Bitterroot Amateur Radio Club
July 2014 Program

Power Supply Safety

BARC July 2014 Program

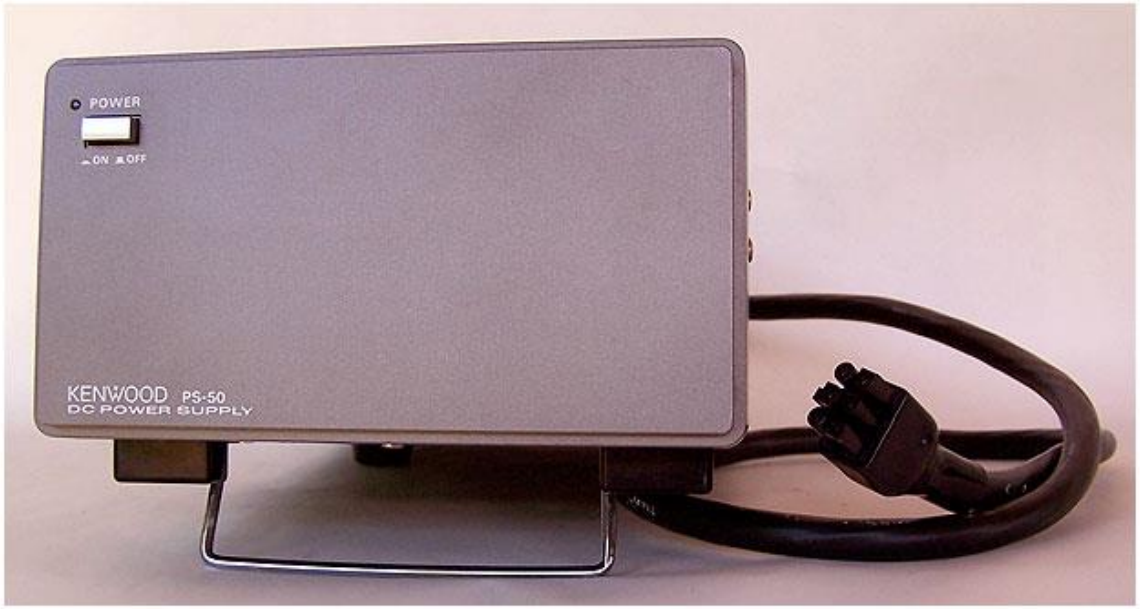
Power Supply Safety

- Types of Power Supplies
- Matching the Power Requirements
- Correct Wiring
- Using Fuses
- Grounding

Power Supply & Battery Types

- Linear
- Switching
- Cranking Battery
- Deep Cycle Battery

Linear Supply



- The linear design uses a hefty transformer to shift the 120 V ac line voltage from your wall outlet to a lower voltage for later conversion to 13.8 V dc. These power supplies tend to be large and heavy, especially the high-current models.

Switching Supply

- In the switching power supply, the ac line voltage is converted directly to dc and filtered. This high-voltage dc is then fed to a power oscillator that "switches" it on an off at a rate of about 20 to 500 kHz. The result is pulsating dc that can be applied to a transformer for conversation to 13.8 V or whatever is needed. The reason for doing this is that rapidly pulsating dc can be transformed to lower voltages without the need for large transformers. It is the transformer that accounts for most of the weight, size and cost of traditional linear power supplies. A switching power supply is much smaller and lighter, and usually less expensive. If you're considering a switching power supply, look for models that boast low "RFI" (radio frequency interference).

Starting Battery

The starting battery (SLI starting lights ignition) is designed to deliver quick bursts of energy & therefore has a greater plate count. The plates are thinner and have somewhat different material composition.

Deep Cycle Battery

The deep cycle battery has less instant energy, but greater long-term energy delivery. Deep cycle batteries have thicker plates and can survive a number of discharge cycles.

Deep Cycle – Wet Cell

The Wet cell comes in two styles; Serviceable and Maintenance free. Both are filled with electrolyte and are basicaly the same. These tend to sulfate or degrade easily and require caution because of a hydrogen gas explosion or corrosion.

Deep Cycle – AGM

AGM: The Absorbed Glass Matt construction allows the electrolyte to be suspended in close proximity with the plates active material. In theory, this enhances both the discharge and recharge efficiency.

Deep Cycle – GEL Cell

GEL: The Gel Cell is similar to the AGM style. The electrolyte in a Gel Cell has a silica additive that causes it to set up or stiffen. Gel Batteries are best used in VERY DEEP cycle application and may last a bit longer in hot weather applications.

