

Safety mat system Introduction



CARLO GAVAZZI **SM** safety mat series provides effective protection to potentially hazardous areas, as typically around industrial machineries. The SM safety mat is the sensing element controlled by the monitoring safety unit **NT1/2-D** or **MT1-D** which, being connected to the mat, causes dangerous movements to be stopped every time an operator violates the protected area.

The pressure sensing mat SM together with the respective control safety relay, constitutes a safety system of Safety Category 3, in conformity with European Machinery Directive, the EN 954-1 and EN 1760-1 standards.

Structure

The safety mat basic external structure consists of a bottom plastic layer resting on the floor and a plastic slip-free top layer, which constitutes the operating surface. Between these two layers, thin conductive films are placed, separated by an appropriate insulating material. The perimeter of the mat is welded with a special industrial process which allows to seal accurately the surfaces, protecting the internal structure of safety mat from external agents.

The mat is anchored at the floor by screws in the holes provided along the

aluminium perimeter fixing trim; the output connection is given by a four-wire cable routed through the channel provided through the fixing edge.

The structural features of the **SM** safety mat assure outstanding reliability and durability as well as the possibility to use this heavy duty safety device in extremely harsh environments, where, as consequence of the damp and dusty operating conditions, no other safety devices could be properly adopted.

Functioning

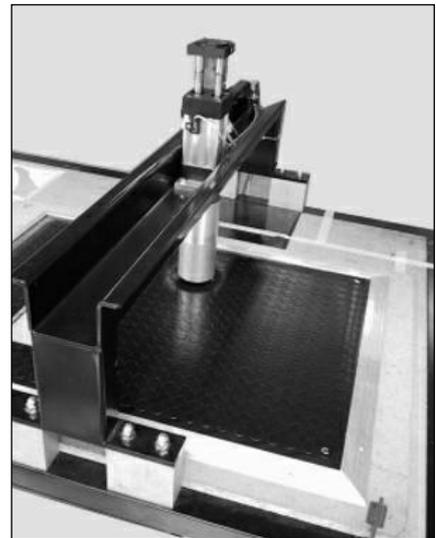
The two internal conductive surfaces operate like a normal switch; since the relative safety control unit checks continuously the safety mat status and integrity, as soon as the protected area is violated, the pressure sensing conductive elements embedded in the mat get in touch causing the closing of the circuit; the safety module detects the switching of the mat and opening its safety output contacts, causes the hazardous movements of the machinery to be stopped.

The same happens in case of failure, anomaly in the system or cable disconnection.

On the basis of specific needs / applications, the safety mat system can be operated with automatic or manual restart.

Tests and performances

CARLO GAVAZZI's **SM** safety mat concept starts from the research and the accurate selection of the components. The adoption of such durable and simple structure in fact has been made possible only by means firstly of a systematic selection of the materials and then through the most strict and demanding tests and experiences both in the field and under specific testing equipments.



The result is a heavy duty safety device which can withstands the most binding applications assuring at the same time a mechanical life of over one million cycles.

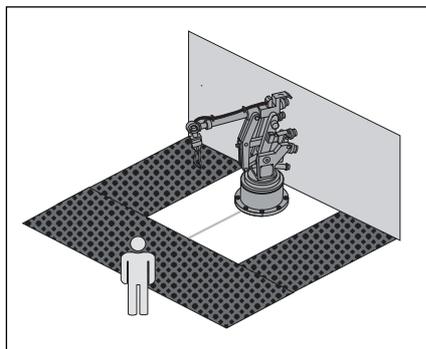
The SM safety mat is able to detect a minimum pressure of 300 g/sqcm and resists to maximum load of 100 Kg/sqm.

Applications

The operating features of the **SM** safety mat make it suitable for a large variety of applications in the industrial field, where an effective protection around a dangerous area or point of operation is requested, such as:

- Automatic robots
- Automated material handling
- Wood-working machines
- Machine tools





Assembly machines
 Packaging machines
 Presses and punches
 Other automatic machines or cells of machine
 Other hazardous areas

Custom-made solutions

SM safety mat from CARLO GAVAZZI means not only a possible solution but “the” solution to the exact needs of the specific application.

