

Specification

Customer name

Product Name: Full-Function BMS

Base Plate Model: FJB25-DVC24120-007-A01.1

Product Specifications: 24S120A – Lithium Iron Phosphate Series

Finished product code:

Communication method: Isolated RS485 + Isolated CAN + UART

Sample Submission Date:

Software Version: V10

Hardware Version: A01

Customer Confirmation (Seal)

Check :

Examine and
verify :

Ratify :

Qualified: ☐

Unqualified: ☐

Manufacturer

Check :

Examine and
verify :

Examine and
verify :

Ratify :

Version Revision List

Order number	Version number	Revision Date	Revision content	Person liable
1	A01	2025-08-30	Editio princeps	Blake
2	A01.1	2025-09-30	Circuit Optimization	Blake

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1、Product Overview

This product is a battery management system (BMS) specifically designed for two-and three-wheeled vehicles, featuring current, voltage, and temperature acquisition and monitoring capabilities, as well as protection functions against overcurrent, undervoltage, overvoltage, short circuit, high temperature, and low temperature. It adopts an integrated design that combines data acquisition, management, and communication functions into a single unit.

2、Product Function

2.1 Basic Function Configuration

Function	Configure	Function	Configure
Support Series Number	(8~24S)	UART Communication (GPS Interface)	Support
Dynamic current	(60-120A)	Isolation 485 Communication	Support
Temperature monitoring	2 Built-in: 4 channels; External: 4 channels	Isolate CAN Communication	Support
Equilibrium Function	Passive equilibrium	Non-isolated CAN Communication	Support
Pre-discharge function	Support	Heating Film Interface	Optional
Historical data	Support	Light Panel Interface	Support
Capacity Calculation	Support	Buzzer	Optional
Charging Handshake	Support	Electric door lock	Optional
Discharge Handshake	Support		
Low-voltage switch	Optional		

2.2 Basic Function Introduction

2.2.1 Voltage Acquisition and Protection Functions

1、Monomer Voltage Overcharge Protection and Recovery

When the voltage of any cell exceeds the set overcharge threshold for that cell and remains above it for the specified duration, the system enters an overcharge protection mode, turns off the charging MOS transistor, and prevents battery charging.

After enabling overcharge protection for individual cells, the protection is lifted when the voltage of all cells drops below the preset recovery threshold. It can also be disabled during discharge.

2、Overall Voltage Overcharge Protection and Recovery Mechanism

When the overall voltage exceeds the preset overvoltage threshold and remains elevated for the specified overcharge delay period, the system enters an overcharge protection state, turning off the charging MOS transistor and preventing battery charging.

When the total voltage falls below the overvoltage protection recovery threshold, the overcharge protection is lifted; it can also be released through discharge.

3、Monomer Voltage Over-Discharge Protection and Recovery

When the minimum cell voltage falls below the set over-discharge threshold and remains below it for the specified duration, the system enters an over-discharge protection mode, turning off the discharge MOS transistor and preventing battery discharge.

After applying over-discharge protection to all monomers, the protection is lifted once their voltages rise above the designated recovery threshold.

4、Overall Voltage Over-Discharge Protection and Recovery Mechanism

When the overall voltage falls below the preset over-discharge threshold and remains below it for the specified duration, the system enters an over-discharge protection state, turning off the discharge MOS transistor and preventing battery discharge.

After the overall over-discharge protection is activated, charging the battery pack will activate it again.

2.2.2 Current Acquisition and Protection Functions

1、 Overcurrent Protection and Recovery

When the charging current exceeds the overcurrent protection threshold and remains elevated for the duration of the overcurrent detection delay, the system enters overcurrent protection mode and turns off the charging MOS.

The overcurrent protection will automatically resume after a 1-minute delay, or the overcurrent state can be cleared during discharge.

2、 Discharge Overcurrent Protection and Recovery

When the discharge current exceeds the overcurrent protection threshold and remains elevated for the duration of the overcurrent detection delay, the system enters overcurrent protection mode and turns off the discharge MOS.

