Safety Mat / Safety Mat Controller
UM/MC3

Stay one step ahead in safety
OMRON Safety Mats continue on their unique path of evolution. On-site safety can be further improved by placing Safety Mats precisely in areas where other sensors do not reach. The Safety Mats elicit the full power of every location and are suitable for any application.

Safety Mats are safety measures that take into consideration usability in the workplace.

Complies with international safety standards

The safety mat has received EN ISO 13856-1 safety standard certification and complies with ANSI/RIA15.06 and other standards. Meets PLe/Safety Category 3 (EN ISO13849-1) requirements when used in combination with the safety controller G9SP or the safety mat controller MC3.
OMRON Safety Mats continue on their unique path of evolution. On-site safety can be further improved by placing Safety Mats precisely in areas where other sensors do not reach. The Safety Mats elicit the full power of every location and are suitable for any application.

Safety Mats are safety measures that take into consideration usability in the workplace.

OMRON Safety Mats continue on their unique path of evolution. On-site safety can be further improved by placing Safety Mats precisely in areas where other sensors do not reach. The Safety Mats elicit the full power of every location and are suitable for any application.

The UM system takes the site into consideration.

Reduce labor associated with cumbersome layout, installation and maintenance.

- Connectors make wiring simple.
- Cables with connectors make wiring easy, even when multiple mats are used.

1. Wiring for two Safety Mats.
2. Wiring for six Safety Mats.

Trim that takes wiring and maintenance into consideration.

- The snap-type trim ensures proper cable installation and simplifies the maintenance and installation of mats.

3. Aluminium Trim
4. PVC Trim Cover

Broad product selection ensures compatibility with a wide variety of sites.

A variety of mat sizes are available. You can select mats that suit the protected area.

Complies with international safety standards.

The safety mat has received EN1760-1:1998 safety standard certification and complies with ANSI/RIA15.06-1999 and other standards. Meets PlC/3 Safety Category 3 (EN ISO13849-1: 2008) requirements when used in combination with the safety controller G9SP or the safety mat controller MC3.

Mats sized in inches are also available for use in North America. Contact your dealer for more information about the models and delivery periods.
Safety Mat That Is Easy to Install and Maintain

- Simple connection allows multiple mats to be joined together.
- A wide variety of mat sizes are available.
- Meets PLd/Safety Category 3 (EN ISO13849-1) requirements when used in combination with the safety controller G9SP or the safety mat controller MC3.
- Complies with North American safety standards, including ANSI/RIA15.06.

Be sure to read the “Safety Precautions” on page 14 and 15.

Model Number Structure

Model Number Legend

Safety Mat

UMM5-0300-0300

1. Color
None : Black
Y : Yellow

2. Unit of Length
None : Inch
M : Millimeter

3. Cable Length
5 : 5 m
10 : 10 m

4. Safety Mat Dimension A

5. Safety Mat Dimension B

Ordering Information

Safety Mat Controller

<table>
<thead>
<tr>
<th>Safety Mat outputs</th>
<th>Auxiliary outputs</th>
<th>Rated voltage</th>
<th>Terminal block type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPDT-NO</td>
<td>SPDT-NC</td>
<td>24 VDC</td>
<td>Screw terminals</td>
<td>MC3</td>
</tr>
</tbody>
</table>