Matching Power Requirements

- Input Voltage
- Output Voltage
- Current Output
- Regulation

Input Voltage

- Typical Rating for a Power Supply in the USA would be 120 VAC 60 Hz input, 12.8 VDC @ 10 Amps output.

Regulation

- The Regulation is the ratio of the no-load voltage to full-load voltage. The Regulator circuit controls the amount of voltage from a Power Supply. Good regulation prevents voltage fluctuations from reaching sensitive circuits and causing damage.

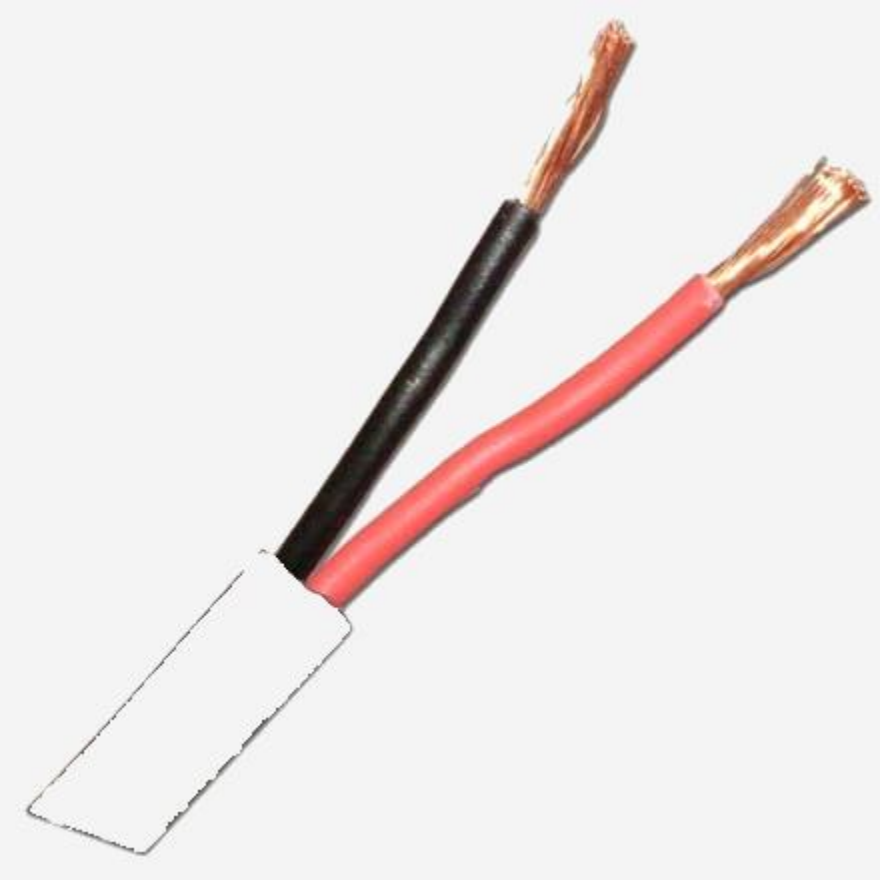
How much Power do I need?

- When choosing a power supply, make sure you have enough CONTINUOUS output to meet the power requirements of your radio. If your 100 watt Transceiver requires 12 amps, then your supply should provide at least that amount (Continuous, not just Peak) and probably 15% - 50% more would be better.

