Smart Active BMS for lithium battery

Operation and maintenance instructions

Product warranty terms

Product Name: Smart Active BMS
Warranty period: one year

1 Overview

The intelligent protection board of lithium battery is a management system specially designed for large-capacity series lithium battery packs. which has the functions of voltage acquisition, high current active balance, overcharge, over discharge, over current and over temperature protection, coulomb counter, Bluetooth communication, GPS remote, etc. It can be applied to lithium iron phosphate, ternary
lithium and other battery types.

Based on the energy transfer active balance technology with independent intellectual property rights, the protection board can achieve the maximum continuous 2A balance current. High current active balance technology can guarantee the battery consistency, improve the battery life and delay the battery aging to the greatest extent.

The protection board has a supporting mobile app, supporting Android and IOS operating systems. The app can be connected to the protection board via Bluetooth to check the battery working status, modify the working parameters of the protection board, control the switch of charging and discharging, etc. The protection panel is small in size, simple in operation and full in function, which can be widely used in battery pack of small sightseeing bus, scooter, shared car, high-power energy storage, base station standby power supply, solar power station and other products.

2 Main Technical Parameters

2.1 Main Technical Indicators

The main technical indicators of the protection board A60/A80/A100/A150are shown in Table 1. and Table2

Table 1. Main technical indicators of protection boardA60/A80

Technical Index	Product model					
	HT-817S06A60	HT-820S06A60	HT-824S06A60	HT-817S06A80	HT-820S06A80	HT-820S06A80
Number of battery strings (ternary lithium)	7〜17	7〜20	7〜24	7〜17	7〜20	7〜24

Number of battery strings (LifePo4)	8～17	8～20	8～24	8～17	8～20	8～24
Number of battery strings (LTO)	14~17	14 ～20	14 ～24	14 ～17	14 ～20	14 ～24
balance mode	Active balance					
Equalizing current	0.6A					
Main circuit conduction internal	1.53 mΩ			1.2 mΩ		
Continuous discharge current	60A			80A		
Maximum discharge current	100A			150A		
Charging overcurrent	10 ～60 A			10～80 A		
RS485 sc	yes					
CAN	yes					
Display interface	yes					
Entry cable	Same port					
Single voltage range	1～5V					
Voltage acquisition	±3mV					
Overcharge protection voltage	1. 2～4. 35V adjustable					
Overcharge release voltage	1. 2～4. 35V adjustable					
Discharge time of charging	2～120S adjustable					
Number of temperature	3					
Temperature protection	yes					

Short circuit protection	yes
Coulomb meter	yes
Bluetooth function	Support Android and IOS
GPS remote (optional)	RS485/GPS
Over discharge protection voltage	1.2～4.35V adjustable
Over discharge protection voltage	1.2～4.35V adjustable

Table 2. Main technical indicators of protection board A100/A150/A200

Technical Index	Product model					
	HT-820S06A100	HT-824S06A100	HT-820S1A150	HT-824S1A150	HT-824S2A150	HT-824S2A200
Number of battery strings (ternary lithium)	7～20	7～24	7～20	7～24	7～24	7～24
Number of battery strings (LifePo4)	8～20	8～24	8～20	8～24	8～24	8～24
Number of battery strings (LTO)	14	14 ～20	14 ～20	14 ～24	14 ～24	14 ～24
balance mode	Active balance					
Equalizing current	0.6A		1A		2A	
Main circuit conduction internal	1 mΩ		0.65mΩ		0.47mΩ	
Continuous discharge current	100A	100A	150A	150A	150A	200A
Maximum discharge current	200A	200A	300A	300A	300A	350A
Charging overcurrent	10 ～100A	10 ～100A	10 ～150A	10 ～150A	10 ～200A	10 ～200A
RS485 sc	yes					
CAN	yes					

Display interface	yes
Entry cable	Same port
Single voltage range	1～5V
Voltage acquisition	±3mV
Overcharge protection voltage	1. 2～4. 35V adjustable
Overcharge release voltage	1. 2～4. 35V adjustable
Discharge time of charging	2～120S adjustable
Discharge time of charging	2～120S adjustable
Discharge time of charging	2～120S adjustable
Number of temperature	3
Temperature protection	yes
Short circuit protection	yes
Coulomb meter	yes
Bluetooth function	Support Android and IOS
GPS remote (optional)	RS485/GPS

2.2 Application Environment

a) Operating temperature range: - 30 °C ~ 70 °C;

b) Power requirements: 20 ~ 100V.

c）Power consumption: 8mA @ 100V in balanced state and 7mA @ 100V in imbalanced state.

3Connector and Interface Description

3.1 Connector and LED Position Description.

The positions of two types of protection board connectors and   LED lights are shown in Figure 1 and Figure 2.
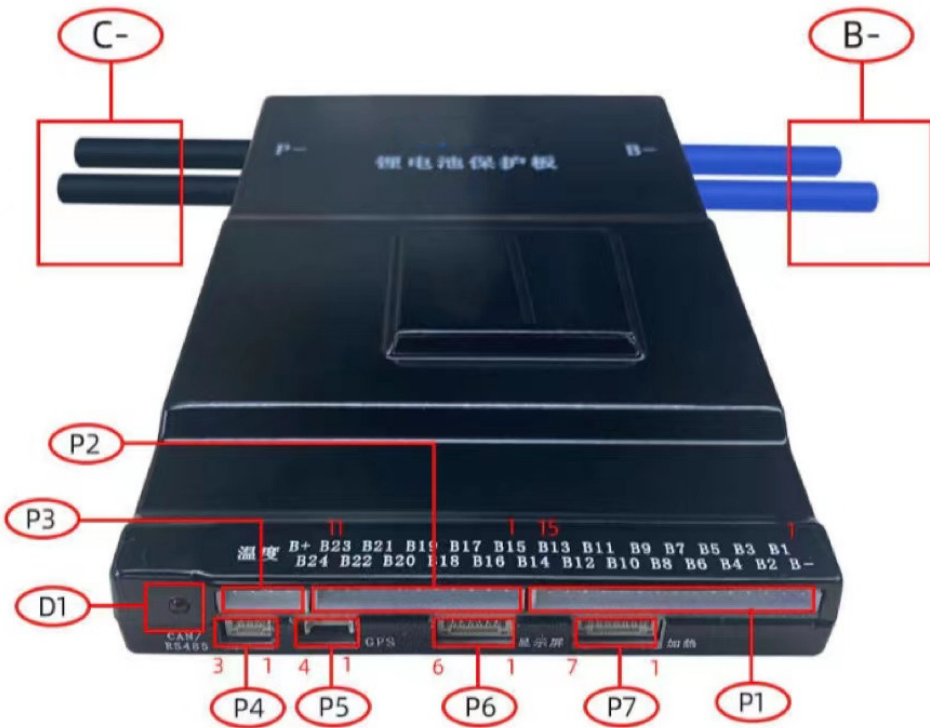
Figure1. HT-820S06A100/ HT-824S06A100/ HT-820S1A150 /HT-824S1A150/ HT-824S2A150 /HT-824S2A200 Connector Diagram

Figure 2..HT-817S06A60/ HT-820S06A60/ HT-824S06A60/ HT-817S06A80

/HT-820S06A80 /HT-824S06A80 Connector Diagram

3.2 Connector and Interface Description

HT-817S06A60/ HT-820S06A60 /HT-824S06A60/ HT-817S06A80 /HT-820S06A80 /HT-824S06A80 /HT-820S06A100/ HT-824S06A100 /HT-820S1A150/ HT-824S1A150/HT-824S2A150/ HT-824S2A200 connector and LED light definition are shown on table 3 and table 4.

Connector	Interface Name	Pin No.	HT-817S06A60/HT-820S06A60/HT-824S06A60/HT-817S06A80/HT-820S06A80/HT-824S06A80/HT-820S06A100/HT-824S06A100/ HT-820S1A150/HT-824S1A150/HT-824S2A150/HT-824S2A200/HT-824S06A80/HT-820S06A100/HT-824S06A100/HT-820S1A150 HT-824S1A150	
			Name	Definition
P1	Uniform and acquisition interface	1	B-	Total battery negative
		2	B1	Cell 1 Positive
		3	B2	Cell 2 Positive
		4	B3	Cell 3 Positive
		5	B4	Cell 4 Positive
		6	B5	Cell 5 Positive
		7	B6	Cell 6 Positive
		8	B7	Cell 7 Positive
		9	B8	Cell 8 Positive

		10	B9	Cell 9 Positive
		11	B10	Cell 10 Positive
		12	B11	Cell 11 Positive
		13	B12	Cell 12 Positive
		14	B13	Cell 13 Positive
		15	B14	Cell 14 Positive
		1	B15	Cell 15 Positive
		2	B16	Cell 16 Positive
		3	B17	Cell 17 Positive
		4	B18	Cell 18 Positive
		5	B19	Cell 19Positive
		6	B20	Cell 20 Positive
		7	B21	Cell 21 Positive
		8	B22	Cell 22 Positive
		9	B23	Cell 23 Positive
		10	B24	Cell 24 Positive （charge positive ）
P2		11	B+	Protection board power （charge positive ）
P3	Temperature Interface	1	T1A	1 st temperature sensor A pin
		2	T1B	1 st temperature sensor B pin
		3	T2A	2 st temperature sensor A pin
		4	T2B	1 st temperature sensor B pin
P4	Connector Interface	1	D_N	CAN_L/RS485-N （optional）
		2	D_P	CAN_H/RS485-P　（optional）
		3	GND	Protection board power

Table 3
HT-817S06A60/HT-820S06A60/HT-824S06A60/HT-817S06A80/HT-820S06A80/HT-824S06A80/
HT-820S06A100/HT-824S06A100/
HT-820S1A150/HT-824S1A150/HT-824S2A150/HT-824S2A200/HT-824S06A80/HT-820S06A100
/HT-824S06A100/HT-820S1A150 for connector definition and LED light definition.

