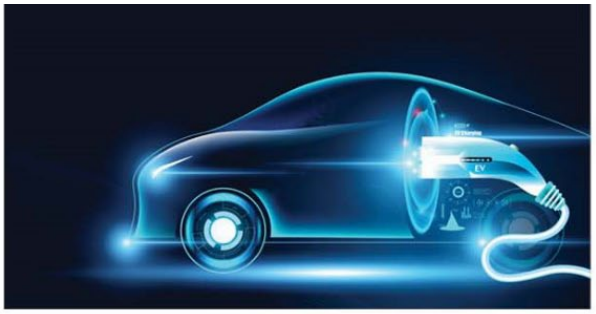
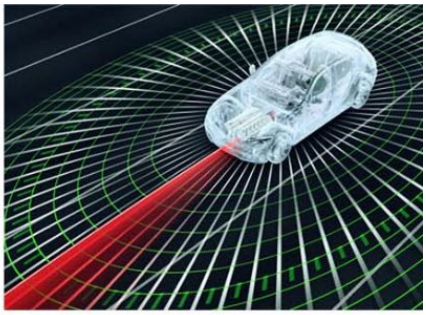
Seica

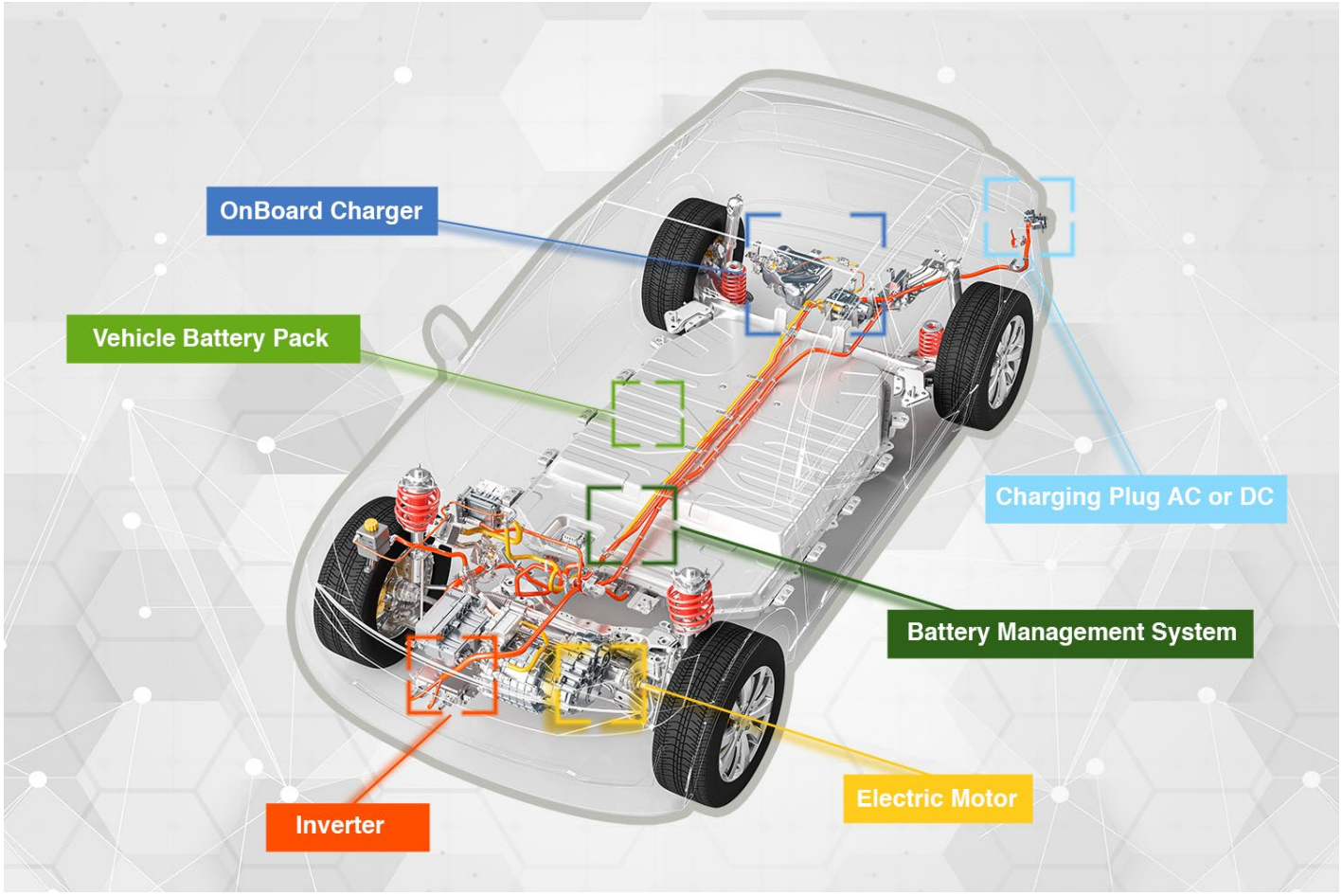
The rapid rise in demand for **Electric Vehicles (EVs)** in the automotive market has brought new technological challenges for manufacturers, especially in the **area of testing**. **Seica** has developed innovative solutions to address the issues involved in testing all **EV components**, a crucial step to ensure their safety and reliability.