Safety Mat

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Black</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (mm)</td>
<td>Model</td>
<td>Model</td>
</tr>
<tr>
<td>300</td>
<td>UMM5-0300-0300</td>
<td>UMYM5-0300-0300</td>
</tr>
<tr>
<td>400</td>
<td>UMM5-0400-0400</td>
<td>UMYM5-0400-0400</td>
</tr>
<tr>
<td>500</td>
<td>UMM5-0500-0250</td>
<td>UMYM5-0500-0250</td>
</tr>
<tr>
<td>500</td>
<td>UMM5-0500-0400</td>
<td>UMYM5-0500-0400</td>
</tr>
<tr>
<td>500</td>
<td>UMM5-0500-0500</td>
<td>UMYM5-0500-0500</td>
</tr>
<tr>
<td>500</td>
<td>UMM5-0500-1500</td>
<td>UMYM5-0500-1500</td>
</tr>
<tr>
<td>600</td>
<td>UMM5-0600-0400</td>
<td>UMYM5-0600-0400</td>
</tr>
<tr>
<td>750</td>
<td>UMM5-0750-0250</td>
<td>UMYM5-0750-0250</td>
</tr>
<tr>
<td>750</td>
<td>UMM5-0750-0500</td>
<td>UMYM5-0750-0500</td>
</tr>
<tr>
<td>750</td>
<td>UMM5-0750-0750</td>
<td>UMYM5-0750-0750</td>
</tr>
<tr>
<td>750</td>
<td>UMM5-0750-1500</td>
<td>UMYM5-0750-1500</td>
</tr>
<tr>
<td>1000</td>
<td>UMM5-1000-0500</td>
<td>UMYM5-1000-0500</td>
</tr>
<tr>
<td>1000</td>
<td>UMM5-1000-0750</td>
<td>UMYM5-1000-0750</td>
</tr>
<tr>
<td>1000</td>
<td>UMM5-1000-1000</td>
<td>UMYM5-1000-1000</td>
</tr>
<tr>
<td>1000</td>
<td>UMM5-1000-1250</td>
<td>UMYM5-1000-1250</td>
</tr>
<tr>
<td>1000</td>
<td>UMM5-1000-1500</td>
<td>UMYM5-1000-1500</td>
</tr>
</tbody>
</table>

Note: 1. These Mats are made of rubber, and there is a tolerance of ±6 mm for the dimensions that are given above.
2. Refer to Safety Mat in Dimensions on page 10 for the dimensions of the base and the location of the cable.
### Trims

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Name</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ramp Trim with Yellow PVC Cover (1.22 m)</td>
<td>UMRT4</td>
<td>Installed on the perimeter of the Safety Mat. Each Trim is composed of two parts, an aluminum base and a PVC Cover. Possible to install cables inside.</td>
</tr>
<tr>
<td></td>
<td>Ramp Trim with Yellow PVC Cover (2.44 m)</td>
<td>UMRT8</td>
<td>The Joining Trims join the Safety Mats when two or more Safety Mats are being combined. In addition to joining the Safety Mats, the Joining Trims preserve the Safety Mat’s sensitivity at the joints.</td>
</tr>
<tr>
<td></td>
<td>Joining Trim (1.22 m)</td>
<td>UMJS4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Joining Trim (2.44 m)</td>
<td>UMJS8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminum Ramp Trim (2.44 m)</td>
<td>UMAL</td>
<td>Installed on the perimeter of the Safety Mat.</td>
</tr>
<tr>
<td></td>
<td>Molded Outside Corner</td>
<td>UMOC</td>
<td>Installed at the outside corners of the Safety Mat combining with Ramp Trims with Yellow PVC Cover.</td>
</tr>
<tr>
<td></td>
<td>Molded Inside Corner</td>
<td>UMIC</td>
<td>Installed at the inside corners when two or more Safety Mats combining with Ramp Trims with Yellow PVC Cover are being combined.</td>
</tr>
</tbody>
</table>

**Note:** Screws (No. 8 × 32 mm) and anchors (12 each) are included with each Trim.

### Accessories

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Name</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distribution Box (for six mats)</td>
<td>UMDB-6</td>
<td>Used to connect to two or more Safety Mats to the single MC3 Safety Mat Controller.</td>
</tr>
<tr>
<td></td>
<td>Waterproof Cover</td>
<td>XS2Z-22</td>
<td>Used to protect the unused connectors of UMDB-6.</td>
</tr>
<tr>
<td></td>
<td>Y Connector</td>
<td>UM-Y-2-1</td>
<td>Used to connect two Safety Mats to the single MC3 Safety Mat Controller.</td>
</tr>
<tr>
<td></td>
<td>Panel-mount Connector</td>
<td>UMPMC</td>
<td>Distributes to individual lines to connect the Safety Mat to a MC3 Safety Mat Controller.</td>
</tr>
<tr>
<td></td>
<td>Extension Cable (3 m)</td>
<td>UMEC-03</td>
<td>This cable is used to extend a cable, or to connect the UMPMC to the UMDB-6.</td>
</tr>
<tr>
<td></td>
<td>Extension Cable (5 m)</td>
<td>UMEC-05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension Cable (10 m)</td>
<td>UMEC-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension Cable (15 m)</td>
<td>UMEC-15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connector with cable Socket on one cable end (1 m)</td>
<td>XS2F-D421-C80-F</td>
<td>Used to connect the UMDB-6 to the MC3 Safety Mat Controllers.</td>
</tr>
<tr>
<td></td>
<td>Connector with cable Socket on one cable end (2 m)</td>
<td>XS2F-D421-D80-F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connector with cable Socket on one cable end (5 m)</td>
<td>XS2F-D421-G80-F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connector with cable Socket on one cable end (10 m)</td>
<td>XS2F-D421-J80-F</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** For trims and accessories required for the Safety Mat system configuration, see “Installation” on page 7.
### Specifications