Table 4. Connector Definition

Connector	Connector Name	Pin No.	HT-817S06A60/HT-820S06A60/HT-824S06A60/HT-817S06A80/HT-820S06A80 /HT-824S06A80 /HT-820S06A100/ HT-824S06A100/ HT-820S1A150/ HT-824S1A150/ HT-824S2A150 /HT-824S2A200	
			Name	Definition
P5	GPS Interface	1	VGPS	Power output ，the voltage is close to B+
		2	TX	UART_TX,3. 3V

		3	RX	UART_RX,3. 3V
		4	GND	Power
P6	Display Interface	1	VCC	Display screen power output
		2	A	Display screen RS485 positive signal
		3	B	Display screenRS485negative signal
		4	GND	Connected to electric core negative
		5	K+	Activate signal positive terminal
		6	K-	Activate signal negative terminal
P7	Heating interface (optional)	1	HT-	Headed negative electrode —— （HT-817S06A60/ HT-820S06A60/ HT-824S06A60/ HT-817S06A80/ HT-820S06A80/ HT-824S06A80 no such function ）
		2	HT-	Headed negative electrode —— （HT-817S06A60/ HT-820S06A60/HT-824S06A60/HT-817S06A80/ HT-820S06A80/ HT-824S06A80 no such function ） HT-824S06A80on such function ）
		3	HT-	Headed negative electrode —— （HT-817S06A60/ HT-820S06A60/HT-824S06A60/HT-817S06A80/ HT-820006A80/ HT-824S06A80 no such function ）
		4	HT-	Headed negative electrode —— （HT-817S06A60/ HT-820S06A60 /HT-824S06A60/ HT-817S06A80/ HT-820S06A80/HT-824S06A80 no such function ）
		5	HT-	Headed negative electrode —— （HT-817S06A60/ HT-820S06A60/ HT-824S06A60/ HT-817S06A80/ HT-820S06A80/HT-824S06A80 no such function ）
		6	CD+	Charge indication input positive terminal —— （HT-817S06A60/HT-820S06A60/HT-824S06A60/ HT-817S06A80/ HT-820S06A80/ HT-824S06A80no such function ）
		7	CD-	Charge indication input negative terminal —— （HT-817S06A60/ HT-820S06A60/ HT-824S06A60/ HT-817S06A80/ HT-820S06A80/HT-824S06A80 HT-824S06A80 no such function ）
D1	Bluetooth connection indicator. When the protection board is connected to Bluetooth, the indicator is always on. When disconnected, the indicator blinks.。			
C-	Connect external load or charger negative			
B-	Connected to electric core negative			

3.3 Product Appearance

HT-820S06A100 HT-824S06A100 HT-820S1A150 HT-824S1A150 HT-824S2A150 HT-824S2A200 product appearance is shown in Figure 3.

Figure 3.   HT-820S06A100 HT-824S06A100 HT-820S1A150 HT-824S1A150 HT-824S2A150 HT-824S2A200 product appearance .

HT-817S06A60 HT-820S06A60 HT-824S06A60 HT-817S06A80 HT-820S06A80 HT-824S06A80 product appearance is shown in Figure 4.

Figure 4. HT-817S06A60 HT-820S06A60 HT-824S06A60 HT-817S06A80 HT-820S06A80 HT-824S06A80   Product Appearance.

3.4. Size

The size of HT-820S06A100/HT-824S06A100/HT-820S1A150/HT-824S1A150/
HT-824S2A150/HT-824S2A200 protection board is 162mm*102mm*20.4mm, and its dimensions are
shown in Figure 5.
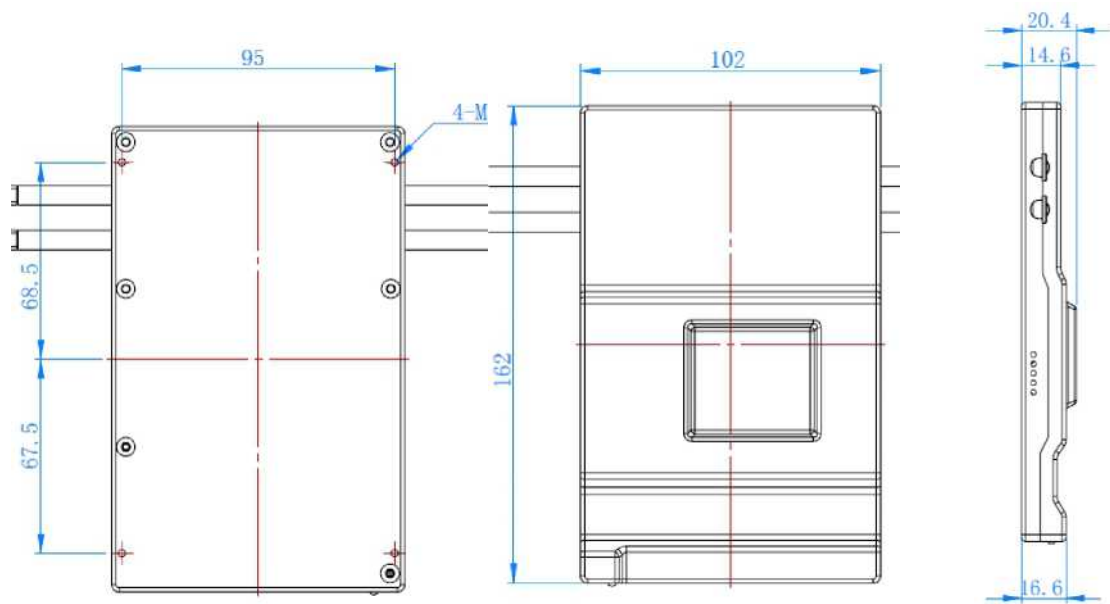
Figure 5. Outline Dimension Diagram of
HT-820S06A100/HT-824S06A100/HT-820S1A150/HT-824S1A150/
HT-824S2A150/HT-824S2A200

The size of HT-817S06A60/ HT-820S06A60/HT-824S06A60/HT-817S06A80/ HT-820S06A80/ HT-824S06A80　is 1 3 6 m m x 8 3 m m x 17.6mm, and the overall dimension is shown in Figure 6.
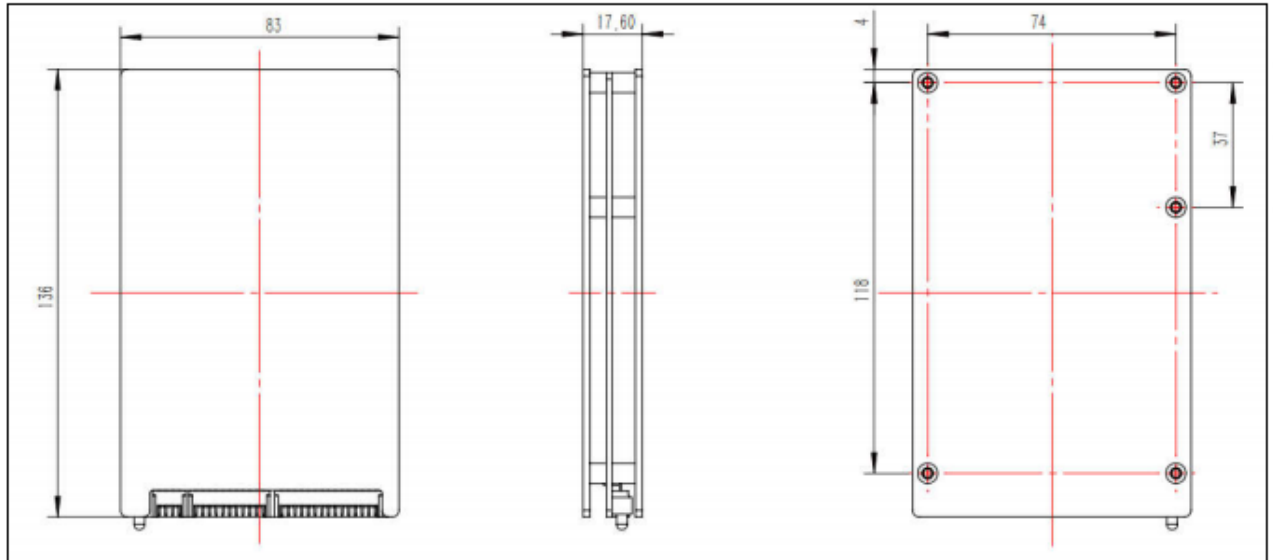
Figure6.Outline Dimension Drawing of HT-817S06A60/
HT-820S06A60/HT-824S06A60/HT-817S06A80/
HT-820S06A80/ HT-824S06A80

3.5 Weight

The weight of HT-817S06A60/ HT-820S06A60/HT-824S06A60/HT-817S06A80/
HT-820S06A80/ HT-824S06A80　protection board is about 257g .

The weight of HT-820S06A100/ HT-824S06A100 protection board is about 360g.

