BMS State of Charge Accuracy Improvements

The EG4® Electronics battery management systems (BMS) use a formula for the State of Charge (SOC) that all advanced battery management systems use.

The formula for this will be the following:
Actual Ah Battery Capacity / Total Ah Battery Capacity = State of Charge

Actual Battery Capacity is the “actual Ah (Ampere hour) capacity of the cell pack”, meaning if the 51.2V 100Ah battery module is at 50% SOC, the capacity of the cell pack is 50Ah.

Total Ah Battery Capacity is the fully charged Ah capacity of the cell pack, meaning that the fully charged Ah capacity of the 51.2V 100Ah battery module will be 100Ah.
(Although as the SOH% (State of Health) changes the Total Ah Battery Capacity will reduce.)

ISSUE:

All battery management systems that use the SOC% algorithm for the LiFePo4 chemistry all fundamentally have the same issue due to the flat voltage curve of the LiFePo4 cells. This fundamentally makes the SOC% difficult to determine under certain conditions.

Very specifically when three or more batteries are in parallel with an inverter and the inverters idle consumption will begin to consume the batteries’ capacity. Over time this will lead to a parasitic draw that occurs on the batteries and de-calibrates the SOC%. The EG4 Electronics line of batteries will not detect below 0.5A DC due to modern day hardware limitations. All of the BMS systems reviewed from other companies will also **NOT** detect under 0.5A DC. This is a universal modern problem in the off-grid battery space.

The idle consumption will vary depending on the inverter circuit. For example, the EG4 18kPV and FlexBOSS series of inverters is on average 1.3A DC. This amperage spread between three batteries can equal 0.43A. This specific scenario will lead to a SOC% de-calibration the longer the inverter and battery bank side idle due to the batteries not detecting under 0.5A DC.

This issue will cause the battery bank to report an incorrect SOC%. When the customer begins to use the battery bank and inverter for home backup the system will quickly shut down due to this calibration.

IMPROVEMENTS:

The EG4® Electronics Research and Development lab has been thoroughly testing firmware to help combat this issue within the Lithium-Ion genre, specifically LiFePo4 which is what all EG4 Electronics batteries use.

EG4 has been working on firmware specifically for LiFePo4 chemistry that will track the total voltage while the battery is idle (BMS powered ON, breaker powered ON) and will help keep the battery within calibration for the SOC%.

This new algorithm will keep the batteries SOC% calibrated for when a parasitic draw occurs. The battery bank will stay in calibration and report correctly to the inverter in closed-loop communication.

Currently, these firmware updates will be available for the following EG4 batteries:

- 51.2V 280Ah WallMount All Weather
- 51.2V 280Ah WallMount Indoor
- 51.2V 100Ah LiFePower4 V2
- 51.2V 100Ah LL-S
- 51.2V 100Ah LL V2 (6-dip switch)

EG4 Electronics is continuously working on improving the battery management systems for all products and to give our customers the most accurate and reliable battery backup systems.

THESAURUS

Ah – Ampere hour
BMS – Battery Management System
SOC% - State of Charge
SOH – State of Health