#### Ratings

**Safety Mat Controller**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power input</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power voltage</strong></td>
<td></td>
<td>24 VDC</td>
</tr>
<tr>
<td><strong>Operating voltage range</strong></td>
<td></td>
<td>-15% to +15% of rated supply voltage</td>
</tr>
<tr>
<td><strong>Power consumption</strong> *</td>
<td></td>
<td>3 W max.</td>
</tr>
</tbody>
</table>

*Power consumption of loads is not included.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switch</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated load</strong></td>
<td></td>
<td>6 A at 230 VAC/6 A at 24 VDC (resistive load) 5 A at 230 VAC (AC15)/2 A at 24 VDC (DC13) (inductive load)</td>
</tr>
<tr>
<td><strong>Maximum rated voltage</strong></td>
<td></td>
<td>250 VAC/24 VDC</td>
</tr>
<tr>
<td><strong>Rated carry current</strong></td>
<td></td>
<td>6 A</td>
</tr>
<tr>
<td><strong>Maximum switching capacity</strong></td>
<td></td>
<td>1,500 VA</td>
</tr>
</tbody>
</table>

#### Characteristics

**Safety Mat**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>UM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Detection method</strong></td>
<td></td>
<td>Pressure sensing method</td>
</tr>
<tr>
<td><strong>Actuating force</strong></td>
<td></td>
<td>300 N min.</td>
</tr>
<tr>
<td><strong>Maximum allowable load</strong></td>
<td></td>
<td>2,000 N (EN ISO 13856-1 requirement)</td>
</tr>
<tr>
<td><strong>Mechanical durability</strong></td>
<td></td>
<td>1 million cycles min.</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td></td>
<td>PVC (Polyvinyl Chloride)</td>
</tr>
<tr>
<td><strong>Ambient operating temperature</strong></td>
<td></td>
<td>-37 to 66°C (with no icing or condensation)</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td></td>
<td>IP67</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td>Approx. 24.4 kg/m²</td>
</tr>
</tbody>
</table>

**Safety Mat Controller**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response time</strong></td>
<td></td>
<td>30 ms max.</td>
</tr>
<tr>
<td><strong>Safety input</strong></td>
<td></td>
<td>Four-wire Safety Mat only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mat can be connected in series (Connectable number: 12 max.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The external impedance must be 8 Ω or less between M11 and M21 and between M12 and M22.</td>
</tr>
<tr>
<td><strong>Safety output</strong></td>
<td></td>
<td>SPDT-NO</td>
</tr>
<tr>
<td><strong>Auxiliary output</strong></td>
<td></td>
<td>SPDT-NC</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td></td>
<td>20 MΩ min. (at 500 VDC)</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td></td>
<td>Between different poles of outputs 1,800 VAC, 50/60 Hz for 1 sec.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Between power supply and output</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td></td>
<td>Malfunction: 10 to 55 Hz, 0.15 mm single amplitude</td>
</tr>
<tr>
<td><strong>Mechanical shock resistance</strong></td>
<td></td>
<td>Malfunction: 98 m/s²</td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td></td>
<td>10,000,000 cycles min.</td>
</tr>
<tr>
<td><strong>Ambient operating temperature</strong></td>
<td></td>
<td>0 to 55°C (with no icing or condensation)</td>
</tr>
<tr>
<td><strong>Ambient operating humidity</strong></td>
<td></td>
<td>0% to 90% RH</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Terminal tightening torque</strong></td>
<td></td>
<td>0.5 N·m</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td>Approx. 360 g</td>
</tr>
</tbody>
</table>
Installation

Using Trim Pieces

**Ramp Trim with Yellow PVC Cover: UMRT4/UMRT8**
Secures the edges of the Safety Mats to the floor.
It is composed of two parts with an aluminum base and a PVC Cover.

