X1 Series Battery Management System

ERX1-NMC14S30A, ERX1-NMC14S50A, ERX1-NMC14S70A, ERX1-NMC14S100A

1 Features

- Industrial grade BMS for 51.8V NMC battery
- AIS-156-A3 compliant
- Ultra-fast current response time: $8\mu S$
- High tolerance to transient voltages
- Typical cell voltage accuracy of $4mV$
- Supports 4 battery temperature sensors
- Onboard flash memory for up to 3 months of battery data storage
- Integrated audio alarm for fault indication
- CAN and RS-485 communication
- Dedicated peripheral attachment port with support for Display, GPRS, GPS and Bluetooth
- Parameter configuration through PC and mobile application

2 Applications

- Energy storage battery for inverters, UPS
- Low speed two-wheeler and three-wheeler electric vehicle
- Solar grade batteries up to 10kWhrz

3 Description

X1 series battery management system (BMS) is a robust and reliable industrial grade smart BMS with the right balance between accuracy, performance and price. The BMS has an outstanding ability to handle surge currents and transient voltages associated with inductive loads.

X1 BMS is AIS156-A3 complaint and IP-51 rated. It is supplied with $250°C$ PTFE wiring harness as standard with all models. Wired communication options include RS-485, UART and CAN that can work simultaneously. Along with the standard communication port, the BMS features a peripheral port that can connect to Bluetooth and IoT devices.

The BMS is compatible with RXN's computer and mobile software that facilitates seamless real time data monitoring, logging and crucial BMS parameter adjustment.

ERX1-NMC14S	
Cell Chemistry	$LiNiMnCoO_2$
Nominal Cell Voltage	3.7V
Series Cells	14
Nominal battery voltage	51.8V

4.1 General Specification

SN	PARAMETER	VALUE	UNIT	REMARKS	
1	Nominal battery voltage	51.8	V	14S cell configuration	
2	Operating current – active	8	mA	Battery voltage 51.8V	
3	Operating current – Sleep	500	µA	Battery voltage 51.8V	
4	Power MOSFET configuration	SPST	–	Negative terminal, Low side	
5	Internal resistance (Terminal to terminal)	5.0 3.0 1.5 1.1	mΩ	ERX1-NMC14S30A ERX1-NMC14S50A ERX1-NMC14S70A ERX1-NMC14S100A	Max resistance $T_{BMS} = 50°C$
6	Battery temperature sensors	4	–		
7	Onboard data logging period	90	Days		
8	Communication			CAN, RS-485	
9	Communication isolation	NO	–	Non isolated channels	

4.2 Absolute Maximum Rating

SN	PARAMETER	MIN	MAX	UNIT
1	Battery voltage	-1	75	V
2	Cell voltage $V_N - V_{N-1}$	-0.2	5	V
3	Operating ambient temperature	-20	70	°C
4	Maximum load inductance[#1]		100	µH

Operation beyond the absolute maximum rating may cause immediate damage to the device.

4.3 Measurement Accuracy

SN	PARAMETER	TYP	MAX	TEST CONDITION
1	Cell voltage accuracy	4mV	10mV	$-10°C$ to $60°C$, 0V to 4.5V
2	Battery voltage accuracy	0.2%	0.35%	$-10°C$ to $60°C$, 10V to 30V
3	Current accuracy (0A – 120%)	2% ± 0.1A	4% ± 0.2A	$25°C$ ambient, $T_{BMS} < 60°C$
4	Current accuracy (> 120%)	3%	5%	$25°C$ ambient, $T_{BMS} < 60°C$
5	Current thermal drift	–	0.03%/°C	T_{BMS} $25°C$ to $90°C$
6	Temperature accuracy	1°C	3°C	$-10°C$ to $60°C$
7	Measurement bandwidth[#2]	5Hz		
8	Data readout frequency	1Hz		

#1 Maximum load inductance is limited by the ability of the BMS to successfully interrupt currents as high as the short circuit limit without failure. If the nature of load is highly inductive, external TVS must be installed across the load. The clamping voltage of the TVS must not exceed the absolute maximum rated voltage of the BMS

#2 Measurement bandwidth refers to the bandwidth of current and voltage signal provided by the BMS to the external host after internal digital filtering. The actual acquisition and measurement bandwidth of the BMS is much higher. High bandwidth data is used only for internal functioning of the BMS.

