Terminus™

SHOCK DETECTION PRODUCTS

Install Manual
11/30/06

Perimeter Shock Detection Systems

All Information is subject to change without notice.

Terminus Products, Inc. • 2240 Prospect Drive • Christiansburg, VA 24073
www.terminusproducts.com • Sales & Service: 1.866.680.TERM (8376) • Fax: 1.866.908.5655

Terminus™

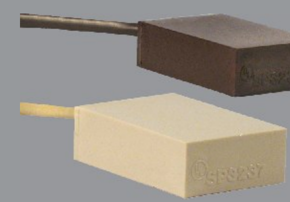
SHOCK DETECTION PRODUCTS

Install Manual

TABLE OF CONTENTS

TABLE OF FIGURES

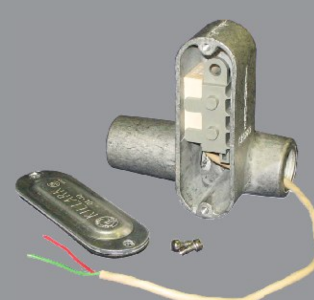
Terminus Products, Inc. • 2240 Prospect Drive • Christiansburg, VA 24073
www.terminusproducts.com • Sales & Service: 1.866.680.TERM (8376) • Fax: 1.866.908.5655



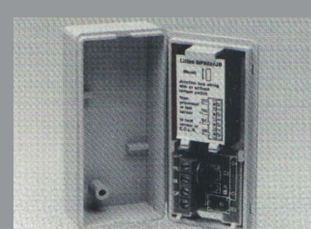
Shown in Beige & Brown
SP3237 - Standard Sensor

Shown in White & Brown
SP3227 - Recessed Sensor

SP2539 Standard Fence Kit



SP3223 Pass-Thru Fence Kit



SP3237JB Junction Box Sensor

All Information is subject to change without notice.

TERMINUS™ SHOCK DETECTION SYSTEM

Shock sensors detect the sharpness of a disturbance in a barrier such as a wall, window or fence. A shock is a sharp rap, tap, crack, break, etc. Shocks occur when a material is broken, hammered, cut, sawed or strained. Shock detection systems lend themselves ideally to perimeter protection because they detect disturbances but generally ignore ambient noises such as thunder, passing trains, nearby traffic or other disturbances that could cause false alarms.

A cutaway view of a Terminus™ shock sensor is shown in figure 1. Two disk sit on the points of two E-shaped contacts forming two normally closed switches. A sharp shock will cause the disks to bounce off the contacts momentarily interrupting the current flow and causing an electronic signal. Background vibrations caused by normal ambient conditions or activities are not usually sensed. These ambient conditions are not sharp enough to cause the disks to leave the contacts.

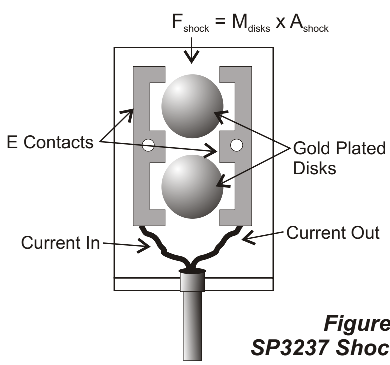


Figure 1
SP3237 Shock Sensor

There are many different types of shock sensors. While the operation and design of all sensors is similar to that described above, applications vary for each model. The list that follows will help you in selecting the correct sensor for each installation.

SP3237 Standard Shock Sensor - is used in installations where mounting is uniform on a given loop. Typical applications include walls, roofs, and windows. The small size and easy mounting makes it the most versatile and common shock sensor. It is shipped with a bracket for mounting purposes, and comes in three colors: white, brown, and beige.

SP3237D Damped Shock Sensor - similar to the SP3237, the SP3237D is used in loops where a rattle-prone condition may exist, such as a loose fitting door or window. There is a dampening capacitor electrically across the contacts of the sensor which makes the unit slightly less sensitive. The damped sensor can also be used when a loop contains sensors mounted perpendicular and parallel to the protected surface. See the section titled "Orienting Sensors for False Alarm Resistance" on page 6.

SP3227 Recessed Shock Sensor - provides protection for windows and doors in a package that recesses into the frame. The sensor installs flush into a ¾ inch diameter hole in the frame. The sensor flange can be painted allowing almost invisible protection. The SP3227 is available in a white housing.

SP2539 Standard Fence Kit - is designed primarily for fences and other outdoor uses but can also be used for walls. The kit contains one SP3237 Shock Sensor and hardware necessary for mounting. The sensor housing accepts a ½ inch EMT conduit, which makes it ideal for applications where the loop wiring must be protected from damage or weather.

SP2549 Damped Standard Fence Kit - similar to the SP2539 but designed for use in loops where a rattle-prone condition may exist, such as a gate. Applications for the SP2549 are similar to those for the SP2539. It contains one SP3237D Shock Sensor and hardware necessary for mounting.

SP3223 Pass-Thru Fence Kit - is designed primarily for fences and other outdoor uses. The SP3223 is comprised of a two inlet conduit housing containing an SP3237 Shock Sensor. Two versions are available: one for ½ inch conduit and one for ¾ inch conduit. The unit uses compression fittings and does not require conduit tees. This ease of installation makes it our most popular fence sensor.

SP3224 Wall Kit - contains the SP3237 shock sensor with a retainer and a condulet housing. The assembly is attached to a mounting block for installation on materials such as wood, brick or cinder block walls, or metal buildings.

SP3223D Damped Pass-Thru Fence Kit - similar to the SP3223 but designed for use in loops where a rattle-prone condition may exist, such as a loose fitting gate. It contains one SP3237D Shock Sensor and hardware necessary for mounting. As with the SP3223, two versions are available: One for ½ inch conduit and one for ¾ inch conduit.

SP3237JB Junction Box Sensor - is used in installations where mounting is uniform throughout the loop. The unit has an SP3237 Shock Sensor mounted in a box with the sensor leads terminated to a printed circuit board. Although larger than the SP3237 sensor, the junction box is very attractive. It is common in installations where appearance is important. A terminal strip makes for easy sensor loop connections and service. A tamper switch (optional) interrupts the loop circuit when the cover is removed.

SP3237DJB Damped Junction Box Sensor - is used in the same applications as the SP3237D. The unit has an SP3237D Shock Sensor mounted in a box with the sensor leads terminated to a printed circuit board. A terminal strip makes for easy sensor loop connections and serviceability. A tamper switch (optional) interrupts the loop circuit when the cover is removed.

An SP3228 Multi-position Bracket is available to attach the SP3237, SP3237D, SP3237JB, and SP3237DJB to areas that are not vertical such as roofs and skylights. The bracket is needed because shock sensors must be mounted upright.

Guidelines for Shock Sensor Installation

Shock detection can be used to protect against intrusion through almost any structural material providing a barrier between an intruder and his goal. Walls, windows, fences, doors, etc. These barriers may contain wood, glass, brick, block, gypsum board or chain link fence. Although different materials have different shock transmitting characteristics, there are application rules that are common to all materials. The rules for the location and use of the SP3237 Shock Sensor will be covered first. Equipment set-up, application details, and special notes will follow.

The following are general guidelines for the location of sensors on materials and structures to provide the best protection. In these guidelines, the letter "D" represents the center-to-center spacing of sensors. To figure out what "D" number your particular application should use, see the Materials and Set-Up Summary chart on page 15.

Large Surfaces

Walls and ceilings are examples of large surfaces. On continuous unbroken surfaces, sensors can be spaced uniformly to provide consistent protection as shown in Figure 2. When a wall is both long and tall and protection is desired for the entire wall, sensor locations must be staggered as shown in Figure 3.

A long, narrow surface is one where a single sensor can protect from ceiling to floor. It is less than "D" in height so that sensors may be mounted in a line along the surface to provide complete coverage. See Figure 2. For example, a hollow cinder-block wall 100 feet long and 10 feet high needs to be protected. "D" for hollow cinder-blocks is 12 feet. The wall is considered a long-narrow structure because it is less than "D" feet high. Sensors would be installed five feet above the floor on ten foot intervals over the entire length of the wall for complete coverage.

