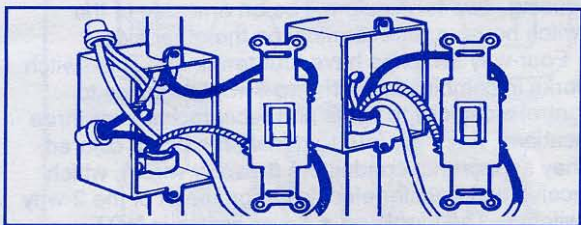


#4

3-WAY SWITCHES



#1

HomeClub

AMERICA'S DO-IT-YOURSELF

WAREHOUSE

**IN SERVICE, SELECTION
& SAVINGS!**

TOOL and MATERIAL CHECKLIST

No. 12/3 Wire ♦ Wire Nuts® ♦ Switch Boxes ♦
Outlet Boxes ♦ Needlenose Pliers ♦ Wire Strippers
♦ Electrician's Tape ♦ 3-Way Switches ♦
Tape Measure

Read this Entire How-To Booklet for Specific Tools
and Materials Not Noted in the Basics Listed Above.

Three-way switches control a light source, for example, from two points: a light in a hallway that can be operated from the first floor or second floor. Or, a light in a garage that can be turned on/off from the garage and the kitchen or pantry or living room.

Three-way switches require a 3-wire cable: the power wire, the neutral wire, and the traveler or switch wire ("T" in drawings).

NOTE: The traveler or switch wire in the drawings is shown as a striped wire, but in reality that wire is usually red.

The cable should also have a ground wire, or a total of 4 wires in the cable. The system also requires 3-way switches. The switches are wider than regular single-pole switches and they have three terminal screws on the side (sometimes back) of the switch housing. Two terminals will be on one side of the switch housing; one terminal on the other side.

Four-way switches have four terminals. This switch works in combination with two 3-way switches to control electricity to lights and receptacles from three locations. All of the four terminals are brass colored. They support hot conductors (traveler wires), which receive and transfer electricity from each of the 3-way switches. The toggle on a 4-way switch is NOT marked "off" and "on." This is the only way to tell the difference between it and a double-pole switch, which is marked "off" and "on."

According to national code, residential wiring must be No. 12 wire with an ampere (amp) rating of 20. Local codes, however, may differ from the national code and should be checked before starting a project.

NOTE: All codes dictate that spliced wire (wire united by twisting together) must be placed inside a switch, receptacle or junction box.

HOW MUCH WIRE?

Measure the distance between the new switch and the power source. Add an extra foot for every connection you will make along the line. Then, to provide a margin for error, add 20% more.

For example, if you measure 12 ft. of cable between a new switch and existing fixture, add another 2 ft. for the two connections, making the total 14 ft. Then add

20%, about 3 ft., to the total. To do this job, you would need 17 ft. of cable.

WORKING WITH WIRE

To make connections, wire must be pulled through boxes about 6 in., cut, and the insulation stripped from it. Here is the procedure to follow:

1. Cut the cable to the proper length using lineman's pliers or a hacksaw.

2. With a sharp knife, slit the outer sheathing being very careful not to cut the insulation covering the wires inside the cable. If possible, lay the cable on a flat, firm surface to slit it properly.

3. Peel back the sheathing and trim it square.

4. With wire strippers, put single wires in the proper size groove in the handle, as 12 for No. 12 gauge wire. Twist the stripper or rotate it 360 degrees, sliding the insulation off the wire as it breaks loose under the cutting blades. Remove 3/4-to-1 inch of insulation.

Spliced wire should be topped with the proper size Wire Nut® then wrapped with electrician's tape.

See Booklet #5, "Wires & Wiring," for more details.

