Anchor Bay Amateur Radio Club

- Elmer Night - September 17, 2008 - de W6WTI

External Power Sources for Your HT or Mobile Radio

How Long will your HT radio operate on its batteries?

- some manuals provide estimated battery life on a fresh set of alkaline cells or on fully charged NiCad or NiMH battery packs of different capacities..
- How long a battery pack will last depends on several things:
  - the capacity of the battery ... **AND** its state of charge
  - the duty cycle
    - How much time in squelched receive (stand by) mode
    - How much time in receiving mode, and its volume setting
    - How much time in transmit mode
    - The Output Power Setting (Hi, Med, Low)

- Kenwood TH-K2 Manual on Specifications page says:

Duty Cycle: Xmt 6 sec, Rcv 6 sec, Stdby 48 sec ... for each minute

- is this typical? If more Rec or more Xmt - the shorter the life.

With BT14 9 volt battery (6 fresh AA size batteries installed)

High Power	4 hours
Med Power	8 hours
Low Power	10.5 hours

- How many extra batteries do you have on hand?

- **Question?:** If we had an earthquake and you ran your TH-K2A radio continuously how long would you be able to operate using the example duty cycle on High Power if you had **6 sets** of fresh AA cells for your BT-14 battery case?

6 cells/set x 6 sets = **36 AA** cells
6 sets x 4 hours/set = **24 hours ... . Then what?**

After 24 hours are you still on the air?

How about an External Source of Power for your HT ?

Your car battery?
An RV/Marine Battery?

Such batteries are heavy, usually contain sulphuric acid as liquid or gel, require attention from time to time, but contain a lot of electrical energy to run your radio(s).

Example TH-K2A :

10 min Stdby at 0.10 amp	= 1 amp-minute
40 min Rec at 0.50 amp	= 20 amp-minute
10 min Xmt at 1.8 amp	= 18 amp-minute

Would use 39 amp-minutes per hour of operation, or 0.65 amp-hours/hr at High Pwr. 15.6 amp hours/24 hour day. If your RV/Marine battery has 120 amp-hour capacity it'll run the HT for more than **7.5 days** at that duty cycle before needing to be recharged.

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Deep Cycle/RV Battery Considerations

- Vehicle batteries are designed for heavy starting current ... but will power radios, too.
- Deep Cycle/Marine batteries are designed for lesser drains, over a longer period and deeper discharge.
- Keep battery in acid proof battery box
- RV type battery have wingnut / screw connections as well as cable terminals
- Monitor battery voltage (the VOM in your ready kit will do nicely, record values)
- Emergency recharge via generator/charger, or using jumper cables from your car.
- Normally charge with battery maintainer (not trickle charger)
- Check electrolyte levels carefully, monthly or quarterly.
- **High Current 12 VDC can be very dangerous. No rings, watches, bracelets or other metal jewelry should be worn as you work with a charged battery. Even a 'discharged' battery can spark impressively. Watch your metal tools, they conduct!**

Other battery packs?

The Power Station has a 6 amp hour 12 volt battery (360 amp minutes) - it'll run the TH-K2A for **9 hours** at that duty cycle (360 amp-minutes / 39 amp-minutes/hour = 9.2 hrs))

Designing emergency power sources to run your HT, mobile radios and other items is an area for a lot of **creativity**.

Designing a battery pack using 'D' Cells:

The capacity of a D cell is substantially more than that of a AAA or AA cell.

D cells deliver nominally 20.5 amp hour of service
AA cells deliver nominally 2.8 amp hour of service

8 D cells in **series** would supply 12 volts ... but your radio needs AT LEAST 12 VDC to operate correctly ... so the life of the pack would be significantly shorter if designed to deliver 12 VDC, than one starting out at 13.5 VDC or 15 VDC..

Both battery sizes supply nominal 1.5 VDC per cell.

8 D Cells – 1.5 VDC batteries in series will provide	12 Volt DC
9 D Cells – 1.5 VDC batteries in series will provide	13.5 Volt DC
10 D cells – 1.5 VDC batteries in series will provide	15.0 Volt DC

The Kenwood TH K2A will accept **up to 16 Volts**. Starting out at 15 volts, the pack voltage will decline with use. As the battery pack drops below 12 volts, performance of the HT will become impaired.

Regardless of how many cells you use **in series**, a fresh D cell will provide 20.5 amp-hour or 1230 amp minutes of service. A Kenwood TH-K2A uses 39 amp-minutes / hour. So the D cell pack would be expected to run the radio at the design duty cycle for about **31 hours**.

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Check Your Manual Before You Start:

- Make sure you know the voltage requirements for your radio - check your Manual to be sure of its requirements.

For example:

Kenwood TH-79 specifies:
External Power, DC jack 5.5V – 16 V (13.8 V)

Kenwood TH-KT2A specifies:
Operating Voltage, DC IN jack DC 12.0 – 16.0 V (13.8 nominal)

- **Connector for External DC**

- often a coaxial outlet is on the HT (**check size and polarity**) ... most commonly the center pin of the plug is + and the ring is - .