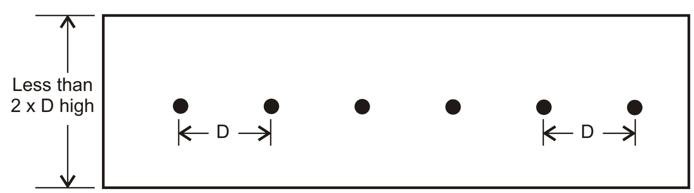


Figure 2
Long Normal Height Wall with In Line Installation

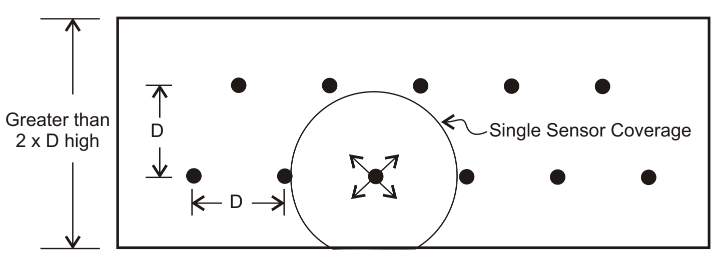


Figure 3
high Wall Staggered Installation

A high, wide surface is one with two dimensions greater than D. In these installations, sensors must be placed in staggered rows to provide complete coverage as in Figure 3. On walls, locate the first row of sensors at the elevation where intrusion is most likely to occur. For roofs and high walls, stagger sensors for complete coverage.

Corners and Joints

Corners, joints and openings (such as windows and doors) can block the transmission of shock waves and limit the coverage of shock sensors. Special spacing rules Must be applied when installing shock - sensors around these obstructions (see Figure 4). Do not space sensors more than D/2 from the center of an obstruction. For larger openings, this may not be possible. In these cases, locate sensors around its perimeter to provide complete coverage. An example is shown in Figure 5. Do not depend on a shock being transmitted across an obstruction. Install sensors on both sides of the obstruction to be certain of protection.

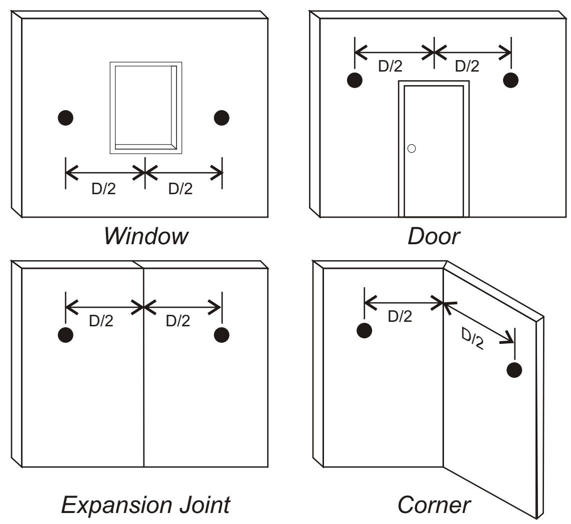


Figure 4
Typical Shock Obstructions

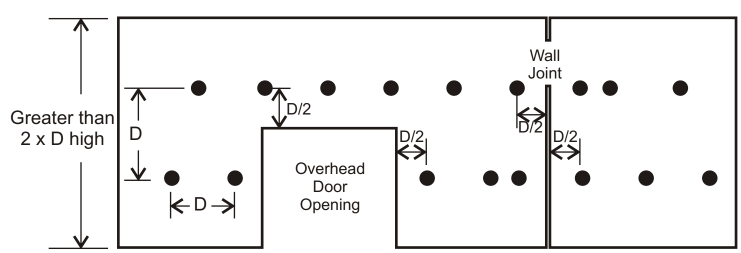


Figure 5
Large Shock Obstructions

Rattles and Loose Fitting Structures
Shock sensors will detect rattles and clanks that can be a cause of false or nuisance alarms in loose-fitting structures. If possible, loose-fitting parts of a structure should be tightened or corrected before shock protection is installed. Examples of loose-fitting conditions that should be repaired are a pipe banging on a wall, a shaky metal wall, a rattling window, or loose fence fabric.

When a rattle or loose fitting structure cannot be changed or corrected, there are several courses of action that can be taken. If an entire zone of sensors is installed on a loose or rattle-prone structure, reduce sensitivity at the processor. If the problem is confined to a couple of isolated areas, use less-sensitive damped sensors in these areas. Damped sensors are SP3237D, SP2549, and SP3223D. If possible, rotate sensor to edge mounting system for more selective sensing (See "Orienting Sensor for False Alarm Resistance" on page 6). In some extreme cases, it may be best to use another method of detection.

Locating Sensors for Best Detection
When installing sensors on a barrier (fence, wall, etc.), locate sensors at the level that an intrusion attempt is most likely to occur. Approximately 2 to 5 feet above the outside ground level is typical as shown in Figure 6. When installing the sensors on a wall that is partially below grade, the most likely level of intrusion is above the outside ground level. The elevation of inside sensors should therefore be adjusted upward accordingly.

Sensors installed on walls that are below ground do not have the same range as sensors on walls above grade. The ground will dampen the shock signal. For below grade walls, reduce the sensor coverage by one half. (Coverage = D/2) Sensors that are two or more feet above grade have full coverage.

Using Beams and Studs as Shock Transmitters
The more rigid and resilient a material is, the better that material transmits shock. Locating shock sensors on or over beams or studs will provide a direct path to the sensor from a large area of a surface. Both metal and wooden studs are used in walls.

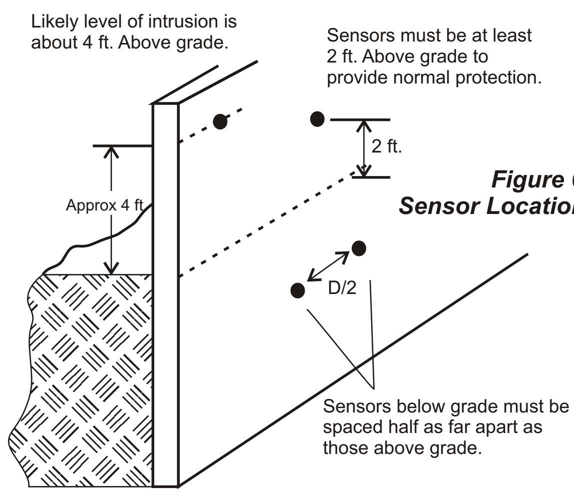


Figure 6
Sensor Location on Wall

Metal studs make better shock transmitters than wooden studs but either will extend the sensors range by ½ “D”. The effective sensor range up and down a studded wall is about 1½ x “D”. Along the horizontal length of the wall the sensor range remains “D”. This is illustrated in Figure 7.

In ceilings, sensors can be attached to beams to extend shock coverage. Due to the soft nature of some roofing materials, conservative spacing of sensors should always be used. Never exceed the sensor “D” rating for the roof material between beams.

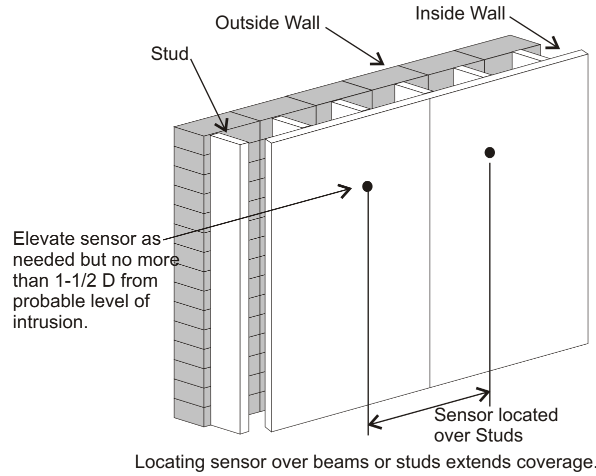


Figure 7
Sensor Location on Studs and Beams

Conduit Applications
Metal conduit can do more than simply protect wiring when used with shock sensors. Metal conduit extends the range of sensors. Plastic conduit is too flexible to conduct shock effectively and does not have any effect on range. When shock sensors are installed on a surface in a rigid network of conduit, the conduit becomes part of the shock sensing system. Any shock detected along the conduit is conducted directly to the sensor. Conduit extends the sensor's range by about 1/2D if the metal conduit is anchored to the structure as shown in Figure 8. The conduit should be securely attached to the wall between sensor locations.

