



How To Eliminate Engine Noise

(For Basic Radio Installations)

Document# 999501

For additional information on similar topics, please consult the following technical documents:

- 999502** How To Eliminate Engine Noise (For Amplifier And Additional Audio Equipment Installations)
- 999503** Road And Wind Noise (Alternate Methods To Fight Road And Wind Noises)
- 999001** Basic DC Electronics For Automotive Applications (Voltage/Current/Resistance)
- 999002** Car Audio Basics (How Mobile Electronics Integrate With Each Other)
- 999003** Radio Install Basics (How Aftermarket Radios Integrate Into Electronics Of Vehicles)

Do You Have Strange Noises In Your Speakers When You Accelerate, Turn On Your Windshield Wipers, Air Conditioner, Or Other Accessories In Your Vehicle?

All strange noises you hear in your speakers are caused by 1 of 2 problems: Ground Loops and EMI (ElectroMagnetic Interference). Commonly referred to as “engine noises”, these 2 problems are responsible for ALL “engine noise” problems.

Ground Loops: Electronic circuits are simply a power source connected to device or load (electronic equipment). In order for the circuit to operate, voltage from the power source (in mobile electronics that source is the vehicles battery) is sent through wires to the electronic device or equipment. The device will still not work unless a return wire is connected from the devices “ground” connection to the power sources “ground” connection or terminal which will complete the circuit path allowing the equipment or device to work. In automotive applications, the vehicles battery has a thick or heavy gauge battery cable connected to the (+) positive terminal or battery post that supplies the vehicles electrical system with power. What most people do not see is a similar heavy gauge power wire connected to the batteries (-) negative terminal or battery post. This cable usually connects to the vehicles alternator (-) negative terminal or contact then it is bolted to the metal frame of the vehicle itself. In doing this, the metal frame of the vehicle is now the electric “ground” of the vehicle. A “ground” is simply another word for the (-) negative return path back to the power supplies (vehicles battery) (-) negative terminal or battery post. Auto makers do this because it effectively reduces the wire run through the electrical system in half. The auto maker generally only has to run (+) positive voltage wires to components while the (-) negative ground wires can simply be screwed directly to a nearby metal part of the vehicles body frame. This way the (-) negative ground return to the battery is carried by the vehicles metal frame, to the heavy gauge battery cable bolted to the frame which will return the (-) negative ground back to the battery - completing the circuit necessary to make the equipment run.

Ground loops are usually caused when the (-) negative ground returning to the battery has a high resistance, or the wire or metal frame used to send the (-) negative ground is not the best path and the (-) negative ground has to fight to return back to the battery.

Radio Ground Loops: 2 basic types of radio ground loops exist.

Too many components using the same ground wire. This is a common problem when installing a new replacement radio using the auto makers factory power and speaker wire attached to the radio wire harness (The Install Doctor HIGHLY recommends using the auto makers factory power and speaker wires. Most vehicles will never have ground loop problems). Auto makers, in an attempt to simplify wiring around the radio and air conditioner try to reduce wiring by using only a few ground wires. Many times the auto maker will merge ground wires from multiple accessories (radio, air conditioner, hazard switch, and others) into a single ground wire before connecting it to the metal of the vehicles frame. When this happens, a ground loop forms. Ground loops would not normally affect the operation of these other accessories, but it does affect the radio. Since the radio makes noise, the ground loop will be “heard” through the radio.

Solution: For many vehicles, it is sound installation practice to connect the new replacement radios ground wire directly to the metal of the vehicles frame and avoid using the original radios ground wire in the vehicles radio wire harness.

Too small (thin) of a ground wire. The radio ground wire in the auto makers dash wire harness was designed to handle the power (current) requirements of the auto makers factory radio. Most auto makers factory radios will typically draw less than 4 or 5 amps of power from the vehicles battery. The ground wire in the dash wire harness is big enough to handle this small power consumption but it might not be big enough to handle many new replacement radios 5 to 10 amps of power consumption.

Solution: Connect the new replacement radios ground wire directly to the metal of the vehicles frame and avoid using the original radios ground wire in the vehicles radio wire harness.

