The VollrathD " BattIR Meter"

How the calculations work on this project. Note that the BattIR meter also displays all of the voltage and current measurements that are involved on its LCD display, so the mathematics of the calculations can be checked if desired.

How the IR values are calculated

The software function for the IR calculation is fairly straight forward.
First, the meter connects a 5 ohm resistor across the battery, and measures and stores the voltage on each cell. Then, it connects both the 5 Ohm and 2 Ohm resistor across the battery, and again measures and stores the voltage on each cell. The voltage accuracy on the current meter design is on the order of 0.5%.

Now, we have a voltage measurement at a low current value, and a voltage measurement at a high current value for each cell in the battery pack. This helps account a little for any surface voltage charge on the battery pack that might exist with no load currents, especially with those A123 cells.

The formula consists of the change in voltage drop divided by the change in current value. (A so called "Two Tier" method.)

So, we have the following formula:

BattIR per cell = (Voltage@Low_Amps minus Voltage@High_Amps) divided by (Current@High_Amps minus Current@Low_Amps)

The maximum safe current formula was derived by Giles and his associates by testing piles of batteries. That formula allows a maximum of 6 Watts of internal cell heating due to its internal resistance per Ampere hour rating.

So, a 3300 mah pack (ie 3.3 Amp Hours) can not handle more than 6 times 3.3 Amp Hours or around 19.8 Watts per cell of internal heating.

Since P = I^R, the maximum current allowed is I = Square root of P/R.

As an example, if that cell has 6 milliohms internal resistance , you have the square root of 19.8 Watts/0.006 Ohms or 57.4 Amps maximum current rating.