The weight of HT-820S1A150/ HT-824S1A150/ HT-824S2A150/ HT-824S2A200 is about 430 g

4 Installation Methods and Precautions

4.1 Unpacking Inspection and Precautions

Unpacking inspection and precautions are as follows:

a) The packing box and protection board shall be handled with care and not inverted as far as possible;

b) Before unpacking, pay attention to whether the package is in good condition, such as whether there are impact marks, damage, etc;

4.2 Wiring Diagram

HT-820S06A100/HT-824S06A100/HT-820S1A150/HT-824S1A150/HT-824S2A150 /HT-824S2A200 intelligent lithium battery protection board is suitable for 724 series of lithium battery packs and the battery pack wiring method is different for different numbers of batteries.
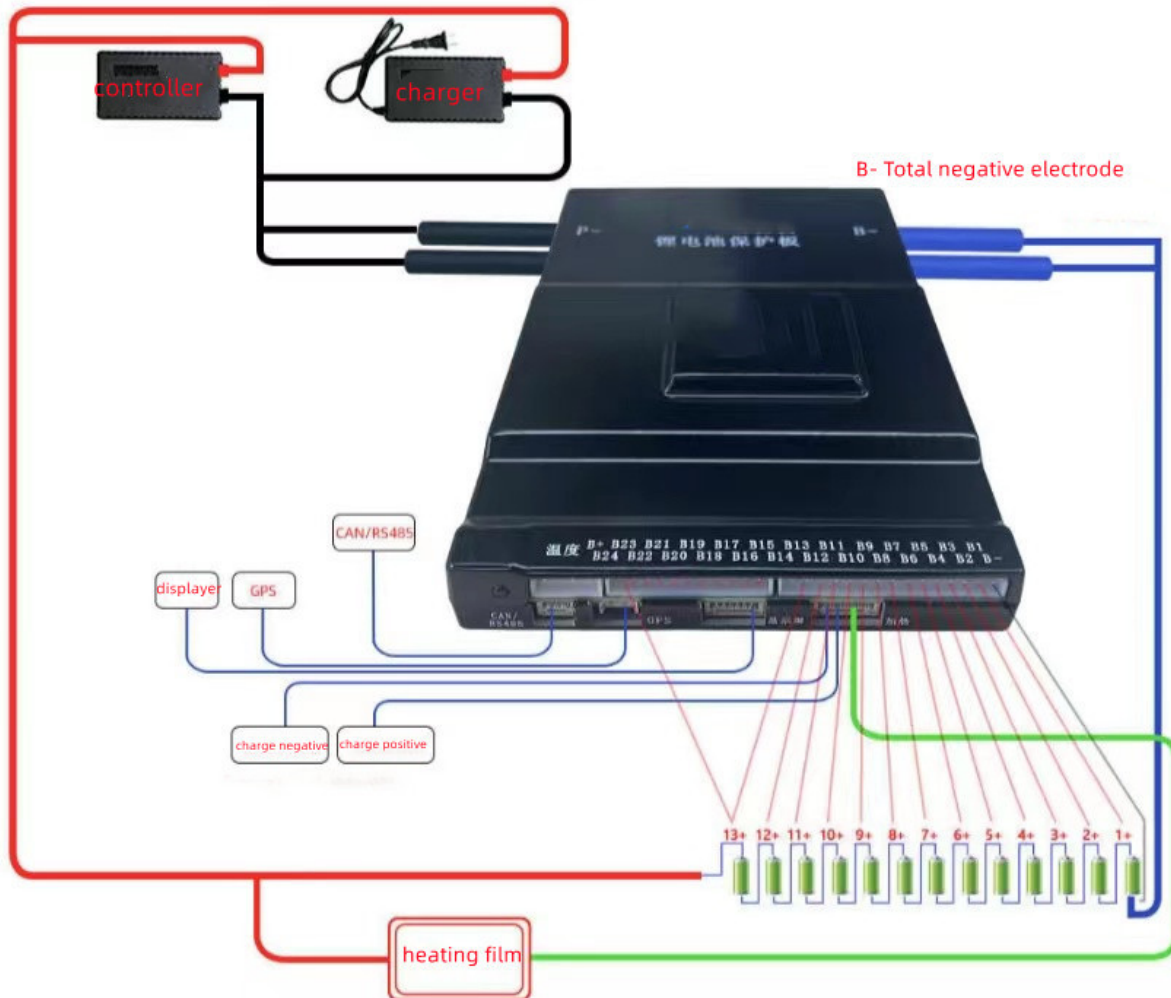
Figure7. heating function wiring diagram

For a battery pack with 24 strings in series, the installation and wiring method is shown in Figure 8.
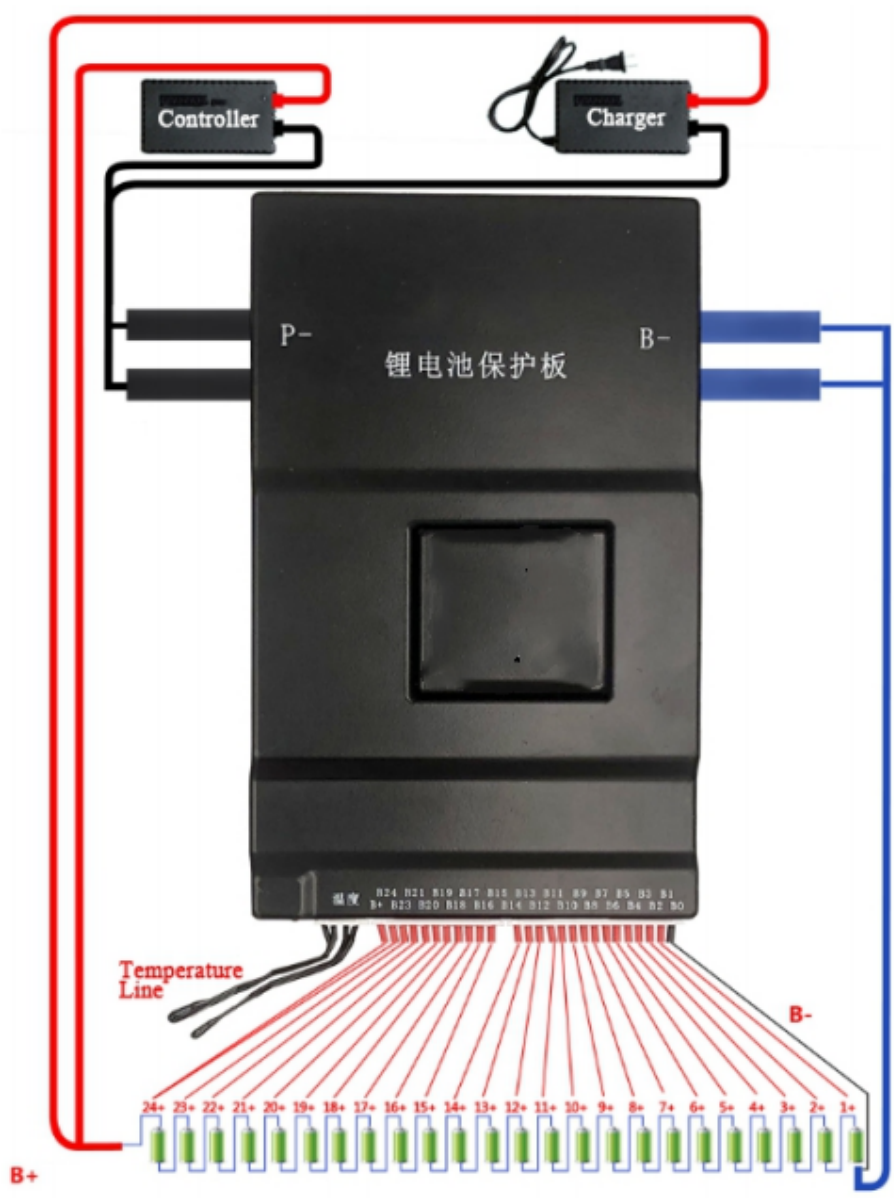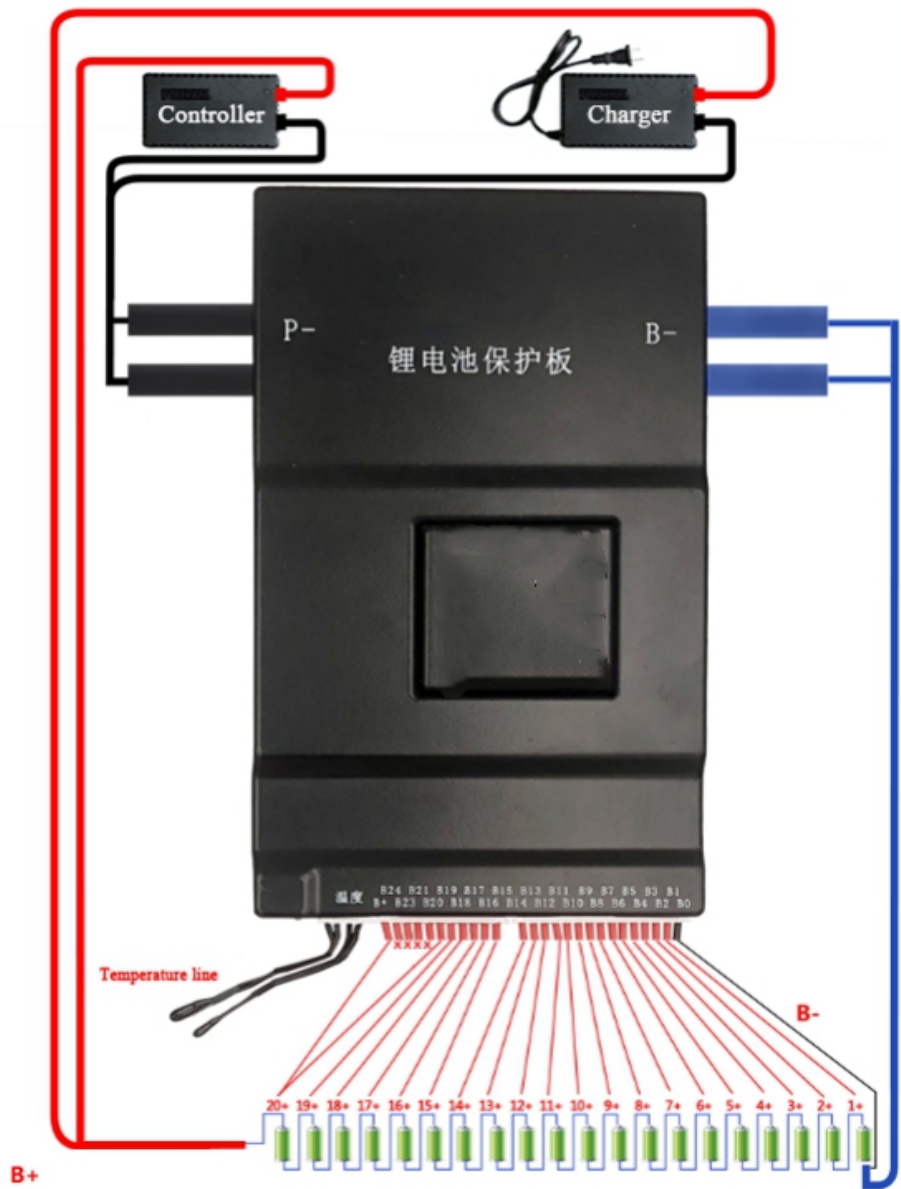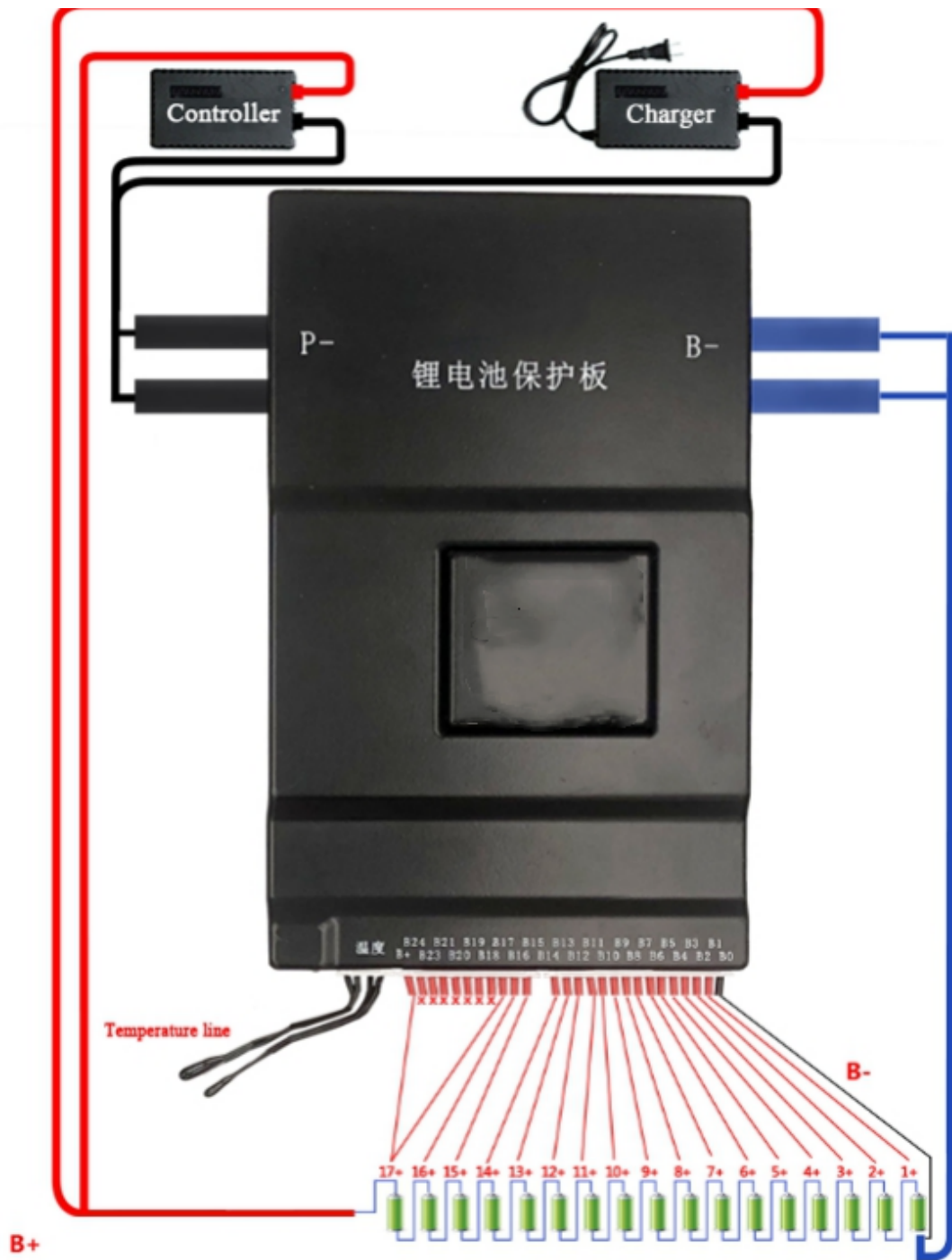
Figure 8. 24S Battery Wiring Diagram

