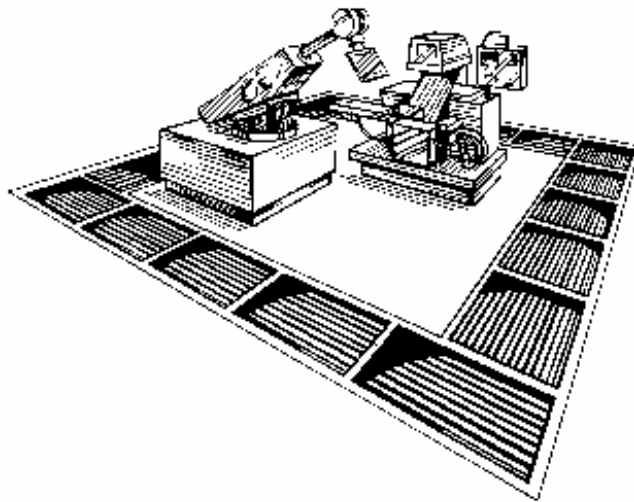




## Recora Company Switchmat Installation Guide

READ THIS MANUAL IN FULL BEFORE INSTALLATION



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## **TABLE OF CONTENTS:**

<b>Introduction</b>	<b>Page 3</b>
<b>Storage and Handling</b>	<b>Page 3</b>
<b>System Description</b>	<b>Page 4</b>
<b>Calculation Safe Distances</b>	<b>Page 5</b>
<b>Electrical Requirements</b>	<b>Page 6</b>
<b>Installation of Switchmats</b>	<b>Page 7</b>
<b>Care of Switchmat Lead Wires</b>	<b>Page 9</b>
<b>Waterproof Seal for Lead Cables</b>	<b>Page 10</b>
<b>Installation of Waterproof Seal for Lead Cables</b>	<b>Page 10</b>
<b>Trouble Shooting a Switchmat System</b>	<b>Page 11</b>
<b>Warranty</b>	<b>Page 12</b>

## **Introduction**

The Recora Switchmat system is a pressure sensitive mat system designed for use as a safety product in an industrial environment. The system provides the detection of a presence in the protected work cell or perimeter.

*Before installing your Recora Switchmat system, please read this information in full. All installation procedures should be carried out by trained and qualified personnel and should be in accordance with all safety regulations.*

Presence sensing mats and controllers used to guard machinery and equipment are regulated by government agencies, such as OSHA and ANSI. The responsibility of compliance for a machine application, presence sensing mat and controller is in the hands of the employer. The employer is responsible for proper installation, maintenance, and training of users of safety devices. When a Recora presence-sensing mat and controller are used to protect personnel from machinery or other hazards, it is the employers' responsibility to meet all local, state, and federal regulations.

### **Warning!**

The entire machine safety system must be tested at the start of every shift. Machine testing should include proper machine operation and stopping capability and verification of proper installation and settings of all operation guards and devices before the operation is released for production.

## **Storage and Handling**

Common caution is needed when unpacking and assembling the Recora Switchmat.

**DO NOT** drop the Switchmat, the edges and/or corners can be damaged

**DO NOT** use a sharp object when opening the shipping carton.

**DO NOT** pull the Switchmat using its lead wire(s).

The Switchmats should be stored in a vertical position. For larger Switchmats, two people are required for safe lifting and to prevent damage to the switching element of the mat.

## **System Description**

Recora Switchmats are available in either a single or dual lead configuration, designated as H for single lead and HD for dual lead. The type of series used should only be determined after a risk assessment is performed. The level of safety protection required for a given application is based on the risk associated with that application. The risk associated with an operation is based on a number of factors that must be taken together and evaluated in total to establish the risk level for any equipment or operation. **It is important to note that using a Switchmat alone will not make the installation a safety system. A Switchmat monitoring controller must be used to complete the safety system. When a 14HD (4-wire) series Switchmat is used together with the FSC-6 mat controller, the safety system reaches a safety category 3 level.** Safety controls must have positive operation indicators; force guided relays, redundant critical control components in order to meet the ANSI B11.19 guidelines.

