Troubleshooting Amp Noise 101

Most amp noise within a vehicle can be classified into 2 main categories that are typically related directly or indirectly to the vehicle. In no way should you ever need to put in a “noise suppressor” or a “ground loop isolator” these are “patches” that will limit your systems capabilities. Check the end there is a “tech tips” section to virtually eliminate power related noises and some radiated noise problems before you ever begin an installation.

Radiated Noise:
Radiated noise is caused by something that is not directly connected to the installed audio equipment.

- ***Most common things to pick up radiated noise:*** RCA’s, Passive Crossover, and Amplifier.
- ***Things that will typically create radiated noise***: Electric fuel pump, non-RFI spark plug wires, ECU, ABS control unit, SRS/Airbag control unit, Power steering assist control unit.
- Can be located with a noise-sniffer, which can be easily made from a portable cassette player with an extension wired in so that the tape head can be held out like a microphone.

Power Noise:
Power noise is the most common problem and is typically related to problems with the starting and charging systems of the vehicle.

- ***Common symptoms:*** whining sound that changes when you move the gas pedal, noise when you first start the vehicle that gradually goes away after running for awhile, pops and clicks when you operate other vehicle systems.
- ***Causes:*** weak battery, bad alternator, bad starter, bad ground, corroded battery terminals.
- ***Quick checks:*** check battery voltage- should be 12.3-12.6 volts with the vehicle off, and 14.4-14.7 volts while running.

Troubleshooting steps:

Pops and Clicks:
If you have pops and clicks run a common power and ground from your signal source to your amp, do not use the factory power and ground leads. If this does not work, check the battery voltage and upgrade the factory ground from the battery to the chassis.

Whining, Buzzing and Humming:

1. Disconnect the RCA’s directly at the amp. No noise, proceed to the next step; still have noise proceed to 6.
2. Disconnect the RCA’s directly at the head unit and reconnect at the amp. No noise, proceed to the next step; Noise, proceed to 11.
3. With the RCA ends near the signal source use a metal object to short the outside contact to the inside contact of the inputs to the amp. No noise, proceed to the next step; Noise, proceed to 11.
4. Run a 12+ and 12- lead (remember to fuse) from the signal source to a common point with the amp and then disconnect the existing +&- connections. No noise, you’re done; Noise, proceed to the next step.
5. Run a ground lead from the battery to the amp, disconnect chassis ground. No noise, you’re done; Noise, bench test amp try a different unit, or seek further assistance.
6. With no signal to amp, unscrew the unit and place a sheet of cardboard underneath the amp. No noise, proceed to the next step; Noise, proceed to 8.
7. Cut a piece of MDF or Plywood to the shape you want, and make it a finished piece, mount this to the vehicle and then mount the amp to it. Make sure the screws that you use to mount the amp do not go through the panel and make contact with the chassis of the car. No noise, you’re done;
   Noise, double-check the mounting screws.
8. Remove amp from the vehicle and bench test it, using a verified power and signal source. No noise, proceed to the next step; noise, replace amp and you should be done if not follow steps from the beginning.
9. Reconnect amp in vehicle and move to a different location, minimum of 18 inches away (if you cannot move the amp proceed to the next step). No noise, clean up wiring and mount it you are done; Noise, proceed to the next step.
10. Create a noise shield (instructions at the end) and place it under the amp. No noise, make it pretty and permanent you’re done; Noise, consider relocating the amp or find the source of the radiated noise and relocate it.
11. Disconnect RCA’s at the amp, using a DMM check the RCA’s for continuity. If good proceed to the next step; if bad plug in new set to test, proceed to 13.
12. Plug in a test set of long RCA’s to signal source and amp, routed over the roof line. No noise, proceed to next step; Noise, bench test the signal source, try a different unit, or seek further assistance.
13. Route the test RCA’s as close to the path that the original ones are on, but on top of the carpet. No noise, make permanent you’re done; Noise, proceed to the next step.
14. Route RCA’s down the opposite side of the vehicle. No noise, make permanent you’re done; Noise, try a better set of RCA’s, find the source of the radiated noise and relocate it, or seek further assistance.

How to make a noise shield:
To make a noise shield, take a piece of MDF and attach a thin sheet of aluminum to it with an adhesive. If you do not have aluminum available there are sound deadening products available that work as good as or better than aluminum (one is a sticky rubbery material with a metallic layer on that, and the other is two thin sheets of foam with a thin layer of lead between them). Make a short lead from the metal of the noise shield that can be connected to the ground of the equipment being shielded, try with and without wire connected to see which works best. Place shield with wood toward the noise and metal towards the electronics to be shielded.

