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SECURITRON MODEL MSS SERIES MAXIMUM SECURITY SWITCH INSTALLATION & OPERATING INSTRUCTIONS

1. DESCRIPTION

Securitron's maximum security magnetic switch is intended to monitor the open or closed position of doors, windows, machinery safety barriers or other movable assemblies in critical environments where an attempt to defeat the switch is a concern. The switch includes numerous design features that make it highly defeat resistant, reduce false alarms and provide for easy and accurate installation. It is available in two versions to deal with different physical mounting conditions and may be used **indoors or outdoors**. Each version consists of two pieces: the switch module and the magnet pack. The MSS-1 is mainly intended for use on doors and includes a jacketed cable which can be hidden in the door frame. The MSS-1G provides a stainless steel jacketed cable which is suitable for a range of applications where the cable cannot be hidden and must resist possible attack. A remote test option is also available (add "RT" to the part number). See Section 5.

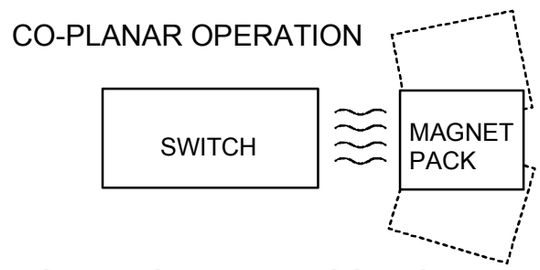
2. DEFEAT RESISTANCE ISSUES

The most common approach used to defeat a magnetic switch is to introduce an external magnet near the switch module so that the door, window or other barrier can be opened without the switch alarming. The MSS cannot be defeated in this way as **its own magnet pack** (which contains a magnet array) **must be used to put it into the secure state**. If a very powerful external magnet is used in an attempt to defeat the MSS, it may even put the MSS into alarm.

Another method which represents a more serious threat is when an intruder attempts to defeat the switch by obtaining a second MSS magnet pack. If access to the MSS can be obtained, the switch might be defeated by positioning the second magnet pack near the switch module in a manner that permits the door to be opened without an alarm being signaled.

The MSS design includes two defenses against this risk.

The first is called **co-planar operation**. The switch will only respond to the magnet pack if the pack is located in roughly the same plane as the switch. A second magnet pack placed in proximity to the switch will not activate the switch because it will be off-plane. In effect, there is only room for one magnet pack being read by the switch at a time, so a second pack cannot compromise security.



TO ENHANCE DEFEAT RESISTANCE, THE MAGNET PACK CAN ONLY BE READ IN A NARROW ANGLE IN FRONT OF THE SWITCH.

In certain physical situations however it may be possible to slowly open the door and slowly introduce a second magnet pack. The MSS includes an extra defense against this. The product is **manufactured in different types**. The magnet pack must be of the same type as the switch module to work. The MSS is delivered as a matched pair with no marking that identifies its type. Therefore, a person attempting the difficult task of trying to slowly open a barrier while introducing a second MSS magnet pack in an attempt to defeat the switch may well have the wrong type pack.

Another attack possibility is removal of the switch module. This can serve several purposes. It can provide access to the cable (assuming the cable is hidden in the door frame). It can also be part of an attempt to remove both the switch module and the magnet pack as a unit to permit opening the door or window without triggering an alarm. To forestall this, the MSS includes a **hidden tamper switch feature**. The tamper switch provides a two wire output which is normally closed and opens if the switch is removed. This line can be separately monitored or connected in series with the main switch output. See Section 3.

Finally, a very serious threat is removal of the magnet pack from the door. If the magnet pack can be removed from the door and maintained at a correct distance from the switch module,

PN# 500-16700
Rev. B, 7/07

clearly the door can be opened without signaling an alarm. The MSS's mounting methods coupled with co-planar operation, however, preclude this. See Sections 3.2 and 3.3. To conclude, in a security application, the MSS's array of anti-defeat features will almost always result in the alarm sounding while the switch is being tampered with. This can lead to the person attempting to defeat the switch being identified and detained.

