

# **Smart Active Balancing Relay-Control BMS**

## **User Manual (HT-S252ARP)**

**Heltec Energy**

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## 1. Introduction

The HT-S252ARP battery management system is tailored for high-capacity series connected lithium battery packs. This system is suitable for battery packs ranging from 8 to 25 strings and has functions such as battery protection, voltage acquisition, and voltage balancing. The balancing function of this system uses super-capacitors as the medium to achieve active energy transfer balancing. During the operation of the system, battery protection functions such as overcharge, over-discharge protection, and short circuit protection are implemented, and energy transfer is carried out with a continuous maximum balanced current of 2A. The balanced current does not depend on the voltage difference of the series connected battery cells in the battery pack. The voltage collection range is 1V to 5V, with an accuracy of  $\pm 3\text{mV}$ . External communication interfaces can choose from RS485 bus, CAN bus, GPS interface, or LCD display interface. Suitable for all types of batteries on the market, such as lithium iron phosphate, lithium ternary, titanium acid, lithium lead-acid, etc.

The system has Bluetooth communication function and is equipped with mobile App software. You can connect to the device system through Bluetooth to view individual battery voltage, view balance status, modify setting parameters, and other operations. It can be applied in the battery pack of small sightseeing vehicles, scooters, forklifts, shared cars, high-power energy storage, backup power supply for base stations, solar power stations, and other products, and can also be used for battery balancing maintenance, repair, and other occasions.

This BMS is a relay-control model, which can support max **1000A** current. It needs at least two relays to start operation in general. Contact us to determine exactly how many relays will you need for your application.

## 2. Main Technical Parameters

### 2.1 Main Functions and Technical Indicators

- Support 8 to 25 series of battery packs;
- The over-charge, over-discharge voltage protection, and over-current protection parameters can be set through the APP, with short-circuit protection function;
- Real time and active balancing, with a balancing current of 2A, and a voltage difference between batteries after balancing  $\leq 5\text{mV}$ ;
- Support charging, discharging, and pre-charging relay control functions, with relay drive voltage of 12V;
- Supports 3 temperature probes;
- Single cell voltage range 1V~4.5V, accuracy  $\pm 5\text{mV}$ ;
- Equipped with Coulomb meter function;
- Suitable for high capacity ternary, lithium iron, lithium titanate and other lithium battery packs;
- Bluetooth communication function, equipped with an APP, allowing real-time viewing of battery cell status;
- Support external interfaces: GPS interface, CAN interface, RS485 needs to be customized;
- Low voltage shutdown function to prevent battery damage caused by over discharge;
- Heating function, supporting up to 5A heating current;
- Support ACC ignition switch for key start discharge;
- shunt specification setting function for easy replacement of different shunts.

### 2.2 Environmental Conditions for Use

- Working temperature range:  $-20\text{ }^{\circ}\text{C}\sim 70\text{ }^{\circ}\text{C}$ ;
- Power requirements: 16V~100V, can be powered by batteries or external power sources.

- Power consumption: The maximum power consumption of the protection board is 1.5W (excluding relay power consumption), and the shutdown power consumption is 20mW.

### 3. Connector and Interface Description

#### 3.1 Front Panel Connector and LED Light Position Description

The positions of the front connector and the illuminated switch are shown in Figure 1.

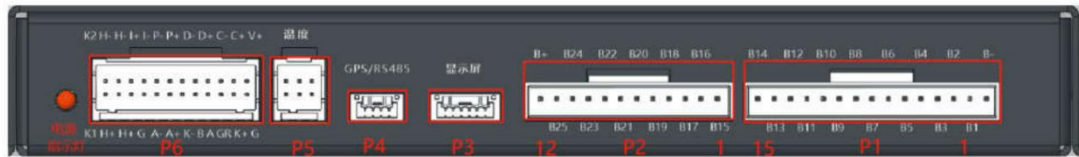


Figure 1. Connector Diagram

#### 3.2 Definition and Description of Front Panel Connectors and Illuminated Switches

The definition of the front panel connector is shown in Table 1.

