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Battery Management Solutions for Energy Storage



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Battery Management Solutions

and Energy Storage Engineering Services





The first configurable battery management system in the world to be UL 1973 Recognized for stationary energy storage.



Nuvation Energy's fourth-generation battery management system represents over a decade of product innovation and is currently used in over 130 energy storage projects worldwide.

Minimize your system integration effort by leveraging our battery management expertise. Our engineers can also provide system design support to optimally configure your battery stack for target applications and to meet performance requirements.

Services range from BMS system integration support to delivery of turnkey energy storage systems.









Battery Management Systems

Nuvation Energy's low- and high-voltage battery management systems meet the functional safety requirements of UL 991 and UL 1998. Conformance to these standards greatly simplifies testing and certification of battery stacks to UL 1973, and energy storage systems to UL 9540. The BMS provides both configurable flexibility and functional safety by physically separating the functional safety profile from the user-configurable settings.



Designed for Safety

Nuvation Energy battery management systems have been architected to ensure that no single point of failure will compromise the safety of your battery system, and that battery stacks are connected and disconnected in a manner that minimizes electrical threats.

- Includes two redundant CPUs that continuously monitor each other to verify that both are fully operational.
- The BMS conducts a diagnostic test during startup, to verify the integrity of communications across all battery management modules.
- Includes configurable support for a pre-charge circuit that helps prevent current surges when bringing up a stack and connecting it to a capacitive bus.
- The Stack Switchgear component of the High-Voltage BMS includes contactors and fuses that will safely intervene to disconnect the battery stack from the DC bus if batteries exceed voltage, current, or temperature thresholds.
- Reports the presence of disconnected and poorly connected voltage taps and temperature sensors.

 Contactor management features include reporting when a component replacement is due, electrical arcing mitigation, and powering the contactor directly from the BMS.

FUNCTIONAL SAFETY





Battery Control Panel

The Battery Control Panel aggregates battery stacks in parallel and enables operation of the ESS as a single battery. It includes all the software and connections required to integrate the stacks with ESS controllers such as the PCS and other system managers. The user-friendly graphical interface provides at-a-glance system status and can be used to make battery management configuration changes, connect / disconnect stacks, and troubleshoot battery performance issues.



nController EMS

The nController Energy Management System (EMS) is a customizable energy management solution for battery energy storage systems. It can be used for demand charge management, renewables smoothing, islanding, black start, and microgrid control. This feature-rich energy controller is custom-configured by Nuvation Energy's engineers for the target energy infrastructure and for customer-defined energy management functions.

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45 kW	Docharging 40 KW	134 kW	49 899	Para Data
1,234 MWh	89 kWh	4.096 MWb	2,810 MWh	60 Hz
	152 kWh		S.1 KWh	479.9
Referant .	Astro-1	Astest	Beleved .	Astroph
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NUVATION

nController EMS





High-Voltage BMS

The High-Voltage BMS (60 – 1250 VDC) provides cell- and stack-level control for battery stacks. One Stack Switchgear unit manages each stack and connects it to the DC bus of the energy storage system. The Battery Control Panel aggregates the battery stacks and acts as a central control hub for the PCS and other ESS controllers.



Low-Voltage BMS

Nuvation Energy's Low-Voltage BMS (11 – 60 VDC) is used in commercial and residential energy storage applications, specialty vehicles, telecom power backup systems and more. For batteries that include an equalization process (e.g. lead-acid), it will support the periodic peak voltages of up to 68 VDC that can occur during that maintenance operation.



nController EMS



The nController receives data from each asset to determine available power and energy, and intelligently leverages your energy storage resources to provide demand charge management functions such as peak shaving, load shifting, backup power, etc.



High-Voltage Battery Management System Modules



nController EMS

The nController Energy Management System ("nController EMS") is a demand charge management and asset prioritization and control system for energy storage and distributed energy resources operating behind the meter. Whether you are adding energy storage to your facility for peak shaving, or creating a multi-asset microgrid, this site controller will coordinate the operation of your energy assets.

- Includes all Battery Control Panel functions as well as application-level software for demand charge management and other higher-level energy storage system control.
- Native support for PCS from Sinexcel (PWS2-30M-EX, PWS-30K-NA), Dynapower (DPS-500, MPS-125, MPS-250), LS Energy (PowerBRiC), SMA: Sunny Central. Support for additional power conversion systems added upon request.
- Native support for power meters from Wattnode (WND-WR-MB), Circutor (CVM-C10), Schneider (LV430491). Support for additional meters added upon request.
- 10" touch screen interface.
- Cellular modem (US and Canadian networks only).
- 110/240 VAC Power supply.



Battery Control Panel

The Battery Control Panel (BCP) aggregates all the battery stacks in your energy storage system. It enables operation of the overall system as a single unified battery, and also provides stack-level information and control.

- Contains a Multi-Stack Controller that aggregates up to 36 stacks in parallel via a bank of Ethernet ports.
- LCD touchscreen provides access to the BMS Operator Interface.
- Cellular modem and antenna (US/Canada) enables redundant internet connectivity.
- Available dedicated Ethernet port for energy controller connectivity.



Multi-Stack Controller

The Multi-Stack Controller aggregates multiple stacks to operate as a single battery. One is included in each Battery Control Panel (BCP). Can also be sold separately.