Tech Tips

- Use a common power and ground point for your signal source and amp, processor, crossover etc…(do not use the factory supplied power and ground for the signal source it generates pops and clicks)
- Don’t just run the minimum recommended power cables step up to the next size.
- Run a power and a ground lead directly from the battery. The ground will degrade through the chassis of the vehicle via small factory chassis ground and spot welds.
- Upgrade the factory ground leads from the chassis to the battery and to the alternator (they’re usually very small).
- Never mount an amp directly to the vehicle metal, mount it a piece of wood or plastic so the chassis of the car and the chassis of the amp do not have an electrical connection of any kind.

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TECH TIPS

MAKE YOUR SYSTEM SOUND BETTER

TROUBLESHOOTING AMP NOISE

THIELE SMALL PARAMETERS – What They Mean

POWER CABLE CALCULATOR

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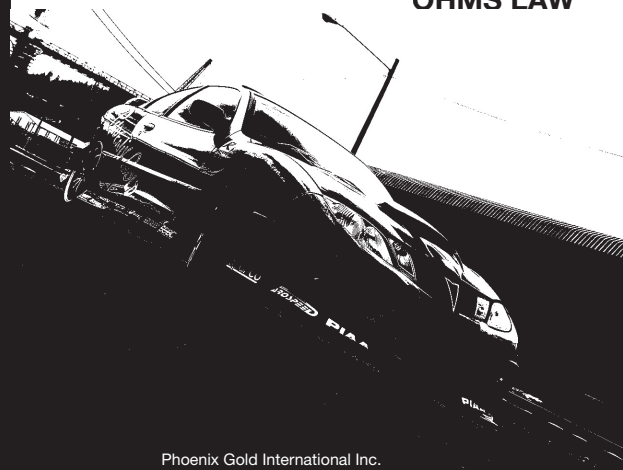

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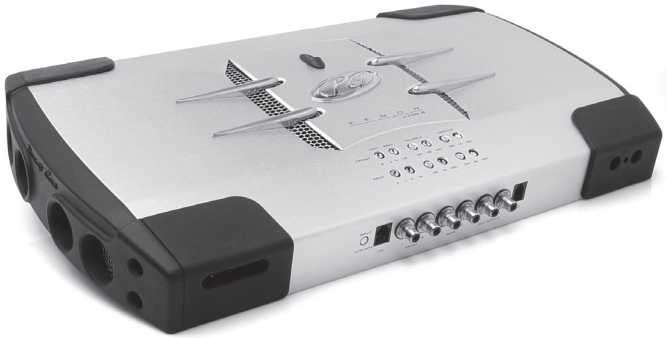
Tricks to Make Your System Sound Better

Below will be listed a few tricks they will not tell you. These tricks with the proper application will improve your sound without costing you anything and will usually take very little time to implement. All proceeding steps take into account that some people do not have access to a DMM or Oscilloscope which would allow for the most accurate adjustments.

In order to do this you must be able to recognize the sound of clipping and distortion if you do not, do not attempt this. You can damage your speakers!

Amp Adjustment (Multiple Amps)

1. If you have multiple amps disconnect all the RCA's except the ones connected to the amp that is powering your front speakers.
2. Set all of your controls on your radio flat (0 bass, 0 treble, etc.). Set the high-pass crossover on the amp (if variable) to around 100 Hz (120 Hz for small speakers 4" etc.).
3. Turn the gain all the way down on your amp, turn your stereo on at this point. Your speakers should be making very minimal sound.
4. Turn your stereo to it's maximum volume, but avoid clipping/ distorting your speakers.
5. Now back the stereo's volume to just about 1/16 – 1/8 less than max.
6. Turn the gain on your amp up at this point until you start to hear clipping/distortion and then back it down just a little, like you did the volume on your radio.
7. Now you adjust your crossover (if variable) to a lower frequency, going lower than 60 Hz is not recommended for most speakers. Keep listening for the distortion when you start to hear it turn the crossover back up a little.
8. If you have an amp for your rear speakers repeat steps 1-7 on the rear amp. Once you do this make sure you reconnect the front amp listen to see how well the amp/speakers balance adjust the rear amp gain down until you can just barely hear that there are rear speakers, this will help provide a better sound stage.
9. Now if you have a sub amp you'll need to repeat steps 2-6 keep the other amps connected, keep in mind this is a sub amp so replace high-pass with low-pass and the recommended range is 60-80 Hz (up to 120 Hz for 8"), once you have completed steps 2-6 adjust the volume on your stereo and see if the sounds stay balanced from high to low volume in most cases you'll have too much or too little sub adjust the gain accordingly and try again.
10. When you have all amps running listen for a loss of bass/mid-bass, from when it is one amp or the other. If so please check the section on phasing when you finish your adjustments.