The discharge overcurrent protection will be restored after removing the load for 3 seconds, or the discharge overcurrent state can also be cleared during charging.

2.2.3 Temperature Collection and Protection Function

1、 Cell Temperature Monitoring and Protection Mechanisms for High/low Temperatures

a、 During charging or discharging, when the NTC sensor detects that the cell surface temperature exceeds the preset high-temperature protection threshold, the management system activates.

During high-temperature protection of the cell, turn off the charging MOS or discharging MOS.

When the surface temperature of the battery cell drops to the preset high-temperature recovery threshold, the high-temperature protection state is lifted, allowing the charging or discharging MOS to be activated.

B、 During charging or discharging, if the temperature detected by the NTC sensor on the cell surface falls below the preset low-temperature protection threshold, the management system activates low-temperature protection and shuts down either the charging MOS or the discharging MOS.

When the surface temperature of the cell rises to the low-temperature recovery threshold, the low-temperature protection state is lifted and charging or discharging MOS devices may be activated.

2、 MOS Temperature Monitoring and High-Temperature Protection Function

During charging or discharging, when the MOS-NTC sensor detects that the surface temperature of the MOS exceeds the preset high-temperature protection threshold, the management system activates high-temperature protection mode and simultaneously shuts down both the charging and discharging MOS devices.

When the temperature on the MOS surface drops to the high-temperature recovery threshold, the high-temperature protection state is lifted, allowing charging and discharging of the MOS to proceed.

3、 Environmental Temperature Acquisition and Protection Functions for Both High and Low Temperatures.

a、 During charging or discharging, if the environmental NTC sensor detects that the internal temperature of the battery pack exceeds the preset high-temperature protection threshold, the management system

The system enters a high-temperature protection mode, simultaneously shutting down both the charging MOS and discharge MOS.

When the ambient temperature drops to the preset high-temperature recovery value, the high-temperature protection state is lifted, allowing the charging and discharging MOS devices to operate.

B、 During charging or discharging, when the ambient temperature detected by the NTC sensor falls below the preset low-temperature protection threshold, the management system activates low-temperature protection mode and simultaneously shuts down both the charging MOS and discharge MOS.

When the ambient temperature rises to the low-temperature recovery set value, the low-temperature protection state is lifted, allowing charging and discharging MOS devices to operate.

2.2.4 Equilibrium Function

The management system employs a resistor bypass method to balance the battery cells.

The balancing function activates when, during charging or standby, the highest voltage of any individual cell in the battery pack reaches the preset equalization start voltage value, and the voltage difference between the lowest and highest cell voltages exceeds the specified threshold.

Equilibration stops when the cell voltage difference falls below the set value or when all individual cell voltages are below the equilibrium activation voltage.

2.2.5 Capacity Calculation

The State of Charge (SOC) of the battery pack can be accurately calculated by integrating current and time values. The full capacity and cycle capacity of the battery pack can be configured via a host computer, with capacities automatically updated after completing a full charge-discharge cycle. The system includes a cycle count function: when the cumulative discharge capacity reaches the preset cycle threshold, the cycle count increments by one.

Note: For newly installed batteries, set the nominal design capacity and full cycle capacity according to the battery capacity, and perform one capacity learning cycle; otherwise, inaccurate capacity readings may occur. Capacity learning procedure: First discharge to under-voltage protection, then charge to over-voltage protection, and finally discharge again.

