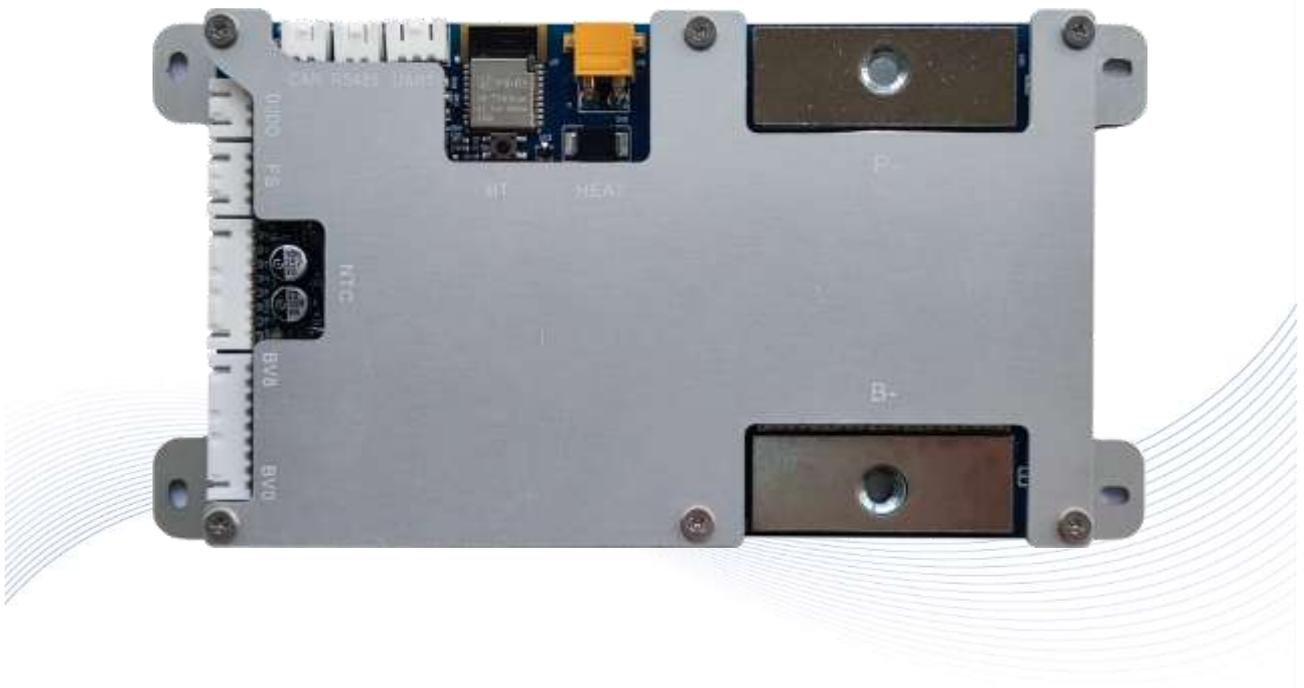


SmartGen

MAKING CONTROL SMARTER

HPE100-8-150 LITHIUM BATTERY PROTECTION BOARD USER MANUAL



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CONTENT

1 OVERVIEW	5
2 NAMING CONVENTION	5
3 PERFORMANCE AND CHARACTERISTICS	6
4 TECHNICAL INDEX.....	7
5 PHYSICAL PICTURE, TERMINAL DEFINITION AND OVERALL DIMENSIONS.....	8
5.1 PHYSICAL PICTURE	8
5.2 TERMINAL DEFINITION	8
5.3 OVERALL DIMENSIONS	10
6 OPERATION DESCRIPTION.....	11
6.1 FORCED START DESCRIPTION	11
6.2 SLEEP/WAKEUP DESCRIPTION	11
6.3 HEATING DESCRIPTION	11
7 PARAMETER SETTING.....	13
7.1 CONTENTS AND RANGES OF PARAMETER SETTING.....	13
7.2 SETTING CONTENTS OF DIGITAL OUTPUT PORTS	19
7.3 DEFINED CONTENTS OF DIGITAL OUTPUT PORTS.....	19
8 BLUETOOTH APP OPERATION DESCRIPTION.....	20
8.1 ILLUSTRATION	20
8.2 CONNECTION DESCRIPTION	20
8.3 MONITORING INTERFACE	21
8.4 CONFIGURATION INTERFACE (READ CONFIGURATION VIA DROP-DOWN)	21
8.5 WRITE CONFIGURATION EXAMPLE	22
9 TYPICAL APPLICATION DIAGRAM	23
10 TROUBLESHOOTING.....	24

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Table 1 Software Version

Date	Version	Note
2025-07-07	1.0	Original release.

Table 2 Notation Clarification

Sign	Instruction
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

Glossary and List of Abbreviations

BMS: Battery Management System

AFE: Analog Front End



1 OVERVIEW

HPE100-8-150 lithium battery protection board is specially developed and designed for genset, parking air conditioner and truck starting battery pack. It is an important component of starting power module and mainly used for 8-string lithium battery. The lithium battery protection board can collect, process and store important information of the running battery pack in real time and monitor the working status (voltage, current, temperature, etc.) of battery pack to alarm and protect the over/under voltage, over current, over temperature, etc. It can effectively absorb the surge voltage during the load dump process and also provide the balanced protection function to extend the service life for battery cell. With the one-key forced start function, it can effectively address key issues such as the safety, convenience and service life of the starting power system.

