

Mat Controller

MC6 Series

Installation and Operating Manual *Original Instructions*



Mat Controller MC6

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1 IMPORTANT SAFETY MESSAGE

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▲ **WARNING!** Read and understand this section prior to installing the MC6 system.

A presence sensing mat (UM Series) and controller (MC6) are general purpose presence sensing devices designed to guard personnel working around moving machinery. The use of this type of guarding system is regulated by government safety agencies. Please contact Omron STI in California, USA at 510-608-3400 for additional assistance.

Whether a specific machine application and presence sensing mat and controller installation complies with government regulations depends upon several items, including: the proper application, installation, maintenance and operation of the presence sensing mat and controller. These items are the sole responsibility of the purchaser, installer and employer.

The employer is also responsible for the selection and training of the personnel necessary to properly install, operate and maintain the machine and its safeguarding systems. For example, the presence sensing mat and controller should be installed, checked out and maintained only by a qualified person, as “*a person or persons who, by possession of a recognized degree or certificate of professional training or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work*” (ANSI B30.2-1983)

The machine operator must notify management if the machine, tooling or safety devices are not operating properly. Never use the machine if it or the safety equipment is not in proper working order.

The following additional requirements must be met before using a safety mat and controller system:

- The machine on which the presence sensing mat and controller are installed must be capable of stopping motion anywhere in its cycle or stroke. Never use a presence sensing mat and controller on a power press with a full-revolution clutch.
- Do not use a presence sensing mat and controller:
 - on any device with inconsistent stopping time or inadequate control devices or mechanisms.
 - where the environment, such as corrosive chemicals, may degrade the performance of the mat and/or controller.
 - to initiate machine motion.
- When a presence sensing mat and controller are used as a safety device, the employer has the responsibility to ensure that all applicable federal, state, and local requirements, rules, codes and regulations are satisfied.
- All safety related machine control circuit elements, including pneumatic, electric or hydraulic controls, must be control reliable as defined by ANSI B11.19-1990, 5.5, which states in part “*...the device, system or interface shall be designed, constructed and installed such that a single component failure within the device, interface or system shall not prevent normal stopping action from taking place, but shall prevent a successive machine cycle...*”

Employer's Responsibility

- All other machinery or equipment must meet OSHA standard 1910.212 for general machine guarding plus all applicable governmental and local rules, codes, and regulations must be satisfied. All safety-related machine control elements must be designed so that a fault in the control logic or failure of the control circuit does not lead to a failure or danger.

- Additional guarding may be required for access to dangerous areas not covered by the MC6 controller and the Universal Safety Mat system.
- Additional guarding such as safety light curtains or mechanical guards may be required if the presence sensing mat and controller do not protect all areas of entry to the point of operation hazard.
- All brakes and stopping mechanisms must be inspected regularly to ensure proper working order. If the stopping mechanisms are not working properly, the machine may not stop safely even though the presence sensing mat and controller are functioning properly.
- Perform the Omron STI test procedure at installation and after maintenance, adjustment, repair or modification to the machine controls, tooling, dies or machine, or on the presence sensing mat and controller.
- The Test Procedure is presented in this manual. (See *Appendix A*).
- Do not perform any test or repairs other than those outlined in this manual. All electrical wiring must be installed in accordance with local electrical codes and regulations.
- The user must follow all procedures in this manual for proper operation of the MC6 controller. The enforcement of these requirements is beyond Omron STI's control. The employer has the sole responsibility to follow the preceding requirements and any procedures, conditions and requirements specific to his machinery.

▲ WARNING!

Despite inherent safe design measures, safeguarding and complementary protective measures adopted by the user, residual risk may remain in any installation. Potential risks are strictly under the control of the end user and may include severe injury or death.



2 GLOSSARY

2

Automatic Start

Upon completion of power-up, the control unit will enter the *Machine Run* state as soon as all of the selected sensing inputs are in the *Mat Clear* state. Omron STI has traditionally referred to this as the *Normal* mode.

Control unit

A device that responds to the condition of the sensor(s) and controls the state of the output signal switching device. It may also monitor the integrity of the pressure sensitive mat or pressure sensitive floor and it may contain facilities to process a start signal. The control unit may be integrated with the machine control system.

Failure

The state of an item characterized by its inability to perform a required function.

Fault

The state of an item characterized by its inability to perform a required function, excluding the inability during preventative maintenance or other planned actions, or due to a lack of external resources.

Interlock

For the controller to enter this state the controller must be set to either the *Start Interlock* or *Start/Restart Interlock* mode. In this state the safety outputs (OSSDs) are inactive and all of the mat zones are clear. In this state the yellow *Interlock* LED is on and Red *Machine Stop* LED is on.

Lockout(Fault)

When the control unit detects a fault, it transitions to this state. The safety outputs (OSSDs) will be held to the inactive state and the control unit will not attempt to leave this state without performing a comprehensive power-up self-test. A power-up-self-test will be initiated by either cycling the control unit power or by a Start signal transition.

Machine Run

When the control unit is in this state the two safety outputs (OSSDs) are both active. In this state the Green *Machine Run* and *Mat Clear* LEDs are on and the Red *Machine Stop* LED is off.

Machine Stop

When the control unit is in this state the two safety outputs (OSSD's) are both inactive. In this state the Green *Machine Run* LED is off, the Red *Machine Stop* LED is on.

Mat Clear condition

When the pressure applied to the pressure sensitive mat is less than the required sensing weight, the pressure sensitive mat zone inputs to the controller are at electrical levels that set the controller in a *Mat Clear* condition. *Mat Clear* indicator is on.

MPCE Monitoring

MPCE is the abbreviation for Machine Primary Control Element. The safety controller monitors the state of the MPCE signal produced by the guarded machine to insure that it is in the correct state with respect to *Machine Run* and *Machine Stop*.

OFF state

The state in which the output circuit is interrupted and does not permit the flow of current.

ON state

The state in which the output circuit is complete and permits the flow of current.

Safety Outputs (Output signal switching device – OSSD)

The component of the control unit connected to the control system of the machine which, when the sensing device is actuated during normal operation, responds by going to an *Off* state.

Pressure sensitive mat system

A safety device which detects a person standing on it or who steps onto it. It comprises a sensor(s) that responds to the application of pressure and a control unit, and one or more output signal switching device(s). In a pressure sensitive mat the effective sensing area is deformed locally when the sensor(s) is actuated.

Pressure Sensing condition

When the pressure applied to the pressure sensitive mat is equal or greater than the required sensing weight, the mat zone inputs to the controller are at electrical levels that set the controller to a pressure sensing condition. *Mat Clear* indicator is Off.