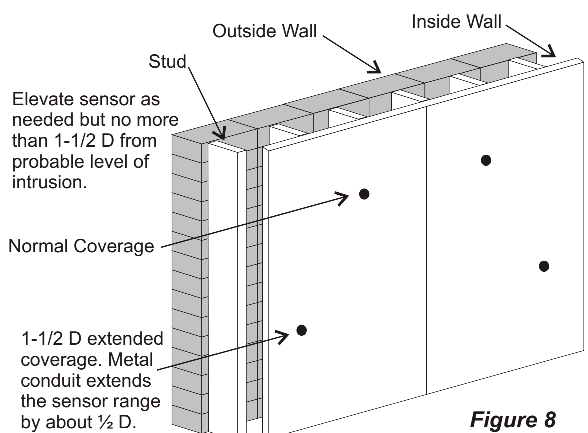


Figure 8
Sensor Location with Conduit

Orienting the Sensor for False Alarm Resistance

The Terminus™ SP3237 Shock Sensor has two sensitivity modes depending on how it is mounted. As shown in Figure 9, a sensor mounted flat against a vertical wall is more sensitive to low frequency movement than a sensor mounted with its edge against a vertical wall. With either mounting scheme the sensitivity to high frequency shocks is essentially the same.

The **"flat against the wall"** mounting is useful where the leaning, sway or low frequency vibration of a structure is to be detected. "Flat against the wall" mounting also increases the SP3237 shock sensor's sensitivity to the reverberation or "ringing" in a structure.

The **"edge against the wall"** mounting makes the SP3237 shock sensor less sensitive to low frequency vibrations. Edge mounting is useful on live structures, such as metal walls, to dampen out the "ringing" that can occur after a hard single blow.

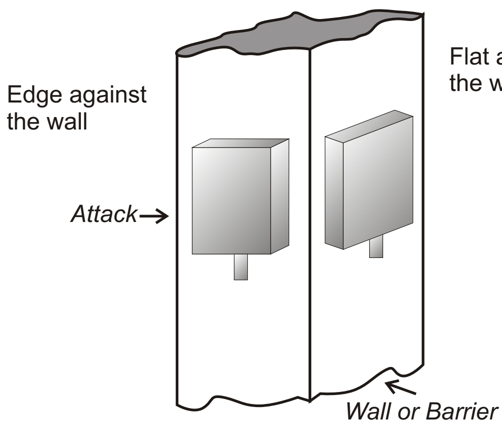


Figure 9
Edge or Flat Sensor Mounting

Mounting the Sensor

The Terminus™ SP3237 and SP3237D Standard Shock Sensor can be conveniently mounted in two ways. Two #4 machine, wood, or sheet metal screws through the mounting holes in the bracket can be used. Or for glass only, with adhesive applied to the smooth flat surface on the back side of the bracket. Dow-Corning general purpose sealant is very good for adverse environments such as sweaty windows. Refer to the installation manual shipped with the sensor for details on installation and testing.

The Terminus™ SP3237JB and SP3237DJB Shock Sensor is mounted using two #4 machine, wood, or sheet metal screws through the mounting holes in the base. Holes in the base allow the wiring to be brought onto the surface or behind the wall.

The SP3227 is mounted by drilling a 3/4 inch hole on the window frame and inserting the sensor into the hole. The wiring extends into the wall behind the sensor. See figure 10.

The SP2539 and SP2549 are normally used in walls or fences. For fence applications, use the clamp shipped with the sensor around the sensor housing, fence fabric, and fence post. For wall applications, drill through the housing and attach the housing to the wall using screws. For some wall applications, rigid conduit can be used to attach the sensors to the wall.

The SP3223 and SP3223D are normally used on fences. Use the clamp shipped with the sensor around the sensor housing , fence fabric, and fence post.

Rigid hardware such as screws and metal clamps transmit shock better than soft hardware like double-faced foam tape Or flexible adhesives. Where very high sensitivity is a consideration, sensors should be mounted with rigid metal hardware. Adhesives are less reliable but can be used where care is taken to clean the mounting area. Apply adhesive uniformly and secure sensor until adhesive is cured.

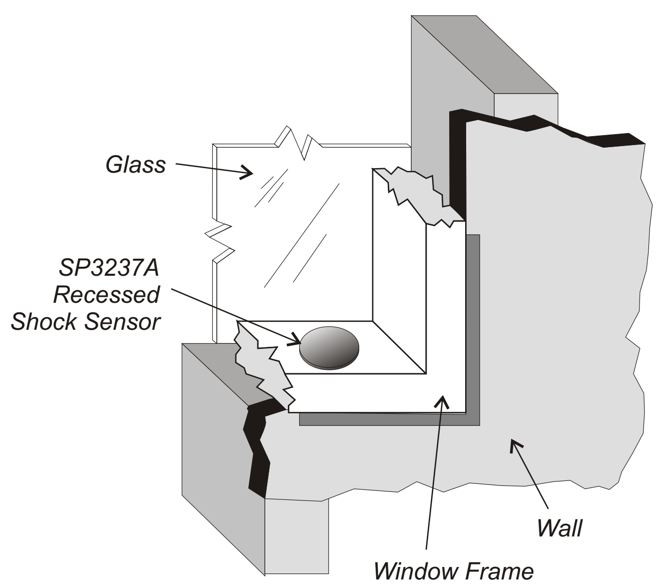


Figure 10
Recessed Sensor Mounting

Loop Wiring for Shock Sensors

All Terminus™ controls have fully supervised loops incorporating end-of-line resistors. These loops transmit the sensor signals that cause an alarm to be generated to an open loop, shorted loop, or shock sensor disturbance. See Figures 11 and 12.

Wires used to connect Terminus™ processors to Terminus™ sensors may be freely routed through walls, ceilings, and along baseboards. Terminus™ processors will accept very long loops. For loops less than 1,500 feet, 22 AWG twisted pair wire must be used. 18 AWG (or larger) twisted pair wire must be used for loops greater than 1,500 feet. Shielded cable is generally not needed but may be used with some advantage in areas of very high electromagnetic interference. A maximum of 50 shock sensors per loop can be used on a processor. Usually, the installer will want to use fewer sensors on each loop to improve zoning.

There are several techniques that can eliminate potential maintenance problems. Use home-run wiring where possible to aid in setup. Never route loop wiring with high voltage power cables. High voltage power lines can induce electrical noise into the loop wiring causing false alarms and equipment damage. Always solder and tape all connections.

Home Runs

It is always a good practice to wire the premises as several loops when installing a hard-wired security system. Bring each of these small loops back to the main control. These smaller loops are then interconnected at the control panel to form one large loop or several zone loops as desired. Segmenting an installation in this way permits easy expansion and aids troubleshooting. Figure 13 shows how a home-run scheme might be used in an office environment.

