

DIY Security System / Burglar Alarm

Information on wiring your own security alarm with keypads, door/window sensors, motion detectors, glass break sensors and the wiring panel. Save money on both home owners insurance and alarm monitoring by installing it yourself.

This section of the [Structured Home Wiring](#) site covers everything you need to know to setup your own security system. Follow the links below for more information.

- [Alarm Components](#) - Details each part of the security system
- [Planning an Alarm System](#) - Determine how to layout the system so that your home is protected before running any wires
- [Tamper Proof Wiring](#) - Specific information on normally open (NO) vs. normally closed (NC) sensors and end of line resistors (EOLR)
- [Wiring an Alarm System](#) - How to connect the wires to sensors and the alarm panel
- [Sample DSC Alarm](#) - Pictures and diagrams of some DSC components for reference
- [Programming the Alarm](#) - General information for setting up zones and other data
- [Alarm Testing/Maintenance](#) - One time and periodic testing for your alarm system
- [Wireless Alarms](#) - For existing homes or if you aren't good with wires

For a home under construction, you should also read our guide to [structured wiring for a new home](#). For an existing home, try our guide to [wiring existing homes](#).

Other Considerations

Realize that an alarm system does not guarantee the safety of you and your family. An alarm system is not a replacement for home owner's insurance. While a siren going off may chase off an intruder, it is not a guarantee. Even with alarm monitoring it will take a couple of minutes for police to arrive and the intruder knows this.

Many common sense rules apply whether you have an alarm system or not. Don't have any large bushes that cover doors or windows. You don't want to give a burglar a place where he can take his time to break in without being seen. Having exterior flood lights activated by motion detectors is even better. Having an alarm sign out front and/or in the windows can be more of a deterrent than the alarm system itself. A barking dog is also a deterrent. You just need to give a thief a reason to move on to the next home. If you have a walk out basement in the back of the home, then the basement door is a security risk. You should have an alarm sign on that door also, you should have a motion activated flood light, and you should protect the basement with sensors just as you would the the first floor.

Disclaimer

The information on this site is provided free of charge. All information provided on this web site is provided 'AS IS'. No guarantee is provided for the accuracy of the information or the application of the information provided herein. I accept no responsibility or liability with regards to the accuracy or currency of the information provided. By using, reading or accessing this web site, you agree to be the user of the information provided. The user accepts full responsibility for all information provided. Although I try to keep the information on this site as accurate as possible, there is no guarantee that my reference materials or the material on this site is correct. This information is provided for reference purposes only! The technical information listed here are for general applications only. When in doubt, always seek the help of a professional!

Always consult your local building codes for the most accurate information regarding wiring and electrical codes. All counties and cities have their own building codes which will vary slightly. This web site only addresses some of the most common building codes. Please note that improper wiring could cause you to fail a home inspection, prevent you from selling your home, or even cause a fire.

Some of the examples provided on this (Ex: Wiring a DSC alarm) are for a specific release of a specific product by a specific company. The examples on this site are provided for reference purposes. You should always consult the documentation provided from the manufacturer.

Security System / Burglar Alarm Components

Before you can even start the planning phase of your alarm system, you need to understand what components you may need to use. Alarm components can be broken up into several categories:

- **Input Devices:** These are the sensors that will activate the alarm when someone breaks into your home. Examples include door and window sensors, motion detectors, and glass break sensors.
- **24 hour Input Devices:** These are special types of sensors that activate the alarm whether it is turned on or off (24 hours a day). These include fire/smoke sensors and water leak sensors.
- **Output Devices:** Example output devices include horns/sirens and strobe lights. These tell you and your neighbors that the alarm has been activated and scare off intruders.
- **Alarm Panel:** The alarm panel is the brains of the alarm system. This consists of the circuit board, power supply and battery to provide power, your phone line connection, and the a metal box to secure it all.
- **Keypads:** These are used to activate/deactivate the alarm, determine what zone has tripped the alarm, perform programming and diagnostics activities.

Types of Sensors / Input Devices

Door Sensor

Door sensors will trigger the alarm when the door is opened. These should be installed at every exterior door including the door to the garage. These sensors can also be used as a door chime which makes a quick beep when a door is opened and the alarm is not active. Installing the round plug style sensors can void the warranty on your door and your builder may not let you install them until you have purchased the home. You could use window style sensors on a door (although they will not be hidden) or you could pre-wire the sensor and drill the hole in the door later after you move in.



Window Sensor

Window sensors will trigger the alarm when the window is opened. Having a separate channel for each window will quickly use up all the available channels on your alarm panel (this is covered in the [Alarm Planning](#) guide). Unlike door sensors, these sensors are visible on the window. There are types of window sensors that are hidden, but drilling into a window to hide a magnet is usually a very bad idea. You will probably break the seal on your window and any drilling in the window will void the warranty. Your best bet is to use 2-way tape to attach the sensor to the window so that no drilling is required. Sometimes you may want to activate the alarm at night even though a bedroom window is open. This can be done, but obviously that window is not protected by the alarm. Using motion detectors may be a better option.

Motion Detector

Motion detectors will trigger the alarm when they detect motion in their area of coverage. Typically these are not installed on the second floor. You don't want the alarm going off when someone goes to the bathroom in the middle of the night. Motion detector usually have 90 degree area of coverage, so installing them in the corner of the room works best. Motion detectors should be installed in every major room of the home and if necessary they should also protect the alarm panel (in the basement or a utility closet). I prefer to install the motion detectors near the 4 exterior corners of the first floor so that they also cover the hallways. In an existing home you may choose to install them on an interior wall so that you don't have to deal with insulation when running the wires. Some motion detectors will detect small pets and set off the alarm, while others are designed ignore pets up to 40 or even 80 pounds. Be sure to review the specifications of the sensor before purchasing. Note: Usually motion detectors are referred to as PIR (Passive InfraRed) sensors. Some sensors utilize both PIR and microwave sensors for increased reliability.



Glass Break Sensor

A glass break sensor will trigger the alarm when it detects the noise or vibration of glass breaking. The model on the left is attached directly to the window and can only determine if that window is broken. These are usually used by businesses on large plate glass windows. The model on the right can detect any glass breaking within a given distance and are usually mounted toward the center of the home or near an area with a lot of windows. In the example floor plan above, the glass break sensor is facing the rear exit glass door. Dropping a glass or loud noises can sometimes trip a glass break sensor and set off the alarm. The quality and sensitivity setting of the alarm control this behavior.



Water Sensor: 24 hour

Water sensors are used to alert you or your alarm monitoring company in case there is a water leak. Typically, water problems occur in the laundry room when one of the flexible hoses to the washer bursts, in the basement near the sump pump, or near the furnace if the water run off from the air conditioner backs up. Some water sensors / alarm systems are capable of turning off the water when a leak is detected. Since the sump pump should be near the lowest part of the basement, if you only have one sensor in the basement it should be near the sump pump.



Smoke Sensor: 24 hour

If you are building a new home then the builder will already be installing smoke detectors, but if you are paying for alarm monitoring you may want to connect these smoke detectors to the alarm system. In a new home by code the builder will place one smoke detector on every floor and in every sleeping room. These should be combination smoke/carbon monoxide detectors. Ideally they will be networked and hard wired for power with battery backup.



Sirens / Output Devices

Horn/Siren

The siren makes the noise when the alarm is activated. The horn on the left is intended to be hidden (perhaps in the basement) or mounted outside the home to alert neighbors. The siren on the right should be mounted near the center of the first floor. Although a horn/siren is optional, it is strongly recommended since it will do the most to scare away a burglar.



Strobe Light

Mounting a strobe light outside the home is another way to alert neighbors that your alarm has been activated. Strobe lights can also be used inside the home for the hearing impaired.



Other Alarm Components

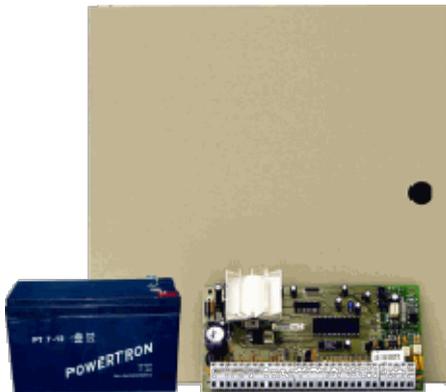
Keypad

Keypads are used to activate and deactivate the alarm. They can also be used to indicate which sensors (zones) are currently active. More advanced keypads can report a history of past alarms and perform programming functions. A keypad should be located near the entrance/exit of your home that you are most likely to use so you can activate the alarm as you leave. You can also install a second keypad in the master bedroom to activate the alarm system at night.



Main Panel

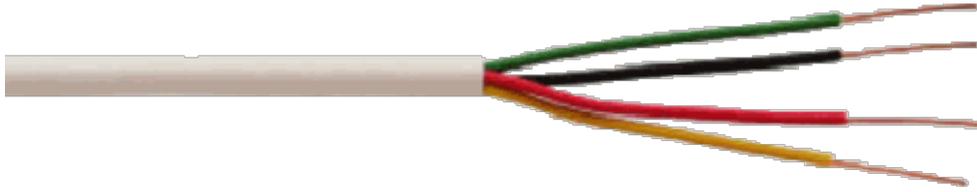
The main panel is the "brain" of the alarm system. The circuit boards are placed in a locked metal box that also contains a battery backup. All wires for the alarm system will run to this panel. The panel should be located in the basement (if available) otherwise it should be placed in a utility closet.



Alarm Wire

Your best bet for alarm wiring is to purchase a roll of solid 4 conductor 22 AWG alarm wire (black, red, green, & yellow). Although solid copper wire doesn't bend as easily as stranded wires, I prefer using it because it eliminates the chance that a loose strand of wire will cause a short. With lots of small screw down connectors all right next to each other, one strand could easily come loose and touch the wrong screw which could break the alarm or cause a false reading. Door and window sensors and horns only require 2 conductors, but keypads, motion detectors and glass break sensors will require 4 wires. Since the price of 2 and 4 conductor wire is so similar, you may be better off with a single 500 ft roll of 4 conductor wire. If you plan on wiring every window, then you will probably need 2 spools of cable and getting a spool of 2 conductor wire (black & red) would make sense.

Note: 22 gauge wire cannot be used for smoke detectors and power. The smoke sensors and the power wires for the alarm typically should be 18 AWG or better. Review the manual for your security system, smoke detectors, and any local fire codes more information.



Planning a Security System / Burglar Alarm

The first step when installing any alarm system is to determine what you will install and where. Below is a typical floor plan from a home builder that has been marked up to indicate where alarm components will be installed. These simple plans are the type that builders normally provide to people looking to build a new home and can sometimes be found on the builder's web site. Marking up a copy of these plans is a good place to start to determine how many window & door sensors and motion detectors you will need to protect the entire home.