For a battery pack with 20 strings in series, the installation and wiring method is shown in Figure9.

Figure 9. 20S Battery Wiring Diagram

For a battery pack with 1 7strings in series the installation and wiring method is shown in Figure 10.

Figure 10. 17S Battery Wiring Diagram

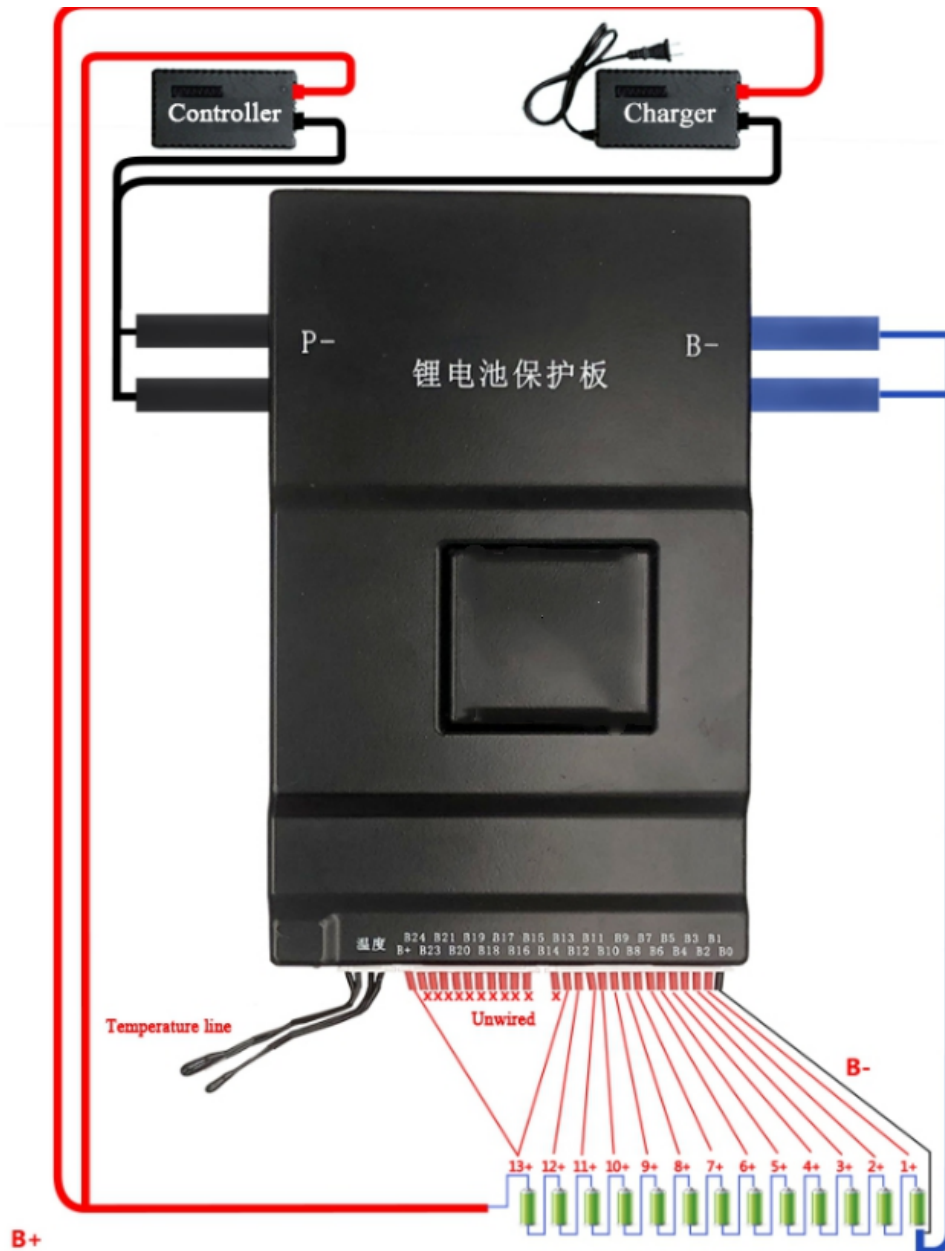For a battery pack with 13 strings in series, the installation and wiring method is shown in Figure 11..