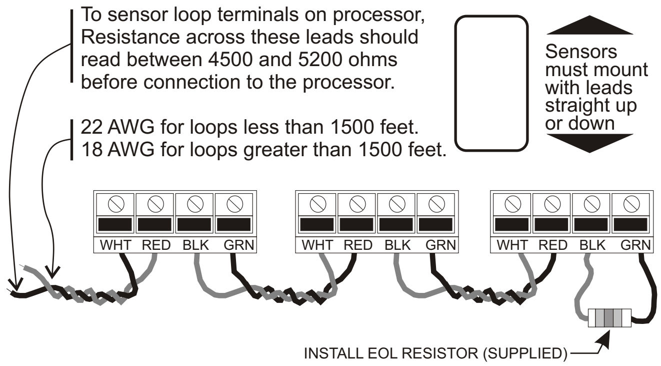


Figure 11
junction Box Wiring

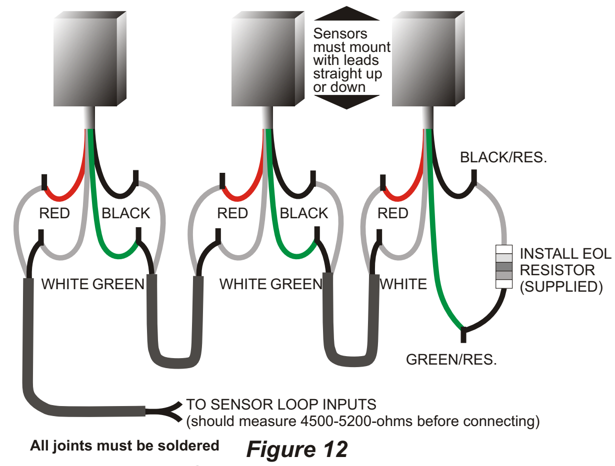


Figure 12
Sensor Loop Wiring

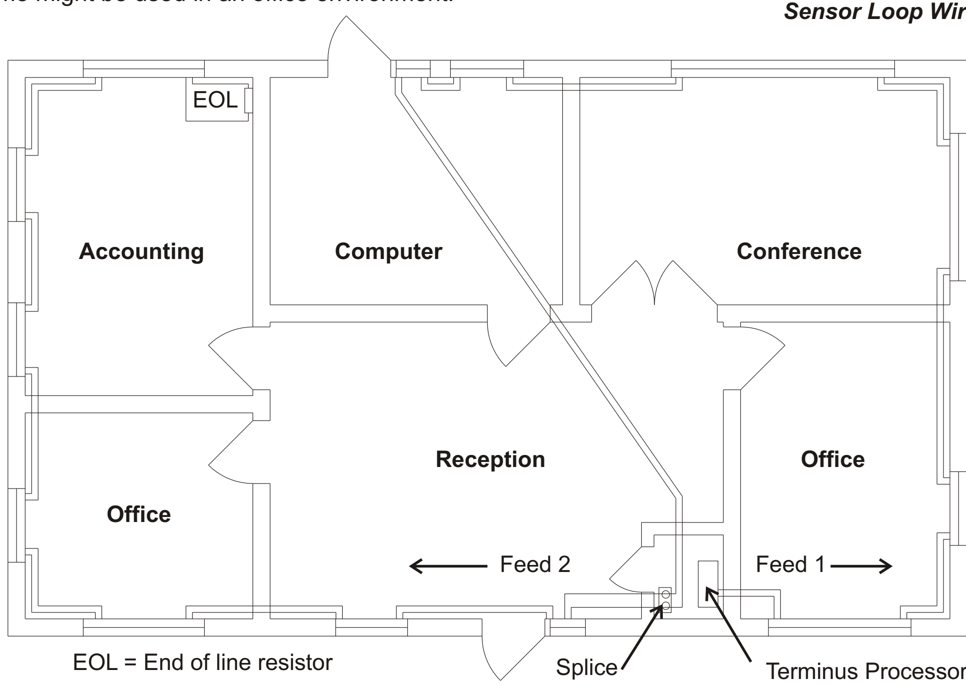


Figure 13
Home Run Wiring

Loop Wiring for Shock Sensors

Terminus™ shock sensors must be used with Terminus™ processors. The processor filters signals from the sensors and separates background activity from intrusion attempts. All Terminus™ processors feature microprocessor based SMD (surface mount device) technology. Individual relay outputs and status LEDs for each zone indicate the current status of the system.

Six processors are available for use with Terminus™ Shock Sensors:

- **SP3219-1** Single Zone Pac-A-Dap Processor
- **SP3219-2** Two Zone Pac-A-Dap Processor
- **SP3219-4** Four Zone Pac-A-Dap Processor
- **SP3268** Single Zone Processor
- **SP3274** Four Zone Processor
- **SP3273** Four Zone Expander Processor

Terminus™ processors will work with any alarm panel. The tables below show the features of each processor.

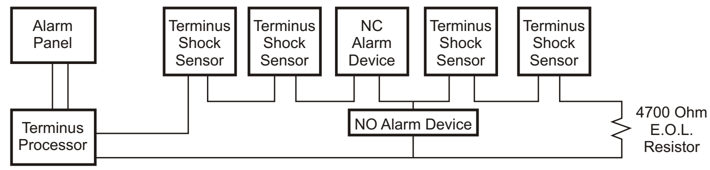


TABLE 1: PROCESSOR SPECIFICATIONS

PROCESSORS	ZONES	MAXIMUM SENSORS PER ZONE	SIZE *(INCHES)*	TAMPER SWITCH	CABINET LOCK	PRIMARY POWER	BACK-UP POWER	ENVIRONMENTAL RATINGS	ALARM RELAYS	RELAY CONTACT RATING
SP3219-1	1	50	5 high 3 wide 1 3/8 deep	none	none	10.5 TO 16.5 VDC @ 20 mA	none	32° to 120°F < 95% relative Humidity (non-condensing)	Form A NC SPST	.5 A 10 VAC 20 VDC
SP3219-2	2	50	5 1/4 high 3 1/4 wide 2 1/4 deep	none	none	10.5 TO 16.5 VDC @ 20 mA	none	32° to 120°F < 95% relative Humidity (non-condensing)	Form A NC SPST	.5 A 10 VAC 20 VDC
SP3219-4	4	50	8 1/4 high 8 1/4 wide 2 1/4 deep	none	none	10.5 TO 16.5 VDC @ 20 mA	none	32° to 120°F < 95% relative Humidity (non-condensing)	Form A NC SPST	.5 A 10 VAC 20 VDC
SP3268	1	50	13 ½ high 9 5/8 wide 3 1/4 deep	yes	yes	16.5 VDC 20 mA With plug-in Transformer	12 volt 5.0 Ah Battery Supplied	32° to 120°F < 95% relative Humidity (non-condensing)	Form C NC SPDT	2 A 20 VAC 30 VDC
SP3274	4	50	13 ½ high 9 5/8 wide 3 1/4 deep	yes	yes	16.5 VDC 20 mA With plug-in Transformer	12 volt 5.0 Ah Battery Supplied	32° to 120°F < 95% relative Humidity (non-condensing)	Form C NC SPDT	2 A 20 VAC 30 VDC
SP3273	4	50	13 ½ high 9 5/8 wide 3 1/4 deep	yes	yes	16.5 VDC 20 mA With plug-in Transformer	12 volt 5.0 Ah Battery Supplied	32° to 120°F < 95% relative Humidity (non-condensing)	Form C NC SPDT	2 A 20 VAC 30 VDC

TABLE 2: PROCESSOR ELECTRONIC SPECIFICATIONS

PROCESSORS	GLASS BREAK MODE	COUNT MODE	SENSITIVITY	COUNT INTERVAL	PULSE WIDTH	ENTRY/EXIT DELAY	ZONE DISABLE SWITCH	ALARM RELAY AUTOMATIC RESET
SP3219-1	yes	yes	Adjustable from 1 to 60 milliseconds	Fixed at 18 seconds	Fixed at .2 seconds	none	none	Fixed at 5 seconds if loop is not faulted
SP3219-2	yes	yes	Adjustable from 1 to 60 milliseconds	Fixed at 18 seconds	Fixed at .2 seconds	none	none	Fixed at 5 seconds if loop is not faulted
SP3219-4	yes	yes	Adjustable from 1 to 60 milliseconds	Fixed at 18 seconds	Fixed at .2 seconds	none	none	Fixed at 5 seconds if loop is not faulted
SP3268	yes	yes	Adjustable from 1 to 60 milliseconds	Adjustable from 1 sec to 2.5 min.	Adjustable from .05sec to 1.5 sec.	selectable 0 or 40 sec	yes	Selectable 5 sec or 4 min if loop is not faulted
SP3274	yes	yes	Adjustable from 1 to 60 milliseconds	Adjustable from 1 sec to 2.5 min.	Adjustable from .05sec to 1.5 sec.	selectable 0 or 40 sec	yes	Selectable 5 sec or 4 min if loop is not faulted
SP3273	yes	yes	Adjustable from 1 to 60 milliseconds	Adjustable from 1 sec to 2.5 min.	Adjustable from .05sec to 1.5 sec.	selectable 0 or 40 sec	yes	Selectable 5 sec or 4 min if loop is not faulted

Terminus™ Processors

The Terminus™ processors shown below are UL-Listed and feature microprocessor-based SMD (surface mount device) technology, individual relay outputs, as well as a choice of glass-break or count select mode. The processors are housed in a hinged, metal box that measures 13½" x 9½" x 3¼". All unit are shipped with a stand-by battery.

There are three Terminus™ Processors available:

SP3268 Single Zone Processor

The SP3268 Processor monitors up to 50 Terminus™ sensors.

SP3274 Four Zone Processor

The SP3274 Processor allows a protected area to be divided into four zones, monitoring up to 50 Terminus™ sensors on each zone. Each zone has its own set-up adjustment, providing optimum performance.

SP3273 Four Zone Expander Processor

Each SP3273 monitors up to four additional zones of Terminus™ sensors, with the same capabilities as the SP3274 Four Zone Processor.

Terminus™ Pac-A-Dap Processors

The Pac-A-Dap processors monitor up to fifty SP3227 or SP3237 shock sensors per zone and operate from a 10.5 - 16.5 VDC control panel or its own separate power supply. Normally-open and normally-closed alarm devices can be included in the same loop.

