

Emergency Power for Amateur Radio Stations

Southern California ERC Conference

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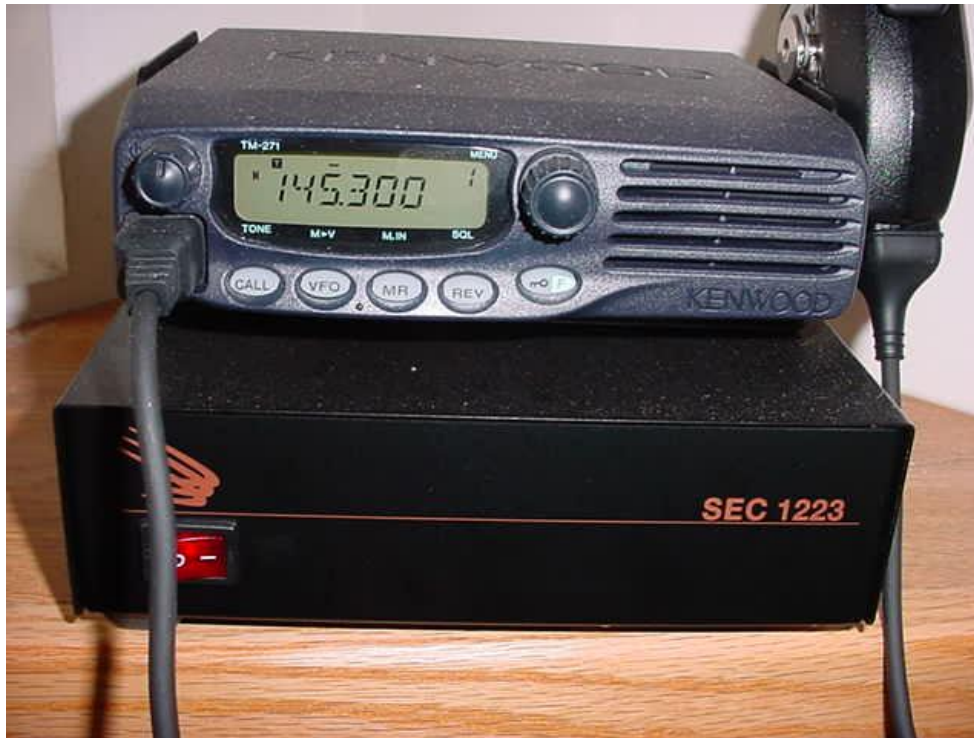
Cerritos, Ca

Emergency Backup Power

1. Assess station requirements
2. Design backup power system
3. Purchase & Install
4. Test Monthly

Equipment Decisions

What do you have now?



Equipment Decisions

What do you have now?



Equipment Decisions

What do you have now?



Equipment Decisions

What do you have now?

- Have you used your mobile checking into local nets?
- Have you tested your HT checking into local nets?
- Have you found some locations work better?
- Do you have an adapter to connect roof antenna?
- Consider buying a AA battery pack (lower power?)
- Consider buying a cigar lighter power adapter

Establish Station Requirements

What do you want to do?

1. Type of operation

- Monitoring
- Net control

2. Duration and duty cycle

3. Computer equipment

4. Consider other household needs (lights?)

Radio & other equipment

- List all components
 - Transceivers/tuners/interfaces
 - Computer & monitor
 - Phone land-line/cell
 - Lighting?
- For each component, determine:
 - Voltage requirements
 - Peak current consumption
 - Duty cycle Requirements/How long

Radio & other equipment

<u>Item</u>	<u>Xmit</u>	<u>Receive</u>
HF Transceiver 100W	22A	1.5A
HF Tuner	>1A	
VHF/UHF Mobile 50W	12A	1.0A
Desktop PC 154w	2.5A @120v	
Laptop (charging) 70w	1.5A @120v	
Light- desk lamp 60w	0.5A @120v	

Equipment Decisions

Generator vs. Battery System

What do you have now?