ADDING NEW WIRING

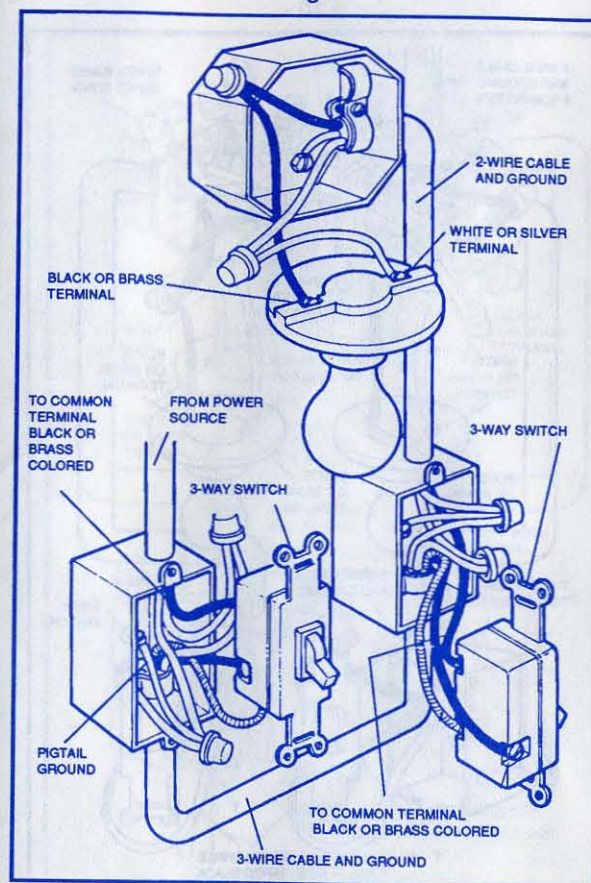
This involves pulling wires through studs and rafters in back of the wallcovering (plaster, gypsum wallboard). You will need a hand brace, long electrician's bit, a coil of electrician's fish wire and lots of patience.

NOTE: If wires going to the switches and fixtures are going to be exposed to dampness, use conduit or plastic sheathed cable (Romex) designated NMC.

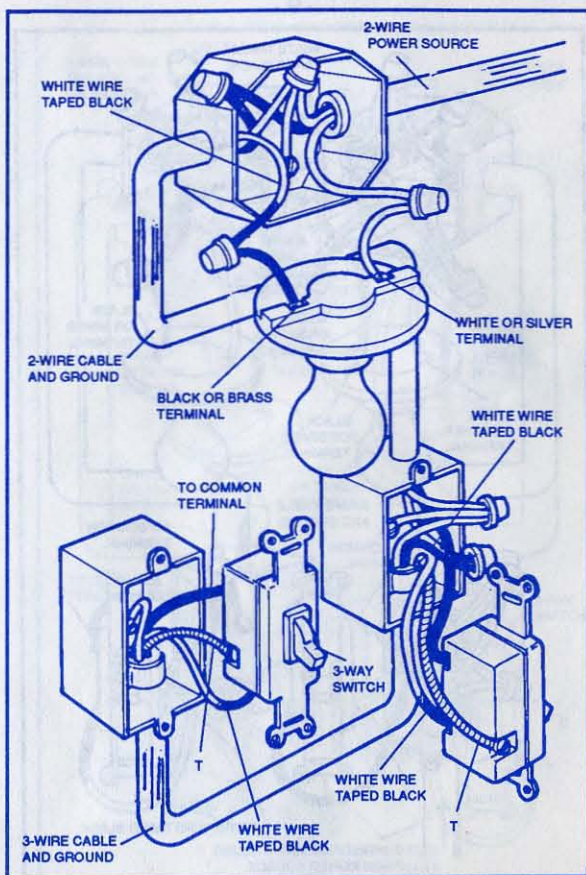
In wiring 3-way switches, the power wire is connected to the COMMON terminal, usually marked "COM" (C in drawings). The location of this common terminal may vary according to the manufacturer of the switch. Check the switch. If not marked, the common terminal may be color coded black or brass.

Track each wire with a finger or pencil to its conclusion at the fixture. This way, you will ensure all connections are made properly.