3、Technical Specifications

3.1 Parameter Setting

Order number	Key Indicators		Default factory parameters	Tolerance Value	Remarks
1	Monomer Overcharge Protection	Monomer Overcharge Alarm Voltage	/	±25mV	
		Monomer Overcharge Protection Voltage	3650mV	±25mV	
		Monomer overcharge protection delay	1.0S	±0.5S	
	Monomer overvoltage protection has been lifted	Voltage at which protection against overcharging of the monomer is lifted	3400mV	±25mV	
		Delay period for解除 of monomer overcharge protection	1.0S	±0.5S	
2	Monomer Overcharge Protection	Monomer Overcharge Alarm Voltage	2800mV	±25mV	
		Monomer Overcharge Protection Voltage	2500mV	±25mV	
		Monomer over-discharge protection delay	1.0S	±0.5S	
	Relief of protection against excessive discharge of the monomer	Monomer over-discharge protection release voltage	3000mV	±25mV	
		Delay period for解除 protection after excessive discharge of a single unit	1.0S	±0.5S	
3	Overall Overcharge Protection	Overall overcharge alarm voltage	/	±300mV	
		Overall overcharge protection voltage	3.65 V * Number of串联 cells	±300mV	
		Overall overcharge protection delay	3.0S	±0.8S	
	Overall overvoltage protection has been lifted.	Total Overcharge Protection Release Voltage	3.40 V * Number of Series Connections	±300mV	
		Overall overcharge protection delay release time	3.0S	±0.8S	
4	Overall overcharge protection	Overall Over-Warning Voltage	2.80 V * Number of串联 cells	±300mV	
		Overall over-discharge protection voltage	2.50 V * Number of串联 cells	±300mV	
		Overall over-discharge protection delay	3.0S	±0.8S	
	The overall overcharge protection has been lifted.	Total overcharge protection release voltage	3.00 V * Number of串联 units	±300mV	
		Overall delay in releasing the overcharge protection mechanism	3.0S	±0.8S	
5	Overcurrent Protection 1	Overcurrent alarm current for charging	144A	±5%	
		Overcurrent protection current for charging	180A	±5%	
		Overcurrent protection delay during charging	10S	±2S	
		Overcurrent protection current for charging	240A	±5%	
		Overcurrent protection delay for charging	2.0S	±0.8S	
	Overcurrent protection has been lifted	Auto-Unlink	1min	±5S	
		Discharge Release	Discharge current> 0.6 A		
6	Overcurrent Protection 1	Discharge overcurrent alarm current	144A	±5%	
		Discharge overcurrent protection current	180A	±5S	
		Discharge overcurrent protection delay	60S	±5S	
		Discharge overcurrent protection current	240A	±5%	
		Discharge overcurrent protection delay	2.0S	±0.8S	
	Discharge Overcurrent Protection 1 Released	Remove Load	Remove Load to Unload		
		Charge Removal	Charging current>0.6 A		

7	Discharge Overcurrent 2	Discharge Overcurrent Protection 2 Current	364A	±10%	
		Discharge overcurrent protection 2: Delay mechanism	400mS	±100mS	
	Discharge Overcurrent Protection 2 Released	Remove Load	Remove Load to Unload		
		Charge Removal	Charging current>0.6 A		
8	Short-circuit protection	Short-circuit protection current	980A	/	
		Short-circuit protection delay	375μS	±200μS	
		Short-circuit protection has been lifted.	Remove Load to Unload		
9	Equilibrium Function	Equalization Turn-on Voltage	3350mV	±25mV	Note: When balanced mode is enabled, the voltage acquisition delay is 2.5 seconds.
		Turn on pressure differential	30mV	±10mV	
		Static equilibrium	Open	±25mV	
10	Cell Temperature Protection	High-temperature protection temperature during charging	65°C	±3°C	
		Temperature at which the thermal protection during charging is lifted	60°C	±3°C	
		Charging Low-Temperature Protection Temperature	-5°C	±3°C	
		Temperature at which the cooling protection mechanism is activated and subsequently deactivated	0°C	±3°C	
		Discharge High-Temperature Protection Temperature	65°C	±3°C	
		Temperature at which discharge high-temperature protection is lifted	60°C	±3°C	
		Discharge low-temperature protection temperature	-25°C	±3°C	
		Temperature at which low-temperature protection during discharge is lifted	-20°C	±3°C	
11	Power Loss Protection	Power-off voltage	≤2.40V	±25mV	Meet all three conditions simultaneously
		Power-off delay	10min	±1min	
		Power-off current	≤1.0A	±5%	
12	MOS High-Temperature Protection	MOS Overtemperature Protection Temperature	105°C	±3°C	
		MOS Overtemperature Recovery Temperature	80°C	±3°C	
		MOS Overtemperature Protection Delay	5.0S	±1.0S	
13	Environmental Temperature Protection	Environmental temperature protection threshold	80°C	±3°C	
		Environmental temperature recovery temperature	75°C	±3°C	
		Environmental temperature protection threshold	-30°C	±3°C	
		Environmental temperature recovery temperature	-25°C	±3°C	
14	In full swing	Total Pressure Voltage	≥3.45 V * Number of串联 cells	±300mV	Meet all three conditions above and adjust the SOC to 100%.
		Charging current	≤2.0A	±10%	
		With delay	10S	±2.0S	
15	Default Capacity Settings	Low Battery Alert	10%	±5%	Can be configured according to actual battery calibration settings
		Full capacity	100AH	/	
		Design Capacity	100AH	/	
16	Consumption Current (Average for a single unit: 3.3 V)	Electric current consumed during operation	≤20mA	/	
		The power consumption current during the light hibernation mode (GPS power consumption included)	≤2mA	Enter: No current, no equalization; communication disconnects for 10 seconds Activation: Power Supply, Communication Access	
		Power-off Mode Current	≤30μA	Enter: [Reference Power Off Mode] Activation: 1. Close the charging switch	

