



**Is your Home
Wired for
Security, Cable,
High Speed
Internet, Sound
and Health
Alert?**

**Home
Wiring
Services**

White Paper

Is your Home Wired for Security, Cable, High Speed Internet, Sound and Health? Home Wiring Services

Electrical System Basics

Electricity is a safe and convenient source of energy for heat, light and power in your home, provided it is distributed in correctly sized and properly protected conductors. Good wiring systems are safe and energy-efficient.

Because of their convenience, households have accumulated many electrical appliances and property owners often fail to give proper attention to the wiring system that serves them. Energy-efficient appliances should always be served by good wiring systems.

Many older homes and service buildings are not adequately wired to serve today's electrical loads. Some new homes fall into this category, too. The safety of the system depends first on how well you have maintained the safety valves — your electrical fuses or your circuit breakers. It also depends upon the care taken by the homebuilder or electrician in the placement of electric cables. All cables in attics should be placed on *top* of attic insulation materials.

National Codes

Every safe home wiring system should equal or exceed the requirements of the national electrical code. But more than that, every system should be designed for economy of installation, operation, expandability and maintenance. The code itself is chiefly concerned with safety. Thus, it is usually desirable to install systems that exceed code standards. It is more economical to plan an adequate and easily expandable system than it is to rewire after your home has been built.

Licensed Electricians

Owners of existing homes should have a qualified person replace deteriorated and damaged receptacles and, at the same time, upgrade their home electrical system to present safety standards. The simplest and most effective method to protect against electrocution is through the installation of ground-fault circuit interrupters (GFCIs).

A permit is needed any time you add new lights that require new wiring, new switches or receptacles. Wiring is an intricate process when you get into installing proper junction boxes, connectors and ground lines. It is easy to electrocute yourself if you don't know what you're doing. If electrical is part of the work being done on your home, make sure your contractor has a proper permit and sub-contracts a licensed electrician to do the work. It is your right to ask to see the **electrician's valid license**.

Cables

These are the wires used for transmitting electrical information from one point to another. Their primary function is to get the signals across without significant alteration. A perfect cable refers to one that passes a signal from one end to the other without any alteration. The physical structure of the cable and its connectors determine the degree to which a cable deviates from the perfect cable.

Keep electrical wires separate from computer or cable wires. The household current carried through electrical wires can cause interference in other cables. An easy solution is to keep them at least 4 inches apart and never tie them together. If they need to cross, keep them at right angles.

Useful Terms

- **Ampere.** Measures the number of electrically charged particles that flow past a given point on a circuit (per second).
- **Breaker box (breaker panel).** Houses the circuit breakers or fuses, distributes power to various parts of your house.
- **Circuit.** All wiring controlled by one fuse or circuit breaker.
- **Circuit breaker.** Protective device for each circuit, which automatically cuts off power from the main breaker in the event of an overload or short. Only a regulated amount of current can pass through the breaker before it will "trip."
- **Fish tape.** A long, flexible metal strip with a formed hook to which you fasten the cable or wire to pull through walls, raceway, or conduit.
- **Main breaker.** Turns the power entering your home through the breaker box on or off. This is sometimes found in the breaker box, or it may be in a separate box and at another location.
- **Neutral bus bar.** The bar to which the neutral wire is connected in the breaker box.
- **Roughing-in.** Placement of outlets, switches and lights prior to actual electrical hook-up.
- **Volt.** Measures the current pressure at receptacles and lights. Average household voltage is 120.
- **Watt.** The rate at which an electrical device (light bulb, appliance, etc.) consumes energy
Watts=volts x amps.

Residential Electrical Tips and Safety Precautions

Lightning Arrestors

Consider installing a lightning arrestor in your main electrical panel. These devices have the ability to capture massive voltage surges entering your service entrance cables that power your entire house. The devices, when installed with a first class grounding system, bleed the voltage surge to the ground. These devices must be used in conjunction with point of use surge protectors that are commonly sold with sensitive electronic equipment in order to provide the highest level of protection for electronic equipment.

A homeowner who is familiar with service panel wiring can install these devices. Do not install these devices unless you are 100 percent positive you know what you are doing. If installed improperly, they are ineffective.

Cat5 Cable

Whether you have a 100-year-old home or a new one that is being built, all homes today need Cat5 cable. What is this? It is a new standard of wiring that can network computers and appliances and take care of telephone needs all in one.

Category 5 wiring is low voltage cable. It has 4 pairs of wires within one cable. The coloring of the wires is standardized. You will find a solid blue, green, orange, and brown wire. Twisted around each of these is a white wire that has a same color tracer on the wire. So you will have a solid blue twisted with a white wire that has blue dashes or streaks on it.

You can network a computer to another one and have two different phone lines all in the same space as you would normally have a regular duplex outlet. Not only that, there is actually space within the box and special outlets for three other connections.

Seasonal Outdoor Lighting

If you make a habit of installing outdoor seasonal lighting of any type, you might consider installing several strategically located outdoor receptacles that are controlled by an indoor switch. Many people struggle with extension cords that have to be draped through windows or doors. These cords have to be plugged in and out each night. The indoor switch makes the job easier and safer. Extension cords are major sources of electrocution and fires. Avoid using them at any expense.