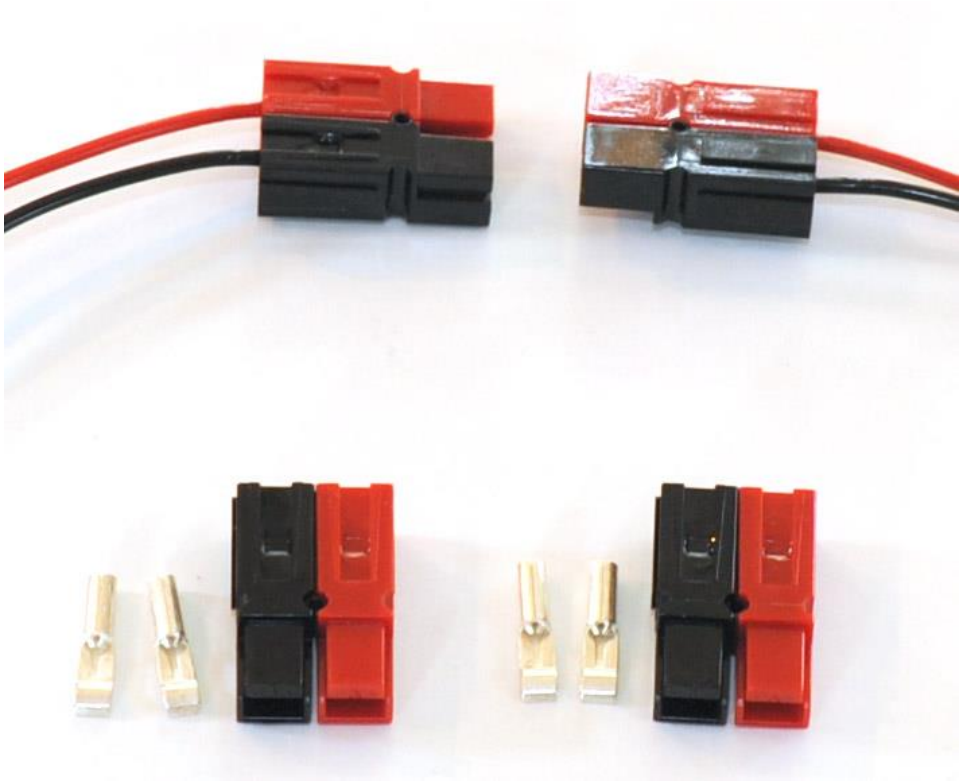
Correct Wiring

- Positive and Negative wired correctly
- Anderson Power Poles
- Mobile Installation