Table 1. Connector Definition

Connector	No.	Name	Definition
P1	1	B-	Battery total negative electrode
	2	B1	1 <sup>st</sup> string battery positive pole
	3	B2	2 <sup>nd</sup> string battery positive pole
	4	B3	3 <sup>rd</sup> string battery positive pole
	5	B4	4 <sup>th</sup> string battery positive pole
	6	B5	5 <sup>th</sup> string battery positive pole
	7	B6	6 <sup>th</sup> string battery positive pole
	8	B7	7 <sup>th</sup> string battery positive pole
	9	B8	8 <sup>th</sup> string battery positive pole

	10	B9	9 <sup>th</sup> string battery positive pole
	11	B10	10 <sup>th</sup> string battery positive pole
	12	B11	11 <sup>st</sup> string battery positive pole
	13	B12	12 <sup>nd</sup> string battery positive pole
	14	B13	13 <sup>rd</sup> string battery positive pole
	15	B14	14 <sup>th</sup> string battery positive pole
P2	1	B15	15 <sup>th</sup> string battery positive pole
	2	B16	16 <sup>th</sup> string battery positive pole
	3	B17	17 <sup>th</sup> string battery positive pole
	4	B18	18 <sup>th</sup> string battery positive pole
	5	B19	19 <sup>th</sup> string battery positive pole
	6	B20	20 <sup>th</sup> string battery positive pole
	7	B21	21 <sup>st</sup> string battery positive pole
	8	B22	22 <sup>nd</sup> string battery positive pole
	9	B23	23 <sup>rd</sup> string battery positive pole
	10	B24	24 <sup>th</sup> string battery positive pole
	11	B25	25 <sup>th</sup> string battery positive pole
	12	B+	Battery total positive electrode
P3	Display interface		
P4	GPS interface		
P5	上 1	T1	Thermal sensor 1 positive
	上 2	T2	Thermal sensor 2 positive
	上 3	T3	Thermal sensor 3 positive
	下 1	GP	Thermal sensor ground
	下 2	GP	Thermal sensor ground
	下 3	GP	Thermal sensor ground

No.	Printing	Cable ID	Definition
上 1	K2	K-O2	Reserved pins

P6	上 2	H-	Heat-	Heating switch negative
	上 3	H-	Heat-	Heating switch negative
	上 4	I+	C-sence+	Shunt positive
	上 5	I-	C-sence-	Shunt negative
	上 6	P-	Pre-char-	Pre charge switch negative
	上 7	P+	Pre-char+	Pre charge switch positive
	上 8	D-	Dis-char-	Discharge switch negative
	上 9	D+	Dis-char+	Discharge switch positive
	上 10	C-	Char-	Charging switch negative
	上 11	C+	Char+	Charging switch positive
	上 12	V+	VIN	Protection board power supply positive
	下 1	K1	K-O1	Reserved pins
	下 2	H+	Heat+	Heating switch positive
	下 3	H+	Heat+	Heating switch positive
	下 4	G	GND	Protection board power supply negative
	下 5	A-	ACC-	Ignition switch negative
	下 6	A+	ACC+	Ignition switch positive
	下 7	K-	R12/CD-	No Connection
	下 8	B	485-B/CAN-L	485-B/CAN-L, CAN-L by default
	下 9	A	485-B/CAN-H	485-B/CAN-H, CAN-L by default
	下 10	GR	GND-TR	RS485/CAN Ground
	下 11	K+	K+/CD+	Charging switch positive
	下 12	G	GND	Protection board power supply negative
	LED Light	Indicator light		Power indicator light

### 3.3 Product Appearance

The product appearance is shown in Figure 2.

