LIMITED ENERGY RESOURCE CENTER

BASICS OF BURGLAR ALARM SYSTEMS

Burglar Alarms

In today's market of no less than 20 manufacturers of alarm panels, it is reassuring that one constant still remains: the alarm panel. Try to think of an alarm as a person. If the alarm is the whole person, then the alarm panel is the brain of that person.

PANELS

The alarm panel functions much like a human brain. It collects information from its sensor, processes that information and responds to the received inputs. In the human body there are many more ***circuits*** (nerves) delivering messages to the brain than in an alarm, but, the concept is valid. The human has circuits for touch, sight, hearing, and taste. The alarm panel can have circuits for touch, door and window contacts, sight, photo electric beams and PIR's, and hearing, microwave and ultrasonic detectors. How the panel responds to this received information depends upon what it has been programmed to do.

INPUT CIRCUITS

All alarm panels on the market today have a minimum of 4 protective loop circuits, and, most have many more (up to 96). These circuits can be used for many types of information gathering sensors. Normally circuits are designed to input one or more of the same type sensor, say, all the entrance doors to a premises. The next circuit might have some or all of the windows on it. Both of these circuits are considered to be perimeter circuits or loops. The next circuit could have passive infrared detectors to see movement of heat emitting sources. Another circuit might have smoke detectors on it. Still another might have a wireless medical alert, or hold-up device.

In each case, when a circuit reports a problem the alarm panel needs to respond correctly to that information. The response will be determined by how the panel was programmed and whether the circuit is to be responded to on a 24 hour basis or only when the panel has been "armed" (turned completely on).

CONTROL CIRCUITS

The normal ***control circuits*** on an alarm panel are those connecting keypads from remote locations directly to the panel. These keypads are used to turn the panel on or off. Remember that some circuits could be programmed to be on all the time, such as, fire protection, and hold-up circuits.

POWER CIRCUIT

Just as the human needs food and water to survive the alarm panel needs electricity to survive. The alarm panels of today normally run on 12 VDC. The transformer is normally rated at from 16 to 18 volts and 20 to 50 milliamps. This is the food the panel needs to operate. Like its human counterpart the panel has

stored up some fat just in case the AC electricity is cut off for a while. Its internal battery will keep the panel running for up to 7 days. During normal operations the panel accepts the 16 to 18 volts AC and converts it to 12 volts DC then splits the DC voltage into two internal circuits, one on which to operate and the other to charge the battery.

OUTPUT CIRCUITS

Again, like the human, the alarm panel has many ways to let someone know that it has received some information. This normally is done two ways.

- 1. By calling up a central station to notify them of a problem.
- 2. Locally by setting off sirens, bells, and or strobe lights.

In the following sections we will delve into the inner workings of the different sensors the alarm industry uses today.

Input Circuits & Devices

Although this section covers many of the different types of ***input devices*** (sensors), it does not cover all the different types on the market today. The ones covered are the most common and come in a myriad of different configurations and are made by many different manufacturers.
The first thing we need to do is define the different electrical circuit types or loops to which these sensors are made to be wired.

FOUR CIRCUIT TYPES

The alarm industry ***has 4 different types of circuits*** that are commonly used in the protective loops. These are known as normally open, normally closed, the EOL or end of line resistored circuit and the multiplexed circuit. All circuits shall be of #22 AWG-Cu, for burglar, hold up or medical and #18 AWG-Cu solid conductor for fire circuits.

NORMALLY OPEN CIRCUIT

The ***normally open circuit*** is the most unsecure of all the protective loops. The reason is that the panel has no reference to verify that the circuit has not been cut, since in its normal state there is no completed circuit for the panel to know the wiring and protective devices are in tact.

NORMALLY CLOSED CIRCUIT

The ***normally closed circuit*** was the standard for many years. As the name implies in its normal "non-alarmed" state the panel can see that there is a clear constant flow of electricity throughout the loop.