17	Full Capacity Attenuation Factor Setting	Self-discharge rate	1%	Proportion of electricity consumed monthly in a stationary state
		Cycle Capacity Ratio	90%	A cycle is defined as the period during which the cumulative discharge capacity reaches 90% of the battery's total capacity.
		SOC 0% Voltage	2.60V	Monomer voltage corresponding to a capacity ratio of 0%
18	Protective Plate Size	Length * Width * Height (mm)	180(±0.5)*90(±0.5)* < 18	

3.2 Other Parameters

Order number	Project	Condition
1	Detection Accuracy	Current measurement accuracy: $\leq (\pm 2\%FSR \pm 0.05A)$ Voltage Measurement Accuracy: $\leq \pm 0.3\%FSR \pm 10mV$ Temperature measurement accuracy: $\leq 3^{\circ}C$ SOC mean accuracy: $\leq 8\%$
2	Current Threshold	Charging Current: 0.5 A Discharge current: 0.5 A
3	Failure Type	1. Charging MOS failure 2. Discharge MOS failure 3. Temperature detection failure 4. Voltage detection failure (charging is prohibited when cell voltage falls below 1.5 V)
4	Storing of information	Maximum storage capacity: 1,000 resume entries, including protection counts, current total voltage, current, temperature, SOC, SOH, cycle count, and operating status
5	SOC calculate	Using the current integration algorithm
6	Short	The total internal resistance of the battery pack and short-circuit path must be no less than 40 mΩ, with a short-circuit current not exceeding 2000 A. The system shall withstand 50 short-circuit cycles using an air switch.

4、Other Functional Logic

4.1 MOS Control Instructions

4.1.1 Charging MOS Control Instructions

The charging MOS on the BMS is initially enabled. If no charging current is detected within 2 seconds or if CIN connects to P+, the charging MOS turns off. When CIN reconnects to P+ again, both the charging and discharging MOSes are activated simultaneously.

After the CIN signal is disconnected, if no charging current is detected within 2 seconds, the charge/discharge MOS turns off; upon re-detection of the CIN signal, it turns back on.

During overcharge protection, CIN connects to P+ to activate the charging MOS; after a sustained 10-second activation of the charging MOS without detecting any charging current, the discharge MOS is turned off.

4.1.2 Discharge MOS Control Instructions

The discharge MOS turns off during charging. Connecting DIN to P+ activates the discharge MOS; disconnecting DIN without CIN connection triggers a 5-second timeout in central control communication, and the discharge MOS shuts down when the discharge current falls below 1 A.

4.2 GPS Power Supply Control

When the system is in under-voltage protection mode and not charging, the GPS power supply will be turned off for 3 minutes. If GPS power is off, turn it on after charging for 10 seconds.

Do not turn on the GPS power supply if the voltage is below (power-off voltage + 0.1 V); otherwise, turn it on after the voltage remains above (power-off voltage + 0.1 V) for 1 hour.