Phasing

This is a critical part of sound quality that is rarely if ever touched on in any tech sheets or installation notes. In a vehicle there are multiple angles and materials in the interior. What does this mean, this means although your speakers may be electrically in phase they may not be acoustically in phase. Crossover's will also affect phasing between speakers especially in component sets. You can buy an expensive time alignment device but unless you are a serious competitor this may not be needed. To do the next steps you'll need to be in a fairly quiet area and you'll need to have your radio adjusted to a good listening level, with a very dynamic song that you are familiar with.

1. Disconnect your sub-amp signal, play your front and rear speakers together and listen closely to the music.
2. Switch your rear speaker leads (not the power but the signal leads going from the amp to the speakers themselves) electrically out of phase, meaning + to – and – to +. Listen closely to your music again.
3. If you have more mid-bass leave the wires switched if you have less switch them back
4. Reconnect your sub-amp signal, listen closely to your music again.
5. Unplug the wires going to your sub enclosure and plug them back in electrically out of phase. Listen closely to your music to see if you have more or less mid-bass. If you have more leave it, if you have less switch it back.

The above steps are suggestions and not necessarily a cure for any problem but you may find that it can make a big difference. You can change the electrical phasing on any one speaker and notice a difference good or bad, but it is typically recommended to do in pairs. From my experience you'll see the best results when switching the phase on tweeters in a set of components that are mounted more than 6 inches apart.

More or Better Sound

1. Tweeters pointed to reflect off of glass will typically show a +3db gain (remember to wire out of phase)
2. Vehicles will typically rattle audibly around 125 Hz, set your crossovers accordingly.
3. An internally cross-braced sub enclosure will yield more output than a completely airtight enclosure, do both. An airtight enclosure is less likely to distort than a leaky box.
4. Multi-texture installs tend to create more predictable sound. If it's metal cover it with a sound deadener, if it is wood cover it with carpet or vinyl. You'll have fewer reflections that can cancel some frequencies.
5. A properly installed and adjusted system sounds better than a higher quantity of the same equipment.
6. Most amps are not capable of a 1 Ohm mono load, if you have two 4 ohm woofers wire them stereo or with the coils in series with the amp bridged.

Thiele Small Parameters

Fs - is the free air resonant frequency of the transducer.

Qes - is the electrical Q of the transducer.

Qms - is the mechanical Q of the transducer.

Vas - is the compliance volume of the transducer.

Sd - is the area of the transducer diaphragm.

Xmax - is the maximum linear cone excursion of a transducer, typically measured one way.

Re - is the DC electrical resistance of the voice coil.

No - is the reference efficiency of the transducer.

Pe - is the continuous thermal power rating for the transducer.

*Some manufacturers also quote **Vd**, which is the maximum volume displaced by the diaphragm. Note that **Vd** equals **Sd** multiplied by **Xmax**. **(Vd = Sd * Xmax)**.*

Power Cable Calculator

	4 ft	8 ft	12 ft	16 ft	20 ft	24 ft
100 w	10	10	8	8	4	4
200 w	10	8	8	4	4	4
400 w	8	8	4	4	4	2
600 w	8	4	4	4	2	2
800 w	4	4	4	2	2	2
1000 w	4	4	2	2	2	1/0
1400 w	4	2	2	2	1/0	1/0
1800 w	2	2	2	1/0	1/0	1/0
2200 w	2	2	1/0	1/0	1/0	1/0 x 2
2600 w	2	1/0	1/0	1/0	1/0 x 2	1/0 x 2
3000 w	1/0	1/0	1/0	1/0 x 2	1/0 x 2	1/0 x 2

1. Find the distance (feet) of the cable run along the top
2. Find the total power (watts) the cable must support on the left
3. Where the two meet indicates the proper gauge cable.

** If the distance or power falls between two columns or rows, always round up to the next larger cable size or distance.*

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