Q. What is a BMS? Types of BMS and different type of BMS.

Ans A Battery Management system will manages the electronic of a rechargable battery pack, thus becomes a crucial factor in ensuring electric vehicle safety. It safeguards both the user and the battery by ensuring that the cell operates within its safe operating parameters

BMS also monitor State of Health of battery, collects data, control environmental factor that effect the cells and manage voltage. BMS may protect it battery by preventing it from operating outside its safe operating area.

Basically BMS are classified int two

1). Hardware BMS:-

All BMS have atleast all function of hardware BMS. Mainly the functions are

→ Over voltage cutoff
→ Under voltage cutoff
→ Continous current
→ Over current detection
→ Over temperature detection.
→ Over temperature cutoff.

The BMS will also control the recharging of the battery by redirecting the recovery energy from regenerative braking back into the battery pack.

Battery thermal management system can be either passive or active, and the cooling medium can be either air, liquid, or some form of phase change. Air cooling is advantageous in its simplicity.

2. The major disadvantages of air cooling is its inefficiency. Large amount of power must be used to operate the cooling mechanism. this mechanism also add weight to the BMS.

2. Software BMS / Smart BMS

It have all the features of hardware BMS. In additional to that they can control data, it have monitor to store data, transmit data via CAN, Bluetooth A smart BMS offers benefits such as online monitoring for battery status regarding voltage, current, impedance, internal temperature etc. This reduce potential battery accident.

A smart BMS called a BMS data center due to all the historical data collection, storage, and analysis At the sametime, you can get real-time battery information via a certain system.

Most battery monitoring suppliers normally provide common solution for their industries. Therefore, DFON provides a targeted solution for different industries that meet the needs of professional customers.

Types of Battery Management System

Battery management System ranges from simple to complex and embrace wide range of different technologies. However these system are categorized based on their topology, which relate to how they are installed and operated upon the cells or modules across the battery pack.

1. Centralized BMS architecture

Has one central BMS in the battery pack assembly. All the battery pack are connected to the central BMS directly. The structure of a centralized BMS is has some advantages. It is more compact, and it tends to be the most economical since there is only one BMS. However, there are disadvantages of a centralized BMS. Since all the batteries are connected to the BMS directly, the BMS needs a lot of ports to connect with all the battery packages. This translate to lots of wire, cabling connector etc. In large battery packs with complicate both troubleshooting and maintainance.

2. Modular BMS Topology

Similar to a centralized implementation, the BMS is divided into several duplicated modules, each with a dedicated bundle of wires and connections to an adjacent assigned portion of a battery stack. In some cases, these BMS submodules may reside under a primary BMS module oversight whose function is to monitor the status of the submodule and communicate with peripheral equipments.

3. Primary / Subordinate BMS

Conceptually similar to the modular topology, however, in the case, the slaves are more restricted to just relaying measurement information, and the master is dedicated to computation and control, as well as external communication; so, while like the modular type, the costs may be lower since the functionality of the slaves tends to be simpler, with likely less overhead and fewer unused features

4. Distributed BMS - Architecture

Considerably different from the other topologies when the electronic hardware and software are encapsulated in modules that interface to the cells via bundles of attached ~~cons~~ wiring. A distributed BMS incorporated all the electronic hardware on a control board placed directly on the cell or module that is being monitored. Consequently each of the more-self-contained, and handles computation and communications as required. However, despite this apparent simplicity, this integrated form does make troubleshooting and maintenance potentially problematic, as it ~~sits~~ resides deep inside a shield module assembly. Costs also tend to be higher as there are more BMS's in the overall battery pack structure.

2. What are the technical parameter to keep in mind while processing a BMS for assembling a battery pack?

Mainly There are 6 components of battery management system

1). Battery cell monitor
2. Cut off FETs
3. Monitoring of Temperature
4. Cell Voltage balance
5. BMS - Algorithms
6) Real time. Clock. (RTC)

1). Battery Cell monitor

A battery cell monitor primarily monitors the voltage for battery system. It is high speed system that offers a low overall cost of high voltage measurements The easiest way to determine the battery pack's charge is to monitor individual cell voltage with reference to set of voltage level. It shows indication on full charge to the limit and lesser charge.

