



TAPESWITCH LMI SAFETY MAT INSTALLATION INSTRUCTIONS

1. INTRODUCTION

The Tapeswitch LMI SAFETY MAT is a pressure sensitive safety device designed to protect operators working at or near dangerous machinery.

The LMI SAFETY MAT is designed to meet and exceed the requirements of EN1760-1: 1998. It is important for the user to select a safety interface that complies with annex B of BSEN954-1: 1996. That will establish a complete safety machine interface system. In addition, the category rating will then be at the level of the attached controller to a maximum category level of 3.

When correctly installed at and interfaced to a machine the LMI SAFETY MAT will: (a) detect a person present in the dangerous area and prevent dangerous motion from occurring. (b) Detect a person entering the dangerous area and cause dangerous motion to cease before the person can reach the dangerous parts. (c) A combination of (a) and (b). The area covered by the LMI SAFETY MAT depends on which of the functions (a), (b) or (c) is to be performed.

2. PRODUCT DESCRIPTION

The active area of the LMI SAFETY MAT is made of moulded PVC with either a ribbed, button or custom surface texture.

A single LMI SAFETY MAT has two options for mounting. LMI SAFETY MATS can be provided with a moulded ramped edge or the edges can be squared off. For square edge LMI SAFETY MATS it is recommended to use the Tapeswitch AE13 Edging for mounting.

The LMI SAFETY MAT is constructed with an internal fail-safe switch sensor. The sensor is a normally open pressure sensitive device. The sensor is constructed by a means of a top and bottom conductor separated by a small distance. When pressure is applied to the LMI SAFETY MAT, the sensor's top and bottom conductors make contact; when the pressure is relieved, the conductors again separate.

LMI SAFETY MATS are equipped with 2 x 2 core Dri-Run cables. Dri-Run cables are extruded vinyl cables without the fibrous cloth fillers which tend to wick moisture along the cable. The standard length is 5 metres and a maximum length of 30 metres is available. The standard lead location is 2 cables on the long side as shown in Figure 1.

The LMI SAFETY MAT has an inactive zone around the outer edges. This inactive zone is 20mm wide or 40mm greater than the overall dimensions of the active area. Refer to figure 1. This should be considered when specifying the size of LMI SAFETY MAT for a particular application.

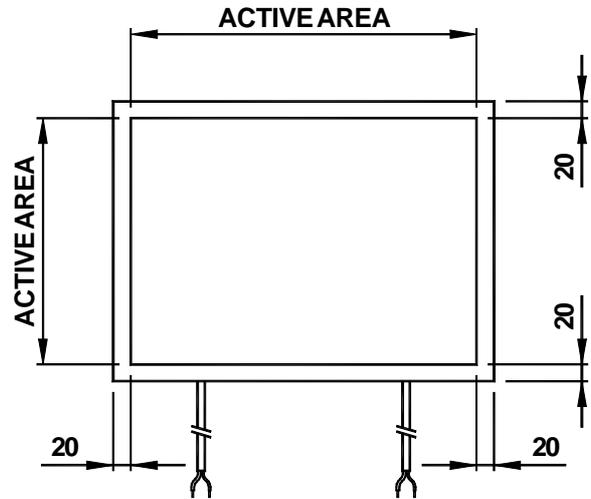


Figure 1

3. DETERMINE THE MAT SIZE

To determine the size needed, use this simple formula below.

Active area + 40mm = overall length or width.

The dimensions of the sensors and their layout must be that, access to the machine is not possible without stepping on the LMI SAFETY MAT. The dimensions of the dangerous area depend upon each application.

In order to determine the position of the front edge of the active zone, its necessary to consider the stopping performance of the machine. Any machine, regardless of the efficiency of its braking system, will take a certain time to come to rest after a stop signal is generated. From the instant a person's foot touches the mat to the instant that dangerous motion actually ceases is called the overall system response time.

The overall system response time, T, is given by the following calculation:

$$T = t1 + t2$$

Where t1 = The maximum response time of the safety device between the actuation of the sensor and the generation of a stop signal = 25 ms (with a PSSU Control Unit) or = 45 ms (with a PRSU/2 Control Unit).

and t2 = The response time of the machine between receiving a stop signal from a safety device and the dangerous parts coming to rest.

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WARNING

The dangerous parts will obviously continue to move during this time. The LMI SAFETY MAT must therefore be dimensioned such that the nearest point at which a person could first touch the mat is at a minimum distance from the dangerous parts before they have stopped.

This must take into account the worst case conditions as shown in figure 2 where a person could be a full stride onto the LMI SAFETY MAT before the LMI SAFETY MAT is actuated. This means that a certain distance from the front edge of the LMI SAFETY MAT and the nearest dangerous parts must be maintained.

