The QRP Rig Battery Power Supply

Revised

Al Duncan – VE3RRD

There are several choices when deciding on a power supply for your QRP transceiver, but battery power is preferred for portable operation. If minimum weight is important, then you could use Alkaline AA cells which are often found on sale. AC power supplies (especially "wall warts") generally should be avoided as they can have a noisy DC output that can affect your ability to hear weak stations.
If weight is not important, then a Gel Cell battery of between 4 and 7 ampere hour rating is a good choice. These are available in 12 V and 6V (use 2 in series) versions. Special charging units designed for Gel Cell batteries can be purchased or made (an example is found at: http://www.rason.org/Projects/gelcell/gelcell.htm , and more info can be found at: http://www.qsl.net/wb3gck/gel-cell.htm).

A simple way to charge and maintain a Gel Cell battery is to connect it directly to a regulated power supply with a current limiting resistor installed between the power supply and the battery – this is called a float charging configuration.

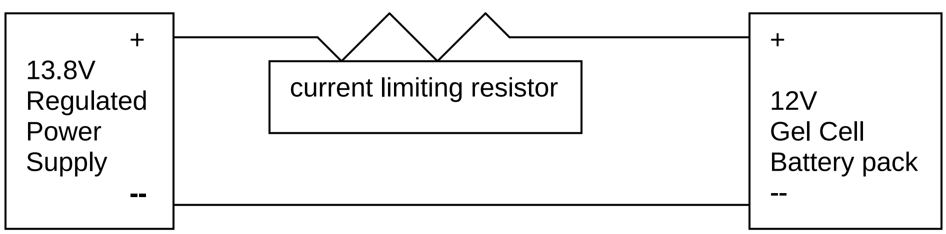
Obtain the manufacturers info sheet on your Gel Cell batteries, but as an example, I use a pair of Sterling batteries model H7-6 (7 Ah rating) in series. These batteries can be float charged with a voltage between 6.8 and 6.9 VDC per cell, or 13.6 VDC to 13.8 VDC for the pair (these values are for batteries charged at room temperature – 25C, if warmer then a lower float voltage should be used). The advantage with float charging is that the battery can remain connected for long periods of time so it is always charged and ready for use.
I use a regulated 13.8 VDC 5A power supply which has an internal voltage adjustment potentiometer which I have set to just below 13.8 VDC (use an accurate digital voltmeter).
The next problem is to limit the maximum charge current so as to be within the manufacturer's maximum value of 10% of the Ah rating of the battery (about 700 ma for my batteries – your battery may have a lower maximum charge rating).
When considering charge current, you should also consider the minimum voltage the manufacturer has specified for a discharged battery (draining a battery below this value can damage it). I have decided not to discharge my battery pack below about 11.5 VDC (the battery voltage drops fairly quickly during discharge after it gets below 12 VDC), you will need some way of monitoring the battery voltage when you are using it in the field as a Gel Cell should never be discharged below 10.5 VDC.
Next you need to calculate the value of resistance needed to limit the current. Assuming a minimum battery voltage of say 10.8 VDC and a float power supply voltage of 13.8 VDC, the voltage difference is 3V. If the current is to be a maximum of 10% of 7A, that equals 0.7A. Since R=E/I or R=3/0.7, the series resistor would have to be at least 4.4 ohms. A 4R7 resistor would require a power rating of (P=I squared R) or about 2W (4W for a 100% safety factor). You can use a 5W 4R7 resistor or two 2W 2R2 resistors in series.

Another solution is to use an automotive light bulb as the current limiting resistor. You may have to try several bulbs in series with an ammeter to find one that limits the current to the desired value. Use a power supply set for 3VDC (in my example above) and connect directly to the light bulb through an ammeter. I am currently using a type 561 automotive bulb which gives me a maximum charge current of just under ½ Amp. The taillight filament in a 2057 bulb gives closer to 1A charge current which would work well for larger 12Ahr batteries.

Charging a discharged battery at the float voltage will take longer than using an automatic gel cell charger which initially uses a higher charge voltage (e.g. 14.5VDC) and then reduces the voltage and charge current after a short time.

Since a float voltage power supply always remains at about 13.8 VDC; with a 4R7 resistor in series, the battery will charge at (I=E/R or 3/4.7) 640ma when discharged to 10.8 VDC. Once the battery voltage reaches say 12V, the charge current will be only (I=E/R or I=1.8/4.7) about 380ma and will continuously get smaller as the battery voltage approaches the voltage of the power supply. Thus the actual charge rate of your battery will vary depending on its terminal voltage (and age – old gel cells can develop internal resistance). Note that the battery voltage can never equal the power supply voltage since the closer the battery gets to 13.8V, the closer the charge current gets to 0 A. It is only the initial charge current that you must worry about, choosing a series resistance that will limit it to less than 10% of the battery rating when the battery is fully discharged (as close to 10.5V as you have permitted it to go). After having my battery pack connected for several days, when I disconnect it for use, the no-load terminal voltage is about 13.2 VDC.

Gel cells can be considered to have a life expectancy of about 10 years from date of manufacture.



More than one battery (each with its own current limiting resistor) can be connected to a single regulated 13.8 VDC power supply, just make sure the continuous output current rating of the power supply is sufficient for the sum of all the maximum charge rates of all the batteries connected.

When shopping for a 12V gel cell battery, take along an accurate digital volt meter. Any battery with a terminal voltage below 10.5 VDC should be avoided.

If you want to actually run a load test on the battery you have purchased, fully charge the battery and then attach a load that will draw about 10A for 1 minute. Check the battery voltage after removing the load – it should be up at about 12.6 VDC (or higher).