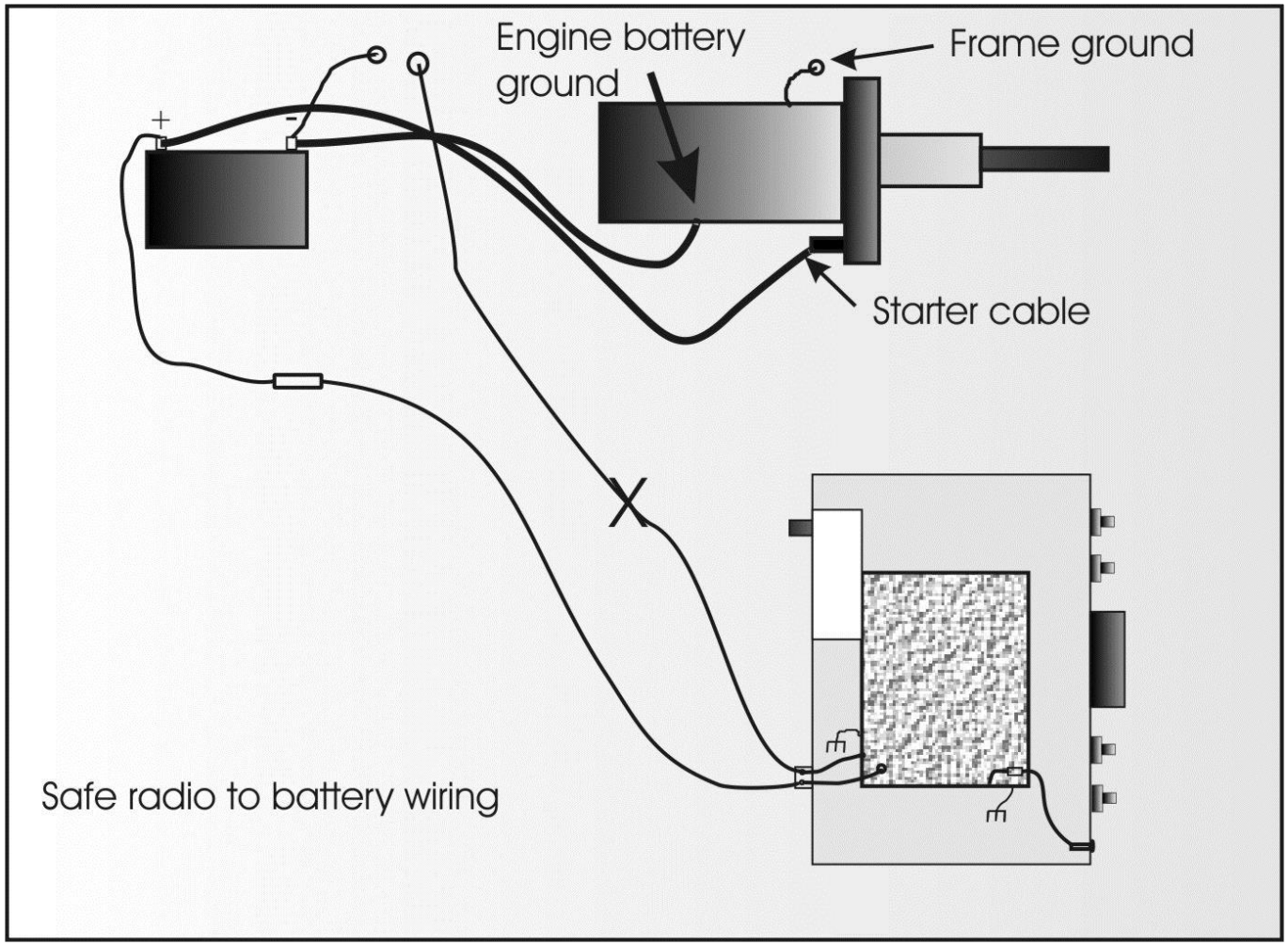
Positive & Negative wired Correctly



Anderson Power Poles



Mobile Installation



Mobile Installation

- Motorola warns to not use a negative fuse or battery negative post connection, but rather directly connect the negative lead to the vehicle chassis.
- Only the positive lead is fused.
- Failure to mount the red (Positive) lead of the power cable directly to the battery may result in severe alternator whine Interference.

Mobile Installations

Table 1
SWR and Impedance at Feed Point of 272-Foot Square Horizontal Loop at Height of 45 Feet

Frequency (MHz)	Z (Ω)	50 Ω SWR	400 Ω SWR
3.6	114 –*j*162	7.2:1	4.1:1
3.75	128 –*j*25	2.6:1	3.2:1
3.9	145 +*j*114	4.8:1	3.0:1
7.05	79 –*j*379	39:1	9.7:1
7.25	74 –*j*199	13:1	6.8:1
10.12	361 –*j*951	58:1	8.2:1
14.15	275 –*j*437	20:1	3.6:1
18.12	328 –*j*128	7.6:1	1.5:1
21.2	316–*j*501	22:1	3.8:1
24.94	381–*j*394	16:1	2.6:1
28.4	350–*j*556	25:1	4.0:1
50.15	450–*j*430	17:1	2.7:1

A horizontal HF loop does work well, and is quite flexible. My predecessor as *QST* Technical Editor, Stu Cohen, W1SC (SK), used a triangular random length horizontal loop to excellent effect from his Berlin, Connecticut home, as have many others over the years. It does work well on all bands above its full wave circumference, although many have had better luck feeding it with window line and a tuner rather than the coax, as suggested in the original article, since it doesn't quite provide a match on every band. Table 1 shows the *EZNEC* predicted feed impedance for a square loop that is a full wave on 80 meters at a height of 45 feet, along with the resulting SWR for 50 Ω coax and window line. The window line is within its reasonable 10:1 SWR on all bands, while the coax SWR is high enough to result in significant loss on some bands, depending on line length.[4]

