AYAA TECHNOLOGY CO., LTD

Datasheet

EF-004 Inspection Drone BMS

SHENZHEN AYAA TECHNOLOGY CO., LTD.

12~18S 250A Smart BMS

Battery Management System

Product Specification

Product Model	12~18S 250A Smart BMS
Battery Configuration	12~18 Series (12S~18S)
Continuous Discharge Current	250A
Communication Interface	RS485 / CAN 2.0B
Document Revision	REV 1.0

1. Product Overview

The 12~18S 250A Smart BMS is a high-performance Battery Management System designed for UAV and industrial lithium battery applications. Supporting 12 to 18 series lithium battery configurations with a continuous discharge current of up to 250A, this BMS features configurable protection parameters, RS485 and CAN 2.0B communication interfaces, comprehensive cell monitoring, and advanced SOC estimation capabilities.

2. Functional Features

No.	Item	Specification	No.	Item	Specification
1	Supported Series	12~18S	10	Temp Detection Accuracy	±2°C
2	Cell Voltage Range	0-5V	11	Temp Sensor Type	NTC
3	Cell Voltage Accuracy	±5mV	12	SOC Estimation Accuracy	<3%
4	Total Voltage Range	30-80V	13	Operating Temperature	-40°C ~ +65°C
5	Total Voltage Accuracy	≤±1%	14	Operating Humidity	5%~90% RH
6	Current Accuracy	≤±60mA (<3A) ≤±3% (≤200A)	15	BMS Dimensions	180×90×15 mm
7	Weight	210g	16	LED Board Dimensions	15.3×18.8×4.5 mm
8	Temp Sensor Count	3	17		
9	Temp Detection Range	-40°C ~ +105°C	18		

2.1 Key Features

- Individual cell voltage and total pack voltage detection with over-charge / over-discharge alarm and protection. Static voltage sampling accuracy ≤10mV at room temperature.
- Charge and discharge current detection with over-current alarm and protection. Positive reading indicates charging; negative indicates discharging. Current sampling accuracy ≤2% at room temperature.
- Cell, environment, and MOSFET temperature monitoring with high/low temperature alarms and protection. Temperature sampling accuracy ≤3°C at room temperature.
- Passive charge balancing function with 50mA balancing current.
- Cell capacity estimation: full charge capacity, current capacity, and design capacity configurable via host PC software. Automatic capacity update after complete charge/discharge cycles.
- SOC static calibration: reduces SOC calculation error by comparing static cell voltage.
- State-of-charge estimation through static calibration combined with coulomb counting, with dynamic end-of-discharge compensation.
- Host PC software for configuring all protection parameters (over-charge, over-discharge, over-current, over-temperature, under-temperature), capacity settings, and firmware updates.
- RS485 communication for host PC monitoring, parameter configuration, and firmware upgrade.
- CAN interface compatible with mainstream flight controller protocols (e.g., DroneCAN).

3. Electrical Characteristics

3.1 Protection Parameter Settings

Note: Unless otherwise specified, all parameters are tested at 25°C ambient temperature.

No.	Protection Item		Default Parameter	Configurable	Remarks
1	Cell Over-Charge Protection	-Warning Voltage	—	—	Over-voltage disables charge MOSFET only.
		-Protection voltage	4450mV	Yes	
		-Protection Delay	1.0s	Yes	
	Cell Over-voltage protection release	-Protection release voltage	4200mV	Yes	
		- Recovery Voltage	Discharge current >0.3A or voltage drops below threshold.		
2	Cell Over-Discharge Protection	-Warning voltage	—	—	Disables discharge MOSFET; ineffective
		-Protection Voltage	3000mV	Yes	
		-Protection delay	2.0s	Yes	

	Cell Over-discharge protection release	-Protection release voltage	3200mV	Yes	during flight.
		- Release upon charging	Enter charge state (current >0.3A) or voltage above threshold.		
3	Pack Over-Charge Protection	-Warning Voltage	—	—	Pack over-voltage disables charge MOSFET.
		-Protection Voltage	X × series count	Yes	
		- Protection Delay	1.0s	Yes	
	Pack Over-Charge Protection release	Protection release voltage	X × series count	Yes	
		- Protection Delay	3.0s	Yes	
		- Release upon discharging	Discharge current >0.6A or voltage drops below threshold.		
4	Pack Over-Discharge Protection	- Warning Voltage	—	—	Does not disable discharge MOSFET (sets SOC to 0 only).
		- Protection Voltage	X × series count	Yes	
		- Protection Delay	2.0s	Yes	
		- Recovery Voltage	X × series count	Yes	