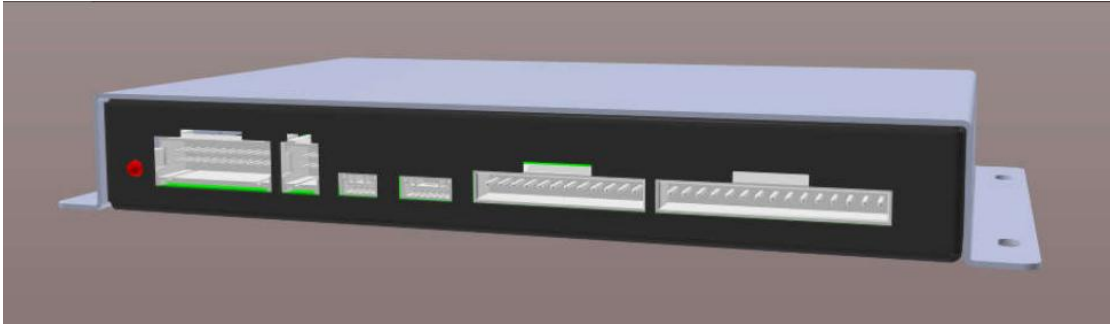
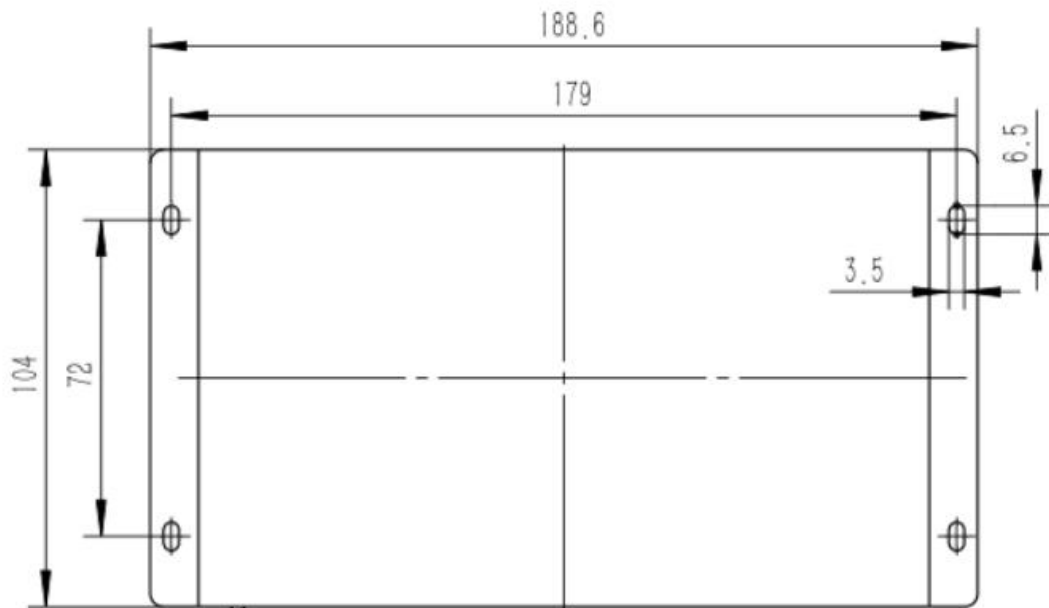


Figure 2. HT-S252ARP Renderings - Front

### 3.4 Dimension

The size of HT-S252ARP protection board is 188.6mm\*94mm\*23.5mm, the appearance and installation hole position dimensions are shown in Figure 3.