Figure 11. 13S Battery Wiring Diagram

The HT-817S06A60/ HT-820S06A60/HT-824S06A60/HT-817S06A80/
HT-820S06A80/ HT-824S06A80 intelligent lithium battery protection board is suitable for 7-24
series of lithium battery packs and the battery pack wiring method is different for different
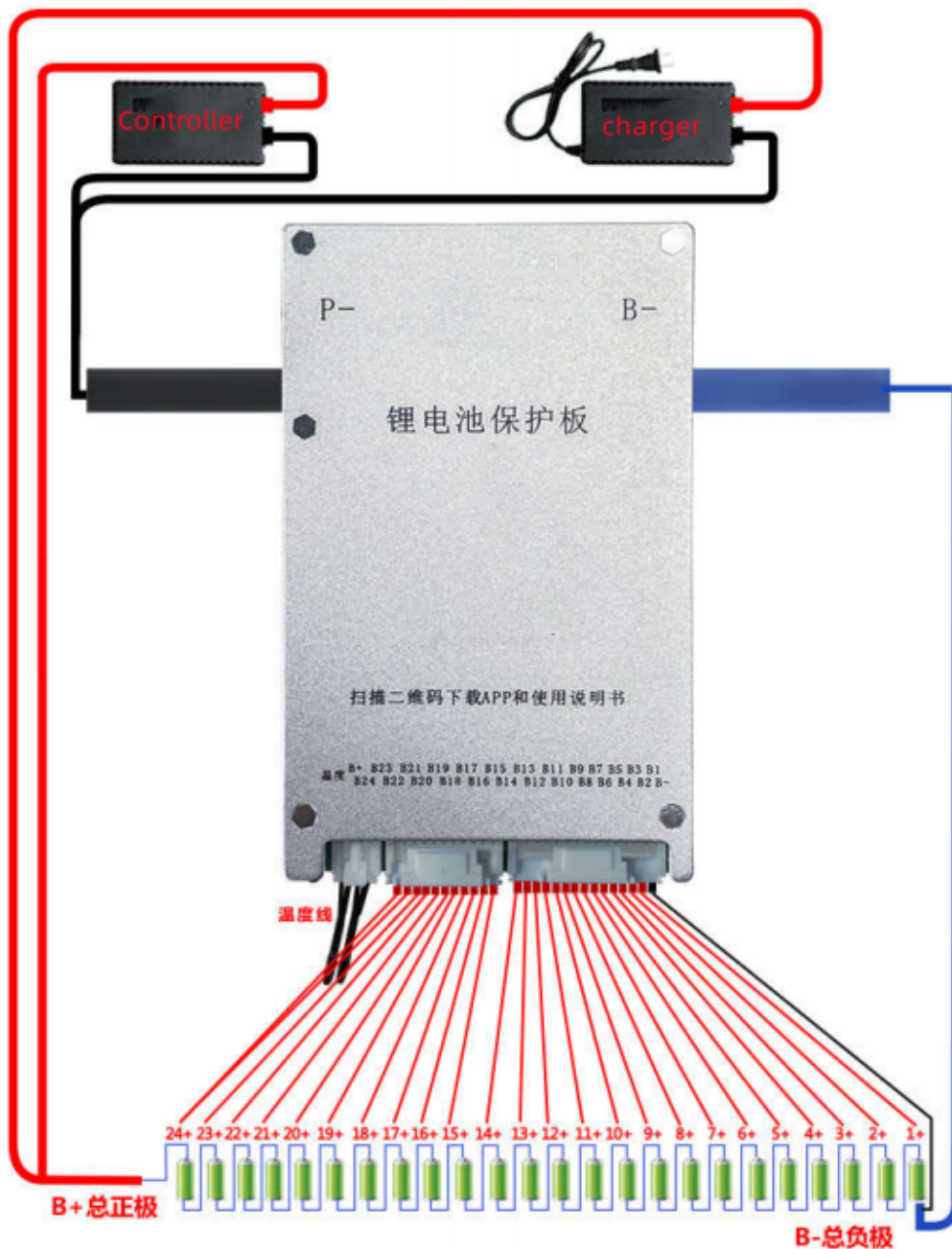numbers of batteries

Figure 12. 24S Battery Wiring Diagram

For a battery pack with 20 strings in series, the installation and wiring method is shown in Figure 13.
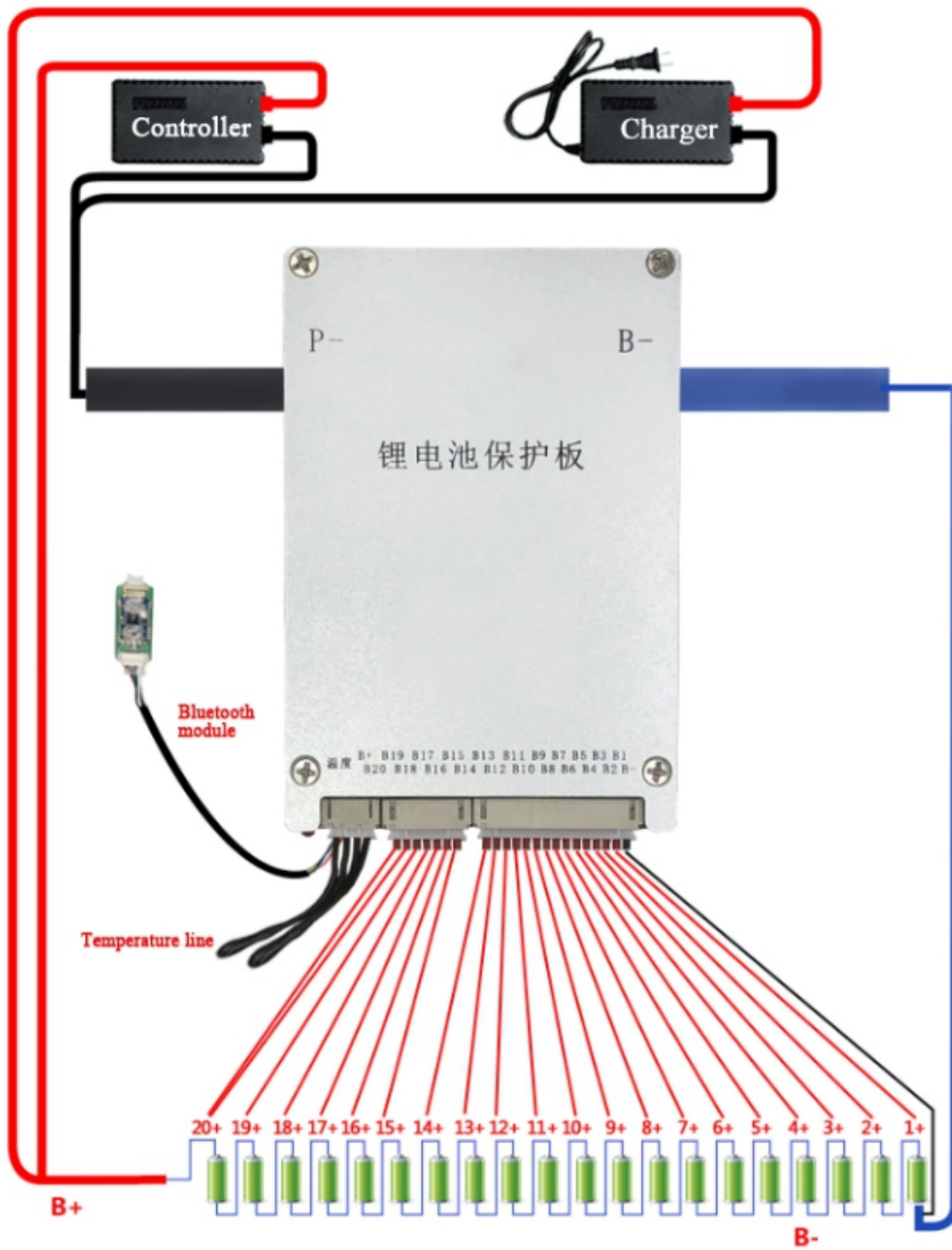
Figure 13. 20S Battery Wiring Diagram

For a battery pack with17 strings in series, the installation and wiring method is shown in Figure 12.
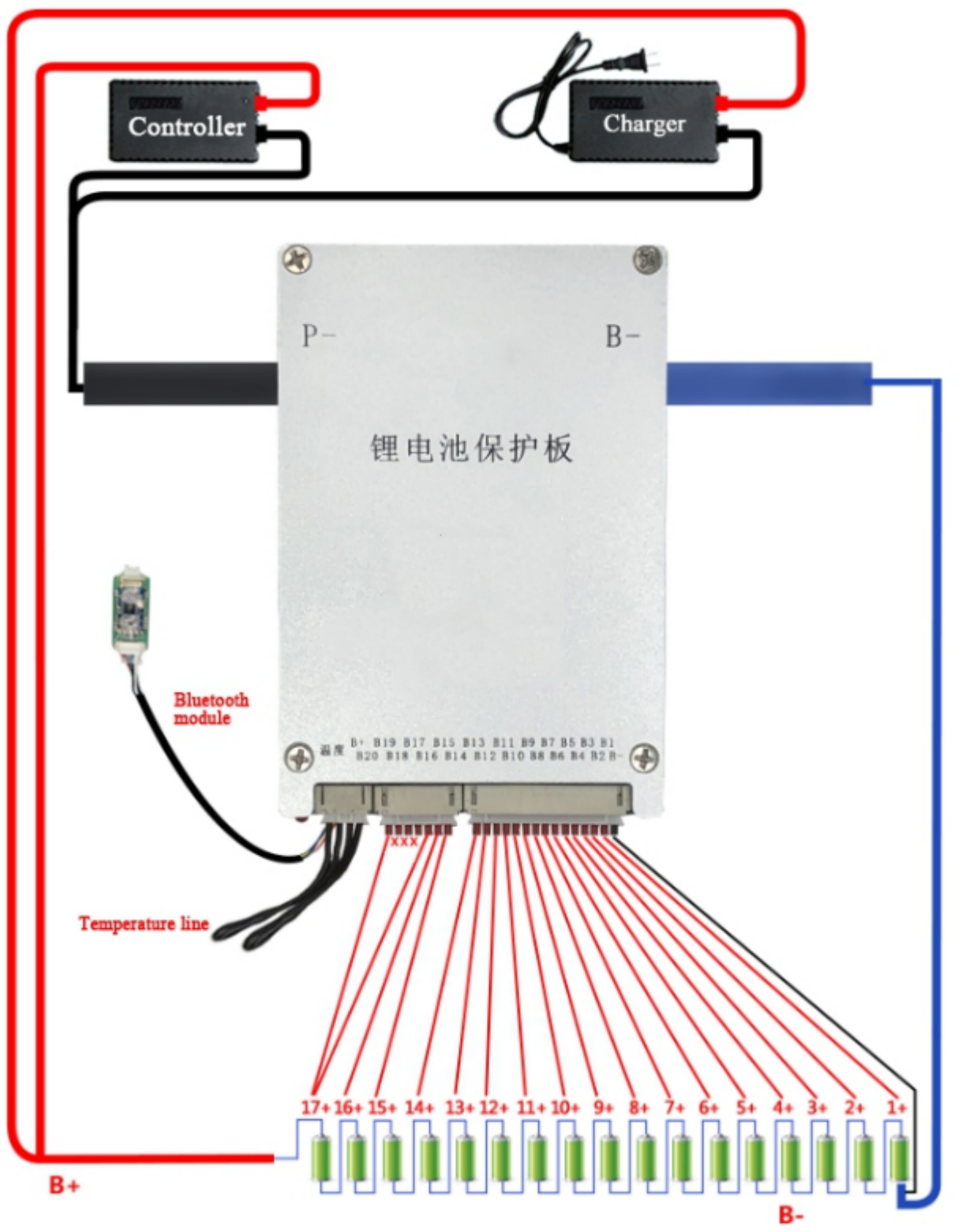
Figure 12. 17S Battery Wiring Diagram