The configuration is shown in Figure 1, and while often shown as a square, can be of other shapes as well. At heights below ½-wavelength, it tends to radiate a very strong vertical lobe, making it quite suitable for medium distance communication via near vertical-incidence skywave (NVIS). On bands at which the electrical height is higher, it has low angle lobes with various azimuth patterns depending on the harmonic, but all have solid gain, so it still works well, at least to the directions that line up with the lobes. See Figures 2 and 3 for patterns on representative bands.

Thus at moderate heights, a horizontal loop provides good regional communications on the lower HF bands, and good DX results on the traditional DX bands.

[4]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

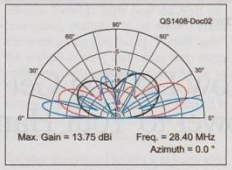


Figure 2 — The black trace is the *EZNEC* elevation pattern of the 272 foot loop of Figure 1, 45 feet above typical ground (conductivity 0.005 S/m, dielectric constant 13) on 40 meters, the peak of the elevation pattern is along the line away from the fed corner. The red trace is the elevation pattern of the same antenna on 20 meters, while the blue trace is the pattern on 10 meters. Other bands have similar patterns with different numbers of lobes. On 80/75 meters, the radiation is almost entirely skyward at this height.

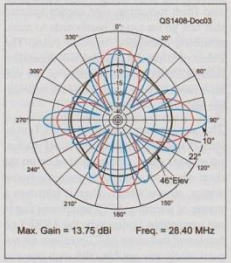


Figure 3 — *EZNEC* azimuth patterns of the square loop at the peak elevation angles shown in Figure 2.

Q Stanley, WA6LVC, asks: If I remember any rule, it is to never put a fuse in the negative lead of a power supply. Thus, I have been surprised to see that some (but apparently not all) manufacturers of Amateur Radio gear provide double-fused power cables.

