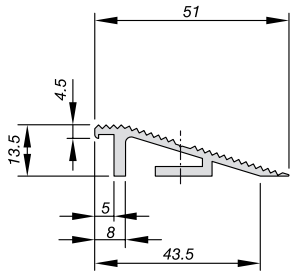
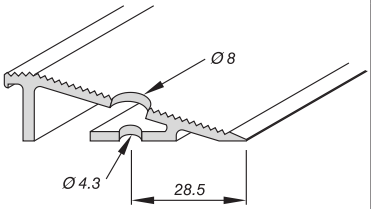
Aluminium-Z/2-profile
- Edging at the machine or wall side
- Rod 3 m (7500385), Rod 6 m (1001666) or fixed length



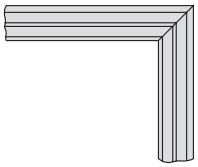
Aluminium Ramp Edge AK 51
- 1-part with cable conduit
- Combinations up to max. 2 sensors
- Sensor without plug
- Rod 3 m (7500384), Rod 6 m (1001667) or fixed length



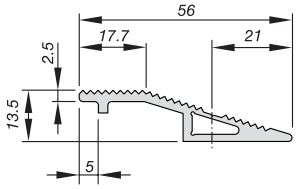
Threaded hole for AK 51
- For fixing Ramp Edge AK 51



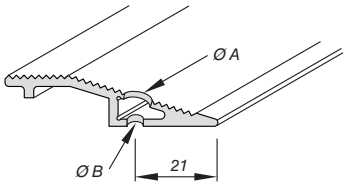
Mitre cut
- For corner connections of Ramp Edge AK 51



Aluminium Ramp Edge AK 56
1-part with cable conduit
- For combination of several sensors
- Sensors with or without plugs
- Rod 3 m (7501014), Rod 6 m (1002684) or fixed length



Threaded hole for AK 56
- For fixing Ramp Edge AK 56
- Variants:
  1. Ø A: 8,0 mm; Ø B: 4,3 mm
  2. Ø A: 9,0 mm; Ø B: 6,0 mm



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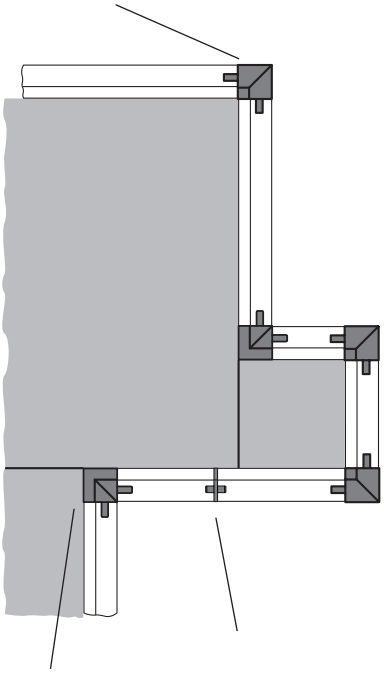
Subject to technical modifications.

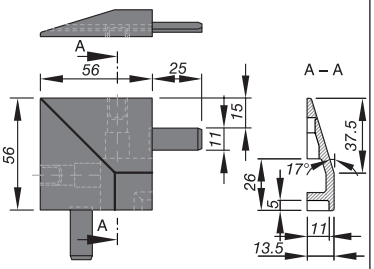
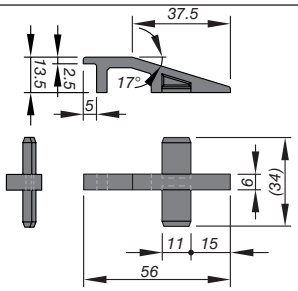
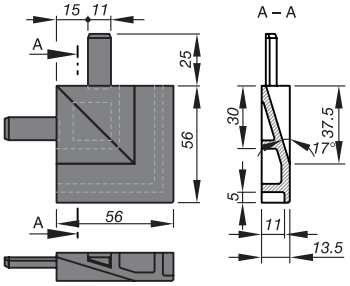
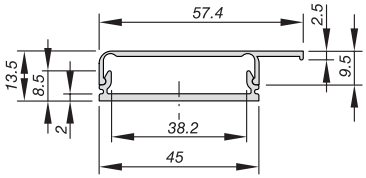
Example

Outer corner connector



Connecting wedge

Inner corner conector

Outercorner connector E1 AK 56 outer - for corner connectors for Ramp Edge AK 56 - Material: plastic, black (1002751)	
Connecting wedge Vk AK 56 - for longitudinal connection of Ramp Edge AK 56 - Material: plastic, black (1002996)	
Inner corner connector E2 AK 56 - for Corner conectors for Ramp Edge AK 56 - Material: plastic black (1002752)	
Aluminium cable conduit AP 45 - 2-part cable conduit - For combination of several sensors - Sensors with or without plugs - Upper section is clipped into bottom section. - Rod 3 m upper section (1002546), Rod 3 m bottom section (1002547) or fixed length upper and bottom section	

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Subject to technical modifications.

