STEP BY STEP
GUIDE BOOK ON
Home Wiring

BLACK WIRE ATTACHED
TO BRASS TERMINAL SCREW

GROUND WIRES

FROM/POWER SOURCE
12-2 WIRE (WITH GROUND)

COMMON TERMINAL SCREW
(Black or Copper Colored)

WALL BOX

THREE-WAY SWITCH

GROUND WIRES

LOADED WITH
SIMPLE, EASY TO
FOLLOW WIRING
DIAGRAMS

ALL ABOUT OUTLETS PAGE 25

HOW TO WIRE THREE-WAY
SWITCHES PAGE 30

12-2 WIRE (WITH GROUND)
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IMPORTANT

ALL OF THE ILLUSTRATIONS IN THIS BOOK SHOW TYPICAL WIRING METHODS, ACTUAL INSTALLATIONS MUST BE ADAPTED TO INDIVIDUAL REQUIREMENTS, SO FOLLOW NATIONAL, STATE, AND LOCAL ELECTRICAL CODES.

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Author: Ray McReynolds

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Step-By-Step Guide Book Co.
P.O. Box 70865
Salt Lake City, Utah 84170
Color coding of wire

- The black wire is HOT
- The white wire is NEUTRAL

Etch this wiring rule in your memory and keep it there. NEVER CONNECT THE BLACK (HOT) WIRE TO THE WHITE (NEUTRAL) WIRE. (Exception: see page 20)

Connect the black wire to the brass-colored terminal on switches, receptacles, sockets, fuse boxes, and to the black wires on pull chain fixtures. The white (neutral or ground wire—also called the "continuous wire") is grounded at the electric service switch. Connect it to the silver or light-colored terminal of all receptacles, etc., and to the white wire on all lighting fixtures. Again—never hook to the hot wire!
How the Home Electrical System Works

The picture below shows how the power supply comes out of the breaker box supplying power to the outlets and how to change direction of the wire with the use of a junction box.

From power source:
- 12-2 wire (with ground)
- White wire attached to white or silver terminal screw
- Black wire attached to brass terminal screw
- Ground wire attached to green hex grounding terminal screw

Junction box:
- Put covers on junction boxes.

Ceiling box:
- Put covers on junction boxes.

Wall box:
- Black wire attached to brass terminal screw
- Ground wire attached to green hex grounding terminal screw

On this page we show using metal wall and metal ceiling boxes. The wiring in plastic and metal boxes is the same except for the ground wire. The ground wire attaches to the metal boxes. In plastic it does not. See page 6 and 7 for more on how the ground wire works in plastic boxes.
How to Turn off Main Power Supply

Before starting any work, you must disconnect (or "kill") the circuit you’ll be working on at its source in the service panel. If your circuits are protected by fuses, removing the appropriate fuse disconnects the circuit from incoming service. In a service panel equipped with circuit breakers, you can disconnect a circuit by switching its breaker to the OFF position.

To make sure you disconnect the correct circuit, turn on a light that's connected to the circuit before you remove the fuse or turn off the circuit breaker. The light will go out when you’ve removed the correct fuse or turned off the correct breaker.

If you have any doubt about which fuse or breaker protects which circuit, shut off all current coming into your home at the main disconnect

While you’re at your service panel, spend another moment to prevent a possible disaster. Tape a note on the panel explaining what you’re doing so no one will come along and replace the fuse or reset the circuit breaker while you’re working on the wiring. Then either carry the fuse with you in your pocket or tape the circuit breaker in its OFF position.

With the electricity turned off, you can work in complete safety. Still, it's a good idea to keep a few additional safety precautions in mind.

Remember that water and electricity don't mix. Never work on wiring, fixtures, switches, or appliances when you’re wet or standing on a damp spot. Lay down dry boards to stand on if the floor or ground is wet.

<table>
<thead>
<tr>
<th>Color of Wire</th>
<th>Color of Terminal Screw</th>
<th>Hot — Neutral or Grounding Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Silver or White</td>
<td>Neutral Wire</td>
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<tr>
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<td>Brass</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Red</td>
<td>Brass</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
<tr>
<td>Bare Wire</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
</tbody>
</table>

Lever disconnect. An external handle controls contact with two main fuses in the cabinet. When you pull the handle to the OFF position, you shut off the main power supply.

Pull-out block. The main cartridge fuses are mounted on one or two nonmetallic pull-out blocks. By pulling firmly on the handgrips, you can remove the blocks from the cabinet and disconnect all power.
THE THREE WAYS TO GET POWER TO YOUR NEW WIRING JOB

Important To Your Safety

NOTE:
YOU MUST NOT EXCEED THE NUMBER OF POLES OR SPACES FOR WHICH THE PANEL BOARD IS APPROVED REGARDLESS OF WHETHER THERE IS ROOM OR SPACE IN THE PANEL.

1. FIRST YOU LOCATE THE CIRCUIT BREAKER BOX THAT CONTROLS THE POWER COMING INTO THE HOUSE, SEE IF THERE IS ANY ROOM LEFT FOR THE CIRCUIT BREAKERS YOU NEED. IF THERE IS GET THE MAKE AND MODEL OFF OF IT AND GO TO YOUR LOCAL ELECT. PARTS STORE AND PURCHASE THE BREAKERS YOU NEED. (SEE PICTURE #1)

2. SECOND, IF THERE IS NO ROOM LEFT IN CIRCUIT BREAKER BOX, CHECK MAKE AND MODEL AS IN #1 ABOVE AND SEE IF THEY HAVE A NARROWER CIRCUIT BREAKER THAT WILL FIT YOUR PARTICULAR BREAKER BOX. MOST CIRCUIT BREAKERS ARE 1" THICK BUT THEY MAKE SOME BREAKERS 1/2" THICK. TAKE OUT ONE THAT IS 1" THICK AND INSTALL 2 - 1/2" THICK ONES. (SEE PICTURE #2)

3. THIRD, IF WAYS #1 AND #2 DO NOT WORK FOR YOU, GO TO YOUR LOCAL ELECT. PARTS STORE AND GET A SUB-PANEL THAT WILL WORK WITH THE MULTI BREAKER YOU HAVE - BRAND ETC. GET ONE THAT HAS AS MANY NEW BREAKERS AS YOU NEED FOR YOUR JOB. (SEE PICTURE #3)

Important
IF USING #14-2 WIRE WITH GROUND, USE A 15 AMP BREAKER TO PROTECT THE LINE.
IF USING #12-2 WIRE WITH GROUND, USE A 20 AMP BREAKER TO PROTECT THE LINE.