Emergency Backup Power

1. Assess station requirements
2. Design backup power system
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Equipment Decisions

Generator

- Plug 120v stuff in
- Need power supplies to run 12vdc equipment
- Gas, oil, maintenance



Battery System

- Independent of all else
- Use 12v directly
- Need inverter to use 120v stuff
- Charger, maintenance, battery replace 3-5 years



150W
AUTO Power Inverter 120V AC

Equipment Decisions

Generator vs. Battery System

Both can be viable options if properly designed

- Automatic
- Manual
- Cost
- Maintenance Issues

Equipment Decisions

Generator Systems-

750 kW turbo diesel self contained w/36 hours fuel
Auto Transfer Switch monitors SCE

1,700 amps/480vac

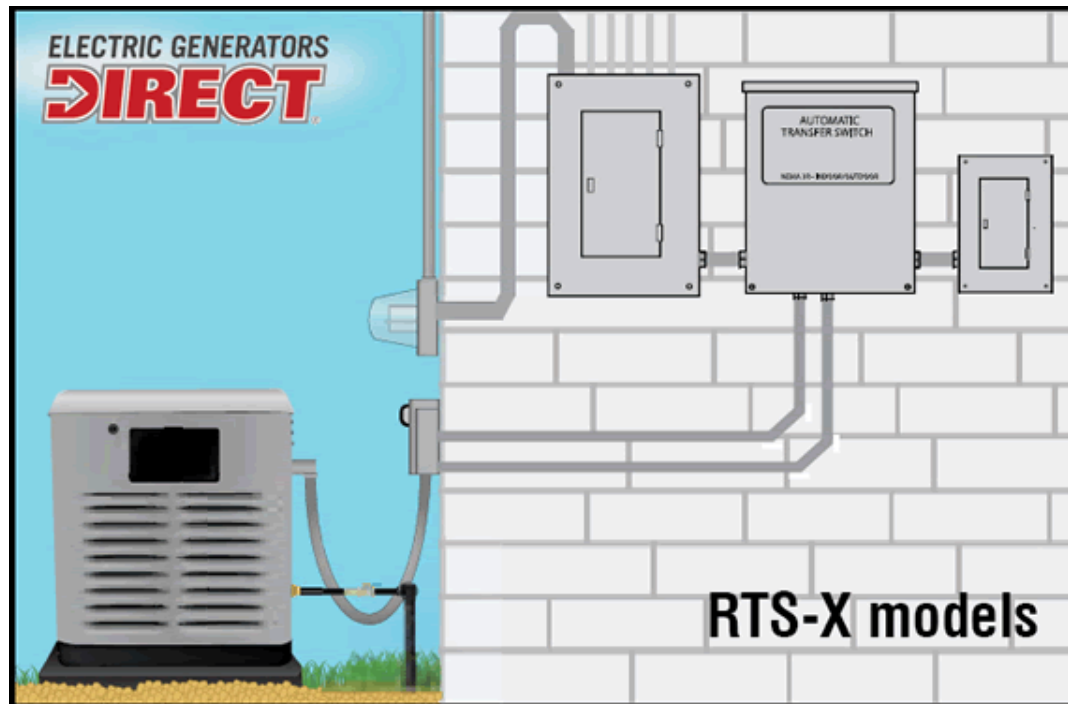


Equipment Decisions

Generator Systems-

Auto Transfer Switch monitors SCE

27 kW 113 amps @120/240 fueled LP or NG



Equipment Decisions

Generators-



- Honda eb11000
 - 120/240V 9500W cont.(79.2/39.6A) with 4 120v 20 Amp receptacles plus 3 twist lock; 2-30A and 1-50A
 - DC output: NA
 - Fuel Gasoline 6.9 gallons approx runtime 4 hours 80dB
 - 403 lbs. dry and about \$5200

Equipment Decisions

Generators-



- Honda eu1000i
 - 7.5 Amps @ 120V from two 15 Amp receptacles
 - DC output: 12V, 8.3 Amps
 - Fuel Gasoline 0.6 gallons approx runtime 4.1 hours 61dB
 - 28.8 lbs. dry and about \$800
 - Astron RS-20A input 120V 500W 4.2A

Equipment Decisions

Battery Systems

Indoor

vs.

