

## 2024-01-09 Hamlet Net - Power Supplies

### Announcements:

- Test Session Info
  - Next VE session is Saturday, January 27th in the Clover Building at the Boulder County Fairgrounds, and starts at 9 am. It is a Patriot VE team session, so pre-registration is recommended. For more info, and to pre-register, see the Licensing/Testing page on the club web site, <https://w0eno.org/>, under the Education menu.
- We have some volunteer opportunities available where you can help out LARC:
  - Photographer / videographer - record team activities and upload to web site / YouTube
  - Newsletter Editor - put together the monthly Splatter newsletter
- There are several Board positions that will be available in October. Currently, the President, Treasurer and Secretary are planning to make this their last year of service. If you are interested in serving on the board of a 501(c)3 non-profit, please consider running for one of these positions. The current members would be more than happy to "show you the ropes" during the year, so you wouldn't start with zero experience.
- The Northern Colorado Amateur Radio Club's Winter HamFest is Saturday, January 20th. Doors open at 8am and it runs to 1pm. Tables are still available if you have stuff to sell. Admission is \$7. They've got some great raffle prizes this year - A Yaesu FT-891 mobile, a Yaesu FTM-300R mobile, a Yaesu FTM-200R mobile, and two Yaesu handhelds. For more info, see their web site at: [www.ncarc.net](http://www.ncarc.net)
- January 27th, 2024 Winter Field Day - Clover Building at the Boulder County Fair Grounds. Runs from Noon to ?? Setup will start after the VE testing at around 10:30 - 11am.
- Our sister club up in Nederland is looking for some help with events they are running. They have a weekly Monday night net with no predetermined agenda, so you can lead it however you want. They are also planning a Field Day site at Golden Gate State Park and are welcoming anyone who wants to participate. Finally, they are looking for operators for the Ned Gravel run on July 8th. They have signup links for all these events, so head over to their web site <https://w0ned.org/> for more information!
- You can start earning your 2024 membership or future renewal by acting as NCS for at least 5 nets this year. You can run either this Tuesday night net or the Thursday night net (or both). We have scripts available for both, so all you need is a good connection into the repeater, and somewhere to keep track of names and call signs as people check

in. If you're going to be on the net anyway, why not save some dough at the same time! There are four free memberships available for 2023, so don't wait to get started!

- Chuck has set a goal for the Club of running at least one activity a month. This can be a hands-on construction activity, an operating activity like Field Day, a fox hunt, or a special event station. The goal is to get people together to have fun with amateur radio! We have multiple locations at our disposal, as well as lots of Club equipment, so if you have an idea for something you think others hams would like to do, please let us know, and if you're willing to run it, even better!
- The Club is also looking for presentation topics for 2024. If you have any ideas, or better yet, would like to present, please let Chuck know and we'll get you on the schedule!
- All club activities are open to anyone - members and non-members. If you have questions, ask them on a net or **send email to [elmer@w0eno.org](mailto:elmer@w0eno.org)**

**Presenter: Bryan, AF0W**

### **Topic: Power Supplies**

- If you are using a mobile or larger base station type of HF station in your shack, you are very likely using a power supply
- In this case, a power supply is a device that converts the 110 volts AC from a wall outlet into 12 volts DC that is required by your radio
- There are numerous options out there, so how do you find out which one is right for you?
- The first thing you need to consider are the power requirements of your station.
- For most gear, you can find power requirements in the manual. There are typically multiple currents specified, such as when receiving and when transmitting.
  - Unless you plan only on listening, you need to take into account the maximum current required by your device, which will be when transmitting at full power.
- In the case of my Kenwood TS-440S, the manual specifies 1.9 amps in receive with no signal, and 20 amps in transmit mode, so I would require a power supply capable of supplying at least 20 amps
- It also specifies a voltage requirement of 12 to 16 volts DC, with a reference voltage of 13.8 volts, which is a common average voltage of a vehicle's battery while being charged by an alternator.
- That brings up the specifications of the power supply itself