Sample Alarm Wiring Plan

Legend

P: Main Alarm Panel

K: Keypad

Input Devices

M: Motion Detector

D: Door Sensor

W: Window Sensor

G: Glass Break Sensor

L: Liquid/Water Sensor

24 Hour Input Devices

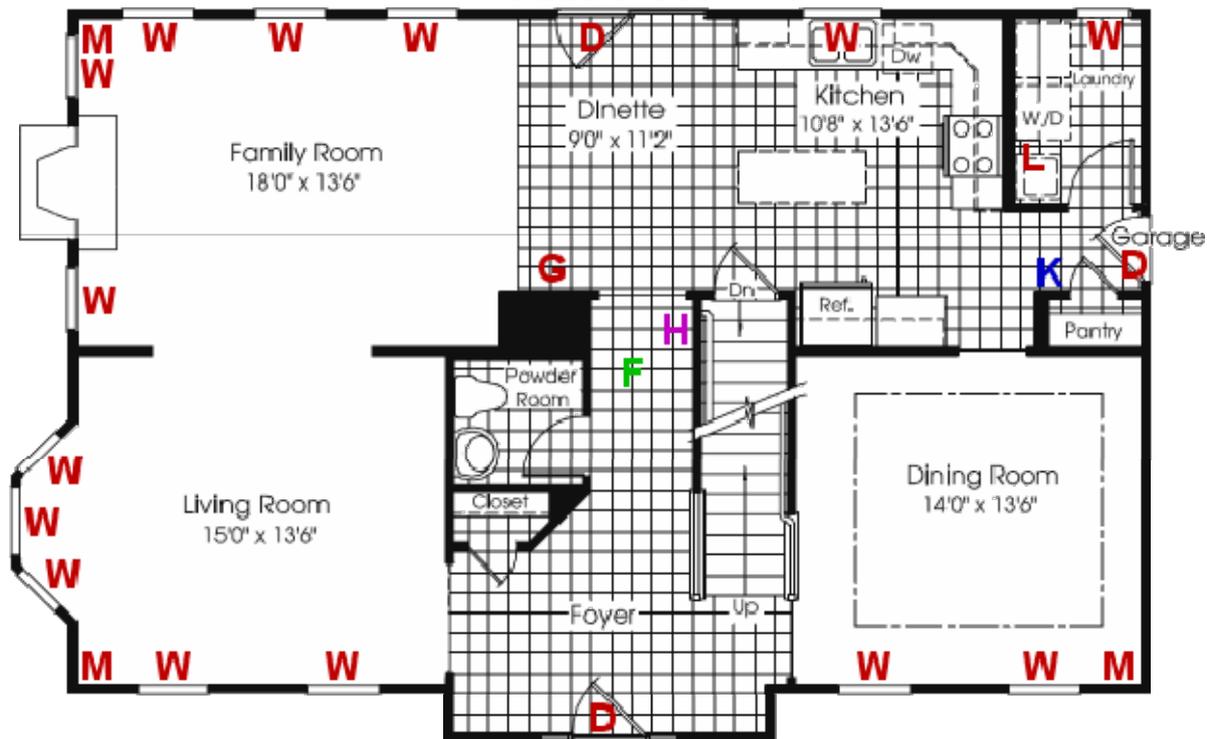
F: Fire/Smoke/Heat Sensor

Output Devices

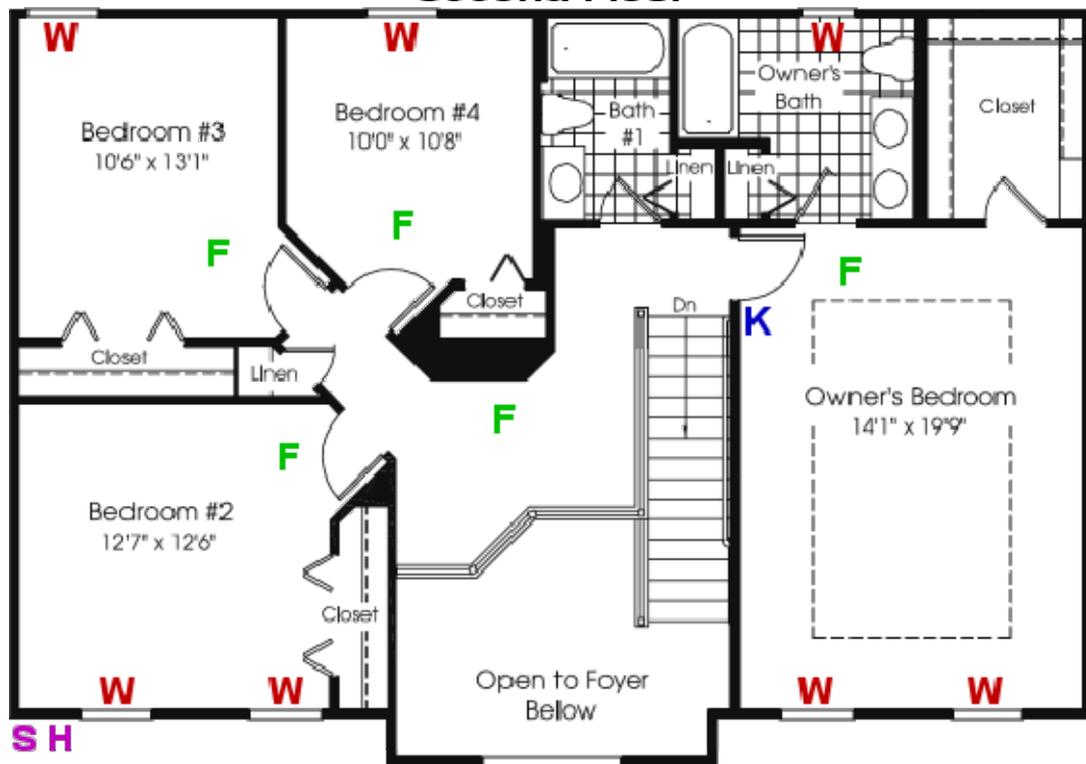
H: Horn/Siren

S: Strobe Light

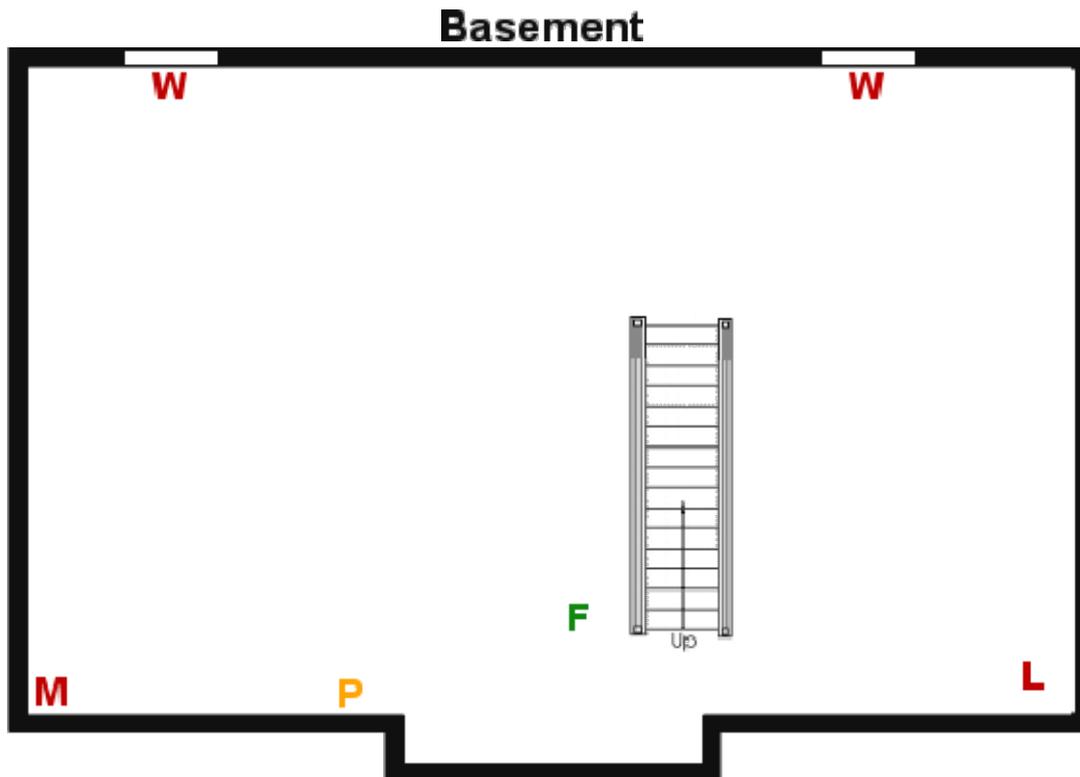
First Floor



Second Floor



SH



The first major decision is to determine if you want to have sensors for every window in the home or are motion detectors good enough to provide coverage. A quick look at these floor plans shows that wiring sensors for every window more than doubles the amount of wires that you will need to run.

A typical entry level panel is limited to 8 zones. Even higher end panels need expander cards to support more than 8 zones. Even if you have more than 8 sensors you can still use an 8 zone panel. You will just need to wire multiple sensors to a single zone. When a zone with multiple sensors is tripped, you will not be able to determine which sensor is the cause. Also, if there is a fault/error with a multiple-sensor zone it will be more difficult to diagnose.

Here are some examples of 8, 16, & 32 zone setups.

8 zone: - Assumes Fire detectors are handled separately

- Living Room Motion Detector
- Family Room Motion Detector
- Dining Room Motion Detector
- Basement Motion Detector
- Front Door
- Back + Garage Door
- Dinette Glass Break Sensor

- Water Sensor

16 zone: - The above 8 zone layout plus window sensors (multiple windows per zone)

- Dining Room Windows
- Living Room Windows
- Family Room Windows
- Kitchen/Laundry Windows
- Owner's Bedroom/Bathroom Windows
- Bedroom 2 Windows
- Bedroom 3+4 Windows
- Basement Windows

32 zone: - With 32 zones, every sensor indicated in the floor plan above will have its own sensor.

There are other considerations when combining sensors into a single zone. Alarm systems can be activated with some zones disabled. For example, if you activate the alarm at night when you sleep you want the doors and windows protected, but you do not the motion sensors active. You probably want the motion sensors disabled so that you can walk around the house without setting off the alarm. Therefore, you should not combine the window & motion sensors from the same room into a single zone. During a hot summer night you may want to leave the windows in your room open, but not any of the downstairs windows. Again, these windows would need to be in separate zones so that you could leave upstairs windows open but have the downstairs windows protected.

Tamper Proof Security System / Burglar Alarm Wiring

Information on Normally Closed vs. Normally Open circuits and
EOLR (Single End Of Line Resistor) & DEOLR (Double End Of Line Resistors)

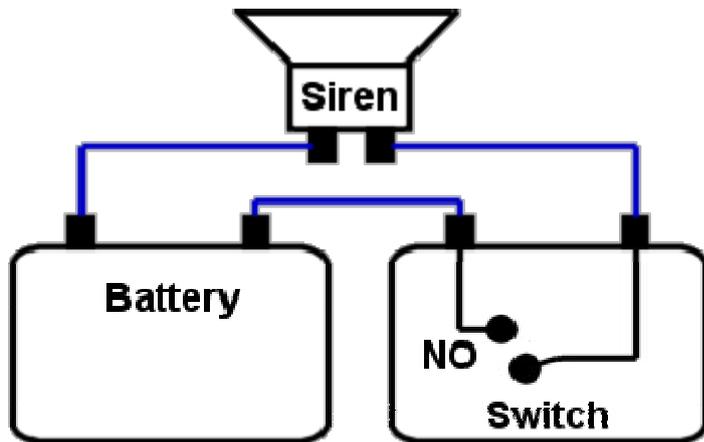
Normally Open vs. Normally Closed

While no wiring can be completely tamper proof, there are a couple of things you can do to make disabling your alarm system more difficult. These methods may not be enough to protect a business like a jewelry store, but they are more than adequate to protect your home from a common thief.

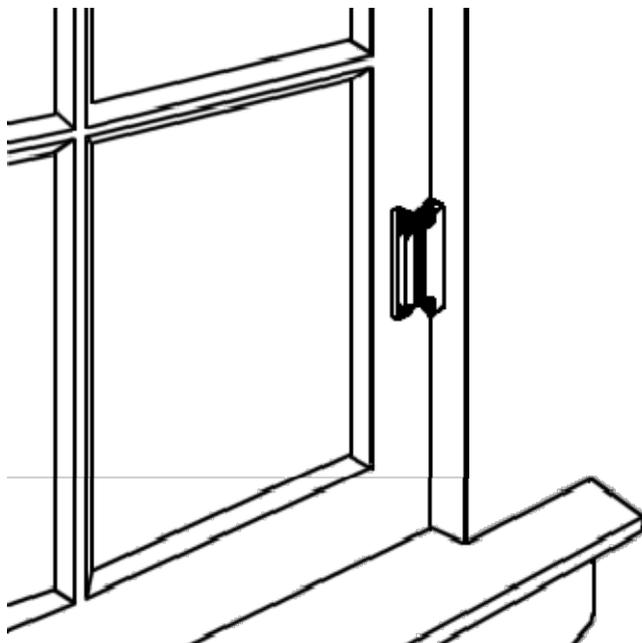
The first thing to do is to use normally closed (NC) circuits when possible. Most alarms and sensors by default are configured this way. To understand why you should first understand how a common window sensor works. An open circuit is a broken, interrupted, or incomplete circuit. For alarm systems, a normally open (NO) circuit is in the open state when the alarm has not been tripped. Closing the circuit sets off the alarm. A closed circuit is a connected and complete circuit. A normally

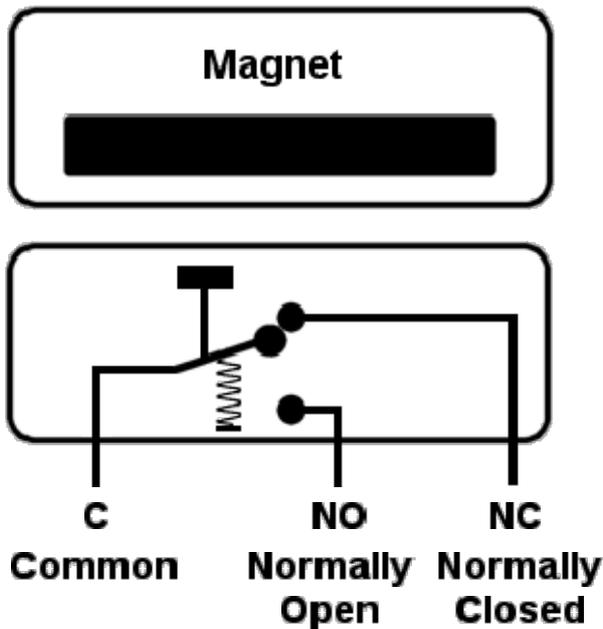
closed circuit is closed when the alarm is not active. opening a normally closed circuit sets off the alarm.

