



INDOOR PIRAMID

(Passive Infrared and Microwave Intruder Detector)

Installation Guide

Dated November 1, 2006

Instructions For:

Model SDI-76
Model SDI-77

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PIRAMID SPECIFICATIONS

Input Voltage:	8.5 VDC to 20 VDC
Current @ 12 VDC:	
SDI-76	155mA (LED's ON), 130mA (LED's OFF)
SDI-77	170mA (LED's ON), 140mA (LED's OFF)
R.F. Power Density:	120uW/cm ² at faceplate
Operating Temperature	-30° F to 130° F -34° C to 54° C
Operating Humidity	0 to 100% Humidity
Relay Contact Rating	. 1A, 50V - Form A and Form B (Jumper for Form C)
Sensitivity:	One to four steps in protection pattern
Stereo Doppler Range	SDI-76 - 15ft. to 75ft. SDI-77 – 30ft. to 200ft.
Stereo Doppler Target	3"/sec. To 10 MPH
Weight (with bracket)	2 lbs. 11 oz.

PIRAMID FEATURES

Long Range: SDI-76: 75ft. x 75ft. Standard SDI-77: 100ft. x 10ft. Standard
Supervised Stereo Doppler Microwave
Dual-Element Passive Infrared
Balanced Temperature Compensation Circuit
Compact, All Metal Housing
Digital Sensitivity Control Adjustment
Digital Range Control Adjustment
Enhanced Bird and Animal Immunity Adjustment
Interchangeable PIR Lens Modules
Form C, Solid State Relays
Analytic Walk Test LED's

PIRAMID – A BASIC DESCRIPTION

PROTECH's Passive Infrared and Microwave Intruder Detector (**PIRAMID**) uses a combination of microwave and passive infrared sensors to detect both the motion and the body heat of an intruder (see Figure 1). When **both** the microwave and infrared sensors detect an intruder at the same time, they trip master alarm relays which provide contact closures for an alarm device or central control panel.

If one kind of sensor goes into alarm and the other one doesn't, the master alarm relay will not be tripped. The passive infrared (PIR) and microwave elements verify each other's alarms, reliably catching intruders but rejecting the false alarms that often plague single technology devices.

For example, PIR sensors can sometimes go into alarm because of air drafts, air conditioners, heaters or some kinds of visible light. Microwave sensors are unaffected by these things, so they won't cause **PIRAMID** to go into alarm. On the other hand, microwave units can sometimes go into alarm because of harmless movement caused by such things as rattling doors or moving fan blades. Microwave signals may also pass through non-metallic doors and windows and detect motion outside the desired range. PIR sensors are virtually unaffected by motion and infrared light will not penetrate walls or windows. **PIRAMID** uses PIR technology to offset the inherent weaknesses in microwave technology, and vice versa.

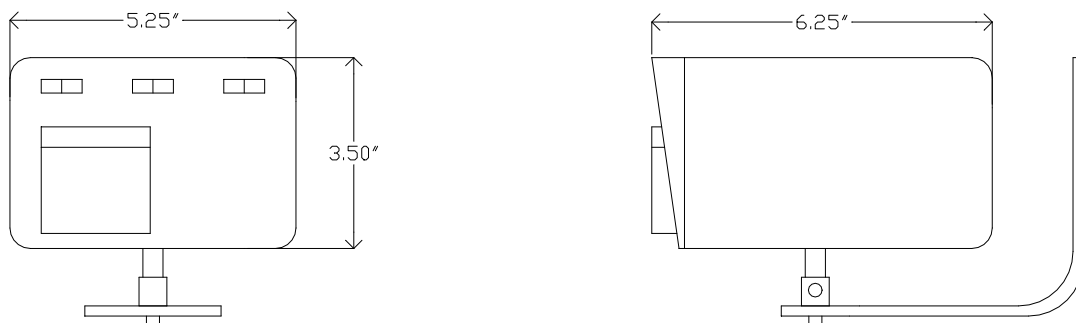


Figure 1 – PIRAMID Faceplate SDI-76/SDI-77

STEREO DOPPLER MICROWAVE

Unlike standard microwave units: **PIRAMID** has two receiving diodes, resulting in two receiving channel outputs. Internal circuitry compares the signal output of the two channels and determines whether an object is moving toward or away from the unit. This determination allows **PIRAMID** to reject a common cause of microwave false alarms: harmless back-and-forth motion caused by swinging signs, overhead doors and the like. An intruder moving a minimum distance in one direction will cause the microwave portion to go into alarm, but limited back-and-forth motion will not.