- A common linear power supply, the Astron RS-35A is rated at 13.8 volts DC with two current ratings:
  - 25 amps continuous duty
  - 35 amps peak
- You should make sure that the total current draw of all your station equipment is below the continuous current rating of your power supply, as the peak rating is specified for a very short duration
  - Operating it for long periods at the peak level will likely damage the power supply due to overheating

### **Linear vs Switching**

- I mentioned that this is a linear power supply, but what does that mean?
  - You may also see them referred to as analog power supplies
- At a very high level, they have large, heavy iron transformers to lower the voltage followed by a rectifier to convert the lowered voltage from AC to DC
- You may have heard the "wall warts" people use to charge their cell phones referred to as "transformers," but this is not technically correct
  - The devices typically play two main roles - one of which is converting the voltage from the wall outlet (110 volts) to that required by the device (5 volts, in many cases)
  - The other main role is to convert the AC (alternating current) voltage from the wall outlet to DC (direct current), this conversion is referred to as rectification
- There is another type of power supply called a switching or switch-mode power supply
- In this design, circuitry such as a MOSFET is quickly turned on and off at a high frequency connected to a small transformer with capacitors and inductors used to fill in the voltage during the times the MOSFETS are turned off
- There are tradeoffs to each design:
- The first is RFI or interference
  - Due to the way it operates, the switching supply generates high frequency signals which, if the supply is not designed properly, this can cause interference with your radio equipment

- The linear supply does not have this issue, as it does not have any high-frequency signals in its operation
- Some switching power supplies have a control to adjust the internal operating frequency if interference is encountered
- I believe Chuck may have had an RFI issue with one of his power supplies
- Next is the overall size and weight of the power supply
  - Because of the large and heavy transformer, a linear supply is going to be much larger and heavier than a switching supply of the same capacity
  - You may remember older wall wart power supplies that were much larger and heavier than the current small switching supplies that come with your iPhone or Android device - those were linear power supplies
- Efficiency is another difference
  - The efficiency of a power supply essentially reflects how much power is wasted (typically to heat) by the device when performing its function
  - It is usually expressed as a percentage and is calculated by dividing the output power in watts by the input power, also in watts
  - A typical efficiency for a linear power supply is around 77%, while a switching power supply will be closer to 80-90%
- Due to their designs, linear power supplies typically run hotter than switching power supplies
- Both types of power supplies also include components to regulate the output voltage
  - Regulation indicates how well the power supply can maintain a steady output as the current demanded by the load increases
    - It is expressed as a percentage.
  - For our sample power supplies, the linear power supply has a 0.08% deviation (so 99.92% regulation), and the switching supply has a 2% deviation, or 98% regulation
  - With low regulation, your power supply may put out 13.8 volts when connected to a very small load, but drop to 11 volts when operating near its maximum capacity.

- We ran into this issue with the battery in the club's GoBox. If both the HF and VHF/UHF radios were turned on, the HF radio would reboot itself when transmitting
- We solved the issue by using a battery booster device. This device contains circuitry that holds the output voltage steady at 13.8 volts even if the input sags.
- The box is not magic, however. It consumes extra current to make this happen, so the battery charge will not last as long, but it will power both radios simultaneously.
- Other features of some supplies are voltage and/or amperage meters, cigarette lighter sockets, PowerPole connectors, and USB charging sockets
- Some hams have used power supplies from computers - usually servers - to run their stations.
  - One of the voltages supplied to modern computers is 12 volts, so these power supplies can be an inexpensive way to power your station. They are typically fairly well shielded, so most do not cause additional RFI.
- Note that while your radio may be the biggest consumer of 12 volt power in your station, it may not be the only one
  - Many pieces of equipment such as SWR meters have a 12 volt input for lighting for the meters or circuitry inside the meter
  - Automatic antenna tuners also frequently run off of 12 volts
  - Many LED strip lights run off of 12 volts as well
  - Some hams have added accessories such as USB chargers to their stations - these can also be powered off of 12 volts
  - Unfortunately, most HT chargers do not operate on 12 volts, so you likely still need their wall wart power supplies
  - An example of a linear power supply is the Astron RS-35A, rated at 25 amps continuous, and weighs 27 pounds and costs \$225.
  - An example of a switching power supply is the Samlex SEC-1235M, rated at 30 amps continuous and only weighs 3.4 pounds and costs \$180.
  - Meters can be useful - I had an issue with my HF antenna, and when I tried to transmit into a high SWR antenna, my radio drew a lot more current than usual. I even saw my LED strip lights dim a bit. My power supply didn't have meters, but I had built an external power distribution box with a bunch of PowerPoles and a