This correspond to the possibility to choose shape, dimensions, number of single mat units, layout, position of the output cable connection etc. in relation to the particular requirements of each case.

Furthermore, thanks to the knowledge of CARLO GAVAZZI in safety control units as well, safety modules for safety mat monitoring have been specifically conceived and designed, what is the same as saying higher reliability and performance of the whole safety system.



Advantages

In comparison with other safeguarding devices, the use of the **SM** safety mat system assures the control of a whole zone and not only a perimeter; besides, it protects operators working around machinery, offering at the same time flexibility without any movement / room restrictions; the requested safety level then can be kept with certainty since there is no worry on replacing mechanical gates or mobile protections.

As far as the durability and the structural features are concerned, the **SM** safety mat is a heavy duty protecting device with high resistance characteristics which make it right for harsh environments without requiring any other maintenance but cleaning.

Calculating mat dimensions

The size of the safety mat should be large enough to prevent entry into hazardous area. In case of safety mats mounted around machineries, the machinery stopping time has to be much shorter than the operator access time to the dangerous zone; in other words it is necessary to select the dimensions of the mat by taking into consideration the inertia of the machinery.

The EN 999 provides a formula for calculating floor mounted mat size:

$$S = 1600 \times (t_1 + t_2) + 1200$$

where:

S is the minimum safety distance intended as the minimum horizontal distance from the outer edge of the mat and the nearest part of the hazard in mm;

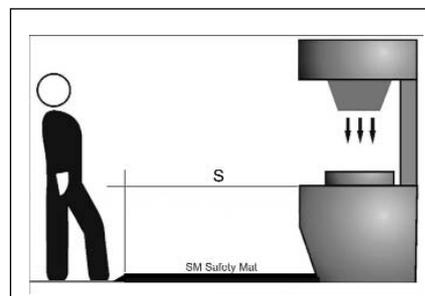
the factor 1600 mm/s is the approach speed based on a standard assumption;

T is the overall stopping time in seconds given by the response time of the system safety mat + safety module (t1), and the stopping time of the machinery once received the output from the safety module (t2);

The added 1200 mm takes into consideration stride length and arm reach. A similar formula is also given for mat mounted not directly on the floor but on a step:

$$S = 1600 \times (t_1+t_2) + 1200 - (0,4 \times H)$$

where H is the height of the step in mm.

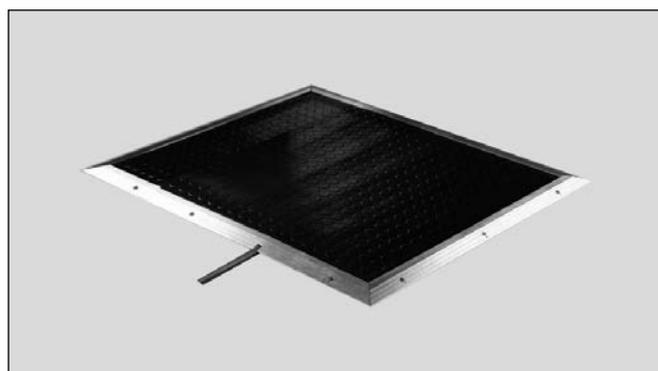


Item number meaning

SM	-	3	-	110x135	I	-	0	-	S	-	C	-	****
1		2		3	4		5		6		7		8

- 1: safety mat
- 2: n. of single units constituting the whole mat
- 3: overall dimensions, perimeter fixing trim excluded (cm)
- 4: if present, the overall dimensions are intended including the perimeter fixing trim
- 5: Perimeter fixing trim: 0 = none
2 = Aluminium
- 6: Packaging type: S = Reinforced wood box
C = Cardboard sheet
L = Without packaging
- 7: Output connection: C = 6 m of four-wire cable ended with ILME CM-04C connector
0 = 6 m of four-wire cable
- 8: Drawing number: mandatory only if digit n. 2 higher than 1

Safety Mat System SM..



