Battery Management System Standards

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(working group chair)

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

The IEEE P2686 working group has spent FY22 reviewing and editing every section. The draft went through its first circulation in July and it received 100+ editorial and technical comments. This is a multi-year consensus-based effort to develop a new standard for battery management systems and will substantially impact how battery systems are designed and built in the coming decades.

P2686 Development Timeline

| 2018 | PAR approved by IEEE |
| 2019 | WG Kickoff Meeting |
| 2020 | Drafting Sections |
| 2021 | Drafting Sections |
| 2022 Fall | WG Balloting |
| 2023 Fall | Estimated Publication Resolution |

Move to online only meetings

PAR (project authorization request)

PAR Extension

The goals of cybersecurity are to protect the confidentiality, integrity, availability, and non-repudiation of information. Confidentiality refers to information only being known by those people and systems who are authorized. Integrity refers to the authenticity of information and its source. Availability is the ability of the intended recipients to make use of the information. Lastly, non-repudiation is the ability to accept information when the communication is authorized or legitimate. IEEE 1547.3-202X provides detailed recommendations for cybersecurity of DER. IEEE 1547.3-202X emphasizes the importance of implementing cybersecurity within and across organizations and networks. Network cybersecurity is normally implemented via a gateway that also converts from the Modbus communication within the BESS to the SCADA protocol implemented by the local utility (often DNP 3). Such gateways are beyond the scope of this document. The role of the BMS in cybersecurity is to have specific features that enable cybersecurity at the network and organizational levels. This subclause provides recommendations for BMS features that support this purpose.

New Content Highlight
(BMS Cybersecurity)

The balancing circuit's architecture should match the physical architecture of the battery. A balancing circuit design should minimize both the number and length of current carrying wires.

Example Balancing Circuit (BC) Architectures

New Content Highlight
(Recommended Configuration by battery type)

Lithium ion battery systems should implement the following battery management functions:

- Voltage management:
  - Functions: over voltage, under voltage, voltage imbalance
  - Operational constraints: maximum cell voltage, minimum cell voltage
  - Warning thresholds: high cell voltage warning, low cell voltage warning, cell voltage imbalance warning
  - Interrupt constraints: trip max cell voltage, trip min cell voltage
  - Notes: This is a safety function. It should be implemented on each cell in the system.

- Current management:
  - Functions: source discharge current, source charge current, sink discharge current, sink charge current
  - Operational constraints: maximum discharge current, maximum charge current
  - Warning thresholds: high discharge current warning, high charge current warning
  - Interrupt constraints: trip max discharge current, trip min charge current
  - Notes: This is a safety function. It should be implemented on each string in the system.

- Charge management:
  - Functions: Overcharge, Overdischarge, and unbalanced charge
  - Operational constraints: over SOC, over SOC
  - Warning thresholds: high SOC warning, low SOC warning
  - Interrupt constraints: trip max, trip min
  - Notes: This is a safety function. The BMS should provide redundant overcharge protection. Cell charge balancing is an important BMS function for most lithium-based chemistries.

- Temperature management:
  - Functions: Overtemperature and untemperatures
  - Operational constraints: over temperature, max temperature
  - Warning thresholds: high temperature warning, low temperature warning
  - Interrupt constraints: trip max temperature, trip min temperature
  - Notes: This is a functionality. The battery system should be designed to be robust to failures of the thermal control system, such that the thermal control system is not essential to the safety of the thermal system.

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 digital working group meeting.

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