The microwave portion of **PIRAMID** is adjustable from approximately 15% of the entire range to the full stated range. (From 15ft. to 75ft. for the SDI-76. From 30ft. to 200ft. for the SDI-77).

Note: If the Stereo Doppler Microwave Portion of **PIRAMID** fails, the unit will lock in the alarm-mode. The unit will not function as a single technology unit.

DUAL-ELEMENT PIR

The passive infrared portion of **PIRAMID** has a side-by-side dual element detector. The voltage output of each element is opposite to the output of the other, and internal circuitry combines the two into a single output.

An Intruder crossing the field of view of one segment of the multi-segmented detector pattern will cause a large voltage swing, first in one direction, then in the other. On the other hand, large-area changes in the background infrared radiation in one segment of the detection pattern will result in little voltage swing, since the voltage outputs of the dual-element detectors are opposite and will cancel each other.

What does this mean to you? It means the **PIRAMID** is sensitive to changes in infrared energy caused by a moving intruder, but is insensitive to most other background changes that might otherwise cause a false alarm.

Balanced Temperature Compensation

As the temperature of the environment climbs above 85 degrees F, conventional PIR's become less able to distinguish a "hot" intruder from a "hot" background. **PIRAMID**, however, has a Balanced Temperature Compensation circuit that does two things as the temperature climbs above 85 degrees F.

1. It increases the sensitivity of the PIR portion – up to 3 time's normal sensitivity.
2. It makes the microwave portion accept more motion before going into alarm. Which offsets the increase in PIR sensitivity.

Balanced Temperature Compensation means the **PIRAMID** will maintain a stable, consistent protection pattern even when the temperature climbs into the 90's and above.

Summary of PIRAMID Installation Steps

Here is a summary of the steps you'll take to install **PIRAMID**. These are discussed in detail later in the manual.

Before going to the Job Site

1. Read this manual through to the end.
2. Verify that you have the right **PIRAMID** unit (SD1-76 or SDI-77) and the right PIR lens before going to the job site, if it is possible to do so. See "Planning the Installation" for details.
3. Replace the standard lens in your **PIRAMID** unit if you need a different coverage pattern. See "Changing the PIR Lens" for details.

On the Job Site

1. Evaluate the security needs and environmental characteristics of the space to be Protected.
4. Remedy or plan to avoid any environmental hazards that will cause obvious problems for either the Microwave or PIR portion of the unit.
3. Mount **PIRAMID** securely to a wall.
4. Wire **PIRAMID** to a power source and to an alarm device or central control panel.
5. Walk-test **PIRAMID** and adjust the unit as needed.

Planning the Installation

Whenever possible, **PIRAMID** should be mounted securely on a wall or other rigid surface at a height of 6 to 8 feet above the floor. It should be aimed so that an intruder will have to walk across its field of view rather than directly toward the unit or away from it. Avoid visual obstruction such as machinery, storage racks, posts, columns, partitions and furniture that may block the sensing pattern.

Careful consideration should be given to the environmental characteristics of the protected space. Avoid or remedy any environmental conditions that will cause obvious problems for either the microwave portion or the PIR portion of **PIRAMID**. It is generally advisable to direct the protection pattern toward the interior of the area to be protected rather than at an exterior wall.

