Battery Charging using Constant Current
with Electronic Loads with automatic current shut off

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[1]Theory of Operation

The electronic load can be used to control the current charging a battery. You need to know 5 things about the battery. It's maximum voltage, minimum voltage, maximum charging current, leakage current, and trickle charging current.

The power supply to charge your battery needs to be about 1 to 2 volts higher than the battery voltage. The reason for this is the electronic load need about 1 to 2 volts dropped across it for good current regulation in charging of the battery. You can use a bigger power supply (more voltage) but you will just waste it in heat dissipation coming electronic load from the load.

Next you need to know the leakage current of the battery. The result here you are trying to achieve is a leakage current across the electronic load greater than the battery leakage current but less than the batteries trickle charge current so the electronic load will automatically shut off its current charging when the battery is charged. Please note all electronic loads have there own leakage currents. Executive Engineering, electronic loads have leakage currents. There impedance is from 50K to 500K consult the factory for the model you are using.

Here is how to calculate if you need to add a Leakage Resistor to the electronic load.
Battery Leakage say is 0.001 A or 1 ma
Your electronic load has a 2.1 volt drop when the battery is charged.
2.1V / 0.001A = 2100 ohms plus you need some more leakage current for room, always take away a little more for safe margin, another 20 - 30% that would be 1470 ohm a 1.5K would do nicely.
Make sure that the R Leakage does not exceed the trickle charging current of the battery.

Pre-adjust the electronic load for the correct charging current with out the battery hooked up, and adjust the START-UP on/off control for the correct voltage cut off point. It works this way. When the battery is discharged the voltage across the battery is low and the voltage across the electronic load

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is high, as the battery starts charging up the voltage shifts from the battery being low to the battery being higher and dropping less voltage across the electronic load. At some point you want to stop the electronic load from charging the battery any more. Since the battery drops more and more voltage when it is charged the electronic loads has less and less. By taking advantage of this fact and using the START-UP circuit of the electronic loads at some point you can shut off the current when the voltage get to a low enough state. This is what the external leakage resistor is for when applied across the electronic load. In the schematic example we have a 3.3 volt battery and have chosen to shut off the electronic load at 3.2 volts. Leaving the load with 2.1 volts across it when the battery is fully charged with a 5 volt power supply.

Setting up the START-UP circuit of the electronic load. First you need to have done the current charging adjustment. Then apply the voltage you want the electronic load to shut down at. Look at the current and adjust the START-UP until the current fall to almost zero. You electronic load is now read to charge you battery.

If you set the START-UP circuit to 0 volts the electronic load will never shut off and you may over charge the battery.

Make sure that you are using an Executive Engineering electronic load with the constant current option in it if you need to charge with constant current as a standalone unit.

We now need to check the power the electronic load is dissipating, so what is the voltage drop when the battery is discharged and what is the maximum battery charging current.
(Power Supply Voltage) – (Discharge Battery Voltage) X (Maximum Charge Current) = Electronic Load Power Dissipation

You will find charging currents of 0.5 – 20 / 40 / 80 Amps will work the best. This type of battery charger is designed for large battery packs at high currents.

Some things to note about the power supply you are using. You need to use a good power supply one that is well regulated and has low ripple and noise. The current supplied by the power supply should be more than what is required by battery charging circuit. Make sure your power supply stays in regulation even at no load (battery fully charged), other wise you could over charge the battery.

Note: You should always charge the battery on the Plus (+) of the electronic loads.

All the source impedances such as current shunts, should also be keep on the Plus + side of the electronic load.

Charging with the qusi-power mode results will not be unpredictable.

Some Questions you may have:

When charging, if your power supply and electronic load are isolated, from you main circuit, you can charge and use your circuit at the same time too keep the battery charged. This works only if you power supply and electronic load are floating, and they should be if you have done the charging circuits correct.

Can you use a non-regulated power supply? Its not a good idea, the electronic load may not shut down when the battery is charged.

Some power supplies may require a minimum load to keep them regulated you should always have a load of about 10% of the power supplies full current loaded on the outputs of the power supply.

If you have questions always consult the factory.