

## Energy - Current Sensing in Battery Management Systems

### Situation

- Battery Management Systems (BMS) control and protect the battery cells used in Electric Vehicle (EV) and Hybrid Electric Vehicle (HEV) systems.

- A BMS has three main objectives:

1. Protect the cells or battery from damage
2. Prolong the life of the battery
3. Maintain the battery charge level so that it functions correctly and meets application needs/specification

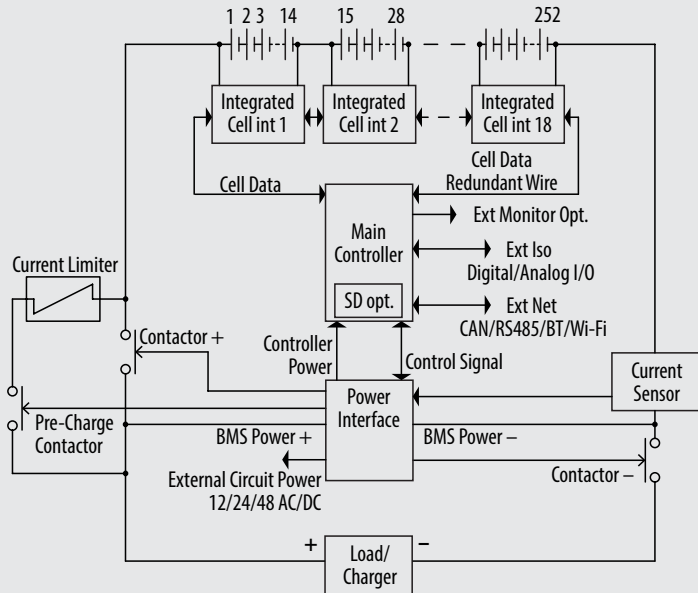
- Current sensing provides critical capabilities for accurate measurement of the charging and discharging current, which affects the life and functionality of the battery.

- Historically, thin film or thick film current sense resistors have not offered the ultra-low resistance and high power rating needed to handle these high current applications. In many applications, multiple resistors placed in parallel to the measured circuit were required, increasing PCB space as well.

- This application brief presents solutions from Bourns to reduce the amount of board space required and provide a more accurate measurement of the amount of current flowing through the circuit of a BMS.

Below is an example of a Distributed Battery Management System created by H. Fiyouz and licensed under the Creative Commons Attribution-Share Alike International License.

### Distributed Battery Management System<sup>1</sup>



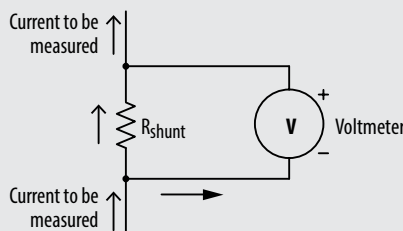
### Solution

- Bourns' current sensing solutions satisfy a fundamental requirement in a wide range of electronic applications from power supplies to DC/DC conversion. As energy efficiency requirements become stricter, extremely accurate measurements of current are needed.

- The Bourns<sup>®</sup> Model CSS2H and CSS4J series shunt resistors can be used where circuit designers must monitor a voltage drop across the sense resistor, converting to a current reading to assist in the efficient operation of the circuit.

- Bourns has developed a family of high power current sense resistors, giving designers solutions for accurate measurement in higher power applications.

#### Simplified Schematic



Bourns<sup>®</sup> Model CSS2H-3920 Characteristics:

- EB (Electronic Beam) welded metal strip
- Very high power
- Excellent long term stability
- Low resistance: <0.2 mΩ to 5.0 mΩ
- Low TCR: ±50 PPM/°C
- Low thermal EMF
- AEC-Q200 qualified
- Small footprint: 3920 package

### Benefits

- Small footprint and high power features assist in reducing the amount of board space required for current sensing.
- Provide an accurate measurement of the amount of current flowing through the circuit of a BMS due to very low resistance, low TCR, very high power and excellent long term stability.

- Bourns<sup>®</sup> CSS Series device features enable accurate measurement even at difficult times such as when current levels rise.

- Bourns<sup>®</sup> CSS Series products are optimal high accuracy current measurement solutions appropriate for many applications ranging from power supplies to DC/DC conversion.