- If possible, remove or secure anything in the protected zone that is likely to sway or Move periodically

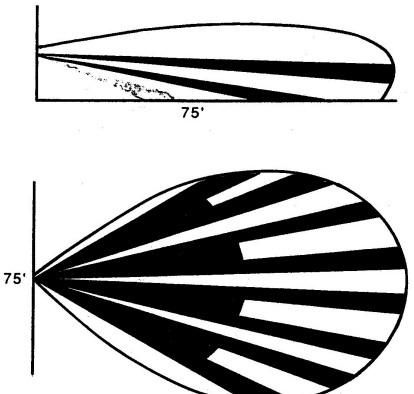
- To minimize non-metallic wall and window penetration of the microwave energy, set the microwave range at the minimum setting to achieve the desired coverage and direct the protection pattern away from windows and walls.
- **FOR THE MICROWAVE PORTION AVOID** – as much as possible – looking at fan blades, metal overhead doors, windows, and fluorescent lights.
- **FOR THE PASSIVE INFRARED PORTION AVOID** – as much as possible – heaters, air conditioners, drafty area, sunlight, open flames, car headlights and other obvious sources of rapid thermal change.
- Small animals if allowed to move close to the detector will cause alarms with any detector and the **PIRAMID** is no exception. Always mount the detector in a location with a clear field of view. Avoid beams in front of the detector. Pointing the detector so that the energy is parallel to the floor usually eliminates rodents as a problem since the rodents present too small a target for the microwave portion to sense at the point where the protection pattern just reaches the floor.
- When rodents are suspected to be present, it is advisable to use the Curtain pattern, Lens D, which doesn't have any protection patterns directed at the floor. If Lens D is not available, turn the A, B, C, G, and H lenses up side down (the letter designation will then be on the bottom). This will direct the protection patterns normally viewing the floor toward the ceiling, thus eliminating rodents on the floor as a nuisance alarm threat.

PIR Lens Coverage Patterns

There are two basic units in the **PIRAMID** family, the SDI-76 and the SDI-77. The standard coverage patterns for each of these units are shown in Figures 2 and 3 on page 7.

The standard PIR lens that came with your unit may be interchanged with other lenses to obtain coverage better suited for your application. These lenses are identified in the table below. Choose the lens that best fits the area to be protected: a large open space, a narrow corridor, a ceiling, etc. The top of your lens is marked with a letter designation identifying the lens pattern.

Note: You can rotate the PIR lenses in 90-degree increments in order to avoid Obstructions or to customize the coverage.

SDI-76 PIRAMID 90 DEGREE MW PATTERN	SDI-77 PIRAMID 60 DEGREE MW PATTERN
<p>Lens A – Wide Angle Max. Coverage: 75 ft. x 75 ft. Field of View: 90 Degrees No. of IR Protection Zones: 15 Plane 1 – 8 protection zones Plane 2 – 4 protection zones Plane 3 – 3 protection zones</p>	<p>LENS D – Vertical Barrier Max. Coverage: 100 ft. x 10 ft. Field of View: 10 degrees No. of IR Protection Zones: 9 No. of Vertical Protection Planes: 7</p>
<p>LENS B – Medium Angle Max. Coverage: 75 ft. x 45 ft. Field of View: 60 Degrees No. of IR Protection Zones: 13 Plane 1 = 6 protection zones Plane 2 = 4 protection zones Plane 3 = 3 protection zones</p>	<p>LENS C – Narrow Angle Max. Coverage 125 ft. x 15 ft. Field of View 10 degrees No. of IR Protection Zones: 8 Plane 1 – 1 protection zone Plane 2 = 1 protection zone Plane 3 = 4 protection zone Place 4 = 2 protection zone</p>
<p>LENS G – High Density Max. Coverage: 75 ft. x 50 ft. Field of View: 88 Degrees No. of IR Protection Zones: 23 Plane 1 = 12 protection zones Plane 2 = 4 protection zones Plane 3 = 4 protection zones Plane 4 = 3 protection zones</p>	
	

Standard Coverage Pattern SDI-76

Wall-Mounting PIRAMID

1. Select a mounting location with a firm base and a good field of view across the likely path of an intruder.

*Remember that **PIRAMID** should be mounted so that an intruder must walk across its sensing pattern rather than directly toward or away from the unit. Avoid visual obstructions that may block the sensing pattern.

2. Loosen the two screws at the sides of the **PIRAMID** housing. Remove the circuit board assembly, before attempting to mount the bracket and housing.
3. Use screws to mount the bracket and housing to the wall at a height of 6 to 8 feet above the floor.

