

## Battery Monitoring Fact Sheet

Merlin Equipment designs and manufactures the World's most accurate line of Battery Monitors. Accurate battery information empowers you to make informed decisions about the use and maintenance of your electrical system.

With vehicles and boats being so power dependent, not being able to accurately determine just how much power is left severely effects reliability, causes inadvertent over discharge of batteries and compromises safety.

### The Disadvantage of Amp Hour Counting Battery Monitors

Conventional battery monitors use a current measurement shunt to monitor how many amps flow in and out of a battery. By starting at a known point (fully charged), they are able to count out the amps and during recharge, count them back in. The problem is that the amount of amps flowing in/out of the battery doesn't necessarily correlate with the battery's SoC% (State of Charge %). Actual battery SoC% is dependent on how quickly (and proportionately to the size of the battery) current is removed or charged, temperature, battery age etc. A new battery is rated at say, 100Ah. After 1 year, its capacity may well have dropped to 85Ah. That's a 15% accuracy problem.

The issue with Ah counting meters is that unless they are regularly reset (95% of monitors aren't ever reset), accuracy error compounds. Combine this with complex read-outs and the average user normally completely ignores their battery monitor! Attempting to automate functions (like automatic generator starting or alarms) from the battery monitor is potentially catastrophic when synchronisation errors exist.

Despite the above, Amp Hour counting is actually very accurate – but only when certain parameters are met. The problem is that its very difficult for the average user to know when his AH counter is accurate unless it is reset each and every charge/discharge cycle.

### The Merlin Method:

Merlin SmartGauge and DataCell Battery Monitors use proprietary monitoring methods. The data acquired is passed through a unique set of algorithms to determine the battery's actual State of Charge. This result is then compared against a computerized Model to provide true battery SoC%.

- Never runs out of synchronisation with the battery; Gives dependable SoC% information at all times.
- Automation of generator starting, load shedding etc is safer & operates correctly.
- Automatically compensates for battery temperature variation
- Handles batteries being stored for long periods of time, Ah counters do not take self discharge into account.
- Automatically compensates for battery aging – providing true SoC% even on batteries at half life.
- Uses just two wires to monitor the battery. No shunts or temperature sensors required

### Ultimate Battery Monitoring:

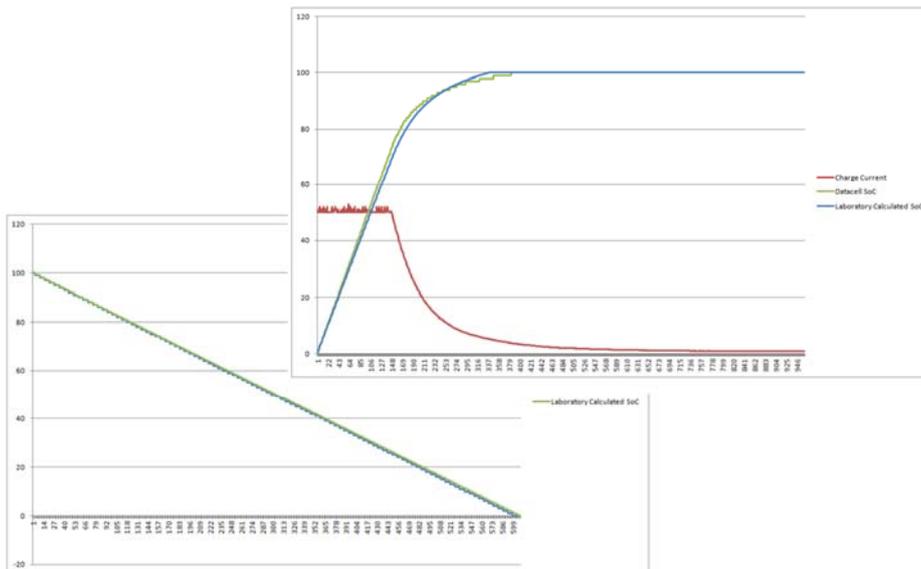
DataCell II combines the proven Merlin Battery Model Method and Amp Hour Counting. By combining the finite accuracy of a properly (and automatically) synched up Ah counter, and our unique algorithms, DataCell II provides repeatable battery monitor accuracy of better than 99% at any time. DataCell II provides more information than any other battery monitor; Including SoH% (State of Health %). Once engineers know SoH%, they can confidently plan battery change outs and ensure that batteries being replaced are at genuine end of life, instead of simply being flat.

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### Independently Verified:

Merlin Battery Monitoring Technology has been independently verified by the World’s largest industrial battery manufacturer, EnerSys; the US Army, Government Test Houses and independent engineers.

In the case of EnerSys, the test was conducted over 35 battery cycles with varied temperatures, load and recharge rates. Total Ah consumed error was 1.24%, State of Charge % error was 0.15%, Time Remaining Error from full to flat was 0.68% and Time Remaining from ¾ charged to flat was 0.03%. EnerSys concluded that at all times the Merlin Technology was “more than capable of producing under normal conditions, SoC and SoH readings with an accuracy within 1 or 2%”.



Upper Graph shows Battery Monitor readings Vs Laboratory Equipment during typical three stage charge from flat.

Lower Graph shows discharge cycle 27 out of 35. The green line shows the laboratory SoC%, the blue line shows the Merlin generated SoC%.



|                                    | <b>SmartGauge</b> | <b>DataCell 1</b> |
|------------------------------------|-------------------|-------------------|
| Number of Batteries                | 1+1               | 1-4               |
| Accuracy error                     | ~5-10%            | ~5-10%            |
| High/Low Voltage Alarm             | Yes               | Multiple          |
| Low SoC% Alarm                     | Yes               | Multiple          |
| Alarm Outputs                      | 1                 | 8*                |
| Display                            | LED               | LED or LCD        |
| Displays Voltage & State of Charge | Yes               | Yes               |
| Voltage                            | 12/24V            | 12/24V            |
| Monitoring Method:                 | Model Based       | Model Based       |
| RS232 Interface                    |                   | Yes               |
| Datalogging Software               |                   | Yes               |
| Merlin Dashboard Software          |                   | Yes               |
| Displays Amps, Ah, Time & Temp     |                   |                   |
| Displays Battery State of Health   |                   |                   |