

# **10A Transformer Feedback Active Balancer**

## **User Manual**

**Heltec Energy**

## 1. Introduction

- This active equalizer is of transformer push-pull rectification feedback type, characterizing in real-time, dynamic, synchronous, and energy transfer.
- The equalizing current is not a fixed size, the range is 0-10A.
- The size of the pressure difference determines the size of the equalizing current.
- Final equalization accuracy, within 5mV (approximately).
- There is no pressure difference starting requirement, no external power supply is required, and the balance will start after the line is connected.
- All cells are balanced synchronously, regardless of whether the cells with differential pressure are adjacent.
- The wiring method is backward compatible.
- There are temperature protection, under-voltage protection, automatic sleep function options.

## 2. Product Dimension (manual measurement, error exists)

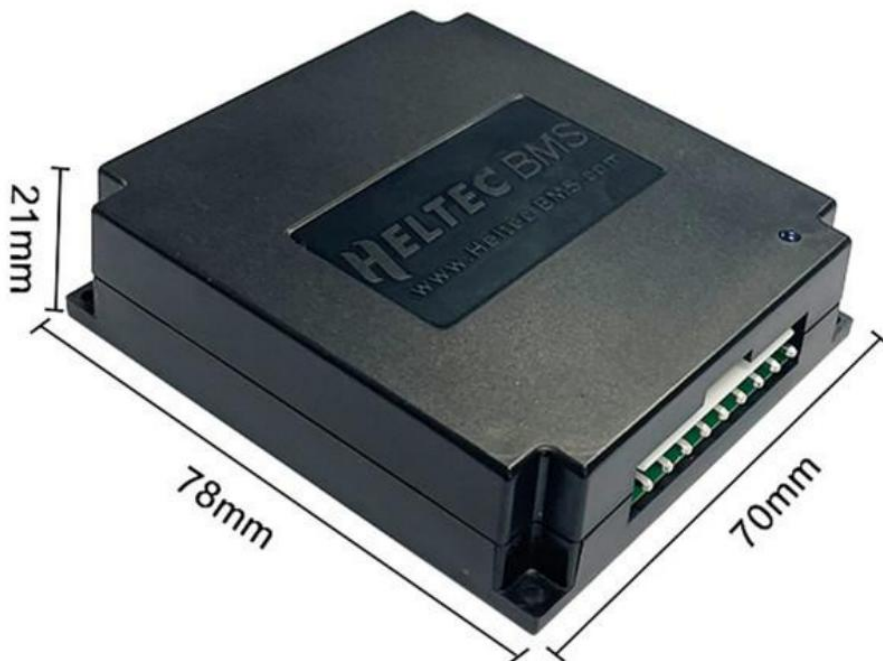


Figure 1. Dimension of



**Applicable cells:** lithium iron phosphate (3.2V), ternary lithium (3.7V), lithium titanate. When using lithium titanate batteries, please note when purchasing.

**Notice:**

1. This equalizer is for long-term use of a battery pack. Do not remove it after it is installed. As a part of a battery pack, it cannot be used as a debugging and maintenance tool. It is used as a maintenance and debugging balance battery voltage, without warranty!

2. If the capacity difference between each string of a battery pack is very large (the capacity difference exceeds 10%), it is not recommended to use this active equalizer.

**The relationship between the equalizer and the BMS**

This equalizer exists in parallel with the protection board, and it has nothing to do with the type of protection board used. The two are wired independently, work independently, and do not affect each other. Regardless of whether the original protection board has active equalization or passive equalization, and whether the protection board used is a software version with Bluetooth or an ordinary hardware board, it does not affect the use of this equalizer.

**Balance current**

The equalizing current has no fixed size, and the voltage difference of each string of batteries determines the equalizing current. As the equalization progresses, the voltage difference also changes, and so does the equalization current. Theoretically, the maximum equilibrium current follows the following rules:

4S 8S equalizer: every 0.1V dropout, the maximum equalizing current is 1.5A.

17S-24S equalizer: per 0.1V voltage difference, the maximum equalizing current is 1.2A.

## For example

4S Equalizer, if the maximum voltage difference of the battery is 0.3V, the maximum balance current that can be measured is about 4.5A.  $(0.3V/0.1V)*1.5A=4.5A$  In actual measurement, this current may not necessarily be measured so accurately.

Because all batteries are balancing, that is to say, there may be current on each line, and the direction of each current may be different. This will partially cancel the current. The equalizing current on each equalizing line can be measured by a DC clamp meter.

We have a nominal 0-10A equalizing current. As long as the voltage difference is reached, this equalizing current can be measured. When the voltage difference is 1V, no more than 10A of balanced current will be generated.

## Equalization Accuracy

Everyone will be concerned about how many MV pressure differences will eventually be equalized? How many hours will my battery pack be well balanced?

In fact, there is no standard for this, and the equilibrium time is not fixed. How big is the battery capacity? How is the pressure difference? Under the same voltage difference, is it when the battery is half charged, or the voltage difference after charging? How many MVs are good for equalization? Is 20MV or 5MV better for balance?

First understand the magnitude of the equalization current and its relationship with the pressure difference, and then understand the equalization accuracy. As the equalization continues, the voltage difference will definitely decrease gradually, and the equalization current will also gradually decrease. Although the pressure difference is gradually decreasing, there is still a lot of power to be transferred, especially for large-capacity batteries, but the current is also gradually decreasing. Therefore, the remaining part of the power is poor, and it may take a long time to equalize.

