# EAGLE EYE TECHNICAL NOTE

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| **Title** | **Battery Resistance vs Impedance Testing** |
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## Revision History

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EAGLE EYE POWER SOLUTIONS

# Battery Resistance vs Impedance Testing

The first point is that resistance testing and impedance testing are carried out by similar but importantly different methods; resistance is measured by using a DC current to perturb (excite) the cell, while impedance uses an oscillating (AC) current.

The resistance method eliminates other parameters present in the cell and measures pure resistance. Impedance tests also measure resistance, but the measurement includes values for other parameters present in the cell, such as capacitance and inductance, without separating these parameters out. Therefore the resulting test values for resistance and impedance for the same cell will be different.

Additionally, impedance is dependent on the frequency used in the test; the measured impedance value of a cell tested at, say, 85Hz will be different to the value obtained when using 115Hz. Different instrument manufacturers favour different frequencies to test for impedance, so none will be the same value for the same cell.

The very low test currents, used by Impedance testers, perhaps only 1 or 2 Amps even for large cells, mean that their measurements are very vulnerable to noise pollution, therefore they have to use very strong filters to reduce the effects of noise and ripple. Since different manufacturers use different filters this results in a further measurement differential, not only from resistance results to impedance results, but between manufacturers of impedance instruments.

**Resistance tests**, even by different manufacturers should show a very similar measured value, given slight differences in their measuring systems.

**The Vigilant system**, to ensure that the response to the test is the energy from the cell and not just the charger, uses a strong test current (up to 20 Amps) to measure pure DC resistance. It also measures the other parameters present in the cell separately and, together with resistance, uses them in its state of health algorithms.

Lastly, the Electrical Power Research Institute (EPRI) using a Megger (AC) and an Alber Cellcorder (DC) in a two year study of resistance and impedance testing of thousands of cells, concluded that there was no discernable difference in the effectiveness of the two methods, although they would show different values for the same cell. The EPRI report also showed that neither resistance nor impedance (or conductance) could be relied on to determine early stages of deterioration; this is why the Vigilant system was developed to determine state of health and not just resistance.