Outlets

Check for outlets that have loose-fitting plugs, which can overheat and lead to fire. Replace any missing or broken wall plates. Make sure there are safety covers on all unused outlets that are accessible to children. Outlets deteriorate from repeated use, from plugging-in and unplugging appliances as is often done in kitchens and bathrooms. As a result, when plugs fit loosely into receptacles, especially the two-prong ungrounded type, they may slip partially or completely out of the receptacle with only slight movement of the attached cord.

Cords

Make sure cords are in good condition—not frayed or cracked. Make sure they are placed out of traffic areas. Cords should never be nailed or stapled to the wall, baseboard or to another object. Do not place cords under carpets or rugs or rest any furniture on them.

Plastic covered wires that run along the top of your baseboards are dangerous, because they can easily be damaged. It is so easy to just add a wire like this that it is often done, with extension cords, or even regular wiring simply being nailed to the baseboards to keep them off the floor. If this is low voltage wiring, it is not safe for the wires, but not dangerous for fire. But when this is 110 or even 220volt wiring, it should be protected. You can get both plastic and metal raceways designed for surface wiring, even electrical boxes that sit safely on the surface of the baseboard.

Extension Cords

Check to see that cords are not overloaded. Additionally, extension cords should only be used on a temporary basis; they are not intended as permanent household wiring. Make sure extension cords have safety closures to help prevent young children from shock hazards and mouth burn injuries.

Plugs

Make sure your plugs fit your outlets. Never remove the ground pin (the third prong) to make a three-prong fit a two-conductor outlet; this could lead to an electrical shock. **NEVER FORCE A PLUG INTO AN OUTLET IF IT DOESN'T FIT.** Plugs should fit securely into outlets. Avoid overloading outlets with too many appliances.

Ground Fault Circuit Interrupters (GFCIs)

GFCIs can help prevent electrocution. They should be used in any area where water and electricity may come into contact. When a GFCI senses current leakage in an electrical circuit, it assumes a ground fault has occurred. It then interrupts power fast enough to help prevent serious injury from electrical shock. Test GFCIs according to the manufacturer's instructions monthly and after major electrical storms to make sure they are working properly.

Light Bulbs

Check the wattage of all bulbs in light fixtures to make sure they are the correct wattage for the size of the fixture. Replace bulbs that have higher wattage than recommended; if you don't know the correct wattage, check with the manufacturer of the fixture. Make sure bulbs are screwed in securely; loose bulbs may overheat. But don't over tighten either. This can lead to bulbs breaking off in the socket.

Circuit Breakers/Fuses

Circuit breakers and fuses should be the correct size current rating for their circuit. If you do not know the correct size, have an electrician identify and label the size to be used. Always replace a fuse with the same size fuse.

Water and Electricity Don't Mix

Don't leave plugged-in appliances where they might fall in contact with water. If a plugged-in appliance falls into water, NEVER reach in to pull it out—even if it's turned off. First turn off the power source at the panel board and then unplug the appliance. If you have an appliance that has gotten wet, don't use it until it has been checked by a qualified repairperson.

Appliances

If an appliance repeatedly blows a fuse, trips a circuit breaker or if it has given you a shock, unplug it and have it repaired or replaced.

Entertainment/Computer Equipment

Check to see that the equipment is in good condition and working properly. Look for cracks or damage in wiring, plugs and connectors. Use a surge protector bearing the seal of a nationally recognized certification agency.

Outdoor Safety

Electric-powered mowers and other tools should not be used in the rain, on wet grass or in wet conditions. Inspect power tools and electric lawn mowers before each use for frayed power cords, broken plugs and cracked or broken housings. If damaged, stop using it immediately. Repair it or replace it. Always use an extension cord marked for outdoor use and rated for the power needs of your tools. Remember to unplug all portable power tools when not in use. When using ladders, watch out for overhead wires and power lines.

Lightning

During an electrical storm, do not use appliances (i.e., hairdryers, toasters and radios) or telephones (except in an emergency); do not take a bath or shower; keep batteries on hand for flashlights and radios in case of a power outage; and use surge protectors on electronic devices, appliances, phones, fax machines and modems.

Space Heaters

Space heaters are meant to supply supplemental heat. Keep space heaters at least 3 ft. away from any combustible materials such as bedding, clothing, draperies, furniture and rugs. Don't use in rooms where children are unsupervised and remember to turn off and unplug when not in use.

Do not use space heaters with extension cords; plug directly into an outlet on a relatively unburdened circuit.

Halogen Floor Lamps

Halogen floor lamps operate at much higher temperatures than a standard incandescent light bulb. Never place a halogen floor lamp where it could come in contact with draperies, clothing or other combustible materials. Be sure to turn the lamp off whenever you leave the room for an extended period of time and never use torchiere lamps in children's bedrooms or playrooms. Consider using cooler fluorescent floor lamps.