For a battery pack with 13 strings in series, the installation and wiring method is shown in Figure 13.
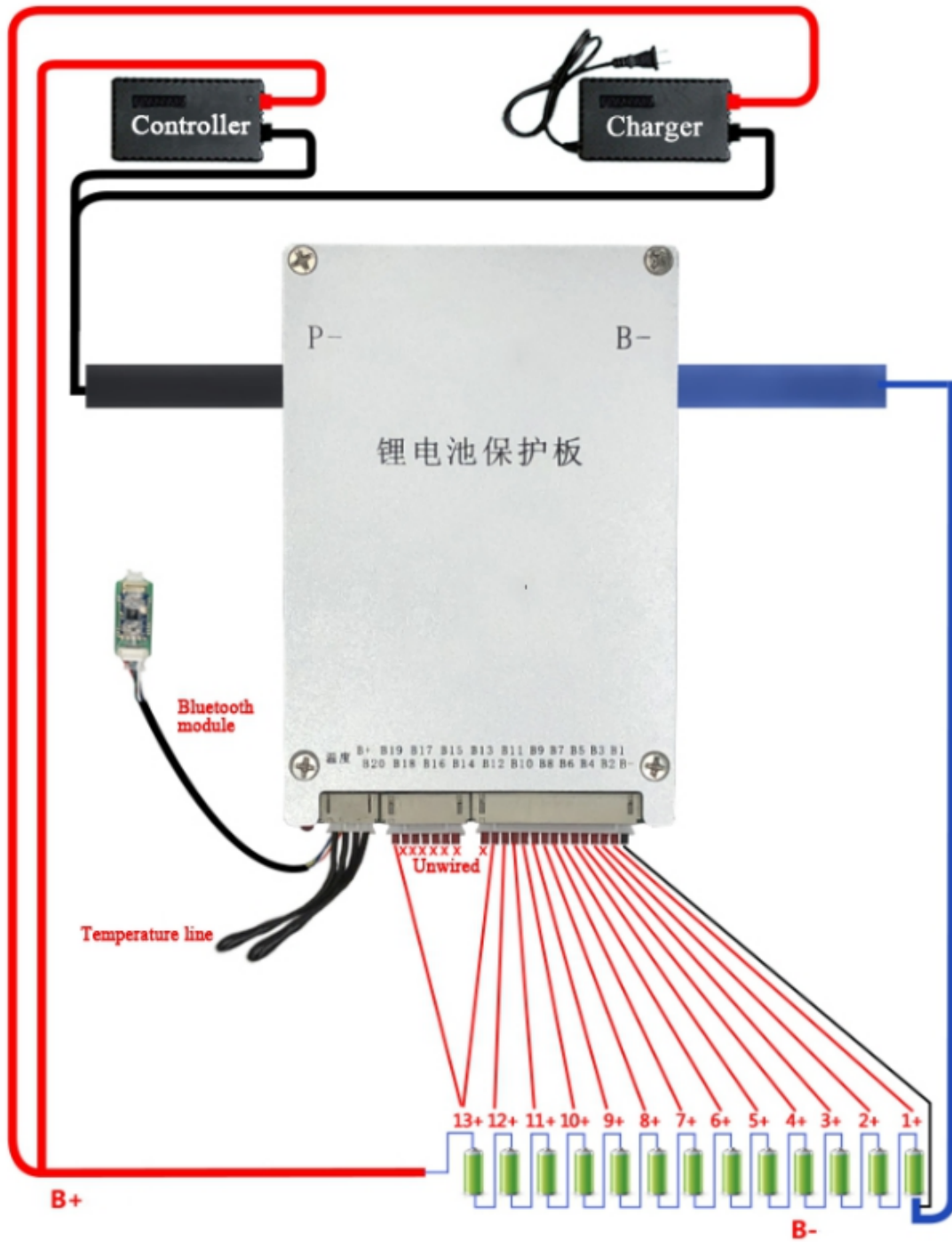
Figure 13.. 13S Battery Wiring Diagram
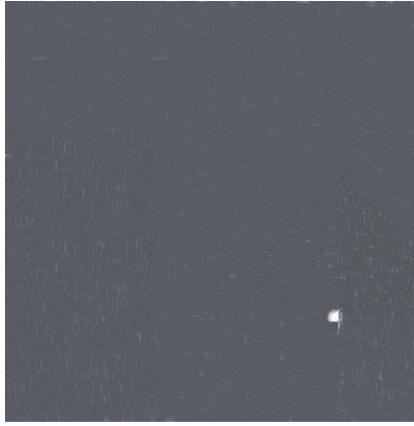
4.3App installation

Figure 14 QR code of mobile app link

5. Use and operation

5.1 Preparation and inspection before use

Before turning on the protection board, please confirm whether the balance line is connected normally and whether "C-" and "B-" are connected correctly. Check whether the protection board is securely fixed to the battery core, and then you can switch on the protection board after confirming that it is correct. Otherwise, it may cause serious consequences such as abnormal operation and even burnout.

5.2 Power on of protection board

After confirming that the above operations are correct, you can power on the protection board. The protection board does not have a power-on control switch, and is designed to be in a charging activation mode.**(meet the condition: the voltage of one charger is 5V higher than that of the battery)** That is, after the battery is assembled, the charger needs to be connected to start the protection board.

5.3 App operating instructions

5.3.1 Equipment operation

a) Equipment connection

First turn on the mobile phone's Bluetooth, and then open the APP, as shown in Figure 15.

Click the icon in the upper left corner to scan the device. After the scan is completed, **click the name of the device to be connected**, such as "JK-B1A24S". The APP will prompt for a password when connecting for the first time. The default password of the device is "1234". The APP will automatically record the password after the device is connected. There is no need to enter the password for the next connection. It will automatically connect after starting the APP, The password input interface is shown in Figure 16.
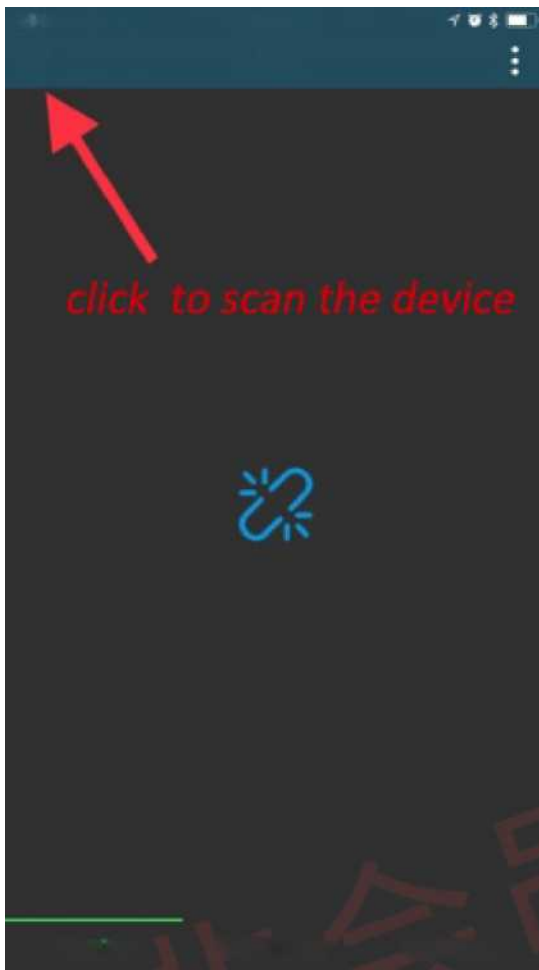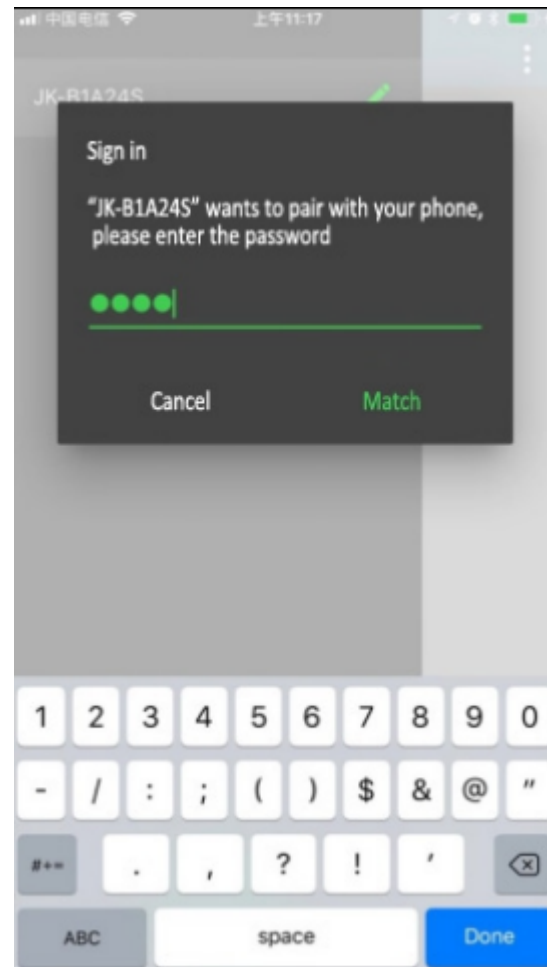
Figure.15 Device scanning   Figure16 .Password input

b) Change name and password

After the device is connected, click the **"pen type"** icon on the right side of the device list to modify the device name and password.

The interface for modifying the device name is shown in Figure 17. Note that the device name only supports English or numbers.