All About Circuit Breakers

Single Circuit Breaker

Double Circuit Breaker

More and more circuit breakers are being used in place of fuses. A circuit breaker looks something like a toggle switch, with a handle that lets it be used just like a switch to turn power on and off. Inside each breaker is a fairly simple mechanism which in case of overload trips the breaker and disconnects the load. If a breaker trips because of overload, in most brands you must force the handle beyond the OFF position, then return it to ON, to reset it. On some brands however, the handle merely goes to the OFF position; reset it by returning it to the ON position.

What is to be done when a breaker trips or a fuse blows? Most people will say: reset the breaker, or install a new fuse. Correct, but first find out why the fuse blew. Fuses are the safety valves of electrical installations.
How The Ground Wire Works in Plastic Wall Boxes

In Plastic Wall Boxes:

- **12-2 Wire (with ground)**
  - From power source
  - Black wire attached to brass terminal screw
  - White wire attached to white or silver terminal screw
  - Ground wire attached to green hex grounding terminal screw

How to Wire Outlets

Wiring Two Outlets

- **12-2 Wire (with ground)**
  - From power source
  - White wire attached to white or silver terminal screw
  - Black wire attached to brass terminal screw
  - Ground wire attached to green hex grounding terminal screw

The wiring in plastic and metal boxes is the same, except for the ground wire. The ground wire attaches to the metal boxes, in plastic it does not, see page 6 and 7 for more on how the ground wire works in plastic boxes.
How The Ground Wire Works in Plastic Wall and Ceiling Boxes

THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT.

How To Wire Single Pole Switch
With Switch Controlling Two Lights

*ON THIS PAGE WE SHOW USING METAL WALL AND METAL CEILING BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT, SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.
All About Electric Wire

CHECK WITH LOCAL CODES ON WIRING SIZES NEEDED FOR YOUR WIRING PROJECT

Chart Shows Copper Wire Size, Amps and Watts

<table>
<thead>
<tr>
<th>Wire Size (Actual Size)</th>
<th>Amps (Also Fuse or Circuit Breaker size)</th>
<th>Watts (Based on 120 Volts at 80% loaded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO. 14 wire</td>
<td>17 amps</td>
<td>1800 watts</td>
</tr>
<tr>
<td>NO. 12 wire</td>
<td>22 amps</td>
<td>2400 watts</td>
</tr>
<tr>
<td>NO. 10 wire</td>
<td>30 amps</td>
<td>3600 watts</td>
</tr>
<tr>
<td>NO. 8 wire</td>
<td>40 amps</td>
<td>4800 watts</td>
</tr>
<tr>
<td>NO. 6 wire</td>
<td>50 amps</td>
<td>6000 watts</td>
</tr>
</tbody>
</table>

The larger the wire gauge number the smaller the diameter of the wire.

Chart Shows Color Coding of Wires and Terminal Screws

<table>
<thead>
<tr>
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<th>Color of Terminal Screw</th>
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<tr>
<td>Black</td>
<td>Brass</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Red</td>
<td>Brass's</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
<tr>
<td>Bare Wire</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
</tbody>
</table>

In Example "A" above, the numbers and letters stamped on the electric wire has the following meaning.

The "12" means it is No. 12 wire in size.
The "2" means it has two wires.
The "G" means with ground wire.
The "N-M" means non-metalic

In Example "B" above, it is exactly like Example A except it has three wires instead of the two.
All About Electric Wire

When doing any electrical wiring, you have to use the right size fuses or multi-breakers to protect the electric wire against any overloads or short circuits. Also, wire can handle only so many watts before it becomes overloaded and blows fuses or kicks breakers off. Check below.

#14-2 WIRE WITH GROUND

When working with No. 14 wire, use a 15 amp fuse or a 15 amp breaker to protect it against overloads or short circuits.

#12-2 WIRE WITH GROUND

When working with No. 12 wire, use a 20 amp fuse or a 20 amp breaker to protect it against overloads or short circuits.

Color coding of wire

- The black wire is HOT
- The white wire is NEUTRAL

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Connect the black wire to the brass-colored terminal on switches, receptacles, sockets, fuse boxes, and to the black wires on pull chain fixtures. The white (neutral or ground wire—also called the "continuous wire") is grounded at the electric service switch. Connect it to the silver or light-colored terminal of all receptacles, etc., and to the white wire on all lighting fixtures. Again—never hook to the hot wire!

Important

ALWAYS SHUT OFF POWER TO THE CIRCUIT YOU WILL BE WORKING ON, OR THE ENTIRE HOUSE IF YOU ARE NOT SURE WHICH FUSE OR BREAKER CONTROLS THE CIRCUIT. DOUBLE CHECK WITH A TESTING DEVICE TO BE ABSOLUTELY SURE THE CIRCUIT IS DEAD.
How To Use Wirenuts and Screw Terminals

HOW TO PUT ON WIRENUT

WIRE NUTS JOIN WIRE ENDS

Step 1. Strip off about 1 inch of insulation from ends of wires you're going to join. Twist the stripped ends clockwise at least one and one-half turns.

Step 2. Snip % to 1/2 inch off the twisted wires so the ends are even.

Step 3. Screw the wirenut on clockwise.

HOW TO JOIN WIRE TO SCREW TERMINALS

Step 1. Strip % inch of insulation off the wire end. Then use a pair of needle nose pliers to form a half loop in the bare wire.

Step 2. Hook the wire clockwise around the screw terminal. As you tighten the screw the loop will close. Always strip wires so no more than 1/16 inch of bare wire extends out beyond the screw head.

BACKWIRED OUTLETS AND SWITCHES can be loosened from the wires by pressing a screwdriver point into the release aperture.