3. PHYSICAL INSTALLATION

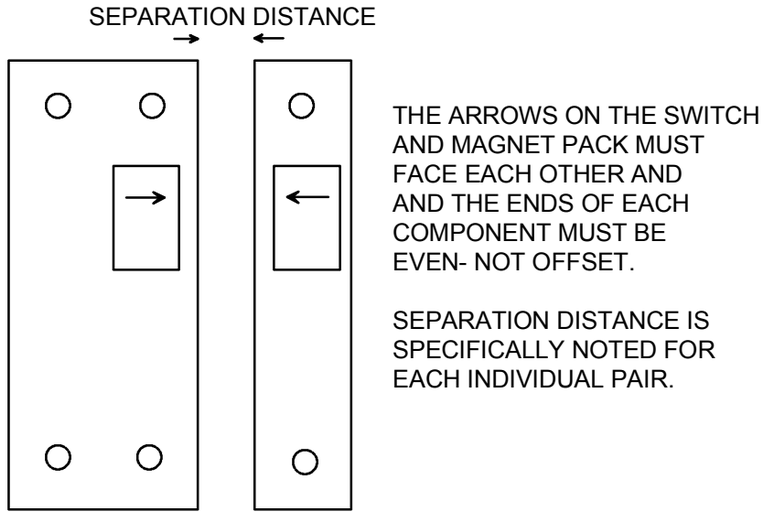
The MSS can be used to monitor the opening of doors, windows, gates and barriers of all types. The switch module is mounted on the part of the assembly that is fixed (such as a door frame) and the magnet pack is mounted on the part of the assembly that moves (the door, for example).

Unlike many magnetic switches, the performance of **the MSS is unaffected by the type of surface it's mounted on**. It will perform the same on steel as on wood.

In planning for mounting the MSS, note that the switch and the magnet pack have to be **oriented correctly, have to be roughly in the same plane and have to be a defined distance apart.**

To obtain correct orientation, note the arrows on the labels on each component. The arrows have to **directly** face each other and the ends of the two pieces must be even, not offset.

The MSS includes **a minimum and maximum operating distance**. The unit will report secure only when the separation distance is between this maximum and minimum. If the magnet pack is too close to the switch module or too far away, the unit will alarm.



The distance between the minimum and maximum separation points is called the gap. The MSS provides **a gap of 4/10"-1/2" (10-12.5MM**). For best reliability, you want to set the actual separation distance exactly midway in the gap. The gap will, however, vary somewhat on each unit and the minimum distance at which the gap starts will also vary. You can, of course determine the optimum midway separation distance by using a ruler and Ohmmeter but as part of our QC procedure, we have checked this distance and it is printed on the switch module label. Use this separation distance when you mount the unit.

The **tamper feature** on the MSS works as follows. An oval head screw (supplied) is set into the surface which is to receive the switch module. Two metal washers are placed under the screw head to yield the correct height. The template shows positioning of this screw. When the switch module is installed, the tamper screw depresses the tamper switch. This **closes** the two wire tamper circuit. Note that if you push the tamper switch in with a paper clip for example, you'll hear it click. This is not the switching point. Switching occurs much earlier in the travel so that the height of the screw head will always move the tamper switch past its switch point but will not bottom it out which could damage the tamper switch. Make sure, however that **you place the two metal washers under the tamper screw head and then screw it down flush with the mounting surface**. This sets up the correct height of the screw head. Note also the fact that the switch module is tampered is undetectable and any attempt to remove the switch module will open the tamper circuit. This circuit may be **directly monitored** (usually by a 24 hour circuit) or **connected in series** with the closed loop of the main switch output such that a tamper violation will create the same alarm signal as if the door was opened.

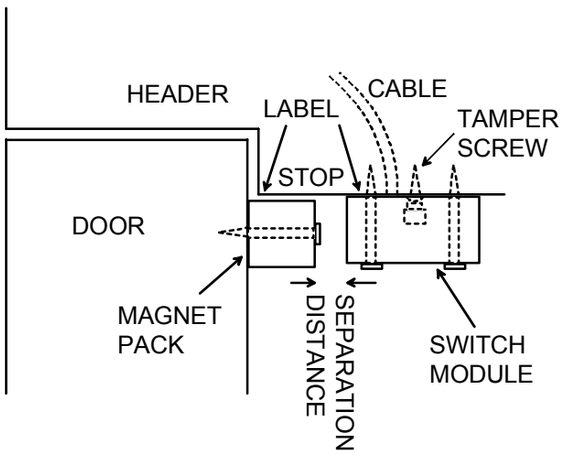
3.1 CABLE PROTECTION

The Underwriter's Laboratories standard for high security switches requires that a cable sheathed in plastic such **as the MSS-1 cable must be protected from attack by being routed through a metal frame**. This is most commonly a door frame but could also be the frame of a gate or other opening. The mounting methods described in sections 3.2, 3.3 and 3.4

show in detail how this is to be accomplished. **If your application is such that the cable cannot be routed through a metal frame member and therefore fully protected**, **you must use model MSS-1G** which includes a stainless steel protective jacket for the cable (see section 3.5). This alternative will satisfy UL's requirements.