Outdoor



Equipment Decisions

Outdoor Battery Systems-

- Automotive/RV Battery can be used
- Large ampere capacity
- Easily available
- Hazard if used inside
- Battery box outside the house
- Standard garage charger can be used
- Consider-
 - Battery Tender type automatic systems
 - Solar Charger/maintainers for RV's



Equipment Decisions

Deep Cycle Storage Battery

- Designed for RV, Boat, Golf Cart use VENTED & OUTSIDE
- **A deep cycle battery is designed to provide a steady amount of current over a long period of time.**
- A deep cycle battery can provide a surge when needed, but nothing like the surge a car battery can.
- A deep cycle battery is also designed to be deeply discharged over and over again (something that would ruin a car battery very quickly). To accomplish this, a deep cycle battery uses thicker plates.

Equipment Decisions

Indoor Battery Systems-

Absorbed Glass Mat (AGM) or Gel

- Designed for use indoors (UPS, Wheelchairs, Alarms, etc)
- no spill
- no explosive gas
- Battery Box still recommended
- AGM will take more abuse than gel
- Gel must be charged at a slower rate or heat damage results



Equipment Decisions

Indoor Battery Systems-

Multi-stage automatic “float” chargers taper down to zero

- www.a-aengineering.com



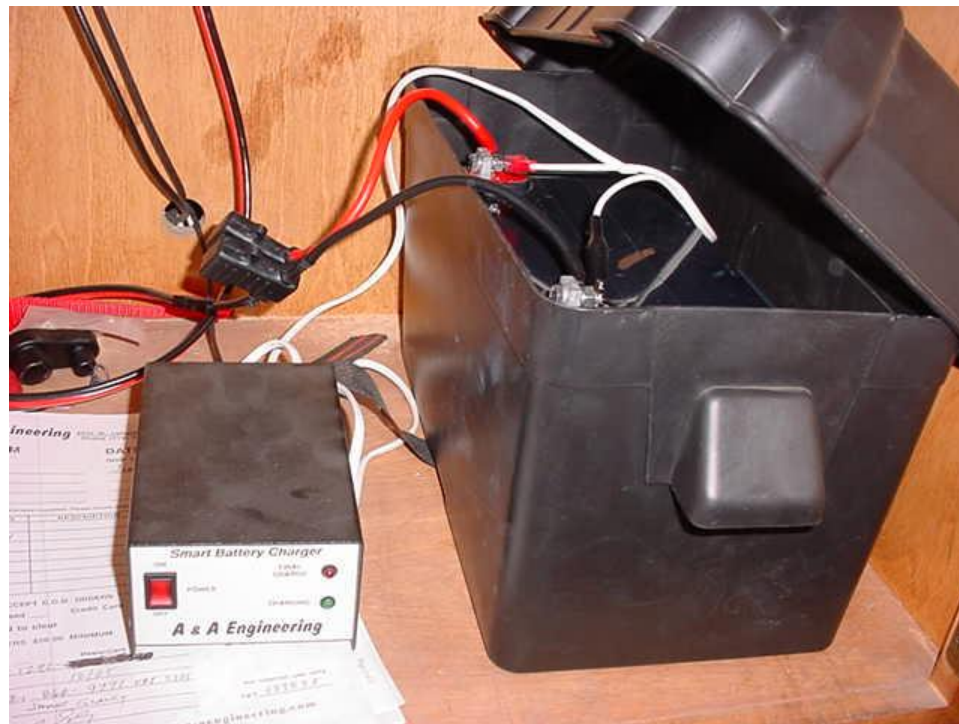
Battery Tender



Equipment Decisions

Indoor Battery Systems-

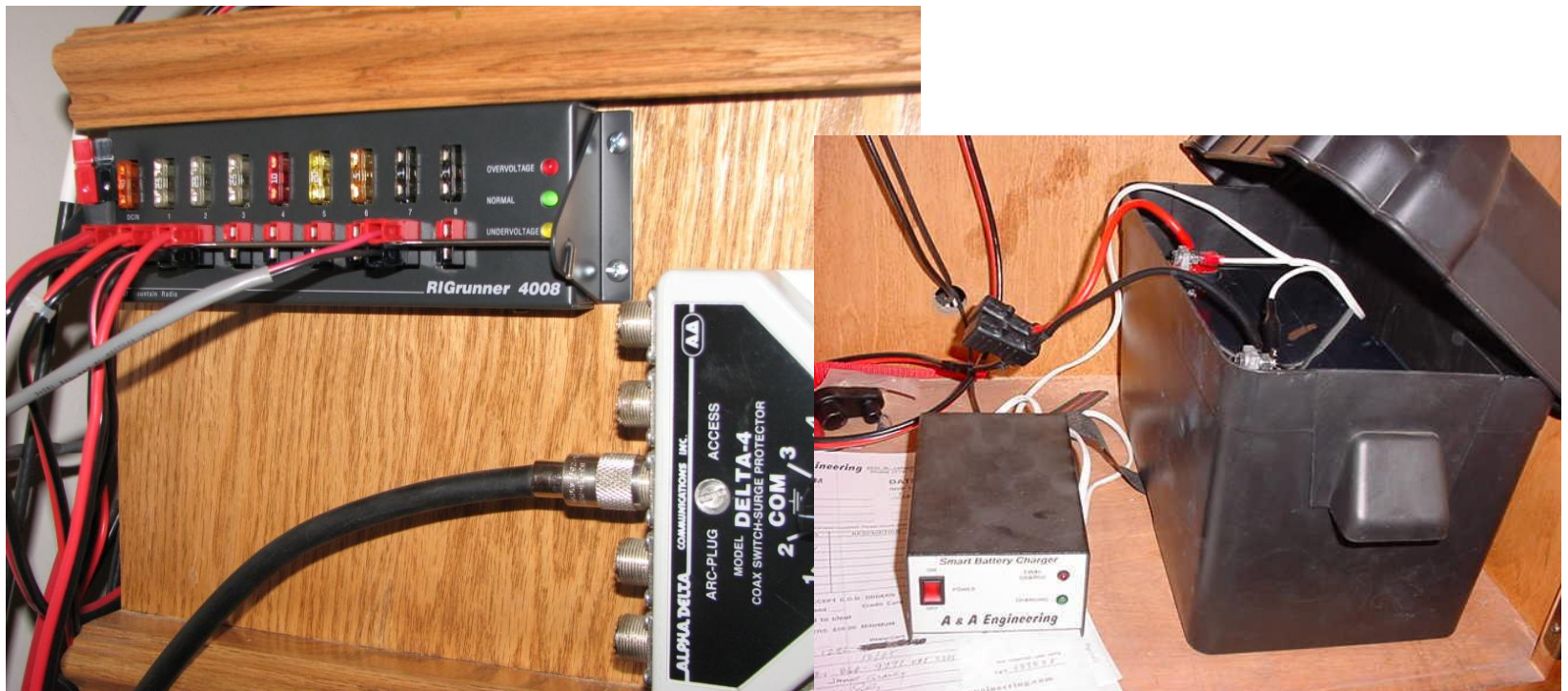
A&A Smart Charger with a 35 amp hour gel battery



Equipment Decisions