*A mounting height of 6 to 8 feet will give you an acceptable “dead zone” directly underneath the unit. A dead zone is the small area where an intruder will not be detected. Such a zone is unavoidable, but it should pose no problem as long as an intruder cannot reach it before being detected. The higher you mount **PIRAMID** the larger the dead zone directly beneath the unit. To minimize the dead zone, aim the unit slightly downward (3 degrees to 4 degrees).



Figure 4 – Top View – PIRAMID Circuit Board Assembly SDI-76/SDI-77

Wiring and Preliminary Set-UP

1. With the housing mounted on the wall, insert the wire through the wire-entry hole, which is located at the bottom of the housing. Use a minimum 18-gauge wire for wire runs greater than 50 feet.
2. Insert the circuit board assembly partway into the mounted housing.
3. Route the wire through the wire guides on the printed circuit board.
4. Connect the wires to the terminal strip in accordance with the diagram on the printed circuit board, which is reproduced in Figure 5.

Note: Observe correct polarity at the power terminals, or the replaceable fuse will blow when power is applied.

Note: For best shielding from Radio Frequency Interference (RFI) and transients due to lightning or electrostatic discharge, terminal 1 (HOUSING GND) should be connected to Cold Water Ground. Terminal 1 is connected by a spring contact to the housing, but is not otherwise connected to the electronic circuit.

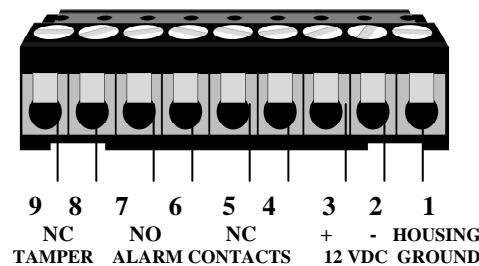


Figure 5 – PIRAMID Terminal Connections SDI-76/SDI-77

5. Set the microwave range control (see Figure 4) to the **LOWEST** estimated range to achieve area coverage.

Note: The microwave control wheel in **SDI-76 PIRAMID** adjusts the range from 15ft. to 75ft. The microwave control wheel in **SDI-77 PIRAMID** adjusts the range from 30ft. to 200ft.

8. Set the 2-position LED switch (see Figure 4) to the “ON” position.
9. Slide the circuit board assembly back into the housing, pulling the excess wire out of the bottom of the unit. Fasten the two side screws.
10. In most instances, it is best to aim the unit at slightly downward angle of 3 degrees to 4 degrees. This minimizes the small “dead zone” directly underneath the unit.

Walk-Testing and Fine Adjustments

1. Apply power and allow at least 1 minute for **PIRAMID** to stabilize.
2. Walk-test **PIRAMID** by entering the coverage area, watching the LED's on the front of the unit. Your goals are:

-To have the Master Alarm LED turn on whenever you take as many as four steps into the coverage area.

-To have no alarms when there is no intrusion into the coverage area.

-To reduce **PIRAMID** microwave power to the **LOWEST** possible range that still trips the Master Alarm Relay whenever you take as many as four steps into the coverage area.

Figures 6 and 7 and the associated commentary will help you walk-test the unit.

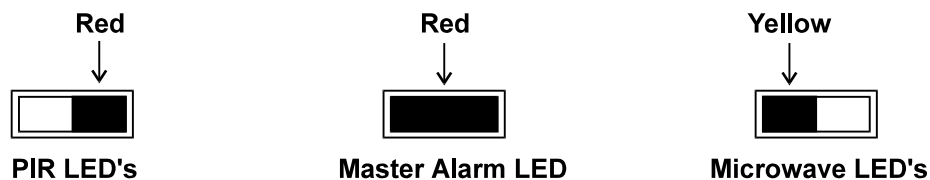


Figure 6 – PIRAMID in Alarm – PIR, Master and Microwave Alarm LED's On

When the **RED PIR LED** is **ON** and the **YELLOW MICROWAVE LED** is **ON** at the same time, both detectors are in alarm. The **RED MASTER LED** will also turn on indicating that the Master Alarm relay has changed state (de-energized). This is a solid state relay, so you won't hear any "clicks" when it changes state.