The circuit below is an over simplified example of a Normally Open alarm circuit. When the switch is open under normal conditions the circuit is incomplete and the siren will not sound. When the switch is closed then the circuit becomes complete. The connection from the battery to the siren is complete and this activates the siren.



Window sensors are the best way to show a real alarm circuit in action. A window sensor consists of 2 parts. The first is a magnet that is attached to the part of the window that moves. The second part has the wire connections and should be mounted to the frame around the window or to the part of the window that doesn't move. When the window is closed, the two parts of the sensor should be right next to each other.





The wired part of the sensor contains a switch that can connect to two different contacts. When the magnet is near this switch, the magnet will attract the switch toward the normally closed contact. When the magnet is removed (because the window has been opened), the spring pulls the switch toward the normally open contact. You will connect the common contact and either the Normally Closed (NC) or Normally Open (NO) contact to your alarm system.

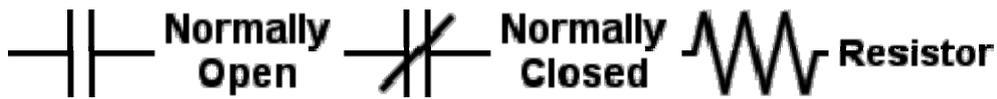
When using the normally open (NO) contact, the connection between the common (C) and NO contacts is broken when the window is closed. When the window is open the magnet is removed and the spring pulls the switch toward the Normally Open contact which closes the circuit and activates the alarm.

One of the drawbacks with Normally Open circuits is that cutting the wire will deactivate the window sensor. With a Normally Closed circuit, cutting the wire will set off the alarm. With a Normally Closed circuit, opening the circuit will activate the alarm and opening the window or cutting the wire has the same effect.

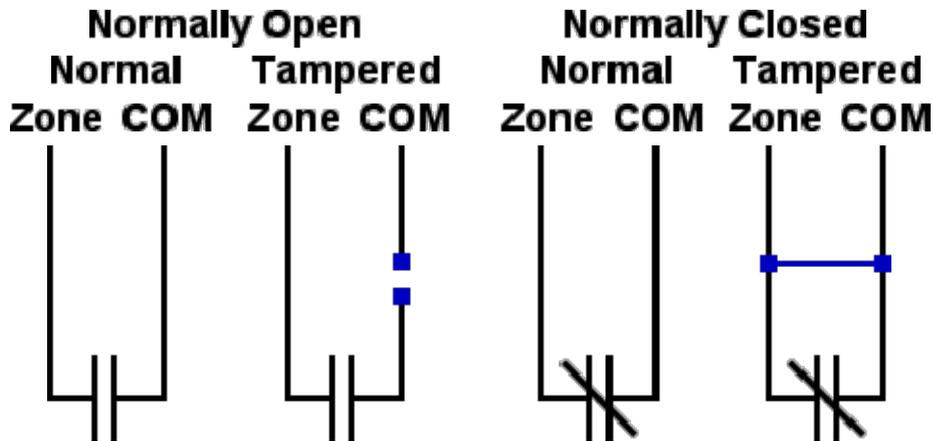
Single and Double End Of Line Resistors

Adding resistors to the sensor circuit path allows the alarm panel to determine more than if the circuit is simply open or closed. It can be used to differentiate between an active alarm, alarm tampering by cutting a wire, and a short in a wire. Note that End Of Line Resistors (EOLRs) can only be used if the alarm panel has been designed to use them. Consult your alarm manual before using any resistors. The diagrams below and resistance values may not apply to your alarm panel.

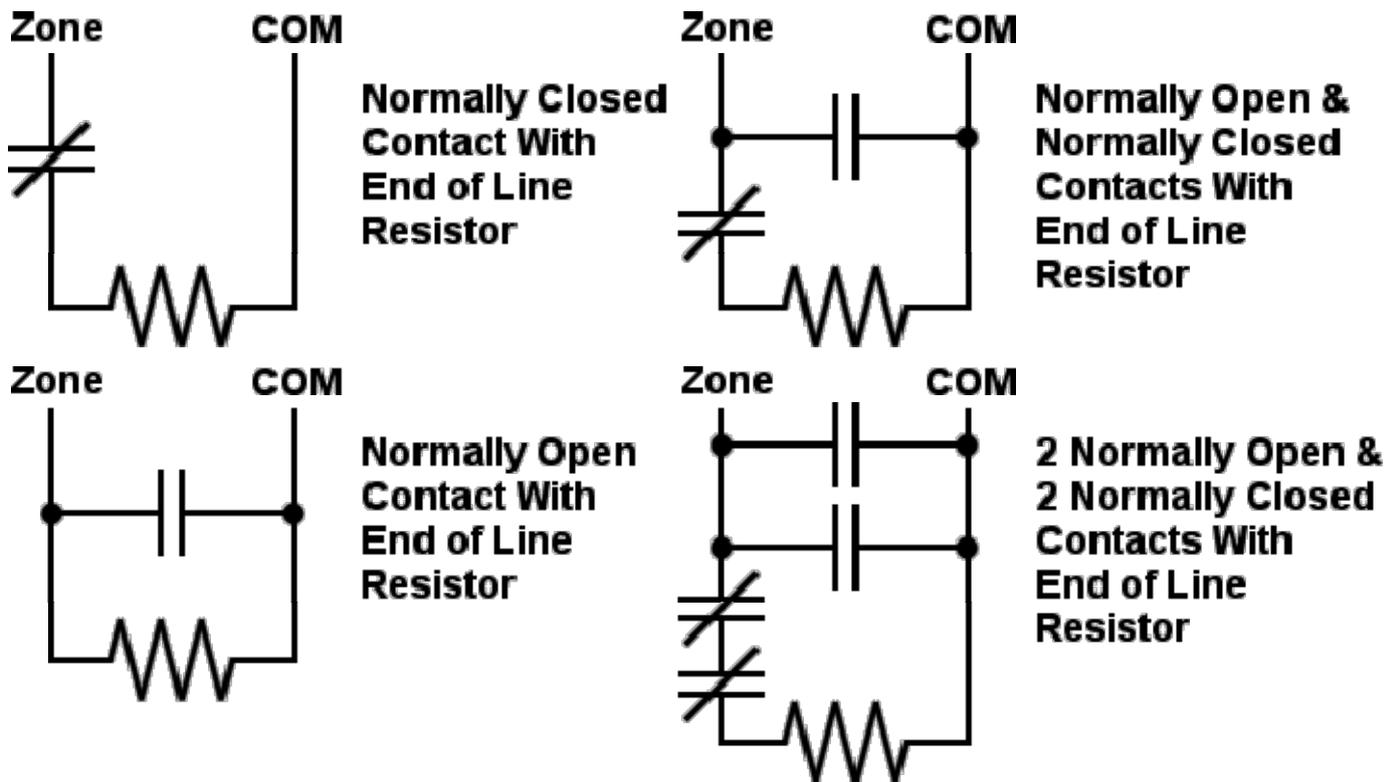
Single End Of Line Resistors (EOLR) are common with monitored alarms so that the monitoring company can differentiate between a cut wire and a tripped sensor. Some installers will place the resistor in the alarm panel but this not correct. The resistor should be placed at the sensor to better detect cut wires.



In an alarm system without resistors, a thief can bypass a sensor by cutting the wire on a normally open circuit, or by shorting the wires in a normally closed circuit. Using normally closed circuits with properly placed resistors makes it harder to bypass the sensor.



Below are diagrams indicating where to place Single End Of Line Resistors. The Normally Open and Normally Closed items in the diagrams represent the sensor and how it was wired.

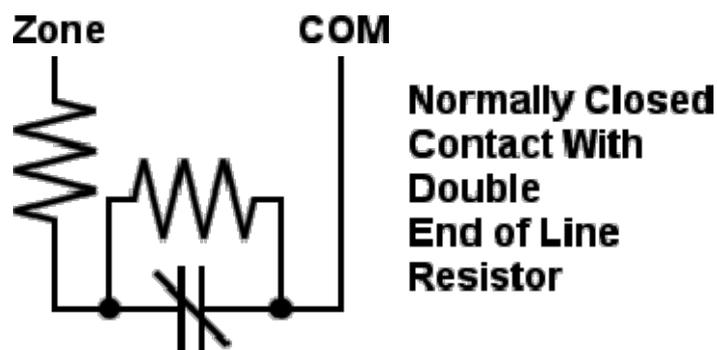


Note: These diagrams show a simplistic version of wiring a sensor. Typically, 2 conductor wire is used to wire window/door sensors and 4 conductor wire is used on motion or glass sensors. It is not a simple loop of single conductor wire as shown above. See our page on [Wiring the Sensors](#) to see how to run the wires and what colors to use.

Tables below assume 5600Ω resistors are used. See [Resistor Color Codes](#) for more info.

Resistance	Normally Open Meaning	Normally Closed Meaning
0Ω	Zone violated. Sensor tripped - Alarm Activated	Zone fault. Wire shorted - Alarm Activated
5600Ω	Zone secure.	Zone secure.
Infinite Ω	Zone fault. Wire shorted - Alarm Activated	Zone violated. Sensor tripped - Alarm Activated

Double End Of Line Resistors (DEOLR) can also indicate if a wire has been cut. DEOLR only works with one Normally Closed sensor per zone. Do not use DEOLR for fire, supervisory and keypad based zones. For this to work properly, both resistors should be with the sensor - not in the alarm panel. Otherwise, tampering with the sensor by shorting it as shown above will successfully bypass the sensor. See [alarm wiring](#) for examples.



Resistance	Meaning
0Ω	Zone fault. Wire shorted - Alarm Activated
5600Ω	Zone secure.
11200Ω	Zone violated. Sensor tripped - Alarm Activated
Infinite Ω	Zone tampered with. Wire cut - Alarm Activated

Other Security Measures

The last security measures to take are with the alarm panel itself. If an intruder is able to get to the alarm panel and disable it before the siren goes off or before it alerts the monitoring company, then

the alarm is useless. Remember that opening a door doesn't automatically set off the alarm. By default you will have 30 seconds to enter the code to deactivate the alarm before the siren sounds. An intruder will also have 30 seconds to find and disable the alarm.

Purchase a lock for the alarm panel box if it did not come with one. Keep the alarm panel locked at all times. Do not store the keys on or near the alarm panel.

All alarm systems have a battery backup, but the battery might not be included with your system. Get the backup battery and keep the battery locked in the alarm box.

The alarm panel should not be visible through any windows (including small basement windows). It should not be placed near any entrance to the home. For example, don't place the panel in the mud room - the room off of the garage entrance. The room containing the alarm panel should be protected by sensors, or if there are no windows to that room, then the adjacent room could also be protected preferably by a motion detector.

Many alarm systems allow each zone to be configured differently. The door to the garage can be configured for a 30 second delay before activating the alarm to give you time to enter the code, while the motion detector that protects the alarm panel can be configured to activate the alarm immediately.

