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Sandia National Laboratories

Battery Management System Standards

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(working group chair)

Working Scope / Purpose

Scope:

This recommended practice includes information on the design, installation, and configuration of battery management systems in stationary applications, including both grid-interactive, standalone cycling and standby modes. This document covers battery management hardware, software, and configuration. Hardware capabilities in large systems include: grounding and isolation; passive and active balancing; and wired or wireless sensors. Software capabilities include: algorithms for optimal operation with reduced risk; best practices for verification and validation; alarms; and communication with external systems. Common settings are discussed along with setting selection methods. Battery types that this document covers include lithium-ion, sodium-beta, advanced lead-acid, and flow batteries. General factors for other types are provided.

This document does not cover battery management systems for mobile applications such as electric vehicles; nor does it include operation in vehicle-to-grid applications. Energy management systems, which control the dispatch of power and energy to and from the grid, are not covered.

Purpose

Well-designed battery management is critical for the safety and longevity of batteries in stationary applications. This document is intended to inform battery system designers and integrators in the challenges to battery management design. This document assists in the selection between design options by supplying the pros and cons of a range of technical solutions.

Many aspects of battery management design require integration with other systems such as energy management or charge control systems. System integration can be made difficult or impossible without a minimal level of communication interface and control interface standardization. To address this issue, this document offers recommendations and best practices for interface design to streamline system integration.

Four study groups were formed at the kickoff meeting in January and presented their initial findings in June.

- Requirements
- Architecture
- Modeling
- Failure Modes

Expected Timeline

2018 – PAR submitted to IEEE

2019 – WG Kickoff Meeting

2020 – Drafting Sections

2021 – Review/Editing

2022 – Balloting

IEEE P2686 Recommended Practice for Battery Management Systems in Stationary Energy Storage Applications

A new working group has formed within the IEEE energy storage and stationary battery (ESSB) committee to develop a recommended practice for battery management systems (BMS).

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Many aspects of battery management design require integration with other systems such as energy management or charge control systems. System integration can be made difficult or impossible without a minimal level of communication interface and control interface standardization. To address this issue, this document will offer recommendations and best practices for interface design to streamline system integration.

The scope of the working group's efforts includes collating and communicating information on the design, installation, and configuration of battery management systems in stationary applications, including both grid-interactive, standalone cycling and standby modes. The document we are working on covers BMS hardware, software, and configuration. Hardware capabilities in large systems include: grounding and isolation; passive and active balancing; and wired or wireless sensors. Software capabilities include: algorithms for optimal operation with reduced risk; best practices for verification and validation; alarms; and communication with external systems. Common settings are discussed along with setting selection methods. Battery types that this document covers include lithium-ion, sodium-beta, advanced lead-acid, and flow batteries. General factors for other types are provided.

Study Groups

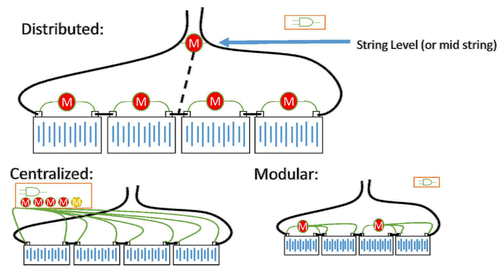
Requirements

Primary Functions

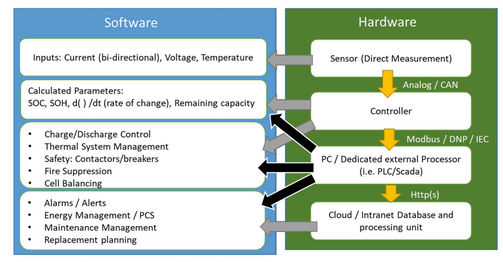
- **Safety**: Protection, Prevention and mitigate of catastrophic thermal events (fire, cell overheating, cell venting)
- **System Protection**: Prevent damage to cells, pack, string, or system from abuse, faults, or failure conditions
- **Ensure Proper System Function**: Maintain the system within proper operational parameters to meet system design requirements.

Architecture

Physical



Stack



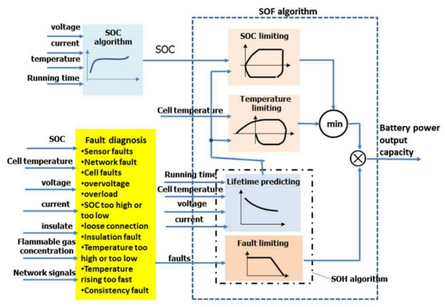
Modeling

Role:

- Predicting performance
- Estimate the battery internal states
- Control battery operation

States:

- State of charge
- State of health
- State of life
- Available power
-



L. Lu et al. / Journal of Power Sources 226 (2013) 272–288

Failure Modes

Categories From IEEE 1679:

- General
- Short circuits
- Overdischarge
- Overcharge
- Thermal runaway
- Electronic failures

If you have knowledge of BMS design and would like to participate in the development of a new IEEE recommended practice, then please contact the working group chair, David Rosewater dmrose@sandia.gov, and join us for the next working group meeting at the IEEE ESSB 2020 Winter General Meeting in Orlando FL, February 10-14. https://cmte.ieee.org/pes-essb/event/essb-2020-meeting-orlando-fl/

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