Home Security - III

Intrusion Detection – Sensors

Sensors detect the intrusion and are an integral part of any intrusion detection system. Sensors may be placed either at the perimeter of the protected area, or within the protected area or a combination of both.

Types of Sensors

- Reed switches.
- Passive Infra-red detectors.
- Ultra sonic detectors
- Microwave detectors.
- Compact surveillance radar.
- Photoelectric beam.
- Glass break detector.
- Smoke, heat and gas detector.
- Vibration sensors.

Sealed reed switches

The hermetically sealed reed switch is a very common type of sensor that operates with an electrically conductive reed switch that is either normally open or normally closed. This switch is under the influence of a magnetic field. When the magnet is moved away from the reed switch, the reed switch either closes or opens, based on whether or not the design is normally open or normally closed. This action coupled with an electric current (typically at 12v dc) allows an alarm control panel

to detect a fault on that zone or circuit. These types of sensors are very common and are found either wired directly to an alarm control panel, or they can typically be found in wireless door/window contacts as sub-components.

Passive infrared detectors

A passive infrared sensor detects motion.

The passive infrared (PIR) motion detector is one of the most common sensors found in household and small business environments. It offers affordable and reliable functionality. **Passive refers to the fact that the detector does not generate or radiate its own energy -** it works entirely by detecting the heat energy given off by other objects.

PIR sensors do not detect motion; rather, they detect abrupt changes in temperature at a given point. As an intruder walks in front of the sensor, the temperature at that point will rise from room temperature to body temperature, and then back again. This quick change triggers the detection. PIR sensors may be designed to be wall or ceiling mounted. These are available in narrow "point" detectors to 360 degree field of view. PIRs require a power supply in addition to the detection signalling circuit.

Ultrasonic detectors

Using frequencies between 15 kHz and 75 kHz, these active detectors transmit ultrasonic sound waves that are inaudible to humans. **Movement of an object results in a change in the ultrasonic frequency to the receiver relative to the transmitting frequency.**

The ultrasonic detector operates by the transmitter emitting an ultrasonic signal into the area to be protected. The sound waves are reflected by solid objects (such as the surrounding floor, walls and ceiling) and then detected by the receiver. Because ultrasonic waves are transmitted through air, then hard-surfaced objects tend to reflect most of the ultrasonic energy, while soft surfaces tend to absorb most energy.

When the surfaces are stationary, the frequency of the waves detected by the receiver will be equal to the transmitted frequency. However, a change in frequency will occur as a result of the Doppler principle, when a person or object is moving towards or away from the detector. Such an event initiates an alarm signal. This technology is considered obsolete by many alarm professionals, and is not actively installed.

Microwave detectors

This device emits microwaves from a transmitter and detects any reflected microwaves or reduction in beam intensity using a receiver. The transmitter and receiver are usually combined inside a single housing (monostatic) for indoor applications, and separate housings (bistatic) for outdoor applications. To reduce false alarms this type of detector is usually combined with a passive infrared detector.

Microwave detectors respond to a Doppler shift in the frequency of the reflected energy, by a phase shift, or by a sudden reduction of the level of received energy. Any of these effects may indicate motion of an intruder.

Compact Surveillance Radar

Compact Surveillance Radar emits microwaves from a transmitter and detects any reflected microwaves. **They are similar to microwave detectors but can detect the precise location of intruders in areas extending over hundreds of acres.** With the capability of measuring range, angle, velocity, direction and size of the target, a CSR is able to pinpoint a precise GPS coordinate of an intruder. This target information is typically displayed on a map, user interface or situational awareness software that defines geographical alert zones or 'geofences' with different types of actions initiated depending on time of day and other factors. CSR is commonly used to protect outside the 'fenceline' of critical facilities such as electrical substations, power plants, dams and bridges.

Photo-electric beams

Photoelectric beam systems detect the presence of an intruder by transmitting visible or infrared light beams across an area, where these beams may be obstructed. To improve the detection surface area, the beams are often employed in stacks of two or more. However, if an intruder is aware of the technology's presence, it can be avoided. The technology can be an effective long-range detection system, if installed in stacks of three or more where the transmitters and receivers are staggered to create a fence-like barrier. Systems are available for both internal and external applications. To prevent a clandestine attack using a secondary light source being used to hold the detector in a 'sealed' condition whilst an intruder passes through, most systems use and detect a modulated light source.

Glass break detection

The glass break detector may be used for internal perimeter building protection. **Glass break acoustic detectors are mounted in close proximity to the glass panes and listen for sound frequencies associated with glass breaking.**

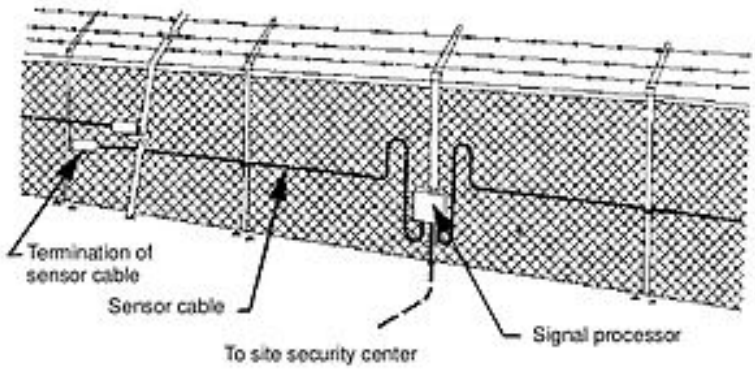
Seismic glass break detectors, generally referred to as "shock sensors" are different in that they are installed on the glass pane. When glass breaks it produces specific shock frequencies which travel through the glass and often through the window frame and the surrounding walls and ceiling. Typically, the most intense frequencies generated are between 3 and 5 kHz, depending on the type of glass and the presence of a plastic interlayer. Seismic glass break detectors "feel" these shock frequencies and in turn generate an alarm condition.

Smoke, heat, and carbon monoxide detectors

Smoke detectors and heat detectors protect from the risk of fire and carbon monoxide detectors protect from the risk of carbon monoxide. Although an intruder alarm panel may also have these detectors connected, it may not meet all the local fire code requirements of a fire alarm system. Traditional smoke detectors are technically ionization smoke detectors which "create an electric current between two metal plates, which sound an alarm when disrupted by smoke entering the chamber. Ionization smoke alarms can quickly detect the small amounts of smoke produced by fast

flaming fires, such as cooking fires or fires fuelled by paper or flammable liquids." A Photoelectric smoke detector contains a light source in a light-sensitive electric sensor, which is positioned at a 90-degree angles to the sensor. "Normally, light from the light source shoots straight across and misses the sensor. When smoke enters the chamber, it scatters the light, which then hits the sensor and triggers the alarm. Photoelectric smoke detectors typically respond faster to a fire in its early, smouldering stage – before the source of the fire bursts into flames."

Vibration sensors



Strain-sensor cable installed on a chain-link/barbed-wire fence

These devices are mounted on barriers and are used primarily to detect an attack on the structure itself. The technology relies on an unstable mechanical configuration that forms part of the electrical circuit. When movement or vibration occurs, the unstable portion of the circuit moves and breaks the current flow, which produces an alarm. The technology of the devices varies and can be sensitive to different levels of vibration. The medium transmitting the vibration must be correctly selected for the specific sensor as they are best suited to different types of structures and configurations.

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