

## Safety mats SM8



EN | Product information

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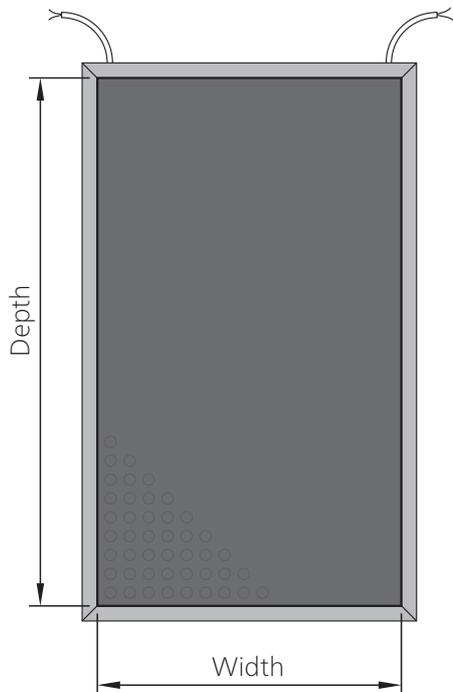
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## Available sizes

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 to the pressure sensitive area. For each side with a moulded ramp, 25 mm must be added.

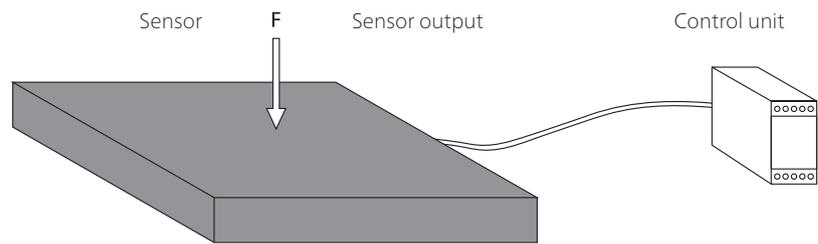


According to ISO 13855, the minimum depth to the danger zone must be taken into account (see Chapter *Calculation of the necessary actuation area*). The non-sensitive edges must be taken into account (see Chapter *Effective actuation area*).

## 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.

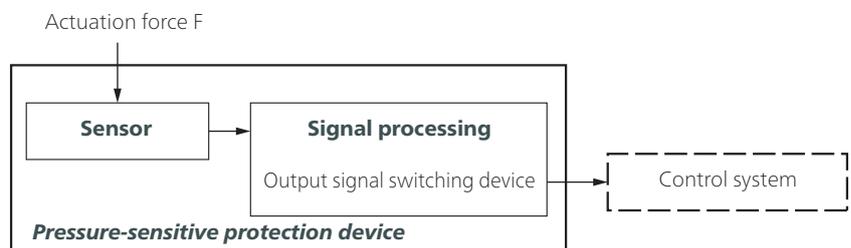


#### Sensor

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.

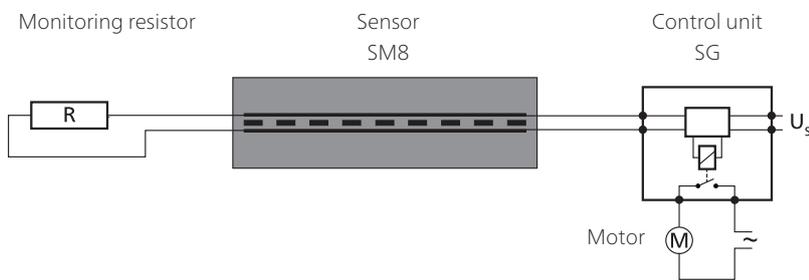


Tip: Terms are defined in ISO 13856-1 Chapter 3.

## Criteria for selecting the sensor type

- Category in accordance with ISO 13849-1
- Performance level of 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 degree of protection must be checked individually.
- Environmental influences such as swarf, oil, coolant, outdoor use...
- Recognition of persons weighing < 35 kg necessary?

