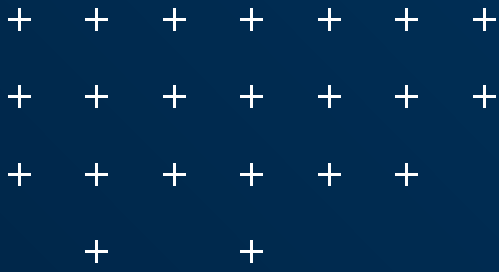


Know the True State of Your Battery

Battery Asset Solutions
enabled by Spectrometry
and Artificial Intelligence (AI)

- + Battery Diagnostics
- + Battery Management System
- + Energy Management Solutions





About Heimdalytics

Heimdalytics' core mission is the provision of next generation energy asset solutions based on the analysis of measured quantities utilizing leading edge artificial intelligence (AI).

Our first motivation is the need to solve battery management challenges especially for Lithium-Ion batteries. Solutions include both diagnosis and repair of batteries and management of critical electrical energy storage systems. Our solutions are based on the use of non-invasive sensing technology wherever feasible.



Dr. Christoph Weber
CEO Heimdalytics



Clemens van Zeyl
CEO Heimdalytics

Heimdalytics offers innovative solutions to the EV/Mobility and Energy Storage Industries to achieve:



Safe operation



Reliable Operation

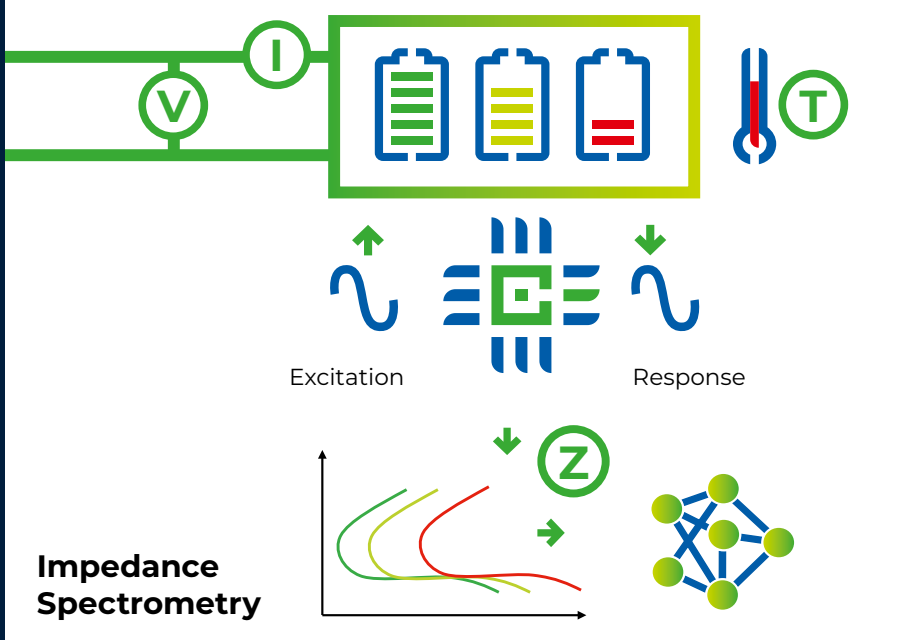


Increased Capacity



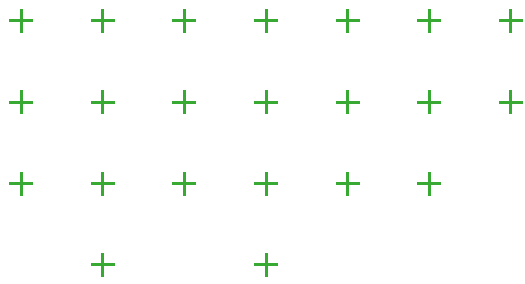
Environmental Stewardship

NEW: Impedance Spectrometry



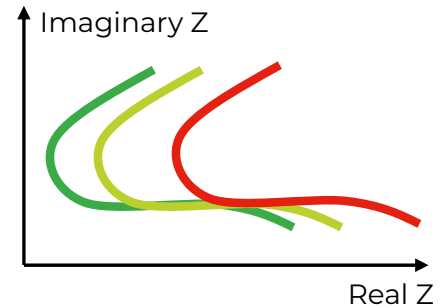
A fourth dimension is added using Impedance Spectrometry (Z), in addition to voltage (V), current (I) and temperature (T), to know the true state of your battery using AI.





Nyquist Plots

A group of battery cells are excited by a current source over a range of frequencies and their voltage response is simultaneously measured. For each measurable cell group, imaginary and real impedance ("Z") is calculated at each frequency. A plot of each imaginary and real Z is known as a Nyquist Plot.