Response time

The maximum amount of time required for the pressure sensitive mat system to recognize a protection zone intrusion and activate a response through its safety outputs (OSSDs).

Start interlock

Upon completion of power-up, the control unit must go to the *Interlock* state. A *Start* signal transition must occur before going to *Machine Run* for the first time. Once the first *Start* condition has been met, the control unit will operate in the *Automatic Start* mode. Omron STI has traditionally referred to this as the *Power-up Inhibit*.

Start/Restart interlock

The control unit will go into the *Interlock State* upon completion of power-up and after a pressure sensing condition has occurred. A *Start* signal transition must occur before returning to *Machine Run* following any transition to *Machine Stop*. Omron STI has traditionally referred to this as *Guard* mode.



3 INTRODUCTION

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Presence sensing mats combined with an MC6 safety mat controller improve productivity while providing access guarding. Less downtime occurs because it is not necessary to set up or remove mechanical safety barriers during operation and maintenance.

Presence sensing mats and the MC6 controller are used where perimeter access guarding is required, such as around robots, manufacturing work cells, food processing equipment and automated assembly equipment.

The MC6 controller is designed to meet the applicable sections of EN1760-1:1997 + A1:2009, EN951-1 1996, ANSI/RIA 15.06-1999, ANSI B11.19-1990, OSHA 1910.212 & 1910.217(c). CE standards are met only when used in conjunction with STI UM and UMQ series presence sensing safety mats.

The MC6 controller is certified to operate only in conjunction with STI four-wire normally open safety mats (such as the Omron STI UM and UMQ series safety mats). The MC6 is a Category 3 safety device, meeting the requirements of EN150 13849-1: 2008.

The MC6 visual indicators provide comprehensive information on the operating status. These indicators are visible from the top cover of the enclosure. See Section 4.3.—
Indicators .

4 DESCRIPTION OF CONTROLS

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4.1. RELAY SAFETY OUTPUTS (OSSD's)

The force-guided relay outputs of the MC6 controller are referred to as safety outputs. When the mat surface is activated by sufficient weight (66 lb. 30 kg), the safety output will respond by going to an *Off* state.

Two-normally open safety outputs are provided across terminal block (TB1) position 1, 2, 4 and 5.

One normally closed safety output is provided across terminal block (TB1) position 2 and 3. See *Figure 6-1* for details.

4.2. SOLID-STATE SAFETY OUTPUTS (OSSD's)

The solid-state safety-rated outputs of the MC6 controller provide 2 current sourcing outputs. (See *Figure 6.2* for details)

Note: The MC6 AC version is available with relay outputs only, on the MC6 DC version either relay or solid-state outputs may be selected.

4.3. INDICATORS

- Diagnostic Display: Two-digit numeric display provides diagnostic codes.
- Mat Clear: (green) Will be lit when all the selected mat zones are properly wired, mats are clear, and it is possible to energize the safety outputs.
- Machine Run: (green) Will be lit when the safety outputs are in the machine run state.

- **Machine Stop:** (red) Will be lit when the safety outputs are in the machine stop state.
- **Interlock:** (yellow) Will be lit when the mat system is in the interlock state. Light will flash in fault state.
- **Mat Zones:** (6 – red) Will be lit when a mat zone is stepped on or shorted. Light will flash when a fault is detected in the related mat zone.

4.4. MAT INPUTS

Up to (6) Zones (Total of all zones cannot exceed 300 sq. ft.) of (4 wire) UM Series Safety Mats.

4.5. OPERATING STATES AND CORRESPONDING OUTPUTS

OUTPUT		POWER ON SELF TEST	MACHINE RUN	MACHINE STOP	INTERLOCK	LOCKOUT (FAULT)
Machine Run, Green LED		OFF*	ON	OFF	OFF	OFF
Machine Stop, Red LED		ON*	OFF	ON	ON	ON
Clear , Green LED		OFF*	ON	OFF	ON	ON or OFF
Interlock or Fault, Yellow LED		OFF*	OFF	OFF	ON	BLINKING
Diagnostic display		88	00	00	01	XX
Safety Output (A)		OFF	ON	OFF	OFF	OFF
Safety Output (B)		OFF	ON	OFF	OFF	OFF
MC6 AUXILIARY OUTPUT	Follow safety outputs indication mode	OFF	ON	OFF	OFF	OFF
	Fault indication mode	OFF	OFF	OFF	OFF	ON

Note: Under normal conditions, the Mat Zone indicators will be OFF when the Zone is clear and ON when the Mat Zone is in the pressure sensing condition. When the controller has detected a wiring error, the faulted Mat Zone indicator will blink at a 1-second rate.

* LED turned on for a few seconds to verify operation.



4.6. OPERATIONAL FLOW CHART

The MC6 safety mat controller module represents a safety control system which integrates up to six safety mat zones together to provide a single pair of controlled safety outputs (OSSD's). The following operational flow chart highlights the different stages of the decision making process.