3.2 OUTSWINGING DOOR INSTALLATION

The MSS-1 version with long jacketed cable is intended for a protected and unobtrusive installation on outswinging doors. The drawing to the right shows the preferred configuration.



Start by mounting the magnet pack on the door. Note that the magnet pack has two sets of screw holes. Select the magnet pack position so that **the arrow on its label is pointing towards the switch module**. As the drawing shows, the label is on the top of the pack (facing up). Then mount the magnet pack as shown. Drill 7/64" (2.75MM) diameter pilot holes for the #8 mounting screws. Don't drop it below the door stop by more than 1/8" (3MM) as it must remain roughly in the same plane as the switch.

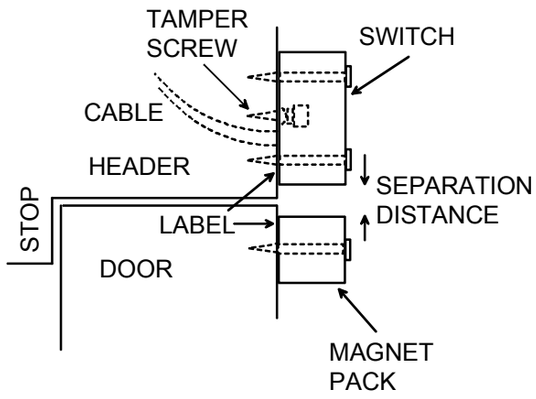
Next, mount the switch. Set the leading edge of the switch to match the separation distance printed on the label. Make sure the switch label arrow points at the magnet pack arrow and, using the template, drill 7/64" (2.75MM) diameter holes for the #8 mounting screws and a 3/8" (9.5MM) diameter hole for the cable which will be concealed in the door frame. If you are planning to use the tamper feature of the switch, drill a 3/32" (2.25 MM) diameter hole for the #6 tamper screw, again following the template. Be sure to **use the two metal washers on the tamper screw** to yield the correct height. This installation technique produces an attractive and high security result. Note that with this mounting method, **the magnet pack cannot be removed without opening the door** which would result in an alarm event.

Some outswinging doors pose special problems. Many aluminum frame glass doors have what is called a blade stop. This is typically about 1/8" (3MM) in width and obviously cannot accept the switch. There are two solutions for this situation. The most professional is to cut out a section of the blade stop just large enough to mount the magnet pack on the door. The switch than mounts directly on to the header which also conceals the cable. An alternate method is to employ a spacer block to position the switch down far enough to clear the blade stop. The magnet pack can then mount lower on the door. This method requires pulling the cable through the spacer block up into the header and also has the disadvantage of weakening the security of the tamper switch. The tamper switch will trigger if the switch module is removed from the spacer block but not if the spacer block is removed from the header while being held tight against the switch module.

Another door problem can occur if a conventional stop is not as wide as is necessary to mount the switch (considering the set-back needed for the magnet pack and separation distance). The back part of the switch will be hanging in space. A spacer piece can be added to the stop to widen it, but note that the switch module can be successfully mounted with only its two front screws. The cable exit has been deliberately located forward so that the cable can be concealed successfully in a narrow door stop. The tamper switch, however, may be unusable.

3.3 INSWINGING DOOR INSTALLATION

The MSS is generally mounted on the inswinging side of a door when that side represents the protected area. The drawing to the right displays a cross section of this configuration. It shows the unit mounted at the top of the door but naturally the unit can also be mounted on the side.



Start by mounting the magnet pack on the door. Note that the magnet pack has two sets of screw holes. Select the magnet pack position so that **the arrow on its label is pointing towards the switch module**. As the drawing shows, the label is facing towards the door. The magnet pack should then be mounted as shown. Drill 7/64" (2.75MM) diameter pilot holes for the #8 mounting screws.

Next, mount the switch module. Set the leading edge of the switch to match the separation distance printed on the label. Make sure the switch label arrow points at the magnet pack arrow and, using the template, drill 7/64" (2.75MM) diameter holes for the #8 mounting screws and a 3/8" (9.5MM) diameter hole for the cable which will be concealed in the door frame. If you are planning to use the tamper feature of the switch, drill a 3/32" (2.25MM) diameter hole for the #6 tamper screw, again following the template. Be sure to **use the two metal washers on the tamper screw** to yield the correct height. This installation technique produces an attractive and high security result. A particular benefit of an inswinging door installation is that when the door opens, **it sweeps out the area under the switch**. Therefore someone trying to defeat the switch with a second magnet pack would be unable to position it in the co-planar position because of movement of the door. Co-planar operation also precludes defeating the switch by removing the magnet pack. As soon as the pack is off-plane an alarm will be signaled.