The H series, a two-conductor lead cable, is used when a simple control function is determined to be sufficient. The Switchmat requires low voltage; this is usually accomplished by using a step-down transformer and a relay. The relay interfaces with the supply voltage, acting as the on/off switches. ***The two conductors H Series should not be considered in a safety application.***

The HD series, a four-conductor lead cable, is usually required when the Switchmat is to be used as a safety mat. The dual leads are necessary when used in conjunction with the Recora Fail-Safe control unit.

### **Specifications:**

- Molded plastisol cover
- Overall thickness is .375” with a corrugated (ribbed) surface
- Shore A hardness 80 +/- 3
- Activation pressure is <300 N, typical activation pressures 10 – 15 lbs.
- Maximum load capacity is 3,000 psi
- S.P.S.T normally open switch, 24V AC/DC
- Standard lead length is determined by the Switchmat model selected, additional cable length is available
- 16 gauge bottom plate, 20 gauge top plate
- 65 durometer silicon spacers
- 18 gauge lead wire, mechanically fixed to the electrode, other cables available. (Quick disconnects, 4-conductor lead cable ect.)
- Standard colors are black, yellow and brown
- High load bearing capacity (forklifts)
- High impact resistance
- Switchmats are totally molded, not laminated, to help prevent fluid entry
- Extruded aluminum 1.500” **ACTIVE** mat connector to combine larger 14HD series Switchmats.
- Extruded aluminum 2.000” ramp and .750” blunt edging and conduit connector included for securing the larger 14H and 14HD series Switchmats.

**SERIES 12, 15 & 30 Switchmats** have been designed for presence sensing applications for stand alone operator detection in smaller areas.

Depending on how these Switchmats are combined with the machine control wiring, these models can require the operator to step on the Switchmat, or off the Switchmat before the machine will cycle or operate.

### **Calculating safe distances**

According to ANSI B11.19-1990, “the size of the safety mat should be large enough to prevent entry into the hazardous area.” In some cases, this may require the use of more than one mat or additional guards.

The safety mat must be of sufficient size to detect entry by an operator or others into a hazardous area. Switchmats are available in a variety of sizes. Knowing the distance that must be covered with the safety mat is important in building a safe installation.

The minimum distance calculated is the minimum horizontal distance from the outer edge of the Switchmat detection zone to the nearest part of the hazard.

The prEN 999 formula for floor mounted safety mats is:

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

S is the minimum safety distance in millimeters

The factor of 1600 is based on the standard assumption of 1600mm/s as the approach speed.

T is the overall stopping time in seconds

The added 1200mm takes into account stride length and arm reach

The overall stopping time T is made up of two parts:  $T = t1 + t2$

t1 is the maximum time between actuation of the sensing function and the output signal switching devices being in the OFF state.

For the Switchmat,  $t1 = 35\text{mS}$

t2 is the response time of the machine i.e. the time required to stop the machine to remove the risks after receiving the output from the Switchmat.

The response time of the machine used in the calculation needs to be the worst case time. Some machines have inconsistent response times which are dependent upon mode of operation, nature of the workpiece and point in the operation cycle at which stopping is initiated. An allowance should be made for wear in brakes etc., if this can affect the response time. An allowance for further delays in the machine control system may be required in some circumstances.

## **CALCULATION EXAMPLE**

In this example the Switchmat being used with a machine whose worst case response time has been measured as 0.485 seconds.

Using the formulae above,

$$\begin{aligned} T &= t_1 + t_2 \\ &= 35\text{mS} + 485\text{mS} \\ &= 520\text{mS} = 0.520\text{S} \end{aligned}$$

$$\begin{aligned} S &= (1600 \times 0.520) + 1200\text{mm} \\ &= 832 + 1200\text{MM} = 2032\text{mm} \end{aligned}$$

Sensor mats will be required from 2032mm right up to the edge of the machine baseplate.