2 NAMING CONVENTION

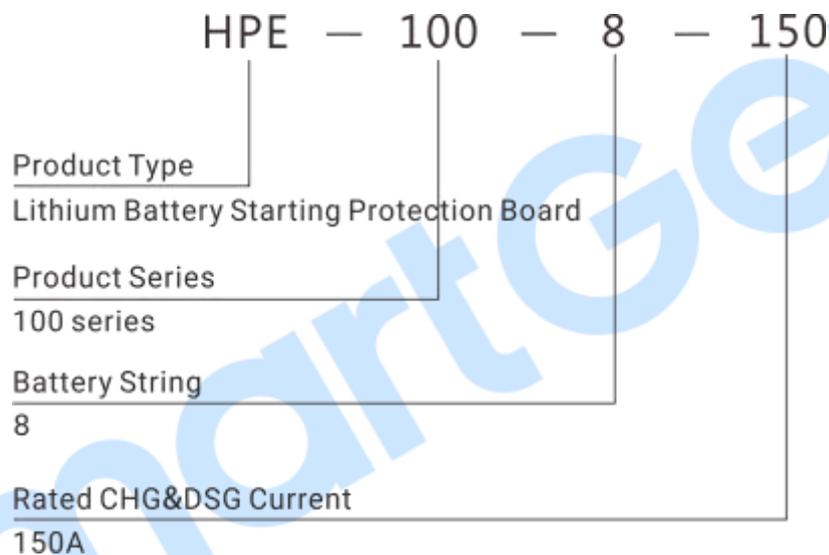


Fig.1 Naming Convention

3 PERFORMANCE AND CHARACTERISTICS

- The stable and reliable AFE chip is adopted to realize the voltage detection of the cells, which supports the voltage detection of 8 strings of cells;
- 2 channels of cell temperature detection are supported, and the temperature sensor type is NTC 10K-3950;
- 1 MOS temperature sampling function, 1 ambient temperature sampling function, 1 heating board temperature sampling function;
- Alarm and protection functions of over/under voltage, over current, over temperature, etc.;
- With short circuit protection function and short circuit current can be configured;
- With forced start function, which can meet power demand in special circumstances;
- Battery loop charge and discharge control;
- With 1# CANBUS interface, 1# isolated RS485 interface, RS485 communication baud rate can be set;
- With Bluetooth communication function enables data monitoring, parameter setting, etc.;
- With heating function, including auto heating, manual heating, and can be used for battery module heating. Max heating current is 20A;
- 1 Aux. input port;
- 1 Aux. output port;
- With sleep and wakeup functions for low power consumption;
- With passive balance function, and the max. balanced current is 150mA;
- With event log function, which can circularly record 200 groups of warning, protection, fault and other alarms when they occur;
- The power is supplied by battery module;
- The firmware is upgraded via RS485 interface and Bluetooth.

4 TECHNICAL INDEX

Table 3 Technical Index

Item	Contents
Working Voltage	Battery supply: DC(10~35)V
Overall Power Consumption	Normal working: <1.2W Sleep: <10mW
Cell Voltage Collection	Range: (0~5000)mV Resolution: 1mV Accuracy: ±15mV
Temperature Collection	Range: (-40~+125)°C Resolution: 0.1°C Accuracy: ±2°C Temp. Sensor Type: NTC 10K-3950
Current Collection	Range: (-1500~+1500)A Resolution: 0.01A Accuracy: 3%FS (Full Range)
SOC Accuracy	±5%
CAN Interface	1#, 250kbps, non-isolation
RS485 Interface	2#, 9600bps, isolation
Digital Input	Low on threshold voltage 1.1V, max input voltage 36V
Digital Output	Max continuous output 10mA
EMC Standard	GB/T 34131-2023
Vibration	5Hz~8Hz: displacement=±7.5mm 8Hz~500Hz: a=±2g IEC 60068-2-6
Shock	50g, 11ms, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27
Bump	20g, 16ms, half-sine IEC 60255-21-2
Case Dimensions	175mmx92mmx21.1mm
Panel Cutout	165mmx76mm
Working Temperature	(-40~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-40~+80) °C
Weight	0.38kg