## Operation principle 2-wire-technology



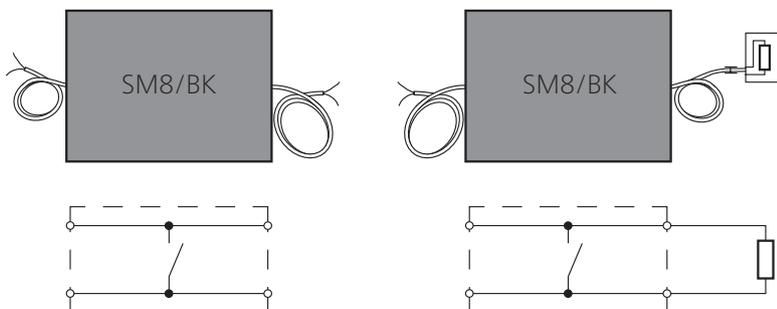
The monitoring resistor must be compatible with the control unit.  
Standard value is 8k $\Omega$ .

For your safety:

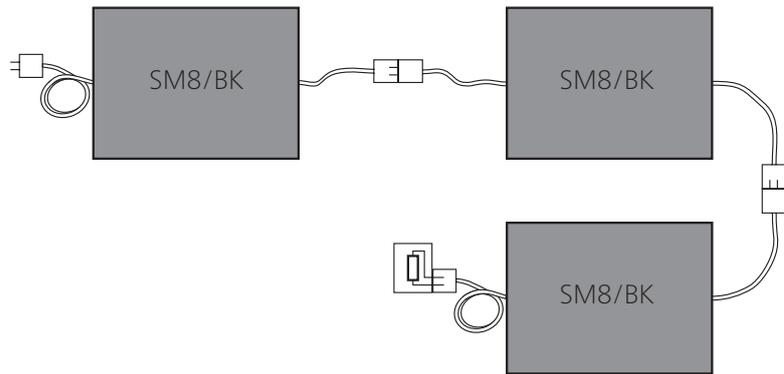
Sensor and connecting cables are constantly monitored for function.  
Monitoring is carried out by controlled bridging of the contact surfaces  
with a monitoring resistor (closed current principle).

## Design

SM8/BK with cables on both sides as a through sensor or as an end sensor with external monitoring resistor



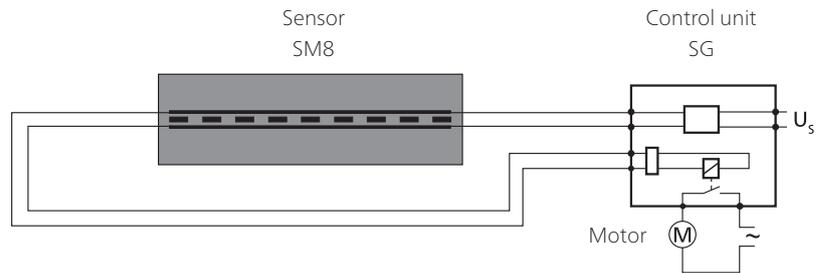
## Combination of sensors



Combination:

- connection of more than one sensor
- only one control unit required
- individual design of control areas with regard to size and shape

## Operation principle 4-wire-technology



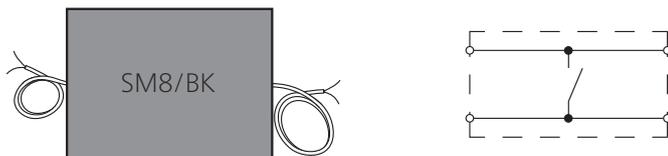
The 4-wire technology can be used only together with control unit SG-EFS 104/4L.

For your safety:

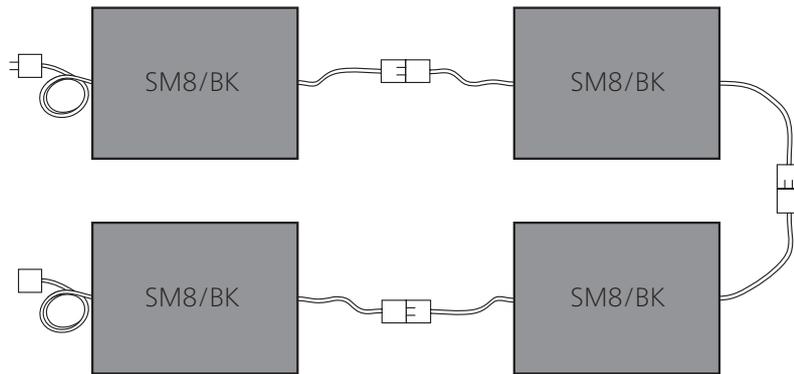
Sensor and connecting cables are constantly monitored for function. This is possible because of signal transmission feedback – without monitoring resistor.