**NOTE-** Ramp edging is often used to secure a safety mat to the proper location and also helps to minimize tripping hazards.

### **Other considerations for Recora Switchmats would be as follows:**

1. Machine installations must be capable of stopping motion anywhere in the stroke or cycle. Do not use the Switchmat (presence sensing device) on a power press with a full revolution clutch.
2. Do not use a safety mat to initiate machine motion.
3. Do not use a Switchmat or controller in an environment that may degrade the integrity of the device such as a caustic or corrosive environment.
4. Additional guarding may be necessary to protect personnel from machinery or hazardous areas. Switchmats may be used to complement other guarding such as light curtains and hard guards.

### **Electrical Requirements**

All Recora Switchmats are designed for low voltage operation, Class II N.E.C. circuit operation, 100-volt amperes at 24 Volts AC or DC. Switch is single pole, single throw, normally open, momentary contact type designed to activate with 10-15 pounds foot pressure.

## **Installation of Switchmats**

### **Surface preparation:**

Isolate and lock off the machine power supply at source. Preparing the surface on which the mats will be placed is important. The area needs to be a clean, smooth surface with no protruding objects on the floor or crevices in excess of .500" wide.

### **12H, 15H, 30H 30HD Series Switchmats**

Place these free standing Switchmats at the desired location and attach the lead wire(s) to the power source. Once the electrical connections have been made, the mat should be tested to insure proper performance. Pressure applied to each mat should perform required function. ***If it does not, DO NOT PROCEED until the problem has been identified and corrected.***

### **14H, 14HD Series Switchmats**

Place the mat at the desired location. Align and attach edging to the mat with the lead(s) exiting through the proper grooves. Connect to the control source and test the mat by applying pressure to the surface. (If connecting to the Recora FSC control, see instructions for complete installation). ***If the test fails, DO NOT PROCEED until the problem has been identified and corrected.*** After successful testing, secure edging with the supplied anchors and screws. Care is to be observed when tightening the aluminum edging. If the placement surface is uneven or rough, over torquing of the mounting hardware could activate the mat.

### **Multiple Switchmat Systems**

Multiple Switchmat systems are supplied with an installation drawing indicating the mat and edging and suggested lead routing in the system.

The system mats should be laid out in accordance with the installation drawing. The aluminum ramp and active mat connectors are marked according to the drawing.

Align the mats and attach edging, dressing out the leads in accordance with the print using the Recora installation drawing. (See Waterproof Seal for Lead Cables).

Leave sufficient wire tail length to enable the connection to be remade if a mat is ever replaced, but ensure that the interconnection wires will fit easily under the trim kit. When interconnecting the leads between the mats, continuity should be maintained by connecting wire "A" of the first mat to wire "A" of the adjacent mat, then connect wire "B" of the first mat to wire "B" of the adjacent mat. Follow this procedure until all mats in the configuration are connected. Leads then need to be routed to the control circuit via flexible or rigid surface conduit to prevent damage to the wires. Connect the mats to the control source and test the system by applying pressure on the surfaces. (If connecting to the Recora FSC control, see instructions for complete installation). ***If the test fails, DO NOT PROCEED until the problem has been identified and corrected.***





**Note: Special consideration is to be observed with the active mat connector. The design of this component is that it will "free float" when pressure is applied. Alignment of the through holes of the rail and anchor is such that no binding is allowed. Over torque will activate the mat.**

The edging strips have been grooved according to the installation drawing to allow accommodation for the lead wire. **Important** – If the edging is used in a different manner, a groove **MUST BE** cut in the edging where it lies over the lead wire. The leads must not have any undue pressure applied to them, as this will cause mat failure. Also, it is recommended that the leads from each mat be held to a minimum length of 2 feet each.

**Care of the Switchmat lead wire(s)**

Lead wire(s) must be routed to prevent damaging insulation or breaking internal wires.

