A2495 POWER WIRING

By David Navone

At A2000 we get asked to check out quite a few competition, demo, and regular customer vehicles. Sometimes clients drive their cars to our California office and other times they take their cars to North Carolina. No matter what the problem, we usually require at least a schematic or pictorial drawing of the sound system before we start evaluating the situation. Even though the power-wiring scheme is not usually depicted, the installer will sometimes go to great lengths discussing the subject of power wiring car audio systems. Let's discuss the considerations for successful power wiring.

Contesting or Real Life?

At the beginning of every installation there must be a decision made as to how the vehicle will be used. Will the client ever enter a sanctioned contest? If so, then what are the considerations as far as power wiring is concerned? First of all, the rulebooks state that the power wires leading to the positive battery post must be fused within a relatively short distance from that post. We have absolutely no problem with that rule. Eliminating the catastrophic short circuit protection would be foolish.

Next the rulebooks usually list various gauges of wire along with their maximum current carrying capacity. Basically, our amps consume their energy in short intervals rather than continuously. Therefore the wire charts in the rulebooks usually require oversized wire gauges. This is not really a problem. If you're going to contest, go ahead and use the big stuff.

Our recommendation is that the wire size recommendations of the amplifier manufacturer be followed, unless you're contesting, in which case you'll end up with garden hose sized power cables.

Type of Power Wire

All power wire is not alike. Solid wire, such as that used in house wiring, is definitely NOT advised for car audio installations. Fine stranded copper wire is the item of choice. Usually, more strands in the wire result in a better (more flexible) cable.

The insulation should be approved for automotive applications. This means that the wire is relatively immune to the adverse effects of petroleum products. Remember, the power leads usually get routed to the inside of the engine compartment and can therefore be subjected to gas, diesel, oil, brake fluid, radiator coolant, etc.

We have seen the recent emergence of shielded power wire. What do they think they're shielding against, quark rays from Mars? In car audio, we're mostly concerned with low frequency electromagnetic interference. When someone comes up with an effective shield for that, give the Electric Boat Company a call and have him or her shield his or her next sub. The amount of low frequency attenuation achieved by shielding would be difficult to measure -- even with laboratory equipment.

The Positive Wiring Scheme

Ok, here it is -- the A2000 preferred power-wiring scheme. Let's start with the main +12 volt DC power lead. Let's assume that we have a modern, four-door vehicle with the engine and starting battery up front and the amplifiers installed in the trunk. (Since we aren't interested in listening to the sound system for extended periods of time with the engine off, we won't be installing a second battery.)

When the engine is not running, the car's battery supplies all the energy for the car audio system. This is why we connect our main power lead to the positive battery post. When the engine is started, the alternator supplies virtually all of the electrical energy for the accessories. But rather than connect our main power cable to the output of the alternator, we usually stick with the positive battery post. This is because most factory wiring schemes insure a great connection between the output of the alternator and the positive battery post.

Let's say that we're using around 500 watts of amplification divided between four amplifiers. If we're going to contest, we'll have to use, say #4 AWG (American Wire Gauge) wire. This size is basically jumper cable stuff, but let's do it anyway.

We recommend temporarily removing the ground cable from the car's battery before commencing your power wiring.

1) Begin by using a suitable terminal and connecting one end of the #4 gauge cable to the positive battery post. Take care not to diminish the factory connections.

2) Within 18" of the positive battery post, install a 100-amp circuit breaker or a 100-amp fuse. The circuit breaker is much easier to use and can really help out later when you're making changes to your system. Remember, the exact fuse value is not important here because it is only for short circuit protection of the vehicle in the event of something like a major wreck.

3) Continuing out of the circuit breaker, route the #4 gauge +12 volt DC power cable inside or under the vehicle and up into the trunk. If the cable is routed under the car, make sure that it is well protected. It is a good idea to use a strong metal conduit if the cable is exposed. The conduit is for protection -- not for shielding low frequency noise!

4) At the trunk, connect the business end of the #4 gauge +12 volt power cable to the common positive terminal of a Stiffening Capacitor. Install as many big caps as is practical because it is the capacitors that will supply the peak energy to your amplifiers by load leveling the demands on the alternator. For this system, we would recommend a minimum of one farad. (You don't need to fuse the Stiffening Capacitor because you already have a fuse at the battery, remember?)

5) Using the shortest possible wires, connect the +12 volt power wires of all the amplifiers to the Stiffening Capacitor. Long, thin wires will increase the inductance and diminish the ability of the Stiffening Capacitor to deliver its energy in quick, powerful, bursts. If you have to externally fuse each amplifier, then go ahead. Many amps are internally or externally fused in the event of meltdown. Leave these fuses in place.

That's it for the main +12 volt DC power wiring. Let's take a look at the negative return.

The Negative (Ground) Wiring Scheme

There are very few engineers who would route long ground leads to anywhere. An electrical ground can be defined as a point of equipotential with all other grounding points. On a car, the conductive metal chassis is the electrical ground for virtually every electrical accessory. Since our power amplifiers feature isolated switching power supplies, we are usually not concerned with sharing ground returns with other vehicle accessories. (Unfortunately, the same cannot be said for poorly isolated pre-amp level components.)

1) Connect one end of a #4 gauge power ground cable to the negative battery post connector. Take care not to diminish the factory connections. (For safety, the negative battery post itself is still unconnected.)

2) Connect the other end of this #4 gauge cable to the frame of the vehicle and as close to the negative battery post as possible. We recommend using star washers, fine threaded nuts and bolts, and a clean metal to clean metal bond. This connection will insure the return to the negative supply.

3) On some older vehicles, it is a good idea to connect the case of the alternator directly to the negative battery post. Recall GM full sized pickups from 1974 up to around 1990 or so. The alternator bracket was connected with large gauge cable directly to the negative battery post. We particularly recommend this connection if the engine has been replaced. Very few mechanics manage to get all the grounding straps back. Although it may seem like a good idea to connect your main power grounding cable directly to the case of the alternator, for many practical reasons we are reluctant to recommend such a practice.

4) Back at the trunk, connect one end of a #4 gauge power ground cable to the negative terminal of the Stiffening Capacitor. Make sure to use a properly sized ring terminal and a star-type washer to insure a good connection.

5) Using as short a piece as possible, connect the other end of this #4 gauge ground lead to the frame of the car. It is a good idea to locate a trunk grounding point that can be shared with both the car's chassis and frame. Again, use non-corrosive, properly sized and terminated connectors, fine threaded bolts and nuts, and star washers for this procedure. A good length of cable here would be less than two feet. It is a good idea to seal the connection with something like paint or grease.

6) Connect the power ground leads from the amplifiers to the negative terminal on the Stiffening Capacitor. Again, the ground leads must be short as possible and definitely NOT fused.

You can now re-connect the negative battery post back into the system and activate the main power circuit breaker when you're ready.

Notice that we used the chassis and frame of the car as a ground lead. That's because there is usually more conductive metal in the car's chassis/frame than in a long piece of cable,even 0000 gauge cable. The Stiffening Capacitor really supplies the switching power supplies with their energy. Our main purpose is to replenish the cap in between the musical transients.

That's it for power wiring. As always, if your alternator can't keep up with the demands, you'll have to check out a larger model. And if your battery seems to be draining way too quickly when the engine is off, you'll have to add more batteries. However, if you correctly wire your system and plan on listening to musical program material, you may be able to keep your factory alternator and get by with a single battery.