Be sure to change all default passwords for the alarm system - not just the master code, but the installer codes also. These default passwords are well documented and can be found by anyone.

If possible, hide the wires as they enter the alarm panel. For a basement installation I like to vertically mount two 2x4s to the concrete wall, and then mount a 2'x4' sheet of plywood to those studs. That gives me a good working area that I can easily drill screws into without having to deal with concrete. You can then run the wires behind this sheet of plywood and enter the alarm panel box through a hole in the back of the box. The sheet of plywood should cover up the wires near the top of the basement wall. From there I tuck the wires under the insulation that surrounds the exterior of the home above the concrete wall. Remember that this does not need to be perfect. You only need to slow the intruder down for a couple of seconds.

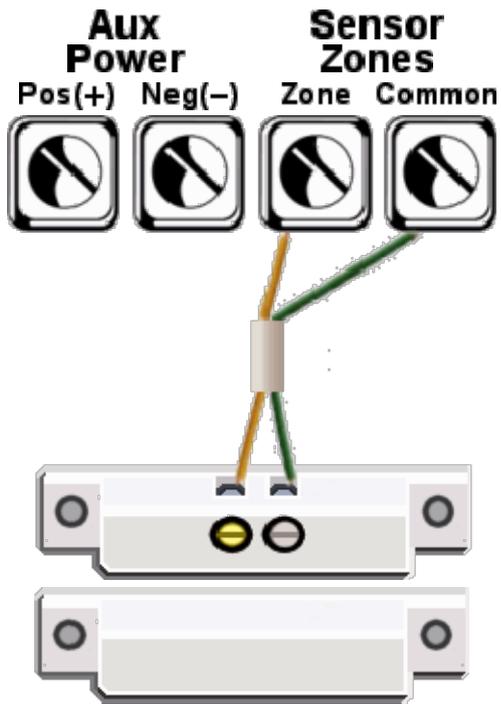
For first floor / drywall mounted alarm panels, try to run all of the wires hidden through the drywall and then through the back of the alarm panel box. You will not be able to hide the power connection (it would be a code violation to hide an outlet in the drywall), but this is OK since the battery backup should be locked inside of the panel.

Consider getting motion detectors or a glass break sensor. Window sensors only detect if the window is opened. Breaking the glass and going through the broken window doesn't set off the alarm.

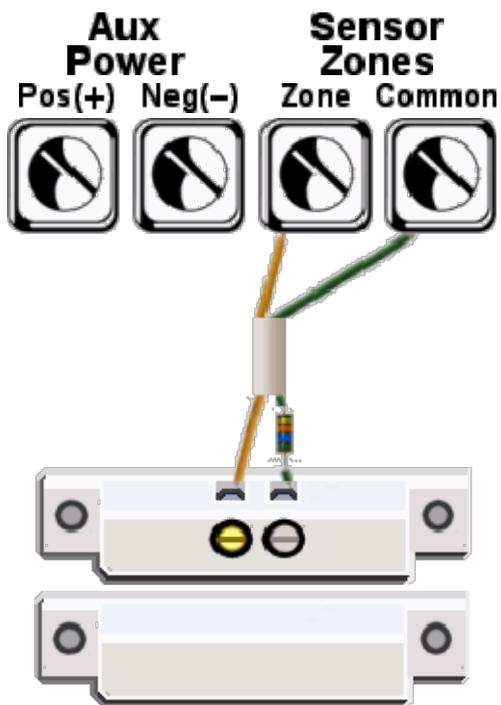
Security System / Burglar Alarm Wiring for Powered and Magnetic Sensors

Passive (Door / Window) Magnet Sensor Wiring

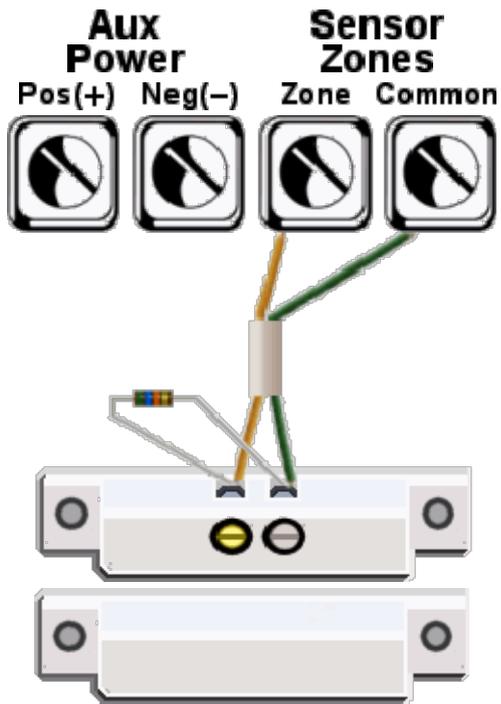
Single Normally Closed or Normally Open Window Sensor



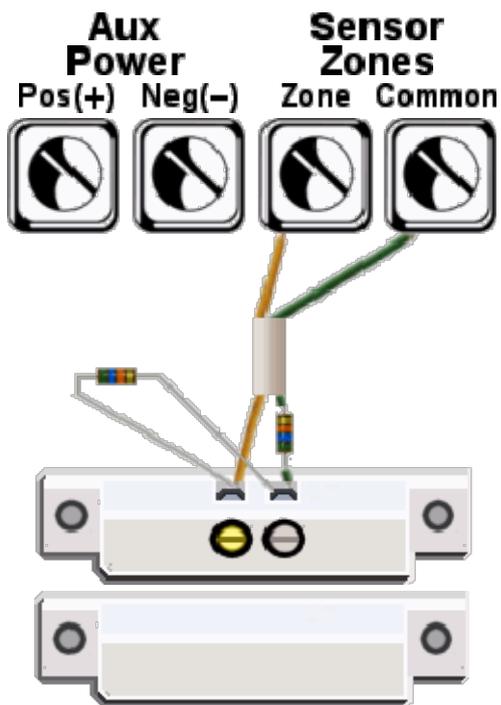
Single Normally Closed Sensor With Single End Of Line Resistor



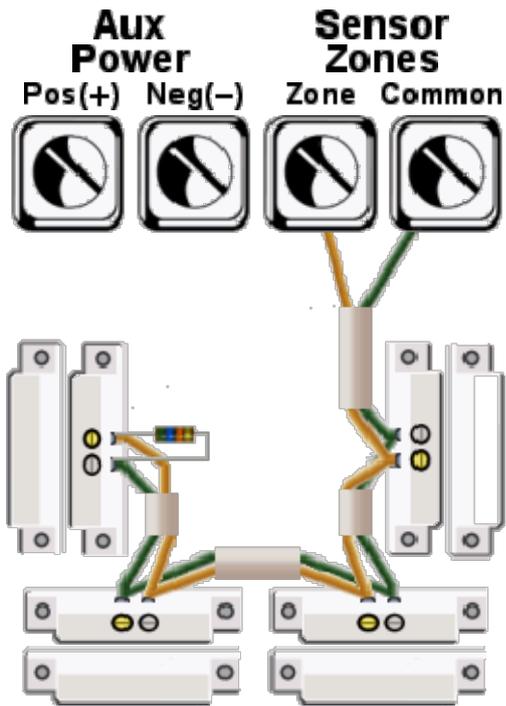
Single Normally Open Sensor With Single End Of Line Resistor



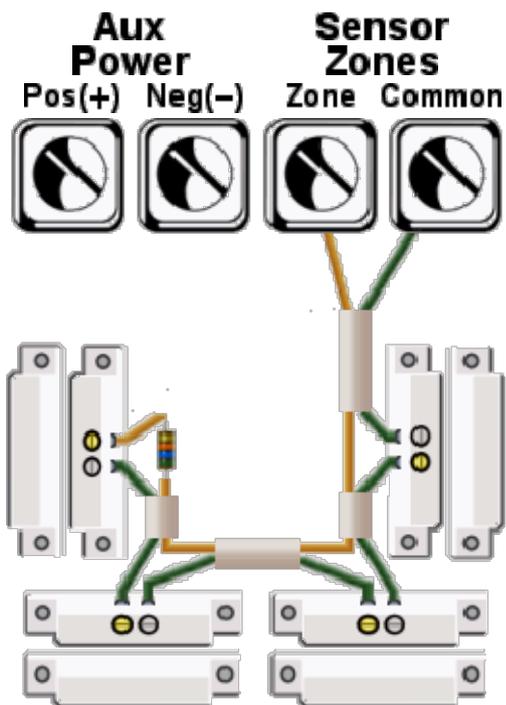
Single Normally Closed Sensor With Double End Of Line Resistors