This distance is the minimum separation distance. All possible directions of approach must be considered. The minimum separation distance, S, can be calculated using the following formula:

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

The overall system response time, T, should be measured several times and the highest value recorded, plus a suitable allowance for brake deterioration, should be used in the calculation of the minimum separation distance.

TAPESWITCH SAFETY SYSTEMS ARE DESIGNED TO PROTECT OPERATORS WORKING AT OR NEAR DANGEROUS MACHINES. THEY CAN ONLY PERFORM THAT FUNCTION IF THEY ARE CORRECTLY FITTED AND INTERFACED TO A SUITABLE MACHINE. EVERY EFFORT HAS BEEN MADE TO PROVIDE COMPREHENSIVE AND ACCURATE INFORMATION. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE THAT ALL PERSONS INVOLVED IN THE INSTALLATION OF THE PRODUCT HAVE THE KNOWLEDGE, TRAINING AND EXPERIENCE NECESSARY AND THAT THEY ARE FULLY CONVERSANT WITH ALL LAWS, RULES, REGULATIONS AND CODES OF PRACTICE PERTAINING TO THEIR TASK.

The surface on which the LMI SAFETY MAT is mounted must be sound and reasonably flat. The LMI SAFETY MAT can tolerate irregularities, but sharp edges or projections may set the sensor to the actuated state and produce an undesired machine stop. Where the surface is rough, cracked or breaking up, it should be treated using sealing and levelling compounds.

The LMI SAFETY MAT must be fixed permanently in position. Tapeswitch aluminium edging AE13 should be used around the outer edge of the sensor. This specially designed edging comes in two parts, a base and a cover. The cover provides a 20 degree ramp to prevent a tripping hazard at the outer sensor edges. The base can accommodate sensor wiring which protects the cables from damage and acts as a conduit to route the cables to the control unit. Refer to AE13 Installation sheet for details.

The LMI SAFETY MAT is designed to provide simple, fast and easy mounting provisions for the installer. The basic construction provides the necessary means for affixing the LMI SAFETY MAT in the desired location.

The LMI SAFETY MAT is manufactured to the size and shape requirements of the customer. It is fully assembled and ready for simple, easy installation.

For additional assistance in determining the size, layout or mounting of the LMI SAFETY MAT, call your local Tapeswitch representative

5. COMMISSIONING CHECKS

The commissioning checks should be carried out by persons who are competent and who have access to all the information supplied with the machine and its safety equipment. The results of the examination should be recorded and the user and the employer of the person performing the examination should keep copies of this record.

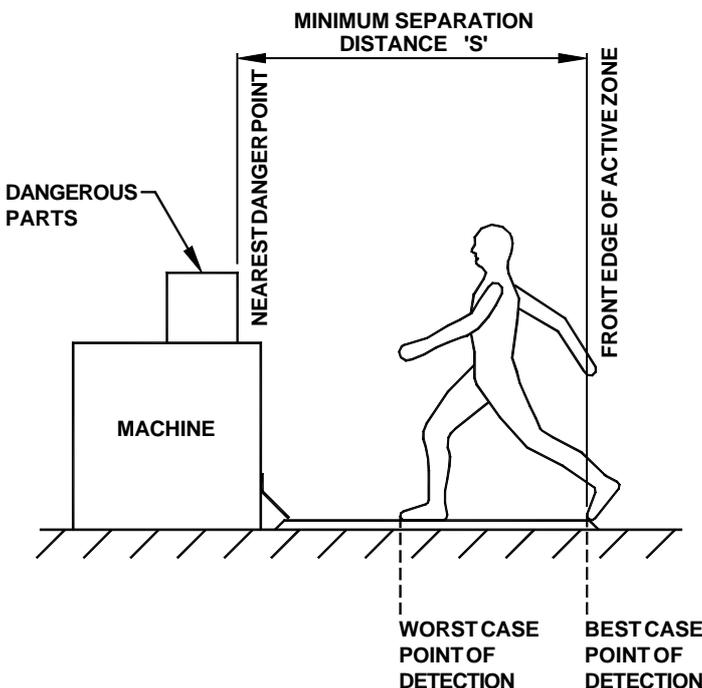


Figure 2

The person carrying out the examination should, as a minimum, perform the following checks:

