

Smart Transformer Balancer
For Lithium Battery
(BT04S05B/BT04S10B)
Operation and Maintenance Manual

Heltec Energy

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1. Introduction

The lithium battery active equalizer is tailor-made for the charging and discharging of large-capacity series-parallel battery packs. It has the whole set of full-scale non-differential equalization, automatic low-voltage sleep, and temperature protection. The circuit board is sprayed with conformal paint, which has excellent performances such as insulation, moisture resistance, leakage prevention, shock resistance, dust resistance, corrosion resistance, aging resistance, and corona resistance, which can effectively protect the circuit and improve the safety and reliability of the product.

The circuit board is equipped with an aluminum heat sink, which has the characteristics of fast heat dissipation and low temperature rise when working with high current. This product is suitable for ternary lithium, lithium iron phosphate, and lithium titanate batteries. The maximum balancing voltage difference is 0.005V, and the maximum balancing current is 10A. When the voltage difference is 0.1V, the current is about 1A (its actually related to the capacity and internal resistance of the battery). When the battery is lower than 2.7V (ternary lithium/lithium iron phosphate), it stops working and enters dormancy, with over-discharge protection function.



Figure 1. BT04S05B Balance Board

2. Technical Parameters

The main technical indicators of the intelligent balance board are listed below in Table 1.

Table 1. Main Technical Indicators

Indicators	SKU	
	BT04S05B	BT04S10B
Applicable battery strings	3S-4S	
Max balancing current	5A	10A
Applicable battery type	NCM/LFP/LTO	
Working voltage range	2.7V-4.5V	2.7V-4.5V
Voltage balance accuracy	5mV (typical)	
Sleep protection voltage	NCM/LFP: 2.7V; LTO: 1.8V. (Customizable if not listed)	
Standby working current	5.5mA	6mA
Sleep current	0.1mA	
Working temperature	-10°C~60°C	
Dimension (mm)	94*64*17	

3. Installation and Configuration

3.1 Wiring Diagram and Connection Description

The connection position of the balance board is shown in Figure 2, and its definition is shown in Table 2.

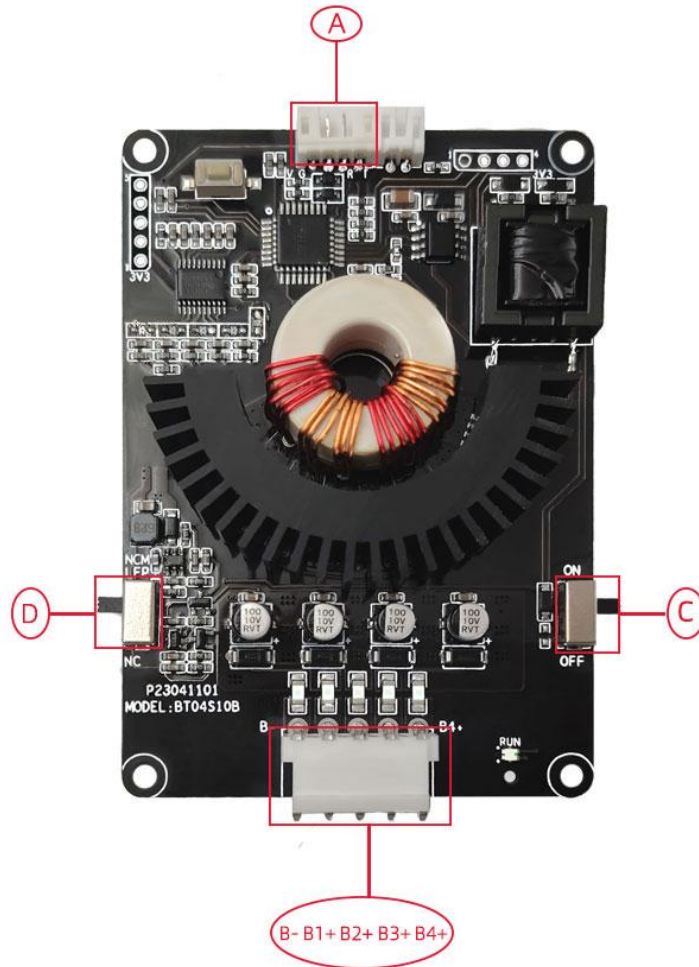


Figure 2 - BT04S05B Connection Diagram

Table 2. Connection Definition

Connector	BT04S05B	
	Name	Definition
A	Quad string connector	Bluetooth module/display module connection port
B- ~ B4+	B-	First battery negative
	B1+	The positive pole of the first string of batteries
	B2+	Second string battery positive pole
	B3+	Positive pole of the third battery
	B4+	The positive pole of the fourth string battery
C	DIP switch	ON: Balance function is on OFF: Balance function off
D	DIP switch	NCMLFP: Ternary lithium/lithium iron phosphate CN: no function

3.2 Connection of Accessories

The connection effects of each accessory are shown in Figure 3 and Figure 4.