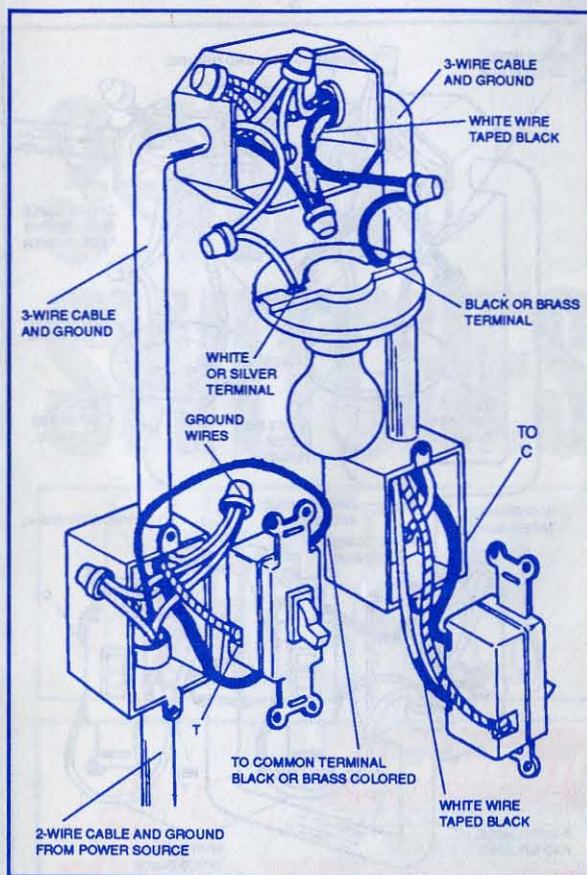
CAUTION. When working with electricity, ALWAYS turn off the power at the main service (fuse or circuit breaker) panel before you start working. BE SURE THE CIRCUIT IS COMPLETELY DEAD.



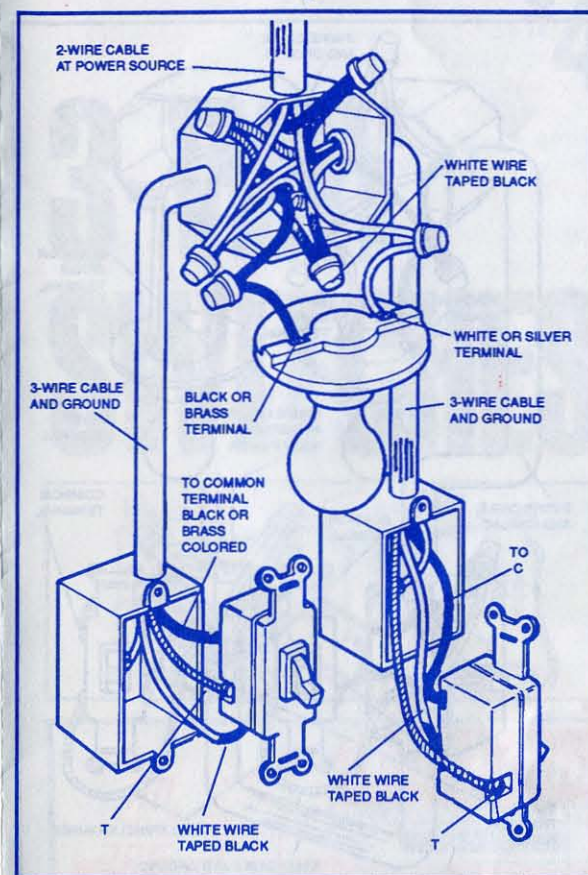
TWO 3-WAY SWITCHES controlling one light with the electric power coming through the first switch, flowing to the second switch, and then to the light fixture. The bare ground wire goes through both switch boxes and the ceiling light box and it is connected at all junctions, except the light, with a pigtail (short piece of wire) and Wire Nut® splice. The hot wire in the drawing is black and is connected to the COM terminal. The traveler or switch wire is striped. The neutral wire is white. Track each with a finger to its conclusion at the light fixture to ensure proper connection.



TWO 3-WAY SWITCHES controlling one light with the electric power coming through the light on a two wire cable. In order to code the white wire, which is used as a power wire from the light fixture through the switches, black electrician's tape is wrapped around the wire in the boxes. This way, if you or someone else goes into the boxes for repairs, the white wire taped black will indicate a hot (beware) wire. The traveler (switch) wire runs just between the two switches, not the light. Note connections of the ground wire throughout.