Multiple Normally Open Sensors in Parallel With Single End Of Line Resistor

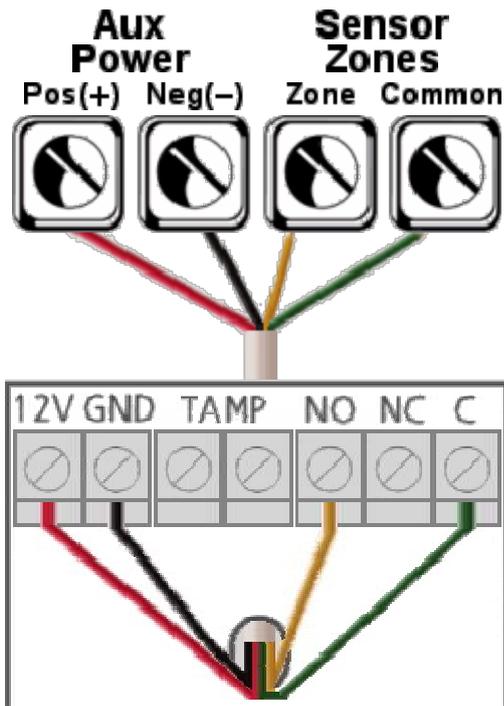


Multiple Normally Closed Sensors in Series With Single End Of Line Resistor

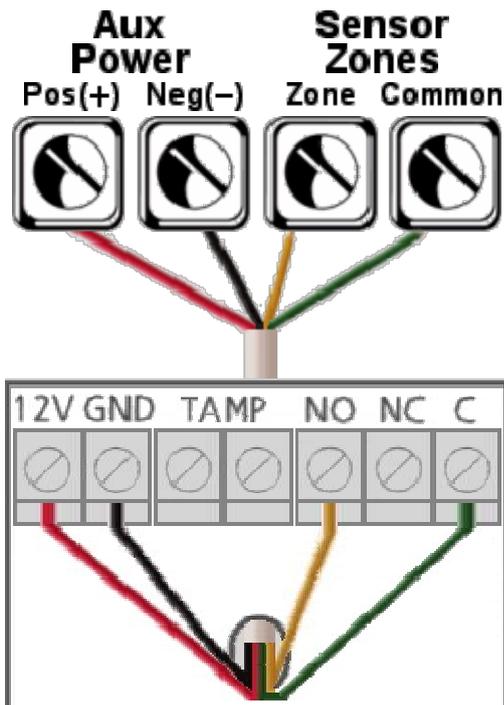


Powered (Motion Detector / Glass Break) Sensor Wiring

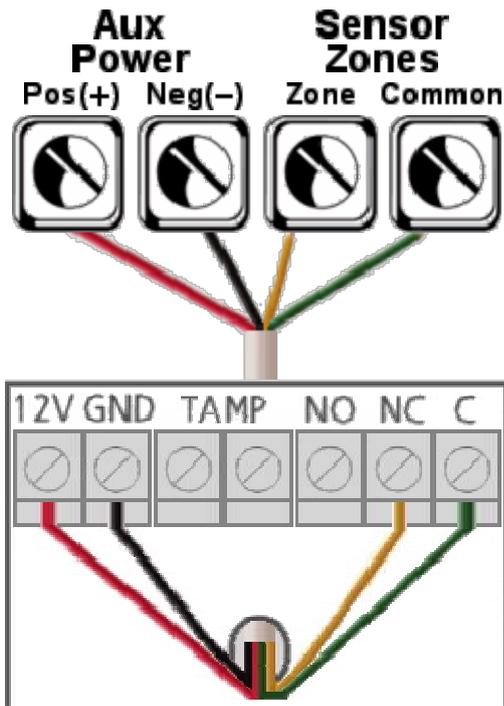
Single Normally Open Powered Sensor



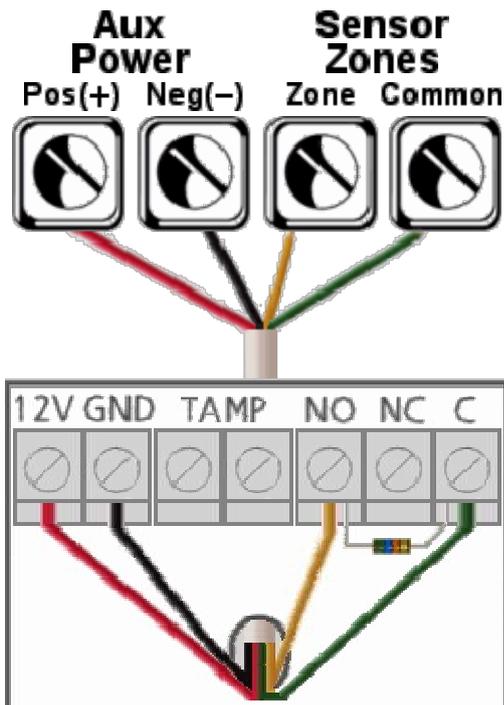
Single Normally Open Powered Sensor



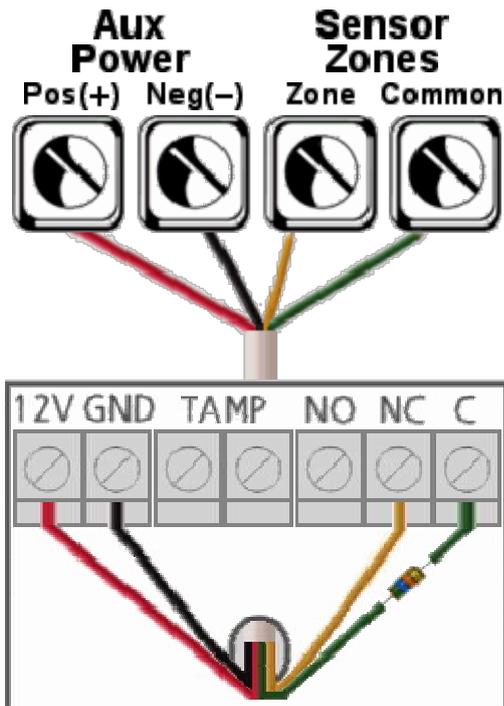
Single Normally Closed Powered Sensor



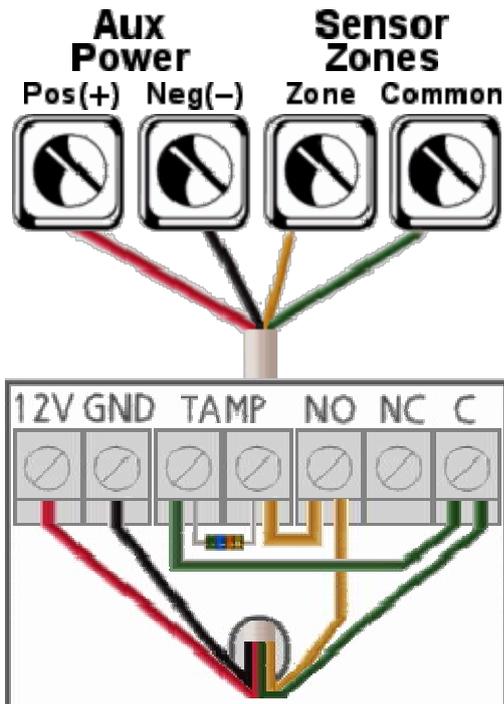
Single Normally Open Powered Sensor With Single End Of Line Resistor



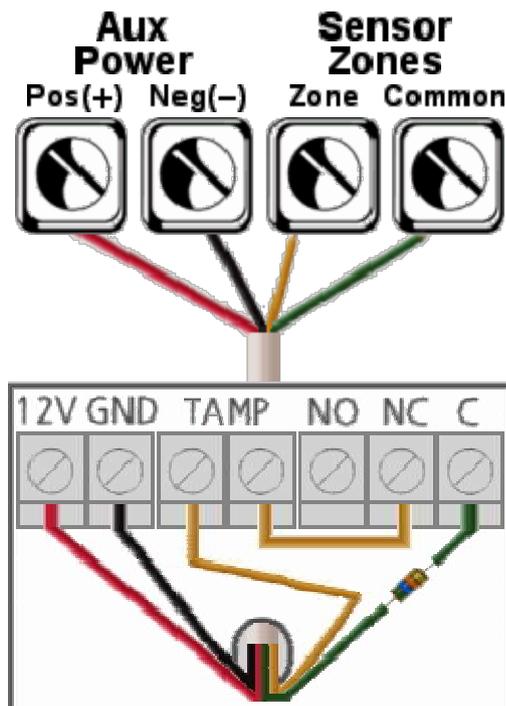
Single Normally Closed Powered Sensor With Single End Of Line Resistor



Single Normally Open Powered Sensor With Single End Of Line Resistor With Tamper Wired on Same Zone



Single Normally Closed Powered Sensor With Single End Of Line Resistor With Tamper Wired on Same Zone



Single Normally Closed Powered Sensor With Double End Of Line Resistor

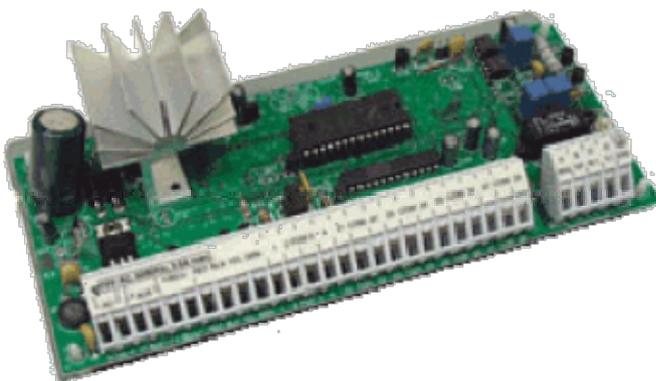
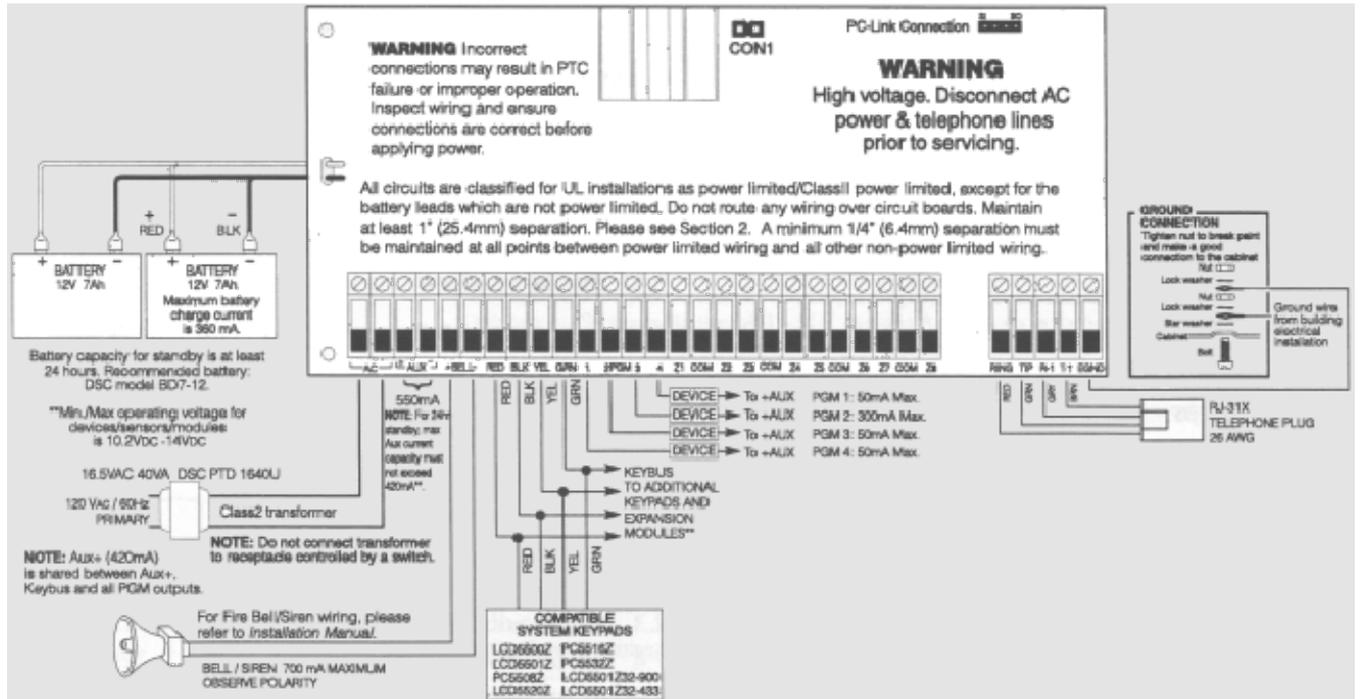
Security System / Burglar Alarm - Sample DSC Alarm System

This guide uses the DSC Power 864 security system with DSC accessories as an example to detail exactly how to wire a security system. Actual wiring diagrams and pictures are provided for real DSC products. This guide assumes that all of the components will work together. See the [Alarm Wiring](#) guide for more information.

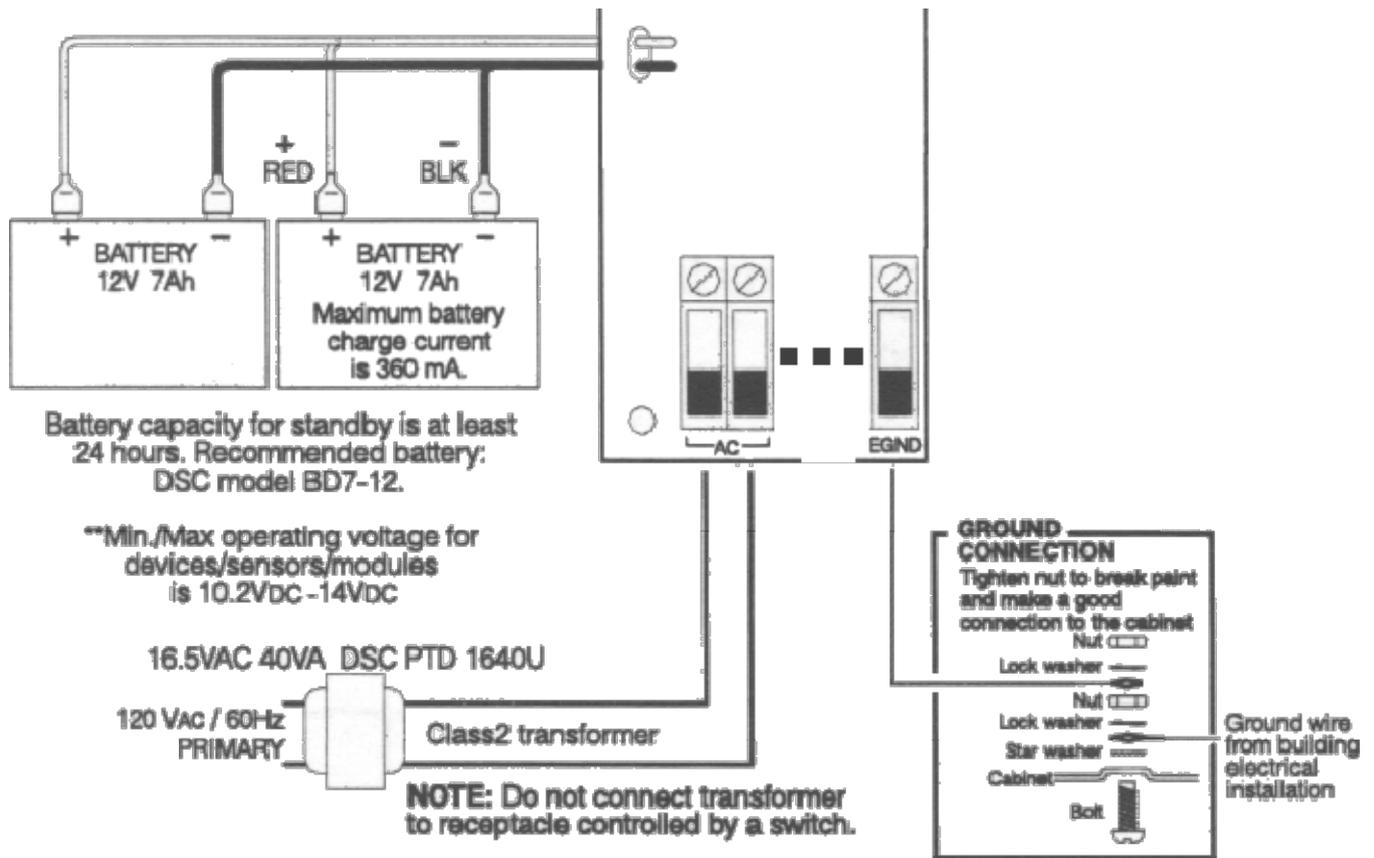
This is the master wiring diagram for a Power 864 main panel. The Power 864 supports 64 different zones, but only 8 zones are available with the main board. Additional boards would have to be purchased to expand this system. This panel contains connections for power, the siren, keypads, devices, and sensors. Each will be covered in detail below.

