

## BMS Battery Management System

BMS stands for the battery management system which is used to manage the lithium ion batteries to prevent it from the overcharging, discharging, and to maintain balance charging. It provides the protection from the short circuit. Let suppose if we have four lithium cells and we connect it in series and if we want to charge it, one cell will charge quickly other cell will charge late due to which proper combination will not be obtained. Due to which we will not get stable voltage at the output. In this case we make use of BMS module.

### State of determination

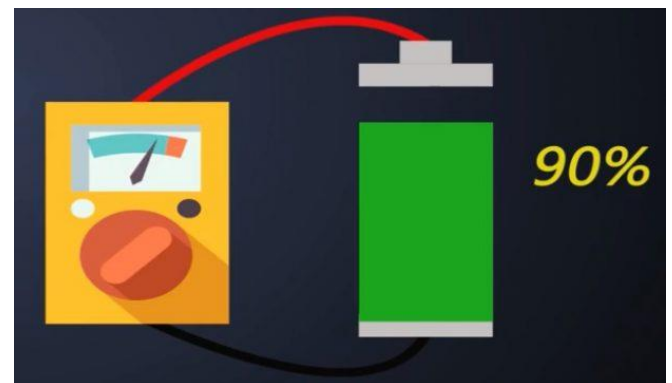
Second is the state of charge determination one of the features of the BMS battery management system is to keep the track of (SOC) State of charge of the battery. The SOC indicates the user about current capacity of the battery. There are several methods to determine SOC.

The SOC can be determined through:

- Direct voltage measurement
- Coulomb counting

### Direct Voltage Measurement:

We can simply use a voltmeter because the voltage decreases more or less linearly during the discharge cycle of the battery. So if the voltage decreases the associate of the battery also decreases.



### Coulomb counting

In the Coulomb counting method the current coming in or going out of a battery is measured over time to calculate the relative amount of charge. It is like pouring water into water tank and fetching it out, imagine the battery as a jar and water is like electrical energy or charge.

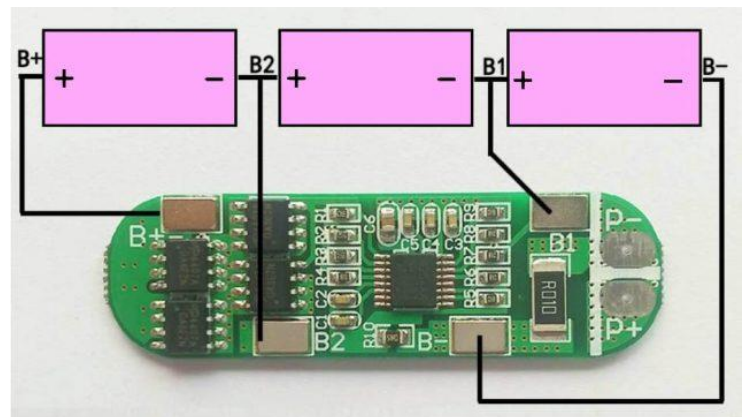
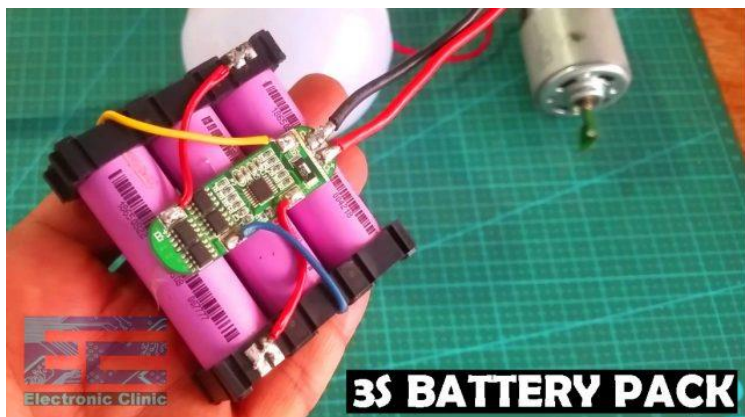
## How to make Lithium Ion Battery using 3S BMS and 4S BMS