- Intelligently manages connection and disconnection of multiple stacks to one DC bus.
- Enables monitoring and control of the entire battery pack though a single Modbus TCP interface.
- Collects pack-level voltage, temperature, and current statistics for all cells.
- Calculates State of Charge and Depth of Discharge of the unified energy storage system.
- Aggregates system-wide faults and warnings and provides battery pack diagnostics.
- Ensures that measurements and control signals are propagating though all BMS modules.
- Functions as a data analytics gateway by providing access to battery measurements for data capture.



Stack Switchgear



Nuvation Energy Stack Switchgear protects the cells in a high-voltage battery stack and manages the Cell Interface modules that connect directly to the cells. It connects and disconnects a battery stack to the DC Bus, and provides connectivity between the battery system and higher level ESS controllers.

- Includes one Power Interface and one Stack Controller.
- Includes all components required to connect the stack to the DC bus, i.e. fuses, contactors, bus bars, current shunts, pre-charge circuits, e-stop, short-circuit protection, and networking.
- Calculates State of Charge (SOC) and Depth of Discharge (DOD). Uses voltage and temperature data from the Cell Interfaces to dynamically adjust current thresholds provided to the PCS.
- Reports available capacity changes to the PCS and other ESS managers.
- Provides terminal connections for the battery stack as well as communications I/O for other ESS controllers.
- Disconnects the battery stack if the cells are performing outside of their safety profile.
- Controls battery rack cooling fans.



Stack Controller

The Stack Controller is the master controller of all BMS modules in a battery stack. It is located inside the Stack Switchgear unit, and can also be sold separately.

- Connects to Cell Interface modules to manage balancing and provide stack management.
- Calculates State of Charge and Depth of Discharge at the cell and stack levels.
- Communicates with external systems via Modbus TCP (Ethernet), Modbus RTU (RS-485), or CAN bus.
- Supports firmware upgrades via Ethernet.



Power Interface

The Power Interface module is located inside the Stack Switchgear and can also be sold separately. It measures stack current and provides power to other High-Voltage BMS modules.

- Provides operating power for the system, sourced from a 24 VAC/VDC input, which allows full functionality even with fully discharged battery cells.
- Measures stack current (via a current shunt) and stack voltage.
- Includes coil drivers for up to four contactors.
 Provides 24 VDC power for energizing contactor coils. Can include an optional external coil power input to provide voltage flexibility.



Cell Interface

The Cell Interface module can be used in both low- and high-voltage battery stacks. It connects directly to battery cells to measure voltage and temperature, and to provide cell balancing. In a high-voltage battery stack, multiple Cell Interface modules manage series-connected cells to reach voltages of up to 1250 VDC.

- 12- and 16-channel models available. Also available
 4-channel model designed specifically for 12 V monobloc cells (usually lead-acid batteries).
- Includes up to eight temperature sensor inputs.
- Provides passive balancing up to 300 mA (12- and 16-channel models only).
- Stackable architecture enables multiple Cell Interface modules to be used in each battery stack to connect hundreds of cells in series.
- Galvanically isolated serial communications between Cell Interface modules and the Stack Controller. This protects the system from electromagnetic interference, enables floating battery architectures and highly accurate voltage readings.
- Each Cell Interface can manage up to 80 VDC.
- Daisy chain architecture; no addressing switches to set.



Used in hundreds of energy storage systems worldwide



Wastewater Treatment Plant, Santa Rosa, California

Nuvation Energy designed and built this custom 2 MW / 588 KWh energy storage system for a microgrid located at the City of Santa Rosa Municipal Wastewater Treatment Plant.



T&D Upgrade Deferral, Norway

Nuvation Energy designed this 1MW / 700 kWh energy storage system used for utility grid transmission and distribution upgrade deferral at a substation in Norway.



Island Microgrid, Lifuka, Kingdom of Tonga

Nuvation Energy provided battery management system modules and on-site system integration support for this microgrid that utilizes solar panels, 480 kW / 495 kWh of batteries, and diesel generator backup systems.



Via Verde Residential Microgrid, **New York City**

After Hurricane Sandy, New York City launched a program to help residential buildings become more resilient to extended power outages. Nuvation Energy's low-voltage battery management system was selected for the energy storage system of a solar microgrid connected to this residential building.



Nuvation Energy battery management systems are used by Spiers New Technologies for their second life energy storage solutions. These 57 kWh systems utilize used Nissan Leaf cells for demand charge management at EV charging

stations across the United States.



Islas Secas Microgrid, near Panama

Civic Solar chose Nuvation Energy to provide battery management solutions for Islas Secas, a 100% solar-powered island resort off the coast of Panama. Nuvation's nController EMS provides unified control of 27 battery banks and two diesel gensets. We also provided a battery management system to augment the battery storage by an additional 432 kWh.

Your Energy Storage Advantage

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Nuvation Energy provides battery and energy management solutions to energy storage system integrators and battery manufacturers. We enable the proliferation of energy storage by providing engineering services and configurable off the shelf products that resolve the technical challenges typically associated with developing new energy storage solutions.

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Nuvation Energy is part of Nuvation Research Corporation, which was founded in 1997 to advance the state of the art in complex technologies. We are headquartered in Silicon Valley, California, USA, with an Energy Storage Design Center in Waterloo, Ontario, Canada. Nuvation has completed over 1000 engineering design projects for high-reliability systems including energy storage, electric vehicles, industrial controls, defense and aerospace platforms, and much more.

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