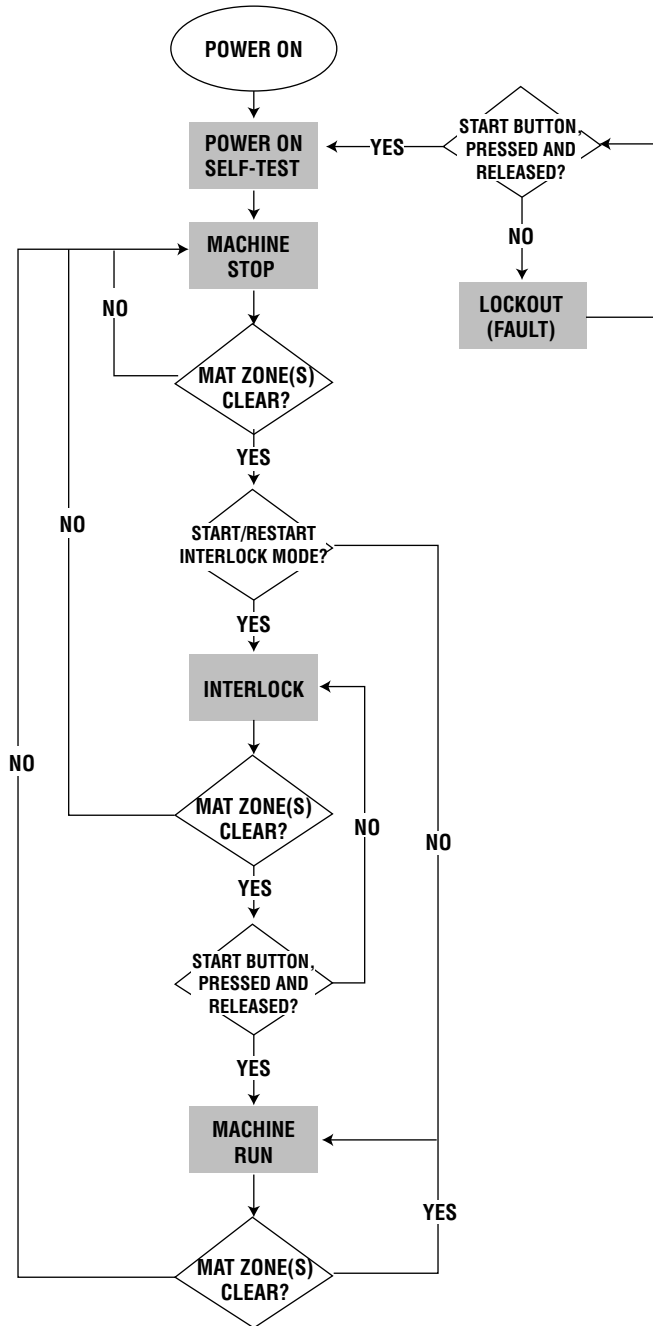


Figure 4-1 Operational Flow Chart

Note: Any failure within the Operational flow of the MC6 will cause the Mat Controller to transition to the Lockout(Fault) condition.

5 OPERATING AND WIRING INSTRUCTIONS

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▲ WARNING! Read this manual completely before installing the MC6 controller. The MC6 controller should only be installed, checked out, tested and maintained by a qualified person (as described in the Important Safety Message at the beginning of this manual). It is important that the user be familiar with the installation requirements, safe mounting distance, controls and features of the MC6 controller before using the guarding system.

5.1. MC6 CONTROLLER

5.1.1 AUTOMATIC START

- DIP Switches, SW1 and SW2 Positions 1 and 2
- Set Position 1 ON, Set Position 2 ON, on both SW1 and SW2

In automatic start mode, the MC6 will power up with its safety outputs off and perform system initialization and self-tests. If no faults are detected the control module will transition to the machine stop state. When all of the selected mat zone inputs are in the mat clear condition the MC6 will enter the machine run state. When any of the selected mat zone inputs change to the pressure sensing condition, the MC6 will automatically change from machine run to machine stop with no operator intervention. The MC6 will remain in machine stop as long as any of the selected mat zone inputs are indicating the pressure sensing condition. Once all of the selected mat zone inputs indicate mat clear condition, the MC6 will automatically change from machine stop to machine run, with no operator intervention.

5.1.2 START INTERLOCK

- DIP Switches, SW1 and SW2 Positions 1 and 2
- Set Position 1 ON, Set Position 2 OFF, on both SW1 and SW2

In start interlock mode, MC6 will power-up with its safety outputs off and perform system initialization and self-tests. If no faults are detected and all of the selected inputs from the mat zones are in the *Mat Clear* condition, the MC6 then enters the *Interlock* state. If any of the selected mat zone inputs are in the pressure sensing condition, the MC6 remains in the *Machine Stop* state. When all of the inputs from the selected mat zones are in the *Mat Clear* condition, the MC6 automatically transitions to *Interlock*. The operator must cycle the start input (from open to closed, and back to open) before the MC6 enters the *Machine Run* state for the first time. If then any of the selected mat zone inputs are in the pressure sensing condition the MC6 will automatically change from the *Machine Run* to *Machine Stop* state. When all of the selected zone(s) are in the *Mat Clear* condition, the MC6 will automatically change from the *Machine Stop* to *Machine Run* state with no operator intervention.

5.1.3 START/RESTART INTERLOCK

- DIP Switches, SW1 and SW2 Positions 1 and 2
- Set Position 1 OFF, Set Position 2 OFF, on both SW1 and SW2



In *Start/Restart Interlock* mode, the MC6 shall power-up with its safety outputs off and perform system initialization and self-tests. If no faults are detected and all of the selected mat zone inputs are in the *Mat Clear* condition, the MC6 then enters the *Interlock* state. If any of the mat zone inputs are in the pressure sensing condition, the MC6 remains in the *Machine Stop* state. When all of the selected mat zone inputs are in the *Mat Clear* condition, the MC6 automatically change to *Interlock*. The operator must cycle the start input (from open to closed, and back to open) before the MC6 enters the *Machine Run* state. When any of the selected mat zone inputs are in the pressure sensing condition, the MC6 will automatically change from *Machine Run* to *Machine Stop*. When all of the selected mat zone inputs are in the *Mat Clear* condition the MC6 then enters the *Interlock* state. The operator must cycle the start input before the MC6 exits *Interlock* and enters *Machine Run*.

5.1.4 **START PUSHBUTTON OR KEYSWITCH (NORMALLY OPEN)**

Used only in start interlock and start/restart interlock modes. When the automatic start mode is used, no connection is required. When a start switch is required, a customer-supplied remote start switch with a single set of normally open contacts or an optional key-switch (may be factory installed) may be used.

Connect the remote start switch between terminals start 1 and start 2, on TB3 (See *Figure 6-1* and *Figure 6-2*).

- ▲ WARNING!** Perimeter Guarding Special Requirements: Perimeter guarding refers to installations where the presence sensing mats are positioned around the outside perimeter of the machine, robot or area to be guarded. This could leave sufficient space for an operator to stand between the mats and the machine. For perimeter guarding installations, the guarded machine or robot must be wired such that any interruption of the sensing area will cause an immediate stop of the hazardous motion. The machine or robot must only be restarted by an actuation of a start switch. This start switch must be located outside the area of hazardous motion and positioned such that the hazardous area may be observed by the start switch operator. Unexpected or automatic restart of the machine or robot may cause severe injury or death to the operator or other personnel.

Always contact the machine manufacturer for advice and assistance on the proper connection of any safety device.

5.1.5 **MPCE MONITORING:**

- DIP Switches, SW1 and SW2 Position 3
- Set Position 3 OFF on SW1 and SW2 to enable monitoring
- Set Position 3 ON on SW1 and SW2 to disable monitoring

Connect the wiring from the circuit to be monitored to start 1 and MPCE on the controller terminal block TB3 (See *Figure 6-1* and *Figure 6-2*).

Note: When MPCE is disabled, MPCE must be connected to the MC6, start 1 terminal on TB3.