		- Release upon charging	Enter charge state (current >0.3A) or voltage above threshold.		
5	Charge Over-Current Protection	- Rated Current	≤250A	—	Disables charge MOSFET.
		- Protection Current	200A	Yes	
		- Protection Delay	1.0s	Yes	
		Auto release	Auto after 10s	—	
		- Recovery	Recovery: discharge current >0.3A.		
6	Discharge Over-Current Level 1	- Rated Current	≤250A	—	Disables discharge MOSFET; ineffective during flight.
		- Protection Current	300A	Yes	
		- Protection Delay	10.0s	Yes	
	Discharge Over-Current Level 1 release	Auto release	Auto release after 10s	—	
		- Release upon charging	Recovery: charge current >0.3A.		
7	Discharge Over-Current Level 2	- Protection Current	500A	—	
		- Protection Delay	1000ms	Yes	
	Discharge Over-Current	Auto release	Auto release after 10s	—	

	Level 2 release	- Release upon charging	Charge current >0.3A.		
8	Short Circuit Protection	- Protection Current	1000A	— — —	Effective in both ground and flight modes. Disables discharge MOSFET.
		- Protection Delay	200μs		
		- Recovery	Auto after 10s		
			Recovery: charge current >0.3A.		
9	MOSFET Temperature	Over-Temperature - Protection	100°C	Yes	Disables charge MOSFET.
		- Recovery Temperature	70°C	Yes	
10	Cell Temperature	- Charge Low-Temp Protection	0°C	Yes	Charge high/low temp disables charge MOSFET. Charge high-temp detection only during charging; low-temp in any state.
		- Charge Low-Temp Recovery	5°C	Yes	
		- Charge High-Temp Protection	45°C	Yes	
		- Charge High-Temp Recovery	43°C	Yes	
		- Discharge Low-Temp Warning	-20°C	Yes	

	Protection	- Discharge Low-Temp Recovery	-15°C	Yes	Discharge high/low temp: warning only, does not disable discharge MOSFET.
		- Discharge High-Temp Warning	55°C	Yes	
		- Discharge High-Temp Recovery	50°C	Yes	
		- Protection Delay	5.0s	—	
11	SOC Accuracy	SOC Accuracy	1%~3%	Requires one complete charge/discharge cycle after initial power-on.	
12	Quiescent Current	- Operating	≤12mA	—	
		- Low-Power Mode	≤150μA	—	
13	Battery Capacity	Battery Design Capacity	8500mAh	Yes	
14	Balancing Function	- Balancing On Voltage	4000mV	—	
		- Voltage Difference Threshold	50mV	—	
		- Balancing Current	50mA	—	

3.2 Electrical Performance

Note: Unless otherwise specified, all parameters are tested at 25°C ambient temperature.

Item	Description	Min	Typ	Max	Unit	Notes
1	Operating Voltage	20	48	90	V	
2	Operating Current	—	10	12	mA	
3	Deep Sleep Current	—	100	150	μA	
4	Charge MOSFET Voltage Rating	—	100–120	—	V	
5	Discharge MOSFET Voltage Rating	100	120	—	V	
6	LED Drive Current	—	5	—	mA	
7	Peak Discharge Current	—	—	400	A	
8	Rated Temperature Rise	—	—	40	°C	250A continuous for 1h
9	Balancing / Self-Discharge Time	—	0.5	—	s	Per-second balancing duration

3.3 LED Indicator Description

(1) The PCB board is equipped with one LED indicator. Under normal operation, the LED flashes slowly; when the BMS detects an abnormal condition, the LED flashes rapidly.

(2) The LED indicator board is equipped with four LEDs. Under normal operation, the LEDs remain off. A short press of the button displays the battery level, which automatically turns off after 5 seconds. During charging, the battery level is displayed continuously.

3.4 Operating Modes

Idle Mode: Charge/discharge current < 0.15A. The BMS operates normally with full protection and communication functions.

Charging Mode: Charging current > 0.3A. Exits charging mode when current drops below 0.15A.

Discharging Mode: Discharge current > 0.3A. Exits discharge mode when current drops below 0.15A.

Sleep Mode: Low-power mode. Can be restored to idle mode via external wake-up.

3.5 Signal Description

(1) Power button: A short press displays the battery level. A short press followed by a long press performs power on/off operation.

3.6 Sleep and Wake-up

3.6.1 Sleep Conditions

The BMS enters sleep mode when any of the following conditions is met:

- Cell over-discharge occurs, and recovery is not achieved within 1 minute, with no charging, no communication, and no charger connected.
- The battery remains in idle mode with no communication, no self-discharge condition, no external signal, no button operation, no load, and no charger connected for 1 continuous hour.

In sleep mode, the MCU stops operating. Neither charging nor discharging is possible; the BMS can only be restored via external wake-up conditions.