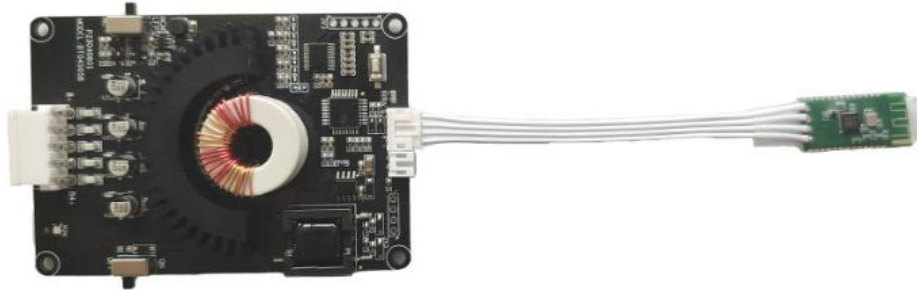


Figure 3. Bluetooth Module Connection

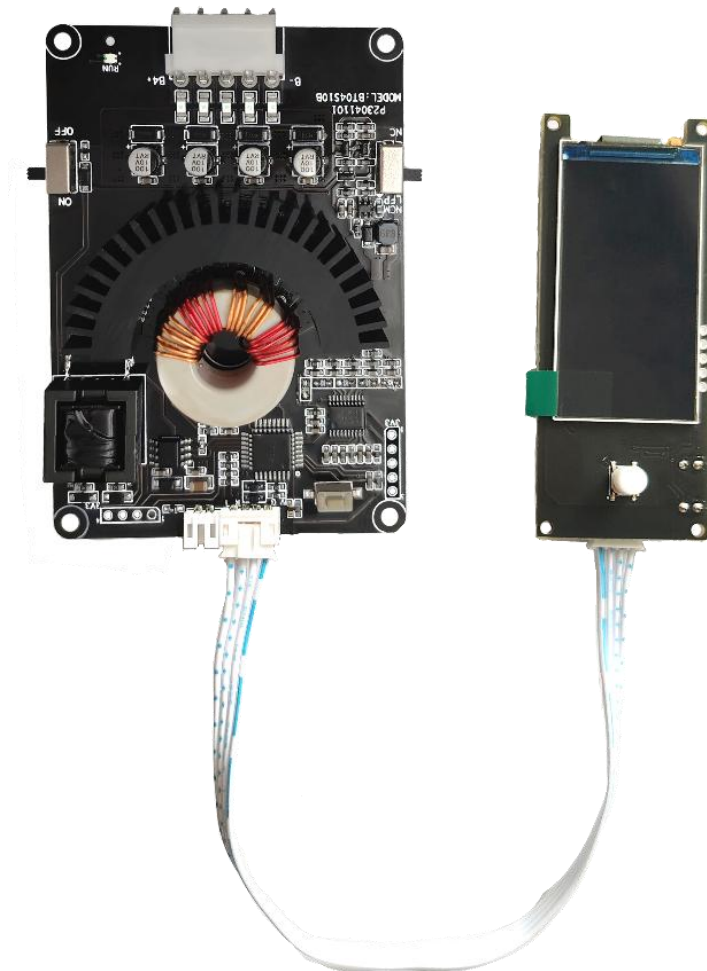


Figure 4. Display Connection

*Please see the appendix for detailed specifications of each module.

3.3 Indicator Light Status Description

The specific status of the indicator light is described in Table 3.