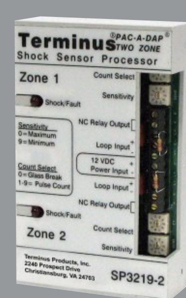
Pac-A-Dap processors have two operating modes - count Mode for hard surfaces and glass-break mode. It features an SPDT normally-closed relay and a sensitivity adjustment. An end-of-line resistor is supplied with the unit.

Pac-A-Dap processors cannot be used for fence systems.

There are three Pac-A-Dap processors available:

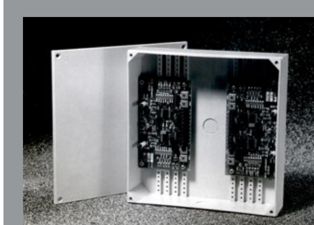
SP3219-1

Terminus Pac-A-Dap One Zone Processor
The One Zone has a 3" x 5" circuit board with two-sided foam tape on the back.



SP3219-2

Terminus Pac-A-Dap Two Zone Processor
The Two Zone is enclosed in a 3¼" x 5¼" plastic case.



SP3219-4

Terminus Pac-A-Dap Four Zone Processor
The Four Zone has two 3" x 5" circuit board enclosed in a 8¼" square plastic case.

Processor Operation and Set-Up

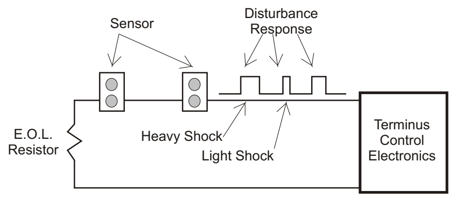


Figure 14
Shock Sensing Process

General Explanation of Shock Sensors

Shock sensors produce short electrical pulses on the protective loop in response to disturbances. The number of pulses is proportional to the amount of activity in an attempted intrusion. The size (length) of the pulse is proportional to the vigor of the attack. See Figure 14.

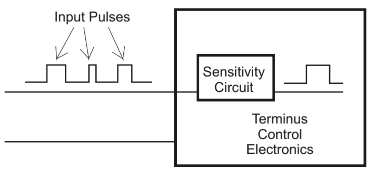


Figure 15
Sensitivity Circuit

The sensitivity circuit filters sensor pulses according to their length which indicates how vigorous the attack is. For a given sensitivity setting, only pulses that are long enough are passed on to the other processing circuits. Terminus™ electronic controls can detect pulses as short as 1 milliseconds when set on the most sensitive setting. See Figure 15.

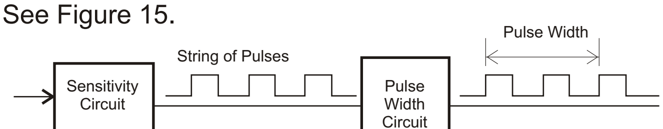


Figure 16
Pulse Width Circuit

After passing through the sensitivity circuit, pulses go to the pulse width circuit. The pulse width circuit permits pulses to pass through it only at predetermined intervals. See Figure 16.

Once the preset counter setting has been reached, the alarm circuit is tripped. See Figure 17.

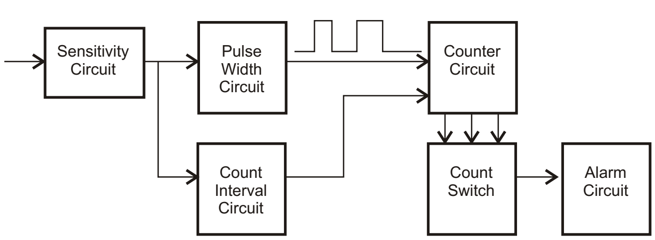


Figure 17
Alarm Circuit

However, there is still one more important timing circuit. If it were not for the count interval circuit the counter would continuously accumulate pulses over hours or even days. With random disturbances such as birds, sleet, or hail, continuous counting could lead to false alarms. The count interval circuit limits how long the counter remembers pulses. For best performance this time is typically between 15 seconds and 2 minutes depending on the application and the Terminus™ electronics used.

All Terminus™ controls have the above processing circuitry. External adjustments of these circuits are possible on some controls while only count and sensitivity are adjustable on others. The following paragraphs give guidelines for system adjustments.

Adjustments

The ***sensitivity switch*** sets pulse intensity registered as disturbances. The minimum is 1 millisecond (most sensitive) and the maximum is 150 milliseconds (least sensitive). This control should be adjusted to the least sensitive point where effective detection occurs.

The ***pulse width switch*** sets the required interval between sensed pulses. The minimum is 50 milliseconds and the maximum is 1.5 seconds. This control is used to eliminate the effects of ringing found in a live structure such as a metal building. With the circuit set correctly only the blow is detected, not the reverberations. This control should be adjusted for the shortest time that will give good protection.

The ***count switch*** sets the number of disturbances necessary to cause an alarm. The minimum is 1 count, and the maximum is 9 counts. This control is used to eliminate false alarms while still permitting a high sensitivity level to be used. A count setting of 3 is common; higher counts are used in difficult applications. Lower counts are sometimes used in high security applications.

The ***count interval switch*** sets the time in which the count must occur to cause an alarm. The minimum is 1 second and the maximum is 2 1/2 minutes. This control should be set to the shortest time in which effective detection can occur. A typical setting is 15 seconds.

The ***automatic reset time switch*** sets time during which the unit stays in alarm mode. There are two settings available: 5 seconds and 4 minutes.

The ***Entry/Exit delay switch*** allows the installer to select an Entry/Exit delay for a zone. If this switch is On, all activity on the sensor loop will be ignored for 40 seconds after the zone is armed to give the user time to exit the premises. Similarly, the unit will delay alarming on entry to allow the user time to reset it and abort the alarm.

These switches are not on the SP3219 processors. On the SP3219s these functions are fixed.

Zoning
Security systems are often installed in zones of protection. Zones are segments of an installation that operate with some degree of independence from other segments. A security zone usually has its own independent means of reporting status (safe, violation, etc.).

Security system zoning is done for several reasons. Common reasons would be to accommodate such variables as very large installations locating an alarm, different types of sensing devices, and different types of barrier material. For reasons of size and reliability, very large systems are often broken into several independent zones. It is often important to know where an intrusion attempt is taking place; a zone system can help pinpoint the troubled areas. By zoning, perimeter and space detection devices can be handled separately. Shock detection can be used to protect many different kinds of materials and structures (i.e., windows, walls, fences, etc.). Each type of material has different shock characteristics and therefore requires different control setups. Different materials should be zoned independently. Figure 18 illustrates a zoned installation.