5.1.6 **SAFETY MAT**

DIP Switches, SW1 and SW2 Positions 4, 5 and 6

- 1 mat zone connected:
Set Position 4 ON, 5 ON, 6 OFF, on SW1 and SW2
- 2 mat zones connected:
Set Position 4 ON, 5 OFF, 6 ON, on SW1 and SW2

- 3 mat zones connected:
Set Position 4 ON, 5 OFF, 6 OFF, on SW1 and SW2
- 4 mat zones connected:
Set Position 4 OFF, 5 ON, 6 ON, on SW1 and SW2
- 5 mat zones connected:
Set Position 4 OFF, 5 ON, 6 OFF, on SW1 and SW2
- 6 mat zones connected:
Set Position 4 OFF, 5 OFF, 6 ON, on SW1 and SW2

Mats must be set up and connected to zones in sequence, ie. Zones 1, 2, 3, for a 3 zone system.

Mats cannot be connected to zones 1, 4, 5 and function as a 3 zone system.

Zones must be used in sequence.

At least one Omron STI 4-wire mat must be connected. For an Omron STI Universal safety mat the blue and black conductors are connected to the bottom electrode plate. The brown and white conductors are connected to the top electrode plate. For a single mat installation the black and blue conductors are connected to 1 BLK and 1 BLU, The brown and white conductors are connected to 1 BRN and 1 WHT. See “Figure 6.1 and 6.2 Connection Diagrams”.

Multiple mats may be connected to the controller in series. To wire an Omron STI UM series multiple mat system in series, follow the wiring as shown in the drawing below:

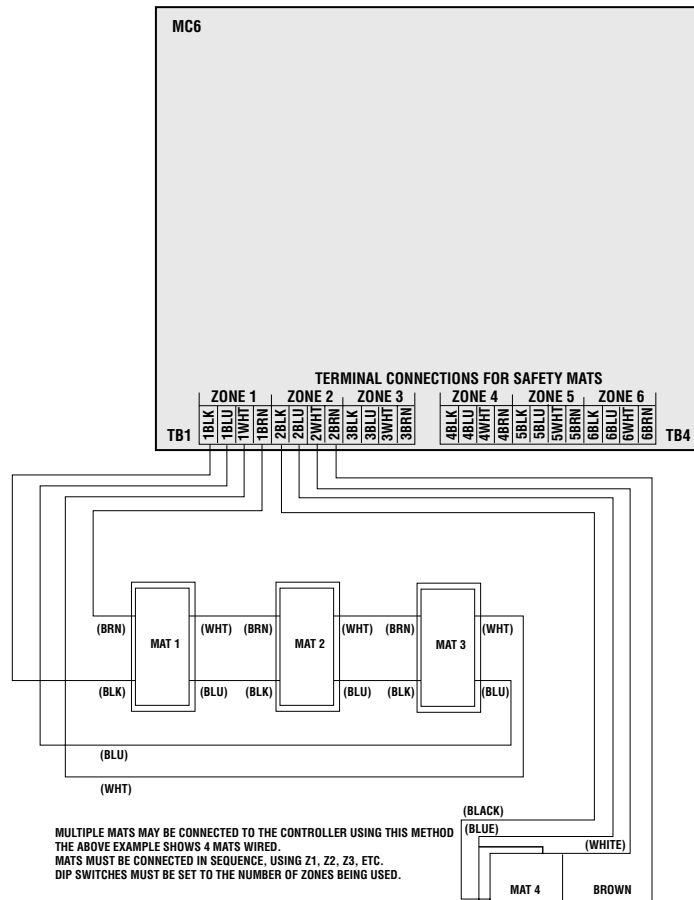


Figure 5-1 Multiple Mat Connection to a Single Zone



- ▲ **WARNING!** Connecting mats in parallel will appear to work, but it is an UNSAFE installation. In this configuration, it is possible for one or more mats to be disconnected or have an open wire and the controller will not detect that these mats are non-functioning. The MC6 metal enclosure must be connected to earth ground. Make the earth connection through the use of the screw clamp mounted on the inside wall of the enclosure.

5.1.7 AUXILIARY OUTPUT MODE:

- DIP Switches, SW1 and SW2 Position 7

Set Position 7 ON, on SW1 and SW2 for *Follow* Safety Output Indication

Set Position 7 OFF, on SW1 and SW2 for Fault Monitoring

Auxiliary outputs may be used for indicator or communications purposes.

The relay version offers 1 NO and 1 NC set of relay contacts.

The solid-state version provides 1 current sourcing (PNP) and 1 current sinking output (NPN).

NOTE: Auxiliary outputs are for monitoring only, and shall not be used for safety.

6 MACHINE CONTROL CONNECTIONS

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6.1. SAFETY OUTPUT WIRING

The two safety outputs must be connected to the two MPCE's of the guarded machine, one to each. See *Figure 6-1* and *Figure 6-2*. The relay version offers two normally open (NO) safety outputs for this purpose. One normally closed (NC) safety output may be used as an auxiliary control input. The solid-state version offers 2 current sourcing outputs (PNP). The solid-state version is compatible with Omron STI's RM4 module and could be used as 1 input device to the RM4. The customer shall wire the system using industry accepted methods. For relay outputs, external over-current protection must be provided by the user.

6.2. CABLE LENGTHS

The following table lists the recommended maximum lengths for the MC6 input & output signals.

Table 6-1 MC6 Output & Input Signal Cable Lengths

Signal Names	Wire Gauge minimum	Specified max. length
Safety Outputs A & B (solid state)	20 AWG wire with cable capacitance less than 100pF/ft.	Unshielded: 50 meter (164ft)
Safety Outputs A & B (mechanical relay)	14 AWG wire	Unshielded: 7 Ampere load: 40 meter (131ft) 4 Ampere load: 79 meter (260ft)
Auxiliary output (solid state or mechanical)	20 AWG wire	Unshielded: 50 meter (164ft)
Four-wire Mat inputs	18 AWG wire	Unshielded: 30 meter (100ft)
Start Input	22 AWG wire	Unshielded: 50 meter (164ft)
MPCE Monitor Input	22 AWG wire	Unshielded: 50 meter (164ft)

It is recommended that cables connected to the mat controller not be run in parallel with voltage power lines. Having the signal and power lines separate will insure the reliable operation of the mat sensing system.

6.3. TWO NORMALLY OPEN PREFERRED CONNECTION METHOD

The following connection scheme uses both of the normally open output relay contacts to control the machine. This is the Omron STI recommended wiring method. See "Figure 6-1 Two Normally Open Preferred Connection" on page 13.

In the machine control circuit, locate the two machine primary control elements (MPCE1 & MPCE2). These are defined as "The electrically powered element that directly controls the normal operation of a machine in such a way that it is the last element (in time) to function when machine operation is to be initiated or arrested." IEC 61496-1

The method to arrest hazardous machine motion will vary depending on the type of machine. Control methods include hydraulic, pneumatic, clutch and mechanical braking systems. For example, an MPCE may consist of relays, contactors, solenoids or electromechanical valves. If relays are used, the MPCE must use force-guided contact type relays.