5 PHYSICAL PICTURE, TERMINAL DEFINITION AND OVERALL DIMENSIONS

5.1 PHYSICAL PICTURE

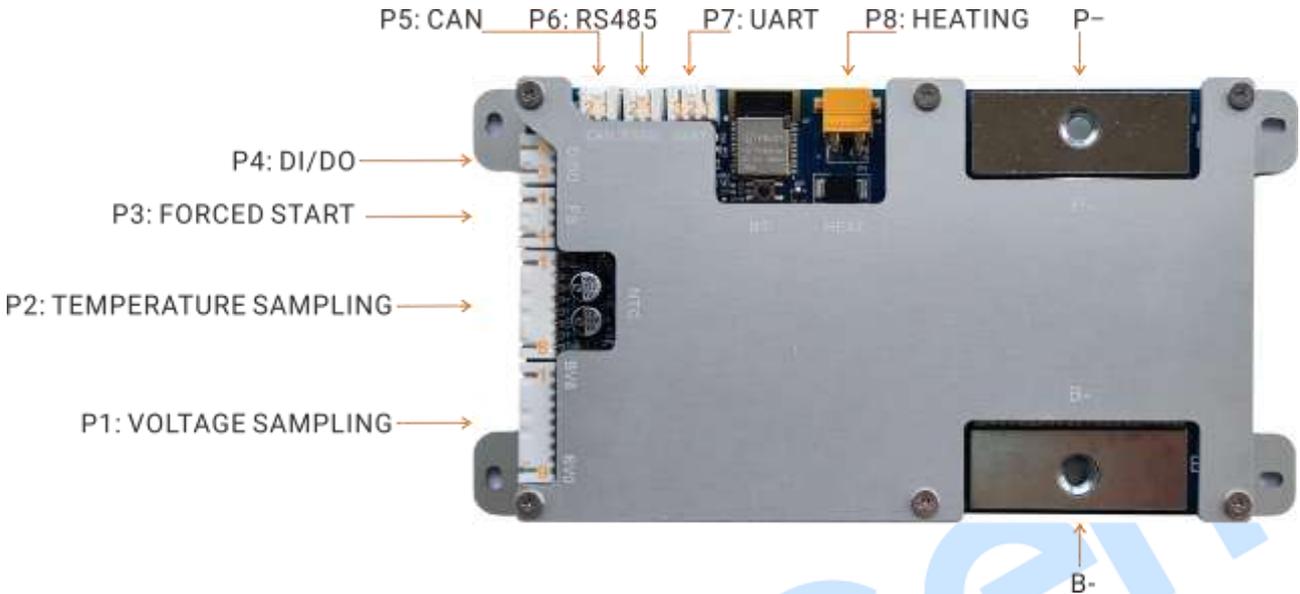


Fig.2 Physical Picture

5.2 TERMINAL DEFINITION

Table 4 Terminal Definition

No.	Definition	Function
Terminal P1 (If the terminal at the bottom of the physical picture is no.9, then the terminal at the top is no.1)		
1	BV8	Positive of the 8 th battery
2	BV7	Positive of the 7 th battery
3	BV6	Positive of the 6 th battery
4	BV5	Positive of the 5 th battery
5	BV4	Positive of the 4 th battery
6	BV3	Positive of the 3 rd battery
7	BV2	Positive of the 2 nd battery
8	BV1	Positive of the 1 st battery
9	BV0	Negative of the 1 st battery
Terminal P2 (If the terminal at the bottom of the physical picture is no.8, then the terminal at the top is no.1)		
1	GND	Temperature detection2 negative of the heating board
2	T2	Temperature detection2 positive of the heating board
3	GND	Temperature detection1 negative of the heating board
4	T1	Temperature detection1 positive of the heating board
5	GND	Negative of cell temperature detection2
6	NTC2	Positive of cell temperature detection2
7	GND	Negative of cell temperature detection1
8	NTC1	Positive of cell temperature detection1

No.	Definition	Function
Terminal P3 (If the terminal at the bottom of the physical picture is no.4, then the terminal at the top is no.1)		
1	GND	Input negative of forced start
2	IN	Forced start input
3	LED-	LED indicator of forced start (max 10mA output)
4	LED+	
Terminal P4 (If the terminal at the bottom of the physical picture is no.3, then the terminal at the top is no.1)		
1	GND	Input/output COM
2	DI	Digital input
3	DO	Digital output
Terminal P5 (If the leftmost terminal of the physical picture is no.2, then the rightmost terminal no.1)		
1	CAN_L	Non-isolated CAN for communication with external device
2	CAN_H	
Terminal P6 (If the leftmost terminal of the physical picture is no.2, then the rightmost terminal no.1)		
1	RS485A	Isolated 485 for communication with PC
2	RS485B	
Terminal P7 (If the leftmost terminal of the physical picture is no.3, then the rightmost terminal no.1)		
1	GND	UART COM
2	TX	UART for program upgrade
3	RX	
Terminal P8		
1	Heat	The heating film is connected to the negative end, the other end is connected to battery positive (max heating current is 20A)
2		

