ECO Smart Battery Management System (BMS)

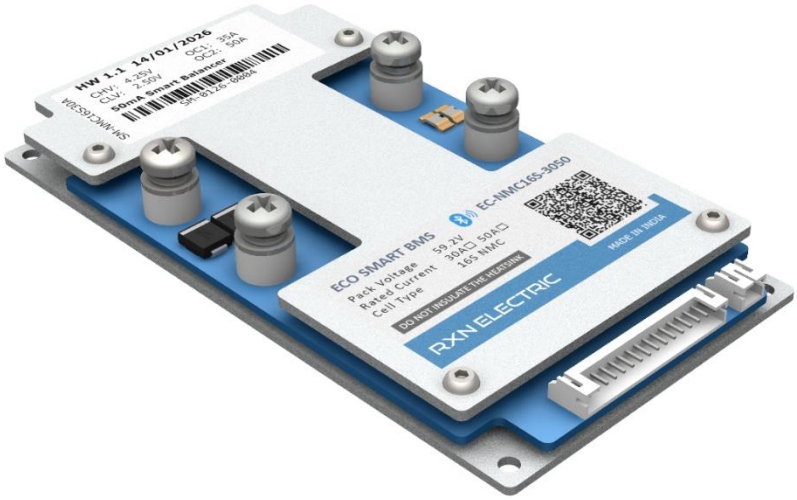
1. Features

1. **Available in three variants**.
   - STD Version – UART Port
   - BLE Version – UART + Bluetooth
   - ULC Version – Ultra Low Current
2. **Industry-leading low operating current**
   - 3mA for BLE version
   - 1.4mA for STD version
   - 290µA for ULC version
3. **Smart cell balancing up to 50mA**
4. **±5 mV cell voltage accuracy**
5. **Pre-charge support**
   Controlled pre-charge for safe connection of high-capacitance loads and inrush current limiting
6. **High-side MOSFET architecture**
7. **Configurable BMS parameters**
8. **Comprehensive protection features**
   - Over-voltage
   - Under-voltage
   - Over-current
   - Short-circuit
   - Over-temperature

2. Description

The **ECO Smart BMS series** is designed for reliable protection, long storage life, and accurate cell monitoring in lithium battery packs. Built around a precision AFE architecture, it delivers consistent performance across a wide range of operating conditions while maintaining extremely low standby power consumption.

The series is available in multiple variants to suit different application needs —
STD – Standard version with UART communication. Data monitoring and parameter configuration is supported via UART communication port.
BLE – Bluetooth version with UART port and in-built Bluetooth Low Energy. Data monitoring and configuration is supported via UART and BLE
ULC – Ultra low current version is designed for extremely low operating current, suitable for small battery packs as well as larger packs requiring extended shelf life and minimal standby consumption. Data monitoring and configuration are supported via RXN's ECO-ULC Interface Module. UART and BLE communication are not supported in the ECO-ULC variant.



3. Electrical Specification

PARAMETER	VALUE				UNIT
Series	3-16 (Non-configurable)				-
Rated Current	30, 50, 60				A
Cell Voltage Specifications	**LFP**		**NMC**		
High Voltage Cutoff	3650		4200		mV
High Voltage Cutoff Recovery	3550		4100		mV
Low Voltage Cutoff	2500		2500		mV
Low Voltage Cutoff Recovery	2600		2600		mV
Shutdown Voltage	2000		2000		mV
High Voltage Cutoff Delay	0.25				s
Low Voltage Cutoff Delay	1				s
Current Specifications	**30A**	**50A**	**60A**	**80A**	
Discharge Current Cutoff 1	35	55	65	85	A
Discharge Current Cutoff 2	50	80	90	120	A
Discharge Current Cutoff 3	90	150	180	240	A
Charge Current Cutoff	30	50	60	80	A
Short-circuit Current Cutoff	300	500	600	600	A
Discharge Current Cutoff 1 Delay	30 (current < 150% of rated current)				s
Discharge Current Cutoff 2 Delay	0.4 (current < 300% of rated current)				s
Discharge Current Cutoff 3 Delay	0.1 (current > 300% of rated current)				s
Charge Current Cutoff Delay	0.1				s
Short-circuit Current Reaction Time	15				µs
Overcurrent Recovery Time	10				s
Short-circuit Recovery Time	10				s
Balancing Specifications	**LFP**		**NMC**		
Balancing Start Threshold	3200		3400		mV
Balancing Start Voltage Difference	40				mV
Balancing Stop Voltage Difference	20				mV
Max Balancing Current	*50*				*mA*
Temperature Specifications	**Cutoff**		**Recovery**		
Battery High Temperature	65		60		°C
BMS High Temperature	110		90		°C
Battery Low Temperature	-20		-15		°C
BMS Low Temperature	-20		-15		°C
Temperature Cutoff Delay	2				s
General Specifications					
Cell Voltage Accuracy	5				mV
Current Accuracy	±10				%
No of NTC	1				-
Pre-charge Resistor	100				Ω
Working Current	STD – 1.4mA, BLE – 3.0mA, ULC – 280uA				
Sleep/Idle Current	70				µA
Shutdown Current	1				µA
Switching Terminal	Battery Positive				-
Dimensions	130 x 70 x 10 (L x W x H)				mm
Country of Manufacture	India				-

4. Connection Diagram

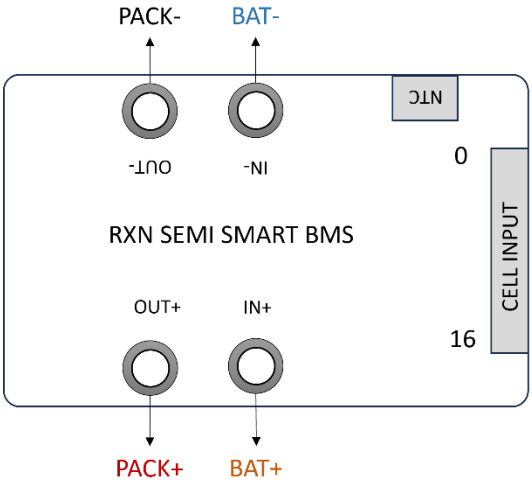


Figure 1: Connection ports

1. Firmly attach the cell input wires to the cells. The wire marked 0 goes to the negative of cell 1, wire 1 to positive of cell 1, wire 2 to positive of cell 2, and so on till the last cell, N, depending on the series configuration of the BMS. For e.g., if series configuration is 8, then N=8, for 16 series, N=16, etc.
2. Attach the NTC to the battery to measure its temperature. Do not attach it to the BMS heatsink (aluminum plate).
3. Insert the Cell Input connector to the BMS. While connecting, it is advisable to keep the connector slightly tilted and start inserting from the end marked 0. This ensures that the GND of the battery makes contact first.
4. Connect **IN-** to the battery negative with a power cable.
5. Connect **IN+** to the battery positive with a power cable.
6. Load or charger can be connected to the **OUT+** and **OUT-** output, where OUT+ is the positive terminal and OUT- is the negative terminal coming out from the BMS.
7. Do not remove any power connector while connected to load or charger. This may damage the BMS