END OF LINE RESISTORED CIRCUIT

Again as the name indicates, the ***EOL circuit*** or loop has a ***resistor at the furthest point of the circuit from the panel***. This resistor lets the panel know that the circuit is in tact. Although the closed loop circuit had this capability, there was an outside chance that a set of wires could be shorted together and thus cutting any sensor beyond that point out of the circuit. With the end of line resistor at the furthest point and connected at the last sensor no part of the circuit could be cut without the panel seeing the change. A huge majority of today's panels use this type of protective loop technology. The panels are looking for a known resistance (within a given percentage tolerance) instead of either a open or closed condition. Both normally open and normally closed sensors can be used on this type circuit.

MULTIPLEXED CIRCUITS

These circuits are normally arranged in series and ***each sensor has a transmitter*** within it to transmit a signal at certain intervals to the panel to let it know all is well. If a sensor fails to transmit or transmits the wrong code the panel considers it an alarm. This is far and away the most secure of all the input circuit types. Although it is also by far the most expensive. It is not just expensive because of the technology, but, also because of the cost of the transmitters at each protected point.

SENSORS - INPUT DEVICES CONTACTS

Contacts, better known as switches, come in both single and 2 part types. The single piece contact is also known as a ***plunger switch***. This switch is, with the plunger in, normally a closed circuit type sensor. When the door/window it is protecting is opened, it opens and causes the alarm to go off. Some of these switches instead of having a standard spring loaded button as the triggering device, have balls that are kept depressed until activated; this allows the switch to be used in more applications than the standard plunger type.

Magnetic contacts, like the *plunger switch,* come in many different configurations. The two most often used are the recessed and the surface mounted switch. The ***recessed switch*** is normally 3/8" diameter and approximately 1" long. Its magnet is the same size. The switch is embedded in the frame of the door or window with the wire leads hidden inside the wall. The magnet is embedded in the door or window so it lines up with the switch. Most of these switches are normally closed and open the circuit when the door or window opens. The ***surface mount*** version of the contacts act the same as the recessed versions but can be seen so are not normally used in residential installations. As indicated before, usually contacts are normally closed, but most are available in normally open as well as "form C contacts" that have 3 wires coming from them and can be either normally open or closed depending how they are wired into the circuit.

FOIL & LACING

One of the oldest and most time tested sensors is ***window foil***. You have all seen it from time to time. This was the only way to protect windows for many years.

There are two types of foil, the first is the self sticking type, and the second does not have adhesive. There are many different kinds of foil within each of these types. Foil can range from 5/32" wide and .001 thick to 1" wide and .010 thick. To be U.L. listed for a UL certified installation the foil cannot exceed .0015 in thickness and no more than 1/2" wide and has to be applied in a prescribed manner depending upon the type of glass it is being used on.

Normally when one installs foil on windows it is placed parallel to at least 3 sides of a window pane if not all 4 sides. The foil is normally located between 2.5" and 4" in from the edge of the window on all sides; this of course does not include the entry and exit ends of the foil circuit.

On tempered glass the foil pattern is also prescribed by U.L but is only required to be a circuit running along the top of the door.

Remember when using foil:

- 1. It does have a maintenance factor to it. Depending where it is used, you might have to do service calls to repair tears that will occur from everyday use of the doors or windows it is used on.

- 2. It physically becomes part of the protective circuit and acts as a wire in that circuit.

- 3. Because of the nature of foil and the adhesives used to stick it to glass, foil cannot be applied in temperatures under 40 degrees fahrenheit. Once it is applied though there is no temperature problem.

- 4. Always remember when installing or repairing foil to use a clear varnish to protect the foil from being scratched.

Foil can also be used on hollow doors and other items in a zigzag design to protect from someone breaking through the protected door. The zigzag design should parallel every 8".

Lacing or trap wire is a very thin single solid conductor used quite similarly to foil but on solid objects such as temporary plywood panels to cover a broken window.

Lacing wire is also used to protect skylights by making a grid of it run both back and forth and sideways to checker board the windows expanse in no larger than 6" squares.

