PIHER sensing systems
an Amphenol® company

Utilizing Non-Intrusive External Hall Effect Current Transducers in Vehicle Battery Management Systems

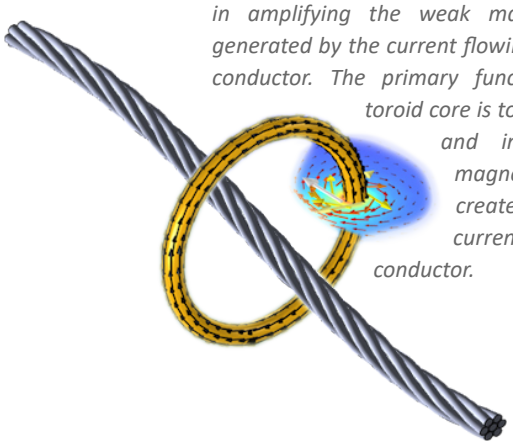
In modern vehicles, Battery Management Systems (BMS) play a crucial role in monitoring and managing the state of the battery. One critical parameter to monitor is the current flowing in and out of the battery with provides crucial data for determining the State of Charge (SoC) and State of Health (SoH) that is vital for maintaining its strength and longevity.

External Hall Effect current transducers are commonly employed in BMS for this purpose due to their accuracy, reliability, and non-intrusive nature.

Non-Intrusive Hall Effect for High Current Applications

Hall Effect current transducers operate based on the Hall Effect, which is the production of a voltage difference across an electrical conductor when a magnetic field is applied perpendicular to the current flow. In the context of current measurement, when a current-carrying conductor is placed in the vicinity of a magnetic field, the transducer generates a voltage proportional to the current.

Unlike traditional methods, the HCSO-1W Hall effect integrated circuits measure current without needing to directly touch the conductor, making them non-intrusive and suitable for use in high current applications. This ensures safety by keeping the high-current path isolated from the sensor. Additionally, Hall effect sensors have a smaller footprint and avoid the significant power loss and heat generation that plague resistive methods, promoting a more efficient system.



In an open-loop Hall effect current transducer, the toroid core plays a vital role in amplifying the weak magnetic field generated by the current flowing through a conductor. The primary function of the toroid core is to concentrate and intensify the magnetic field created by the current in the conductor.

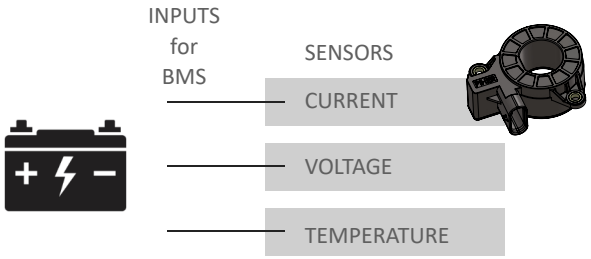
Integration into the BMS

The Hall effect transducer's output voltage is typically conditioned by the BMS through an amplifier and filtering stage. This processed signal is then fed to the BMS microcontroller, which converts it into a current value using the calibration data specific to the transducer. The BMS software then utilizes this current data for various functions, including:

- State of Charge (SOC): By integrating the charging and discharging currents over time, the BMS can estimate the remaining battery capacity.
- State of Health (SOH): Comparison between the battery's present capacity and its initial capacity at purchase. Offers useful details regarding the battery's life expectancy and potential replacement dates.

■ Over-current and Over-temperature Protection: The BMS can monitor current and temperature readings to prevent damage caused by excessive current draw or high battery temperatures. In such cases, the BMS can take corrective actions like reducing power output or disconnecting the battery.

■ Cell Balancing: During charging, the BMS can monitor individual cell voltages and use the current data to balance cells with slightly different capacities, extending battery life.



SOC and SOH are crucial input parameters for the BMS. They work together to ensure safe and efficient battery operation by monitoring its current state and long-term health. The complexity of the algorithms used can vary, but the overall concepts are essential for maximizing battery lifespan and performance in a vehicle.

PIHER's response: HSCP-1W Wire Mount Current Sensor

The **HCSO-1W** is a high-accuracy **dual channel** sensor that is ideal for measuring AC and DC currents in battery management systems, industrial battery chargers and motor control applications.

Installing the sensor directly on the current-carrying conductor, without the need for additional hardware simplifies the installation process and reduces the risk of errors and downtime.

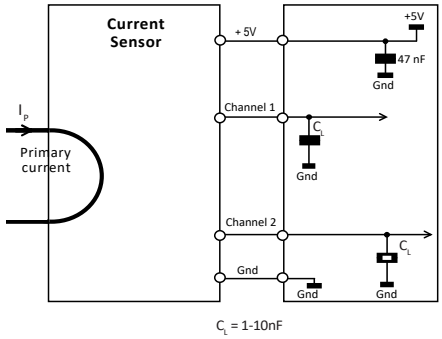
The sensor is available in a variety of current ranges and features a cablemounting option for easy installation. Dual output ready for **maximum versatility and redundant mode.**

It can measure currents from ±25 A to ±1000 A in cables with diameter section up to 22,5mm The sensor is easy to install and calibrate, making it a cost-effective choice.

Main Specifications:

Supply voltage	5 V ±10%
Current consumption	Typ. 26 mA
Analog output	0.5 V to 4.5 V
Creepage distance	3.95 mm
Clearance	3.95 mm
Operating temperature	-40 °C +125 °C
Over voltage protection	+10 V
IP rating	IP67 / IP69K (not considering connector)
Connector	TYCO 1-1564559-1
Max. Mounting torque	2.5 N.m (M4x, 7mm)

Scheme Example



Connect With Us Today

Piher Sensors & Controls
Polígono Industrial Municipal Vial T2, 22
31500 Tudela, Navarra, Spain
Tel: +34 948 820450

info@piher.net
www.piher.net