The password change interface is shown in Figure 18. To change the device password, you must first enter the old password of the device. Only when the current password is correct can you enter the new password entry option. After entering the new password twice, click 'OK' to complete the device password modification.
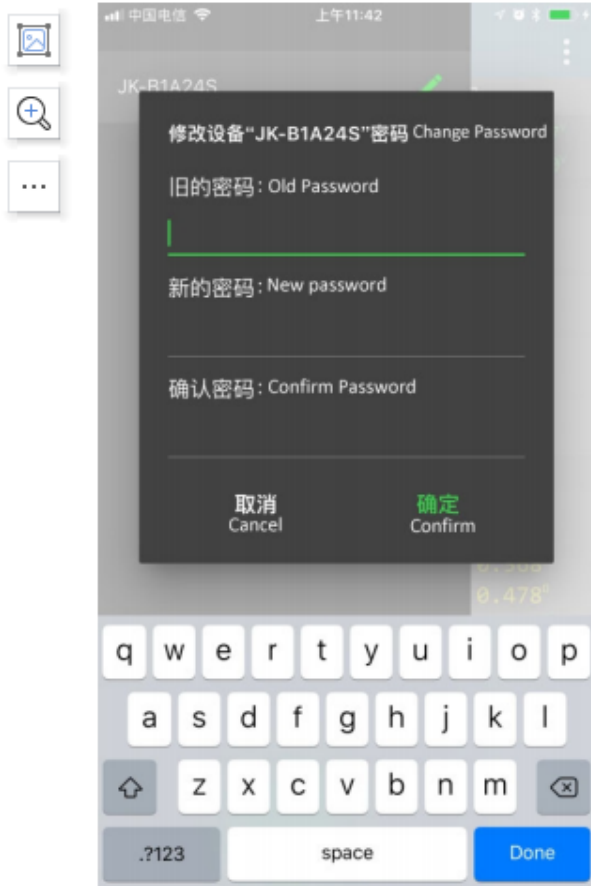
Figure 17 Name Modification   Figure 18 Password Modification

5.3.2 Status View

The real-time status interface is shown in Figure 19.
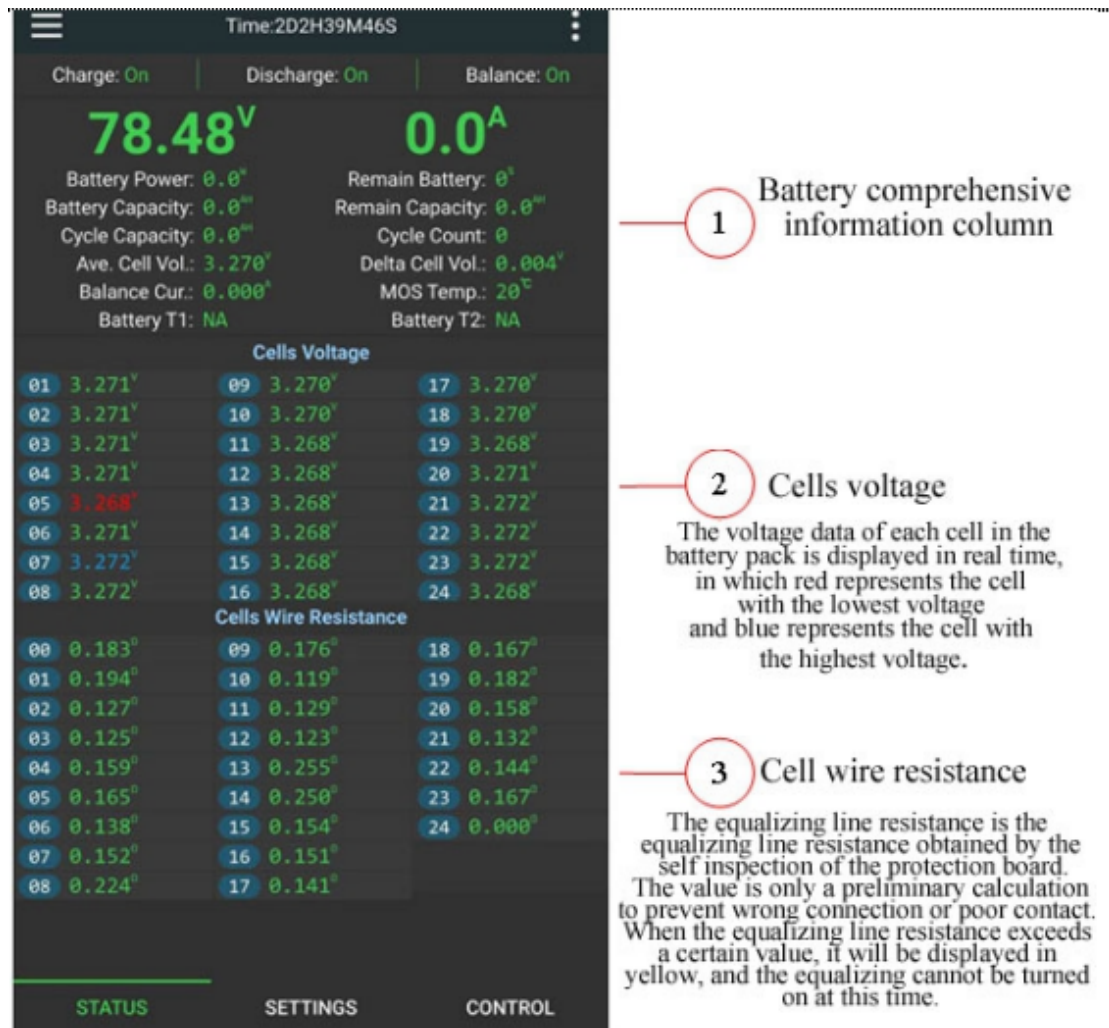
Figure19.The real-time status display.

The real-time status page is divided into 3 areas.

Area 1 in the figure is battery comprehensive information column. The parameters are defined as follows:

a) Time

The time indicates the total running time from the time the protection board is turned on until now.

b) Charging

Indicates the opening status of the current protection board charging MOS. When "on" is displayed, it means that the current protection board charging MOS is on and the battery is allowed to charge; when "off" is displayed, it means that the current

protection board charging MOS is off and the battery is not allowed to charge.

c) Discharge

Indicates the open status of the current protection board discharge MOS. When "on" is displayed, it means that the current protection board discharge MOS is on and the battery is allowed to discharge; when "off" is displayed, it means that the current protection board discharge MOS is off and the battery is not allowed to discharge.

d) Balance

Indicates the on / off status of the protection board. When "On" is displayed, the protection board will automatically balance after the balance starting conditions are met; when "Off" is displayed, it means that the balance is off, and the protection board will not balance the battery.

e) Voltage

The voltage area displays the current total voltage of the battery in real time, and the total voltage is the sum of all unit voltages.

f) Current

The current area displays the total current of the current battery in real time. When the battery is charging, the current is positive, and when the battery is discharging, the current is negative.

g) Battery Power

Represents the total power of the current battery output or input. Its value is the product of the current battery voltage and the absolute value of the battery current.

h) Remain Battery

Represents the percentage of current battery power remaining.

i) Battery Capacity

Represents the actual battery capacity calculated by the current protection board based on the high-precision SOC. The unit is AH. **(The value needs to be updated after the battery has completed a full discharge and charge cycle)**

j) Remain Capacity

Remaining capacity indicates the remaining capacity of the current battery, unit: AH.

k) Cycle Capacity

The cycle capacity indicates the cumulative discharge capacity of the battery, and the unit is AH.

l) Cycle Count

The Cycle Count indicates the number of charge saturation times of the current battery, the unit is: times.

m) Ave. Cell Vol.

The average cell voltage of the current battery unit: V.

n) Delta Cell Vol.

The Delta Cell Vol. represents the difference between the highest battery voltage and the lowest battery voltage of the entire battery pack. The unit is V

o) Balance CUR

When the protection board turns on the balance function and reaches the balance condition, it displays the balance current in real time. Unit: A.

When the balance is performed, the status display area of the real-time status, blue represents a discharged battery, and red represents a charged battery.

When balance is in progress, the status display area of the real-time status, blue represents the discharged battery, and red represents the charged battery. The negative current of balance current indicates that the battery is discharging. At this time, the blue flashes. The positive current of balance current indicates that the battery is charging. At this time, the red flashes.

Active balance technology is used in the protection board. The principle of balance is to take power from the high-voltage core, store it in the protection board, and then put it into the low-voltage core.

p) MOS Temp

Real time display of the temperature of current protection board power MOS, unit: °C.

q) Battery T1

Display "Na" when the temperature sensor 1 is not installed, and display the temperature of the temperature sensor 1 in real time when the temperature sensor is installed, unit: °C.

r) Battery T2

Display "NA" when the temperature sensor 2 is not installed, and display the temperature of the temperature sensor 2 in real time when the temperature sensor is installed, unit: °C.

In the figure, area 2 is the voltage area of single body. The voltage data of each cell in the battery pack is displayed in real time, in which red represents the cell with the lowest voltage and blue represents the cell with the highest voltage.

Area 3 in the figure is the area of cells wire resistance. The cells wire resistance is obtained by the self inspection of the protection board. The value is only a preliminary calculation to prevent wrong connection or poor contact. When the cells wire resistance exceeds a certain value, it will be displayed in yellow, and the balance cannot be turned on at this time.