Whether used in a base station or a mobile arrangement, it seems that if the rig is strapped to ground properly, there is no point in having a fuse in the negative line. Alternately, if the rig is not strapped to ground properly or that path fails, and the negative fuse blows, you are at best left with a faux ground through the coax that may fool you into thinking everything is fine, while putting the rig, and perhaps other equipment, at risk. What's the story?

A This is a question with some nuances! There are two schools of thought. My understanding of the reason for the fuse in the negative lead has to do with mobile operation in the usual vehicle. In that case, most recommend that the radio be connected directly to the vehicle battery, and with an additional fuse right at the positive terminal to protect against power wires that might short against the car infrastructure. I think that last extra fuse is the most important, because it can protect against a serious car fire in case the power wire gets pinched on the way to the fuses near the radio.

The fuse in the negative lead at the radio is intended to protect against an unusual failure mode, but one I've seen, so it can happen. The negative battery lead in most vehicles connects directly to the engine block through a heavy braid that carries the starter motor current and everything else. Due to engine vibration, or other reasons, that connection can loosen or even corrode and break off. If so, when you turn the key, the starter current will try to return via other vehicle ground paths, particularly the path to your grounded antenna and through your radio chassis to the negative lead of your radio and then back to the battery.

The resistance will likely be far too high for the starter to actually crank, however, whatever current flows will flow through that path through the radio's internal ground wires. It won't be the 100+ A of the starter motor, but it will likely be higher than the connections inside your radio want to handle.

So this negative power lead fuse is intended to protect your radio from a possible car problem, while the one in the positive lead near the battery will protect your car from a wiring problem.

Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to "The Doctor," ARRL, 225 Main St, Newington, CT 06111; for fastest response, e-mail **doctor@arrl.org**.

Using Fuses

- Why use a fuse
- Where to place a fuse
- How much fuse to use

Why use a fuse?

Where to place a fuse

- Near the power entrance to your radio to prevent your radio from overload

- In a mobile installation, be sure to fuse right at the positive terminal to protect against power wires that might short against the car infrastructure to protect against a serious car fire. Wire can be pinched on the way to the fuse near the radio.

How much fuse

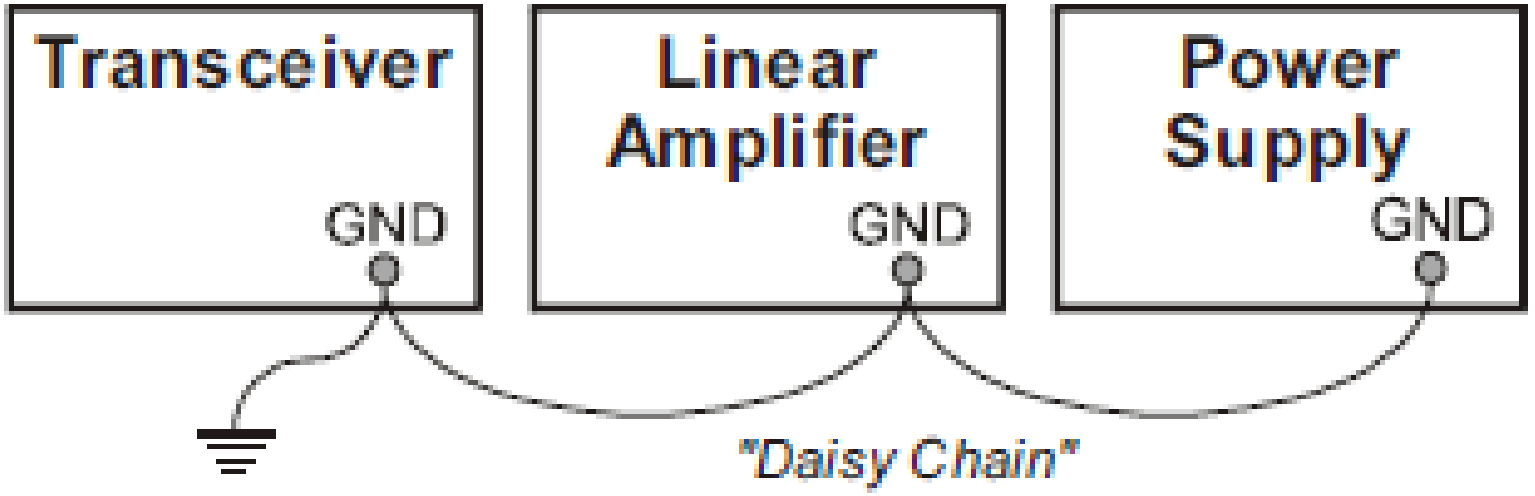
- Be sure to have a fuse that is rated to allow enough current, but not too much
- If your radio needs 12A continuous, then a 10A fuse will not be enough
- If your radio needs 1A continuous, then a 25A fuse may allow to much current, which could damage your radio