The wire itself is very thin and has no insulation except a thin black varnish applied to it to make it harder to see. Other uses of Lacing wire would be to trap air conditioners that are installed in window areas, and large vent openings to keep people from using them to enter the premises.

POWERED SENSORS

As the name indicates, all of the detectors listed hereafter require 12 VDC to power them. Because of this, they require a 4 conductor cable to connect them to the panel. Two conductors (normally red and black conductors) for the 12 VDC and two conductors (normally green and yellow) for the protective loop.

This is a list of the powered sensor detectors on the market by technology type:

Passive Infrared Detectors
Ultrasonic Detectors
Microwave Detectors
Dual Technology Units
Photo Electric Beams
Glass Break Detectors

PASSIVE INFRARED DETECTORS

These are the newest and most popular single detector technology in use today.

As the name implies, this detector is passive, it emits no light, sound, or radio transmission. The passive infrared through either; 1) a lens, or 2) by use of mirrors, focuses a pattern of sample areas of a room looking for a change in the ambient temperature. The newest models are looking for *the movement of a heat emitting source.* When the sensor sees this movement, it causes a relay to trigger within the unit which is tied into the protection loop and is then processed by the alarm panel.

Different types of passive infrareds (PIR's) are on the market that can be ceiling mounted or wall mounted. Each has at least one protection pattern and most can be used to either protect a complete 35' x35' room or a 6' x 80' hallway.

As a false alarm prevention method, most if not all PIR's have circuits within them to allow for a alarm to occur only if more than a preset number of protected fields sense an intruder.

ULTRASONIC & MICROWAVE DETECTORS

I have bunched both technologies into one subsection because there are more similarities shared by the two than there are differences.

Both of these units:

- 1. Use the Doppler theory to operate. This is to say that both emit a signal and listen for that signal to bounce off solid objects within the protected area and return to the unit. If a solid object within the protected area moves the returning signal will change, thus causing an alarm.

- 2. Both units are volumetric by nature. This means that both can cover a room size area with no problem. But make sure that, in covering a room, the units signal is not blocked by a room divider.

- 3. Both units can be had with different protection patterns making them useful in many types of applications.

The ***main differences*** are;

- 1. The ***ultrasonic units*** transmit and listen for sound waves and as such are more sensitive to movements within their pattern of coverage. They can also be blocked by an item being placed in front of them. They can also false alarm if a piece of paper falls from a desk. They cannot see through a solid object.

- 2. ***Microwave units*** transmit radio signals (10 gig frequency range) and these signals do penetrate solid objects. False alarms can occur when the signal penetrates the protected areas walls and someone walks past the protected area on the other side of the wall.

DUAL TECHNOLOGY UNITS

As the name implies, dual technology detectors utilize two different technologies, both having to be tripped to cause an alarm. The most common of these detectors is made up of a passive infrared and a microwave unit. Both are housed in one unit, and both cover the same protection area.

The main reason for using dual-tecs is to cut down on the possibility of false alarms. If you think about this concept it is quite valid. Now you have a unit that:

- 1) has to see movement of a heat emitting object, and,

- 2) the object has to be solid and of reasonable size to cause the microwave to trigger.

The newest entries in the dual-tec market can now tell the difference between 3 cats, or a dog, and a human and only trigger when a human trips the detector.

PHOTO ELECTRIC BEAMS

Photo electric beams (PE beams) have been used in the alarm industry for the last 50 years. Not without many changes. Today's PE beams use a light emitting diode to produce a pulsed light beam at a tuned transmission rate and the receiver is tuned to look for that pulse rate or go into alarm.

PE beams come basically in two different types. The first is the interior type. This usually is a single light source transmitter and a single receiver. The exterior PE beam comes in both dual and quad transmission

beams and receiver units. The reason for the multiple beam transmission is that all beams need to be tripped within a preset time to cause an alarm. This cut down on false alarms because a leaf can't trigger all the beams at the same time.