5.3 OVERALL DIMENSIONS

Unit: mm

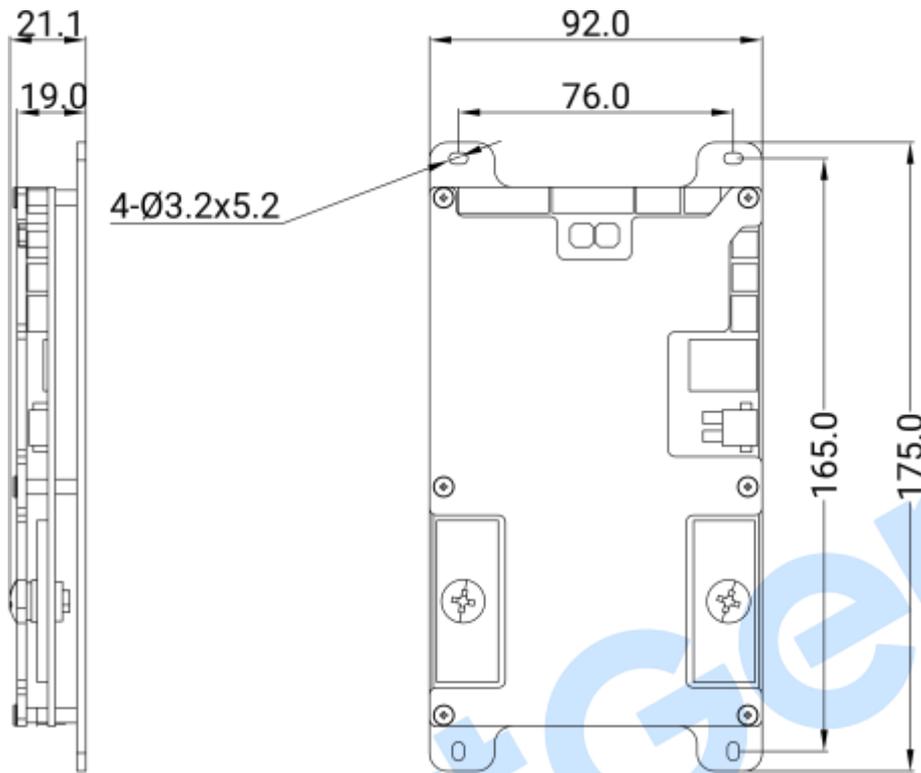


Fig.3 Overall Dimensions

6 OPERATION DESCRIPTION

6.1 FORCED START DESCRIPTION

When BMS is in sleep mode, long press the “Forced Start” key for (1~3)s, BMS will enter running mode.

When BMS is in running mode, long press the “Forced Start” key for (3~6)s, BMS will enter forced start mode (this function is unavailable after entering this mode for 60s).

When BMS is in running mode, long press the “Forced Start” key for more than 6s, BMS will enter sleep mode.

6.2 SLEEP/WAKEUP DESCRIPTION

System will enter the sleep mode if any of the following conditions are met:

(1) The single cell or the total voltage over discharge protection is not removed after a delay of 30s, and no communication, charger connection, charging and discharging;

(2) Long press the “forced Start” key for 6s and no communication, charger connection, charging and discharging;

(3) The system has been in the static state for more than 24 hours and no communication & charger connection;

(4) When the system is in the static state, the min. single cell voltage is lower than the sleep voltage, and the duration reaches the sleep delay time without communication and charger connection;

(5) SOC is lower than 30% when BMS is running;

(6) The system enters sleep mode via sleep key of PC software.

System will enter the running mode if any of the following conditions are met:

(1) Connect to charger, the output voltage of charger is greater than battery voltage;

(2) Long press the “ Forced Start” key for (1~3)s;

(3) BMS is waken and enters running mode in CAN communication;

(4) BMS is waken and enters running mode in RS485 communication via PC software.

6.3 HEATING DESCRIPTION

The protection board is equipped with heating function, which can quickly restore the activity of the battery pack in a low temperature environment and enhance the charging and discharging capacity of the battery pack. The heating function includes auto heating, manual heating, and forced heating, max heating current is 20A.

Table 5 Heating Description

Name	Heating Mode	Remark
Heating Module	Auto Heating	Start conditions (charging status and meet the following conditions at the same time): 1. Min. cell temperature is lower than 0°C (heating start temperature can be configured via PC); 2. Charging status (charging current is greater than 2A).
		Stop conditions (meet any of the conditions): 1. Min. cell temperature is greater than 5°C; 2. Heating film has fault (continues 15min, cell temperature rise<2°C);

Name	Heating Mode	Remark
		3. Discharging current is greater than 8A.
	Manual Heating	Start conditions (only in system standby or discharging status, and meet the following conditions at the same time): 1. Press "Forced Start" key for 3s; 2. Min. cell temperature is lower than 5°C (heating start temperature can be configured via PC).
		Stop conditions (meet any of the conditions): 1. Min. cell temperature is greater than 5°C; 2. Heating film has fault (continues 15min, cell temperature rise<2°C); 3. Min cell voltage is lower than 2.5V.
	Forced Heating	Start conditions (meet all the following conditions): 1. Click "Start Heating" button on the PC; 2. Auto heating and manual heating are closed.
		Stop conditions (meet all the following conditions): 1. Click "Stop Heating" button on the PC; 2. Heating is started via PC.

7 PARAMETER SETTING

7.1 CONTENTS AND RANGES OF PARAMETER SETTING

Table 6 Contents and Ranges of Parameter Setting

No.	Item		Range	Default	Description	
Module Setting						
1	Password		(0-65534)	1234		
2	RS485 Comm. Baud Rate		(0-2)	0	0: 9600bit/s 1: 19200bit/s 2: 115200bit/s	
3	RS485 Comm. Stop Bit		(0-1)	0	0: 1bit 1: 2 bits	
4	RS485 Parity Check Bit		(0-2)	0	0: No parity 1: Odd 2: Even	
5	Digital Output Contents		(0~1)	0	0: NO 1: NC	
6			(0-20)	1	See Table 7 Digital Output Contents	
7	Module Address		(1-15)	1		
Battery Module						
1	System Nominal Capacity		(1-600.0)AH	135.0		
2	System Total Capacity		(1-600.0)AH	135.0		
3	Balance Start Voltage		(2000-5000)mV	3450		
4	Balance Start Voltage Difference		(0-1000)mV	50		
5	Sleep Voltage for Single Cell		(2000-5000)mV	2500		
6	Sleep Delay for Single Cell		(1-120)min	5		
7	Fully Pre-charge SOC		(80.0-100.0)%	95.0		
8	Full Cut-off Current		(50-10000)mA	5000		
9	Self-discharge SOC		(0.0-10.0)%	1.0		
10	Start Temp. of Auto Heating		(-20.0-30.0)°C	0.0		
11	Start Temp. of Manual Heating		(-20.0-30.0)°C	5.0		
Protection Parameter Setting						
1	Single Cell Over Volt. Protection	Protecti on Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
2			Warning Threshold	(2000-5000)mV	3550	
3			Protection Threshold	(2000-5000)mV	3650	
4			Protection Delay	(0-60.0)s	3.0	
5		Return Condi tion	Return Volt.	(2000-5000)mV	3450	When the single cell voltage is less than or equal to the setting
6			Return SOC	(0-100)%	90	

