

Mobile radio installations

There have been several club members who have either worked on, or asked about mobile radio installations in the last couple of months. I know several of you are already experts at this by having done your own mobile installs, but I wanted to cover some basic installation concepts for those who are planning on doing their first install. I'm going to use a simple install in a 4 door sedan, because A) I have one to use pictures from, and B) in some ways it's a simpler installation than some other types of vehicles. It makes a good starting point to illustrate the concepts on, and you can adapt them around what your particular vehicle needs.

The first thing to consider in your install is safety. Vehicle manufacturers refer to bad aftermarket electronic installs as UFO's: Unrestrained Flying Objects. In a severe accident, your vehicle can be spun around, and maybe even rolled over, and unrestrained objects get flung around the vehicle. Even that 1 pound HT becomes a missile when it's flying around during an accident. Everything should be mounted to survive a much larger shock than you anticipate for just rough roads.

Remember your airbag deployment. Don't mount equipment over, or even near the edges of the deployment of your airbags. Even in a minor, slow speed crash, the speed of the airbag deployment can launch your equipment at you with more force than the accident would. You also have to insure that no sharp edges or brackets are sticking up in the airbag inflation area that might scrape or puncture the airbag as well. Take a look at the vehicle service manual for an idea of just how big some airbags are when inflated. There's really NOT much space in the dash area that's safe from the inflation coverage by an airbag.

Your next safety consideration is your ability to drive and operate your radio at the same time. Things should be placed where you can get at them without moving out of the normal driving position, i.e., without leaning over, taking your eyes off the road, etc. Also, the less eye motion it takes to look at the display, and the less change in focus between the road and the display, the easier and quicker it is to use without losing sight of the road. You should try to mount the display where you can glance at it with minimal eye motion, while keeping peripheral vision on the car in front of you. Mounting it to either the ceiling on vans, or the sun visor overhead seems like a neat idea for thin remote control heads, but check that option by putting some printed paper with the same size font as your display up there first. If it's a big change of head motion, or eye focus from something 6" in front of your forehead back to a focus on infinity, it's going to take a long time to adjust and read the display and go back and forth to watching for cars.

After considering these factors, I decided to move the display for my radio up out of the console area where I had planned to mount it, and up onto the dash area, about even with the height of the gauges. I left the controls, volume, etc, all down on the console right behind the transmission selector, where I can feel for the controls and operate them from memory without having to take my eyes off the road, if I don't need to see the display for what I'm doing. See figure 1.



Figure 1 - Locating the display

Now you have to run power to the radio. Avoid the temptation to tap into the power lead on the cigarette lighter, or off the stereo, etc. These wires are only sized to handle their normal load, and cigarette lighters are much more tolerant of voltage drop under load than your rig will be. Also avoid the temptation to use that “accessory” tap on the fuse panel. You’ll get the minimum noise, and maximum voltage under load by going directly to the battery with a dedicated pair of wires.

Be sure to use the correct size of wire for what you’re installing. For a typical 50W mobile rig, and a 10-15 foot run from battery to radio, you should be running a minimum of 12 gauge wire to have minimum drop in voltage under load. For lower power rigs like a 25W mobile, you may be able to run 14 gauge. Remember that we’re not just looking to handle the current requirements without overloading the cable from a safety (heating) standpoint, we’re after voltage drop under load, so 10 or 12 gauge wire will avoid the display and meter lights from dimming when you key up on high power. If you need 20A for a 100W HF rig, you should be running 10 gauge wire minimum. In my case, I installed a 50W mobile rig in my trunk, and required almost 25 feet of wire to reach the battery. I used 10 gauge wire to make the run because of the length. Remember that after the current makes a complete circuit to the radio and back to the battery, it’s crossed 50 feet of wire (25 feet each way) – that’s a long way for that much current to travel without dropping voltage on a smaller conductor.

When connecting the radio to power cable, you may want to choose Anderson power poles to standardize on a connector style. Even if you decide not to, you should still avoid automotive bullet connectors, or low current Molex connectors. Make sure your connectors are rated in excess your amperage demands, not below or even exactly matched to it, or you’ll have voltage drop and heating at that connection, especially after some time for oxidation to set in. Leave yourself some excess current capacity margin in whatever type of connector you choose.

How you connect to the battery depends whether you have top post, or side mounted battery terminals. For a top post battery, the clamps that attach the battery cable to the post are tightened by a bolt that you can remove and place a ring lug onto. It’s quicker to not use a ring, and use a spade lug, but if tugged or moved while driving, they may pull loose. Completely remove the bolt and place a ring lug around it, of the proper size for the wire gauge you are using. See figure 2.



Figure 2- Top post battery connection & fuse holder

For side mount battery cables, there is usually either a small bolt you can use on the battery cable connection already, or you'll have to purchase an adapter that replaces the factory battery terminal bolt with a different one that adds a threaded stud you can attach your ring lug to. These taps usually are rated for large amounts of current, and are a good option if you plan on bussing power to a fuse block for several accessories in the car as well. See figure 3.



Figure 3 - Side post battery terminal replacement

I also recommend soldering the wire to the lug in addition to crimping it, because of the environment under the hood. That cable will experience extremes of temperature under the hood, as well as water spray, and some battery acid around the terminals. It will corrode over several years at the battery post, but by washing your battery terminals with some baking soda and water every so often, and cleaning up the connections (like you should be doing just to keep the car starting every winter) they should give you many years of use. I also coat my terminal connections with a silicone grease after each cleaning, to keep the elements off of them as best I can.