PE beams are normally mounted with the bottom beam being between 18" to 30" off the ground.

PE beams come in different effective lengths from as small as a 5 foot area up to 750 feet.

As PE beams can only detect an alarm when someone or something passes between the transmitter and the receiver they are considered to be point to point protection and not volumetric protection. They are excellent in splitting up a large area within a premises and also for protecting a fence line.

GLASS BREAK DETECTORS

This field of protection devices is broken into 2 different sub-fields of detectors. The first is the single pane protector device. This device is normally a ***piezo electric detector*** tuned to feel the breaking of glass. It is used by mounting it to the glass it is to protect and will only trigger on that specific piece of glass.

The second type of ***glass break*** detector is ***volumetric.*** There are many types of this kind of detector. The most stable type of volumetric glass break detector is one that both listens for the distinct sound frequency and amplitude of the glass breaking, but also the infra shock caused by the glass breaking. This type of detector can cover up to a 50' by 50' room with glass on all walls.

SPECIALTY DETECTORS

The first of the specialty detectors would be the family of ***hold-up detectors***. Hold-up detectors can be as simple as a plunger switch near a cash drawer to a money clip in the cash register to a foot switch near the register. These devices are normally open circuited but can also be wireless transmitters (see below for wireless).

Medical alert transmitters can also be introduced into the system by using either fixed buttons or wireless transmitters the customer can carry and push if they have a problem.

Let us say you are installing a hardwired alarm system in a finished bank. They want protection in 4 areas in which you cannot conceal wiring. Why not use a ***wireless receiver*** capable of receiving 4 different signals and processing those signals to 4 different relays. This would give you the capability of installing a wireless PIR on one circuit and 3 wireless hold-up devices like money clips or hold-up buttons.

Vault security is another of those specialty devices. This can be as simple as a ***vault contact*** to a ***induction field detector*** that senses any mass object enter into its field. Both are excellent. Remember when using a vault or safe contact (these are normally covered contacts so they can't be circumvented) that the safe or vault door cannot be opened more than 4 cm. before the switch goes into alarm.

Finally, there are ***thermometers***, to notify us of changes in freezer temperatures or those in greenhouses. Also available are ***water detectors*** to place in a basement to warn of water entering. Both of these are great sales tools especially when dealing with commercial customers.

Fire Detection Devices

A vast majority of the alarm panels on the market today will accept fire alarm detectors as specific protection circuits or loops. Most of these panels, unless specifically designated as U.L or F.M (Underwriter Laboratory or Factory Mutual) approved, *cannot be used where a fire system is required*, but only as additional protection from loss.

Most required (Underwriter Laboratory or Factory Mutual) systems are fire alarm systems only. Among other technical reasons that fire panels are separated from burglar alarm panels is the requirement that the panels have 2 telephone lines to call into the monitoring station. This redundancy serves as a safeguard; in case the fire burns one line, the second line can be used to call for help.

THREE DETECTION CIRCUIT TYPES

There are 3 different types of fire detection circuits used in today's fire alarm panels. As in the burglar alarm panels, the fire panels can use ***end of line resistored circuit***, either 2 or 4 wire, depending upon what the sensor requires. The second most common type of circuit is the ***Grade A circuit***, This circuit, in its simplest form is a 2 wire circuit that connects to all the sensors in parallel and then returns to the panel. If this type circuit develops a line fault in a protective circuit the panel will feed the circuit from both the normal means and also from the return leg to assure that a single fault does not cause a loss of protection, but will cause a trouble signal to request service. The third type protective circuit is the ***multiplexed circuit***. This type panel is the most expensive, equipment wise, but saves in wiring and labor because it literally can have dozens of sensors on it, each reporting its own code to the panel processor (special sensors with transmitters in them are required).

SENSORS

There are 2 basic types of sensors used in fire alarm systems today. The waterflow type, and the electrical type.