No.	Item		Range	Default	Description	
7		Return Current	(0-50.0)A	1.0	threshold, the protection returns; or when SOC is less than or equal to the setting threshold, the protection returns; or when the discharging current is greater than or equal to the threshold, the protection returns.	
8	Total Cell Over Volt. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
9			Warn	(16.0-40.0)V	28.8	
10			Protection	(16.0-40.0)V	29.2	
11		Return Condition	Delay	(0-60.0)s	3.0	
12			Return	(16.0-40.0)V	27.6	When total voltage is less than or equal to the setting threshold, the protection returns; or when SOC is less than or equal to the setting threshold, the protection returns; or when discharging current is greater than or equal to the setting threshold, the protection returns.
13			Return SOC	(0-100)%	90	
14	Return Current	(0-50.0)A	1.0			
15	Single Cell Under Volt. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
16			Warn	(2000-5000)mV	2700	
17			Protection	(2000-5000)mV	2600	When under voltage protection lasts for 30s and it still cannot be recovered, the unit enters the low-power mode and returns when charging voltage signal is detected.
18		Protection Delay	(0-60.0)s	1.0		
19		Return Condition	Return	(2000-5000)mV	2950	The protection returns when the lowest voltage is greater than or equal to the setting threshold.

No.	Item		Range	Default	Description	
20	Large Single Cell Volt. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
21			Warn	(50-1000) mV	500	
22			Protection	(50-1000) mV	800	
23			Protection Delay	(0-60.0)s	1.0	
24		Return Condition	Restore	(50-1000) mV	750	
25	Total Cell Under Volt. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
26			Warn	(16.0-40.0)V	21.6	
27			Protection	(16.0-40.0)V	20.8	When under voltage protection lasts for 30s and it still cannot be recovered, the unit enters the low-power mode and returns when charging voltage signal is detected.
28			Delay	(0-60.0)s	2.0	
29			Return Condition	Return	(16.0-40.0)V	23.6
30	Charging Over Current Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
31			Warn	(0.1-300.0)%	102.5	
32			Protection	(0.1-300.0)%	105	When charging mos is disconnected for 1min or discharging current is greater than the setting threshold, the protection returns. The protection is cumulated when releases the protection via mos disconnection. If this protection occurs three times continuously, it will no longer be released. The protection cumulative number is reset to zero when this protection is released by discharging.

No.	Item		Range	Default	Description	
33		Delay	(0-60.0)s	3.0		
34		Return Condition	Return Current (0-50.0)A	1.0	The protection returns when discharging current is greater than the setting threshold.	
35	Discharging Over Current Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
36			Warn	(0.1-1000.0)%	150.0	
37			Protection 1	(0.1-1000.0)%	200	When discharging mos is disconnected for 1min or charging current is greater than the setting threshold, the protection returns. The protection is cumulated when releases the protection via mos disconnection. If this protection occurs three times continuously, it will no longer be released. The protection cumulative number is reset to zero when this protection is released by charging.
38			Delay	(0-60.0)s	15.0	
39			Protection 2	(0.1-1000.0)%	500	When discharging mos is disconnected for 1min or charging current is greater than the setting threshold, the protection returns. The protection is cumulated when releases the protection via mos disconnection. If this protection occurs three times continuously, it will no longer be released. The protection cumulative number is reset to zero when this protection is released by charging.
40		Delay	(0-60.0)s	5.0		

No.	Item		Range	Default	Description	
41		Protection 3	(0.1-1000.0)%	800	When discharging mos is disconnected for 1min or charging current is greater than the setting threshold, the protection returns. The protection is cumulated when releases the protection via mos disconnection. If this protection occurs three times continuously, it will no longer be released. The protection cumulative number is reset to zero when this protection is released by charging.	
42		Delay	(0-60.0)s	2.0		
43		Return Condition	Return Current	(0-50.0)A	10.0	The protection returns when charging current is greater than the setting threshold.
44	MOS High	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
45			Warn	(-40-120) °C	95	
46			Protection	(-40-120) °C	115	
47	Temp. Protection	Return Condition	Return	(-40-120) °C	85	The protection returns when MOS temperature is less than or equal to the setting threshold.
48	Low Ambient	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
49			Warn	(-40-120) °C	-10	
50			Protection	(-40-120) °C	-20	
51	Temp. Protection	Return Condition	Return	(-40-120) °C	0	The protection returns when the ambient temperature is greater than or equal to the setting threshold.
52	High Ambient	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
53			Warn	(-40-120) °C	60	
54			Protection	(-40-120) °C	70	