- a) Check that the LMI SAFETY MAT is suitable for use in the application.
 - i) Check that the level of safety integrity provided by the LMI SAFETY MAT is suitable for the level of risk presented by the machine.
 - ii) Check that the environment is suitable for the use of the LMI SAFETY MAT.
- b) Check that the dimensions and position of the LMI SAFETY MAT are correct, taking into account the operating mode. For this purpose it will be necessary to check the overall system response time using a device designed for this purpose.
- c) Check that adequate measures have been taken to prevent access to the dangerous parts of the machine from any direction not covered by the LMI SAFETY MAT.
- d) Examine the machine controls and connections to the LMI SAFETY MAT are correct.
- e) Check that the LMI SAFETY MAT is fixed in position and that no trip hazards are present within the dangerous area.
- f) Except where the device is solely used as a trip device, check that it is not possible to stand in the dangerous area without actuating the LMI SAFETY MAT.
- g) Check that it is not possible for the dangerous parts of the machine to be set in motion while the LMI SAFETY MAT is actuated.
- h) Check that actuation of the LMI SAFETY MAT during a dangerous phase of operation (of the machine) results in the dangerous parts to be arrested, or where appropriate, assuming an otherwise safe condition, before any part of a person could reach them.
- i) Check that after a machine has been stopped by the actuation of the LMI SAFETY MAT, it is not possible for the dangerous parts to be set in motion until the LMI SAFETY MAT has been cleared, a reset button has been operated and released, and the machine start control has been re-operated.
- j) Check that the removal of power from the LMI SAFETY MAT prevents further operation of the machine. It should not be possible for the dangerous parts of the machine to be set in motion until power has been restored, the reset button has been actuated and released, and the machine start control has been actuated.
- k) Check that the LMI SAFETY MAT operates over the whole active area by walking, 'heel to toe' over the whole area in two directions as shown in figure 3.
Examine the stopping performance monitor (if fitted) to ensure that it is fitted and functioning correctly. Ensure that the means by which the stopping performance can be assessed by the operator is indicating correctly.
- m) Test the muting arrangements (if fitted). Ensure that the muting is only possible during non-dangerous operation and ensure that the safety level of the muting device is at or above that of the safety mat but never below.
- n) Examine brakes and clutches (if fitted) as recommended.

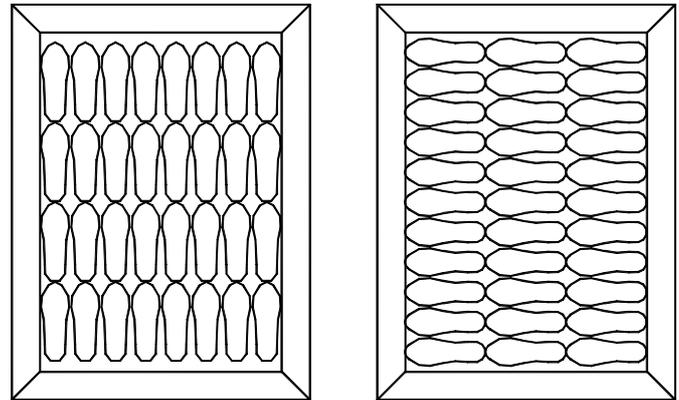


Figure 3

6. OPERATION, MAINTENANCE & SERVICING

Operation of the LMI SAFETY MAT is straightforward. Once installed and interfaced to a machine, the LMI SAFETY MAT will be an active safety sensor. The LMI SAFETY MAT will actuate each time the active surface is stepped on.

Daily work on the LMI SAFETY MAT by one or several persons will not lead to any deterioration of the sensor.

The LMI SAFETY MAT does not need any maintenance, however, the life of the LMI SAFETY MAT will be considerably increased if a basic cleaning routine is observed.

The surface of the LMI SAFETY MAT should be cleaned daily. Dust and dirt should be swept off the mat. Grease and oil on the mat can cause the mat to be made slippery. Spills should be removed immediately or covered with sawdust and removed at the next daily cleaning.

The frequency of cleaning depends on the nature of the environment. In relatively clean environments where water or other fluids are rarely exposed to the LMI SAFETY MAT, monthly cleaning is sufficient. In dirtier environments, weekly cleaning may be necessary.

WARNING

SERVICING OF THE LMI SAFETY MAT SHOULD ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL. SERVICING INVOLVES THE EXPOSURE OF TERMINALS AND DEVICES THAT CARRY POTENTIALLY LETHAL VOLTAGES. ONLY THOSE PERSONS WITH THE APPROPRIATE TRAINING AND EXPERIENCE SHOULD UNDERTAKE THIS WORK. IF THERE ARE ANY QUESTIONS CALL YOUR LOCAL TAPESWITCH REPRESENTATIVE.

IMPORTANT

AFTER ANY PART OF THE SYSTEM HAS BEEN REPLACED, THE INSTALLATION SHOULD BE CONSIDERED AS NEW AND AS SUCH SHOULD BE RE-COMMISSIONED IN ACCORDANCE WITH THIS MANUAL.