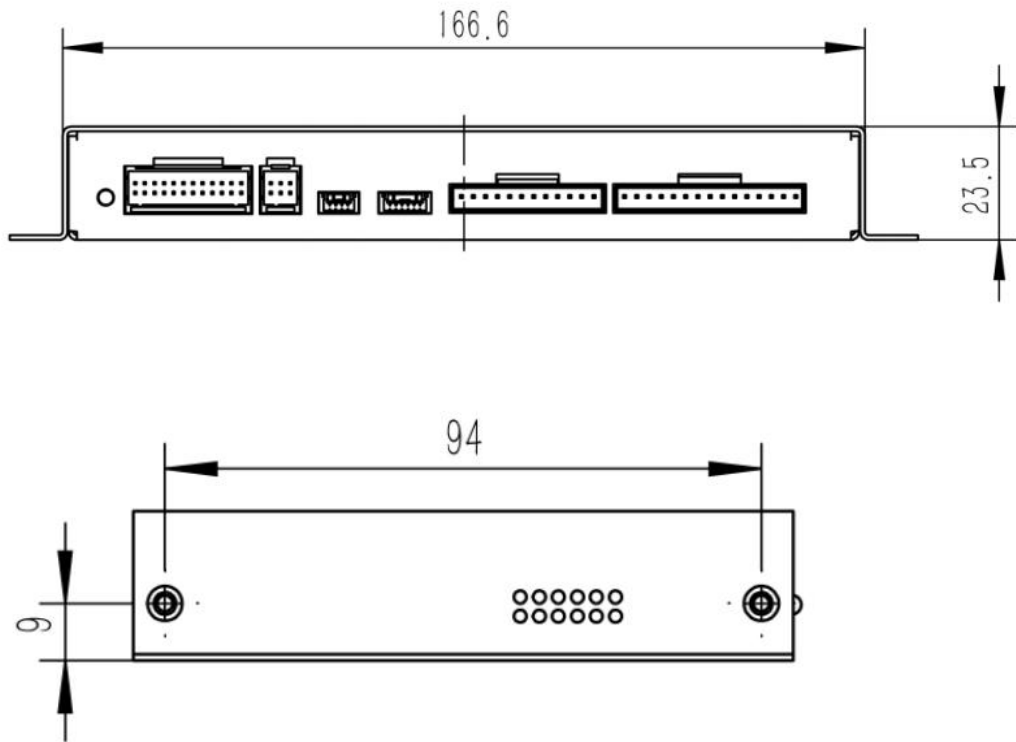


Figure 3. HT-S252ARP Outline Dimensional Drawing

### 3.5 Dimension of Shunt

The standard shunt uses a maximum current of 500A and a full range voltage difference of 75mv. The dimensions are shown in Figure 4.

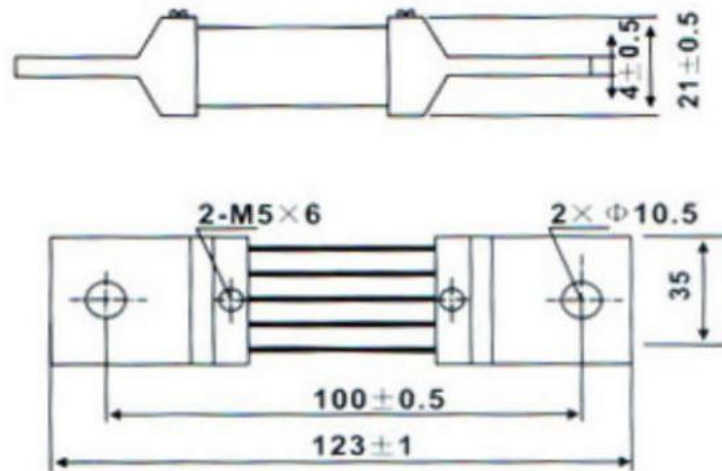


Figure 4. Outline Dimensional Drawing of Shunt

### **3.6 Weight**

The battery management system weighs approximately 700g.

## **4. Installation Methods and Precautions**

### **4.1 Unpacking Inspection and Precautions**

- Handle packaging boxes, equalizers, etc. with care and try not to invert them;
- Before opening the box, pay attention to whether the packaging is intact, such as whether there are any impact marks or damages;
- Take sufficient anti-static measures, such as wearing anti-static clothing, wearing anti-static gloves, and wearing anti-static wristbands. After full discharge, open the anti-static bag and take out the equalizer to check if the appearance of the equalizer is intact.

### **4.2 Installation of BMS Equipment**

The HT-S252ARP battery management system is suitable for 8-25 series battery packs. The wiring method of the 25 series battery pack system is shown in the figure 5.