No.	Item		Range	Default	Description	
55	nt Temp. Protection	Return Condition	Return	(-40-120) °C	50	The protection returns when the ambient temperature is less than or equal to the setting threshold.
56	High Charging Temp. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
57			Warn	(-40-120) °C	50	
58			Protection	(-40-120) °C	65	
59		Return Condition	Return	(-40-120) °C	55	The protection returns when the charging temperature is less than or equal to the setting threshold.
60	Low Charging Temp. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
61			Warn	(-40-120) °C	0	
62			Protection	(-40-120) °C	-10	
63		Return Condition	Return	(-40-120) °C	-1	The protection returns when the charging temperature is greater than or equal to the setting threshold.
64	High Discharging Temp. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
65			Warn	(-40-120) °C	50	
66			Protection	(-40-120) °C	65	
67		Return Condition	Return	(-40-120) °C	60	The protection returns when the discharging temperature is less than or equal to the setting threshold.
68	Low Discharging Temp. Protection	Protection Setting	Warning Enable	(0-1)	1	0: Disable 1: Enable
69			Warn	(-40-120) °C	0	
70			Protection	(-40-120) °C	-20	

No.	Item		Range	Default	Description	
71	Charging Temp. Protection	Return Condition	Return	(-40-120) °C	-10	The protection returns when the discharging temperature is greater than or equal to the setting threshold.
72	Low Power Warning	Warning Threshold		(0-100)%	5	No warning when charging.
73	Short Circuit Protection	Protection Current		(0-2)	1	0: 1000A 1: 1500A 2: 2000A
74		Delay		(100-1000)us	300	When the load is disconnected or charger connection signal is detected, this protection returns. When this protection occurs three times continuously, it will no longer be released.

7.2 SETTING CONTENTS OF DIGITAL OUTPUT PORTS

Table 7 Digital Output Contents

No.	Item	Range	Default	Description
1	Active Type	(0-1)	0	0: NO 1: NC
2	Output Setting	(0-20)	01	See Table 8 Defined Contents of Digital Output.

7.3 DEFINED CONTENTS OF DIGITAL OUTPUT PORTS

Table 8 Defined Contents of Digital Output

No.	Item	Function Description
00	Not Used	
01	Remote Control	Control output via PC software.
02	Low SOC	Output when SOC is lower than set threshold.
03	Alarm Output	Output when there is fault, protection or alarm occurs.
04-21	Reserved	

8 BLUETOOTH APP OPERATION DESCRIPTION

8.1 ILLUSTRATION

The protection board supports Bluetooth function. You can use the cell phone to download HPE100 installation package through our company’s website, then open the APP and phone bluetooth, position information. The related operations should be conducted under standby status. The Bluetooth APP operation description is shown as the following contents.

8.2 CONNECTION DESCRIPTION

- a) Open the Bluetooth APP;
- b) Click “Scan” on the right corner of the interface, then “Scanning” is displayed;
- c) Find the corresponding bluetooth device name and connect it (default name is HPE100).