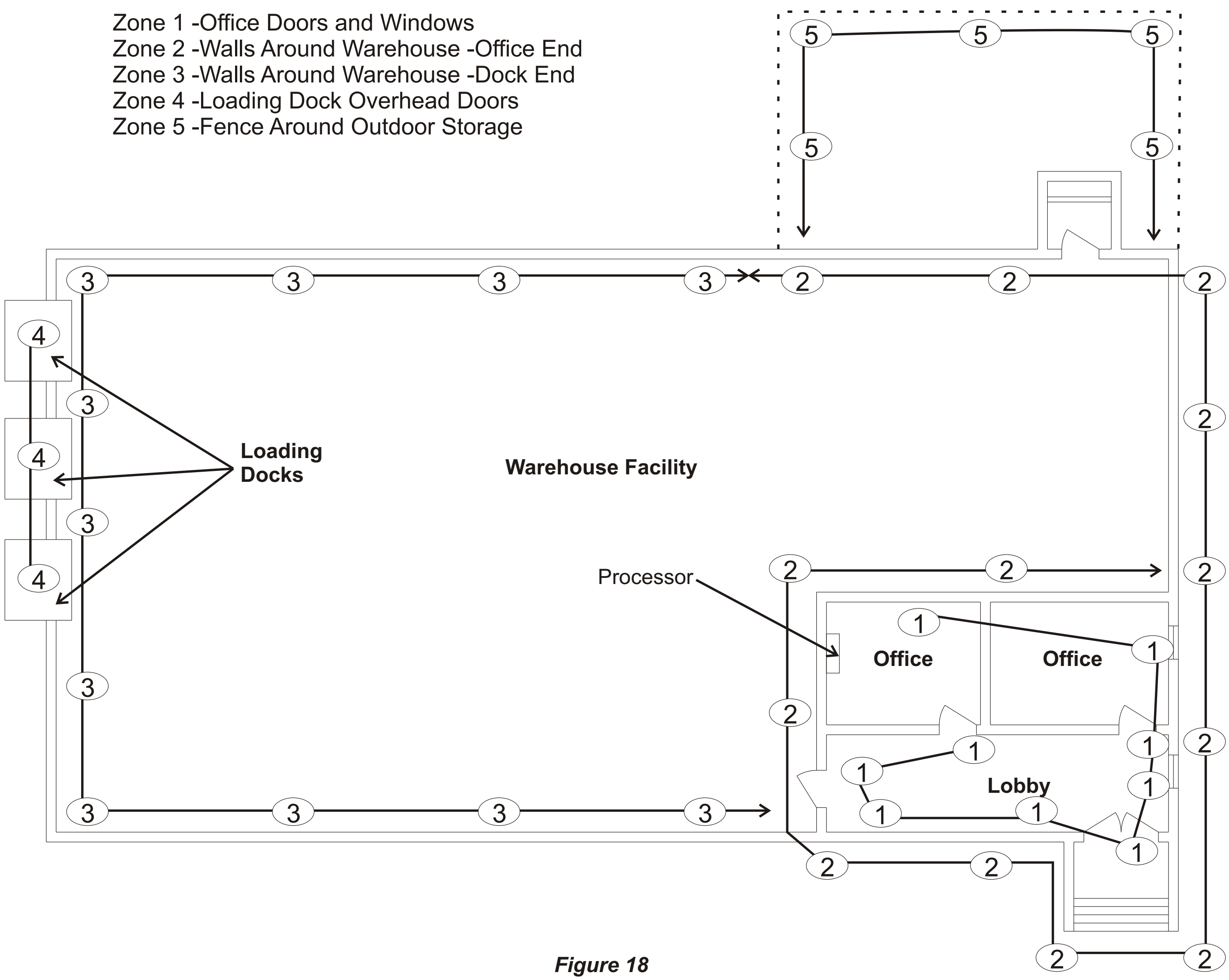


Figure 18
Zoned Installation

Installation Aides & Techniques

Shock detection can be used on many different types of materials and structures. Materials and structures differ from one another in their shock detection characteristics so that some installation aids and procedures are useful for best system set-up.

Testing for coverage on a material or structure involves temporarily applying a shock sensor to the material or structure and simulating an attack. The coverage test described below allows the installer to verify coverage before installation. The Terminus™ SP3219-1 Pac-A-Dap processor is especially well suited to this purpose because of its small size and power requirements.

Coverage Test

1 . Apply the sensor where it might be installed and take care that it is securely fastened.

2. Connect the sensor to a processor. Set the processor to a count of 1 and most sensitive.

3. Rap or tap with a hard instrument (a screwdriver handle, for example) in the most distant point to be covered.

4. Ensure that the processor responds.

5. Reduce sensitivity in one position increments to the point where control stops responding.

6. Turn sensitivity switch back one position toward the more sensitive direction.

7. Observe that the processor responds to test rapping and record position of sensitivity switch.

False Alarm Test

1. Set sensitivity control as established in the coverage test.

2. Shake structure with a firm but gentle hand pressure. Any loose fitting part should rattle because of this test, just as it would in response to wind, traffic, or thunder.

3. If a rattle causes a false alarm to occur, the structure should be tightened or a better sensor location should be found.

5. If above corrections cannot be applied, a less sensitive damped sensor may be used.

6. If the entire loop is affected, the sensitivity on the Processor can be made less sensitive.

Status Versus Activity - What's Sensed

The standard Terminus™ shock sensor is a dynamic sensing device. It senses the activity of an intrusion attempt (prying, breaking, cutting, etc.). The shock sensor by itself cannot show that a door, window, or gate has been accidently left open. To sense the status of an opening, another status show device should be used. To provide the customer with best protection, always install to detect both status and activity in a protected area.

Sensor Response on Structures & Materials

Structures and materials for shock detection purposes can be characterized by how they will transmit a shock. In this manual every material is given a "D" number that is a conservative average center-to-center sensor spacing requirement for the various materials. As discussed on pages 4 and 5 of this manual, the "D" number can be increased or decreased for some special situations.

Hollow Block

Hollow cinder block (minimum thickness of 6 inches) has a short (6 foot) shock conducting range. Sensors should be at a maximum spacing of 12 feet apart. Keep in mind that conduit can extend the range of shock sensors. In some installations, the cost savings of increased shock sensor spacing can make a conduit installed system less expensive than one without conduit.

Hollow block walls are a very forgiving shock detection application because the bulk and strength of the material makes it very stable. People-caused shock disturbances, other than actual intrusion attempts, are unlikely. For these reasons the electronic controls can be adjusted for best protection with little attention to false alarm prevention.

Suggested processor set-up for hollow block walls:

D = 12 ft.
Count: 1 - 3 (2 or 3 best)
Sensitivity; 1 (Most sensitive)
Count Interval: 9 (Maximum = 2½ minutes)
Pulse Width: 1 - 3

Solid Block, Brick and Concrete

These materials have the shortest (5 feet) shock transmitting range of common building materials. This does not mean that they are poor candidates for shock protection. Sensors should be at a maximum spacing (center-to-center) of approximately 10 feet. Minimum acceptable thickness is 33/4 inches. For best protection, sensors should be arranged so that every point to be protected is within approximately 5 feet of a sensor. Conduit is very useful to extend range.

Suggested processor set-up for solid block, brick, and concrete walls:

D = 10 ft.
Count: 1 - 3 (2 or 3 best)
Sensitivity: 1 (Most sensitive)
Count Interval: 9 (Maximum = 2½ minutes)
Pulse Width: 1 - 3

WOOD (Including Plywood)

Wooden walls, partitions, etc. come in a variety of configurations. Among these are planks, slabs, and plywood. These walls may use wood or metal studs and be on interior or exterior walls. However, all wood transmits shock with about the same ability. Joints can insulate one section from another and interrupt shock transmission. Don't allow a joint to come between a sensor and an area which needs protection. For plywood, an effort should be made to have a sensor in contact with every 4 x 8 sheet. Take advantage of stud and beam transmitting characteristics to locate sensors conveniently and to extend the sensor's coverage. Pictures, signs, bulletin boards etc. that are hung on walls can be a source of false alarms. The items should be secured or removed if problems are detected. Typical diameter of coverage on wood walls is 8 feet.

Suggested processor set-up for thick panel (over ¼ inch) wooden walls:

D = 8 ft.
Count: 2 or higher (2 or 3 best)
Sensitivity: 7- 9 (More sensitive)
Count Interval: 5 (15 seconds)
Pulse Width: 2 - 6

Suggested processor set-up for thin panel (1/8 to ¼ inch) wooden walls:

Count: 3 - 7
Sensitivity: 7 - 9 (More sensitive)
Count Interval: 5 (15 seconds)
Pulse Width: 2 - 6

Metals

Metals are used in structures in a variety of forms including heavy structural beams, sheet metal, corrugated metals, expanded metals for security cages and gratings. In metal, the shock transmitting characteristics vary greatly from one form to another, so metals will be broken into two sub-categories: heavy forms and, sheet forms. Heavy forms include beams, heavy sheets, rods, studs, and other solid bulk forms. Sheet forms include sheet metal less than 1/8" in thickness, corrugated sheet, textured sheet, expanded metal grates, etc.

Heavy Metal Forms (18 MSG Steel). Metal beams, supports, studs, rails and thick metal plates transmit shock better than any other materials. Besides being the best shock transmitters, these materials are generally spaced far apart. Typical diameter of coverage on heavy steel is 20 feet.

Suggested processor set-up for heavy form walls:

D = 20 ft.
Count: 3 or higher (4 - 7 is common)
Sensitivity: Entire range (mid-scale is common)
Count Interval: Entire range (15 - 30 seconds is Common)
Pulse Width: Longer half range (¼ - 1.2 seconds)

Sheet Forms (26 MSG). Metal sheets and expanded metals transmit shock well but sheet metal structures have two characteristics which make it necessary to limit sensor coverage. First, sheet metal structures generally have loose fitting joints that interrupt the path of shock waves. This limits the effective range to one sheet. Second, sheet metal structures are generally loose and tend to rattle. This requires lowering the sensitivity at the processor. Often, sheet metal is installed on heavy metal frame work. The sensors can be installed on this framework for heavy metal coverage and stability. Typical diameter of coverage on sheet steel is 10 feet.