DSC PC 5020 - Power 864 Panel

Click image for a larger view



Alarm Panel Power Wiring



The power connections consist of the AC power and the backup battery. Note that I am working from the left to the right on the circuit board, but the power should be the last thing you connect.





For this alarm system, the wires for the battery come directly out of the side of circuit board. First, verify that the power requirements of the circuit board match those of the battery. In this case, they should both be 12 volt 7 amp-hours. Buying the recommended BD7-12 battery or purchasing the battery, power supply, and main board in a kit is easier. The wire colors will be red & black which match perfectly the red and black terminals on the battery itself. Connect the ground first (black), and then the power (red).

Using 18 AWG or better wire, measure the length of wire needed to connect the power supply at the power outlet to the power terminals on the circuit board. First connect the wires to the power supply, then the wires to the alarm panel, and then finally plug in the power supply to the electrical outlet. The power supply will either have 2 screw terminals (+, -) or 3 terminals (+, -, ground). Typically, both the power supply and alarm panel will have power connections labeled + and -. Connect the + terminals together and the - terminals together. Usually your power wire will be colored, labeled with + or -, or will have a stripe (for power) to differentiate the positive and negative wires.

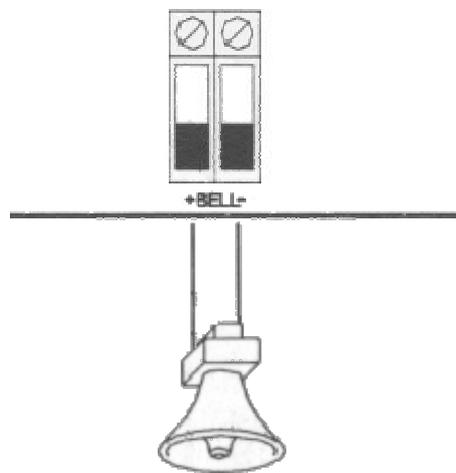
For this alarm, the ground is located at the opposite end of the circuit board. You could run the ground from the ground connector on the power supply and it will work since this ground will run back to the electrical box and then to the building's main ground. I prefer to tap directly into the building's main ground. This is easy for me because my wiring panel (which is only a couple of feet from the electrical box) already has a direct ground connection for other wiring. Tapping the building's main ground normally means clamping a wire to the copper water pipe as a ground or connecting it to a driven ground rod. There is no need to figure this out for yourself. Your home should already have a VERY thick wire that is clamped to this ground connection and run to the electrical box. Also, any coaxial cables for cable TV or satellite will also be grounded right as they enter the home and you can either leverage that ground or trace it back to the grounding clamp. Finding a good ground is another good reason to locate the alarm panel with other wires in a basement or utility closet.

The alarm system also recommends that you also ground the metal alarm panel box. This is done in case a power wire comes loose and contacts the cabinet. With the cabinet grounded, that loose wire will be grounded in case it comes in contact with the cabinet. To ground the cabinet, connect a ring connector to the end of the ground wire. Then, cut another short length of wire and connect a ring connector to one end of that wire. Using one of the existing holes in the cabinet (alarm panel box), bolt both wires to the cabinet as indicated above: bolt, cabinet hole, star washer, long ground wire

to building ground with ring connector, lock washer, nut, short ground wire with ring connector, lock washer, nut. For this specific alarm system, all of these parts were included in the kit. Note: The star connector is required to scratch the paint off of the cabinet. Paint doesn't conduct electricity.

Note that there is a hole located at the top of the power supply housing. If your wall outlet has a screw in the middle of the wall plate, then you can remove that screw, plug the power supply into the bottom outlet, and then put the screw through the hole in the top of the power supply and back through the wall plate. This prevents the power supply from falling out of the outlet or someone removing it by mistake. Also make sure you don't use an outlet that can be turned off by a wall switch.

Alarm Siren/Horn Wiring



**BELL / SIREN 700 mA MAXIMUM
OBSERVE POLARITY**

**For Fire Bell/Siren wiring, please
refer to *Installation Manual*.**

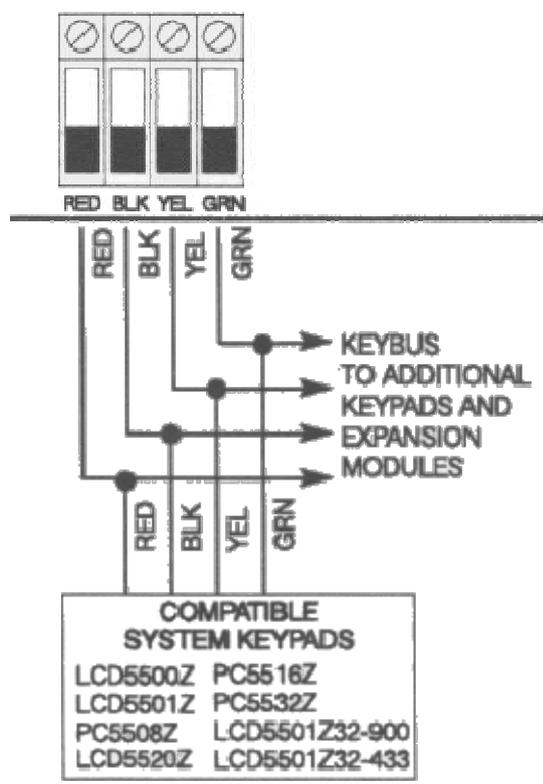
The siren/horn/bell for the system basically makes lots of noise when the alarm goes off. As before, if the siren didn't come as part of a kit, then verify that the siren doesn't draw too much current for the panel, in this case no more than 700 milliamps. This means that the siren must be labeled 700 mA or less.



The siren will either have + and - terminals or black (-) and red (+) wires coming out of it. Connect these wires to the black and red wires of the alarm wire that runs back to the + and - bell terminals on the main panel. For this example, the siren also has an optional yellow (+) wire that can be used instead of the red wire. Using the yellow wire makes a yelp noise and the red wire makes a steady tone.



Alarm Keypad Wiring



Keypads typically require 4 wire connections. For multiple keypads, run each wire from the keypad back to the control panel and simply place multiple wires in each connection. The terminals on the keypad are labeled Z G Y B R. The G (Green), Y (Yellow), B (Black), and R (Red), are the standard 4 colors for alarm wiring. The DSC Z model keypads contain a 5th Z connection that can be used to monitor an additional zone. Remember that the Power 864 panel supports up to 64 zones but only has connectors for 8. The sensor wiring description below details how to use the Z terminals.



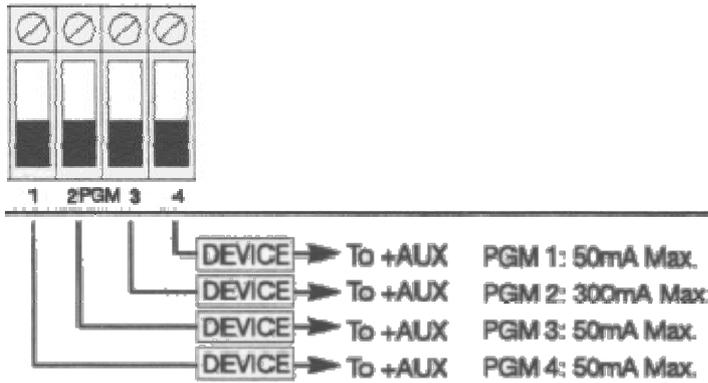
Keypad circuit board



Keypads without zone support do not have this 'Z' terminal

'Z' version keypads are also indicated by a label located on the back of the keypad plastic. The label reads: 'Z' version.

Alarm Device (Smoke Detector) Wiring

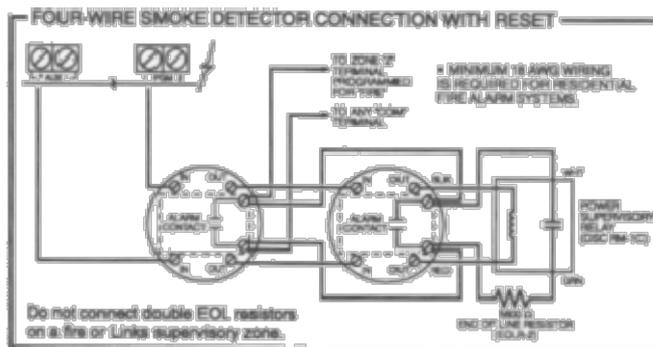


The Device terminals are for smoke detectors and other programmable devices. Below are the instructions for wiring 2 or 4 wire smoke detectors to a DSC alarm. Consult your alarm manual for any specific instructions on wiring programmable devices.



Fire Zone Wiring - 4-wire Smoke Detectors

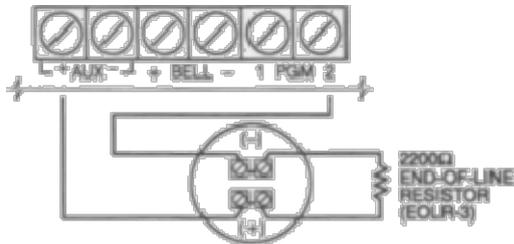
All zones defined as Fire (see section 'Basic Programming PWS Sect 3') must be wired according to the following diagram:



For a complete description of how fire zones operate, see section 'Basic Programming PWS Sect 3'.

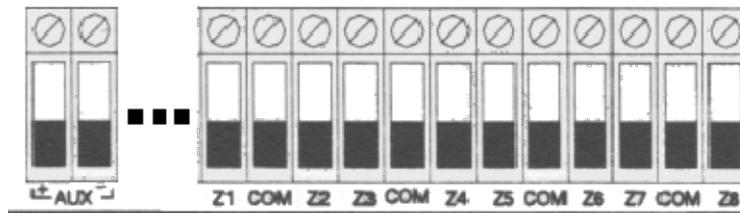
Fire Zone Wiring - 2-wire Smoke Detectors

If PGM2 has been programmed for 2-wire smoke detector connection (see section 'Basic Programming PWS Sect 3'), the detectors must be wired according to the following diagram:



NOTE: If PGM2 is programmed for 2-wire smoke support, Jumper CON1 on the main board must be removed. For a complete description of how fire zones operate, see section 'Basic Programming PWS Sect 3'.

Alarm Sensor Wiring



550mA
NOTE: For 24hr standby, max Aux current capacity must not exceed 420mA**.

All sensors use the COM (common) Z connectors on the control panel circuit board. Powered sensors (Ex: motion detectors) also require the + & - auxiliary power connections. All 4 COM connectors on the board are identical and any of the can be used. The idea is that Z1 & Z2 use the first COM terminal, Z3 & Z4 use the second...

At the alarm panel side, connect the wires using the colors shown below. Door and window sensors don't require Aux Power, so don't connect the red and black wires. You may be tempted to connect these wires when unused just to get them out of the way. That is a bad idea, because it means there will be live +12V power at the other end of that wire. A short could cause the alarm to malfunction or a short could damage the circuit board.