Grounding – 3 types

- Electrical
- Antenna Ground Plane
- Lightning Protection

Electrical Ground – Do Not

Improper Ground Connection



Electrical Ground – Do Not

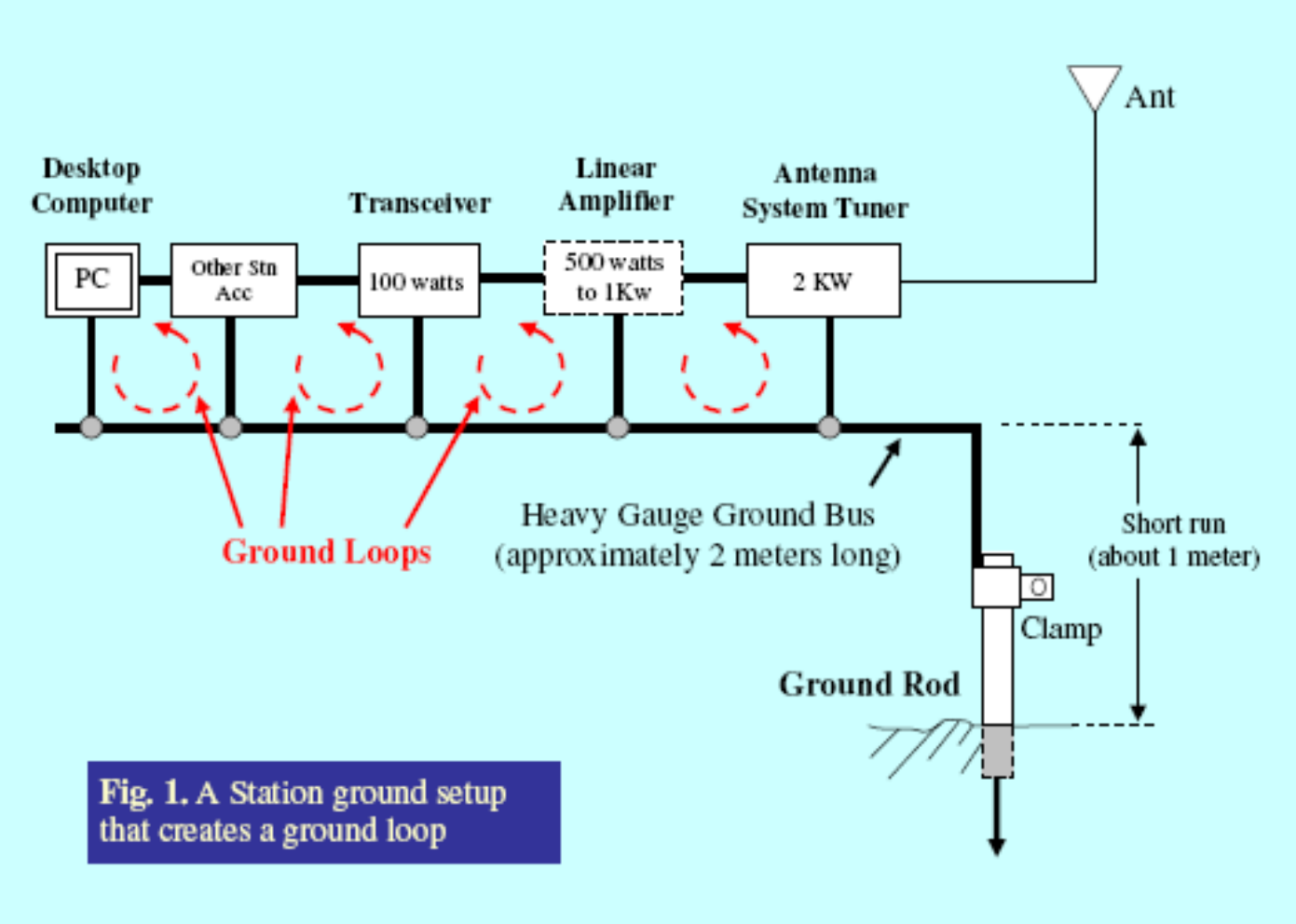


Fig. 1. A Station ground setup that creates a ground loop

Electrical Ground – Do Not

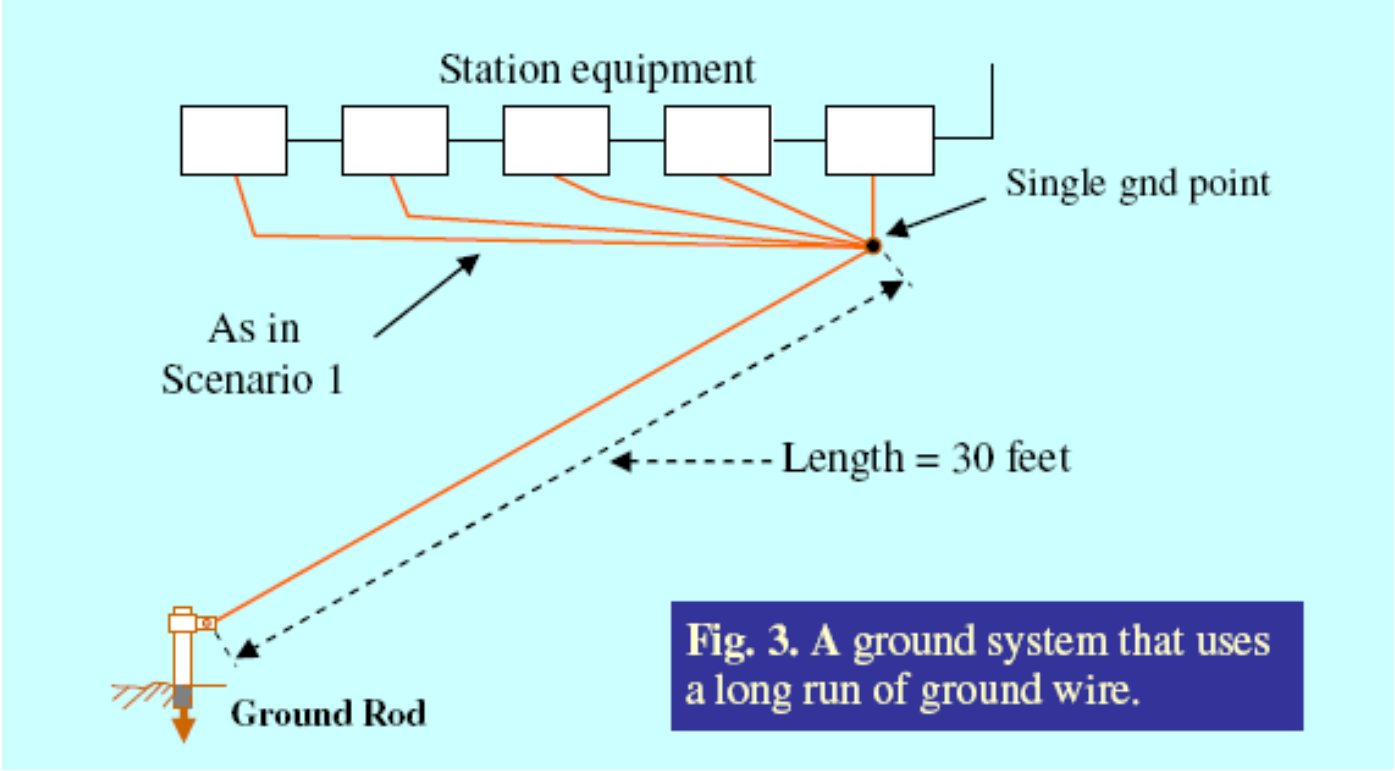


Fig. 3. A ground system that uses a long run of ground wire.

