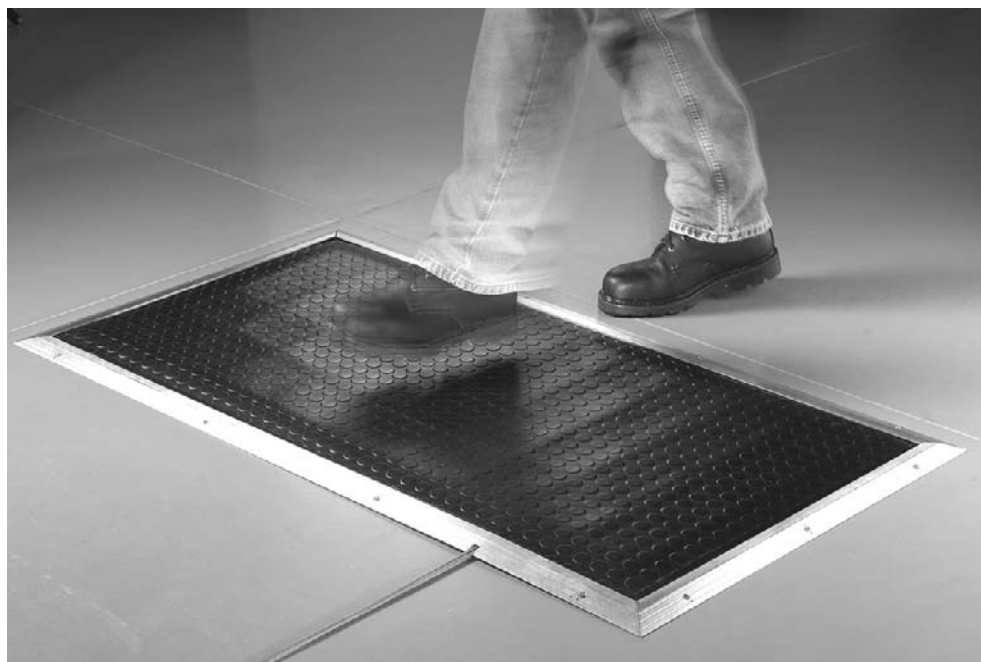

SM.. pressure sensing mat



USER MANUAL



CARLO GAVAZZI

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This user manual must be read and understood completely by personnel dealing with all the activities, even marginal ones, of the SM.. pressure sensing mat. It must be stored in a dry clean place close to where the mat is used for easy consultation.

All the operations described in this manual must be carried out by carefully following all the indications given exclusively by specialised personnel.

Contact SAIET Elettronica and do not carry out any operations on the pressure sensing mat, ensuring the safety of the operators, if there are any doubts over the contents of this manual, or if there is a fault or a malfunction.

The user of the pressure sensing mat is responsible for the evaluation of the risks of the entire system. Based on the evaluation and on the standards in force in the country of use, the user decides with complete responsibility that the product functions described in the user manual are suitable for use in its application.

He must also ensure that the installation, the wiring and the regular inspections take place according to the requested risk reduction level.

The distance of the guard,

connected to the safety device, from the dangerous area, must be calculated on the basis of the machine stop time, including the response time of the Mat + control unit system (see section 5.3: “Choice of device”), so that the operator cannot reach dangerous areas or moving parts.

Whenever the SM.. pressure sensing mat is improperly used, by not following completely all the indications of this manual or whenever these indications are partially, incorrectly or incompletely applied by personnel unspecialised and/or insufficiently trained on the contents of this manual and the machine safety directives, SAIET Elettronica is not responsible for the functioning of the SM.. pressure sensing mat and its capacity to guarantee the operator’s safety.

The SM.. pressure sensing mat does not require internal maintenance: if it is tampered it loses its safety functions and the guarantee is annulled.

The mat must be assembled and disassembled when the machine is not powered and stopped.

The mat is packaged flat with protections that can absorb any knocks.

The mat must be moved, transported and stored avoiding

violent knocks and it must be maintained within storage temperature and humidity parameters (see section 4 “TECHNICAL DATA”).