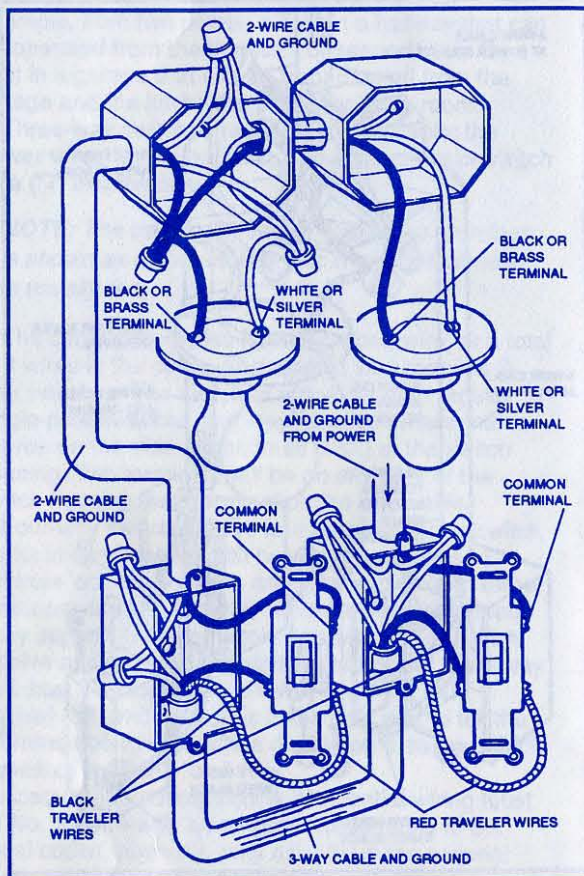


LIGHT CONTROLLED by two 3-way switches with the light between the switches and the power first going through a switch, then to the light, and onto the second 3-way switch. The ground wire is pigtailed and wire-nutted at the first switch box and the ceiling box. It is connected with a grounding screw in the second switch box. Grounding screws often are furnished with boxes and are green. Note that the traveler wire goes through the light ceiling box and that the white wire is taped black between the fixture and second switch.



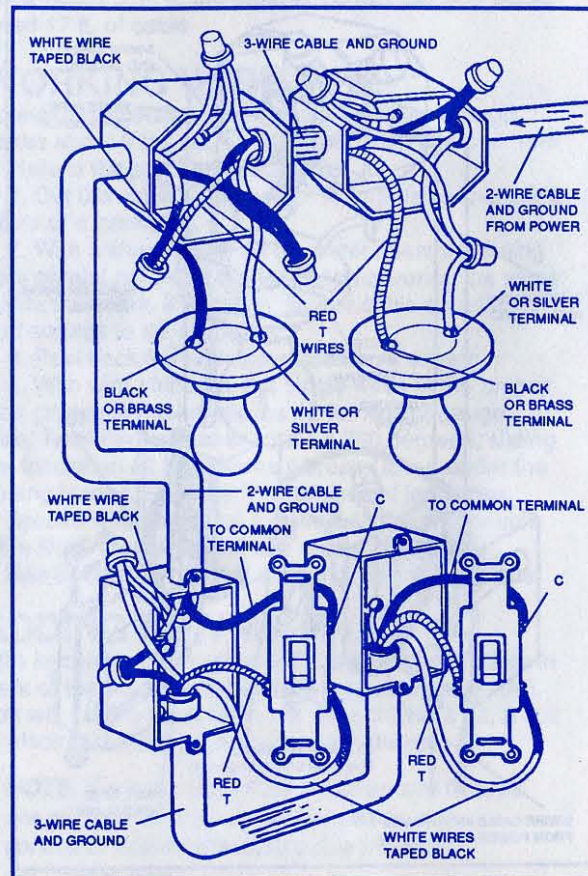
LIGHT BETWEEN SWITCHES with the power source coming from the light. Three-wire cable with a ground wire is used for this connection. The power is routed first through the light ceiling box and then flows to the switches. Note how white neutral wire from the power source is connected directly to the light fixture. The black or hot wire is routed to a switch and then is fed back through the connections via a white wire taped with black electrician's tape to indicate that it is "hot." The traveler wires are connected at the fixture box.