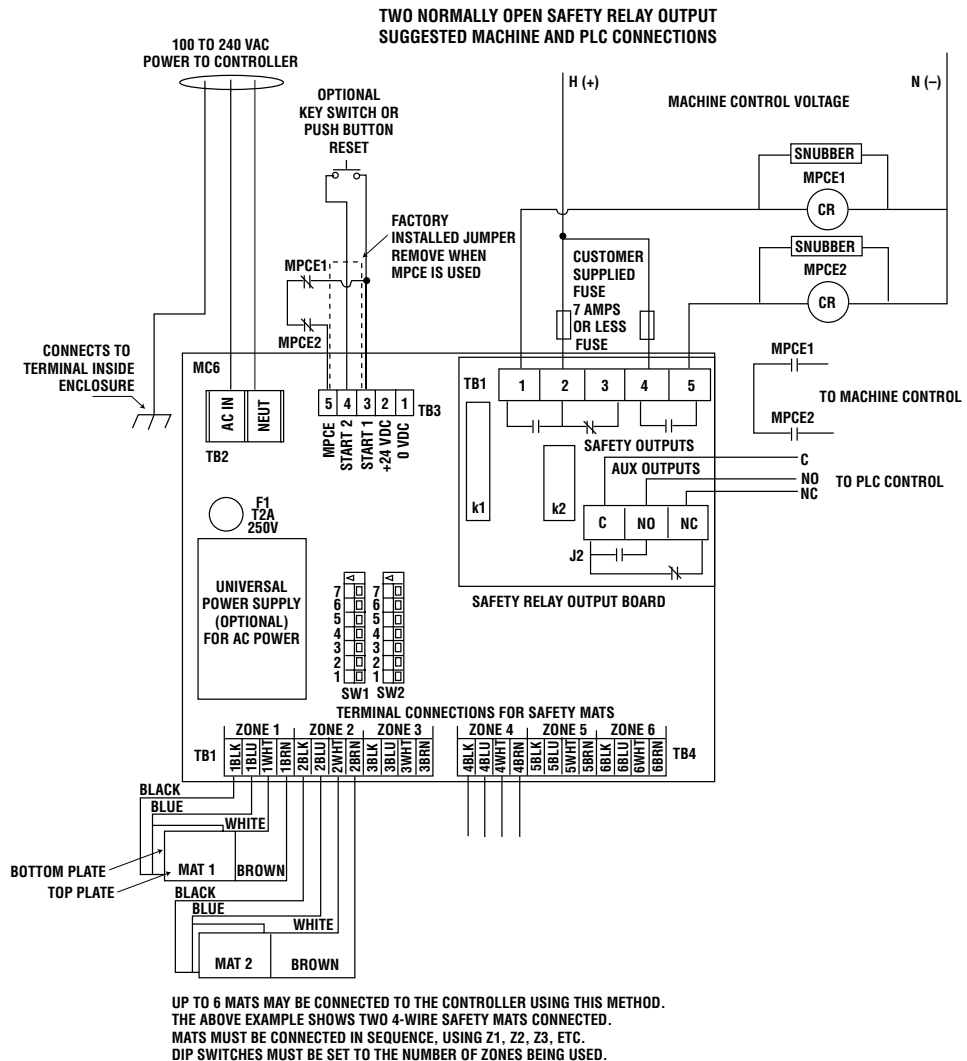


Figure 6-1 Two Normally Open Preferred Connection



6.4. SUGGESTED SOLID STATE CONNECTIONS

Figure 6-2 shows the MC6 solid-state output version connections. The solid-state safety outputs are current sources that directly power the MPCE relay coils.

The wiring from the MC6 controller to the machine control must be control reliable as explained in ANSI B11.19-1990 section 5.5, and B11.TR3 (Risk Assessment and Reduction) and OSHA 1910.217(b)(13).

6.5. AUXILIARY OUTPUTS

The MC6 controller provides Auxiliary Contacts that allows monitoring of the non-safety MC6 controller as a signal input to a PLC. Note that in this diagram, the PLC is not wired directly to the MC6 controller safety outputs and thus removes the PLC from the safety mat controller stop signal circuit.

Always contact the manufacturers of the PLC and the guarded machine before using a PLC in conjunction with an operator safety control.

The PLC control system design, wiring, installation and programming are the sole responsibility of the employer.

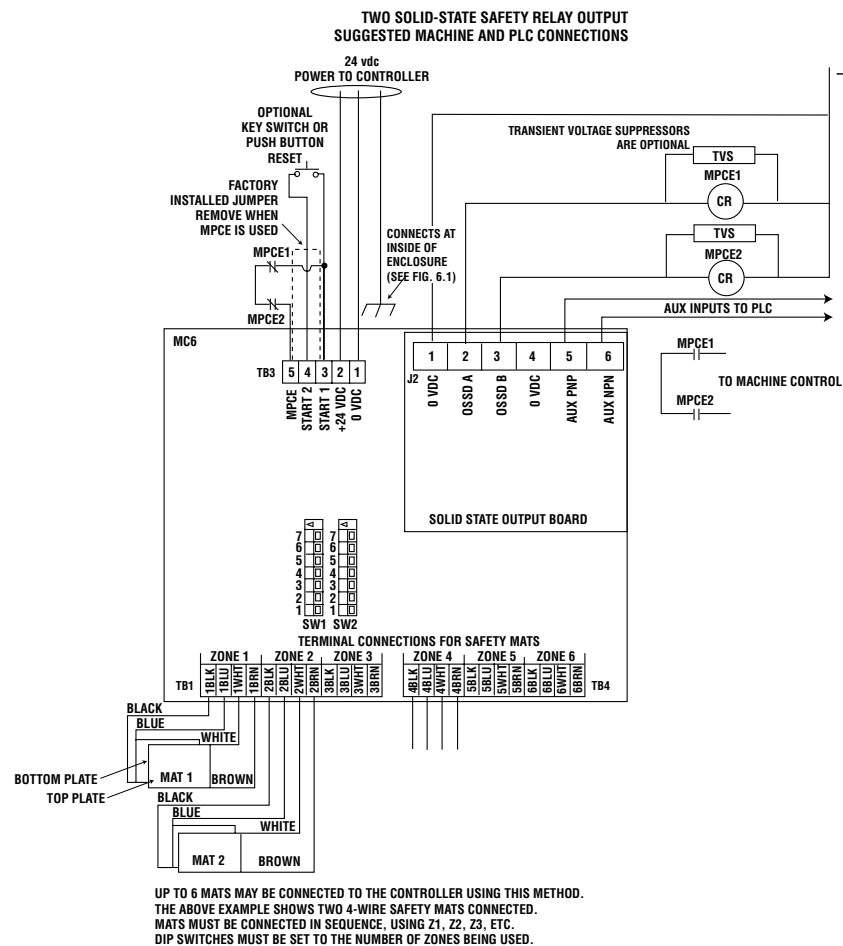


Figure 6-2 Suggested Solid State Connection

▲ WARNING! To prevent severe injury to the operator or other personnel, DO NOT operate this presence sensing safety device (mat and controller system) unless it is properly installed, tested and inspected in accordance with all OSHA, ANSI, government, industry and company safety regulations. The guarded machine must be capable of stopping motion anywhere in its stroke or cycle. Do not use this safety device on a full revolution clutch machine.