WARNING!

The SM mat can be used in safety applications only when combined with the NT1/2 or MT1-D safety control units.

NOTE

This manual refers only to the SM.. mat. The manual of the unit that controls the mat must also be consulted, along with this manual, when installing and using.

WARNING!

The SM safety mat conforms to EN 1760-1 Standard, for applications for people weighing more than 35 Kg, **in any shape combination set out by SAJET (as long as it is correctly installed).**

If the mat consists of only one panel, it conforms to EN 1760-1 Standards, for applications for people weighing more than 20 Kg. Always check the label on the mat.

1. PACKAGE CONTENTS

The package contains

- one or more panels needed to protect the

dangerous area and relative cable;

- a drawing illustrating the connections to be carried out and the positioning of the panels for mats made up of many panels (to set up more than one protected zone);
- aluminium border;
- user manual;
- a sheet describing the connections necessary between the various panels for mats with more than one panel.

If any anomalies are found with the package or its contents, do not proceed with the installation and contact SAJET Elettronica.

2. DESCRIPTION

The pressure sensing mat is the primary element of a system guarding access to potentially dangerous areas. It is constructed so that any pressure on its external covering determines its operation.

The electro-sensitive mats, along with the relative control unit, constitute a safety system guarding access to potentially dangerous areas thus preventing injuries to the operators. This

safety system can protect zones next to plants such as presses, robots, automatic machines that process wood, metal, glass and plastic materials.

The construction philosophy of SM.. mats begins with a careful choice of materials which then undergo rigorous testing. Finished products are tested on site using real or specially recreated situations to obtain a stress level able to guarantee the product's conformity to specifications. Great care has also been given to study the ergonomics of the product.

The SM.. touch sensitive mat must be used for safety functions combined with safety devices that conform to standards applicable to such devices.

The SM.. pressure sensing mat can constitute a category 3 system according to EN 954-1, if it is used according to this manual's indications, connected to one of the following devices:

- mod. MT1-D or mod. NT1/2-D, CARLO GAVAZZI

safety module

- safety module to control pressure sensing mats conforming to category 3 or 4 according to EN 954-1 required to control mats with an operating principle analogous to the SM mat

NOTE

Consult SAIET Elettronica prior to using an SM mat with a module for safety application not produced by SAIET Elettronica.

NOTE

If the SM.. mat is used along with the MT1-D or NT1/2-D CARLO GAVAZZI safety module, the safety module can warn of anomalies and malfunctions of the entire system (module + mat) and operate directly on the commands of the potentially dangerous device, if the operator is in the controlled area. The module constantly controls the integrity of the mat's connection: if one of the wires is disconnected the system switches immediately to an alarm condition.

3. REFERENCE STANDARDS

STANDARD	YEAR
EN 954-1	1998
EN 292-1	1991
EN 292-2	1991
EN 60204-1	1998
EN 1760-1	2000

4. TECHNICAL DATA

PARAMETERS		
GENERAL FEATURES	VALUES	
Covering type	PVC + Thermoplastic rubber	
Applicable voltage ⁽¹⁾	12 Vdc	
Current consumption ⁽¹⁾	50 mA (@ 12 Vdc)	
Resolution (detectable step size)	11 mm	
Dead zone ⁽²⁾	40 mm	
Operating force	< 300 N on gauge diameter 80	
Maximum operating stroke	< 6 mm	
Connection circuit interruption check	Yes (only with the MT1-D or NT1/2-D module)	
System response time (mat + MT1-D or NT1/2-D module)	< 150 ms	
Protection degree ⁽³⁾	IP65	
Operating temperature	0 ÷ 50 °C	
Storage temperature	- 5 ÷ 55 °C	
Mechanical life	> 3 x 10 ⁶ cycles	
Maximum temporary and not accidental admissible load	100 Kg / cm ²	
External covering hardness	≈ 70 SH	
Resistance	oils	good
	greases	good
	water	excellent
	extremely diluted acids	good
	solvents	poor
	petrol	poor
	detergents	poor
	Alcohol	poor
	Abrasive powder	good
Output connection ⁽⁴⁾	PVC cable ILME connector (mod. CK 03 V)	
Total dimensions	On request	
Total thickness	≈ 15 mm	
Covering	Embossed anti-slide	
Border (partially overlapped)	In aluminium	
Floor fixing	With screws and insert	
Weight	≈ 9 Kg/m ²	