4.3 LED Indicator Light Specifications

1) **Discharge** or **Standby** state: Short press the button to display battery level for 3 seconds:

Capacity	LED1	LED2	LED3	LED4	LED5
0%~10%	Bright	Go out	Go out	Go out	Go out
10%~20%	Bright	Go out	Go out	Go out	Go out
21%~40%	Bright	Bright	Go out	Go out	Go out
41%~60%	Bright	Bright	Bright	Go out	Go out
61%~80%	Bright	Bright	Bright	Bright	Go out
81%~100%	Bright	Bright	Bright	Bright	Bright

2) **Charging** status display:

Capacity	LED1	LED2	LED3	LED4	LED5
0%~20%	Dodge	Go out	Go out	Go out	Go out
21%~40%	Bright	Dodge	Go out	Go out	Go out
41%~60%	Bright	Bright	Dodge	Go out	Go out
61%~80%	Bright	Bright	Bright	Dodge	Go out
81%~98%	Bright	Bright	Bright	Bright	Dodge
99%~100%	Bright	Bright	Bright	Bright	Bright

5、Communication Instructions

5.1 RS485 Communication

This device uses isolated RS485 communication with a default baud rate of 9600 bps and connects to a PC via the RS485 serial port. After successful communication, the host computer can display battery package data—including voltage, current, temperature, SOC, SOH, BMS status, and cycle count—and supports program upgrades. (This host computer is compatible with PCs running Windows operating systems.)

5.2 CAN_1 Communication

The device's CAN_1 port supports isolated communication with a default baud rate of 500 KB/s and can connect to external CAN communication devices.

5.3 UART Communication

This device uses non-isolated UART communication with a default baud rate of 9600 BPS, connecting to a PC via a TTL serial port. After successful communication, the host computer can display battery package data—including voltage, current, temperature, SOC, SOH, BMS status, and cycle count—and supports software upgrade functionality. (This host computer is compatible with PCs running the Windows operating system.)

The device's UART communication port can be used to connect a GPS module, and the BMS outputs 12 V by default.

6、 Hibernation, Power-off Mode, and BMS Activation

6.1 Superficial Dormancy

Light hibernation conditions:No current, no equalization, communication is disconnected, and the device enters light hibernation after a 10-second delay.

Deep hibernation wake-up conditions:Current or communication (either condition is sufficient).