Battery Diagnostics & Characterization

A proprietary multi-channel instrument suitable for standard 19" rack and 12 or 16 measurable cell groups. The high current rating of the instrument enables rapid cell rebalancing and capacity verification.

- + Identification of abnormal/outlying modules/cells for replacement
- + Matching of replacement modules/cells to repair a battery pack
- + Rapid rebalancing of replacement battery modules for re-entry into service
- + Enterprise Battery Tracking



How it works



The Nyquist Plots of Z, combined with V, I and T and other data such as capacity measurements, are stored in a cloud data base



AI (Advance Machine Learning) is used to analyze the data, identify unhealthy battery cells or cells groups and categorize them



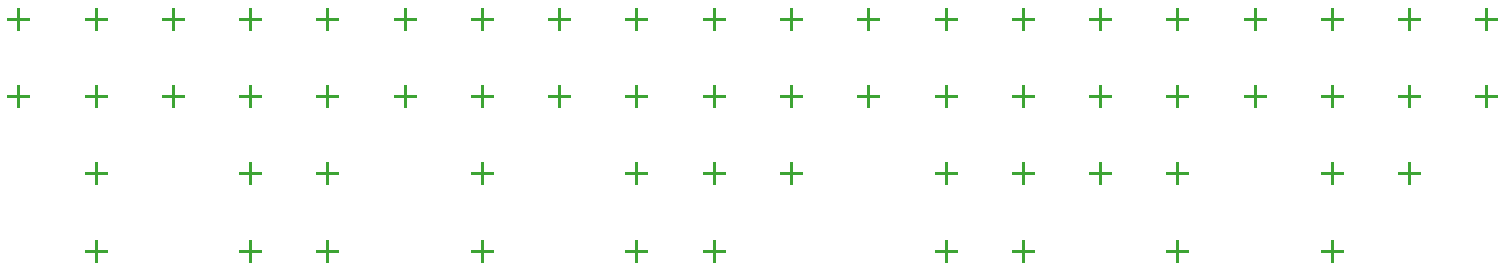
Charging/discharging for capacity measurements and balancing are performed by a controllable power supply



An operator interface terminal controls the Instrument and provides an overview of all measurements



A life-record is stored in a cloud data base for retrieval by a multi-window dashboard



Battery

Management

System



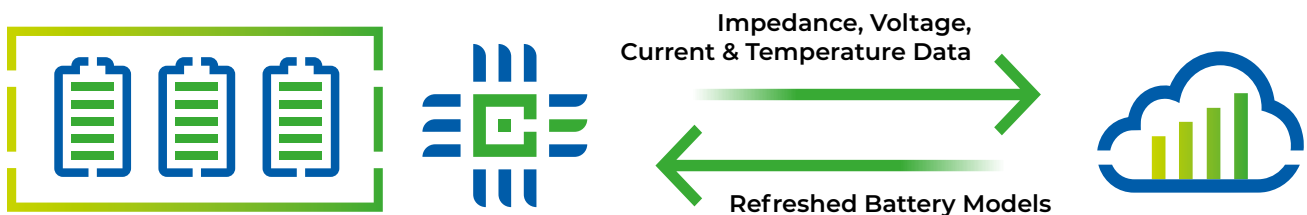
Heimdalytics Battery Management System solution revolutionizes the way battery cells' are measured.

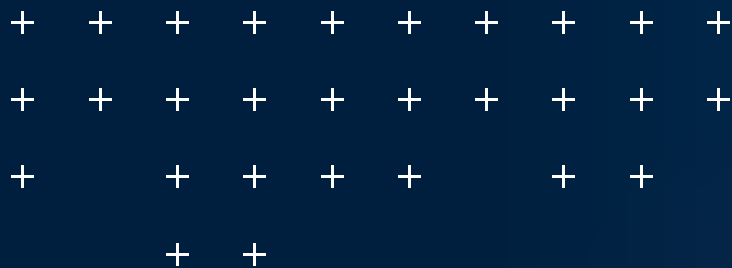
While lithium-ion batteries are prevalent in our lives, they are made safe through the encasement of the battery, combined with temperature sensing and cycle counting. This strategy is effective for electronics and small mobile applications, but impractical for large systems. Large systems require accurate measurement of a battery's "state of health", so that it may be isolated and replaced before failing. Further, accurate measurement of the energy stored, referred to as its "state of charge", is necessary to fully utilize the asset.

A proprietary battery measurement unit (BMU) is mounted with every module of battery cells.

Heimdalytics offers a groundbreaking **Battery Management System (BMS)** solution that revolutionizes the way battery cells' state of health (SoH), state of charge (SoC), and internal core temperature are derived. Our non-invasive approach ensures accurate readings, crucial for safe and reliable battery operation.