Using Lithium-Ion Battery cells you can make any size battery pack of your choice, as you have full control over the voltage and current selection. You can simply connect the lithium-Ion batteries in series to increase the voltage or connect them in parallel to increase the current. Or you can connect them in series and parallel at the same time to increase the voltage and current. So you can make a small 3.7v battery pack for powering up your Arduino, Raspberry, ESP8266, or you can make a Heavy-duty 14 volts battery pack to power up your entire house, or a heavy-duty 72 volts battery pack to power up your electric Car and this is what we need in our project.

Here, I have these different BMS modules; you can see the sizes are different. Don't get confused if you see smaller or bigger BMS modules, their use is 100% the same. These smaller and bigger BMS modules are the 3S BMS modules, the only difference is that the smaller one is for low current applications and this bigger BMS module can deal with high currents. While this other BMS module is 4S.



### 4S BMS Module Wiring



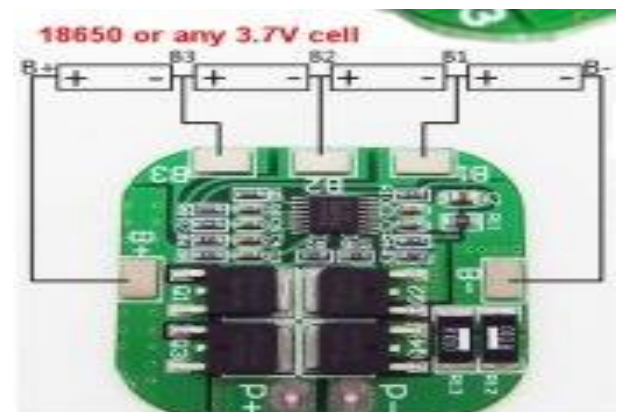
Making a 3S battery pack, which means we need to connect 3 lithium-ion cells in series. Connect the positive side of the first battery with the negative side of the 2nd battery, now connect the positive side of the 2nd battery with the negative side of the 3rd battery. The positive side of the third battery is the main positive of the battery pack and it should be connected with the B+ contact on the BMS and the negative side of the first battery is the main negative of the battery pack and it should be connected with the B- contact on the BMS. The B1 should be connected with the first cell and B2 should be connected with the 2nd cell.

Let's first start with these 3S BMS modules. Both the modules are designed for the same job that is to protect the Lithium-Ion Batteries from Overcharge and Over-discharge. Both the modules got the same contacts. The same P+ and P- contacts, the same B+ and B- contacts, and the same B1 and B2 contacts. The only difference between the two BMS modules is that the smaller BMS module is designed for 10A applications while the bigger BMS module is designed for 25A applications. So, let's start with this smaller 10A BMS module.

The P+ and P- contacts are used for the input and output. Through these contacts, you will charge your batteries and to these contacts, you will also connect your output loads, but one at a time. You can either connect the load or you can charge the batteries. When a charger is connected then you cannot connect the loads. So, first, charge the batteries using these P+ and P- contacts, then remove the charger and connect the load which you want to power up.

The B+ and B- contacts will be connected with the Battery pack main positive and main ground terminals. The B1 contact will be connected with the 3.7Volts, and B2 contact will be connected with 7.4 volts.

### 4S BMS Module Wiring



Now, 4S BMS Module, it has got the same contacts as the 3S BMS module. This module also has these voltages printed which makes it easier to use and the connection diagram is pretty much the same.

The P+ and P- contacts are connected to the XT-60 connector. The B+ and B- contacts are connected with the battery pack main positive voltage and Gnd. B1 is connected with the positive of Battery1, B2 is connected with the positive of Battery2, and finally the B3 contact is connected with the positive of Battery3.