(Note: For chargers with 12V auxiliary power supply, it is necessary to connect the positive pole of the auxiliary power supply to K+ and the positive pole of the auxiliary power supply to the negative pole of the charger.)

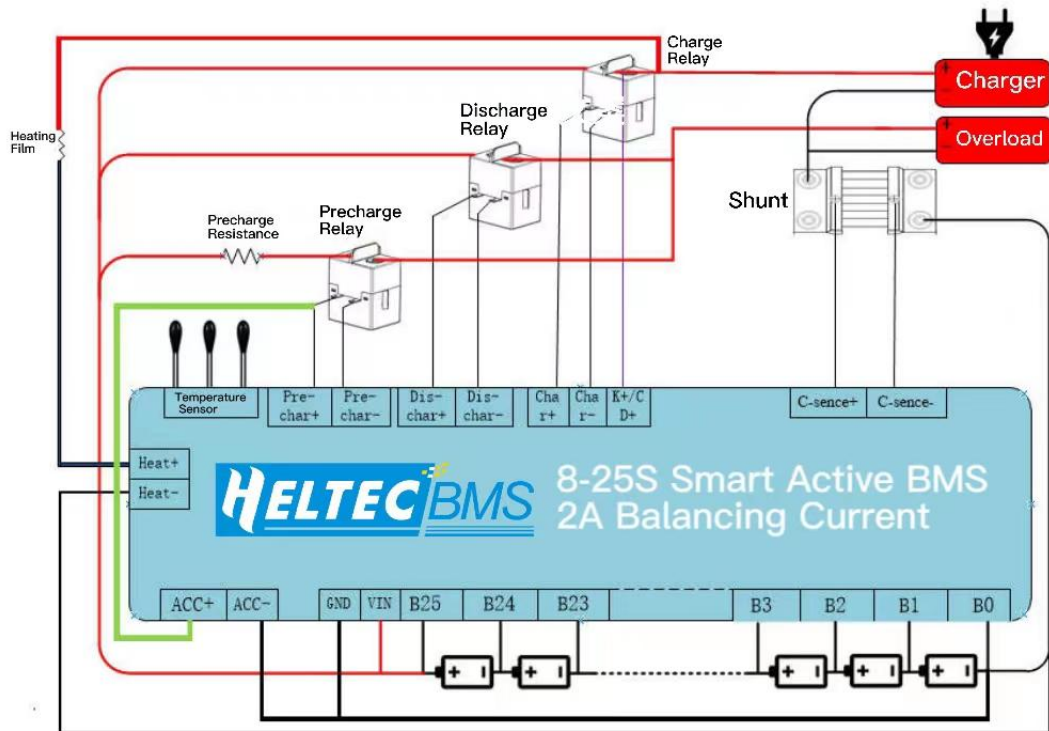


Figure 5. 25S Battery Pack System Wiring Diagram

### 4.3 APP Installation

By scanning the QR code shown in Figure 6, users can obtain a mobile app (Android) that matches the product. IOS mobile users can directly search for "JK BMS" in the Apple Store App Store to download and install it.



## 5. Use and Operation

### 5.1 Preparation and Inspection Before Use

Before turning on the power supply for use, please confirm again whether the cable connection is correct, whether the power supply provided to the battery management system is within the required range, check whether the equipment has been securely placed, confirm whether there are any short circuits or other situations on the circuit board, and only connect the battery management system power supply after confirming that there are no errors. Otherwise, it may cause serious consequences such as abnormal operation or even burning.

### 5.2 Battery Management System Power-on Operation

After confirming that the above operations are correct, the device can be powered on. Insert the matching activation switch plug into the display interface, and press the activation switch to open the protection board.

## 6. General Fault Analysis and Troubleshooting

The cause and handling of the fault are shown in Table 2.