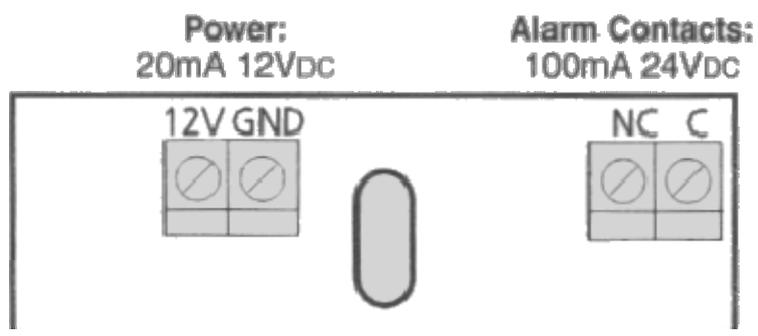
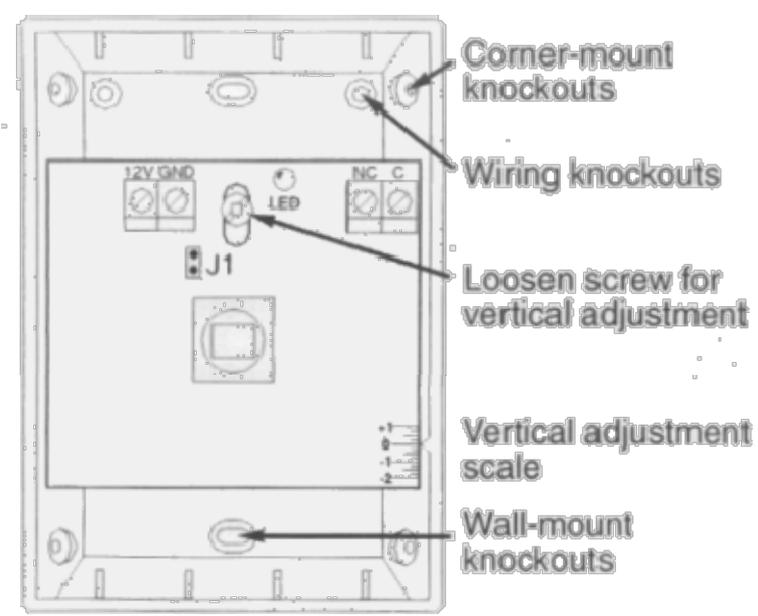
Panel Connector	Color	Powered Sensor Connector	Door/Window Sensor

Z	Green	Normally Closed (NC)	Either wire
COM	Yellow	Common (C)	Either wire
Aux +	Red	Power (+12V)	
Aux -	Black	Ground (GND)	

Below are sample DSC sensors: Motion Detector, Glass Break Sensor, Window Sensor, and a Door Sensor. Specifics for wiring each type of device follows. Be sure to read our sections on [Alarm Wiring](#) and [Tamper Proof Wiring](#) before you do any wiring yourself.



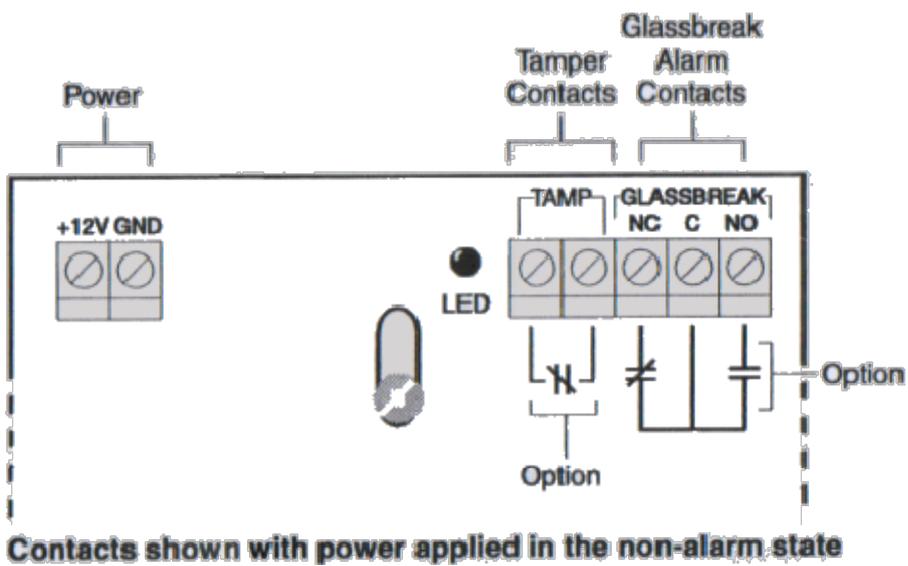
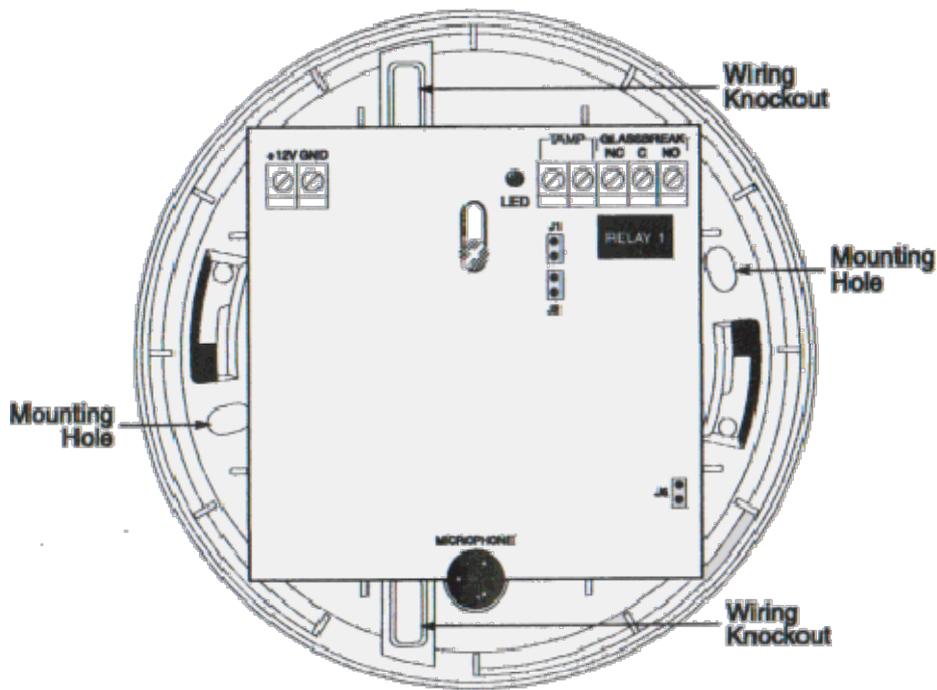
Non-powered sensors like door and window sensors come in 2 parts. The first has 2 wires or 2 connectors on it that connect to the green and yellow wires from the alarm panel. It doesn't matter which wire goes to which connector. The second part of the sensor contains a magnet. It is best to wait to permanently mount the second part of the sensor until the alarm system is running and you are able to verify proper placement.



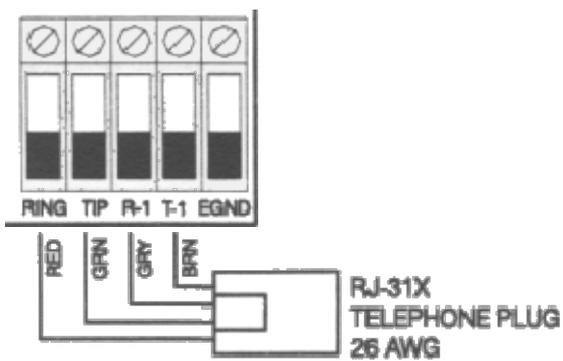
The motion detector above and the glass break sensor below use all 4 wires. The extra 2 wires are for power. As indicated in the control panels diagram, the power draw for all powered devices (including sensors) cannot exceed 550mA. As an example, this motion detector can draw up to 20mA and the glass break sensor can draw 32mA so there is plenty of headroom for many sensors.

The **Normally Closed (NC)** connections are preferred over Normally Open (NO) ones. Cutting a wire to a NC sensor will set off the alarm while cutting a wire to a NO sensor will disable that sensor.

This glass break sensor also includes a tamper connection that can be wired as a separate zone or in series with the Normally Closed contacts. Wiring the tamper circuit to the alarm will activate the alarm when the cover of the sensor is removed.



Phone Wiring



The phone connection is required so that the alarm system can call the alarm monitoring company when the alarm goes off. Even if you are not paying for monitoring, you will want to make the phone connection. Otherwise, the control panel will detect this missing connection as a problem and the *Trouble* light on the alarm will stay lit.

If you have an phone outlet available, the easiest way to make the phone connection is to take a spare phone wire and cut off one of the ends. Then strip the wires and connect the cut end to the control panel. Otherwise, run the wire from the alarm panel to any phone wire you can find in the basement and make the connection there.

Pin	Use	Alarm Color	Standard Phone Wire Color	Cat3/Cat5e Color
1				Green Stripe
2	Line 2 Tip	Brown	Black	Orange Stripe
3	Line 1 Ring	Red	Red	Blue
4	Line 1 Tip	Green	Green	Blue Stripe
5	Line 2 Ring	Gray	Yellow	Orange
6				Green

The phone wire colors on this alarm (at least for Line 2) don't match standard phone wire colors. Also, in new homes many builders use Cat5e cable for phone wire. It is easier and cheaper to buy one large spool of Cat5e cable and use it for both Internet and phone lines. Your own phone wires can be any color. Just make sure that you match up the correct colors when using different types of wires.

Disclaimer

This model of burglar system was chosen because it is one that I am personally familiar with and I had parts and manuals that were available for review. These instructions are provided as an example for how to interpret instruction manuals for different alarm systems so that you will have a better understanding of them. It is not intended that you blindly wire an alarm system exactly as described above. Small changes to the control panel or components may occur over time, so always reference the manual that came with your hardware before this site. Also, please review the [general disclaimer](#).

This example is not intended as an endorsement of DSC and this site is not affiliated with DSC. DSC (Digital Security Controls Ltd.) is a division of Tyco International.

Programming a Home Security System / Burglar Alarm

Every alarm system is different, but there are some basic premises that are consistent for all systems. This guide will focus those areas that are common to all systems.

The first thing to realize is that the manual that a security company gives the homeowner is not the full installers programming manual. The installer programming manuals are much more complicated and involve setup that the homeowner is not expected to perform. If you are setting up an alarm system on your own, expect to do lots of reading and re-reading. Most installation manuals assume you already know what you are doing and they are nothing more than reference guides.

Programming is done from a keypad that is connected to the main panel. At least one of your keypads should be an LCD display. Programming on a keypad with a LCD display is much easier than using one with only lights. With the full LCD screen, you are able to visually verify what mode you are in and what you are typing. With the cheaper keypads, you have to depend on a bunch of green lights to tell you what is going on.



The heart of an alarm system is the main panel which is basically a very simple computer. Like all computers, it stores data and software in bits which are nothing more than zeros and ones. When you configure your alarm system, you will be changing these bits. For simplicity, computers often represent a 4 bits as a single hexadecimal number - a single digit with values ranging from 0 - 15 (or 0-9 and A-F).

0 0 0 0	= 0
0 0 0 1	= 1
0 0 1 0	= 2
0 0 1 1	= 3
0 1 0 0	= 4
0 1 0 1	= 5

0 1 1 0 = 6

0 1 1 1 = 7

1 0 0 0 = 8

1 0 0 1 = 9

1 0 1 0 = A

1 0 1 1 = B

1 1 0 0 = C

1 1 0 1 = D

1 1 1 0 = E

1 1 1 1 = F

All configuration information in the alarm panel is saved in non-volatile memory, meaning that the data is not lost when the device loses power. Think of it as a USB flash drive. This memory is identified by an address or location. To program the alarm panel, you specify the address or section that you want to change and then provide a new value for that address.

Continuing with our [DSC Alarm System Example](#), some of the information here will be DSC specific. Whether you have a DSC or some other alarm system, you should thoroughly read your installer and programming manuals and write down what changes you want to make before proceeding.