THE LMI SAFETY MAT IS DESIGNED TO HAVE NO USER REPAIRABLE PARTS. IF THE LMI SAFETY MAT OR A PART OF THE LMI SAFETY MAT NEEDS REPAIR, CONTACT YOUR LOCAL TAPESWITCH REPRESENTATIVE.

7. CONTROL UNITS

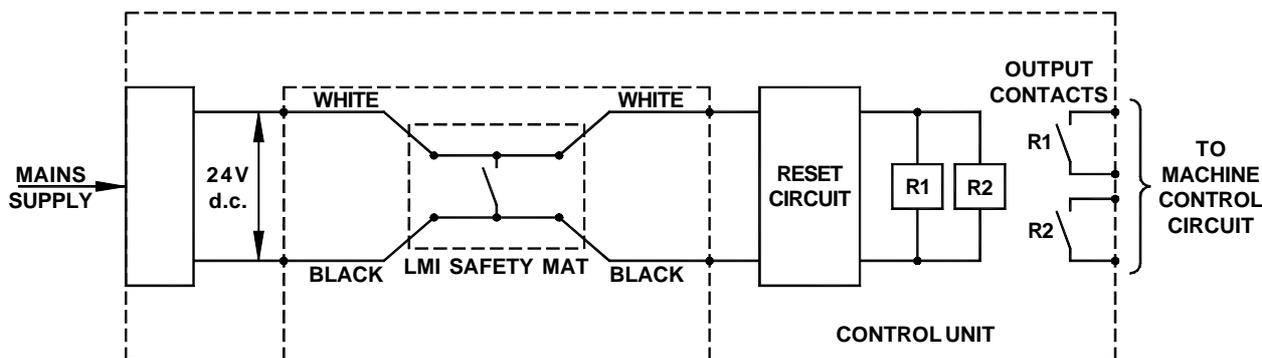


Figure 4 - Fail-Safe Supervised Circuit

It is recommended that the LMI SAFETY MATS are used with the Tapeswitch range of PSSU or PRSU Control Units. Full installation instructions are supplied with each control unit.

Please see your Tapeswitch representative for further details.

The control unit contains the power supply for the system, the safety output relays and the reset circuit. Figure 4 shows the principle of operation. A 24Vdc power supply is taken from the control unit to the switching elements in the sensor(s), +ve to one conductor, -ve to the other conductor, and back to the control unit where it supplies power to the output relays. The output contacts of the safety relays are only closed when the output relays are energised. When the sensor is actuated, the 24Vdc power supply to the output relays is shorted out causing them to de-energise. Furthermore, if the power supply to the output relays is interrupted or shorted out by a fault in the sensor wiring or in the switch elements, power to the output relays will be lost, the relays will de-energise and the output contacts will open. The reset circuit provides start and restart interlock functions as follows:

START INTERLOCK - When power is applied to the system, the output relays cannot be energised until a reset signal has been applied and removed.

RESTART INTERLOCK - Once the sensor has been actuated and the output relays have de-energised, they cannot be energised again until a reset signal has been applied and removed.

Reset will be prevented while the sensor is actuated, if there is a fault in the reset input circuit or if the two output relays are in disparity.

The safety output contacts of the control unit are connected to the machine primary control element(s) or MPCE's in such a way that if either of the safety output relays is de-energised then the machine will be brought to rest regardless of the state of the other relay.

NOTE: A machine primary control element or MPCE is defined as 'an electrically controlled element which directly controls the normal operating motion of a machine such that it is the last(in time) to operate when motion is initiated or arrested'.

In addition, where the machine control system has two MPCE's, these devices can be monitored by connecting normally closed auxiliary contacts from each MPCE in series with the reset input. Disparity between the two MPCE's will prevent a reset.

8. TECHNICAL SPECIFICATION

Requirement Grade	BS EN1760-1: 1998 & BS EN951-1: 1996 Category Rating: To Maximum Category 3.
Operating Voltage	12 to 48V a.c. or d.c.
Operating Current	Min. 50mA. - Max. 1A.
Response Time	< 15ms Mat only < 25ms with PSSU type Control Unit < 45ms with PRSU/2 type Control Unit
Number of Operations	1 million typical
Actuating / Test Force	< 33N with an 80mm diameter test piece
Temperature Range: Operating Storage	0°...50°C -20°...70°C
Protection rating	IP 67
Inactive Zone	20mm wide around outer edge of sensor
Weight (approx.)	9.5kg/m ²
Top Surface Saterial	Moulded PVC with Ribbed, Button or Custom Surface

Table 1