7 TROUBLESHOOTING

7.1. DIAGNOSTIC CODES:

7.1.1 OPERATIONAL CODES:

Code Displayed	System Status
88	Power Up Indication
00	Normal Operation, no Faults
01	Waiting for Start Input

7.1.2 DIP SWITCH FAULTS:

Code Displayed	Fault Indicated
21	Wrong Operation Mode Selection
22	Changed During Operation
23	DIP Switch Setting Not Redundant
27	More Mat Zones connected to MC6 than selected by switches SW1 & SW2.

7.1.3 SOLID STATE SAFETY OUTPUT FAULTS:

Code Displayed	Fault Indicated
31	Safety Outputs shorted together
32	Safety Outputs A shorted to 24 VDC Power
33	Safety Outputs B shorted to 24 VDC Power
34	Safety Outputs A shorted to Ground
35	Safety Outputs B shorted to Ground

7.1.4 RELAY SAFETY OUTPUT FAULTS

Code Displayed	Fault Indicated
36 & 38	Safety Relay A internal fault
37 & 39	Safety Relay B internal fault

7.1.5 MPCE MONITOR FAULTS

Code Displayed	Fault Indicated
41	Wrong before activation
42	Wrong after activation
43	Wrong on power up

7.1.6 CONTROLLER FAULT

Code Displayed	Fault Indicated
50	All Internal Controller Circuit Faults. Consult Omron STI at 888-510-4357

7.1.7 MAT ZONE OPEN WIRE FAULTS

Code Displayed	Fault Indicated
61	Broken wire in Zone 1.
62	Broken wire in Zone 2.
63	Broken wire in Zone 3.
64	Broken wire in Zone 4.
65	Broken wire in Zone 5.
66	Broken wire in Zone 6.

7.1.8 MAT ZONE SHORTED TO GROUND WIRE FAULTS

Code Displayed	Fault Indicated
71	Shorted wire in Mat Zone 1.
72	Shorted wire in Mat Zone 2.
73	Shorted wire in Mat Zone 3.
74	Shorted wire in Mat Zone 4.
75	Shorted wire in Mat Zone 5.
76	Shorted wire in Mat Zone 6.

7.1.9 MAT ZONE SHORTED BETWEEN MATS WIRING FAULTS

Code Displayed	Fault Indicated
82	Mat Zone 2 wire shorted to another Mat Zone
83	Mat Zone 2 wire shorted to another Mat Zone
84	Mat Zone 2 wire shorted to another Mat Zone
85	Mat Zone 2 wire shorted to another Mat Zone
86	Mat Zone 2 wire shorted to another Mat Zone

7.2. SYMPTOMS AND SOLUTIONS
Symptom

No indicators lit.

Possible Solutions

No power to the controller.

For 100 - 240 VAC controllers check for power to AC IN and NEUT. Also check fuse F1 located on the controller board near the power input terminal block.

For 24 VDC units, check power supply and its connections to +24 VDC & 0 V Return.

Symptom

Mat Clear indicator cannot be made to light.

Possible Solutions

Mat wired improperly. See fault codes, Check connections.

Mat wire broken. Replace mat.

Mat is shorted. Is there something on the sensing area? Is the surface deformed?

Symptom

Cannot start in *Start Interlock* or *Start/Restart Interlocks* mode.

Possible Solutions

Check wiring and operation of *Start* switch. Is 24 VDC present between Start 1 and Start 2 terminals when the start switch is open and 0 VDC when start switch is closed.

Also check fuse F1 located on the controller board near terminal block.



8 SPECIFICATIONS

8

8.1. GENERAL SPECIFICATIONS

Category 3: The Omron STI MC6 controller & UM Series Safety mat system are a Category 3 safety device.

Response Time: Less than 30 msec.

8.2. Electrical

AC power: 100 to 240 VAC $\pm 10\%$, 50 to 60 Hz, 20 VA max. (Auto-selecting). Connected to AC IN and NEUT.

DC power: 24 VDC $\pm 10\%$, 10 Watts (Relay Outputs) 50 Watts (Solid-state Outputs). Connected to +24 VDC and 0 VDC .

The AC line fuse shall not exceed 2 amps, 250 V, 2 Amp slow blow (Time Lag).

8.3. SAFETY OUTPUT

Relay outputs: 2 NO & 1 NC contacts. (TB1 on Relay Board).

- AC max. ratings: 230 VAC, 7 Amperes, 1600 VA.
- DC max. ratings: 24 VDC, 2 Amperes (inductive load), 6 Amperes (resistive load).

Solid-State outputs: 2 current sourcing 24 VDC outputs (PNP type). (J2 on Solid-State board).

- Max. rating: 0.625 Amperes at 24 VDC.

8.4. AUXILIARY OUTPUTS:

- Relay outputs: 1 NO & 1 NC contacts.
 - AC max. ratings: 125 VAC, 0.5 Amperes.
 - DC max. ratings: 1 Ampere at 30 VDC.
- Solid State outputs: 1 current sourcing (PNP type) and 1 current sinking (NPN type).
 - Current sourcing max. rating: 0.5 Amperes at 24 VDC.
 - Current sinking max. rating: 0.1 Amperes at 24 VDC.

8.5. MPCE MONITOR SIGNAL

MC6 provides 24 VDC at 50 mA level at MPCE terminal connection.

When MPCE is Enabled: The MC6 enters *Machine Run* state, the MPCE external contacts must open within 300 msec. The MC6 enters *Machine Stop* state, the MPCE external contacts must close within 300 msec .

When MPCE is Disabled: MPCE must be connected to MC6 Start 1 terminal during all states.

8.6. START INPUT

MC6 provides 24 VDC at 10 mA level at Start 2 terminal connection. When optional *Start* switch is used it must have NO (normally open) contacts. When Start switch is not used terminals Start 1 & 2 are to be left open.