BACKWIRED OUTLETS AND SWITCHES

HOW TO JOIN SEVERAL WIRES TO SCREW TERMINALS

Pigtails splice

The electrical code requires that only one wire may be attached to a screw terminal — the above picture shows the only approved way to do this — it is called a pigtail splice.
How to Install Wiring in New Walls and Partitions

**Step 1.** Install box. Secure cables to box so that 6 inches of each cable extends from box. (150 mm)

**Step 2.** Strip outer sheath of insulation to back of box; remove sheath and all separation materials. Strip off Vz to 3/4 inch insulation from wire ends.

### OUTLETS AND SWITCHES

- **ALL OUTLETS MUST BE OF THE GROUNDED TYPE.**
- **Outlets Should Be No More than 12 Ft. Apart.**
- **Outlets Should Be 12" High from Floor.**
- **Switches Should Be 48" High from Floor**
- **Switches Should Always Be Put on Same Side of Door that the Door Knob Is on.**

CHECK ON LOCAL CODES FOR MORE INFORMATION NEEDED ON OUTLETS AND SWITCHES FOR YOUR WIRING PROJECT
The Most Common Measurements for Outlets and Switches

OUTLETS AND SWITCHES

- All outlets must be of the grounded type.
- Outlets should be no more than 12 ft. apart.
- Outlets should be 12" high from floor.
- Switches should be 48" high from floor.
- Switches should always be put on the same side of door that the door knob is on.

Check on local codes for more information needed on outlets and switches for your wiring project.
All About The Ground Wire

- USE THE GREEN OR BARE WIRE AS THE GROUND WIRE IN ELECTRICAL WIRING. USE THE GREEN-COLORED TERMINAL SCREW AS THE GROUNDING SCREW IN ANY ELECTRICAL WORK.

- IF YOU ARE USING ELECTRICAL WIRE THAT HAS NO GROUND WIRE IN IT, USE A GROUND WIRE THE SAME SIZE. FOR EXAMPLE, IF YOU ARE USING NUMBER 12 WIRE USE A NUMBER 12 GROUND WIRE.

- USE 10/32" STOVE BOLTS OR MACHINE SCREWS TO ATTACH THE GROUND WIRE TO THE BACK OF WALL BOXES, SWITCH BOXES, CEILING BOXES, AND JUNCTION BOXES.

- THE GROUND WIRE NOT ONLY PROTECTS YOU FROM GETTING SHOCKED, BUT PROTECTS THE ELECTRICAL ITEMS IN YOUR HOUSE FROM GETTING DAMAGED FROM LIGHTNING.

Checking an Outlets Ground


Underwriter's knot...

To (relact cord from strain, left knot) carry as shown .

. then pull down lightly into recess between prongs
How to Wire Electric Dryers

**120/240-volt, 30-ampere, grounded.** Designed especially for clothes dryers, this large receptacle supplies 240 volts for the heating coils of the drier and 120 volts for such standard accessories as the timer and the pilot light.

Use wire size 10-3 with ground for electric dryers.
How to Wire Electric Range

120/240-volt, 50-ampere, grounded. An electric range requires the high amperage and the combination of voltages provided by this receptacle. High-temperature settings of the oven and burners are connected to the 240-volt circuit. The low temperature settings, timer, pilot lights and built-in receptacles operate on 120 volts.

USE WIRE SIZE 6-3 WITH GROUND FOR ELECTRIC RANGES.
### Watts Used by Different Electrical Items

<table>
<thead>
<tr>
<th>Approximate Ratings</th>
<th>Approximate Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air conditioner (central)</td>
<td>Power tools</td>
</tr>
<tr>
<td>(room, 1/3 ton)</td>
<td>Drill, 1/4 inch</td>
</tr>
<tr>
<td>(room, 3/4 ton)</td>
<td>3/8 inch</td>
</tr>
<tr>
<td>(room, 1 ton)</td>
<td>1/2 inch</td>
</tr>
<tr>
<td>Blender</td>
<td>Grinder</td>
</tr>
<tr>
<td>Bottle warmer</td>
<td>Lather</td>
</tr>
<tr>
<td>Broiler</td>
<td>Lawn Mower</td>
</tr>
<tr>
<td>Can opener</td>
<td>Sander, portable</td>
</tr>
<tr>
<td>Clock</td>
<td>Saw, bander</td>
</tr>
<tr>
<td>Coffee maker</td>
<td>bench</td>
</tr>
<tr>
<td>Corn popper</td>
<td>300-600</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>jig</td>
</tr>
<tr>
<td>Dryer</td>
<td>radial arm</td>
</tr>
<tr>
<td>Electric blanket</td>
<td>sabre</td>
</tr>
<tr>
<td>Fan (attic)</td>
<td>Soldering iron</td>
</tr>
<tr>
<td>(exhaust for range)</td>
<td>Projector (slide or movie)</td>
</tr>
<tr>
<td>(portable)</td>
<td>Radio, console</td>
</tr>
<tr>
<td>Floor polisher</td>
<td>portable</td>
</tr>
<tr>
<td>Food warmer</td>
<td>Range, oven</td>
</tr>
<tr>
<td>Freezer, frostless</td>
<td>4000-8000</td>
</tr>
<tr>
<td>standard</td>
<td>top</td>
</tr>
<tr>
<td>Fryer, deep fat</td>
<td>4000-8000</td>
</tr>
<tr>
<td>Frying pan, automatic</td>
<td>Refrigerator, frostless</td>
</tr>
<tr>
<td>Furnace, coal</td>
<td>standard</td>
</tr>
<tr>
<td>gas</td>
<td>1350</td>
</tr>
<tr>
<td>oil</td>
<td>Roaster</td>
</tr>
<tr>
<td>Garbage disposer</td>
<td>1400</td>
</tr>
<tr>
<td>Grill</td>
<td>Rotisserie</td>
</tr>
<tr>
<td>Hair Dryer</td>
<td>1100</td>
</tr>
<tr>
<td>Heater (hot water)</td>
<td>Sewing machine</td>
</tr>
<tr>
<td>(room)</td>
<td>75</td>
</tr>
<tr>
<td>Hot plate (per burner)</td>
<td>Shaver</td>
</tr>
<tr>
<td>Iron (hand)</td>
<td>300</td>
</tr>
<tr>
<td>(mangle)</td>
<td>Stereo, hi-fi</td>
</tr>
<tr>
<td>Knife sharpner</td>
<td>10</td>
</tr>
<tr>
<td>Lamp (heat)</td>
<td>Sump pump</td>
</tr>
<tr>
<td>(sun)</td>
<td>300</td>
</tr>
<tr>
<td>Lights (fluorescent circular)</td>
<td>250</td>
</tr>
<tr>
<td>(fluorescent tubes)</td>
<td>Television, black and white</td>
</tr>
<tr>
<td>(incandescent, per bulb)</td>
<td>250</td>
</tr>
<tr>
<td>(night light)</td>
<td>color</td>
</tr>
<tr>
<td>Microwave oven</td>
<td>300-800</td>
</tr>
<tr>
<td>Mixer</td>
<td>Toaster</td>
</tr>
<tr>
<td></td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Vacuum cleaner</td>
</tr>
<tr>
<td></td>
<td>300-800</td>
</tr>
<tr>
<td></td>
<td>Washing machine</td>
</tr>
<tr>
<td></td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Coffeemaker</td>
</tr>
<tr>
<td></td>
<td>600 watts</td>
</tr>
<tr>
<td></td>
<td>Television Set</td>
</tr>
<tr>
<td></td>
<td>300 watts</td>
</tr>
<tr>
<td></td>
<td>Automatic Toaster</td>
</tr>
<tr>
<td></td>
<td>1100 watts</td>
</tr>
<tr>
<td></td>
<td>Table Lamp</td>
</tr>
<tr>
<td></td>
<td>100 watts</td>
</tr>
</tbody>
</table>
How to Find the Cause of a Short Circuit