3.6.2 Wake-up Conditions

The BMS wakes up and enters operating mode when any of the following conditions is met:

- Short press the power button.
- Communication signal received.
- A DC voltage higher than the battery voltage + 0.3V is detected at the output terminal.

3.7 Self-Discharge Function

3.7.1 Self-Discharge Activation

When the BMS is in idle mode with SOC > 50% and the lowest cell voltage > 3.85V, self-discharge activates after 7 consecutive days. Self-discharge is implemented through per-cell balancing at 50mA, cycling through odd and even cells: discharge for 0.5s every 1s, until the self-discharge deactivation condition is met.

3.7.2 Self-Discharge Deactivation

Self-discharge stops when any of the following conditions is met:

- The BMS enters charging or discharging mode.
- The power button is briefly pressed.
- The lowest cell voltage drops below 3.85V.
- Battery temperature exceeds the discharge high-temperature warning threshold.
- SOC drops to or below 50%.

3.8 Balancing Function

The BMS features built-in passive balancing with approximately 50mA balancing current. Both charge balancing and idle balancing are supported. When activated, the highest-voltage cell is balanced for 0.5s per cycle, with one cycle per second.

3.8.1 Balancing Activation

Balancing activates when any of the following conditions is met:

- During charging: voltage difference > 11mV and the highest cell voltage < 4.4V, then the highest-voltage cell is balanced.
- During idle mode: the highest cell voltage > 3.85V and SOC > 50%.

3.8.2 Balancing Deactivation

Balancing stops when any of the following conditions is met:

- Discharging mode is active.
- During charging: the highest cell voltage exceeds 4.4V.
- During idle mode: SOC drops to or below 50%.
- In any mode: the voltage difference drops to ≤11mV.
- During idle mode: the highest cell voltage drops below 3.85V.