- Safety Category 3 in conjunction with MT1-D or NT1/2-D safety relay according to EN 954-1
- Expected mechanical life of over one million cycles
- Mat integrity monitoring
- Manual or automatic restart
- Customized dimensions
- Slip-free covering
- Easy screw mounting
- Approval: TUV

Product Description

The safety mat SM.. along with the respective safety module NT1/2-D or MT1-D, constitutes a heavy duty safety system of Safety Category 3, in conformity with European Machinery Directive, EN 954-1 and EN 1760-1 Standards. The safety mat

operates like a normal open switch, stopping the dangerous machinery any time it detects the presence of an operator within the controlled area. The same happens in case of failure of the mat or of the anomaly in the system.

Ordering Key

SM..

Safety Mat _____
 Number of single unit constituting the whole mat _____
 Dimensions _____
 Other specifications _____

General Specifications

Material	PVC + thermoplastic rubber	Resolution	11 mm
Covering	Antislip	Dead zone (fixing trim excluded)	30 mm
Covering stiffness	≈ 70SH	Weight	≈ 9 Kg/m ²

Electrical Specifications

Internal resistance	Inside layer resistance: 1 ÷ 5 Ω Layer to layer resistance: >10 M Ω (mat not operated) 1 ÷ 5 Ω (mat operated)	Mat integrity monitoring	Yes (with MT1-D or NT1/2-D)
		Mat response time	<150ms (SM..+MT1-D) <150ms (SM..+NT1/2-D)

Environmental Specifications

Operating temperature	0 ÷ + 50°C	Storage temperature	-5 ÷ + 55°C
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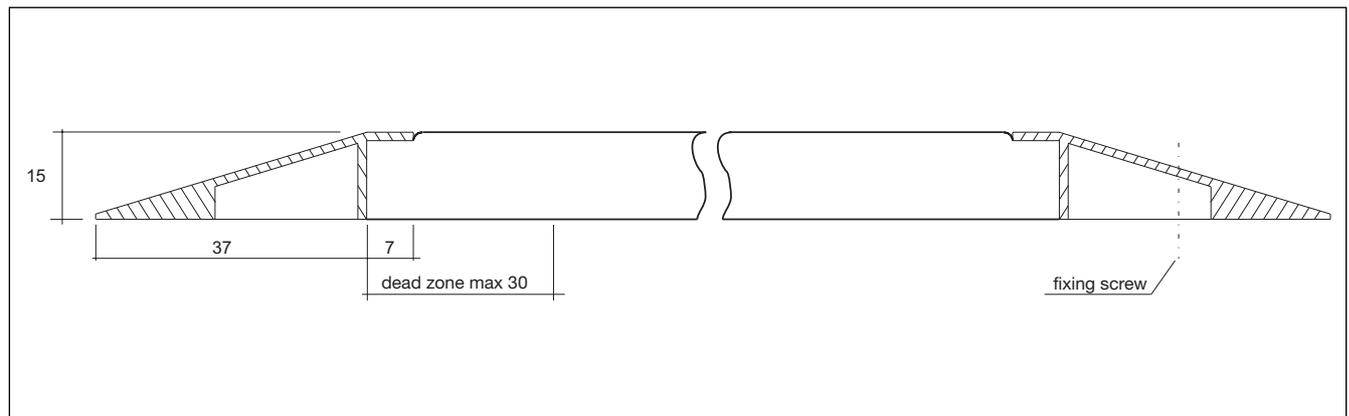
Mechanical Specifications

Actuating force (N / Ø 80 mm)	< 300	Protection degree	IP 65 (IP 67 upon request)
Max actuating stroke	< 6 mm	Dimensions	Upon request
Permissible load not continuous and non caused by object fall	100 Kg/cm ²	Fixing trim	Aluminium profile
Thickness	15 mm	Floor fixing	With screws
Mechanical life	> 3x10 ⁶ swithcing cycles	Output connection	PVC cable, L = 6 m connector ILME CKM04

Chemical Resistance Specifications

Oils	Good	Gasoline	Poor
Greases	Good	Detergents	Poor
Water	Excellent	Alcohol	Poor
Diluted Acids	Good	Abrasive Powder	Good
Solvents	Poor		

Dimensions



Wiring Diagrams