In theory, as long as the time is long enough, the final pressure difference is less

than 5MV, which is normal.

For reference: a normal new group of 100AH batteries, charge for one night, and the balance will be good the next day. Summary: The battery pack with the same pressure difference, the larger the capacity, the longer the balancing time. For a battery pack of the same capacity, the greater the pressure difference, the longer the equalization time.

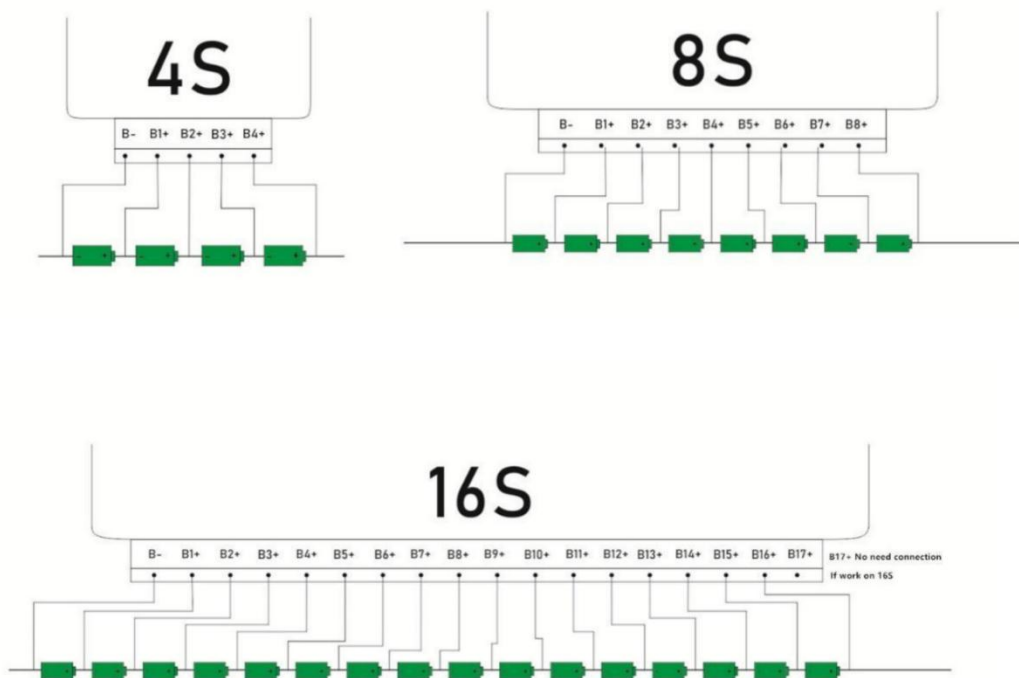
## Sleep switch:

The switches are all set to two positions.

A: Refers to turn on the automatic sleep function. When the battery is well balanced, it will automatically hibernate. When charging or discharging, when the voltage changes, the equalization will be automatically turned on.

M: Turn off the auto sleep function. The equalizer is always in the state of opening equalization and will never sleep. Of course, if it is under voltage, it will sleep.

## Connection



## **About the problem of equalizer heating after equalization is turned on**

Since the voltage difference of the battery pack is different in different states, when the voltage difference is large, for example, it may be 0.4V or even 0.5V for a long time, the balance current is relatively large, and the balance will generate heat. Large-capacity battery, continuous large voltage difference, continuous high current balance, will cause the temperature of the balance board to continue to rise. This equalizer has a temperature protection function. When the temperature is higher than 50 ° C, the balance is turned off, and when the temperature drops to 45 ° C , the balance is turned on automatically. If the maximum voltage difference of the battery does not exceed 0.3V, there is no need to consider the problem of balanced heating. Because temperature is not a problem, we use a plastic case package, which is also easy to place, and there is no need to worry about insulation problems. Some people ask why we don't add a radiator, and some brand has a radiator. It can only be said that it must be added, because if there is no radiator, the temperature is too high to imagine. If you don't believe it, take it apart and try it.

It is a good choice to fundamentally solve the problem of heating, rather than solving the problem of heat dissipation.

## **Regarding wiring issues**

This series of equalizers, except for 4 strings, are all backward compatible. For example, a 24-string equalizer can be used on a 4-24-string battery pack. Of course, since our equalizer does not support daily debugging use, when using it, it is still reasonable to purchase an equalizer with a similar number of strings. When wiring, be sure to unplug the terminal block first, and connect according to the diagram. After all the wiring is completed, confirm that the sequence is correct, and finally plug in the plug. The order of inspection is very important and cannot be taken for granted.

For equalizers with more than 17 strings, there are two plugs, first insert the

low-voltage side terminal of the negative starting point on the left, and then insert the high-voltage terminal on the right. Special reminder: Wrong wiring will directly damage the equalizer! Be sure to wire it correctly before plugging in the terminals.

## **Use in series and parallel**

Due to the different sizes of battery packs, under normal circumstances, a set of batteries with a capacity of about 200AH uses an equalizer, which is enough. But if the capacity is relatively large, such as 500AH or more, two or more equalizers can be used in parallel to increase the equalization effect.

For a multi-string battery pack, two or more equalizers can be connected in series to balance the entire battery pack.

For a 40-string battery pack, two 24-string equalizers can be connected in series to balance the entire battery pack.

For a 120-string battery pack, six 24-string equalizers can be used in series to balance the entire battery pack.

When used in series, there must be a crossover string between the two equalizers. Please refer to the wiring diagram to understand why repeating strings are necessary.