WATERFLOW INDICATORS & SUPERVISORY CONDITION SENSORS

Waterflow and sprinkler supervisory sensors are all mechanical in nature. Waterflow switches are normally embedded in the sprinkler riser (6 to 10 inch pipe that feeds the sprinklers overhead) with a paddle like arm that will move if the water in the pipe starts to run. This action causes the paddle to close the switch causing an alarm. The waterflow switches can be retarded, (set so they don't cause an alarm for up to 90 seconds), to keep the system from going into alarm due to water surges and sudden changes in pressure not related to a sprinkler head going off.

Supervisory switches that are used to indicate that a sprinkler system is operationally able to function include air-pressure switches, PIV and OS&Y switches for water supply, tank temperature switches for water power tanks, and manual fire pull stations.

Air-pressure switches are embedded into the riser of a "dry" sprinkler system and set to alarm if the air-pressure in the riser either gets too high or too low. A "dry sprinkler system" is one that has no water in the pipes above the waterflow switch. The water is held out of the pipes by compressed air. This type of system is common in areas of the country that experience temperatures below 32 degrees during most winters, which would cause the water in a "wet" system to freeze.

PIV and OS&Y switches are ones that are connected to the water supply on/off valves. They monitor whether the sprinkler systems water supply is turned on or opened in case of a fire.

Tank temperature switches are used in some systems where the water for the sprinkler system is located on the roof of the building, in a tank. The switch will notify central station if the temperature of the water gets below 40 degrees.

SMOKE DETECTORS

The most common smoke detector used today is the ***photoelectric detector***. This is not to say that ***ionization type detectors*** cannot be used, they are, but in most cases, photoelectric are used because of the ease of installation and the stability of the technology.

Although most ***duct detectors*** are photo-electric, they are listed separately from the other smoke detectors because of their specific use. As the name suggests, they are detectors that sample the air flow in air ducts to see if there is any smoke.

HEAT DETECTORS

Normally in a residence, rate of rise detectors are installed in the laundry and furnace rooms (135 deg) and in the garage (190 deg) if it is attached to the main house.

In commercial applications, the whole gambit of rate of rise detectors as well as spot heat detectors can be used depending upon the application. Below is a list of the different temperatures available along with their color coding.

COLOR CODES FOR
FIXED TEMPERATURE HEAT DETECTORS

Classification	Temp Range	Color Code
Low	100-134	unmarked
Ordinary	135-174	unmarked
Intermediate	175-249	white
High	250-324	blue
Extra High	325-399	red
Very Extra High	400-499	Green
Ultra High	500-575	Orange

Most all of these heat detectors come in different configurations for different uses, including blast proof so the sensor will trigger even in case of an explosion**.**

PHOTOELECTRIC BEAM DETECTORS

Photoelectric beam detectors (if 12 VDC) can also be used in combination systems; but because of the expense of these and the area of coverage, again, these are normally used only in commercial applications.

Any number of these fire detection sensors can be installed in either a fire alarm panel or a combination panel. Again remember, the authority having jurisdiction has the final word. If they are in tandem with the insurance company say you don't have to separate the systems, have them sign off in writing, the you will be covered.

Output Circuits & Devices

Both output circuits and output devices are divided into two distinct categories. Those used to announce an alarm at the premises and those that transmit the alarm to another location, normally by use of a telephone line hookup.

LOCAL OUTPUT CIRCUITS

All alarm panels have a set of terminals within them listed as either; bell or bell output, siren or siren output, speaker/speaker output, or at least one set of relays labeled as output. This set of terminals is used to hookup local alarm notification devices. The only use of these terminals is to wire up appliances that will by sight or sound or both notify individuals within and around the protected premises of an alarm condition.

TRANSMISSION CIRCUITS

In most alarm panels you will find a set of 4 terminals listed normally as TELCO. To these terminals you will attach a RJ31X cord which will connect to the premises telephone circuit. By programming the alarm panel with specific information, you will enable it to transmit to a central station, just about any change the panel sees, including low battery report, ac failure, any alarm condition, or alarm restoral, whether the alarm is on or off, and if need be who turned it on/off.