**Joining Trim: UMJS4/UMJS8**
The Joining Trims join the Safety Mats when two or more Safety Mats are being combined.
In addition to joining the Safety Mats, the Joining Trims preserve the Safety Mat's sensitivity at the joints.

**Aluminum Ramp Trim: UMAL**
Secures the edges of the Safety Mat to the floor.
The Aluminum Ramp Trim is hollow, so cable can be routed through it.

**Molded Outside Corner: UMOC**
Used together with the Ramp Trim with Yellow PVC Cover (UMRT4/UMRT8) to secure the external corners of the Safety Mats to the floor.

**Molded Inside Corner: UMIC**
Used together with the Ramp Trim with Yellow PVC Cover (UMRT4/UMRT8) to secure the internal corners of the Safety Mats to the floor.

**Note:**
1. The Aluminum Ramp Trim or Ramp Trim with Yellow PVC Cover must be cut to fit the size of the Safety Mats being used. Furthermore, when the Safety Mat's wiring is being routed through the Aluminum Ramp Trim or Ramp Trim with Yellow PVC Cover, it will be necessary to cut or notch the Aluminum Ramp Trim or Ramp Trim with Yellow PVC Cover for cable access. Refer to the Safety Mat Instruction Sheet for details on cutting or notching the Aluminum Ramp Trim or Ramp Trim with Yellow PVC Cover.
2. The Joining Trim must be cut to fit the size of the Safety Mats being used.
3. The Ramp Trim with Yellow PVC Cover and Molded Corner must be anchored to the floor to secure the Safety Mats. It is also necessary to drill holes in the Trim to anchor it. Refer to the Safety Mat Instruction Sheet for details on drilling holes in the Trim and Molded Corner and anchoring it to the floor.

**Safety Mat Configuration**
The Safety Mats are secured by anchoring the Ramp Trim with Yellow PVC Cover and Molded Corner to the floor.

**Example 1: Using a Single Safety Mat**

In this case, the perimeter of the Safety Mat is about 4 m and the following pieces are needed:
The example above consists of the following components:
- UMYM5-1000-1000 Safety Mat : 1 piece
- UMRT4 Ramp Trim with Yellow PVC Cover (1.22 m) : 4 pieces
- UMOC Molded Outside Corner : 4 pieces

**Example 2: Using three Safety Mats**

In this case, the perimeter of the Safety Mat is about 8 m, the joint between the Safety Mats is 2-m long, and the following pieces are required:
The example above consists of the following components:
- UMYM5-1000-1000 Safety Mat : 3 pieces
- UMRT4 Ramp Trim with Yellow PVC Cover (1.22 m) : 8 pieces
- UMJS4 Joining Trim (1.22 m) : 2 pieces
- UMOC Molded Outside Corner : 5 pieces
- UMIC Molded Inside Corner : 1 piece

Before ordering, confirm the number of Ramp Trim with Yellow PVC Cover and Molded Corner pieces that will be needed.
Wiring of Safety Mat and Safety Mat Controller

Example 1: Using a Single Safety Mat

Note: You can cut a Safety Mat's cable and wire it to the MC3 Safety Mat Controller without using UMPMC.

Example 2: Using Two Safety Mats

Example 3: Using Six Safety Mats

Connecting directly to Safety Mat Controller

Connecting to Safety Mat Controller in a panel

Note: 1. Use UMEC- Extension Cables as required by the distance between the Safety Mats and the Mat Controller.
2. When using the UMDB-6 to connect to 1 to 5 Mats, change the wiring inside the UMDB-6. Refer to user documentation provided with the UMDB-6.