The evolution of the automotive electrification requires an important know-how to efficiently face, in a technical and economical way, the test challenges of the **relevant modules** present in the electric vehicles.

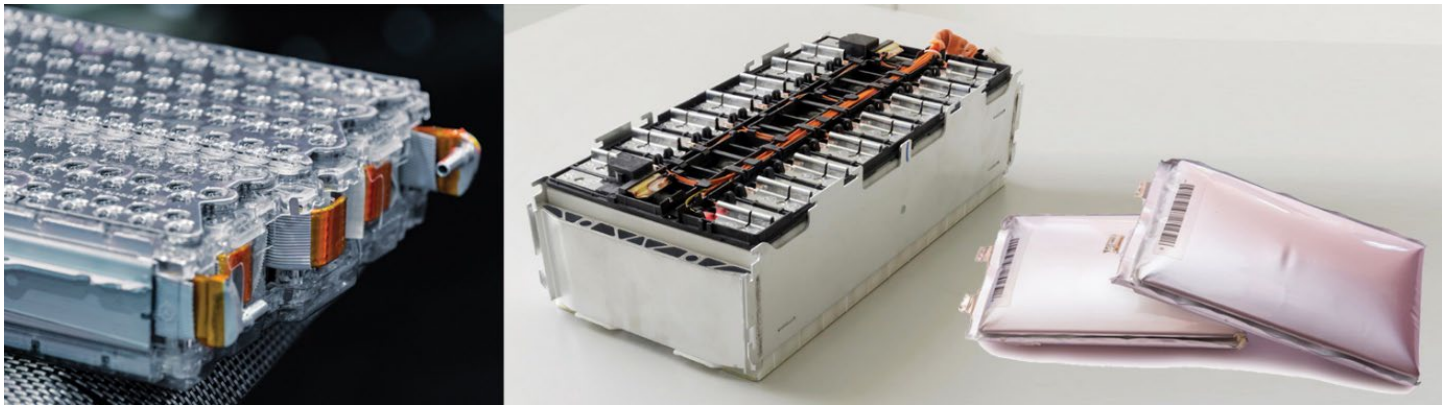
Testing solutions for the **Electric Vehicle Market**, whether for land, sea, air, or space applications, need to address not only battery ultrasonic or laser bonding tests but also all related modules and systems, such as the *Battery Management System (BMS), OnBoard Charger (OBC), inverter, and the electric motor itself*.