5.3.3 Parameter Setting

The parameter setting page is shown in Figure 20

Figure20.Parameters Settings

In the parameter setting page, you can modify the working parameters of the protection board. The definitions of each parameter are as follows.

a) LIFEPO4

This function button can modify all the working parameters of the protection board into the parameters of the iron-lithium battery. For the default values of the parameters, see Appendix I.

b) Ternary lithium

This function button can modify all the working parameters of the protection board into the parameters of the iron-lithium battery. For the default values of the parameters, see Appendix II.

c) LTO

Function This button can modify all the working parameters of the protection board to the parameters of the lithium titanate battery. The default values of the parameters are shown in the appendix.

d) Cells Count

The cells count represents the number of cells in the current battery. Before use, please set this value accurately, otherwise the protection board will not work properly.

e) Battery Capacity

This value is the design capacity of the battery.

f) Trigger Diff Volt

Triggered balance difference Voltage is the only parameter that controls balance. When the balance switch is on, when the maximum difference voltage of the battery pack exceeds this value, the balance starts, and the balance ends when the difference voltage is lower than this value. For example, the balance trigger voltage difference is set to 0.01V. When the battery pack voltage difference is greater than 0.01V, balance is started, and when the battery pack voltage difference is lower than 0.01V, the balance is ended. (It is recommended that the balance trigger difference voltage of the battery above 50AH is 0.005V, and the balance trigger difference voltage of the battery below 50AH is 0.01V)

g) Voltage Calibration

The voltage calibration function can be used to calibrate the accuracy of the equalizer voltage acquisition.

When there is an e □ or between the total voltage collected by the protection board and the total voltage of the battery, you can use the voltage calibration function to calibrate the protection board. The calibration method is to fill in the total battery voltage that is currently measured, and then click "Small Plane" behind the voltage calibration to complete the calibration.

h) "Cell UVP" and "Cell UVPR"

"Cell Low-voltage Protection" refers to the cut-off voltage of the battery cell. As long as the voltage of any cell in the battery pack is lower than this value, the "Cell Low-voltage Alarm" will be generated. At the same time, the protection board will turned off to discharge MOS, at this time, the battery can not discharge, but can only charge.When the alarm occurs, only after the voltage of all the cells exceeds the value

of "Cell Voltage Recovery" the protection board releases the "Cell Low-voltage Alarm" and turns on the discharge MOS at the same time.

i) "Cell OVP", "Cell OVPR"

"Cell OVP" refers to the saturation voltage of the cell. As long as the voltage of any single cell in the battery pack exceeds this value, a "single overcharge alarm" will be generated. At the same time, the protection board will turn off the MOS for charging. At this time, the battery cannot be charged and can only be discharged. After the alarm is generated, only when the voltage value of all cell is lower than the value of "Cell OVPR", the protection board will release the "cell overcharge alarm" and open the charging MOS at the same time.

j) Power Off Vol.

The Power Off Vol. indicates the lowest working voltage of the protection board. When the highest voltage of the cell in the battery pack is lower than this value, the protection board is closed. The value must be lower than "unit low-voltage protection".

k) "Max Charge Current.", "Charge OCP Delay", "Charge OCPR Time"

When charging the battery pack, if the current exceeds the "Max Charge Curr" and the duration exceeds the time of "Charge OCP Delay", the protection board will generate "charging over-current alarm" and turn off the charging MOS at the same time. After the alarm is generated, after the time of "Charge OCPR Time", the protection board will release the charging over-current alarm and restart the charging MOS.

For example, set "Max Charge Curr." as 10A, "Charge OCP Delay" as 10s, "Charge OCPR Time" as 50s. In the charging process, if the charging current exceeds 10A continuously for 10 seconds, the protection board will generate "charging over-current alarm" and close the charging MOS. 50 seconds after the alarm is generated, the "charging over-current alarm" will be released. At the same time, the protection board will restart the charging MOS.

l) "Max Discharge Curr.", "Discharge OCP Delay", "Discharge OCPR Time"

When the battery pack is discharged, when the current exceeds the "Max Discharge Curr." and the duration exceeds the time of "Discharge OCP Delay", the protection board will generate a "discharge over-current alarm" and close the discharge MOS at the same time. After the alarm is generated, after the time of "Discharge OCPR Time", the protection board releases the "discharge over-current alarm" and turns on the discharge MOS again.

For example, set "Max Discharge Curr" as 100A, "Discharge OCP Delay" as 10s, "Discharge OCPR Time" as 50s. During the discharge process, if the discharge current exceeds 100A continuously for 10 seconds, the protection board will generate a "discharge over-current alarm" and turn off the discharge MOS. 50 seconds after the alarm is generated, the "discharge over-current alarm" will be released, and the protection board will restart the discharge MOS.

m) SCPR Time.

When the short-circuit protection occurs, the short-circuit protection will be released after the set time of "SCPR Time".

n) Max Balance Cu ˑ

The balance current it represents the continuous current of high-voltage battery discharge and low-voltage battery charging in the process of energy transfer.

The maximum balance current is the maximum current in the process of energy transfer, and the maximum balance current should not exceed 0.1C. For example: 20Ah battery shall not exceed 20 * 0.1 =2A.

o) "Charge OTP", "Charge OTPR"

During the charging process, when the battery temperature exceeds the value of "Charge OTP", the protection board will generate a "charging over temperature protection alarm", and the protection board will turn off charging MOS. After the alarm is generated, when the temperature is lower than "Charge OTPR", the "charging over temperature protection alarm" will be released, and restart the charging MOS.

p) "Charge UTP", "charge UTPR"

During the charging process, when the battery temperature is lower than the value of "Charge UTP", the protection board will generate a "low temperature protection for charging alarm" , and the protection board will turn off the MOS for charging. After the alarm is generated, when the temperature is higher than "charge UTPR", the protection board will release the warning of "low temperature protection of charging alarm" and restart the MOS of charging.

q) "MOS OTP", "MOS OTPR"

When the MOS temperature exceeds the value of "MOS OTP", the protection board will generate "MOS over temperature alarm" and close the charge discharge MOS at the same time. The battery cannot be charged or discharged. After the alarm is generated and the MOS temperature is lower than the value of "MOS OTPR", the protection board will release the "MOS over temperature alarm" and restart the charge and discharge MOS (the MOS over temperature protection value is 100 °C, the MOS over temperature recovery value is 80 °C, these two values are factory default values and cannot be modified).

Attention:

Any parameter modification, please refer to the manual, improper parameters may make the protection board can not work properly, or even burn the protection board.

After any parameter is modified, you need to click "small aircraft" behind the parameter to complete parameter distribution. After the equalizer successfully receives the parameter, it will send out a "drip" sound.

5.3.4 BMS Control

The BMS control page is shown in the figure 21. Through BMS control, the charging function, discharging function and balancing function of the protection board can be switched on and off, and the power supply of protection can be closed and factory settings can be restored.
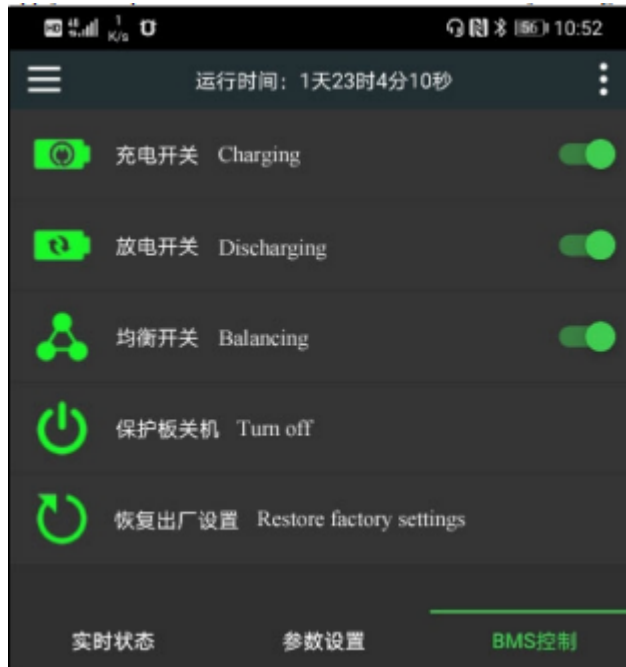
Figure 21. The BMS control page

6 Safety Protection Measures and Precautions

The protection board itself does not have high voltage, which will not cause electric shock to the body.

Please read the instruction manual carefully before use, connect according to the correct wiring diagram of different strings, and connect from the negative pole to the positive pole. After the balanced wire is connected, confirm it with a multimeter again, and insert the protection board after confirmation.

It is not allowed to modify the power line of the protection board without permission. Unauthorized modification of the power line will cause the protection board to overcurrent and burn the protection board.

7 Transportation and Storage

7.1 Transport

The products after packing are not directly affected by the rain, snow and violent bump, it can be transported by normal means of transportation.It is not allowed to put together with acid, alkali and other corrosive substances during transportation.

7.2 Storage

The packed products shall be stored in a permanent warehouse with a temperature of 0 °C ~ 35 °C and a relative humidity of no more than 80%.There should be no acid, alkali and corrosive gas in the storeroom, no strong mechanism vibration and shock, and no strong magnetic field.

Appendix "one bond lithium iron", "one bond ternary" and "one bond lithium titanate" default parameters

No.	Parameter	Lithium Iron Default	Ternary Lithium Default	lithium titanate Default	Unit
1	Cell Low-voltage Protection	2.9	2.6	1.8	V
2	Cell Low-voltage Protection Recovery	3.2	3.0	2.0	V
3	Cell Overcharge Voltage	4.2	3.6	2.7	V
4	Cell Overcharge Protection Recovery	4.1	3.4	2.4	V
5	Trigger Balance Differential Voltage	0.01	0.01	0.01	V
6	Power Off Voltage	2.8	2.5	1.7	V
7	Charge Over-Current Protection	30	30	30	S
8	Charge Over-Current Protection Recovery Time	60	60	60	S
9	Discharge Over-Current Protection Delay	30	30	30	S
10	Discharge Over Current Protection Recovery Time	60	60	60	S
11	Short Circuit Protection Recovery Time	60	60	60	S
12	Charge Over Temperature Protection	60	60	60	C
13	Charging Over Temperature Protection Recovery	55	55	55	°C
14	Discharge Over Temperature Protection	60	60	60	°C
15	Discharge Over Temperature Protection Recovery	55	55	55	C
16	Charging Low Temperature Protection	-20	-20	-20	C
17	Charging Low Temperature Protection Recovery	-10	-10	-10	C
18	MOS Over Temperature Protection	75	75	75	C
19	MOS Over Temperature Protection Recovery	70	70	70	C