Most short circuits occur in flexible cords, plugs, or appliances. Look for black smudge marks on faceplates or frayed or charred cords connected to dead circuit. Simply replace damaged cord or plug before installing new fuse or resetting breaker.

If you find no visible signs of trouble, though, you’ll have to trace your way through circuit. To do this, turn off all wall switches and unplug every appliance on dead circuit. Then install new fuse or reset tripped breaker.

If fuse blows right away, pull out fuse or make sure circuit breaker is OFF. Remove each faceplate and inspect device and wiring. Look for charred wire insulation, wire shorted against back of metal box, or device literally falling apart. Replace defective switch or receptacle or faulty wiring. Then install new fuse or reset breaker.

If new fuse doesn’t blow or breaker doesn’t trip right away, turn on each wall switch, one by one, until fuse blows or circuit breaker trips.

When turning on wall switch causes fuse to blow or breaker to trip, short is in fixture outlet controlled by switch or in ON position of switch. With circuit dead, inspect outlet and switch for charred wire insulation and faulty connections. Replace faulty fixture or switch. Then install new fuse or reset breaker.

If turning on wall switches doesn’t blow fuse or trip breaker, trouble is in appliance. Plug in and turn on appliances one by one. When fuse blows or breaker trips again, you’ll know you’ve found offending appliance. Then install new fuse or reset breaker.

If circuit went dead as soon as you turned appliance on, appliance or its switch is probably defective and should be replaced or repaired.

If circuit went dead as soon as you plugged appliance in, plug or cord is probably at fault and should be replaced.

Note: If none of the above solves the problem and your fuse or breaker still blows or trips, your wiring is at fault. Call an electrician.

Important

ALWAYS SHUT OFF POWER TO THE CIRCUIT YOU WILL BE WORKING ON, OR THE ENTIRE HOUSE IF YOU ARE NOT SURE WHICH FUSE OR BREAKER CONTROLS THE CIRCUIT. DOUBLE CHECK WITH A TESTING DEVICE TO BE ABSOLUTELY SURE THE CIRCUIT IS DEAD.

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</tr>
<tr>
<td>Red</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td>Grounding Wire</td>
</tr>
<tr>
<td>Bare Wire</td>
<td></td>
<td>Electrical Box Ground</td>
</tr>
</tbody>
</table>
## How to Fix Fluorescent Light Fixtures

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>CAUSE</th>
<th>CURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp won’t light</td>
<td>Tube burned out (blackened ends)</td>
<td>Replace tube</td>
</tr>
<tr>
<td></td>
<td>Improper installation</td>
<td>Take out and install again</td>
</tr>
<tr>
<td></td>
<td>Fuse blown or circuit breaker</td>
<td>Replace or reset</td>
</tr>
<tr>
<td></td>
<td>tripped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Starter burned out</td>
<td>Replace starter</td>
</tr>
<tr>
<td></td>
<td>Dirty tube (rapid-start only)</td>
<td>Replace tube</td>
</tr>
<tr>
<td></td>
<td>Tubeholder broken</td>
<td>Replace tube holder</td>
</tr>
<tr>
<td></td>
<td>Fixture too cold</td>
<td>Raise temperature to at least 50°F</td>
</tr>
<tr>
<td></td>
<td>Oxide film buildup on tube pins</td>
<td>Rotate tube in tubeholders once or twice</td>
</tr>
<tr>
<td></td>
<td>Lamp flickers</td>
<td>Poor contact with tubeholders</td>
</tr>
<tr>
<td></td>
<td>(Note: New tubes may flicker a short time</td>
<td>Realign tubeholders; straighten and sand</td>
</tr>
<tr>
<td></td>
<td>after installation.)</td>
<td>tubeholders if necessary</td>
</tr>
<tr>
<td></td>
<td>Tube nearly worn out (blackened ends)</td>
<td>Replace tube</td>
</tr>
<tr>
<td></td>
<td>Oxide buildup on tube pins</td>
<td>Rotate tube in tubeholders once or twice</td>
</tr>
<tr>
<td></td>
<td>Fixture, too cold</td>
<td>Raise temperature to at least 50°F</td>
</tr>
<tr>
<td>Ends of tube are</td>
<td>Tube almost worn out</td>
<td>Replace tube</td>
</tr>
<tr>
<td>discolored</td>
<td>(Note: Darkened bands about 2 inches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>from ends are normal.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If preheat type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with new tubes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discolored on one end only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Defective starter</td>
<td>Replace starter</td>
</tr>
<tr>
<td></td>
<td>Temperamental tube</td>
<td>Remove tube; turn end for end</td>
</tr>
<tr>
<td>Ends of tube glow</td>
<td>Defective starter</td>
<td>Replace starter</td>
</tr>
<tr>
<td>but center doesn’t</td>
<td>Defective ballast</td>
<td>Replace ballast</td>
</tr>
<tr>
<td>Lamp fixture hums</td>
<td>Ballast incorrectly installed</td>
<td>Check wiring on ballast diagram and</td>
</tr>
<tr>
<td></td>
<td>Wrong type of ballast</td>
<td>correct</td>
</tr>
<tr>
<td></td>
<td>Defective ballast</td>
<td>Check wattage and type; replace ballast</td>
</tr>
<tr>
<td></td>
<td>Lamp flickers</td>
<td>Replace ballast</td>
</tr>
</tbody>
</table>