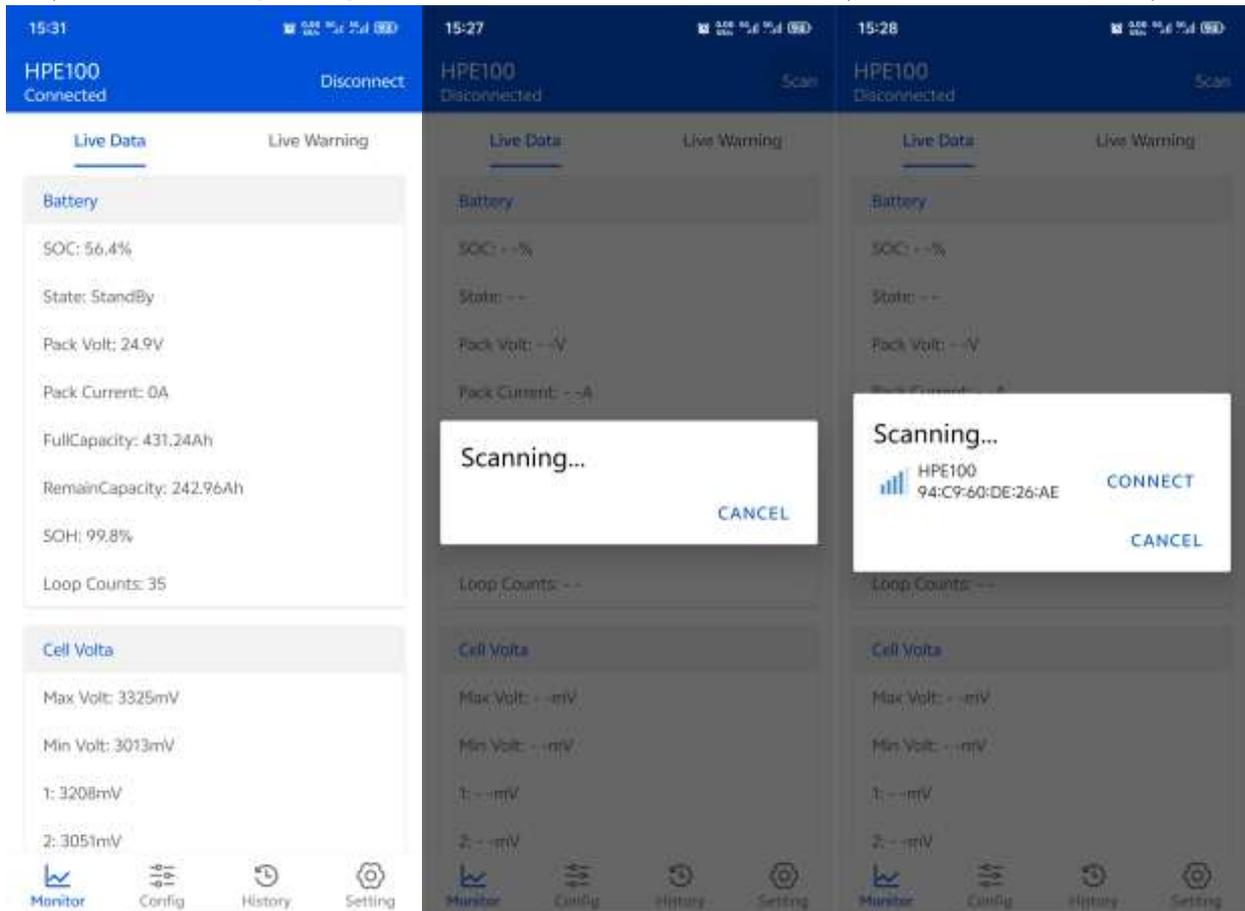


Fig.4 APP Connection Diagram

8.3 MONITORING INTERFACE



Fig.5 Real-time Data Display of Monitoring Interface

8.4 CONFIGURATION INTERFACE (READ CONFIGURATION VIA DROP-DOWN)

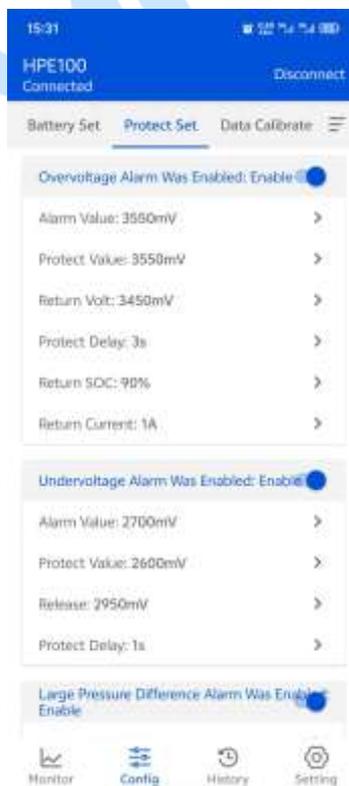


Fig.6 Protection Setting of Configuratio Interface

8.5 WRITE CONFIGURATION EXAMPLE

- a) Click the item you want to change and enter the new protection threshold;
- b) Click “OK”, then “Please input password” window is popped up, click “OK” after entering the correct password;
- c) Write the configuration after entering the correct password.