Detecting Poor Wiring

Any system should avoid excessive voltage drop, wasted energy and overheated wires. You need not have a fire or an appliance failure to discover overloaded circuits, and you need not be an expert to determine whether your home wiring system needs attention. Look for symptoms of poor wiring:

- Fuses blow or circuit breakers trip often.
- Too few switches, outlets and lights.
- Extension cords frequently used.
- Lights dim and TV picture shrinks when refrigerator or other equipment starts.
- Toaster and electric iron heat slowly.

Fuses or circuit breakers of greater amperage will not correct too-small wiring or low-voltage problems, but proper circuit protection will ensure safe use of what you have. If you don't have enough circuits to serve all of your electrical equipment, consult an electrician or power supplier; you will probably need a larger service entrance. If rewiring becomes necessary, develop a wiring layout with help from local electrical specialists.

Replacing the correct fuse

If your circuits are not now identified on your entrance panel, you can make up your own identification record by following this procedure:

1. Turn on all lights in the house.
2. Go to fuse box. **Stand on a dry board** and remove one fuse. (Check type and size.)
3. Tour the house; note the lights that have gone out and check with a test lamp (or small portable electric tool) for duplex outlets that have gone dead.
4. Make a record of lights and outlets served by this circuit.
5. Replace the fuse with the right kind and size of fuse. In most cases, a 15-amp should be used. The right size of tamper-resistant, Type-S fuse with adapter will upgrade old systems and ensure greater safety.
6. Repeat the above procedure for remaining fuses.

Follow a similar procedure if you have the circuit breaker type of service entrance panel. Since manufacturers use different designs for this equipment, check resetting instructions inside the breaker panel. If you follow procedures given, the trigger mechanism will reset properly. Some breakers must be moved to an extreme off position before they will reset.

Trouble shooting

Looking for the cause of a blown fuse or tripped breaker need not be time-consuming if you investigate it in a systematic manner. If you know the cause of trouble, correct it; then replace the fuse or reset the breaker. If you do not know the cause of the trouble:

1. Locate main service entrance panel. It is usually near the point where wires enter the house.
2. Locate fuse or breaker that controls power to the circuit that failed.
3. Check lights served by other circuits to be sure main power source is on.
4. Check for equipment that is hot or has a burned odor.
5. Disconnect any equipment recently added to the circuit.
6. After locating and correcting the source of trouble, replace the blown fuse with the proper size of Type-S, time-delay fuse (15 amp for #14 wire and 20 amp for #12 wire circuits). If you aren't sure of normal circuit wire size, use the #15 ampere Type-S time-delay fuse. If, after giving a breaker an ample cooling period, it does not hold, recheck the load on this circuit.
7. If trouble continues, call your local electrician.

Wire Size Upgrading

The electrical code establishes wire sizes based on fire safety considerations. When an electrical load is run through a wire, the resistance in that wire creates heat. The maximum amperage for a given wire is based on the maximum temperature that its insulation can safely handle. If you run that same current through a larger wire, there is less resistance, less heat, less energy loss.

Wires that run to large frequent motor or resistance loads, like refrigerators, air conditioners, furnace fans and baseboard heaters basically create hundreds of feet of warm wires running through the walls. Outside of the heating season this is a net loss and, even in the winter, wires outside the thermal envelope are a direct loss as well. In fact, warm wires running to air conditioners inside the thermal envelope force the air conditioners to work even harder.

Up-sizing wires one wire size cuts down energy losses by 35 to 40 percent. The increased cost for the wire usually has a payback of as little as one or two years.

Upgrading to a Structured Home Wiring System

The days of basic phone and electric service are quickly disappearing. Working at home increasingly requires high-speed Internet access and networking. Those with high-speed Internet access can maximize speed and performance with a move to structured wiring.

Structured wiring is fast becoming the backbone of home offices. It is a data delivery system that can carry phone, fax, broadband, networking, and video/television technologies. For example, phone and fax communications are predominantly analog, but voice over Internet protocol (VoIP)—a technology that allows you to make phone calls using a broadband Internet connection—is gaining momentum. With a structured-wiring system, your home will be VoIP-ready when it comes to you.

Home wiring systems utilize a series of low-voltage cables throughout the home, servicing individual rooms from a central point. A basic system runs a few hundred dollars, depending on the size of the home, and goes up from there as you add optional features. Because of the amount

of wiring involved, the work is best done while a house is under construction and the walls are open – retrofitting this much cable, unless you don't object to exposed conduit, can add considerably to the cost.

A complete home wiring installation is designed to accommodate **four basic electronic systems:**

- Communications, which includes multi-line telephones, computer modems, and certain types of video access, such as pay-per-view connections;
- Entertainment, which includes access to cable television, roof antennas for local broadcasts, satellite TV, home theater systems, and audio components;
- Security, including fire and intrusion alarm systems, telephone key systems, door intercoms, video security, and other types of in-house systems;
- Computerized local area networks (LAN), which is a data communications system serving a small, limited area.

The heart of the system is the main panel, which is typically located in a garage, basement, or other convenient, out-of-the-way location. The panel box contains a number of knockouts for running the cables into it, just like a standard electrical panel. Inside the panel are a series of connection modules – panels with connection points for the various wires. Different modules accommodate different wiring uses – cable TV, computer, phone, etc. – keeping the systems separate and organized.

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