### Diagram

```
120 V POWER SOURCE -> BALLAST

STARTER -> LAMP SOCKET

WIRE NUT

COVER PLATE

LAMPU
```
How To Wire into Boxes, Fixtures and Switches

HOW TO WIRE INTO A JUNCTION BOX

Most switches in a home are of the single-pole or three-way types. Single-pole switches have two terminals of the same color and a definite right side up. All switches are wired into hot wires only; with a single-pole switch, it makes no difference which hot wire goes to which terminal.

HOW TO WIRE INTO A FIXTURE
Color Coding of Wires, Screw Terminals, Etc.

Chart Shows Color Coding of Wires and Terminal Screws
For Switches, Outlets, Light Fixtures

<table>
<thead>
<tr>
<th>Color of Wire</th>
<th>Color of Terminal Screw</th>
<th>Hot - Neutral or Grounding Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Silver or White</td>
<td>Neutral Wire</td>
</tr>
<tr>
<td>Black</td>
<td>Brass</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Red</td>
<td>Brass</td>
<td>Hot Wire</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Grounding Wire</td>
</tr>
<tr>
<td>Bare Wire</td>
<td>Electrical Box Ground</td>
<td>Grounding Wire</td>
</tr>
</tbody>
</table>

COLOR CODING OF WIRE — WITH ONE EXCEPTION

Up to this point we have assumed that a white wire is always a neutral wire. Wires that are black and red are always hot. But one situation offers an exception to this color coding.

The one exception to the rule is if the power source first goes thru the light fixture and then to the switch, you have to use a white wire as a hot black wire.

When using a white wire this special way, paint the wire insulation black (or tape it with black tape) at both ends where it joins a hot terminal or another hot wire. This identifies it as a hot wire. An example of this is shown in the picture below.

The Picture below is called a Switch Loop.
Electrical Symbols and a Wiring Layout

STANDARD ELECTRICAL SYMBOLS

- CEILING OUTLET
- WALL OUTLET
- CEILING LIGHTING OUTLET
- DUPLEX CONVENIENCE OUTLET
- SWITCH - CONVENIENCE OUTLET
- WEATHERPROOF OUTLET
- ELECTRIC RANGE
- ELECTRIC DRYER
- 230-VOLT POLARIZED OUTLET
- SPECIAL PURPOSE OUTLET
- CEILING FAN
- WALL FAN
- CEILING JUNCTION BOX
- WALL JUNCTION BOX
- CEILING PULL SWITCH
- CLOCK OUTLET
- THERMOSTAT
- GENERATOR
- ELECTRIC MOTOR
- NIGHT LIGHT
- PUSH BUTTON
- DOORBELL
- DOOR BUZZER
- RADIO OUTLET
- TELEVISION
- SINGLE POLE SWITCH
- DOUBLE-POLE SWITCH
- THREE-WAY SWITCH
- FOUR-WAY SWITCH
- WEATHERPROOF SWITCH

All About Switches

A Single Pole Switch
A single-pole switch controls a light or receptacle from one location. It has two brass-colored terminals and "on" and "off" markings on the handle.

A Three Way Switch
Three-way switches, used in pairs to control a light or receptacle from two locations, have three terminals; one black or copper-colored and two brass or silver-colored. There are no "on" and "off" markings.

A Four Way Switch
A four-way switch works with three-way switches to control a light or receptacle from three or more locations. It has four brass-colored terminals and no "on" and "off" markings.

- Switches Should Be 48" High from Floor.
- Switches Should Always Be Put on Same Side of Door that the Door Knob Is on.
How to Add New Outlets to Existing Ones

The picture above shows how to add a new outlet to an existing one by running the wire behind the baseboard. Use 12-2 wire with ground, use grounded outlets, be sure you don't overload the circuit, cover wire with a metal plate or use metal cable to protect wire. Check with local code to see if this wiring arrangement is permitted in your area.

Step 1. Remove molding around door frame and as much baseboard as necessary on either side of door.

Step 2. Run cable between jamb and frame, notching spacers wherever necessary.

How To Wire Doorbells and Buzzers

The picture above shows how to add new outlets to an existing one by running the wire behind the door casing. Use 12-2 wire with ground, use grounded outlets, be sure you don't overload the circuit, cover wire with a metal plate or use metal cable to protect wire. Check with local code to see if this wiring arrangement is permitted in your area.
How to Add New Outlets to Existing Ones

![Diagram of new wiring connecting existing outlet to new outlet]

Existing Outlet

New Outlet

Fish wire (or fish lope)

1. This picture shows an existing outlet that is being used as the power source for the new outlet that is being installed in the wall on other side of room with the wire going thru ceiling joist.

Use 12-2 wire with ground, use grounded outlets, be sure you don't overload the circuit. Check with local code to see if this wiring arrangement is permitted in your area.

How To Wire Doorbells and Buzzers

Wiring for a front doorbell and a back-door buzzer.