(1) the voltage and current applicable to the mat are supplied by the mat control unit. The indicated value is relative to the MT1-D module. We advise against using control units that place the mat under voltages and currents greater than those set out here. Nevertheless contact SAIET Elettronica before using control units that require the application of greater voltages and/or currents.

(2) on the external perimeter, apart from special application on request of the customer (compatibly with welding technology).

(3) IP67 version available on request.

(4) the length, type and connector of the cable can be varied on request.

5. INSTALLATION

5.1 Warnings

The SM.. pressure sensing mat must be installed according to the applicable standards in force in the country of use, in a dry and clean place, when the machine is not powered and with no dangers for the operator.

Ensure that close to the mat installation point there are no conductors, cables or free materials that can come into

contact with the mat (also under floor cables close to the fixing holes).

To avoid interference due to coupling, run the connecting conductors separately from the power conductors.

Ensure that the machine can operate in temperature and humidity conditions compatible with the mat technical data in this manual.

It is recommended to use conductors with section and length adequate to the currents and distances involved, ensuring that the conductors are not excessively tight, that their positioning avoids potential cuts or squashing and that they are not in the way of people or things.

If the pressure sensing mat + control unit do not reduce sufficiently the machine risks (established by the risk evaluation) the user must adopt supplementary protection measures.

Once the safety function has been triggered (operation of the mat) the cause of the danger must be eliminated. No danger condition for the operators must be present prior to restarting the machine. An improper use of the mat could result in a dangerous situation for the operator.

Avoid dropping heavy and/or sharp

objects on the mat and carrying out passages, manoeuvres with shunters, fork lift trucks or any similar type of machine.

Avoid installation during storms.

Do not dispose of the packaging in the environment.

NOTE. It is recommended to keep the original packaging, which must be used if the mat needs to be moved more than once. Using inadequate packaging can permanently damage the mat and annul the guarantee.

5.2 Fitting and Wiring

The mat must be installed by following the indications below:

1. open the package and check its contents;
2. thoroughly clean the zone set aside for the mat, ensuring also that any bumps on the floor are smoothed; no steps or objects that can deform the surface of the mat must be present on the floor. For particularly rough or ruined floors place a sheet of a suitable thickness between the mat and the floor;
3. carefully remove the mat from its packaging, without bending or deforming it. Make sure that the output cable is not pulled or

tangled;

4. place the mat on the zone set aside and place it with the embossed antislip upwards; **do not move the mat by pulling on the cable! Lift it by its sides;**
5. **to assemble mats made up of more than one panel, follow the instructions on the drawing attached. The panels are numbered and identifiable on the drawing by the same number;**
6. extract the metal border and place it on the mat along the edge of the entire perimeter. To simplify assembly the border is numbered in sequence and the same number can be found on the correspondent side of the mat. Carefully mark the drilling position (carry out this operation directly through the holes of the metal border) and fix it all to the floor. **During this step pay attention not to drill the mat.** Ensure that the drilling material can be removed;
7. connect the cable to the control unit, by following the instructions set out in

the control unit manual.
Follow the instructions in the additional sheet to connect any mat zones;

8. check the correct functioning of the mat.

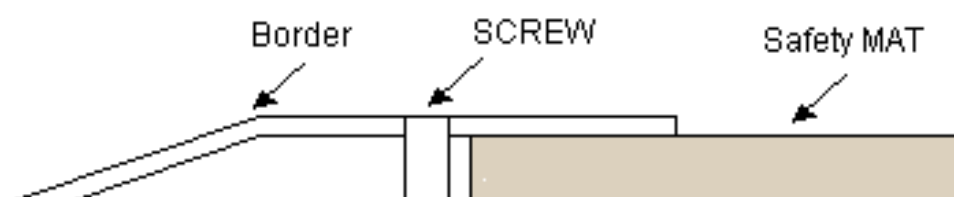


Figure 1: Fitting the border to the mat and to the floor

Figure 3 shows the mat electrical diagram and the connection connector pin-out. To connect the mat to the control unit, refer also to the control unit “User Manual”. Mats with more than one pressure sensing area can be assembled.