EMI Noises: EMI (ElectroMagnetic Interference) has become a buzz word in the electronics industry. What is EMI? As voltage runs through wires, an electric field is generated around the wire. This magnetic field surround ALL wires that have voltage running through them, it is a law of physics. Usually the thicker the wire, the more current that wire can handle. Many auto makers, without a care to the radio system, run power wires above, below, and around the stereo. These power wires are necessary for accessories such as the air conditioner, hazard switch, cigarette lighter, and other accessories to operate. These wires, following the laws of physics, spray out magnetic waves in all directions. These magnetic wave will be picked up by other power wires as well as audio cables such as RCA cables. Now other wires are being affected by a single wires electromagnetic field. Some of the wires affected may be the stereos (+) 12 Volt Battery and Ignition wires and even wires INSIDE the radio.

EMI has actually been a problem in the mobile electronics industry for years. EMI noises are more common with high end stereo systems that use many amplifiers to power the system. EMI is not limited to high end stereo systems, EMI also affects even the most basic radio systems. A sharp installer will even be able to diagnose an auto makers factory radio with EMI problems which cause “whines” or “clicks” through the radios speakers. EMI problems are sometimes hard to isolate or even fix, but there are some basic solutions to help solve EMI related radio problems

Reroute power wires: an installer may cut both the (+) 12 Volt Battery and Ignition wires and run new wires to the fuse box or other reliable source. This requires rerouting the wires away from potential EMI “hot spots” around the electronics of the dash.

Foil: many old school installers claim that wrapping or covering the radio in heavy duty foil or aluminum will reflect EMI that enters into the radio. The Install Doctor has never seen this work, but many companies still sell product to do this. The fallacy we have with this philosophy is that the case of the radio is already aluminum. For an aluminum “shield” to work, there must be a layer of insulation between the radios aluminum case and the added aluminum “shield”. This is how coaxial cables protect the inner conductor or the cable from being induced with EMI. This maybe one of those old “home remedies” that may be hard to prove works, but if it works for you, why not try it.

Aluminum Wire Cover: Now this DOES work. This method is never seen in the mobile electronics industry but is always seen in the aerospace industry where EMI induced on wires can cause a plane to crash. Aluminum wire covers are expensive but they are similar to pipe covers that can be purchased at local hardware stores that keep pipes from freezing in cold weather. These aluminum wire covers are made of many different materials but they all have an outer layer of aluminum or aluminum impregnated fabrics. These aluminum wire covers can be slid over the 6 to 12 inches of wires that extend from the rear of the radio. This aluminum wire cover will not work once the wires extend into the dash where they merge with other wires into thick bundles.

Use A Relay: the (+) 12 Volt Ignition wire to the radio can trigger a relay which will a new, EMI free wire to power the radio

Does Your Radio Have Strange Pops And Clicks When You Turn On Your Air Conditioner, Or Wipers, Or Turn Signals ?	
Application: Radio power wires may have noises induced by the air conditioner, turn signals, wipers, and other devices connected to the same fuse box circuit.	
<p><u>To Understand This Relay Configuration:</u></p> <p>This relay configuration replaces the current radios (+) 12 Volt Ignition and (+) 12 Volt Battery wires that are included in the auto makers factory radios wire harness with a new wire routed to avoid noises caused by other electronic components being connected to the same electric circuit in the automobiles electronic wiring.</p> <p>The current radios (+) 12 Volt Ignition wire will trigger the relay and switch the relay to pin 87 where a new power wire will be sent to the radio at pin 30.</p>	<p>(+) 12 Volt Power Wire usually from a reliable connection directly to the battery or other source (for safety, add a fuse 6-10 inches from the battery)</p> <p>(+) 12 Volt Ignition Wire Can be the same wire that was originally connected to the radio</p> <p>Negative or Ground wire connection</p> <p>Output (add a fuse if necessary) this is the new (+) 12 Volt Ignition wire connected to the new radio</p> <p>No wire connected to this contact</p>
Installation Note: Cut the original (+) 12 Volt Ignition and Battery wires to the radio. Add the relay. Add fuses where shown if no fuses are attached to the radio.	

For additional information on relays, please consult the following technical documents:

999403 Relays, The Basics Of (How They Work)

999404 Relays, Applications For (One Of An Installers Most Powerful Installation Devices)