### Design

SM8/BK with cables on both sides as a through sensor



*Subject to technical modifications.*

**Combination of sensors**

Combination:

- connection of more than one sensor
- only one control unit required
- individual design of control areas with regard to size and shape

## Safety

### 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.

This is shown clearly in Figures B.1 and B.2 in ISO 13856-1.

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. 10 sensors type BK on one control unit
- System size max. 15 m<sup>2</sup>  
= max. number × max. sensor size

### Exclusions

Sensors are not suitable

- for detecting walking aids.
- for detecting individuals who weigh less than 20 kg.
- for navigating with industrial trucks.

Sensor combinations are not suitable

- for detecting individuals who weigh less than 35 kg.

### Program selection

Sensors in the SM8 Safety mat programme are only available in rectangular shape. The surface is to a certain extent resistant to external influences and normal chemical influences.

If you have higher requirements of the sensors, we recommend our line of customised safety mats.

## Other safety aspects

### **Performance Level (PL)**

The PL was determined by means of a simplified process according to ISO 13849-1.

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 safety mat 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.

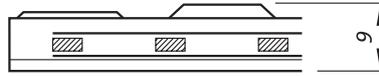
### **Risk and safety assessment**

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.

## Design



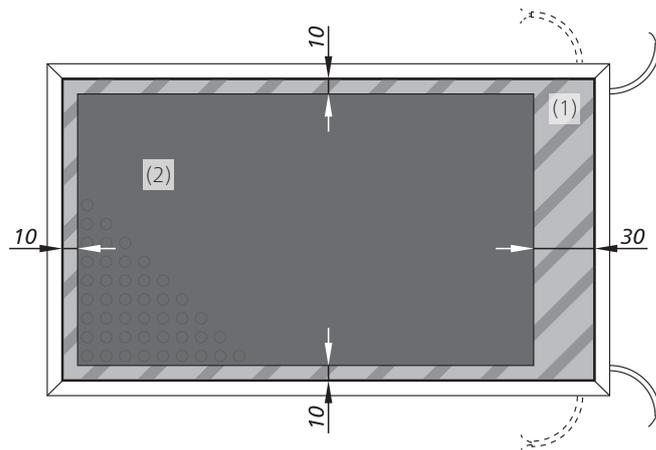
### Standard version

Moulded onto a plastic plate. The surface structure created during casting ensures the necessary non-slip protection as well as mechanical protection.

## Effective actuation area

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

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



The ramps around the edges are not included in determining the effective actuation area.

### Combination of sensors

With a combination of sensors, only the sides with an edge area of 10 mm may be placed together.

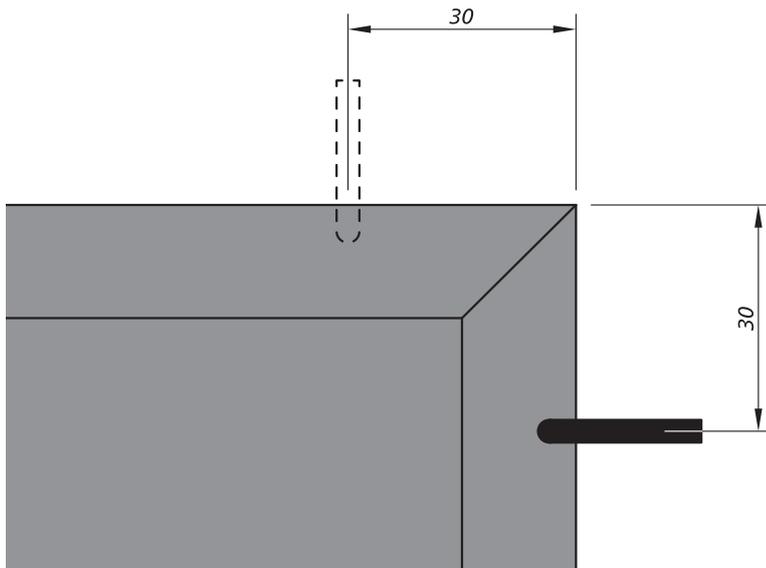
For sensor combinations, the integrated wheelchair ramps must be removed on these sides.