Note: It is recommended that the unit be walk-tested at least once annually.

If the Alarm LED's Don't come On:

First, check to see that you turned the LED switch to the "ALL ON" position.

If the **YELLOW MICROWAVE LED** does not turn on during walk-test, increase the range by using the microwave adjustment in the unit.

If the **RED PIR LED** does not come on during the walk-test, adjust the mounting angle of the unit, as it may be too high or low to detect a target.

Note: The mounting angle is critical. Shifting the angle a small amount will make a large difference

If the **RED PIR LED** still does not come on check the desired coverage compared to the Actual coverage of the PIR lens in your **PIRAMID** unit. An optional lens kit may be required to obtain area coverage (see “PIR lens Coverage Patterns” and “Changing the PIR Lens” in this manual).

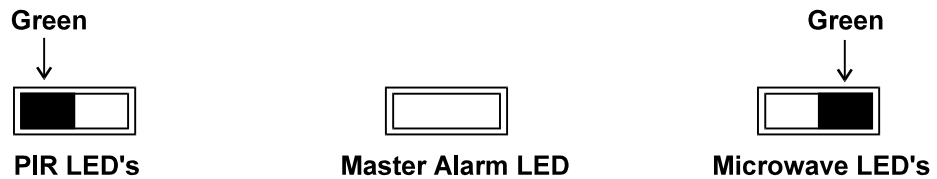


Figure 7- PIRAMID Ready and Stable – Both Green LED’s On

If the **GREEN PIR LED** is on, the PIR element is ready and stable. If the **GREEN MICROWAVE LED** is on; the microwave element is ready and stable. If **BOTH GREEN LED’S** are on, then both elements are stable, there are no environmental hazards interfering with either element, and the unit is ready to walk-test.

When the green LED’s Turn OFF:

When the green LED’s turn off, the corresponding detectors are near the alarm threshold. If both of the green LED’s will not **STAY ON** when no one is in the coverage area, there is an environmental hazard interfering with the corresponding detector.

If the **GREEN PIR LED** won’t stay on, there is interference with the PIR detector. Possible sources of PIR interference include heaters, air conditioners, drafty areas and other sources of rapid temperature change. Fix the environmental problem, if possible. If the problem persists, you may have to relocate **PIRAMID** or try a different PIR lens.

If the **GREEN MICROWAVE LED** won’t stay on, there is interference with the microwave detectors. Remove or secure anything in the protected zone that is likely to sway or move periodically. Minimize non-metallic wall penetration by setting the microwave range at the **MINIMUM** to achieve the desired coverage.

3. Even if you don’t seem to have a problem now with microwave wall penetration, be sure to adjust the microwave element to the **LOWEST** possible range that still trips the Master Alarm Relay whenever you take as many as four steps into the coverage area.

Note: The most common cause of microwave false alarms is a range too far for the desired coverage.

4. When you are satisfied that **PIRAMID** is sensitive and stable, move the LED switch to the “**ALARM**” position.

The unit will now draw less current, and it will be more difficult for an intruder to determine the protection pattern by observing the LED’s.

Range, Sensitivity and Enhanced Bird Immunity Adjustments

The key to success in many applications is the proper adjustment of the sensor’s range and sensitivity.

RANGE CONTROL

The Range Control adjusts the distance (or how far) the sensor detects. It may be necessary to set at the higher range settings (70, 80, 90 and 100 percent of maximum) to attain the maximum desired protection pattern coverage.

Note: Although the sensor can be set at maximum range and operate properly, the “rule of thumb” is to set at the lowest setting to attain the desired range.

SENSITIVITY CONTROL

The Sensitivity Control adjusts the amount of movement required for an alarm condition. The Sensitivity Control is very precise as the **PIRAMID** can determine the exact “distance in inches” an object must move to initiate an alarm. The following table shows the movement required based on the setting.