Table 2. Fault Causes and Handling

No.	Symptom	Analysis	Troubleshooting Method
1	The power indicator light is not on.	Abnormal power supply to equipment.	Check if the power pin on the P2 connector is connected to power source.
2	The APP prompts that the number of individual settings does not match the set value.	Incorrect number of unit settings or abnormal connection of equalization lines.	Check if the number of unit settings is the same as the number of connected batteries.
3	APP prompts that the	Excessive wire	Check for poor contact between

	resistance of the equalizing line is too high.	resistance from battery to connector.	the battery cell and the connector wiring, otherwise replace the wiring.
4	Inaccurate voltage collection.	Wiring error or parameter setting error.	Check the connections one by one to eliminate any wiring errors. Fine tune the voltage collection reference until the collection is accurate.
5	Device does not turn on.	Equipment does not meet working conditions.	Check if the charging cable is connected properly.

The above are general common faults, possible causes, and solutions. If the fault has not been resolved, please contact us for resolution.

## 7. Safety Protection Measures and Precautions

The battery management system itself does not have high voltage and will not cause electrical shock damage to the cell.

The battery management system has static sensitive devices that require anti-static protection. If operated improperly, it can easily cause damage to the equalizer. If you need to operate the equalizer, please pay close attention to the following instructions:

- Before touching the PCB, the personnel performing the operation must discharge the static electricity themselves and take anti-static measures;
- The equipment is not allowed to come into contact with electrical insulation materials - plastic film, insulated tabletops, or clothes made of artificial fibers;
- When conducting welding work on the equipment, it should be ensured that the electric soldering iron head is grounded;
- If it is unavoidable to use non-conductive containers, the PCB must be packed with conductive materials before placement, such as conductive foam rubber or

ordinary aluminum foil.

## **8. Transportation and Storage**

### **8.1 Transportation**

The boxed product is not directly affected by rain or snow, and can be transported using normal transportation tools due to severe collisions and jolts. During transportation, it is not allowed to be placed together with corrosive substances such as acids and alkali.

### **8.2 Storage**

Packaged products should be stored in a permanent warehouse with a temperature of 0°C - 35°C and a relative humidity of no more than 80%. The warehouse should be free of acid, alkali, corrosive gases, strong mechanical vibrations and impacts, and strong magnetic fields.

## Appendix I. Product Warranty Terms

Product Name: Smart Active BMS for Lithium Battery

Warranty Period: One Year

First of all, thank you for purchasing the Smart Active BMS for Lithium Battery launched by Chengdu Heltec Energy Technology Co., Ltd.

Chengdu Heltec Energy Technology Co., Ltd. provides quality warranty for the hardware products and accessories sold by the company. The warranty period is as shown above. If a malfunction occurs due to quality reasons during the warranty period, the company has the right to choose to repair or replace the entire product after receiving notification of the product malfunction and verification. The entire set of replacement products may be new or nearly new.

1. Chengdu Heltec Energy Technology Co., Ltd. guarantees that the products have been fully tested.

2. Chengdu Heltec Energy Technology Co., Ltd. does not guarantee that the product can be used without interruption during the product repair process. However, the company shall ensure that malfunctioning products are repaired within a reasonable period of time.

3. The product warranty period starts from the date of shipment of the product or the date of installation by Chengdu Heltec Energy Technology Co., Ltd. If the installation of the Company's product does not begin within 30 days after the date of shipment due to user schedules or delays, the product warranty period begins on the 31st day after the date of shipment.

4. Chengdu Heltec Energy Technology Co., Ltd. does not provide free warranty for product failure and damage caused by any of the following conditions:

- (a) Incorrect use or improper maintenance;
- (b) Software, accessories, components or other items not provided by Chengdu Heltec Energy Technology Co., Ltd.;
- (c) Unauthorized disassembly, modification and misuse;
- (d) Use beyond the scope specified in the product technical specifications;

(e) Improper transportation, handling and storage;

(f) Failure or damage caused by other non-quality reasons (such as earthquakes, wars, traffic accidents, etc.).

To the extent permitted by law, the above warranty terms are express and exclusive and there are no other warranties of any kind, whether written or oral. Any implied warranties and commercial terms are expressly disclaimed.