## Connection

### Cable exits

The cable exits are located at the corners.

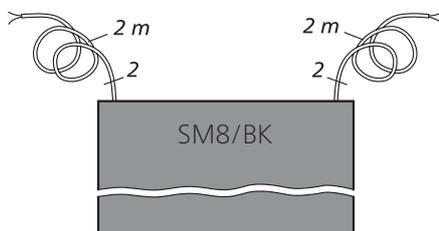
Two cable exits are available for each corner: either to the broad side or the longitudinal side (depth). The cable exit is cut free at the specified location during local installation.



### Cable connection

- Standard cable lengths  
 $L = 2,0 \text{ m}$
- Maximum total cable length to the control unit  
 $L_{\text{max}} = 100 \text{ m}$

### Sensor type BK with 2 lines



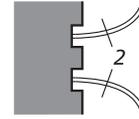
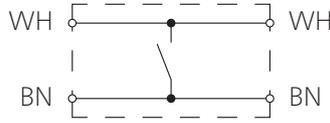
- as a feed-through sensor type BK
- without resistor
- Two 2-wire cables ( $\varnothing 3,8 \text{ mm}$ ;  $2 \times 0,25 \text{ mm}^2 \text{ Cu}$ )

## Wire colours

### Sensor type BK with 2 lines

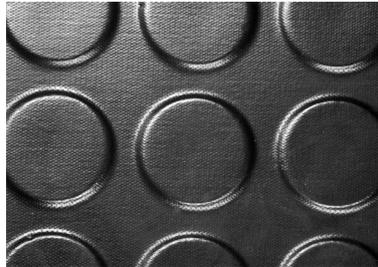
#### Colour coding

BN Brown  
WH White



## Sensor surface

The rubber nub structure is produced during the manufacturing process at the factory. It prevents slipping and provides mechanical protection. Further covering of the sensor is not necessary.



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

## Physical resistance

Surface	PUR
IEC 60529: Degree of protection	IP65
DIN 53516: Abrasion	120 mg
DIN 51130: Non-Slip	R9
Static load (up to 8 h)	≤ 800 N/cm <sup>2</sup>
DIN 4102: Behaviour in fire	B2
Stress when subjected to climate changes	+
UV-resistance	+

#### Explanation of symbols:

+ = resistant

*Subject to technical modifications.*

## 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.

Surface	PUR
Acetone	-
Formic acid 5 %	+
Ammonia	+
ATF gear oil	+
Brake fluid DOT 4	-
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 %	±
Salt water 10 %	+
Suds 5 %	+
White spirit (ethyl alcohol)	-
Universal thinner	-
Water	+
Petroleum ether / petrol	-
Citric acid 10 %	+
Drawing compound	-

**Explanation of symbols:**

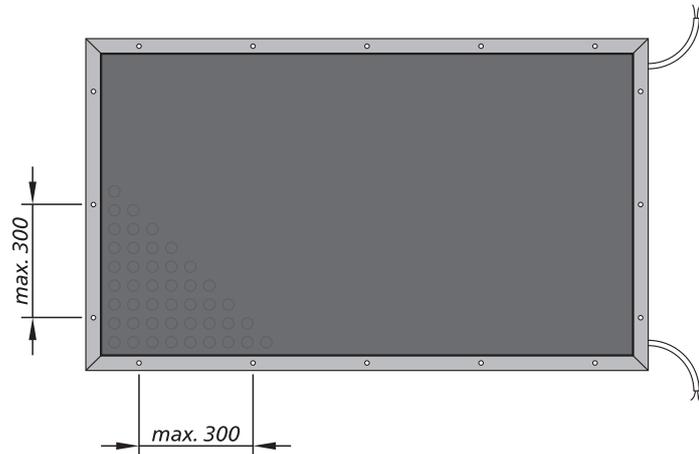
+ = resistant

± = resistant to a certain extent

- = not resistant

## Attachment

The sensor has built-in ramps all around it in order to avoid the risk of tripping. Separate ramp edging is not required.