Indoor Battery Systems-

12V power distribution with Rigrunner & Powerpole system



Equipment Decisions



Equipment Decisions

Indoor Battery Systems-

Astron “BB” system

RS-20ABB provides 12 vdc
at 16 Amps continuous and
auto switch to battery



BATTERY BACKUP POWER SUPPLIES The RS-10A, RS-12A, RS-20A, RM-35A/M, RM-50A/M, RM-10A, RM-12A/M & RM-60M are available with battery revert and trickle charge circuit with zero switch over time. (Battery not included.) To specify the backup circuit add BB after the model number i.e. RS-60M-BB

Equipment Decisions

Indoor Battery Systems-

Alternative is a BB module on your existing Power Supply

Astron BB-30M



Equipment Decisions

Indoor Battery Systems-

Astron BB system

- Leave power supply on 24/7
- Auto charge battery from 6.5 amps down to 'float'
- Seamless auto switchover if AC power fails
- Designed to do exactly what we are doing
- Emergency run time based on battery size & condition

Design System

- Energy storage – lead acid battery
- Safe, rugged, available, economical
- Construction varies
 - Outside- automotive or deep cycle okay
 - Inside- gel cell or absorbed glass mat (AGM)
- Limited charge/discharge cycles
- Best performance with proper charger
- Keep at room temperature for maximum life

Design System

- Just as you have experienced with your car battery life/capacity varies with age and abuse!
- Watch battery voltage and shut down when low voltage critical is reached = 11.75 volts!