Contact your dealer for other wiring combinations.
Connections

Internal Connection

![Diagram of internal connection]

Wiring of Inputs and Outputs

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Terminal name</th>
<th>Description of operation</th>
<th>Wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply input</td>
<td>Y1, Y2</td>
<td>Power supply input terminals for MC3. Connect the power source to the Y1 and Y2 terminals.</td>
<td>Connect the power supply plus (24 VDC) to the Y1 terminal. Connect the power supply minus (GND) to the Y2 terminal.</td>
</tr>
<tr>
<td>Safety Mat input</td>
<td>M11, M12, M21, M22</td>
<td>To turn ON safety outputs, all the connected safety mats must have no load. Otherwise, the safety outputs will NOT turn ON.</td>
<td></td>
</tr>
<tr>
<td>Reset input</td>
<td>X1, X2</td>
<td>The Safety Outputs can be turned ON only after the connection between X1 and X2 closes and then opens. If the connection between X1 and X2 does not close and open, the Safety Outputs will not turn ON.</td>
<td>Manual Reset Mode&lt;br&gt; <img src="image" alt="Reset switch" /> &lt;br&gt; Auto Reset Mode&lt;br&gt; <img src="image" alt="Reset switch" /></td>
</tr>
<tr>
<td>Safety output</td>
<td>13-14, 23-24</td>
<td>The Safety Outputs are turned ON and OFF according to the status of the Safety Mat inputs and the reset input.</td>
<td>Keep these outputs Open when NOT used.</td>
</tr>
<tr>
<td>Auxiliary output</td>
<td>31-32, 41-42</td>
<td>Turns ON/OFF according to the state of the opposite logic to the safety outputs.</td>
<td>Keep these outputs Open when NOT used.</td>
</tr>
</tbody>
</table>

Changing the Reset Mode

You can select either the Auto Reset Mode or the Manual Reset Mode with the MC3 Controller. Remove the terminal block from the top of the MC3 Controller to expose three yellow jumpers. Set the jumps as required by system specifications.

Auto Reset Mode (Factory Setting)
Leave all three jumpers connected.

Manual Reset Mode
Remove all three jumpers.
**UM/MC3**

**Dimensions (Unit: mm)**

**Safety Mat Controller MC3**

- LED (red): Lights when the safety output from the MC3 Safety Mat Controller is OFF
- LED (green): Lights when the safety output from the MC3 Safety Mat Controller is ON
- LED (green): Lights when the UM Safety Mat is not being activated (i.e., when intrusion is not being detected)

**Trims**

**Ramp Trim with Yellow PVC Cover**
- UMRT

**Joining Trim**
- UMJS

**Aluminum Ramp Trim**
- UMAL

**Molded Outside Corner**
- UMOC

**Molded Inside Corner**
- UMIC

**Safety Mat**

- Base dimensions (Mat dimension + 12)

**Example:** UMYM5-0500-0500
**Accessories**

**Distribution Box**

**UMDB-6**

```
```

**Mounting hole dimensions**

```
```

**Y Connector**

**UM-Y-2-1**

```
```

**Internal wiring**

```
```

**Panel-mount Connector**

**UMPMC**

```
```

**Pin arrangement**

```
```

**Extension Cable**

**UMEC-03, UMEC-05, UMEC-10, UMEC-15**

```
```

**Pin arrangement**

```
```

**Connector with Cable Socket on One Cable End**

**XS2F-D421-C80-F, XS2F-D421-D80-F, XS2F-D421-G80-F, XS2F-D421-J80-F**

```
```

**Wiring diagram**

```
```

**Pin arrangement**

```
```
UM/MC3

Application Examples

<table>
<thead>
<tr>
<th>Highest achievable PL/safety category</th>
<th>Model</th>
<th>Stop category</th>
<th>Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLd/3 equivalent</td>
<td>Safety Mat UM series</td>
<td>0</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Mat Controller MC3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview

- The power supply to the motor M is turned OFF when a person steps on the mat.
- The power supply to the motor M is kept OFF until the reset switch S1 is pressed after the person steps out of the mat.