Wiring for a combination bell-buzzer unit.
A 6/32 threaded screw holds the outlets to the wall box.

These wires going to top part of outlet make both the top and bottom parts of the outlet live. Wire may go in from top or bottom of outlet to do this.

Wires coming out of outlet are now live and can be used to go to next outlets to make them live.

Grounding wire on green terminal

Outlets, also called receptacles, have three different colors of screw terminals. The brass-colored screws are hot terminals and here use the black wire. The white or silver-colored screws are neutral terminals, and here use the white wire. The green screw is the grounding terminal, and here use the bare wire for the grounding wire.
How to Wire Outlets

WIRING ONE OUTLET

12-2 WIRE (WITH GROUND) FROM POWER SOURCE

WIRING COLOR GUIDE
- WHITE WIRE NEUTRAL
- BLACK WIRE HOT
- RED WIRE HOT
- BARE WIRE GROUND Wire

GROUND WIRES

RED WIRE NUT

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

WHITE WIRE ATTACHED TO WHITE OR SILVER TERMINAL SCREW

12-2 WIRE (WITH GROUND)

HOW TO PUT TWO OUTLETS IN A DOUBLE BOX

PICTURE ABOVE SHOWS HOW TO PUT TWO OUTLETS IN A DOUBLE BOX

WIRING TWO OUTLETS

12-2 WIRE (WITH GROUND) FROM POWER SOURCE

WIRING COLOR GUIDE
- WHITE WIRE NEUTRAL
- BLACK WIRE HOT
- RED WIRE HOT
- BARE WIRE GROUND Wire

GROUND WIRES

RED WIRE NUT

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

WHITE WIRE ATTACHED TO WHITE OR SILVER TERMINAL SCREW

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

* ON THIS PAGE WE SHOW METAL BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT, SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.
How to Wire Outlets

WIRING THREE OUTLETS

FROM POWER SOURCE

12-2 WIRE (WITH GROUND)

WHITE WIRE ATTACHED TO WHITE OR SILVER TERMINAL SCREW

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

GROUND WIRES

WALL BOX

12-2 WIRE (WITH GROUND)

GROUND WIRES

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

12-2 WIRE (WITH GROUND)

GROUND WIRES

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

ON THIS PAGE WE SHOW METAL BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT. SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.

How to Wire Outlets

WIRING FOUR OUTLETS

12-2 WIRE (WITH GROUND)

FROM POWER SOURCE

WHITE WIRE ATTACHED TO WHITE OR SILVER TERMINAL SCREW

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

GROUND WIRES

WALL BOX

12-2 WIRE (WITH GROUND)

GROUND WIRE ATTACHED TO BRASS TERMINAL SCREW

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

ON THIS PAGE WE SHOW METAL BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT. SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.
How to wire a split-circuit outlet

THE SWITCH CONTROLS THE TOP HALF OF THE OUTLET
THE BOTTOM HALF OF OUTLET IS ALWAYS HOT.

12-3 WIRE
(WITH GROUND)

12-2 WIRE
(WITH GROUND)

ON THIS PAGE WE SHOW USING METAL WALL AND METAL CEILING BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT. SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.
THE PICTURE BELOW SHOWS HOW THE POWER SUPPLY FROM THE BREAKER BOX GOES TO TWO DIFFERENT JUNCTION BOXES, AND GOES IN TWO DIFFERENT DIRECTIONS.

WIRING COLOR GUIDE

<table>
<thead>
<tr>
<th>Color</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHITE</td>
<td>neutral</td>
</tr>
<tr>
<td>BLACK</td>
<td>bar</td>
</tr>
<tr>
<td>RED</td>
<td>line</td>
</tr>
<tr>
<td>BARE</td>
<td>ground</td>
</tr>
</tbody>
</table>

CIRCUIT BREAKER BOX

FROM POWER SOURCE

12-2 WIRE (WITH GROUND)

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

GROUND WIRES

* WALL BOX

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

BLACK WIRE ATTACHED TO BRASS TERMINAL SCREW

JUNCTION BOX

PUT COVERS ON JUNCTION BOXES.

GROUND WIRE

SINGLE POLE SWITCH

12-2 WIRE

(WITH GROUND)

WHITE WIRE ATTACHED TO WHITE OR SILVER TERMINAL SCREW

GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW

PUT COVERS ON JUNCTION BOXES.

GROUND WIRES
ALL ABOUT GROUND FAULT CIRCUIT INTERRUPTERS (GFCI)

GROUND FAULT PROTECTION IS A MUST WHEREVER ELECTRICITY IS USED NEAR WATER

Circuit Breaker Type GFCI

A GFCI installed as the first receptacle in a circuit provides protection to other receptacles beyond

1. THE GFCI'S TURN OFF POWER IN 1/40 OF A SECOND TO PROTECT PEOPLE FROM SHOCK HAZARDS.
2. THE ELECTRICAL CODE REQUIRES GFCI PROTECTION IN AND AROUND THE HOME. CHECK WITH ELECTRICAL INSPECTORS FOR MORE ON THIS.
3. THE MOST USED GFCI'S ARE THE CIRCUIT BREAKER AND THE OUTLET TYPE.

WIRING COLOR GUIDE

- 3 WHITE WIRE: NEUTRAL
- BLACK WIRE: HOT
- RED WIRE: HOT
- BARE WIRE: GROUND WIRE

HOW TO CHANGE A SINGLE POLE SWITCH TO A SWITCH & AND OUTLET

Before

- 12-2 WIRE (WITH GROUND)
- MED WIRE NUT
- WHITE WIRE
- FROM POWER SOURCE
- SINGLE-POLE SWITCH
- ^12-2 WIRE (WITH GROUND)

After

- ^12-2 WIRE (WITH GROUND)
- ^CEILING BOX
- MED WIRE NUT
- WHITE WIRE
- FROM POWER SOURCE
- COMBINES A SINGLE-POLE SWITCH WITH AN OUTLET THAT IS ALWAYS HOT
How To Wire Three-Way Switches
With Switches Controlling One Light

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WIRE NUT GUIDE

12-3 WIRE (WITH GROUND)