I stated that in most alarm panels you would find 4 terminals for telephone hookup. In other panels there could be 2 sets of telephone hookups, these panels are designed to be used to transmit over 2 telephone lines with the secondary as a backup line only for U.L. (Underwriters Laboratory) or F.M. (Factory Mutual listed) fire systems.

In other panels you can also find terminals that say radio. These are for transmission using a radio transmitter not a cellular phone. Cellular phone transmission takes place through a special cellular phone transmitter which hooks up directly to the telephone terminals.

LOCAL OUTPUT DEVICES

Within the realm of local output devices are three different types of devices:

ELECTRONIC SOUNDERS
MECHANICAL SOUNDERS
STROBES

ELECTRONIC SOUNDING DEVICES
This field of output devices include:

PIEZOS
SIREN DRIVERS
SIRENS
SPEAKERS

Piezos or piezo electric sounders, emit intense high pitched sounds and as such are normally used to notify someone near a alarm console of a problem. They use very little electricity and as such many can be used in a single output circuit.

Siren drivers are electronic circuit boards (some panels have them built into their main circuit board) that electronically produce one or more sound outputs when connected to a speaker or group of speakers. Most add-on siren drivers have at least 2 different sounds, one you will use for burglary and one for fire. Others like the Moose JDS-108 are capable of producing 8 different sounds ranging from buzzers to sirens of differing types to an electronic bell sound. The last of the electronic siren drivers is a voice driver. This type driver either comes pre-programmed or can be programmed (using a computer chip for memory) to say anything you want when triggered by the panel, again there is at least 2 channels or messages that can be triggered.

Sirens are speakers that have internal siren drivers built into them. Smaller sirens have one sound that they can make, but, most have two sounds that can be triggered depending upon whether the panel is indicating a fire or burglary.

Speakers used in burglar alarms are 8 ohm and range from 15 watt to 50 watt normal power. These units would not be useful for stereo systems as their response to fine sounds is not great, but they are excellent for general alarm use.

MECHANICAL SOUNDING DEVICES
The mechanical sounder used most often on alarm panels is the ***alarm bell***. This bell comes in sizes ranging from 6” to 12” and runs on 12 VDC. The only other sounder sometimes used is a ***buzzer*** to notify personnel of a supervisory or environmental alarm condition.

STROBES
Strobes used for alarm panels are 12 VDC and come in different physical dimensions. Most strobes come with interchangeable lenses. The standard colors of the lenses are; red, yellow, clear and blue.

Remote Monitoring Stations

Central stations that receive monitoring signals from many companies (for lease central stations) are among the most common today. By processing signals for more than one alarm company they are able to spread the costs of doing business to the alarm companies and thus keep the cost of monitoring well below what it would be per account if they only served one alarm company.

CENTRAL STATION CERTIFICATIONS

There are many types of certifications that a central station can have. The highest is one for both U.L & F.M. listed fire systems and up to and including Grade AA burglar/holdup signaling. (The latter is so expensive to get and maintain that many do not have it and few need the Grade AA type alarm certification, normally that only is used by banks, jewelry stores, and gun shops where security, and insurance requirements mandate such a system). Such systems can only be installed by a few companies and those companies are so large that they have their own central station.

The central station is required, on U.L. listed alarms to have a runner; someone who will answer the alarm by physically going to the premises, either on premises in the central station, or if located elsewhere, has to check in by two-way communications at intervals not exceeding 15 minutes. Most central stations as a minimum are certified by either F.M., Factory Mutual, or U.L. Underwriters Laboratories and meet the requirements set forth in NFPA 72-1993 or later.

Even if your central station is not U.L. or F.M. rated certain minimum requirements should be met. Among these are redundancy of all receiving equipment, that is to say, if a receiver goes down, an indication of automatic switchover turns on and the secondary receiver takes over. Backup power systems are necessary and again standards are used to make sure that no signal is lost upon AC failure from the utilities. If batteries are used as a backup power supply, then they shall not be subjected to more than 150% of their maximum load.