To program the alarm, you first must enter the installer code. For our example, this requires entering [*][8][Installer Code] or * then 8 then the 4 digit default installer code. *No, we won't be providing any default codes here.* If you have a LCD display, you will immediately understand why this makes programming easier. After entering [*][8], the display tells you to enter the Installer Code. When you successfully enter the correct Installer Code, it asks you what section you want to change. If you enter an incorrect code, it tells you the code is incorrect. Without a LCD display, you have to rely on blinking lights and counting the number of beeps to determine if you are doing things correctly.

So, now you have to decide what section (or address) you want to change. For our example, this is a 3 digit number and we know this because our display is showing ___ telling us it is waiting for a 3

digit number. This section number will come from your Installation Manual & Programming Worksheets. For our example we will use something simple, like beeping for 30 seconds after we activate the alarm. We find Audible Exit Beeps as item #6 (of 8 items total) in Section [014] of our manual. All of the items in this section are all simple on/off settings. So we type 0 + 1 + 4 into the keypad to selection Section [014]. We now see - - - - - on the display. This indicates to us that none of the 8 items in Section 014 are on. We now enter 6 on the keypad - remember that Audible Exit Beeps was #6 in this section. We now see - - - - 6 - - on the display indicating only option #6 is on and the rest are off. Now hit the # key to stop editing this Section, and # again to exit the Installer programming completely.

Now for another example. Let's say we want the system to beep whenever we open or close a door, regardless of whether the alarm has been armed. This is the Door Chime feature. Activating this feature does not require an installer code. Some of the better DSC LCD Keypads have a Chime button right on the keypad to turn this feature on or off. You could also type *6 to change this feature without an advanced keypad.

We told the system we want it to beep when a door is opened, but we didn't tell it what zones are doors and which ones are windows sensors or motion detectors. We don't want the system beeping every time we walk past a motion sensor. Sections [101] through [164] are used to program the attributes of Zones 1 through 64 (assuming our system supports this many zones). Let's say our Front Door is Zone 1 and our Back Door is Zone 2. Then we want to turn the Door Chime feature on for Zones 1 & 2 and leave it off for the remaining zones. We again type [*][8][Installer Code] to enter programming mode, and then type 1 + 0 + 1 to program Section [101] which is Zone 1. We then see - - - - - again meaning none of the options for this zone are On. We press 3 (which is the Option # for Chime) and we now see - - 3 - - - - meaning Option 3 is active. Then press # to return to the Section prompt and then do the same for Section [102] to set the same option for the Back Door.

Not all programming consists of turning options on & off. Entering new codes or passwords or specifying names of zones fall into this category.

- For numeric programming (codes) you simply type the new code on the 0-9 keypad.
- For hexadecimal programming, you type 0-9 keypad for the numbers 0-9. To type the letters A-F (representing 10-15), you must first press the star [*] key to enter hexadecimal mode and then 1-6 for the letters A-F. Press [*] again to exit hexadecimal mode. Note: This is DSC specific method. Read your manual.
- Alpha-numeric programming (zone names) is done 2 ways. Either with simple up/down arrows to select letters, or it is similar to sending text messages on a numeric keypad on a cell phone (#2 = ABC). Again, this can vary with the manufacturer.

Here are some things to look for when programming your Security System

Codes - There are several important things to mention here.

- All system codes / passwords should be changed on installation. The default codes are well known and should not be used.
- There are multiple codes per system (master, installer, maintenance, and user codes) and they should all be changed.
- Write down the master & installer codes in the provided booklet and lock them up in the alarm cabinet. After 20 years you might forget them.

The Master Code is the primary code used by the home owner to activate and deactivate the alarm system. This code can be used to create other codes for other people in the home. The other codes are for programming/maintenance and should not be distributed.

Date/Time - This can be changed with the Master Code meaning a home owner can do it. Read your manual for the instructions.

Zone Names - Having real names for each zone (requires LCD keypad) makes it much easier to know what is wrong with your system. "Rear Door Fault" is much easier to understand compared to Zone 2 Fault or a Red light next to the number 2.

Zone Settings:

- **Door Chimes** - Should the system beep when this zone is faulted? Our Door Chime example from above.
- **24 Hour Zones** - These are zones (like Fire, Carbon Monoxide, Water Leak or maybe Glass Break Sensors) that should be active 24 hours a day, whether the system is armed or not.
- **Immediate Violation** - These are zones (like Glass Break Sensors) that should set off the alarm without any delay. After entering your house, you typically get 30 seconds to enter the alarm code. Some zones should not wait 30 seconds to set off the alarm.
- **NO vs. NC** - Are the sensors in this zone wired [NO \(Normally Open\) or NC \(Normally Closed\)](#).
- **Resistors** - Are the sensors in this zone wired with Resistors: [EOLR \(Single End of Line Resistor\) or DEOLR \(Double End of Line Resistor\) or no Resistor](#).
- **Wireless** - If supported by your alarm panel, indicate that this is a wireless sensor.
- **Bypass** - Should users be able to bypass this zone when activating the alarm. For example, you might want to keep the 2nd floor windows open on a hot summer night.

Phone Numbers - What is the phone number(s) of the security company to call when the alarm goes off. Might also need to program the format of the data that is sent to the monitoring company.

Change the entry/exit delays - Give you more time to leave the house or enter the code after entering the home.

Testing - This is covered in the [Alarm Testing and Maintenance](#) page.

Look up recent alarms - This can usually be done by pressing the arrow keys on the LCD keypad.

Manual alarms - The alarm keypads should have buttons right on them to signal a Fire or Security Emergency.

Testing & Maintenance for a Security System / Burglar Alarm

The final part of an alarm installation is making sure all the sensors work properly. You should repeat this process regularly just to make sure everything is still working. Most manufacturers suggest testing the system, sensors, and batteries monthly. At a minimum you will want to test the system annually.

Most testing can be done without actually setting off the alarm. To start, close all doors and windows that have sensors and make sure that the display on the keypad indicates the system is ready to be activated. This might require that everyone in the home not move if you have motion detectors. You should also warn the family if you are going to set off the alarm & start making loud noises.

Note: At this point your system should not show any warning indicators. Even with every sensor properly closed, you could get warnings about primary power, battery backup power, lack of a phone line connection, a tamper warning on the control panel box... These will be covered below.

Testing Door/Window Sensors & Diagnosing Problems:

These are the easiest sensors to test. Simply open each door/window one at a time and verify that the correct zone changes to violated on the keypad. This can be a light turning on next to that zone number, or an alphanumeric message on the keypad. If multiple doors or windows are in the same zone be sure to test each one individually.

If the sensor always shows that the zone is violated then it might be a problem with the magnet part of the sensor not being close enough to the part with the wires. Also, large metal doors can decrease the power of the magnet meaning that the 2 parts of the sensor must be alignment very well or a stronger magnet must be used. You can verify that your problem is a magnet problem by using the magnet portion of another sensor and holding it right next to the sensor while the door or window is open.

If your sensor always shows tampered then you probably have a problem with your End or Line Resistors (EOLR) - either the resistors themselves are missing or not placed properly or the alarm programming for that zone (Normally Open (NO) vs. Normally Closed (NC), No Resistors vs. EOLR vs. DEOLR) doesn't match what you have actually installed. Read our pages on [Normally Open/Closed & End of Line Resistors](#) and [Alarm Programming](#) for more information.

Testing Motion Detectors & Diagnosing Problems:

It is best to test a motion detector with two people. One person simply needs to walk in front of the motion detector and the other is at the keypad to verify that the correct zone properly indicates a violation. Motion detectors work by emitting a series of beams and sensing a change in distance. Depending on the number of beams (more expensive motion detectors have more beams) and your distance from the motion detector, you may be able to take a couple of steps before tripping the

motion detector. Standing and waving your arms will most likely not trip a low end motion detector. This doesn't mean the detector won't work. It should be fine for home use.

If you have dogs or other animals, you will want to have them walk in front of the sensor to make sure they do not trip the motion sensor. There are special motion detectors that are designed to not be set off by animals. If you are using one of these and animals can still set it off, then raise the angle of the sensor. Read the instructions that came with your motion sensor for information on how this is done. If your motion detector is wired properly but isn't detection motion from far away, then the motion detector might be aimed too low or too high. Try adjusting the angle to see if there is any improvement.

Most motion detectors have a red light on the detector itself that lights up when it senses motion. If your motion detector isn't working properly and this light is also not working, then you probably have a power problem - a wiring problem with the two wires for power and ground. If the red light on the motion detector is working, then your problem is probably a NO/NC or a resistor mismatch between what you installed and how the alarm is programmed.

Testing Glass Break Sensors & Diagnosing Problems:

Glass break sensors can be a bit more difficult to test. Assuming you don't want to start smashing glasses to test the sensor, your best bet is to get a glass break tester. These can usually be found online for under \$50. With a glass break sensor, you want to test the power & wiring just like a motion detector. In addition, you will want to test the sensitivity of the sensor and ensure it can detect the noise of glass breaking from any of the windows it is intended to cover.

If your glass break sensor is setup as a 24 hour zone, then it will set off the alarm even if the alarm is not activated. This also means that if you drop a glass during dinner it could set off your alarm. To prevent this from happening, enter the installer code on a keypad before performing your test.

To test a glass break sensor, turn the sensitivity on the sensor up to the highest setting. Then, using the highest setting on the tester, put the tester right in front of the sensor and press the button to emit the glass breaking signal. If this doesn't work, then you most likely have a wiring problem. See above for some tips on diagnosing these problems. If you have entered the installer code on a keypad, then use the LED light on the glass break sensor to know that it has been activated.

Once you have verified that the sensors are functional, the next step is to tweak the sensitivity of the sensor. Starting at the lowest sensor on the tester, test the sensor from each window location that you want the sensor to protect. You want to find the lowest sensitivity on the glass break sensor that can detect the glass break tester from each window position. Turn up the sensitivity on the glass break sensor after each test until it can detect the glass break noise from each window.

If you don't want to pay for the glass break sensor, then start with the highest sensitivity on the sensor and turn it down one step at a time when it goes off for no reason. For example, clapping or any loud noise can set off the glass break sensor at maximum sensitivity. Turn down the sensitivity each time one of these false alarms occur until the stop. Of course, by doing this you don't have any idea how effective the glass break sensor actually is. To verify that the sensor is working after installation, try clapping right next to the sensor to set it off.

Testing Smoke Detectors & Diagnosing Problems:

To test a smoke detector, push the test button on each detector to verify that it makes a noise. Also, check to see that there are no low battery indicators on the detector. It is a good idea to replace the batteries on the smoke detectors once a year. Most new smoke detectors will start to beep when the battery gets low. Mine seem to always start to beep in the middle of the night. It is always a good idea to have spare batteries on hand.

Testing and Replacing the Backup Battery:

Your alarm system should automatically indicate that the backup battery needs to be replaced by displaying a "Replace Battery" message on the LCD keypad. Find a replacement battery that matches the specs of your battery. You can buy the battery on line for about \$10-\$40 (try ebay). Make sure it is roughly the same size so that it fits in the alarm box.

To replace the battery, first disconnect the main power to the alarm panel. Then remove the red & black power cables to the battery and attach them to the new battery. Then, restore main power and close & lock the alarm panel.

If you didn't install the alarm system and the alarm panel has a tamper switch (a switch that detects the alarm panel has been opened) then opening the panel to replace the battery will automatically set off the alarm. Assuming you can get into the alarm panel (you have the key or there is no lock) then I wouldn't worry about setting off the alarm to replace the battery. The alarm monitoring company will charge you more than \$150 to replace the battery compared to about \$25 to do it yourself.

Testing the Phone Connection:

If the phone wire is not detected by the alarm system, it should display an error on the keypad LCD display. Contact your monitoring company about generating a false alarm to test that you have the phone number entered correctly and the system configured properly.

Testing Wireless Sensors & Replacing Batteries:

Test wireless sensor as you would any other sensor. You should replace the batteries on your wireless sensors yearly when you replace the smoke detector batteries. As with the smoke sensors, if your wireless sensors beep when the battery is low, you may choose to wait until then to replace the battery. Just be sure to check that the sensor is still working on a regular basis to make sure the battery isn't completely dead.