With nearly **40 years of expertise**, Seica remains a trusted partner for EV manufacturers, delivering innovative and tailored testing solutions to keep pace with the ever-changing market.



One of the main concerns of many OEMs, integrators, and new start-ups is the testing of **EV battery packs**: the need to increase production throughput, improve reliability of the manufactured product while optimizing the cost of battery pack testing is a major challenge.

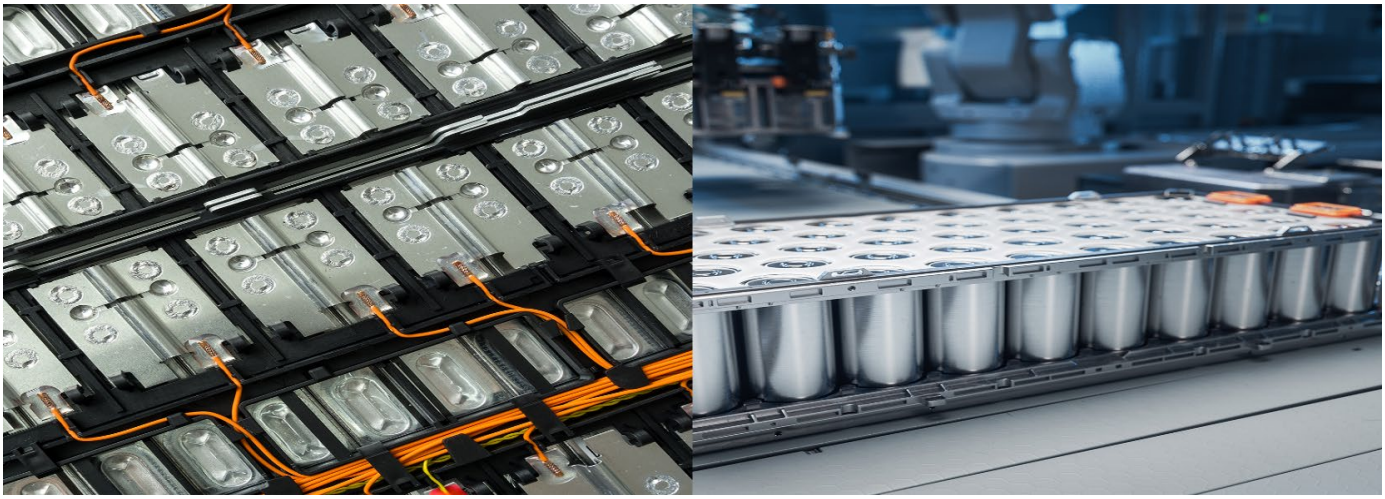
EV BATTERY PACK TEST



The electrical connections between battery cells are fundamental for ensuring both performance and safety, making **bonding tests** a crucial step in the battery manufacturing process. Resistance measurements, which must be conducted within a precise milli-Ohm or micro-Ohm range, are essential for certifying the integrity of these connections. Faulty connections can compromise the efficiency of the battery and, over time, lead to severe risks, including dangerous overheating and potential fire hazards.

Various verification methods can be implemented, including Automated Optical Inspection (AOI), mechanical traction tests, and measurements of power absorption during welding. However, AOI presents significant limitations: it captures images of the bonds and uses algorithms to assess their

quality, but it cannot guarantee the critical resistive parameters necessary for the safety and reliability of the battery pack. Therefore, in a heavily regulated industry like transportation, it is vital to perform physical or contact tests to ensure the safety of these connections.



In the battery manufacturing process, it is crucial to test three primary parameters: shorts, opens, and continuity. Regardless of the assembly method used—whether ultrasonic welding, soldering, brazing, or other techniques—the bonds must be electrically tested. Failure to verify these connections can lead to various risks, such as degradation of battery efficiency, performance issues, and reduced product lifespan.