The mat is structured as indicated below:

- between **PIN 1** and **PIN 3** of the connector there is a first metal layer, with resistance $0 < R_{1-3} < 5 \Omega$;
- between **PIN 2** and **PIN 4** of the connector there is a second metal layer, with resistance $0 < R_{2-4} < 5 \Omega$.

The value of the resistance between the two layers depends on the condition of the mat (pressed or not pressed): the resistance values of the PIN, in particular, are highlighted in Table 1.

	Mat Operated	Mat not Operated
R 1-2	$< 5 \Omega$	$> 1 M\Omega$
R 3-4	$< 5 \Omega$	$> 1 M\Omega$

Table 1: Resistance values between metal layers of the SM mat

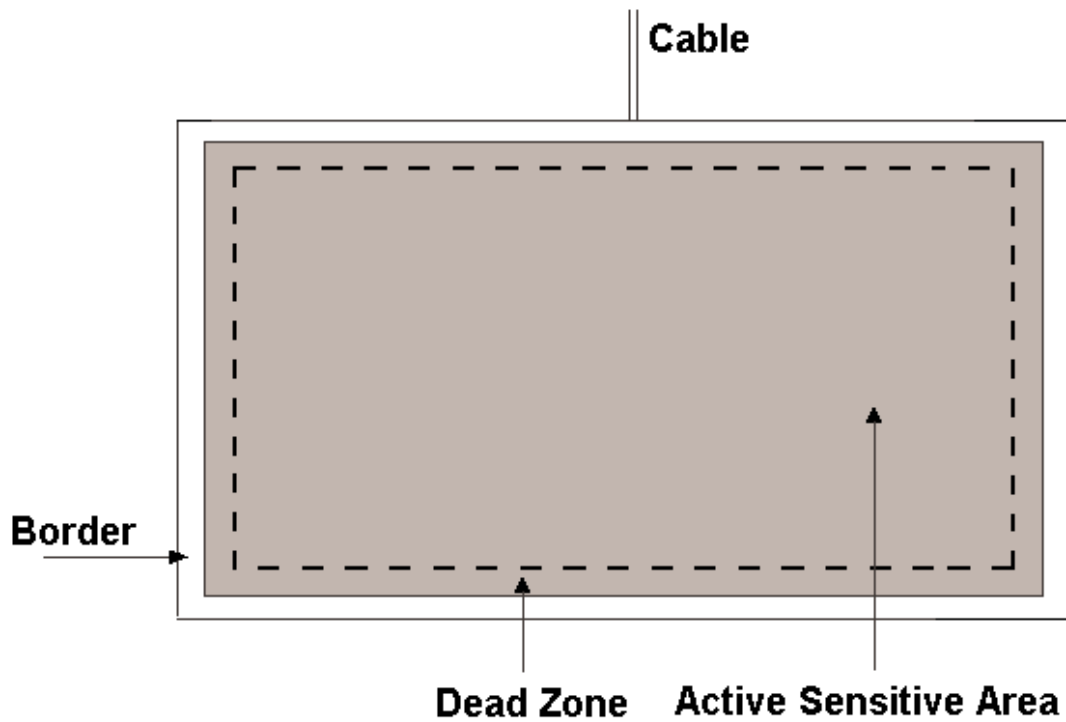


Figure 2: SM.. pressure sensing mat diagram

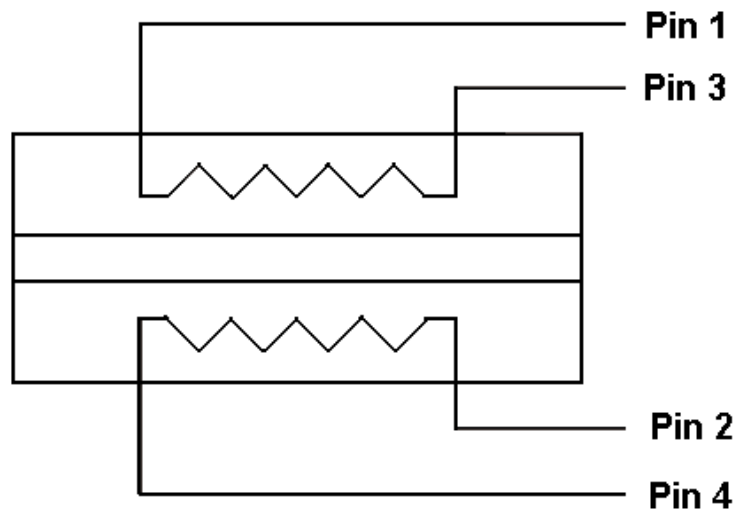


Figure 3: Electrical diagram of the mat and pin-out of the connector.

For a standard supply with an ILME connector, the pins are numbered on the plastic of the connector. For a free cable supply, various solutions are possible: colour coded or numbering on the cable

5.3 Choice of device

The most appropriate mat for the application is chosen on the basis of the environment conditions of the zone set out for the mat, the eventual presence and temperature of liquid, gaseous or solid substances and of the surrounding environment.

The mat must be positioned so that the operator cannot reach the dangerous zone in any way, without operating the mat. The sensing surface of the mat must be chosen with dimensions that take into account the machine inertia in the stopping phase: the time of access to the machine by the operator must be much greater than the machine stop time.

The EN 999 standard indicates the following formula to calculate the minimum distance in mm from the dangerous zone for a mat fitted directly to the floor:

$$S = 1600x(t1+t2) + 1200$$

Where:

- **S** represents the minimum distance (in mm) on an horizontal plane between the dangerous zone and the furthest sensing surface of the mat in the dangerous zone;
- **t1** indicates the response time (in s) of the mat + control unit system;

- **t2** indicates the stop time (in s) of the machine.

In case the mat is fitted on a step, the minimum distance in mm from the dangerous area is as follows:

$$S = 1600x(t1+t2) + 1200 - (0.4xH)$$

Where:

- **H** represent the height (in mm) of the step.