Table 3. Indicator Status Description

Indicator Status	Specific Function
Green Light Always On	Protecting the balance
Green Light Flashes	Equilibrium off state
Yellow Light Always On	High temperature protection
Flashing Yellow Light	Low temperature protection
Light Not On	Low voltage protection sleep

4. Software Installation Instructions

4.1 APP Installation

Scan the QR code shown in Figure 5 to obtain the mobile APP that matches the product. (Android system only)



Figure 5. Mobile APP Link

4.2 Instructions for Use

4.2.1 Preparation and Testing Before Use

Before connecting the balance board, please confirm again whether the "first battery negative pole" and "B -" are connected correctly. Check if the wiring of the equalization board is securely fixed to the battery cell, and only connect the equalization board to the battery after confirming it is correct. Otherwise, it may cause serious consequences such as abnormal operation or even burning out.

4.2.2 Device Connection

First, turn on the phone Bluetooth, and then open the APP, as shown in Figure 6.

Click on the Bluetooth icon below to scan for devices. After the scan is completed, double-click on the name of the device you want to connect to, starting with "D32SP_ * * *", and then click OK to wait for the prompt indicating successful connection.

The connection prompt is shown in Figure 7.

When connecting for the first time, the APP will prompt for pairing, and after successful pairing, it will automatically connect. Wait for the prompt to indicate successful connection, and the pairing interface is shown in Figure 8.