In conclusion, an integrated approach that combines precise resistance measurements with visual and mechanical inspections is essential for ensuring the quality and safety of batteries, especially in a context where performance and reliability are critical parameters.

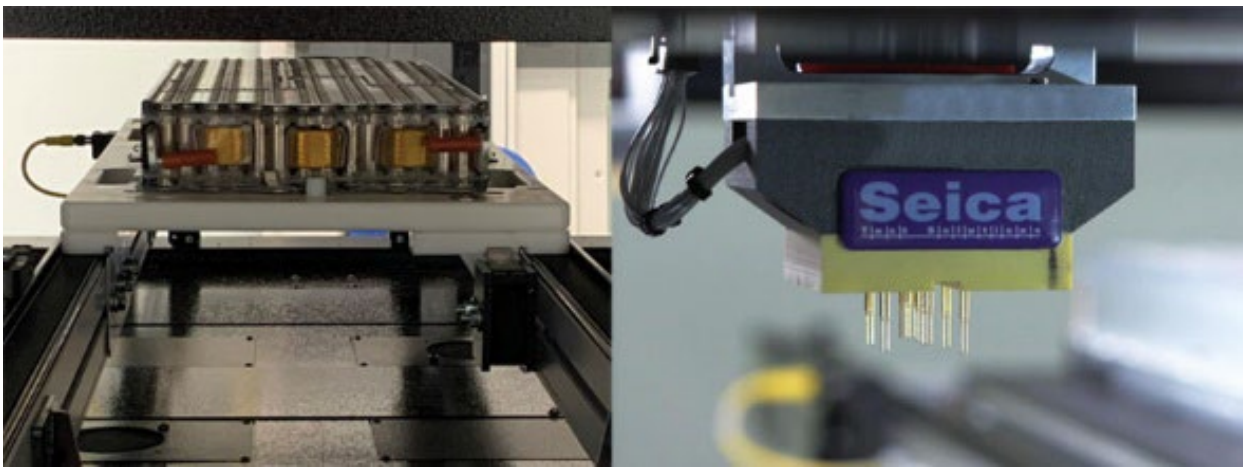
THE UNIVERSAL SOLUTION FOR EV BATTERY TEST

One of the main challenges is ensuring the **quality** and **reliability of the electrical connections between battery cells**, which are essential for the battery pack's proper operation.

To meet the growing need for electrical testing of the bonds inside battery packs, Seica has introduced a new line of flying probe systems: **Pilot BT, Pilot BTV,** and **Pilot BTP.**

The **Pilot BT** system can test the battery pack from the TOP side, performing precise parallel Kelvin tests on more than 32 cells at once, achieving a production rate of almost 4,800 cells per minute in its maximum configuration. It features a large testing area and uses the Bosch handling system to transport batteries.
For more complex battery packs requiring access from multiple sides, Seica has introduced the **Pilot BTV (Vertical Battery Tester)**, a flying probe system that allows simultaneous and automatic access on three sides. The **Pilot BTP** is a fully automated, horizontally oriented test system equipped with four flying test heads, enabling full-scale parallel testing and validation of EV battery packs.

No matter the battery technology, type, size or shape, Seica has a solution for reliable, repeatable electrical test at the required throughput rate, with complete traceability of each measurement.



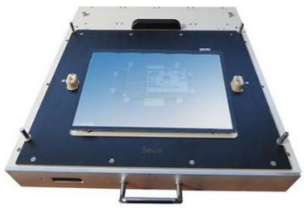
ACIR TESTING

Another crucial aspect of battery testing is measuring the internal resistance (IR) of the cells. Uneven current distribution can cause dangerous temperature variations within the battery pack. Seica offers solutions for both direct current (DCIR) and alternating current (ACIR) resistance measurements, with tools like the **Mini80** and **Mini200**, which can be integrated into automated systems or used for manual testing.