Timing Chart

S1: Reset switch
KM1, KM2: Magnetic contactor
M: Motor

Note: 1. Determine Mat dimensions based on safe distances. Refer to Safety Precautions on page 14 for the information on calculating safe distances.
2. Remove the three yellow jumpers from the MC3 to use Manual Reset Mode. Refer to Changing the Reset Mode on page 9 for the location of the jumpers.
### Highest achievable PL/safety category

<table>
<thead>
<tr>
<th>Model</th>
<th>Stop category</th>
<th>Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Mat UM series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mat Controller MC3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Relay Unit G9SA-301</td>
<td>0</td>
<td>Auto</td>
</tr>
</tbody>
</table>

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

### Application Overview

- The power supply to the motor M is turned OFF when a person steps on the mat.
- The power supply to the motor M is kept OFF until the person steps out of the mat.

### Timing Chart

<table>
<thead>
<tr>
<th>UM Safety Mat</th>
<th>activated</th>
<th>deactivated</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC3 Safety Mat Controller 13-14, 23-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC3 Safety Mat Controller 31-32, 41-42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G9SA-301 13-14, 23-24</td>
<td></td>
<td></td>
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<tr>
<td>KM1 and KM2 (NC)</td>
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<tr>
<td>KM1 and KM2 (NO)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** 1. Determine Mat dimensions based on safe distances. Refer to Safety Precautions on page 14 for the information on calculating safe distances.
2. Remove the three yellow jumpers from the MC3 to use Manual Reset Mode. Refer to Changing the Reset Mode on page 9 for the location of the jumpers.
UM/MC3
Safety Precautions

Before installing and using the Safety Mat System, carefully read the instruction manual attached to the product.

![WARNING]

Serious injury may occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.

Serious injury may occur due to loss of required safety functions. Do not use the Safety Mat with logics that the operation of the mat might turn ON the guarded equipment. Use the Safety Mat with logics by which safety outputs turn OFF in a hazardous state.

Serious injury may occur due to loss of required safety functions. Do not use the Safety Mat with logics by which the operation of the mat might turn ON the guarded equipment. Use the Safety Mat with logics by which safety outputs turn OFF in a hazardous state.

Serious injury may occur due to loss of required safety functions. Wire the Safety Mat properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidently or unintentionally.

Serious injury may occur due to loss of required safety functions. Do not use a Safety Mat to detect children as it does not support child detection.

To use a Safety Mat for the purpose of entry detection, secure the following safety distance until a person reaches a hazardous area by walking on the mat. Otherwise, the machine may not stop before the person reaches the hazardous area, causing injury.

Calculation of the Minimum Safety Distance

The ISO13855 standards provide the following formula to calculate the minimum safety distance for floor-installed Safety Mats:

\[
S = (1.600 x T) + 1,200 \text{ mm}
\]

In this equation, S is the minimum safety distance (unit: mm), the term 1,600 represents a standard approach speed of 1,600 mm/s, T is the overall stop time required for the machinery to stop, and the term 1,200 mm represents the length of a step and the length of an arm.

The overall stop time is comprised of two components:

\[
T = t_1 + t_2
\]

\[
t_1 : \text{Maximum response time from the activation of the detection device to the point that the control device's output goes OFF (30 ms for these Safety Mats).}
\]

\[
t_2 : \text{Response time of the machinery, i.e., the time required to stop the machine or remove the risk after receiving the output signal from the Safety Mat System.}
\]

The worst case scenario for the response time of the machinery (t2) must be used in the formula. The actual response time depends on various factors such as the machinery being used, the operating mode, the product being processed, and the point in the control cycle at which the stop signal is received. If there are other factors that may affect the response time, such as brake wear, these factors must be taken into account as well.

Example Calculation

In this example, the Safety Mats are used with machinery that has a measured worst-case response time of 0.485 s.

\[
T = t_1 + t_2
\]

\[
t_1 = 30 \text{ ms} + 485 \text{ ms} = 515 \text{ ms} = 0.515 \text{ s}
\]

\[
t_2 = S = (1.600 x 0.515) + 1,200 \text{ mm}
\]

\[
S = 824 + 1,200 \text{ mm} = 2,024 \text{ mm}
\]

Consequently, the Safety Mat must be installed at a minimum distance of 2,024 mm from the danger source.

Note: 1. Read the Instruction Sheet included with the Safety Mat System thoroughly for details on designing and installing the Safety Mat System to provide the minimum safety distance mentioned above.