6. REGULAR INSPECTIONS AND MAINTENANCE

The integrity of the pressure sensing mat and of all parts connected to it must be regularly checked. The frequency of the inspections depends on the typology of the machine on which the pressure sensing mat is installed and therefore is part of the machine risks evaluation carried out by the person responsible for such evaluations. It is recommended to carry out the inspections at least weekly.

Operator safety can be compromised by the lack of regular inspections or maintenance, or if they are carried out incorrectly, or by non specialised personnel, or at lower intervals than prescribed.

Regular inspections consist of carrying out an inspection of the integrity of the mat and of the wiring, in operating the mat in various randomly chosen points

along the entire sensing surface and in repeating all the inspection operations set out in section 5 “Installation” of this manual and those relative to the installation and installation procedure of the control unit (for example, if the mat is used with the MT1-D module, all the “Installation procedure” operations set out in the module user manual must be carried out) and of the other control and protection devices which are part of the system.

Maintenance also includes a regular cleaning of the pressure sensing mat (dust and other soiling substances must be removed and it must be dried of liquids or any condensation) and of all integrated command or actuating devices used. The cleaning operations must be carried out whilst the machine is rigorously not powered and in safe conditions for the operator.

The mat can be cleaned with water and soap.

Avoid using solvents.

Avoid using cleaning machines.

7. REPAIRS

Avoid carrying out any repair operations on the mat.

After a repair carried out on a command device or on a part of the machine or after rewiring, all the operations set out in section 5 “Installation” of this manual must be repeated as well as those relative to the installation and installation procedures of the control unit (for example, if the mat is used with the MT1-D module, all the “Installation Procedure” operations set out in the module user manual must be carried out) and of the other control and protection devices which are part of the system.



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