3.4 SLIDING DOOR INSTALLATION

A sliding door installation is exactly the same as an inswinging door installation except in the way the door moves. Note the drawing above and imagine that the door slides downward away from the "header". It is often the case, however, that the surfaces of the "header" and door aren't in the same plane so a spacer will have to be used. Typically, it is the magnet pack that has to be spaced away from the door to be in the same plane as the switch module. Be sure that the arrows on the labels on the magnet pack and switch module point to each other and that the two components are mounted in the same plane.

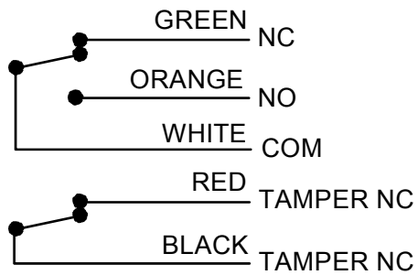
3.5 SURFACE MOUNT WIRING (MODEL MSS-1G)

In some situations, it is not possible to conceal the cable, so the model MSS-1G includes a **stainless steel jacket** for the cable to provide protection according to the Underwriters Laboratories standard. With this model, the cable emerges from the end of the switch module which is necessary for running the cable on the surface. Numerous physical mounting methods can be used so long as the magnet pack and switch module are in the same plane, separated by the correct distance and the arrows on the labels face each other.

4. WIRING

The MSS has five wires that are assigned by color as follows:
White = Common
Green = NC
Orange = NO
Red = Tamper NC
Black = Tamper NC

Because we're using the terms normally open and normally closed, it's necessary to define what we mean by "normal". **The normal condition of the MSS is when it is reporting secure** (the magnet pack is at the separation distance from the switch module). So, for example, you'll read a closed circuit between White and Orange if you meter the switch module in alarm condition (magnet is not near the switch module) but you'll read open if you meter it in the secure condition.

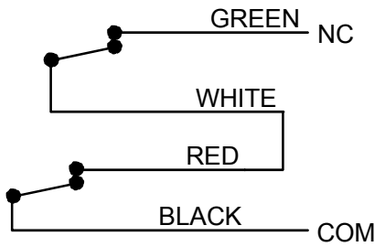


SCHEMATIC SHOWS SWITCH IN SECURE CONDITION WITH TAMPER FEATURE IN USE. CONTACTS WILL SWITCH WHEN SWITCH ALARMS OR TAMPER IS VIOLATED.

The Red and Black tamper wires will be closed when the tamper switch is in secure condition (depressed by the tamper screw) and open if the tamper switch is undisturbed (alarm condition).

Separate connection of the main switch output and the tamper output requires two alarm points. Generally, the switch output is connected to a point which is subject to arming and disarming depending on the time of day. The tamper contacts are connected to a 24 hour point to raise an alarm any time the switch module is tampered with.

If two alarm points are not available (because of wire count limitations for example) the tamper output can be wired in series with the switch's NC loop. With this connection (shown in the drawing to the right), the circuit will open creating an alarm condition if either the door opens or the switch module is tampered with while the door is closed.



SERIES CONNECTION OF SWITCH AND TAMPER NC LOOPS TO MAINTAIN BOTH FEATURES WITH A SINGLE ALARM POINT.

Maximum contact ratings depend on the voltage put through the switch. **They are 250 mA at 12V or less and 125 mA at 24V.** In special applications, the switch can accept up to 100V but the current must be proportionately limited to a maximum 3 watt power rating (60 mA at 50V; 30 mA at 100V). The tamper circuit can handle a **maximum of 1 Amp.**

5. REMOTE TEST OPTION

Units with the remote test option have an eight wire cable and include the suffix **"RT"** in the part number. The remote test feature generally serves the following function. Consider a building with a large number of MSS switches mounted. When the alarm system is armed (at night for example), it is expected that all switches are reporting secure. In this condition, the user cannot be assured that all switches are operating correctly. This security concern is heightened by the possibility that a **switch may have been tampered with** when the alarm system was disarmed.

Remote test allows the user **to electronically put all the switches into alarm from a central point**. This avoids the awkward procedure of opening all the doors. The fact that each switch does go into alarm is monitored by the alarm system in this test mode.