Always fuse the wire right at the battery terminals, as shown in figure 2. The fuses at the back of your rig are to protect the radio, not the cable. A 10 gauge wire that has the insulation chafed from it along it's route can carry a LOT of current, and start a

fire in your car. My fuse holder is connected directly to the battery terminal, and uses a 30A, waterproof, automotive fuse holder that I found at Radio Shack for a couple of bucks. I make sure this fuse is slightly higher in rating than the ones located at the radio, so at least in theory, if the radio has a problem, it will blow its fuse at the radio before it blows the fuse under the hood. If it's a direct short circuit of full current, it's likely they both may blow at the same time anyway.

One good place to get installation recommendations is at the Dayton hamvention, where you can usually find manufacturers reps showing off radio installations and handing out their white papers on the topic. That's where I picked up mine. They also contain recommendations for avoiding RFI to the car's many computers by telling you where to run cable, and where NOT to run cable, especially coax. I've also picked up good tech notes on RFI problems from fuel pumps, chassis grounding, and other things from these same reps at Dayton.

As for getting that power cable through the firewall into the vehicle, you will have to do some searching. Try for existing holes that are running wiring if you can. One example that came off the SARC mailing list was following the remote hood release cable to find at least one hole in the firewall. If all else fails, make your own hole, but check the location you use VERY carefully, about 20 times over before you even pick up the drill. You don't want to accidentally drill into an air conditioning coil, or a black box in the engine compartment, depending on which way you're going. If you drill, de-burr the hole, and insert a rubber grommet to protect the wire, which are available at Radio Shack, or other stereo installation parts shops, and many hamfest flea market tables. I also seal the entire hole area, on both sides, with RTV sealant once it's all done, to keep it from moving and chafing the cable, as well as to prevent moisture ingress into the vehicle interior, or rusting.

If you need to run power or coax to the trunk, either for a remote mount radio, or just to put your antennas back there, take up the sill plates in the doors of the car, and pick up the carpet. In most cars today you're likely to find a cable trough for other vehicle cables. Running DC power inside there is probably OK, but you may want to avoid coax in the same trough. Some of those cables may be for your computer, and it may be very sensitive to RFI. Choose the other side of the car if you can tell that computer control cables are running through the one you're checking out, or read the manufacturers recommendations on location. See figure 4.



Figure 4 – Look for cable raceways under the sill plates

On a standard sedan, you can usually get from the car interior to the trunk by using the vents behind the back seat. Remove the back seat, and pull up any insulation, and check for access by reaching up into the trunk. It's sometimes easier to run a fish tape down from the trunk into the back seat, and pick up the insulation to look for it. Just avoid routing cable where seat bushings will press on it and wear it out. You can see these areas by the marks on the floor and insulation, or you'll find cable clamps already in place for other vehicle wiring that you can follow. See Figure 5.



Figure 5 - Rear seat access to the trunk area.

If you're running coax up to the trunk lid, spend a minute with a flashlight, and lean in the trunk while you move the lid up and down. Watch that the swing arms on the trunk lid have enough slack in your cabling to not pinch or twist it too much. Route for the least motion of cables, and leave an extra loop of cable near the hinge points. If you cable tie, or tape to the trunk lid swing arms, do it on the SIDE of the arms, not the bottom. The first time you put some big luggage in the trunk and the arms hit it on the

way down, you'll have avoided your first smashed or stripped coax, and saved yourself a lot of time replacing cable.

Doing a permanent installation usually means that you are ready to get rid of that magnetic mount antenna and put a hole in the roof, or trunk. If you've never attempted this before, please do NOT grab a 3/4" wood hole saw and start scraping away at the car with it trying to make a hole. I've seen it done before, and it makes a complete mess of the hole, and leaves a ragged edge that's hard to even file down smooth and use. Drill a pilot hole, and use a 3/4" Greenlee knockout punch to make a hole in the sheet metal. It makes a clean hole, it won't skate across the paint and ruin the car, and it's a clean hole you can use to exactly match the NMO style mount. You place the larger half of the punch on the inside of the vehicle, and the smaller half of the punch on the outside. The larger half may leave a circular mark on the paint, and you don't want that on the outside surface of the vehicle. You can get Greenlee punches at some hardware stores, and can probably borrow one for the day from several members in the club if that's the only use you'll ever have for it. See figure 6.



Figure 6 - Greenlee knockout punch

Lastly, you may have a need for some custom mounting brackets, dash panels to make your mount look good, or custom power connectors. For these, look to stereo shops to have things can be readily adapted to ham installs. Check online places like www.crutchfield.com, or www.radioshack.com for parts, or just for ideas. You can also check www.w9iix.com or www.ram-mount.com for vehicle mounting hardware to stack multiple radios, or hold radios in cars that simply have no other place to mount them inside the car. Aircraft suppliers, and marine suppliers for boating electronic installs also have excellent parts for professional mounting or running DC power busses and fusing, but expect to pay a big premium for anything with an aviation or marine part number on it. To find them, search for them on the Internet, or visit the various shops located around most airfields or boat docks, and you'll find an assortment of mounting brackets, radio and antenna accessories, etc. When in doubt, ask your fellow club members who have done a similar installation before, and you may learn a few things to help make your install go smoother.