Local Battery Management with Cloud Generated Battery Models





AI generated models calculate with high accuracy a Battery's State of Health (SoH) and State of Charge (SoC)

How it works



Nyquist Plots of Z, combined with V, I and T, are stored in a cloud data base



When a battery's SoH is approaching red, it is taken offline



Accurate SoC calibrates the "storage gauge" for full utilization of the battery



The cloud-based AI periodically delivers to the battery micro-controller updated battery models for SoH and SoC

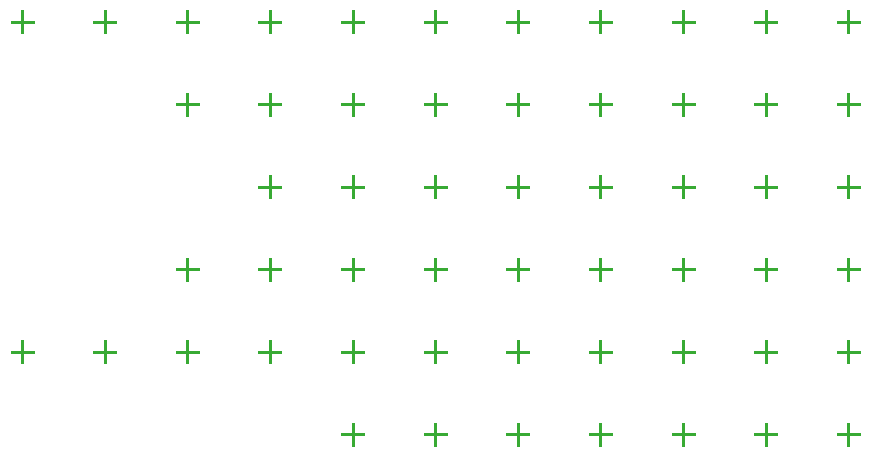


The battery micro-controller also provides standard protections mandated by the codes and standards



A life-record of each battery is maintained in the cloud for future reference

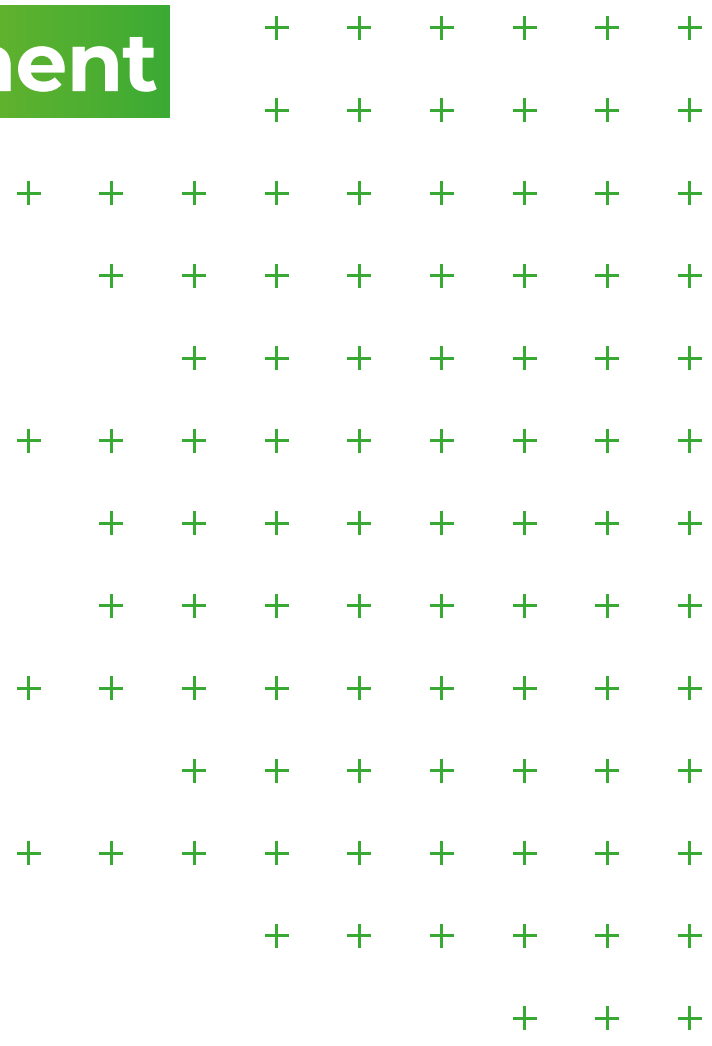
Compatible with all cell chemistries, Li-Ion (LTO, LFP, NMC etc.), Lead-Acid and other battery types.



Energy Management Solutions

Heimdalytics' spectrometry and AI solution can also provide guidelines to an energy management system to extend a battery systems' life.

If you are interested in a pilot project including your battery application, don't hesitate to contact us.



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