- many manufacturers make cables with the coaxial plug and bare ends for connection to a regulated power source. (Batteries not connected to chargers qualify if the voltage is within the specified range)

e.g. Kenwood 's PG-2W DC Power Cable

- many manufacturers make cables to use auto cigarette lighter outlets. These contain circuits to ensure that voltage spikes or overvoltages are not applied to the radio.

e.g. Kenwood's PG-3J Cigarette Outlet Power Cable

- check all disclaimers and warnings - the manufacturers are relatively conservative about their warnings about connecting HT's to auto batteries installed in a vehicle.

About Connectors

If everyone utilized a similar connector for external power input for their radios, and if our emergency power sources used the same connector, then it would be easy to swap in fresh power sources for our radios ... or to change radios if someone wishes to take theirs with them when they go off shift or go to another assignment. Quick for station set up, take down, too..

Is there a power connector standard ? Yes, there is. Meet the Anderson Powerpole !!

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ANDERSON POWERPOLE CONNECTORS
are the standard for VHF Transceiver use.

Either the 15-ampere or 30-ampere sizes may be used, and both sizes mate with each other. The plastic parts are the same for both sizes. The barrel area (which holds the wire) of the 15-ampere silver-plated contact is smaller than that of the 30-ampere contact, but the contact area is the same. The connectors dovetail together as a compact unit.

Housings should be mated according to the diagram above, viewing from the contact side (opposite the wire side), tongue down, hood up, RED on the LEFT, BLACK on the RIGHT. Use a 3/32-inch-diameter roll pin, 1/4 inch long, or a drop of super-glue, to keep the housings from sliding apart.

Identical connector halves are genderless—making assembly quick and easy and reducing the number of parts stocked. Molded-in dovetails allow for customized harness in a variety of configurations. When the connectors are disconnected, no metal parts are exposed.

The 15-ampere contacts are designed for 16-20 AWG wire and the 30-ampere contacts are designed for 12-16 AWG wire. The contacts can be soldered or crimped to wires.

Here are the Anderson part numbers:

15 A **Black** **Red**	**Complete Connector** #1395G1 #1395	**Housing Only** #1327G6 #1327	**Contact Only** #1332 #1332
30 A **Black** **Red**	**Complete Connector** #1330G4 #1330	**Housing Only** #1327G6 #1327	**Contact Only** #1331 #1331

The contact lugs are designed to be crimped. Non uniform crimping can distort the barrel fitting so that the contact will not fit in the housing. Soldering can be done if solder is applied sparingly. The Anderson crimper is a fairly expensive device, but is ideal for the job.

There are a variety of devices on the market using Powerpole connectors ... e.g. RigRunner. The wire from your battery or power supply to a RigRunner or 'Y connector' power distribution network should be heavier gauge and use the 30 A connectors.

Further Reading:

The **ARRL Handbook for Radio Communications** has information about discharge planning, battery charging, sample projects and more in Chapter 17.

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OK ... How About a Mobile Radio ???

A Kenwood TM-731, for example ... an elderly dual band mobile xcvr.

Power required:	13.8 VDC +/- 15% (calculated: 11.7 to 15.8 VDC)				
Current Drain	High Power < **11 amps**				
	Rcv w/ no signal ~0.6 amp				
Output	2 Meters	High	50 Watts	Low	5 Watts
	440	High	35 Watts	Low	5 Watts
Fuse	15 amp				

A Kenwood TM-271 - a current model 2 meter mobile xcvr

Power required:	13.8 V DC ±15% (11.7 ~ 15.8 V)		
Current Drain	High Power **13 amps** or less		
	Rcv at 2 Watt Output - Less than 1 amp.		
Output	2 Meters	Hi Pwr	60 Watts
		Low Pwr	25 Watts
Fuse	15 amp.		

In mobile installations Kenwood's recommendation is to connect the radio directly to a nominal 12 volt vehicle battery using the supplied wire (#16 or larger gauge) with fuses on both positive and negative sides. Red to positive, black to negative.

The same 120 amp-hour battery will run one of these radios at the 40/10/10 duty cycle for about 40 hours. (Assumes 13 amp drain in xmt, and 1 amp drain for stdby and rec.)

There is no apparent warning about overvoltage conditions for connection to the vehicle battery in the manual for either of these mobile radios.

Grabbing power from other places ?

> ... 'my batteries are all flat and I ran out of replacements and no chargers are running'
> **What to do ?**
>
> With a power cord with heavy battery clips on one end and Anderson Powerpoles on the other, you can connect to **any 12 VDC auto battery** you can borrow. **Watch polarity.**
>
> Brush or wipe down 'borrowed' batteries so that chemical crusts or drips don't come into contact with your skin or sensitive components. (A box of sodium bicarbonate can neutralize any small spills.)

This solution also allows quick connections to power supplies that may be available when your wrench, screwdrivers, or other tools aren't at hand. Clip onto the terminals, plug in the Powerpoles and you're in business. These are a bit more vulnerable to jostling which may cause short circuits or other interruptions. Position them safely out of harms way.