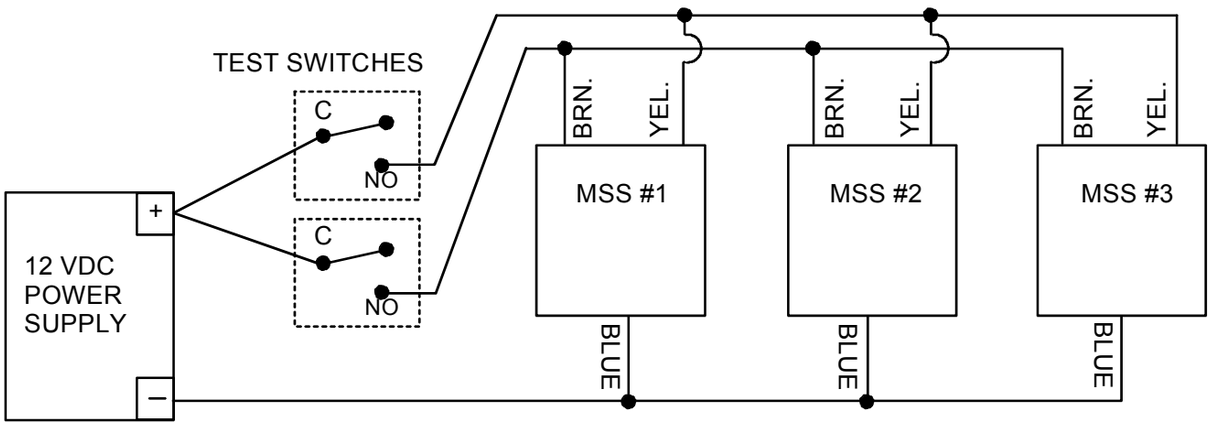
Beyond the simple function of putting the switch into alarm, the MSS has a special remote test feature which requires an explanation. Putting each switch into alarm does verify that it will go into alarm if the door opens, but does not verify that it is working in full high security mode. To explain, the MSS employs two internal reed switches. For it to report secure, both switches have to be put into the secure mode by the proximity of the magnet pack. If either or both switches are not in the secure mode, the unit will report an alarm condition. Suppose that one of the reed switches suffered an internal failure such that it was always in the secure mode. The MSS would appear to work but with only one working reed it would be functioning as an **ordinary magnetic switch** which can be defeated with a single external magnet. The chances of such failure are extremely low in a sealed unit, but they are not zero and they can be detected with the MSS's unique remote test procedure.

The remote test circuit employs three wires. Blue is common and yellow and brown constitute two separate test points. By applying +12V to yellow, you put one of the internal reeds into the

alarm condition. The output of the MSS will then also be in alarm condition. Next, by applying +12V to brown, you put the second internal reed into the alarm condition and the MSS should go into alarm once again. If both tests fail to put the MSS into alarm, it is either entirely defective or (more likely) there is a problem with its wiring to the alarm panel. If one test fails, the MSS is operating on a single reed as an ordinary magnetic switch and must be replaced. This test procedure **assures full high security operation** of the MSS.

Naturally in an actual installation, the switches are tested **simultaneously**. All blue, yellow and brown wires are tied together with like colored wires and connected to a 12V power supply through two normally open test switches. First one "side" of all switches are tested and then the second side is tested. You interpret the results as described in the preceding paragraph. Note that each test point will draw **15 mA** for each switch so you need to plan your power supply capacity by multiplying 15 mA times the number of switches wired together. For example, a 100 switch installation would draw 1.5 Amps during each of the two tests so you should employ a two Amp supply to have some headroom. Make sure it is a **UL listed Class II or Power Limited** power source. Also insure that the **normally open test switch contacts** are able to handle the current. Finally, be sure never to perform both tests at the same time or they will be meaningless and you may overload your power supply.

The drawing on the next page shows typical remote test wiring for three units. Naturally it can be expanded to any number of MSS switches. Note that the 12V power supply **need not be regulated**. Full wave rectified DC power is acceptable. Also, you may realize that the remote test function energizes small coils within the units which generate a magnetic field to put the switch into alarm. These coils do not produce any inductive kickback as they are internally suppressed. There will be no arcing across the test switch contacts.



REMOTE TEST WIRING SHOWN WITH THREE MSS SWITCHES. ANY NUMBER OF MSS SWITCHES CAN BE CONNECTED IN THIS WAY. NOTE THE TWO NORMALLY OPEN TEST SWITCHES. THEY SHOULD BE CLOSED ONE AT A TIME AND ALL MSS SWITCHES SHOULD GO INTO ALARM TWICE TO PASS THE TEST.

PATENT NOTE: The products discussed in this manual are covered under US patent #5,668,533

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