8.7. SETUP

Configuration Setup Guide for switches SW1 & SW2:

Position	Function Selection	Description
7	Auxiliary Output Mode	Follow Safety Outputs Indication, 7 ON Fault Indication, 7 OFF
6	Number of Mat Zones	Invalid setting: 4 ON, 5 ON, 6 ON 1 Zone System: 4 ON, 5 ON, 6 OFF
5		2 Zone System: 4 ON, 5 OFF, 6 ON 3 Zone System: 4 ON, 5 OFF, 6 OFF
4		4 Zone System: 4 OFF, 5 ON, 6 ON 5 Zone System: 4 OFF, 5 ON, 6 OFF
		6 Zone System: 4 OFF, 5 OFF, 6 ON
3	MPCE Monitoring	Enabled 3 OFF, Disabled 3 ON
2	Mode	Automatic Start: 1 ON, 2 ON
1		Start Interlock: 1 ON, 2 OFF Invalid: 1 OFF, 2 ON Start/Restart Interlock: 1 OFF, 2 OFF

Note: Corresponding mat zone indicator will flash.

8.8. CONSTRUCTION

14 Ga. Steel, Nema 12, IP65

Shipping Wt. Approx. 9 lbs, (4 kg.)

8.9. CONNECTORS (CONTROLLER)

Cage clamp terminal strips

8.10. CONNECTOR (MAT INPUT)

4 pole micro single keyway (Omron STI Part No. 60477).

8.11. ENVIRONMENTAL

Operating Temperature: 32 to 131 Degrees F (0 to 55 C)

Relative Humidity: 90%

Vibration: Per IEC 68-2-6, 0.15mm displacement, 10 to 55 Hz

Bump: Per IEC 68-2-29, 10G, 16 msec pulses, 1000 per axis.



8.12. ELECTROMAGNETIC COMPATIBILITY (EMC)

The MC6 with the Omron STI mats have been verified to meet the radiated/conducted emission levels of EN55011 (Group 1, class A) and to maintain normal operation in the presence of the following EMC disturbance levels.

Electrostatic discharge (ESD): ± 15 kV (air discharge) & ± 8 kV (contact discharge).

Radiated RF field: 20 volts/meter, 80 to 1,000 MHz.

Surge: ± 2 kV and I/O ports, 14 kV power ports (common mode).

Electrical Fast Transients: ± 2 kV I/O ports, ± 4 kV power ports.

8.13. STANDARDS CONFORMITY

Designed in Accordance with: EN1760-1:1997 + A1:2009, EN 62061:2005, EN ISO 13849-1:2008, IEC 61508, parts 1-7:1998-2000, EN 50178:1997, EN 60204-1:2006, Machinery Directive 2006/42/EC, ANSI/RIA 15.06-1999, ANSI B11.19-2003, OSHA 1910.212 & 1910.217(b), ANSI/RIA 15.06-1999, ANSI B11.19-1990, OSHA 1910.212 & 1910.217(c).

8.14 APPROVALS

CE, TUV, CSA

8.15 CONFORMITIES

PSPD Type 3 (EN 1760-1:1997 + A1:2009),
 Category 3 / PL d (EN ISO 13849-1),
 SIL 2 / SIL2 CL2 (IEC 61508 / EN 62061).

8.16 SAFETY RELATED PARAMETERS

PFH = 2.99 E-08 1/h (24VDC Solid State),
 PFH = 3.29 E-08 1/h (24VDC Relay),
 PFH= 4.56 E-08 1/h (230VAC Relay),
 MTTFd =66 years (24VDC Solid State),
 MTTFd =58 years (24VDC Relay),
 MTTFd =57 years (230VAC Relay),
 Proof Test Interval = 20 years.