## Waterproof Seal for Lead Cables

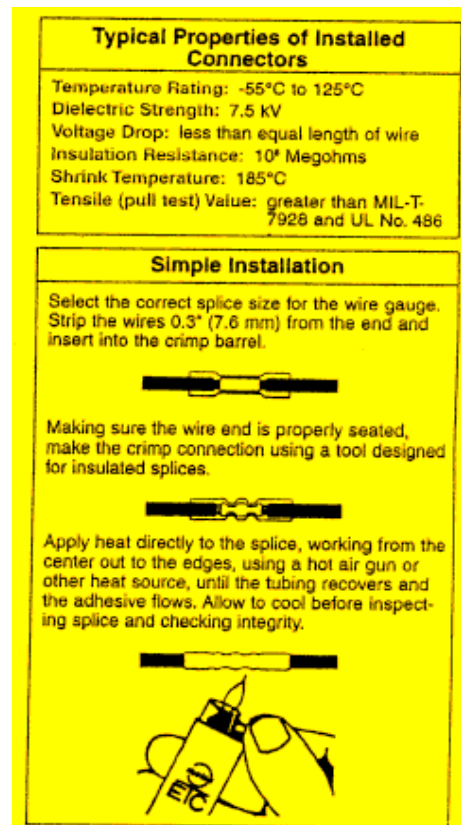
### **Description**

Recora terminals and splices give long-lasting, moisture-proof connections that withstand water, salt, condensation, corrosion and heat, all of which cause serious problems for conventional, unsealed splices. The inner wall of the heat-shrinkable nylon Recora sleeve is lined with a special hot-melt adhesive, which is inert at room temperature, permitting wires to be inserted easily into the splices and terminals. As the sleeve is heated, the adhesive melts and flows under pressure from the tubing. This action fills any existing voids and creates a seal which repels moisture incursion, even during pressure cycling, and stands up to some of the most rigorous tests that can be applied to high-performance splices.

Recora splices and terminals can be installed easily with commonly available tools. All that is required is a good-quality crimping tool designed for insulated splices, such as the ETC-Molex ABC-500 multi-purpose crimper or UNI-3000 ratchet tool and a standard hot air gun or other heat source.

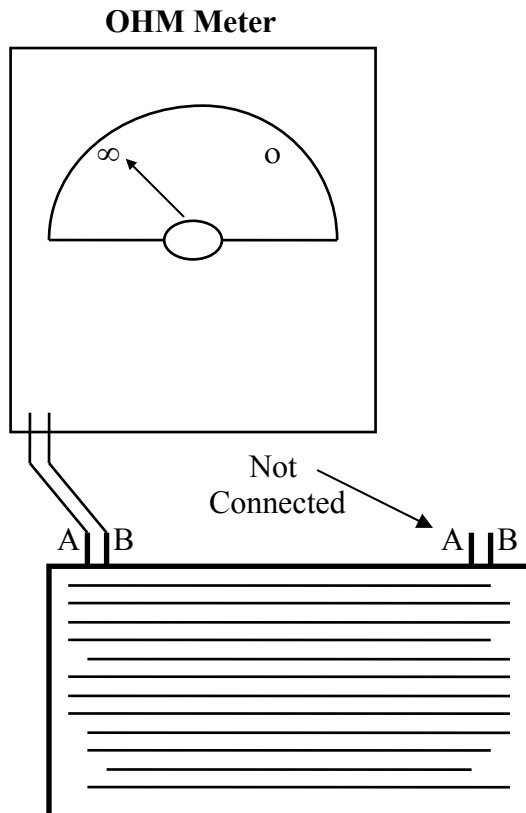
### **Installation**

Select the correct splice size for the wire gauge. Strip the wire 0.3" (7.6mm) from the end and insert into the crimp barrel. Make sure the wire end is properly seated, make the crimp connection using a tool designed for insulated splices. Apply heat directly to the splice, working from the center out to the edges, using a hot air gun or other heat sources, until the tubing recovers and the adhesive flows. Allow cooling before inspecting the splice and checking integrity.