6.2 Power-off Mode and BMS Activation

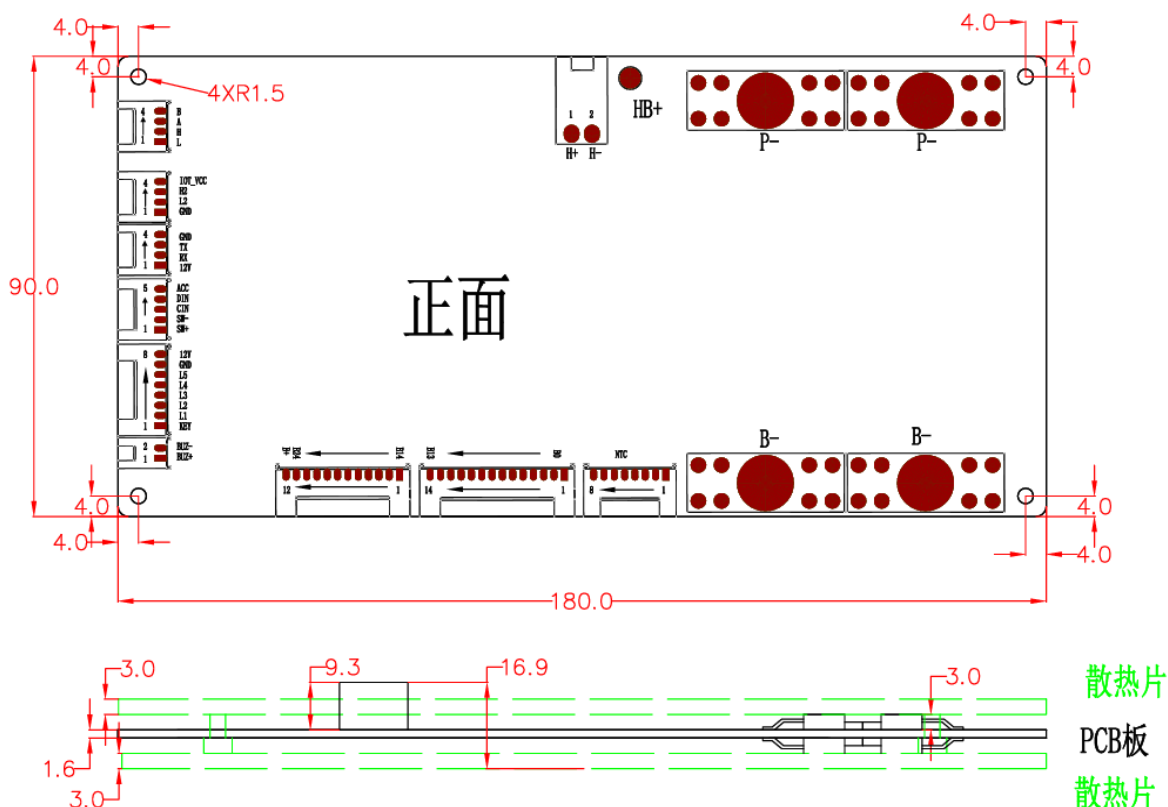
When using the charger for the first time, activate the protection board by connecting it to the power supply or pressing the button briefly. The charger voltage must be at least 2 V higher than the battery's nominal voltage. Do not connect the charger in reverse, and ensure its voltage does not exceed 90 V.

When the minimum cell voltage falls below 2.40 V for 10 minutes with a current below 1 A, the protection board enters power-off mode and cannot discharge under this condition.

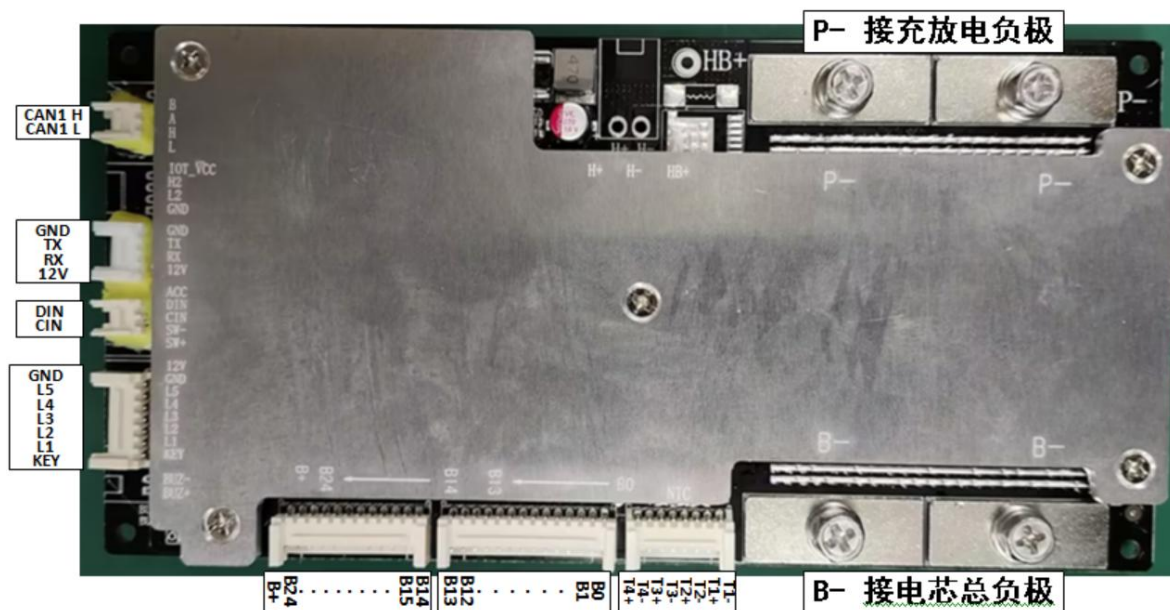
Use the charger or press the button briefly to activate the protection board in power-off mode.