* CEILING BOX

12-2 WIRE (WITH GROUND)

* WALL BOX

FROM POWER SOURCE

How to Wire Three-Way Switches
With Switches Controlling Two Lights

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WIRE NUT GUIDE

12-3 WIRE (WITH GROUND)

* CEILING BOX

12-2 WIRE (WITH GROUND)

* WALL BOX

FROM POWER SOURCE

* COMMON TERMINAL SCREW (Black or Copper Colored)

* COMMON TERMINAL SCREW (Black or Copper Colored)

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* COMMON TERMINAL SCREW (Black or Copper Colored)
How to Wire Three-Way Switches
With Switches Controlling Three Lights

WIRING COLOR GUIDE
- WHITE WIRE: NEUTRAL
- BLACK WIRE: HOT
- RED WIRE: NOT
- BARE WIRE: GROUND WIRE

WIRE NUT GUIDE
- USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How to Wire Three-Way Switches
With Switches Controlling Four Lights

WIRING COLOR GUIDE
- WHITE WIRE: NEUTRAL
- BLACK WIRE: HOT
- RED WIRE: NOT
- BARE WIRE: GROUND WIRE

WIRE NUT GUIDE
- USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

ON THIS PAGE WE SHOW USING METAL WALL AND METAL CEILING BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT, SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.
How To Wire Three-Way Switches
With Switches Controlling One Light

FROM POWER SOURCE

12-2 WIRE (WITH GROUND)

12-3 WIRE (WITH GROUND)

12-3 WIRE (WITH GROUND)

COMMON TERMINAL SCREW (Black or Copper Colored)

WALL BOX

CEILING BOX

GROUND WIRE

GROUNDED WIRE

GROUNDED WIRE

GROUND WIRE

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WHITE WIRE WITH BLACK ELECTRICAL TAPE ON END TO SHOW IT IS BEING USED AS A BLACK (HOT) WIRE.

ON THIS PAGE WE SHOW USING METAL WALL AND METAL CEILING BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT, SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.

How to Wire Three-Way Switches
With Switches Controlling Two Lights

FROM POWER SOURCE

12-2 WIRE (WITH GROUND)

12-3 WIRE (WITH GROUND)

12-3 WIRE (WITH GROUND)

COMMON TERMINAL SCREW (Black or Copper Colored)

WALL BOX

CEILING BOX

GROUND WIRE

GROUNDED WIRE

GROUNDED WIRE

GROUND WIRE

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WHITE WIRE WITH BLACK ELECTRICAL TAPE ON END TO SHOW IT IS BEING USED AS A BLACK (HOT) WIRE.

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How To Wire Three-Way Switches
With Switches Controlling Three Lights

1. Use red wire nuts where wire nuts are used on this page including ground wires.
2. Use white wire nuts on end to show it is being used as a black wire.
3. Use red electrical tape on end to show it is being used as a black wire.

About the Wires:
- White wire is neutral.
- Black wire is hot.
- Bare wire is ground wire.

Wiring Color Guide:
- White wire: neutral
- Black wire: hot
- Bare wire: ground wire

Wire Nut Guide:
- Use red wire nuts where wire nuts are used on this page including ground wires.

How to Wire Three-Way Switches
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How to Wire Three-Way Switches
With Switches Controlling One Light

**WIRING COLOR GUIDE**

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**HOW TO WIRE**

- **Wall Box**
- **Common Terminal Screw** (Black or Copper Colored)
- **12-2 Wire** (with ground)
- **12-3 Wire** (with ground)

**FROM POWER SOURCE**

**Ceiling Box**

**Common Terminal Screw** (Black or Copper Colored)

**GROUND WIRE**

**Three-Way Switch**

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How To Wire Three-Way Switches
With Switches Controlling Two Lights

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With Switches Controlling Three Lights

How to Wire Three-Way Switches
With Switches Controlling Four Lights

WIRING COLOR GUIDE
- WHITE WIRE
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WIRING COLOR GUIDE
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- BARE WIRE: GROUND

GROUND WIRES

COMMON TERMINAL SCREW
(Black or Copper Colored)

WHITE WIRE WITH BLACK ELECTRICAL TAPE ON END TO SHOW IT IS BEING USED AS A BLACK (HOT) WIRE.

12-2 WIRE (WITH GROUND)

12-3 WIRE (WITH GROUND)
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CEILING BOX

WIRE NUT GUIDE

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12-2 WIRE (WITH GROUND)

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How to Wire Three-Way Switches
With Switches Controlling Two Lights

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GROUND WIRES

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CEILING BOX

WIRE NUT GUIDE

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GROUND WIRES

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WIRING COLOR GUIDE

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WIRE NUT GUIDE

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How to Wire Three-Way Switches
With Switches Controlling Four Lights

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How to Wire Single Pole Switch
With Switch Controlling One Light

WIRING COLOR GUIDE
- WHITE WIRE: NEUTRAL
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12-2 WIRE (WITH GROUND)
- **WALL BOX**
- **WHITE WIRES**
- **RED WIRE NUT**
- **GROUND WIRES**
- **CEILING BOX**

FROM POWER SOURCE
- **BLACK WIRE**
- **12-2 WIRE (WITH GROUND)**

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How To Wire Single Pole Switch
With Switch Controlling Two Lights

WIRING COLOR GUIDE
- WHITE WIRE: NEUTRAL
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- RED WIRE: HOT
- BARE WIRE: GROUND

12-2 WIRE (WITH GROUND)
- **WALL BOX**
- **WHITE WIRES**
- **GROUND WIRES**
- **CEILING BOX**

FROM POWER SOURCE
- **BLACK WIRE**
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With Switch Controlling Three Lights

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With Switch Controlling One Light

How To Wire Single Pole Switch
With Switch Controlling Two Lights
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With Switch Controlling Three Lights

WIRING COLOR GUIDE
- WHITE WIRE NEUTRAL
- BLACK WIRE HOT
- RED WIRE HOT
- BARE WIRE GROUND WIRE

How to Wire Single Pole Switch
With Switch Controlling Four Lights

WIRE NUT GUIDE
USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCORPORATING GROUND WIRES.
One Power Source Supplying Two Single Pole Switches With Lights

**WIRING COLOR GUIDE**
- WHITE WIRE: neutral
- BLACK WIRE: hot
- RED WIRE: minimum
- BARE WIRE: ground wire

**WIRE NUT GUIDE**
Use red wire nuts where wire nuts are used on this page including ground wires.

- **DOUBLE WALL BOX**
- **CEILING BOX**

12-2 wire (with ground)

From power source

SINGLE-POLE SWITCHES

**Note:** On this page, we show using metal wall and metal ceiling boxes. The wiring in plastic and metal boxes is the same, except for the ground wire. The ground wire attaches to the metal boxes, in plastic it does not. See page 6 and 7 for more on how the ground wire works in plastic boxes.