The sensor is fixed to the floor with screws, min. Ø 5 mm (recommended: flat head screws 6 x 50). These are not included in the standard delivery scope. The distance between screws must not exceed 300 mm.

## Calculation of the necessary actuation area

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

In accordance with ISO 13855, the necessary effective actuation area in relation to the danger area is calculated as follows:

$$S = (K \times T) + C \quad \text{where:} \quad K = 1600 \text{ mm/s}$$

$$T = t_1 + t_2$$

$$C = 1200 \text{ mm} - 0.4H$$

### With installation at floor level

H = 0; hence:

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

### With installation on a step

H ≠ 0; hence:

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

*Subject to technical modifications.*

## 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 140 ms, the response time of the protective device is 38 ms.

$$S = (1600 \text{ mm/s} \times (140 \text{ ms} + 38 \text{ ms})) + 1200 \text{ mm}$$

$$S = 285 \text{ mm} + 1200 \text{ mm}$$

$$S = 1485 \text{ mm}$$

### Example 2

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

$$S = (1600 \text{ mm/s} \times (140 \text{ ms} + 38 \text{ ms})) + (1200 - (0.4 \times 150)) \text{ mm}$$

$$S = (1600 \text{ mm/s} \times 0.178 \text{ s}) + (1200 - 60) \text{ mm}$$

$$S = 285 \text{ mm} + 1140 \text{ mm}$$

$$S = 1425 \text{ mm}$$

## Maintenance and cleaning

The sensor is 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.

## Technical data

<b>Safety mat</b>	<b>SM8/BK with SG-EFS 104/4L</b>
Testing basis	ISO 13856-1
<b>Switching characteristics at <math>v_{\text{Test}} = 250 \text{ mm/s}</math></b>	
Switching operations at 0.1 A	$> 4 \times 10^6$
Actuation forces	
Test piece $\varnothing$ 80 mm	$< 300 \text{ N}$
Test piece $\varnothing$ 200 mm	$< 600 \text{ N}$
Response time with control unit	38 ms
<b>Safety classifications</b>	
ISO 13856: Reset function	with/without
ISO 13849-1:2015	category 3 PL d
$MTTF_D$ (Pressure-sensitive protection device)	65 a
$MTTF_D$ (Sensor)	1142 a
$B_{10D}$ (Sensor)	$6 \times 10^6$
$n_{op}$ (Acceptance)	52560 per year
<b>Mechanical operating conditions</b>	
Sensor size	max. 1.5 m <sup>2</sup>
Static load (up to 8 h)	max. 800 N/cm <sup>2</sup>
Driving on with industrial trucks	not suitable
Weight	13.0 kg/m <sup>2</sup>
IEC 60529: Degree of protection	IP65
max. humidity (23 °C)	95 % (not-condensing)
Operating temperature	
single sensor	-25 to +55 °C
combined sensor	+5 to +55 °C
Storage temperature	-25 to +55 °C
<b>Electrical operating conditions</b>	
Connection cable	$\varnothing$ 3.8 mm PVC 2x 0.25 mm <sup>2</sup>
Sensor	DC 24 V / max. 100 mA
Number of BK type sensors	max. 10 in series
<b>Dimensional tolerances</b>	
Length dimension	ISO 2768-c
Perpendicularity	ISO 2768-c

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

## Request for quotation

### Submitted by

Company

Department

Surname, first name

P.O. Box

Postcode

Town/city

Street

Postcode

Town/city

Phone

Fax

E-mail

**Fax:**

**+49 731 2061-222**

### Area of application

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

### Protection of the danger zone with:

- SM8/BK 750 × 1000 Quantity: \_\_\_\_\_
- SM8/BK 750 × 1250 Quantity: \_\_\_\_\_
- SM8/BK 750 × 1500 Quantity: \_\_\_\_\_
- SM8/BK 1000 × 1000 Quantity: \_\_\_\_\_
- SM8/BK 1000 × 1250 Quantity: \_\_\_\_\_
- SM8/BK 1000 × 1500 Quantity: \_\_\_\_\_

### Area to be secured:

(Diagram incl. cable routing)

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For internal notes only