7、 Schematic Diagram of the Protective Board's Dimensions and Interfaces

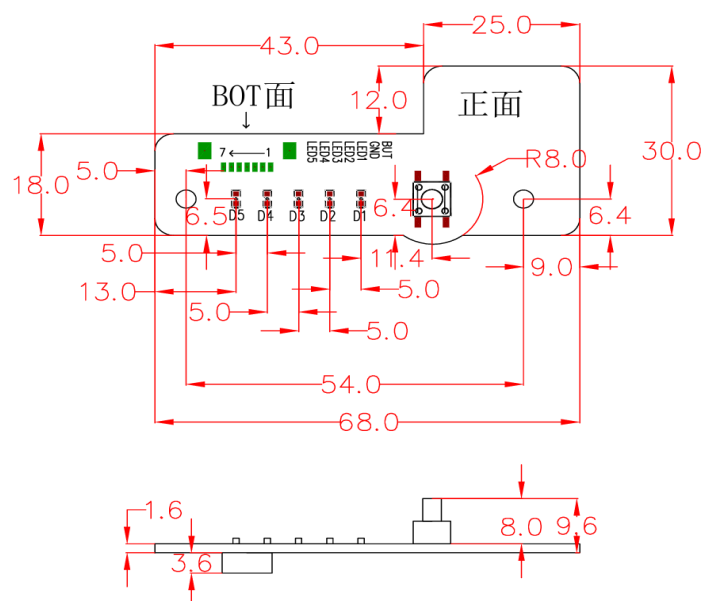
7.1 Plate Frame Dimension Diagram



7.2 Protection Board Interface Labeling



7.3 Schematic Diagram and Actual Image of the LED Light Panel Frame



7.4 Protection Board Interface Definition

Interface Name	Order number	Tab	Defined declaration
B Interface		B-	Total negative electrode of the battery cell: B-
P Interface		P-	Connect to the charging negative terminal and the discharging negative terminal.
Cell Temperature Measurement Interface	1/2	T1	Cell Temperature 1
	3/4	T2	Cell Temperature 2
	5/6	T3	Cell Temperature 3
	7/8	T4	Cell Temperature 4
Cell Voltage Acquisition Interface 1	1	B0	Connect to the first battery negative terminal (the main battery negative terminal)
	2	B1	Connect to the battery cathode in Section 1
	3	B2	Connect to the battery cathode in Section 2
	4	B3	Connect to the battery cathode in Section 3
	5	B4	Connect to the battery cathode in Section 4
	6	B5	Connect to the battery cathode in Section 5
	7	B6	Connect to the battery cathode in Section 6
	8	B7	Connect to the battery cathode in Section 7
	9	B8	Connect to the battery cathode in Section 8
	10	B9	Connect to the battery cathode in Section 9
	11	B10	Connect to the battery cathode in Section 10
	12	B11	Continue from Section 11: Battery Positive Pole
	13	B12	Connect to the battery cathode in Section 12
	14	B13	Continue from Section 13: Battery Cathode
Cell Voltage Acquisition Interface 2	1	B14	Continue to Section 14: Battery Positive Terminal
	2	B15	Continue from Section 15: Battery Positive Terminal
	3	B16	Continue from Section 16: Battery Positive Terminal
	4	B17	Continue from Section 17: Battery Cathode
	5	B18	Continue from Section 18: Battery Positive Terminal
	6	B19	Connect to the battery cathode in Section 19
	7	B20	Connect to the battery cathode in Section 20
	8	B21	Connect to the battery cathode in Section 21
	9	B22	Connect to the battery cathode in Section 22
	10	B23	Connect to the battery cathode in Section 23
	11	B24	Connect to the battery cathode in Section 24
	12	B+	Connect to the 24th battery cathode (total battery cathode B+)
Isolate Communication Interface		B	Connect to RS485 Communication B Signal
		A	Connect to RS485 Communication A Signal
	1	CAN1_H	Receive CAN1 Communication H Signal
	2	CAN2_L	Receive CAN1 Communication L Signal
GPS Interface	1	GND	Connect to the negative terminal of the GPS module
	2	TX	Protection Board Data Sender TX (to GPS Device Receiver RX)
	3	RX	Data receiving end RX of the protection board (connects to the transmitting end TX of the GPS device)
	4	12V	The BMS outputs 12 V to the positive terminal of the GPS module.