4.4 Electrical Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
	PACK VOLTAGE SPECIFICATION			
1	Over-charge entry threshold	59.3	V	Equivalent to 4.23V/Cell
2	Over-charge exit threshold	56.0	V	Equivalent to 4.0V/Cell
3	Over-discharge entry threshold	39.2	V	Equivalent to 2.80V/Cell
4	Over-discharge exit threshold	42.0	V	Equivalent to 3.00V/Cell
5	Sleep mode entry threshold	36.4	V	Equivalent to 2.60V/Cell
6	Sleep mode exit threshold	38.5	V	Equivalent to 2.75V/Cell
	CELL VOLTAGE SPECIFICATION			
7	High voltage entry threshold	4.25	V	
8	High voltage exit threshold	4.10	V	
9	Low voltage entry threshold	2.75	V	
10	Low voltage exit threshold	2.90	V	
	CURRENT SPECIFICATION			
11	Continuous current rating Discharge | Charge	30 | 15 50 | 25 70 | 35 100 | 50	A	ERX1-NMC14S30A ERX1-NMC14S50A ERX1-NMC14S70A ERX1-NMC14S100A
12	Over current capacity	120 150 300	%	Overload duration: 60s Overload duration: 20s Overload duration: 1s
13	Short circuit current threshold	550	%	% of continuous rating
14	Short circuit reaction time	8	µs	
15	Short circuit auto-restart time	3	s	Auto restart after short removal
16	Over load auto-restart time	10	s	
17	Max output load for successful hot—start after a fault trip	70	%	% of rated load current
	PRECHARGE SPECIFICATION			
18	Precharge resistance	54	Ω	
19	Maximum precharge duration	2	s	
20	Precharge repeat time	5	s	
	Maximum load capacitance for successful one shot precharge	4,500	µF	
	BALANCER SPECIFICATION			
21	Balancer type	Passive		
22	Typical balancing current	30	mA	When balancing non adjacent cells
23	Balancer ON ΔV_{Cell} threshold	40 20	mV	Corse balancing Fine balancing
24	Balancer OFF ΔV_{Cell} threshold	10	mV	
25	Low V_Cell stop threshold	3.30	V	Balancing stops below this voltage
26	High V_Cell discharge threshold	3.65	V	Forced discharge is initiated on cells above this voltage regardless of cell voltage differential

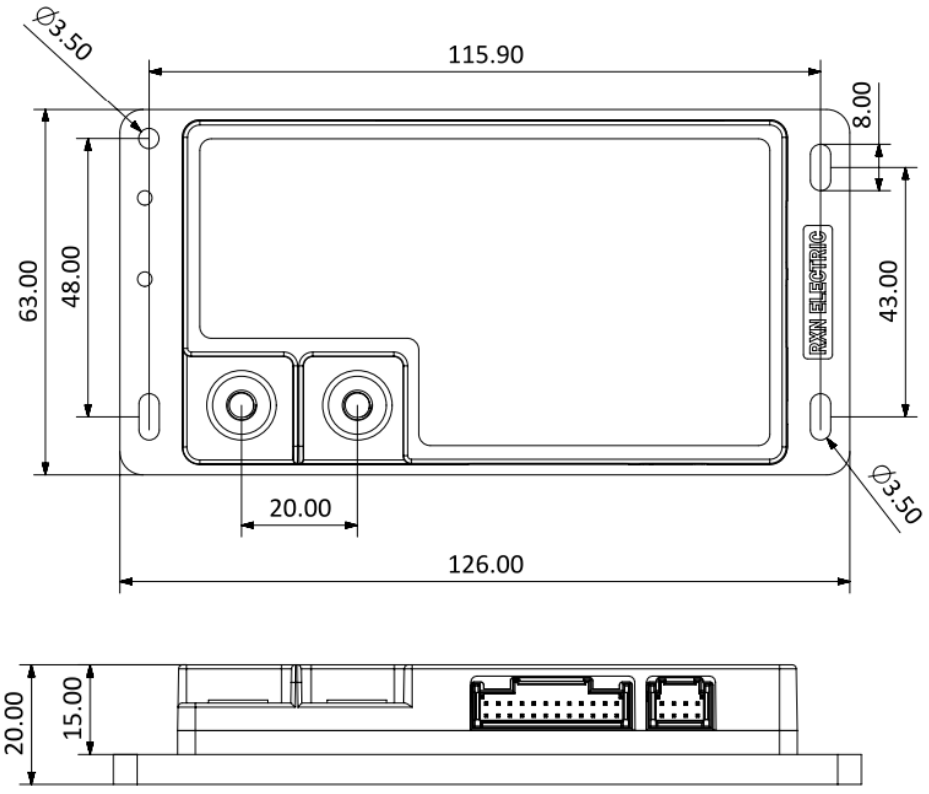
4.5 Thermal Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
1	Maximum heat dissipation at rated current	5 8	W	ERX1-NMC14S30A ERX1-NMC14S50A 70A,100A BMS to be updated
2	Thermal resistance $R\theta_{CA}$ Case to ambient (vertical mounting)	5.0 3.0	°C/W	ERX1-NMC14S30A ERX1-NMC14S50A 70A,100A BMS to be updated
3	ΔT max at rated current	< 30	°C	
4	Working temperature range (ambient temperature)	-20 to 60	°C	Derate maximum permissible current above 50°C

4.6 Mechanical Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
1	Dimensions	126x63x20 126x63x32.5	mm	ERX1-NMC14S30A ERX1-NMC14S50A 70A and 100A version to be updated
2	Weight	160 260	g	ERX1-NMC14S30A ERX1-NMC14S50A 70A and 100A version to be updated
3	Waterproofing	IP51		Protected from limited dust and water droplets

X1-Series 30A BMS Mechanical Drawing



X1-Series 50A BMS Mechanical Drawing