2. Cut off FETs

FET driver is accountable for connection and isolation between load and charge of the battery pack. The behaviour prediction is done through voltage, current measurements, and real time detect circuits. They can be connected to a battery pack's a low or high side. The ground connection of the battery pack floats using low-side cut-off FETs. This can affect the IC performance, make it more sensitive to instructed noise measurement. (5)

3. Monitoring of Temperature

When the increase in product requirements, the batteries have been on a constant surge in delivering currents at fixed voltages. The continuous operation process may cause a catastrophic event such as fire or explosion. We can identify whether battery Charging or discharging is observable using temperature measurements. Temperature sensor monitor the energy storage system or cell grouping for compact portable applications.

4. Cell Voltage Balance

It is crucial to determine the health of the battery pack. That is why cell voltage monitoring is done to ensure that the cell are in proper running condition for attaining a long battery life. The operating voltage ranges from 2.5V to 4.2V in a lithium ion battery. The battery life is significantly affected while

5. BMS Algorithms

To make quick and effective decision in real time based on the information received. For this purpose, a micro-controller for battery management system is need to collect, organize and access the information from the sensing circuit.

6. Real-Time Clocks

Allowing the user to know the battery packs behaviour before any alarming event, the real time clock acts as blackbox system for time-stamping and memory storage. The BMS electronic is kept away from synchronizing with a third party battery pack through battery authentications.

Q. What is the purpose of BMS with communication? What are the various protocols of communication used in a BMS?

The main goal of BMS is to keep the battery within the safety operation region in terms of voltage, current, and temperature during the charge, the discharge and in certain case at open circuit. When working with a BMS, you usually use a BMS IC. Depending on the BMS IC being used to control your BMS, you may need to connect to an external microcontroller or another external IC. There IC's need to be able to communicate with each other to send and or receive information from one another.

UART

UART, which stands for universal Asynchronous Receiver (Transmitter) is the most widely used communication protocol used in battery management systems. UART is a form of serial communication, which means bits are sent one after another sequentially instead of multiple bits sent at once which is what occurs with parallel communication. The UART communication is widely used for communication between a microcontroller and the BMS IC in a BMS. It is also used for communication between the microcontroller and the GSM, bluetooth or WIFI module. In UART communication, two UARTs communicate directly with each other. UARTs transmit data asynchronously, which means there is no clock signal to synchronize the output of bits from the transmitting UART to the sampling of the bits by the receiving UART.

I2C

I2C, Inter-Integrated Circuit communication, is a protocol used for IC to IC communication. I2C is intended primarily for short-distance communication between ICs on the same printed circuit board. I2C allows multi-master-multi-slave topology. The I2C is a standard bidirectional interface that uses a controller known as the master to communicate with slave devices. The device generate the clock is the master device, which all other devices are slave devices. Each device on I2C bus have a specific device can have one or multiple registers where data is stored, written or read. The physical I2C interface consists of the serial clock (SCL) and serial data (SDA) lines. Both SDA and SCL lines must be connected to VCC through a pull-up resistor. Being that the SDA line is bidirectional, it functions to transmit or receive data.

SPI

SPI, Serial peripheral Interface, is a master-slave type protocol that provides a simple and low cost interface between a microcontroller and its peripherals. The SPI protocol uses a dedicated clock signal that is created by the master device to synchronize the transmitter and receiver or master and slave. One device is considered the master of the bus, and all the other device are considered as slave devices. The microcontroller can communicate with the BMC IC via SPI communication. Their application memory devices such as SD cards, MMC, EEPROM or Flash sensor such as temperature or pressure sensors, control devices such as ADC, DAC, digital POTs, and audio codec, and other device such as touch screen

devices, LCD device, RTC, or video game controller. SPI communication uses 4 lines of each device. The is an input data line and output data line, a clock line, and a chip select line to identify which slaves device the master is trying to communicate with. If there are multiple SPI bo slaves devices connected to the master, then the chip select line function to select the specific slave device either to transmit data to it or receive data from it.

CAN

CAN, Controller Area Network, is the most widely used communication protocol in the automotive industry. CAN communication are used frequently in automotive application because it removes all signal noises such as electromagnetic noises. It also removes a host of core harnesses from a system. It is one of the most robust and reliable communication protocols. CAN application can be used in simple to extremely complex applications. They are used in both gasoline and electric vehicle. The CAN protocol is used with a chip that's allows for CAN communication between devices. One example of this is the TCAN1042-Q1 Automotive Fault Protected CAN Transceiver with CAN FD.

The microcontroller connects to the CAN chip which then connects to the outside devices. The CAN chip has TXD and RXD pins, which allows it to the communicate with the microcontroller. The TXD pin is for the transmission of data and the RXD pin is for the receiving of data. So these are the most common and most used communication protocols for battery management systems.