Suggested processor set-up for sheet form metal walls:

D = 10 ft.
Count: 3 or higher (4 to 7 is common)
Sensitivity: Entire range (mid-range to least sensitive is common)
Count Interval: Entire range (5 to 30 seconds is common)
Pulse Width: Longer half range (¼ to 1.5 seconds is common)

Automated Teller Machines

For ATMs, two to three shock sensors placed on different surfaces should be adequate. Use shock sensors on surfaces that are most likely to be attacked. Be careful to set the sensitivity to ignore normal machine operation.

Suggested processor set-up for sheet form ATMs:

Count: 3 or higher
Sensitivity: mid-range to least sensitive
Count Interval: 5 or 6 (15-30 seconds)
Pulse Width: Longer half range (¼ to 1.5 seconds is common)

Safes and Vaults

For safe walls with a minimum of 1 " thick steel, one detector should be mounted on the door and one on each side of the safe. For large safes, additional sensors should be mounted at 40 inches center-to-center. For 1/8" steel on 2½" concrete safes, sensors should be mounted at 40 inches center-to-center.

Suggested processor set-up for sheet form safes and vaults:
Count: 3

Sensitivity: 0 to 5 (mid-range to least sensitive)
Count Interval: 5 or 6 (15-30 seconds)
Pulse Width: Longer half range (¼ to 1.2 seconds is common)

False Alarm Prevention in Metal Structures

Metal structures are often very live and tend to ring after a disturbance. To help overcome this characteristic, sensors should be located in the most stable, rigid section of these structures. Edge mounting should be used wherever possible in these cases (see "Orienting Sensor for False Alarm Resistance" on page 6). Another property of metal structures is their tendency to pop and crack as they expand and contract in response to temperature changes. This problem can be reduced by locating sensors in stable areas of the structure and adjusting the electronic controls as outlined below.

The following are suggestions to correct some potential difficulties that may occur in protecting metal structures. Processor adjustment, however, is not a substitute for good job layout and proper sensor installation.

Count: Increase count to reduce the effect of rattles and thermal pops.
Sensitivity: Reduce sensitivity to reduce effect of hard rain, sleet, or hail, nearby traffic and small rodents.
Count Interval: Make interval shorter to reduce effect of thermal pops, rattles, rain, sleet, or hail.
Pulse Width: Make interval longer to eliminate effect of reverberation (ringing), rain, sleet, and hail.

Fiberglass and Structural Sheet Composites

This category of material includes corrugated fiberglass panels, other corrugated plastic panels, and flat sheets of rigid composite building materials. Maximum spacing should be one sensor per 4' x 8' sheet (8 feet center-to-center). These materials act much like sheet metal for shock detection, except that their shock transmission range is much shorter. As with sheet metal, these materials have a tendency to rattle and reverberate. To eliminate this, the structure should be as tight as possible. If a sheet structure cannot be made rigid, it may not be a good candidate for shock protection. Beams and studs can be used to extend the effective shock coverage on these materials as will conduit. Typical diameter of coverage on sheet steel is 8 feet.

The processor set-up emphasizes false alarm prevention on fiberglass and other plastic structural sheet materials. (See "False Alarm Prevention For Metals"). These materials are so live that intrusion detection is effective even when the controls are desensitized for false alarm prevention.

Suggested processor set-up for fiberglass and structural sheet composites:

D = 8 ft.
Count: 3 to 7 (5 to 7 is common)
Sensitivity: 5 to 9 (half scale is common)
Count Interval: 3 to 8 (5 to 90 seconds depending on application)
Pulse Width: 5 to 9 (1/3 to 1.5 seconds depending on application)

Glass

Glass includes sheet glass such as external building windows, internal office windows, display cases, etc. Glass is used in many different arrangements, but most of these fall into one of two categories. Continuous glass and multi-pane windows will be discussed separately. In addition, there are several different types of glass and each has different characteristics. They include:

1/8" float (plate)	1/4" wired
1/4" float (plate)	1/4" tempered
1/4" laminated	

Continuous glass. Continuous glass refers to continuous panes of glass 1/8" thick or greater, 5 square feet or larger, and rigidly mounted in a frame. The minimum size of glass should be 1 foot by 1 foot. Continuous glass can include any of the types of glass described above.

Sensors are normally mounted on the frame within two inches of the glass. Better detection can be obtained when the sensor is touching the glass as shown in Figure 19 on the next page. Attach the sensor to the frame using the bracket supplied and two #4 machine, wood or sheet metal screws. This method will provide the best performance. The bracket can also be mounted with adhesive applied to the smooth flat surface on the back side of the bracket. This method of mounting provides less sensitivity and cannot be used in UL Listed systems. Only top-performance adhesives may be used to glue sensors to glass. Dow-Corning general purpose sealant will provide good performance when applied to a thoroughly cleaned surface. It is very good for adverse environments such as sweaty windows.

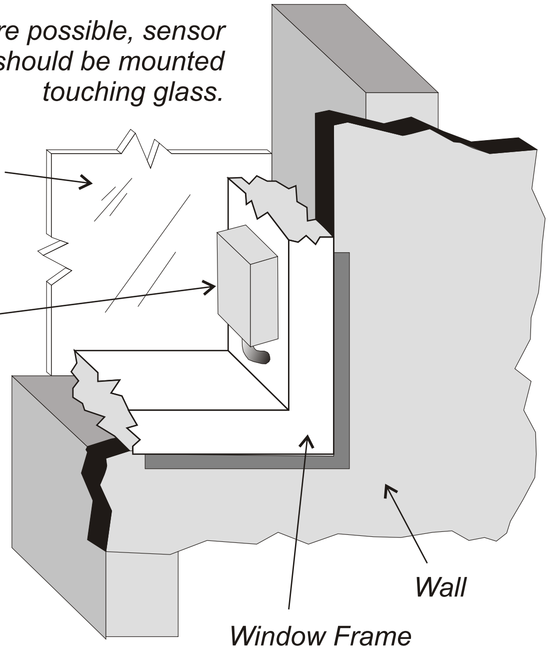


Figure 19
Sensor Mounting for Glass

Coverage for Continuous ¼ inch float (plate) and ¼ inch tempered glass is 5 feet radius.

Coverage for Continuous 1/8 inch float (plate) and 1/8 inch tempered glass is 4½ feet radius.

Coverage for laminated and armor-coated glass is limited to two feet or less.

In all cases, the installation should be tested to insure good coverage. For more information on sensor placement, refer to the manual shipped with the sensor.

FALSE ALARM TEST

1. Set the processor count to 1 and set sensitivity control to 1.
2. Tap the glass with a hard object such as a screwdriver handle in several places and verify that the processor Alarms.
3. Lower the sensitivity one increment at a time and Repeat the test until the processor stops responding.
4. Raise the sensitivity by one increment and repeat test.
5. When satisfied that the processor responds properly, set the processor to the glass break mode. The glass break mode on the Terminus™ processor is recommended for all glass applications. The only set up necessary for the glass break mode is the sensitivity adjustment.

Multi-Pane Windows

A multi-pane window is two or more panes of glass, each having a 5 square feet or less area, mounted in a common frame system. There are many similarities between shock protection of multi-pane windows and plate glass windows. For this reason only items peculiar to multi-pane windows will be discussed.