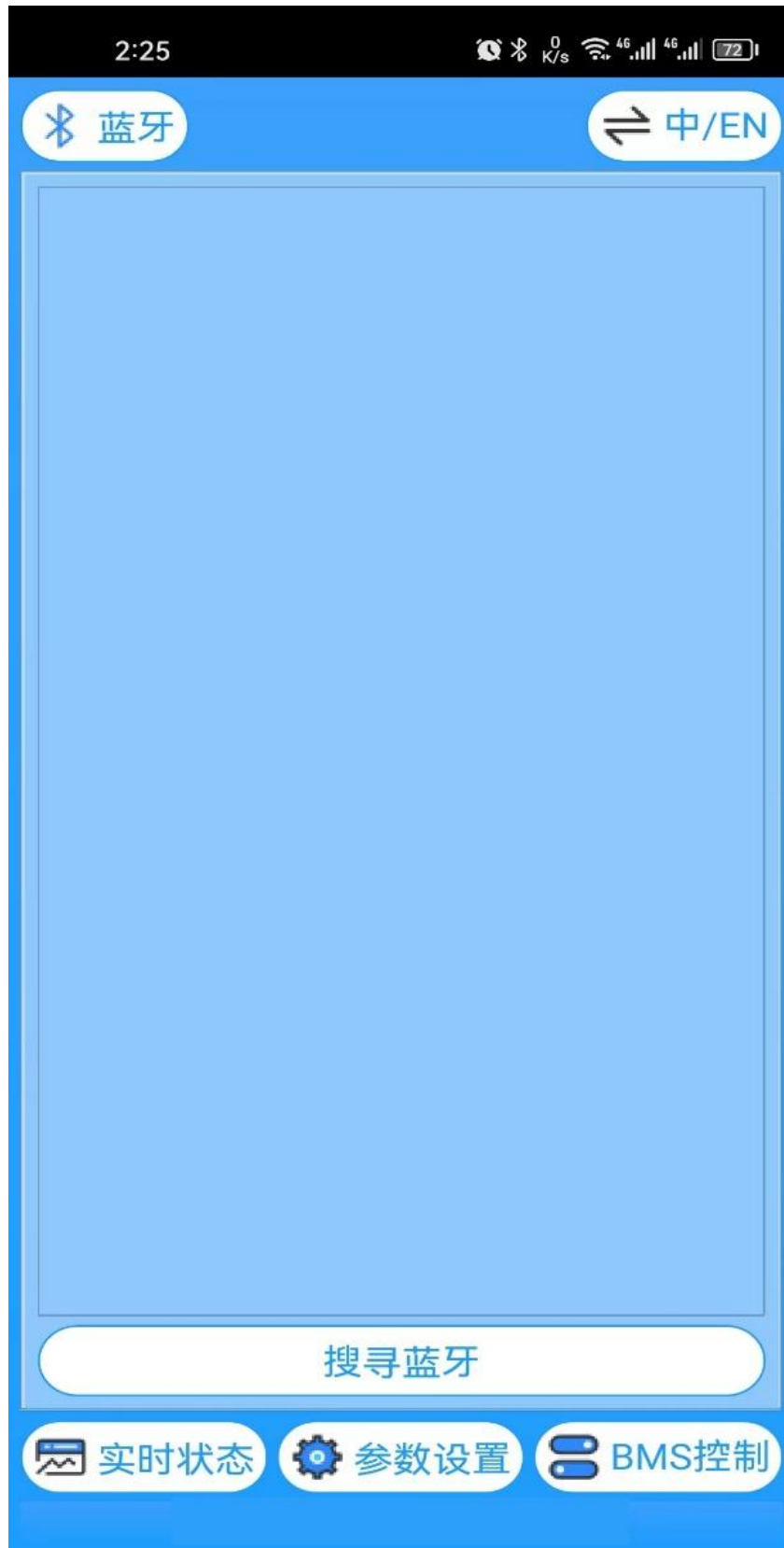


Figure 6. Bluetooth Connection Interface



Figure 7. Device Connecting



Figure 8. Bluetooth Connection Pairing

4.2.3 Status View

The real-time display after successful connection is shown in Figure 9.



Figure 9. Interface Display

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

Area 1 in the figure is the battery comprehensive information column. The parameters of each parameter are explained as follows:

- Bluetooth name: the model name of the Bluetooth module.
- Equipment serial number: Equipment serial number of the balancing board.
- Battery type: balanced battery type selection.
- Temperature status: shows whether the temperature is between the set thresholds.
- Equipment model: Balance board model.
- Equilibrium state: working state.
- Software version: Current software version.
- Hardware version: Balancing board hardware version.
- Highest voltage: the highest voltage of a single battery in the battery pack, unit in V.
- Minimum voltage: the minimum voltage of a single battery in a battery pack, unit in V.
- Number of battery strings: The maximum number of battery strings that the software can display.
- Number of battery strings: The actual number of battery strings connected.
- Board temperature: Equilibrium board temperature, unit in °C.
- Battery temperature: the temperature of the battery pack, unit in °C.
- Overall voltage: the total voltage of the battery pack, unit in V.
- Maximum voltage difference: the voltage difference between the highest single cell voltage and the lowest single cell voltage in the battery pack, unit in V.

Area 2 in the figure is the voltage of each string of batteries, unit in V.

4.2.4 Parameter Settings

The parameter setting page is shown in Figure 10.



Figure 10. Parameter Setting Page

On the parameter setting page, various working parameters of the protection board can be modified, and the explanation of each parameter is as follows:

- High temperature protection threshold: The high temperature protection threshold means that when the temperature of the equalization board exceeds the set temperature threshold, the equalization will be automatically stopped, and it will enter the high temperature protection state and wait for the temperature of the equalization board to drop and return to normal.
- High temperature recovery threshold: The high temperature recovery threshold refers to the temperature required for the balance board to work normally again after entering the high temperature protection state. Only when the balance board is lower than this threshold will it work again. (Recommended to be 5°C lower than high temperature protection).
- Low temperature protection threshold: The low temperature protection threshold means that when the temperature of the balancing plate is lower than the set temperature threshold, it will automatically stop balancing and enter the low temperature protection state to wait for the temperature of the balancing plate to rise and return to normal.
- Low temperature recovery threshold: The low temperature recovery threshold refers to the temperature required for the balance board to work normally again after entering the low temperature protection state. Only when the balance board is higher than this threshold will it work again. (It is recommended to be 5°C higher than low temperature protection).
- Equalizing voltage difference: Only when the voltage difference between the highest single cell voltage and the lowest single cell voltage of the battery pack is greater than the set threshold will the equalization work be performed. The setting range is 5mV-500mV.

4.2.5 BMS Control

The BMS control page is shown in Figure 11. Through the BMS control, the balance function, high temperature protection function and low temperature protection function of the balance board can be switched on and off.



Figure 11. BMS Control Page

5. Precautions

1. This board works on the principle of adjacent balancing and cannot be used as a maintenance tool. To connect to the battery, it must be used with lithium battery protection. The voltage difference generated by charging and discharging triggers the balancing board to achieve energy transfer balancing.

2. Be sure to follow the design parameters and usage conditions during use, and do not use it in violation of the parameters in this specification, otherwise it will easily damage the protective plate and then damage the battery pack.

3. It is necessary to prevent static electricity during use. When testing, installing, and touching the protective board, corresponding static discharge measures must be taken.

4. Be careful not to touch the components on the circuit board with the lead wire, electric soldering iron, tin slag, etc. during use, otherwise the balance board may be damaged.

5. If there is any abnormality during use, please stop using it immediately, send it back to the original factory or ask professional maintenance personnel to repair it.