4. Mechanical Dimensions

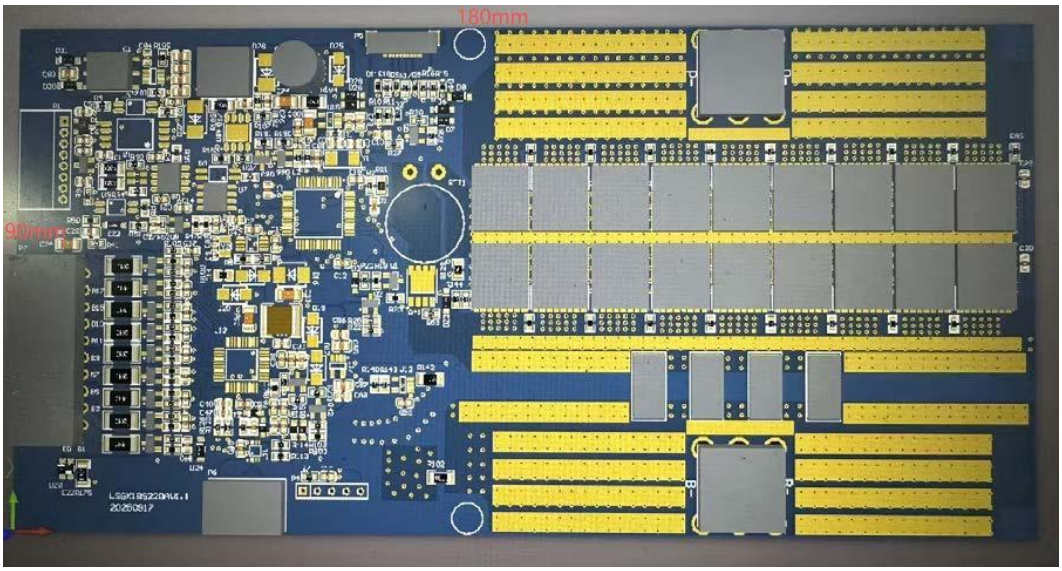

Figure 4-1: BMS Board Mechanical Dimensions

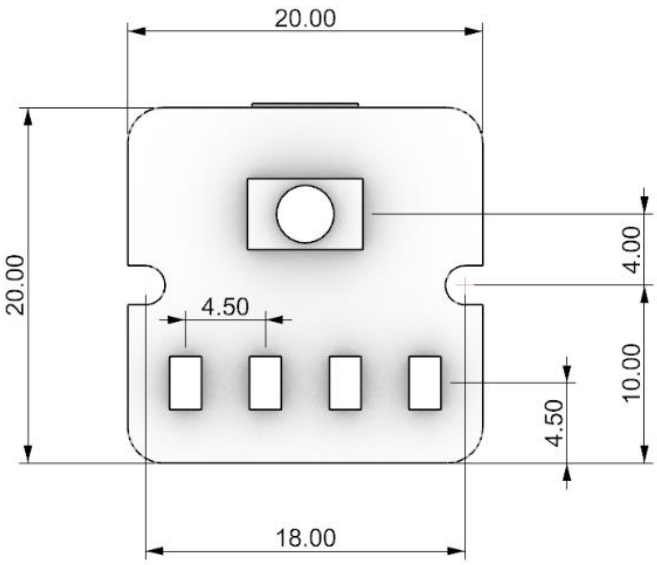

Figure 4-2: LED Board Mechanical Dimensions

Figure 4-3: Finished Product Photo

5. External Interfaces

5.1 External Interface Diagram

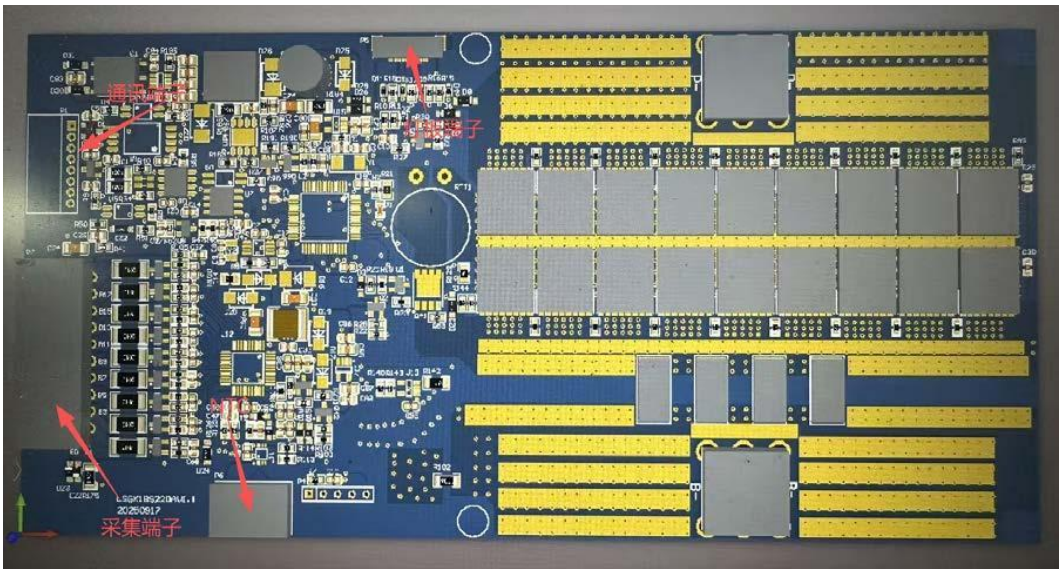

Figure 5-1: External Interface Diagram

5.2 Sampling Terminal

The sampling terminal adopts MX3.0-P connectors. The number of connectors can be adjusted

according to the actual series configuration.

5.3 Communication Terminal

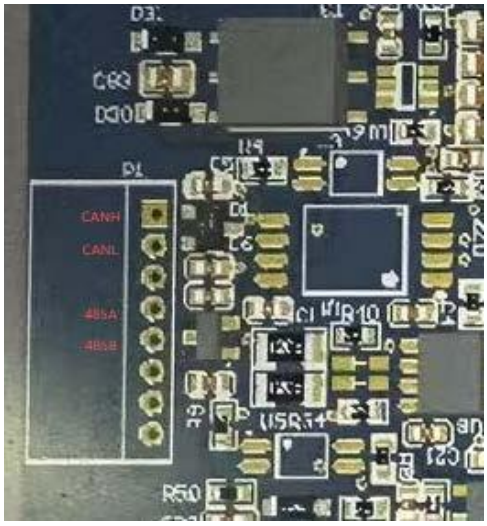

Figure 5-2: Communication Terminal

Note: The positions marked on the BMS diagram are for reference only. Actual positions are subject to the physical product.

Note: When the actual number of connected cells is fewer than 18, the product will be shipped with factory-configured jumper connections. Users only need to connect according to the wire sequence. The B- and C- terminals are configured with multiple power cables. All cables must be connected during installation to ensure proper current sampling accuracy and normal BMS operation.

6. Usage Precautions

- When soldering battery leads, ensure there is no incorrect or reversed connections. If misconnection has occurred, the circuit board may be damaged and must be re-tested before use.
- During assembly, do not allow the BMS to directly contact the cell surface to prevent cell damage. Assembly must be secure and reliable.
- During use, keep soldering iron tips, solder, and wire ends away from the circuit board components to prevent damage.
- Observe anti-static, moisture-proof, and water-proof precautions during operation.
- Follow all design parameters and usage conditions specified in this document. Do not exceed the rated values, as this may damage the BMS.
- After assembling the battery pack with the BMS, if no voltage output or charging is not possible on initial power-up, please verify that all wiring connections are correct.