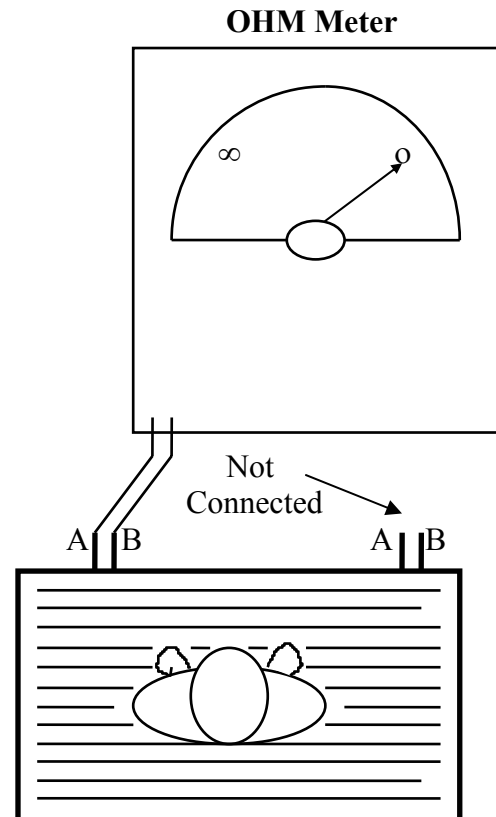


## Trouble Shooting a Switchmat System

All Switchmats are wired in series. Therefore, if any Switchmat in the system is shorting out, the technician will not be able to tell which Switchmat has failed. In order to determine which Switchmat has failed, the technician has to electrically disconnect each Switchmat (all four wires) and test it independently of the system. Once the Switchmat is disconnected a simple resistance check can be done to determine if the Switchmat is operating properly. A properly functioning Switchmat will show infinite resistance when no weight is on the Switchmat and  $5\Omega$  or less when a person is standing on the Switchmat. If the Switchmat reads  $5\Omega$  or less without any weight on the Switchmat, it is shorted and must be replaced. If the Switchmat reads  $\infty\Omega$  with the operator standing on the Switchmat it is open. An open Switchmat is **very unusual**, carefully inspect the wire for a break or where a screw has gone through the wire. **If no broken wire is found check your meter leads.**



**No Weight On Mat**  
1 meter lead connected to A  
2nd meter lead connected to B



**Operator on Safety Mat**  
1 meter lead connected to A  
2nd meter lead connected to B

**TIP:** A careful visual inspection of the Switchmat surface for dents or deformities may lead the technician to the faulty Switchmat without having to take apart the entire system. The most common cause of Switchmat failure is due to the corner of a heavy object being dropped on the Switchmat, this dents the electrode and causes the Switchmat to short out.

## **Warranty**

Recora Switchmats are quality products manufactured by the Recora Company meeting all specifications and engineering department requirements.

All Switchmats are guaranteed against defective workmanship or material for a period of 12 months from the date of purchase. This warranty does not apply to Switchmats that are damaged due to improper installation or other misuses.

The defective Switchmat must be returned to Recora Company (freight prepaid) where it will be inspected for defects. If the Switchmat is found defective due to workmanship or material, a replacement Switchmat will be sent. This warranty is limited to the replacement of defective Switchmats only and does not obligate Recora Company to assume any liability for the expense involved in removing and/or replacing the defective Switchmat.

# ***Recora Switchmat***<sup>®</sup>

For over 50 years Recora Company has manufactured and designed a full line of standard and custom electrical *Switchmats* and flexible pressure sensitive switches. Offering effective and reliable solutions to problems found in industrial environments wherever presence or absence detection is essential.

Used for Machinery Safety, Auto Industry, Automated Equipment and Personnel/Vehicle Detection. Consultants are available to assist you with your standard requirements or your most complex applications.

Standard Product Line: Switchmat, *Sensi-Switch*, Auto Alert, Controls and Footswitch.

Specializing in Custom-Design applications  
to suit individual requirements.

You may contact us at 1.866.2RECORA with requests for any custom size *Switchmats* and special sensor applications.

***The Switch is On to Recora!***