9 DIMENSIONAL DRAWING

9.1. MAT CONTROLLER MC6 DIMENSIONAL DRAWING

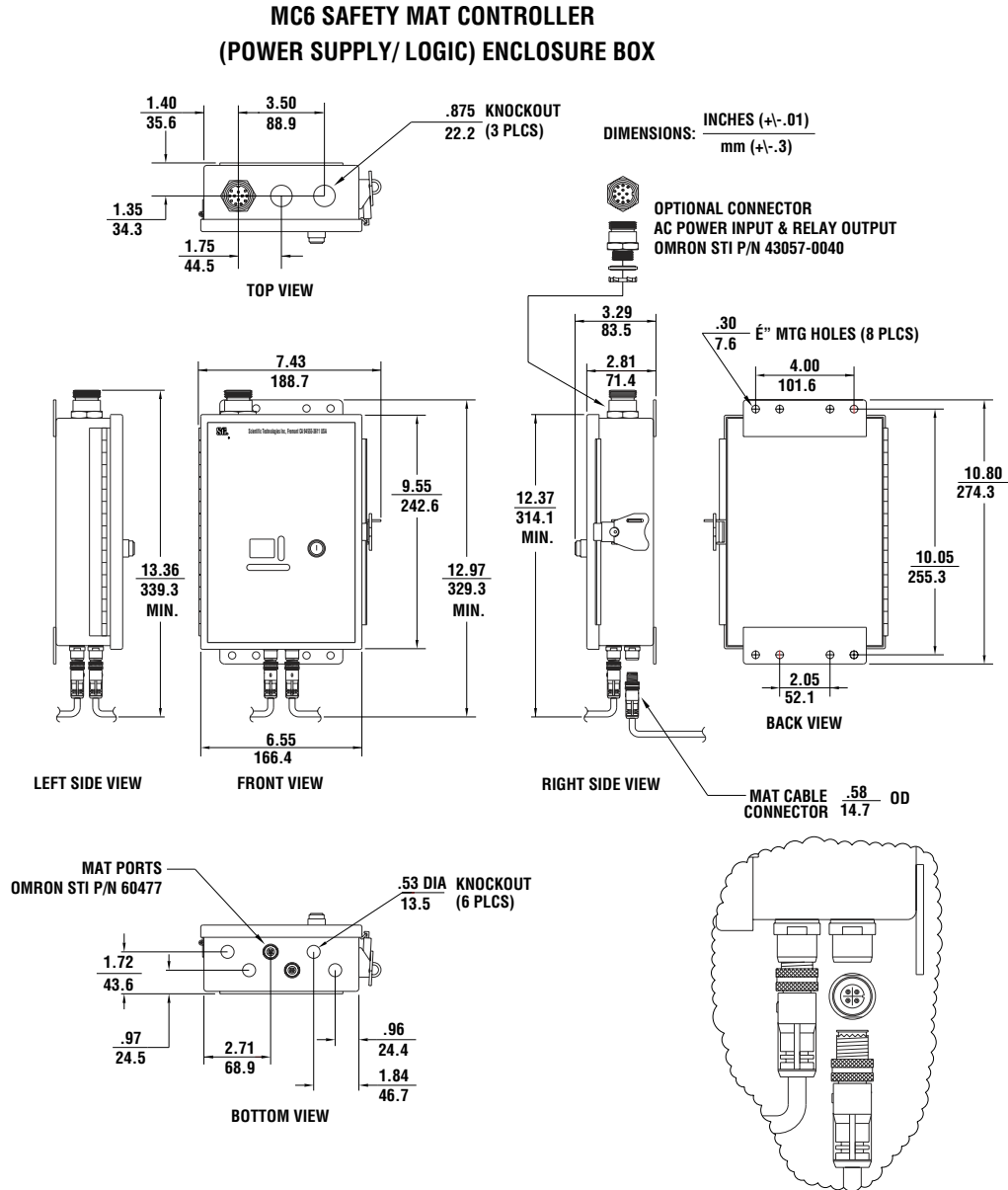


Figure 9-1 Mat Controller MC6 Mechanical Drawing



10 WARRANTY AND ADDITIONAL INFORMATION

10

10.1. OMRON STI WARRANTY

Omron STI warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within one year from the date of installation and not to exceed 18 months from date of factory shipment.

The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether expressed or implied by operation of law or otherwise including but not limited to any implied warranties of merchantability or fitness for a particular purpose. No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of Omron STI which is not specifically set forth herein shall be binding upon Omron STI. Omron STI shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and Omron STI's liability hereunder, in any case, is expressly limited to repair or replacement (at Omron STI's option) of goods.

Warranty is specifically at the factory or an Omron STI authorized service location. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/electrical protection devices. Omron STI shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

10.2. PATENTS

Elements of the electronics and optics essential to meet the specifications and performance standards of Omron STI controls are covered by one or more of the following U.S. Patent Numbers: 3,774,039; 3,867,628; 3,967,111; 3,996,476; 4,007,387; 4,101,784; 5,015,840; Design 255,031, and other patents pending.

10.3. REPAIRS

Omron STI offers product repair service at our factory. If you need repairs made to any Omron STI product, contact our Customer Service Department.

10.4. RETURNS

Whenever you return a product to Omron STI (even if the product is in warranty) please contact our Customer Service Department and request a Returned Goods Authorization number (RGA). Goods that are returned for credit are subject to final review by Omron STI and are subject to restocking charges as determined by Omron STI.



APPENDIX A — TEST PROCEDURE

A.1. TEST PROCEDURE LOG

The following test procedure must be performed by qualified personnel at installation and after any maintenance, adjustment or modification to the presence sensing mats, the MC6 controller or the machine and machine control circuitry. Testing ensures that the presense sensing mats, MC6 controller, machine and machine controll circuitry work properly to stop the machine. Failure to test properly could result in serious injury to personnel. Familiarity with this installation and operating manual is required before proceeding.

Item	Condition	Comments
1. Disable the machine to be guarded, apply power to the MC6 controller. <ul style="list-style-type: none"> • Automatic Restart Mode: With no object on the safety mat, verify the green "Clear" and "Run" lights are ON and the display indicates "00", proceed to Step 2. • Start or Start/Restart Interlock Mode: With no object on the safety mat, verify the green "Clear", yellow "interlock" and red "Stop" lights are ON and the display indicate "01". Actuate the Start switch. The green "Run" light should now be ON and the red "Stop" light should be OFF. Proceed to Step 2. 	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
2. Step on the Mat to operate the MC6 controller. Both the green "Clear" and "Run" light should go OFF, the red "Stop" light should turn ON and the display should indicate "00". Repeat this for each mat connected to the MC6 controller.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
3. With the controller in "Automatic Start" mode, start the machine, and then step on the mat. The machine must stop immediately and the red "Stop" light should be ON.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
4. If the safety mat, controller or the machine fail any of these tests, do not run the machine. Immediately tage and lockout the machine to prevent its use and notify the supervisor.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
5. Visually inspect the machine to ensure entry to the hazardous area(s) is only through the sensing area of the safety mats. If not, additional guarding including mechanical guarding devices and barriers are installed and operating properly.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

- ▲ WARNING! To prevent severe injury to the operator or other personnel, DO NOT operate this presence sensing safety device unless it is properly installed, tested and inspected in accordance with all applicable ANSI, OSHA, government, industry and company safety regulations. The guarded machine must be capable of stopping motion anywhere in its cycle or stroke. Do not use this safety device on a full revolution clutch machine.**



APPENDIX B — DECLARATION OF CONFORMITY INFORMATION

OMRON SCIENTIFIC TECHNOLOGIES INCORPORATED *EC Declaration of Conformity*

OMRON Scientific Technologies Incorporated (at 6550 Dumbarton Circle, Fremont, CA 94555-3605, U.S.A.), hereby declares that the following series manufactured products listed below conform with the relevant Essential Health and Safety Requirements (EHSRs) of the European **Machinery Directive** (2006/42/EC), the relevant requirements of the **Low Voltage Directive** (2006/95/EC), with the essential protection requirements of the **Electromagnetic Compatibility(EMC)** (2004/108/EC).

Universal Safety Mat Systems UM, UMM, UMQ & UMMQ Series with Safety Mat Controller MC6 Series (Pressure-sensitive protective device – consisting of pressure-sensitive mats and controllers. Not suitable for the detection of children)

The **Universal Safety Mat UM Series with MC Series Safety Mat Controllers** products have been type-examined per

**EC Type Examination Certificate,
Registration No: 01/205/0677/09**

issued by notified body **TUV Rheinland Industrie Service GmbH, Certification Body for Machinery (NB No. 0035)**.

The following transposed harmonized European and IEC Standards were used to form the basis for the requirements and tests:

EN 1760-1:1997; + A1:2009 - Safety of Machinery – Pressure-sensitive protective devices
Part 1: General principles for the design and testing of pressure-sensitive mats and pressure-sensitive floors.

EN 62061:2005 – Safety of machinery. Functional safety of safety-related electrical, electronic and programmable electronic control systems.

EN ISO 13849-1:2008 – Safety of machinery. Safety-related parts of control systems. General principles for design

IEC 61508, parts 1 – 7:1998 – 2000 - Functional Safety Of Electrical/Electronic/Programmable electronic Safety-Related Systems.

IEC 50178:1997 - Electronic equipment for use in power installations

EN 60204-1:2006: Safety of machinery – Electrical equipment of machines, Part 1: General requirements.

Documentation Manager of the EU Office
OMRON STI Scientific Technologies, Inc.
Am Garock 8
D-33154 Salzkotten, Germany

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