2. The Safety Mat’s Ramp Trim and Molded Corner are not considered part of the Safety Mat’s detecting area. Do not include the Ramp Trim and Molded Corner in the safety distance.
Make sure to use the Safety Mat UM series in combination with the Safety Mat Controller MC series or the Safety Controller G9SP.

Handle with care
1. Do not drop the Safety Mat to the ground or expose to excessive vibration or mechanical shocks. The Safety Mat may be damaged and may not function properly.
2. Do not apply loads on a certain location of the Safety Mat for a long period of time. It may damage the Safety Mat.
3. Do not use the Safety Mat submerged in water or in locations continuously subject to splashes of water.
4. Store the Safety Mat in a vertical (standing) position prior to install so that loads are not applied to the Safety Mat.

Solvents
Adhesion of solvent such as alcohol, thinner, trichloroethane or gasoline on the product should be avoided.
Such solvents make the marking on the Safety Mat illegible and cause deterioration of parts.

Storage conditions of the Safety Mat
Do not store in such conditions stated below.
1. In direct sunlight
2. At ambient temperatures out of the range of -37 to 66°C.
3. At air pressure out of the range of 86 to 106 kPa.
4. In corrosive or combustible gases
5. With vibration or mechanical shocks out of the rated values.
6. Under splashing of oil, chemicals
7. In the atmosphere containing dust, saline or metal powder.
The Safety Mat may be damaged and may not function properly.

Storage conditions of the Safety Mat Controller
Do not store in such conditions stated below.
1. In direct sunlight
2. At ambient temperatures out of the range of 0 to 55°C.
3. At relative humidity out of the range of 90%RH or under such temperature change that causes condensation.
4. At air pressure out of the range of 86 to 106 kPa.
5. In corrosive or combustible gases
6. With vibration or mechanical shocks out of the rated values.
7. Under splashing of water, oil, chemicals
8. In the atmosphere containing dust, saline or metal powder.
The Safety Mat Controller may be damaged and may not function properly.

Wiring of the Safety Mat Controller
1. Use the following to wire to the Safety Mat Controller
   • Stranded wire (Flexible wire): 0.2 to 2.5 mm²
   • Solid wire: 0.2 to 2.5 mm²
   • Strip the cover of wire no longer than 7 mm.
2. Tighten each screw with a specified torque of 0.4 to 0.5 N·m, or the Safety Mat Controller may malfunction or generate heat.
3. Ground the negative side of the power supply. A controller with the positive side grounding will not work.

Mounting of multiple Safety Mat Controllers
1. In closely contacted mounting, the rated carry current is 3 A. Use at 3 A or less voltage.
2. When applying more than 3A, place the mats farther than 25 mm from the nearest MC3.

Mounting of the Safety Mat Controller to DIN rails
Use end plates (PFP-M: sold separately) on both ends of MC3.

Use of air valve
1. After installing a mat, loose the air valve on the surface of the mat for 30 seconds or more in order to make the internal air pressure equal to external air pressure. Then, close the air valve.
2. Turn the air valve with a torque at 1.5 N·m or less.
3. Do not store or use the the mat with loose air valve. It may allow water penetration.

Mounting of the Safety Mat
1. Use dedicated trims to secure the circumference of the Safety Mat for installation.
2. Do not install the Safety Mat on an environment with a projection. Install it on a flat surface.
3. Do not pull the cables to lift or move the Safety Mat.
4. Do not use the Safety Mat with a cover on it.

Others
This is a Class A product (Product in industrial setting). Use of the product in residential setting may cause radio disturbance. In such case, take appropriate measures.

Safety Category
Certification has been obtained for EN ISO13849-1: 2015 PLd/Safety Category 3 for a system consisting of combination with the Safety Mat Controller MC series or the Safety Controller G9SP.
If you use a UM Safety Mat and MC3 Safety Mat Controller which is selected automatic reset mode, a separate safety controller is required to achieve a category 3, PLd safety circuit if external safety relays or magnetic contactors are connected.

Standards
UM/MC3
ISO13856-1
EN62061
EN ISO13849-1 PLd/Safety Category 3
IEC61508
EN60204-1
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