Design System

Batteries rated in Ampere Hours (ah)

The amp-hour is a unit of battery energy capacity, equal to the amount of continuous current multiplied by the discharge time that a battery can supply before exhausting its internal store of chemical energy.

Peukert's Law (Poi-kairt), presented by the German scientist W. Peukert in 1897, expresses the capacity of a lead-acid battery in terms of the rate at which it is discharged. As the rate increases, the battery's available capacity decreases. This is a real world “service factor” for you calculations. A Peukert factor rating of 1.1 is perfect and 1.6 is terrible.

Design System

An amp-hour is one amp for one hour, or 10 amps for 1/10 of an hour and so forth. It is **amps x hours**. If you have something that pulls 20 amps, and you use it for 20 minutes, then the amp-hours used would be 20 (amps) x .333 (hours), or 6.67 AH.

Therefore if you plan to xmit 20% time on HF:

$$20 \text{ amps} \times 0.333 \text{ hours} = 6.67 \text{ amp hours}$$

$$1.5 \text{ amps} \times 0.66 \text{ hours} = 1.0 \text{ amp hours}$$

You need 7.7 amp hours + 10% Peukert factor = 8.47 ah battery capacity per hour of operation.

Equipment Decisions

Deep Cycle Storage Battery

- Designed for RV, Boat, Golf Cart use VENTED & OUTDOORS
- AC Delco Voyager Premium M30HMF deep-cycle battery :
 - Rated at 900 marine cranking amps (MCA) for 30 seconds at 30 degrees Fahrenheit
 - Rated at 625 cold cranking amps (CCA) for 30 seconds at 0 degrees Fahrenheit
 - 180 Reserve Capacity (RC) length of time sustain a 25 amp draw
 - Rated at 115 amp-hour capacity (minus Peukert factor 84 ah)
 - In the real world the AC Delco-Voyager M30 would last 7 hours under a constant load of 12 amps. Only xmit 6 min/hr it would last 33 hrs!

Design System

- Use all your auto charge adapters with the addition of a cigar lighter outlet
- Use DC-AC inverter for 120 VAC output
 - 300 W consumer unit should be adequate for 200 W continuous load
- Operating time estimated in hours
- Use that time to get your generator running!

Build it!

- Buy parts
 - RIGrunner 4008 kit \$117
 - 79AH AGM battery \$140
 - DC/AC inverter \$40-80
 - Astron RS20A-BB \$130 or Astron BB-30A \$70 add on
 - Misc. cable, powerpoles, connectors \$30
- Spend weekend assembling parts - Priceless

Build it!

- ✓ Powerpole 30 amp connectors
- ✓ Use tie-wraps to dress & secure wiring
- ✓ #12 stranded cable
- ✓ Try to use cables less than 6 feet long
- ✓ Install fuses at the battery



Test it!

- Record discharge time under real conditions
- Check battery voltage at $\frac{1}{2}$ hour intervals
 - 12.1 V is 50% charge
 - Save your rig and don't go below 11.75 V!!!
 - Battery is fully discharged at 10.5 V and possibly damaged
- Tools: good Volt Ohm Meter, battery analyzer, Whattmeter \$70 or other specialty tools

Test it!

Whatt Meter \$75



- Simultaneously reads Volts, Amps, Watts and alternates between A-hrs and W-hrs, fully automatic.
- Take the guesswork out of power measurement.
- Makes it easy to read power consumption and battery capacity.

Maintain

- Discharge/charge cycle
- Test under load
- Record data
- Compare with previous test results
- Clean dirty contacts
- Inspect cables
- Check for corrosion or white dust
 - Signs of overcharging and venting
- Got spare fuses?

References

- For information on battery characteristics and chemistry:
http://www.windsun.com/Batteries/Battery_FAQ.htm
- For information on the newest AGM sealed batteries:
<http://amsolar.com/Lifelinemanual.pdf>
- For information on photovoltaic power with battery storage:
<http://amsolar.com/education.html>
- For information on wire, fused battery cable, & PowerPole accessories:
www.powerwerx.com
www.qsradio.com/PowerPals.htm
- For information on fused DC power panels:
<http://www.westmountainradio.com/RIGrunner.htm>
<http://www.mfjenterprises.com/Product.php?productid=MFJ-1124>