Multifunctional Interface		ACC	Reserve
	1	DIN	Discharge Handshake
	2	CIN	Charging Handshake
		SW-	Reserve
		SW+	Reserve
Light Panel Interface	1	GND	Connect the negative terminal of the light board to the ground, and also connect the negative terminal of the button.
	2	L5	100% Indicator Light
	3	L4	80% indicator light
	4	L3	60% indicator light
	5	L2	40% indicator light
	6	L1	20% indicator light
	7	KEY	Positive terminal of the button
Bell Interface		BUZ-	Reserve
		BUZ+	Reserve

8、Main Components

Order number	Device Category	Model/Brand	Alternative Model/Brand
1	MCU	N32G452REL7 / National Technology	/
2	AFE	DVC1124-22/Jiche	/
3	Charge/Discharge MOS Tube	DSU012N10N/Donghai	/

9、Environmental Suitability

9.1 Work Environment

The BMS protection board operates normally under the following conditions:

ambient temperature: -20°C~75°C;
relative humidity: 5%~90%;
atmospheric pressure: 86kPa~106kPa;

9.2 Storage Environment

The BMS protection board shall be stored in a warehouse with an ambient temperature ranging from -5°C to +40°C, relative humidity not exceeding 70%, and adequate cleanliness and ventilation. The air must be free of corrosive gases or substances that may compromise electrical insulation, and the device must be protected from mechanical impact or heavy pressure. It should be kept away from direct sunlight and maintained at a distance of no less than 2 m from heat sources (e.g., heating equipment).

10、 Usage Instructions

- 1) The battery pack assembled with this BMS must not be connected in series or parallel with other battery packs.
- 2) When connecting the power supply, connect the B-terminal first. The internal resistance of the wire between the battery's negative terminal and the protection board's B-terminal must be less than 1 milliohms (to ensure that under rated current conditions, the voltage drop between B-and the battery pack's negative terminal does not exceed 10 mV, thereby preventing significant errors in first-cell voltage or current measurement).
- 3) When welding battery leads, avoid incorrect or reversed connections. Before connecting the wiring to the BMS, it is recommended to use specialized tools to verify whether there are any miswelded connections to prevent damage to the BMS.
- 4) The impedance of the series connections between battery cells should be uniformly designed. If a single cell exhibits significantly different connection impedance compared to others, the corresponding deviation values must be specified for compensation during BMS design, preventing substantial voltage drops caused by impedance variations during charging/discharging that could lead to inaccurate voltage measurements.
- 5) During assembly, the protective plate must not come into direct contact with the cell surface; it should be securely and reliably mounted. All connectors must be sealed with adhesive and treated for moisture and water resistance.
- 6) During assembly, all tools and equipment that come into contact with the protective plate must be properly grounded, and anti-static measures should be implemented.
- 7) During use, precautions should be taken to prevent static electricity, moisture, and water ingress.
- 8) After assembling the battery pack and protection board, if no voltage output is detected or charging fails during the initial power-up, verify that the wiring is correct.
- 9) The short-circuit protection function shall be verified in accordance with the GB/T 36972–2018 standard "*Lithium-ion Batteries for Electric Bicycles*". If the sum of the internal resistance values of the battery pack and the short-circuit path is less than 40 m Ω , or if the total length of external short-circuit conductors exceeds 1.6 meters, conduct independent testing to determine whether this Battery Management System (BMS) can be used.
- 10) The images in the specification document are sample images and may differ slightly from the actual mass-produced products; please refer to the physical protective board for accurate specifications.