Calculation of the necessary actuation area

In accordance with EN ISO 13855 the necessary effective actuation area in relation to the danger area is calculated according to 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 Safety Mat [mm]
- K = Approximation parameters [mm/s]
- T = Follow-through of the complete system [s]
- t_1 = Response time of the Safety Mat
- t_2 = Stopping time of the machine
- C = Safety tolerance [mm]
- H = Step height [mm]

For installation at floor level

H = 0; hence:

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

For installation on a step

$H \neq 0$; hence:

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

Calculation examples

Example 1

A safety mat detects non-permitted access to the danger zone of an automated movement. The mat is installed flush to the floor, i.e. H = 0. The follow-through time of the movement is 300 ms, the response time of the protective device is 23 ms.

$S = (1600 \text{ mm/s} \times (300 \text{ ms} + 23 \text{ ms})) + 1200 \text{ mm}$

$S = 516.8 \text{ mm} + 1200 \text{ mm}$

$S = 1717 \text{ mm}$

Example 2

The same conditions as Example 1, however, a step with a height of 150 mm must be negotiated to the danger zone.

$S = (1600 \text{ mm/s} \times (300 \text{ ms} + 23 \text{ ms})) + (1200 - (0.4 \times 150) \text{ mm}$

$S = (1600 \text{ mm/s} \times 0{,}323 \text{ s}) + (1200 - 60) \text{ mm}$

$S = 516.8 \text{ mm} + 1140 \text{ mm}$

$S = 1657 \text{ mm}$

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Technical data

Safety Mat SM11 with	SG-EFS 1X4 ZK2/1	SG-EFS 104/2W	SG-EFS 104/4L
Test principle	EN 1760-1, 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) ∅11 mm	< 300 N		
Test piece (cylinder) ∅80 mm	< 300 N		
Test piece (cylinder) ∅200 mm	< 600 N		
Response time with Control Unit	18 ms	23 ms	38 ms
Safety classifications			
EN 1760: Reset	with/without	with/without	with/without
ISO 13849-1:2006	category 3	category 3	category 3
$MTTF_d$ (Sensor)	1142 years	1142 years	1142 years
B_{10d} (Sensor)	6× 10^6	6× 10^6	6× 10^6
n_{op} (acceptance)	52560 per year	52560 per year	52560 per year
Mechanical operating conditions			
Sensor size	max. 1.5 m^2		
Static load (up to 8 h)	max. 800 N/cm^2		
Driving on with industrial trucks	not suitable		
Weight	12.0 kg/m^2		
Degree of protection as per			
IEC 60529	IP65		
max. humidity (23 °C)	95% (non-condensing)		
Operating temperature			
individual sensors	-20 to +55 °C		
combined sensors	+5 to +55 °C		
Storage temperature	-20 to +55 °C		
Electrical operating conditions			
Sensor	DC 24 V / max. 100 mA		
Maintenance and service			
Maintenance	The sensor is maintenance-free.		
Monitoring	Joint monitoring by control unit.		
Inspection	Depending on the load, the sensors are to be tested at regular intervals (at least monthly) for correct function and visible signs of damage by walking on or by applying the relevant test piece (cylinder).		
Chemical resistance			
	The sensor is resistant against normal chemicals over an exposure period of 24 hours.(see page 7)		
Dimensional tolerances			
Length dimension	ISO 2768-c		
Perpendicularity	ISO 2768-c		

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Polymer Electric

Request for quotation

Submitted by

Company

Department

Surname, first name

P.O. Box | Postcode | Town/city

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Phone | Fax | E-mail

Fax:

+49 731 2061-222

Area of application

(e. g. metalworking, textile machines, timber processing, tube drawing, local public transport,, ...)

⇩Please do not write in this column!⇩
For internal notes only

Protection of the danger zone with:

- ❑ SM11/W — Quantity: _____ — Width: _____ — Depth: _____
- ❑ SM11/BK — Quantity: _____ — Width: _____ — Depth: _____

Fixing with:

- ❑ Aluminium Z/2-profile
- ❑ Ramp Edge AK 51
- ❑ Ramp Edge AK 56
- ❑ Aluminium cable conduit AP 45

Area to be secured:

(Diagram incl. edge profiles and cable routing)

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