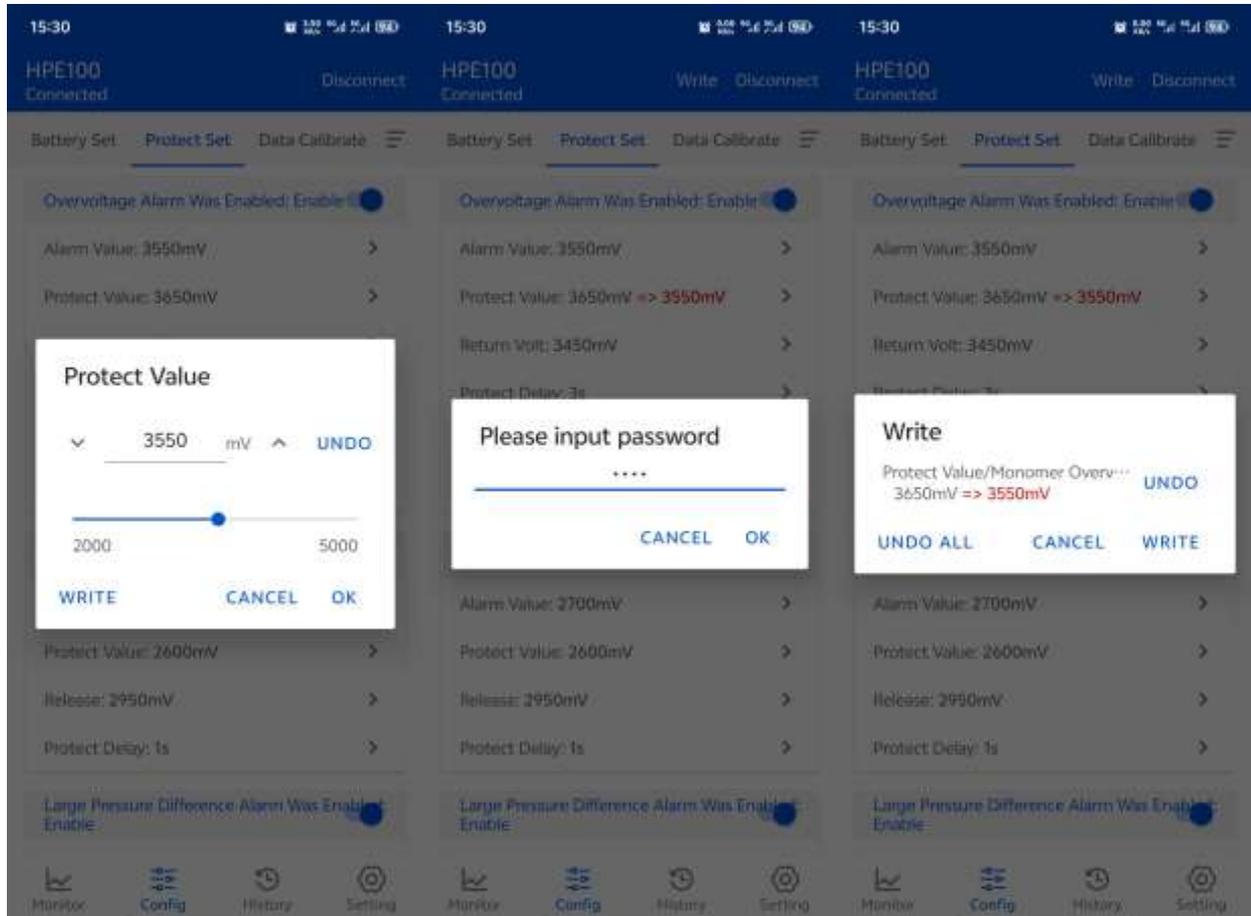


Fig.7 Write Configuration Example

9 TYPICAL APPLICATION DIAGRAM

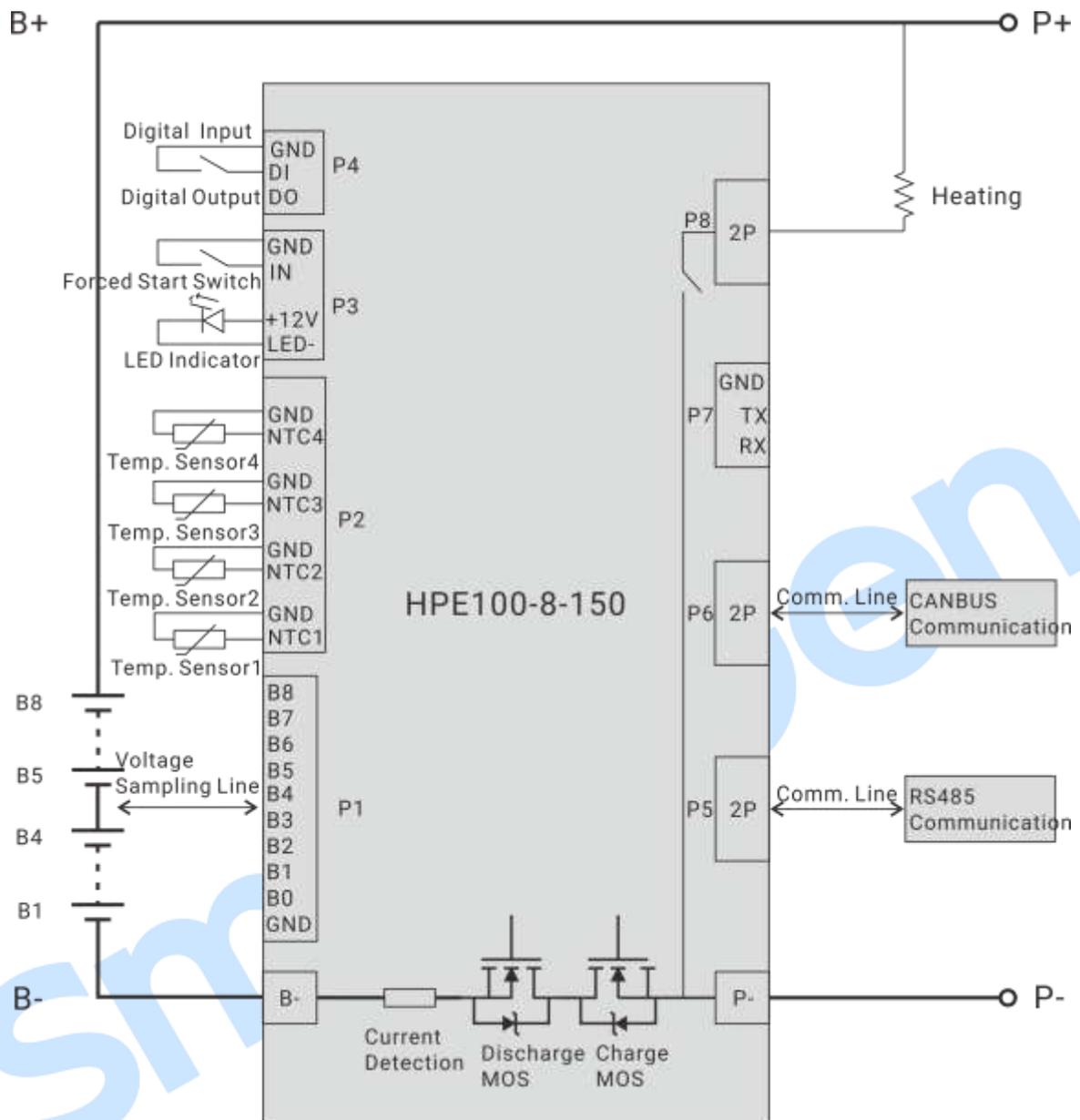


Fig.8 Application Diagram

Table 9 Troubleshooting

Fault Symptom		Possible Measurement
Protection board no response when power on		Check the wirings of protection board.
Communication Failure	CAN Communication Fault	Check the wirings; Check if the wirings between CAN_H and CAN_L are reversely connected; A 120Ω resistor is recommended to connect between CAN_H and CAN_L.
	485 Communication Fault	Check the wirings; Check ID setting; Check if the wirings between RS485_A and RS485_B are reversely connected; Check if PC communication baud rate and parity bit are correct; A 120Ω resistor is recommended to connect between A&B of RS485.
Abnormal battery voltage and temperature data		Check the wirings; Check the connector is tightly inserted.