Electrical Ground – Good

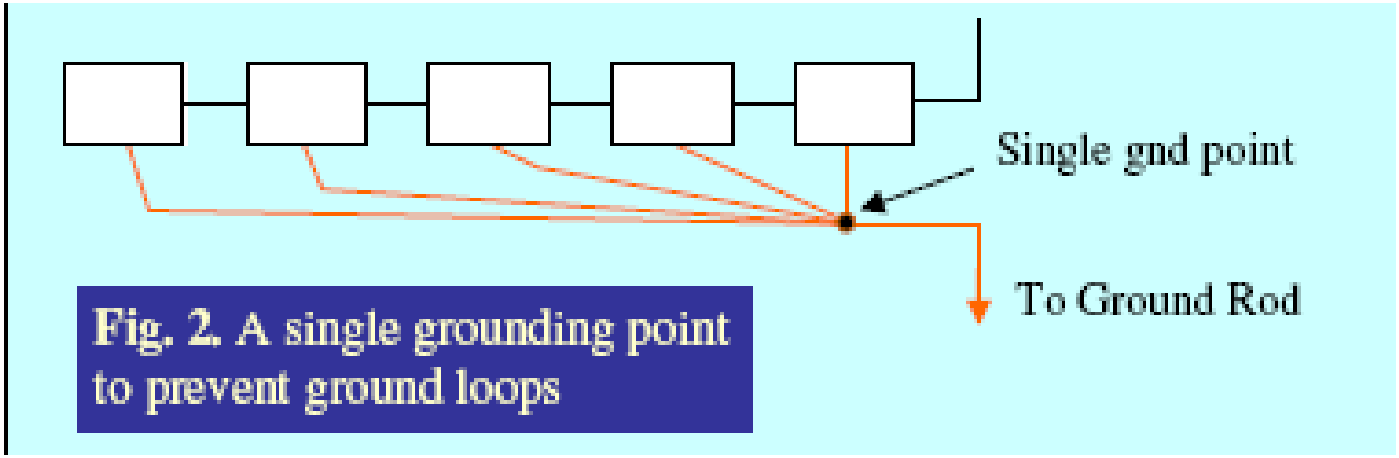
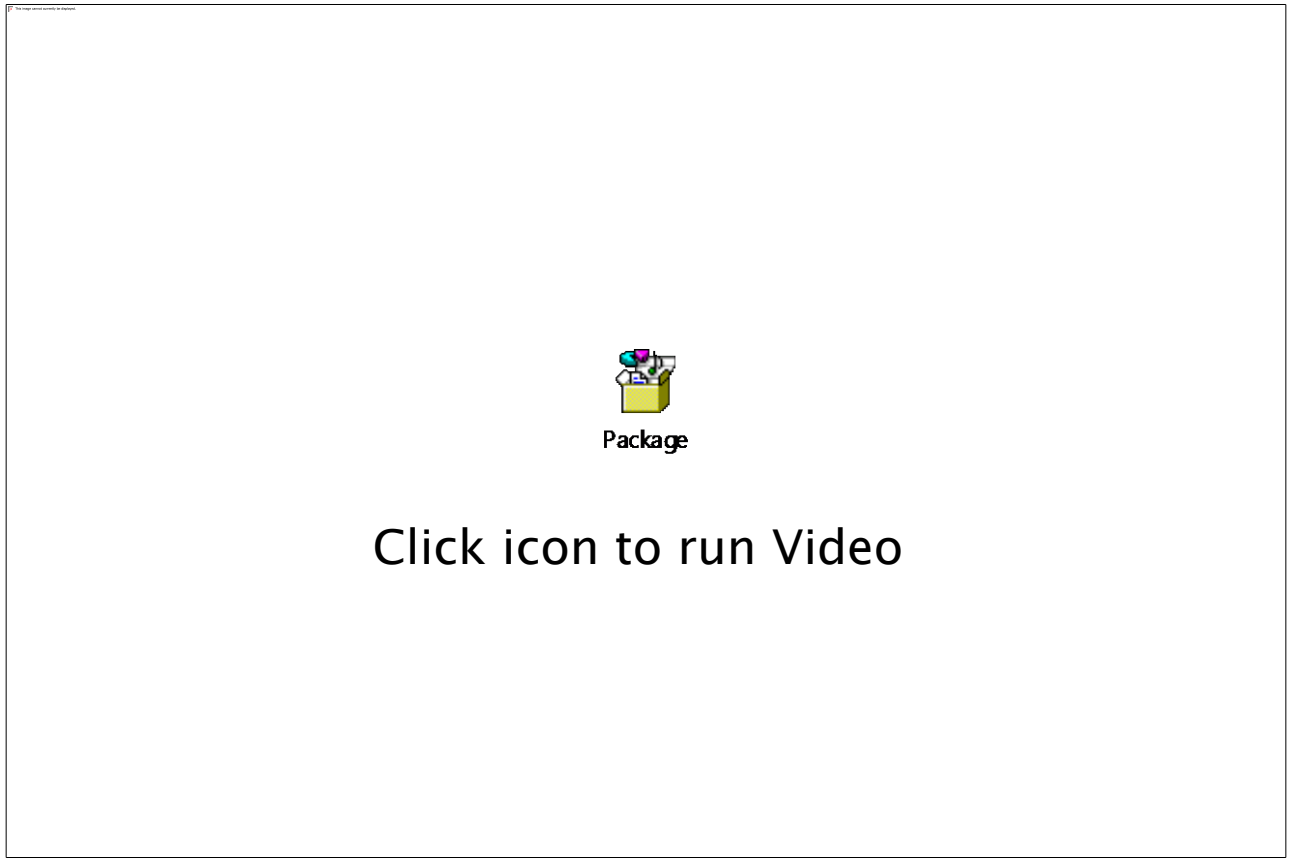


Fig. 2. A single grounding point to prevent ground loops

Ham Radio Funnies



FIN!

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