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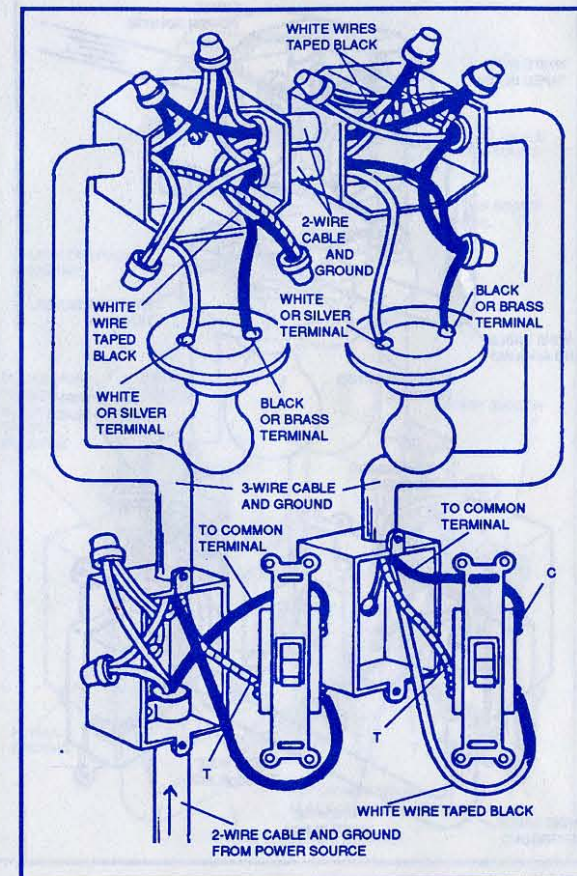
END-OF-RUN LIGHTS controlled by two 3-way switches with 2-wire cable power source coming through the first 3-way switch. Note how the white or neutral wire goes completely through the connection system with pigtail connections at both switches and the first light box. Only 2-wire cable with ground is needed for the boxes at the lights. Traveler wires connect the 3-way switches without going further in the system. In 3-wire cable, traveler wires are usually red and black and connect to the two lower switch terminals.

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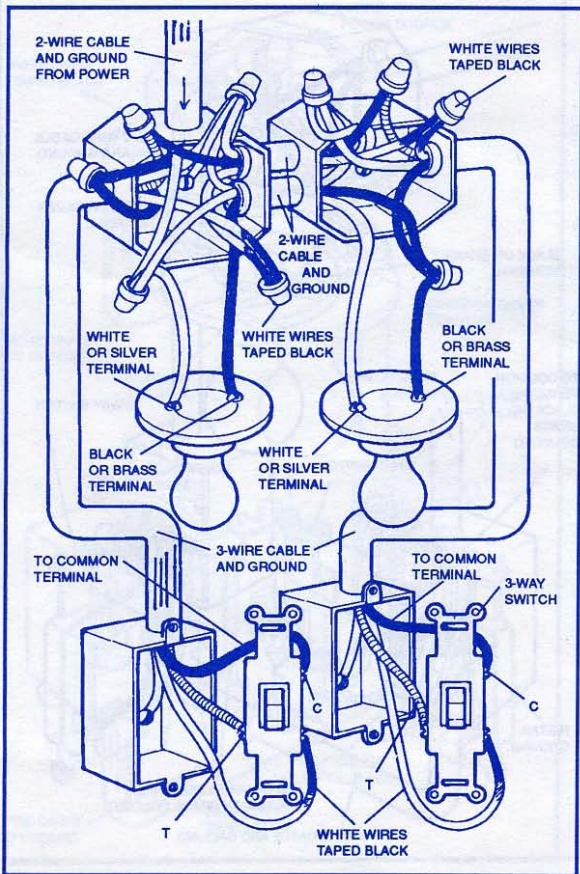


END-WIRED LIGHTS are controlled with two 3-way switches with power routed through the light boxes to 2-wire cable to the two switches. Note how power is connected at lights: white wire taped with black electrician's tape from the nearest switch to a traveler wire that connects the second or end light, then pigtailed to the brass fixture terminal. All wire is utilized this way without waste. Both the white wire taped black and the traveler wire (usually red) indicate "hot" wires, if switches/lights are ever reworked.

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LIGHTS BETWEEN SWITCHES with the electrical power coming through a switch. Second switch is an "end-wired" or end-of-the-run switch. Both three-wire and two-wire cable with ground is used. Note how the traveler wire is connected in the light ceiling boxes: with a length of neutral wire taped black to indicate a "hot" wire. The ground wire is pigtailed throughout but connected at the last junction box with a screw. Neutral wire bypasses first 3-way switch. Note double conduit hookup between lights to handle the multiple wires. Single conduit may be used, of course, although "pulling the wire" may take plenty of muscle in a long run.



POWER THROUGH LIGHTS to 3-way switches has 2-wire cable and ground between the light boxes and 3-wire cable and ground at the switches. White or neutral wire taped with black electrician's tape is used as black power wire to make connections throughout. Grounding wires are pigtailed to the light fixture boxes, but connected directly to the switch box terminals. The switches operate both lights, but the wiring ensures that if one bulb should burn out, the other will still work.



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