IN GENERAL

The central station, upon receipt of an alarm signal dispatches the appropriate authorities, as per written instructions for that alarm account. If a trouble or supervisory signal is received by the central station, it is the job of the operator on duty to notify the responsible partie(s) to clear the problem. Again, this information is in writing, per account in the central station.

Fire alarm signals shall take priority over all other type signals. All fire alarm signal shall be processed and the proper authorities notified, receipt of signal and notification of authorities shall be time stamped in no more than 90 seconds from receipt of signal.

What Do I Protect and How?

What to protect and how? Although there are many schools of thought on the subject, I have found that if you follow a few basic guidelines, you will be able to sleep at night.

Although you cannot request an Underwriters Laboratory Certificate unless your company is U.L. registered, I suggest that you send away for the following U.L. Publications:

681 - Mercantile and Bank Burglar Alarm Systems
1641 - Covering Residential Installations

PROTECTION

When designing a combination system your primary bid, or the design you believe will do the most to protect the client, should be as follows:

- 1. Protect all doors and windows to the premises that are located within 8 feet of an exterior ground plain. This means if a house is a split level and the top level has a deck that is within 8 feet of a ground plain accessible to the public, or stairs, you will contact all doors and windows located within 8 feet of any portion of the deck as well as those on the first floor and/or basement.

- 2. You should install at least one piece of space protection (interior trap) for every 1500 square feet of area within the residence.

- 3. As of the National Electric Code of 1993, all "systems" shall be grounded with there own grounding rod & all grounding rods used on the same structure, (cable TV, phone, electrical) shall be joined.

- 4. Again, as of 1993, if smoke detectors are installed in a combination system, there shall be one smoke detector in each sleeping room and one on each floor, (near the stairs) of a residential installation.

- 5. Spend a little more money on the installation, always use #22 AWG-Cu stranded cable for the burglar alarm side of your installation. With the expansion and contraction that occurs in this area the stranded will have less chance of breaking than solid conductor will.

- 6. Always include one indoor sounder, preferably at least a dual tone unit, to let anyone inside the premises know when an alarm occurs.

- 7. On a residential alarm system, if you don't protect the overhead garage doors you should at least protect any window openings as well as man doors leading to the exterior and those leading from the garage to the house.

WORDS OF CAUTION
When installing smoke detection devices remember the following:

- 1. Do not place a smoke detector in a garage. The fumes from carbon monoxide are residue from a fire (inside the engine) and the smoke detector will go off.

- 2. When dealing with smoke detectors in a room or area with an exposed beam ceiling of 8" beams or less, the ceiling is considered as non obstructed. If the beams are more than 8" place the detectors on the beams.

- 3. Never place smoke detectors within 4" of where the ceiling and any wall meet, this is a dead air space which smoke does not normally flow.

- 4. When dealing with smoke detectors on a ceiling that has a slope of more than 1 foot in 8 feet, and a peak within the protected area, don't install a detector within 3' of the peak as this is a dead area.

DOCUMENTATION

Whoever the person was who first said "The job is never done until the paperwork is done" could not have been more correct when dealing with alarm systems. I have listed below, the basic paperwork that should be filled out with each installation. This is only paperwork on the physical system, not to be confused with sales/lease agreements, monitoring contracts, and/or maintenance agreements.

At least 2 copies of the following documents should be made up at the time of installation completion. One set should be put in the alarm panel, and one set should be put in the customers file in your office.

- 1. A complete listing of all of the wiring, to include where it goes to, the number of the cable, and any special notes.

- 2. A list of all devices on the system and what circuit they are on and where they (the protective devices) are located.

- 3. Where you tapped into the telephone system, and the location of the RJ31X block.

- 4. Where the AC transformer is located and which circuit breaker controls it, and the location of the ground rod.