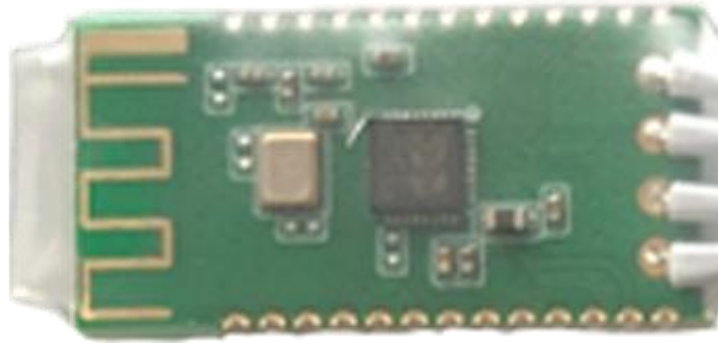
6. This balancing board has undergone a large number of reliability tests. The reliability is much higher than the general balancing boards on the market. The process of the battery core must also be guaranteed at the same time to reduce the occurrence of combustion as much as possible.

* Safety Precautions:

The company is committed to the improvement of quality and reliability, but generally speaking, electrical products will have a certain probability of failure. The durability will be different due to the different environmental conditions of use; the lengthy design is adopted during use to avoid abnormal heat, smoke, and even personal accidents, fire accidents, and social damages caused by overloading.

6. Appendix

6.1 Bluetooth Module



Dimension: 28mm*15mm

Working frequency band: 2.4G

Working voltage: 3.0V ~ 3.6V

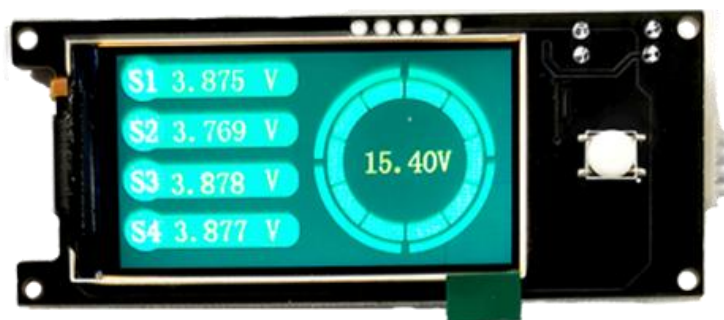
Transmit power: 3dBm

Reference distance: 10m

Antenna interface: built-in PCB antenna

Receiving sensitivity: -90dBm

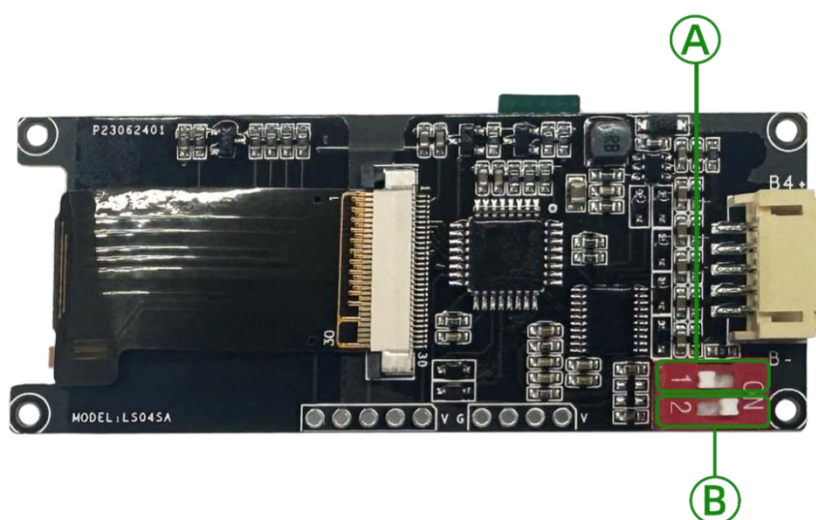
6.2 TFT-LCD Display



Dimension: 77mm*32mm

Front side introduction:

Name	Function
S1	Voltage of the 1 st string
S2	Voltage of the 2 nd string
S3	Voltage of the 3 rd string
S4	Voltage of the 4 th string
In the circle	Total voltage
White button	Screen off status: Press to turn on the screen Screen on status: Press to turn off the screen



Back side introduction:

Name	Function
A	Turn this DIP switch to change the display direction of the screen content.
B	Se to ON: the display is always on. Set to 2: the display will automatically turn off after ten seconds without any operation.