combination digital volt amp meter from eBay. I was able to look at it and see it pulling a lot more current than usual, which led me to troubleshoot my antenna and found that squirrels had chewed through one of the support wires, and half of my dipole was on the ground

- You may wonder why ham radios don't just plug directly into the wall. Some theories I've heard is that requiring an external supply reduces cost and weight (and therefore shipping). Also that the radio manufacturer doesn't have to worry about providing different cords or supporting different voltages or frequencies for sales to different countries. Many radios are made to operate in vehicles - even my gigantic Kenwood TS-440S has a mobile mounting bracket, so 12 volt power capability is a big plus. It's also common that hams have more than one radio - in my case, I've currently got my one power supply running 4 radios, and will be adding two more once I get DC power jacks added to them. Most hams don't transmit on multiple radios simultaneously, so you don't need to size your power supply to drive all your radios at maximum current.
- First dit problem - cheap switchers don't store a lot of energy, and will ramp up quickly when needed, but may not have enough power for the first dit (until power supply catches up)

#### Questions:

- **The question for the week is:** Do you have a power supply in your station, and if so, is it linear or switching?
- **In my case,** for my own station, I started with a switching power supply I ordered from ebay. It was a bare-bones power supply, not something designed for ham radio use. I believe it was made by MegaWatt - MeanWell is another common name (and of course there are chinese clones)

I didn't notice that it generated any RFI, but when I saw a used Astron linear power supply, I bought it and now use it in conjunction with a battery and a device called a Super PWRGate from West Mountain Radio to allow it and the power supply to function as a sort of interruptible power supply.

When there is AC power, the power supply runs the radio equipment and charges the battery. If AC power goes away, then the battery will take over.

#### More Info:

- Astron linear power supplies: <https://www.astroncorp.com/linear-desktop>
- Samlex switching power supplies: <https://samlexamerica.com/product-category/ac-dc-power-supplies/>

- MFJ-4416C battery voltage booster: <https://mfjenterprises.com/products/mfj-4416c>
- MFJ-4418 advanced battery voltage booster: <https://mfjenterprises.com/products/mfj-4418>
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### **Backup Questions:**

1. What hobbies do you have other than ham radio? Do you (or could you) use ham radio in these hobbies?
2. Share an "a-ha" moment you had with amateur radio?

Ham-related gifts purchased or requested

- If you have ideas for net topics or general meeting topics / presenters, please let us know! Tell us on a net, or send email to [k0itp@w0eno.org](mailto:k0itp@w0eno.org)

### **Email to [elmer@w0eno.org](mailto:elmer@w0eno.org)**

1. W0PPC - Steve - Lyons
2. K0ITP - Chuck - Firestone
3. AE0DO - John - N of Longmont
4. WA0JJC - Bob - Boulder
5. WB0AFA - Jeff - Frederick
6. KF0MXH - Art - Longmont
7. KF0MWS - Rick - N Boulder
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9. KM6SJA - Steve - Longmont
10. KL7GOD - Shane - Alaska Echolink (head chef) -
11. AF0W - Bryan - El Paso -
12. KF0ONR - Charles - Longmont
13. WB7FAW - Charlie - Longmont -

**End: 7:55pm**