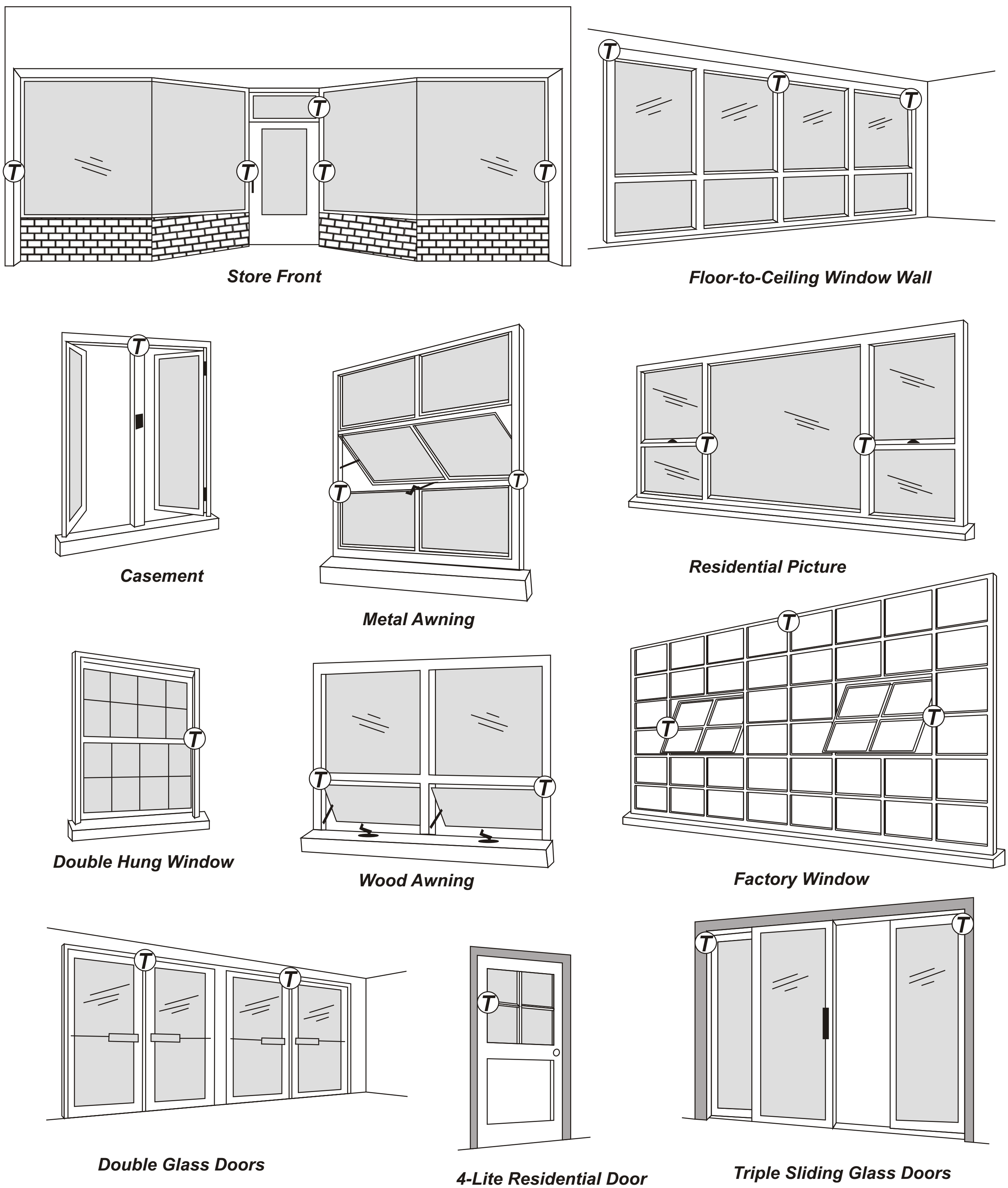
There are many sensor locations open to the installer when protecting a multi-pane window. As with continuous glass, sensors should not be more than two inches from the glass. In general the best sensor location for a multi-pane window is at the center of the frame structure. Coverage on multi-pane windows is a 3 foot radius. For more information on sensor placement refer to the manual shipped with the sensor.

Mounting on multi-pane windows is the same as on plate glass. Because of their construction multi-pane windows can rattle between panes of glass and frame pieces or between various frame pieces. The best solution to this problem is to have the windows repaired. If this is not practical, a damped sensor or processor adjustments can be used to avoid nuisance alarms. In some cases, caulking material around the glass panes is Very flexible and absorbs shock.

TABLE : MATERIALS AND SET-UP SUMMARY

MATERIALS	COVERAGE	COUNTS	SENSITIVITY	COUNT INTERVAL	PULSE WIDTH
Block (hollow) 6” min.	D = 12 ft.	1 to 3	High	Long	Short
Block (solid) concrete, brick 3 3/4” min.	D = 10 ft.	1 to 3	High	Long	Short
Gypsum ½”min.	D = 8 ft.	2 to 5	High	Long	Long
Wooden surface 1/8” min.	D = 8 ft.	2 to 5	High	Long	Long
Heavy metal 18 MSG	D = 20 ft.	3+	As Needed	15 - 30	Long
Sheet metals 26 MSG	D = 10 ft.	3+	As Needed	15 - 30	Long
Fiberglass 1/4” min.	D = 8 ft.	5 to 10	Less Sensitive	5 - 90	Long
Plate Glass 1/4” min.	D = 5 ft. Radius (3 ft. For frame-mounted sensor)	G/B	Low	N/A	N/A
Multi-plane	D = 3 ft. Radius	G/B	High	Long	Short

Figure 20 - Sensor Mounting Location Examples



Fences

The SP3223, SP2539 and SP2549 sensors are designed specifically for fence applications. The sensors are ideal for protection of chain link fence that is six to eight feet high. Each sensor covers a maximum of 10 feet and should be mounted on every post. Metal conduit must be used and must be attached to the fence. PVC conduit is too flexible and shock absorbing to be used for fence applications. For additional information on fence installations, refer to the ***Fence Intrusion Detection System Manual.***

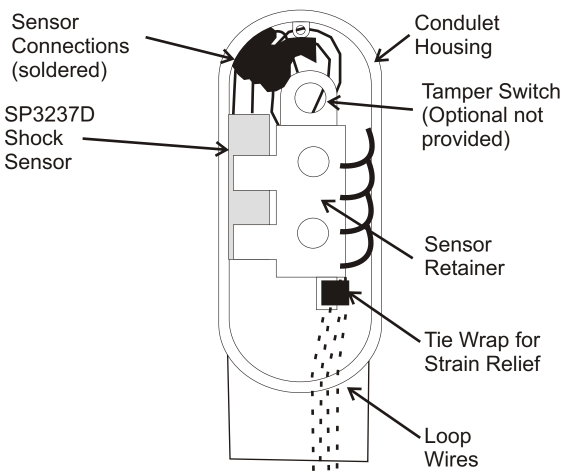
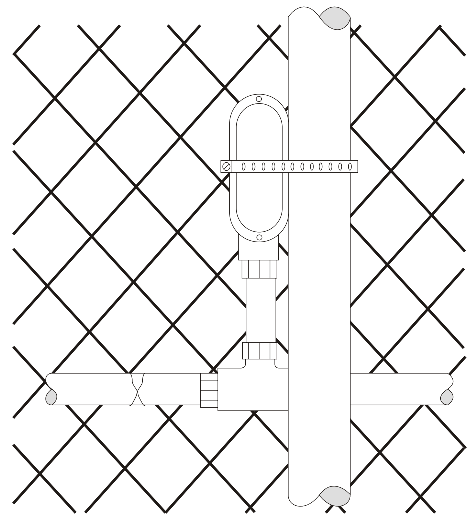


Figure 21
SP2539 Standard Fence Kit



SP2539

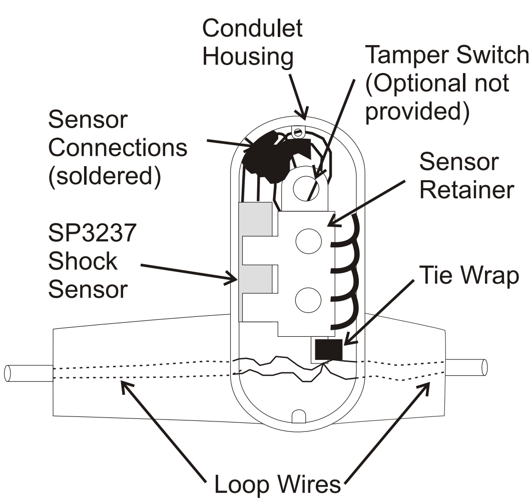
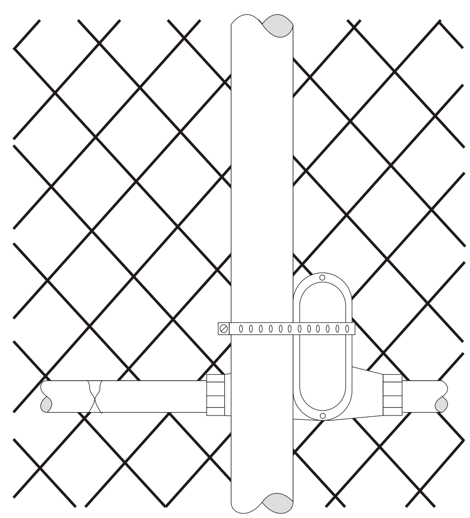


Figure 22
SP3223 Pass-Thru Fence Kit



SP3223

Terminus™

SHOCK DETECTION PRODUCTS

Install Manual

Terminus Products, Inc.
2240 Prospect Drive
Christiansburg, VA 24073
www.terminusproducts.com

Sales & Service: 1.866.680.TERM (8376)

Fax: 1.866.908.5655