THE BATTERY MANAGEMENT SYSTEM (BMS) FUNCTIONAL TEST

The **Battery Management System (BMS)** is another key component, crucial for the performance, reliability, and lifespan of the battery. To ensure that each BMS meets its specifications, **a full**

functional test is necessary, which involves simulating the real operating conditions the BMS will encounter. **Seica** has developed the **Compact BMS Test System** to carry out comprehensive functional tests, simulating scenarios such as cell balancing and temperature fluctuations, ensuring the system operates correctly under all conditions.



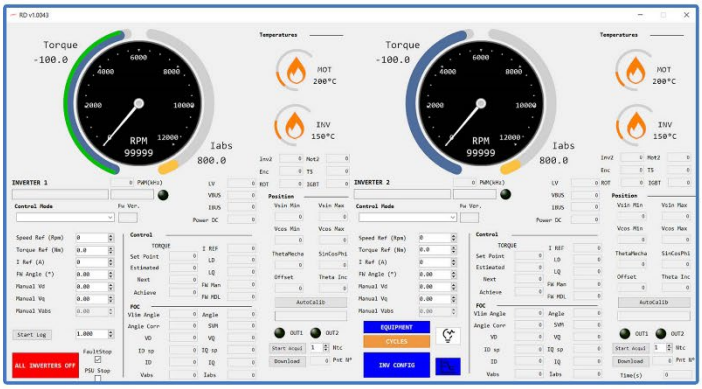
OBC AND INVERTER

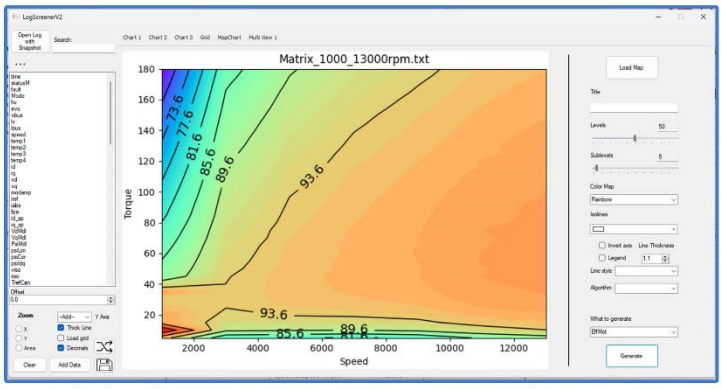
The **OnBoard Charger (OBC)** module is an essential part of electric vehicles, responsible for recharging the battery pack when the vehicle is stationary. The **inverter** module serves a similar role, but in reverse, powering the electric motor.
To thoroughly test these two modules, **Seica** has developed two systems based on its Compact MULTI platform: **Compact Multi-OBC** and **Compact Multi-Inverter.**

ELECTRIC MOTOR

The electric motor transforms electrical energy from the inverter into mechanical power to drive the vehicle's wheels, with speeds that can easily exceed 20,000 RPM. Testing all aspects of an electric motor's performance requires specialized knowledge and a custom-designed testing system.
The test involves using a torque sensor on the motor shaft to measure the force the motor can handle at maximum speed. To simulate the load (the vehicle), a second motor is used, either acting as a load (braking motor) or as a motor to simulate regenerative braking. In this setup, the braking motor functions as a generator, feeding the generated energy back into the power grid to save energy. The test also assesses the motor's efficiency by checking for energy loss and detecting any vibrations. When simulating regenerative braking, the motor under test acts as a generator, sending energy back to the inverter to recharge the battery.

Seica offers the **EMT EOL line for electric motor testing**, which is specifically designed for this purpose. With three different models (250/600/3000), the system can handle a wide range of electric motors. These systems are built on Seica's VIP hardware and software platform, ensuring they can be seamlessly integrated into production lines, traceability systems, and company MES, supporting Industry 4.0 standards.





Thanks to the global extension of Seica and its subsidiaries, Seica can ensure local service support wherever the customer needs it, in addition to 24-hour telephone assistance.

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