Sensitivity Switch Settings	Microwave Sensor (Movement Required for MW Sensor Alarm)	Passive Infrared Sensor (# of IR Edges Violated for a PIR Sensor Alarm)
0 (Max.)	1 inch	1
9	2 inches	1
8	3 inches	1
7	4 inches	1
6	5 inches	1
5	6 inches	1
4	7 inches	1
3	8 inches	1
2	9 inches	1
1 (Min.)	10 inches	1

FIGURE 8 - PIRAMID Sensitivity Control Adjustment Table

VERY IMPORTANT: The Sensitivity Control is the most critical adjustment for false-alarm-free operation. It is best to set in the lower sensitivity settings.

The **PIRAMID** provides good detection in all ten sensitivity settings with respect to movement toward or away from the sensor. Keep in mind that in the lower sensitivity settings (1,2,3,4, and 5) transverse detection (“crosscatch”) is very sluggish. Therefore, it is important for the sensor to be located so that the most likely point of travel is slightly toward or slightly away from the sensor.

Proper mounting location of the **PIRAMID** will enable lower sensitivity settings. Lower sensitivity settings will enhance false-alarm-free performance.

ENHANCED BIRD/ANIMAL IMMUNITY CONTROL SWITCH

A two-position switch adjusts the sensor’s immunity to birds and small animals. Note: The PIRAMID sensor is shipped from PROTECH in the *Standard Immunity Setting*.

Standard Immunity Setting – Offers excellent immunity with respect to birds and small animals and is the best setting in most applications. The PIRAMID sensor will provide good nuisance alarm rejection as well as good detection sensitivity in the *Standard Immunity Setting*.

Enhanced Immunity Setting – Often used as a last resort to eliminate nuisance alarms caused by an abundance of birds and animals in the protected area. The use of a Pet Alley Lens Module (Lens A-Pet, Lens B-Pet and Lens C-Pet) in conjunction with the *Enhanced Immunity Setting* would also be highly recommended in animal prone applications. In the *Enhanced Immunity Setting*, overall detection sensitivity of the PIRAMID sensor will be reduced approximately 20%.

Caution: In the *Enhanced Immunity Setting* the speed of detection is significantly reduced. Therefore, the PIRAMID may not detect an intruder or vehicle traveling at a rate of speed above 3 ½ Feet Per Second.

Note: Each sensor should be periodically walk-tested to ensure that the required detection is attained.

Changing the PIR Lens

1. See “**PIR Lens Coverage Patterns**” in this manual to determine the pattern that would best suite your application.
2. Turn the power off to the **PIRAMID** unit and remove the circuit board assembly from the housing. See “**PIR Lens Coverage Patterns**” in this manual to determine the pattern that would best suit your application.
3. Look behind the PIR lens on the faceplate. Gently pry the tabs open that hold the lens kit and PIR circuit board to the faceplate.
4. Separate the circuit board from the lens kit.

5. Insert the desired lens kit into the faceplate, followed by the PIR circuit board. For standard coverage, be sure to orient the lens kit with the letter designation on the top. Be sure that the circuit board and lens kit is properly seated in the restraining tabs.
6. Insert the circuit board assembly back into the housing and perform a walk-test to proper coverage and operation.

FLUORESCENT LIGHT FILTER MODULE (Model FF-3)

The FF-3 Fluorescent Filter Module is a printed circuit board assembly that can be factory or field installed on all PIRAMID Indoor Sensors. The Fluorescent filter module is generally necessary when the fluorescent lighting is within 20 ft. of the sensor and will be left on during the protected hours. The FF-3 filters out fluorescent light interference and enables the sensors to be used in close proximity without affecting range, sensitivity or stability.

Factory Installation of FF-3

When the FF-3 Fluorescent Filter Module is factory installed it is soldered in place and cannot be removed. This would be considered a permanent-mounting configuration.

Field Installation of FF-3

When the FF-3 Fluorescent Filter Module is not installed at the PROTECH factory the PIRAMID sensor is supplied with an 8-pin socket and plug-in jumper to enable field installation of the FF-3 Fluorescent Filter Module. The plug-in jumper must be installed in the 8-pin socket when the sensor is used without the accessory FF-3 Module. Please note in Figure 9 the proper orientation of the jumpers on the soldered on the underside of the main printed circuit board. A plug-in jumper is installed in the 8-pin socket at the factory in order for the sensor to