**SUN BEST (HONG KONG) INTERNATIONAL CO., LIMITED**

BATTERY MANAGEMENT SYSTEMS

Battery management systems (BMS) mean different things to different people. At SunBest International's BMS is simply constant monitoring of key operational parameters during charging and discharging using outputs from sensors which give the actual status of voltages, currents, and temperatures within the battery as well as the state of charge.

Since we have developed our own unique battery management system we don't have to rely on 3rd parties for battery management system design as a lot of other companies do.

Our state of the art BMS integrates a precise battery gauge, cell balancing, protection circuitry, system control firmware and other safety features like temperature protections that will not allow charging outside of a specified temperature range.
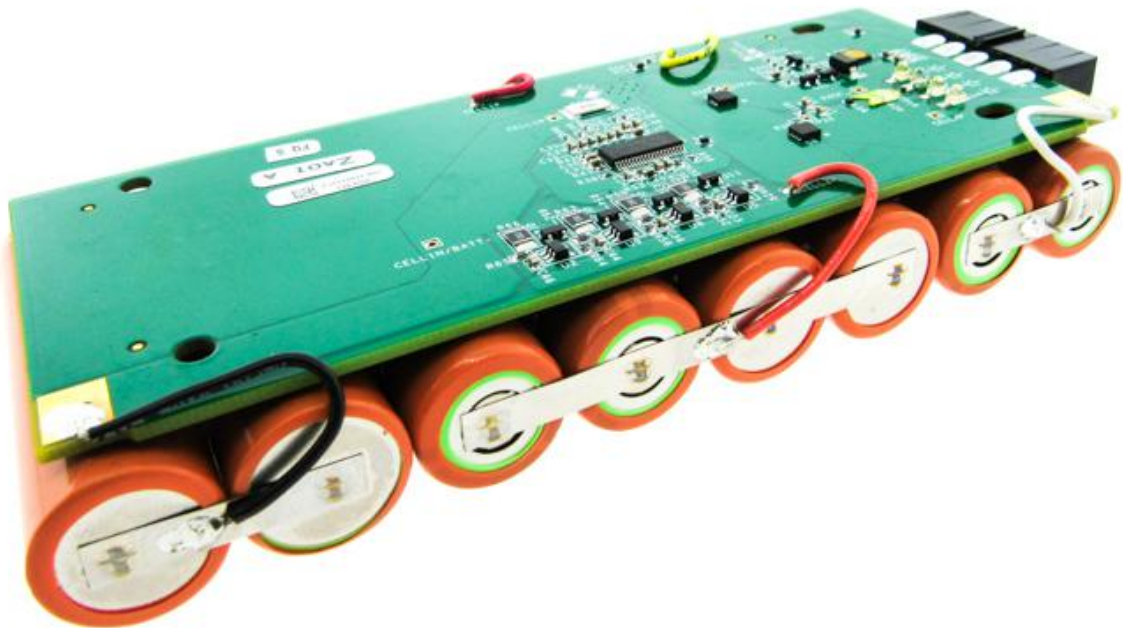
This is done by utilizing a microcontroller to manage information from the sensing circuitry and then make decisions with the received information using application specific algorithms that are digitally encoded into the microcontroller. Working closely with some of the key integrated circuit (IC) manufactures in the industry such as Texas Instruments (TI), Linear Technologies and Sieko, we safely and cost effectively build some of the most creative designs in the industry.

How We Customize A BMS for Each Application

In order to control battery performance and safety it is necessary for an in-depth understanding of the fundamental application requirements that the battery needs to meet. From there we can move into putting all of the building blocks in place.

BMS Critical Components

Every BMS performs 3 critical functions for every application.

- Provides protection for the cells, the battery pack and the pieces of equipment that it is powering as a thermal runaway in a battery pack can cause significant damage.
- Extends the life of the battery by managing how and when it is used which minimizes the number or charge/discharge cycles.
- Keeps the battery in a state so that it is constantly prepared to power the application the moment it becomes necessary.

Additional BMS Functions That Can Be Incorporated

- **Cell Protection:** Lithium ion cells have two critical design issues; if you overcharge them you can damage them and cause overheating and even explosion or flame so it is important to have a battery management system to provide overvoltage protection and they can also be damaged if they're discharged below a certain threshold, approximately 5 percent of total capacity. If the cells are discharged below this threshold their capacity can become permanently reduced.

- **Charge control:** All batteries have a useful number of charge/recharge cycles so managing this function efficiently is critical to the life of the battery back. Along with that, overcharging is the most harmful thing that can happen to any battery.

- **Demand Management:** The objective of any battery pack design is to minimize the current drain on the battery to lengthen the battery life by implementing power saving techniques into the BMS circuitry. This requires a many years of design experience and a library of designs to pick and choose the right tools from.

- **SOC Determination:** Many applications require knowledge of the State of Charge (SOC) of the battery or of the individual cells in the battery chain. This may simply be for providing the user with an indication of the capacity left in the battery, or it could be needed in a control circuit to ensure optimum control of the charging process. In many applications this is the

first reading to the control board as a device may have a minimum SOC for effective use.

- **SOH Determination:** An important aspect of battery diagnostics is the battery state of health (SOH) determination which is a qualitative measure of the battery's ability to store energy and deliver power. Battery diagnostics track the degradation of battery's performance to estimate battery SOH.

- **Cell Balancing:** A battery pack usually consists of several individual cells that work together in combination. Ideally, all the cells in a battery pack should be kept at the same state of charge. If the cells go out of balance, individual cells can get stressed and lead to premature charge termination and a reduction in the overall cycle life of the battery. The cell balancing function extends the life of the battery by preventing this imbalance of charge in individual cells from occurring. While this functionality is not necessary in every application as it adds cost, we make it standard in all of our designs.

- **History - (Log Book Function):** Being able to write data about the performance of the battery pack is another possible function of the BMS. This is an important tool in determining state of health (SOH) of the battery, usage data for next generation designs and in assessing warranty claims.

- **Authentication and Identification:** Being able to write information to the battery pack hardware allows OEM's to serialize, lot number control, and provide any other traceability that an application requires.