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One Power Source Supplying Three Single Pole Switches With Lights

**WIRING COLOR GUIDE**
- WHITE WIRE: neutral
- BLACK WIRE: hot
- RED WIRE: maximum
- BARE WIRE: ground wire

**WIRE NUT GUIDE**
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- **TRIPLE WALL BOX**
- **CEILING BOX**

12-2 wire (with ground)

From power source

SINGLE-POLE SWITCHES

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One Power Source Supplying Two Single Pole Switches with Lights

12-2 WIRE (WITH GROUND)
FROM POWER SOURCE
GROUND WIRES
GROUNDED WIRES

12-3 WIRE (WITH GROUND)
CEILING BOX

DOUBLE WALL BOX

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How to Wire a Single Pole Switch With Lights and Outlets

12-3 WIRE (WITH GROUND)
GROUND WIRES
GROUND WIRES

12-2 WIRE (WITH GROUND)
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All About Four-Way Switches

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- **RED WIRE**: NOT
- **BARE WIRE**: GROUND WIRE

**WIRE NUT GUIDE**
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**GROUND WIRE ATTACHED TO GREEN HEX GROUNDING TERMINAL SCREW**

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How To Wire Outlet-Switch and Light

**WIRING COLOR GUIDE**

- **WHITE WIRE**
- **BLACK WIRE** HOT
- **RED WIRE** HOT
- **BARE WIRE** GROUND WIRE

**WIRE NUT GUIDE**

- Use red wire nuts where wire nuts are used on this page including ground wires.

**Illustration**

- **DOUBLE WALL BOX**

12-2 WIRE (WITH GROUND)

- White wire attached to white or silver terminal screw.
- Black wire attached to brass terminal screw.
- Ground wire attached to green hex grounding terminal screw.

**Diagram Notes**

- From power source.
- On this page, the wires are shown extra long to show how they connect to switch and outlet.
- They need to be only 6" long.

- On this page, we show using metal wall and metal ceiling boxes. The wiring in plastic and metal boxes is the same, except for the ground wire. The ground wire attaches to the metal boxes in plastic. In plastic, it does not; see page 6 and 7 for more on how the ground wire works in plastic boxes.
How to Wire a Single Pole Switch, Light, and Outlet

**WIRE NUT GUIDE**
- **USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES**

**GUIDE**
- **USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES**

**12-3 WIRE (WITH GROUND)**

**WALL BOX**

**GROUND WIRES**

**FROM POWER SOURCE**

**12-2 WIRE (WITH GROUND)**

**CEILING BOX**

**GROUND WIRES**

**12-2 WIRE (WITH GROUND)**

**WALL BOX**

**GROUND WIRES**

**GROUND WIRES**

**12-2 WIRE (WITH GROUND)**

**GROUND WIRES**

**FROM POWER SOURCE**

**12-2 WIRE**

**WITH GROUND**

**CEILING BOX**

**GROUND WIRES**

**12-2 WIRE**

**WITH GROUND**

**WALL BOX**

**GROUND WIRES**

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**12-2 WIRE**

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How To Wire Outlet-Switch and Light

**WIRE NUT GUIDE**
- **USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES**

**WIRING COLOR GUIDE**
- **WHITE WIRE NEUTRAL**
- **BLACK WIRE HOT**
- **RED WIRE HOT**
- **BARE WIRE GROUND**

**12-3 WIRE (WITH GROUND)**

**WALL BOX**

**GROUND WIRES**

**FROM POWER SOURCE**

**12-2 WIRE (WITH GROUND)**

**CEILING BOX**

**GROUND WIRES**

**12-2 WIRE (WITH GROUND)**

**WALL BOX**

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Explanations of Standard Electrical Terms

**Receptacle or Outlet**
A type of outlet to which electric cords can conveniently be plugged in.

**Fuse**
A safety device which breaks the flow of electricity whenever a circuit becomes overloaded.

**Circuit-Breaker**
Performs the same functions as a fuse in the "Circuit-Breaker" types of service panel.

**Electric Service Panel**
The main panel (or fuse cabinet) through which electricity is brought into the building and then distributed to various branch circuits. Contains the main disconnect switch for the entire wiring system, as well as fuses or circuit-breakers.

**Conductors**
Common trade term for electric wires.

**Grounding**
The connection of the electrical system to the earth, a precaution necessary to prevent damage from lightning and minimize danger from shocks.

**"Hot" Wires**
The power-carrying wires (usually black or red) as distinguished from the "neutral" wires (usually white).

**Switch box**
Type of protective box in which switch terminals are connected to the wires.

**Fish wire**
Narrow, springy metal type bent into a hook at one or both ends. Used to pull wire through walls, floors and ceilings in existing homes.

**Fixture**
Any mounted electrical device such as a switch, outlet, ceiling light, etc.

**Line**
Cable comprising or supplying a circuit.

**Thin-wall conduit**
Also called E.M.T. which stands for Electrical Metal Tubing.

**Color-Coding**
Identification of wires by color throughout the system to help assure that "hot" wires will be connected only to "hot" wires and that "neutral" wires run in a continuous uninterrupted connection back to the ground terminal.

**Short circuit**
An improper connection between "hot" "hot" wires or between a "hot" wire and a "neutral".

**Circuit**
Two or more wires through which electricity flows out from the source of supply to one or more outlets, and then back.
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