THE MEASUREMENT SOLUTION. burster

Battery measurement methods

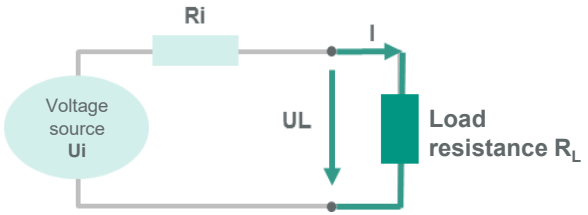
AC/DC internal resistance measurement to ensure the quality and functioning of modern battery systems

Identifying the weakest cell is essential!

AC/DC internal resistance measurement ensures quality and functioning

In e-mobility applications, high quality and safety critical Li-ion battery cells are now used en masse in battery modules or complex systems. Homogeneous, safe and consistent operating behavior of cells in an assembly is required.

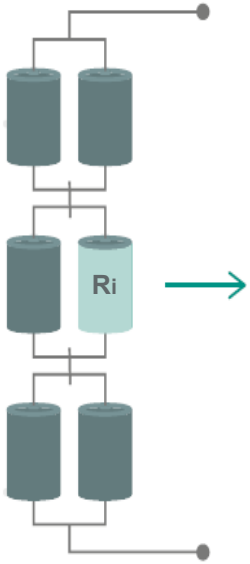
Increased internal resistance of one battery cell in an assembly has serious effects.



The AC/DC internal resistance measurement method (two-frequency measurement) used in burster battery measurement systems is ideally suited to seamless fully automated series production, to prevent serious failures in advance.

Goal: Best possible battery balancing within a battery assembly

Influence of the battery's internal resistance



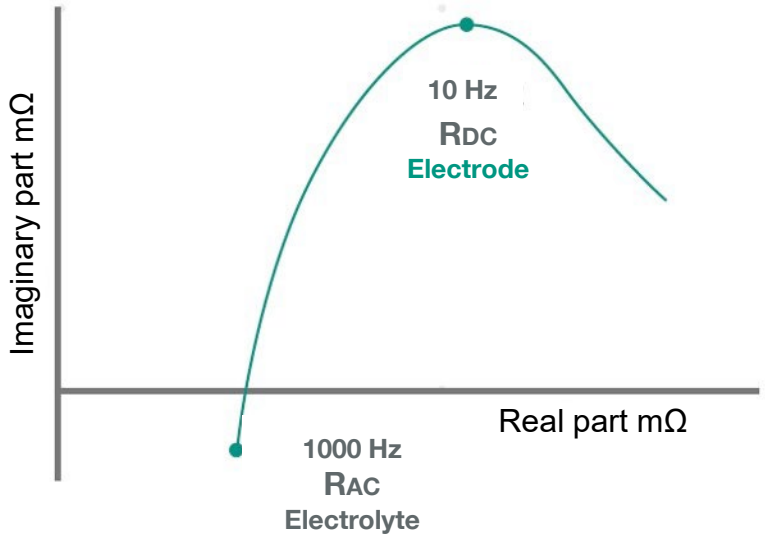
Battery assembly

- Greater heating results in acceleration of the aging process ($P = I^2 \times Ri$)
- Ri causes a difference between internal (U_i) and external (U_L) state at $I \neq 0$ and influences the SoC measurement (e.g. charge balancing)
- Internal resistance Ri influences charge/discharge current, and therefore storable energy and deliverable power
- Battery life

Combined AC/DC internal resistance measurement

- The internal resistance of a battery cell is frequency-dependent
- Increasing frequency results in decreasing internal resistance and capacitive/inductive reactive components
- Combined AC and DC resistance measurement at predefined frequencies (typically 1 kHz and 10 Hz) enables precise measurement and evaluation of significant battery parameters in just a few ms

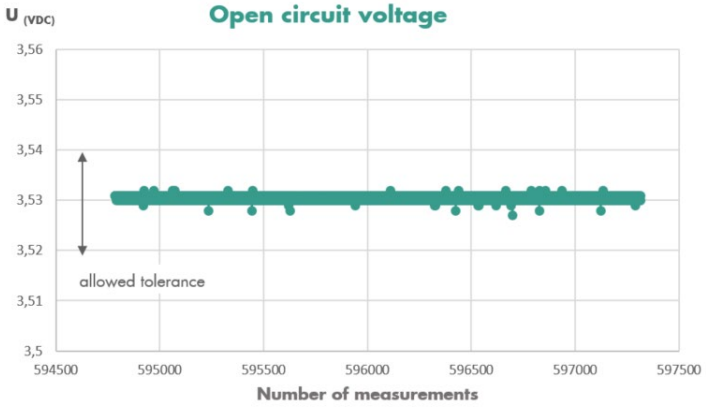
R_{DC} – Internal DC resistance – Electrode
R_{AC} – Internal AC resistance – Electrolyte

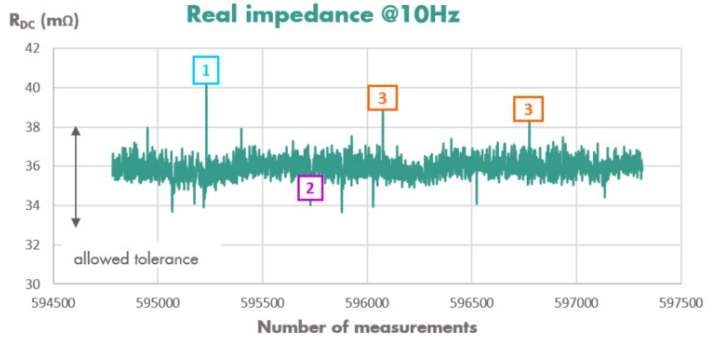


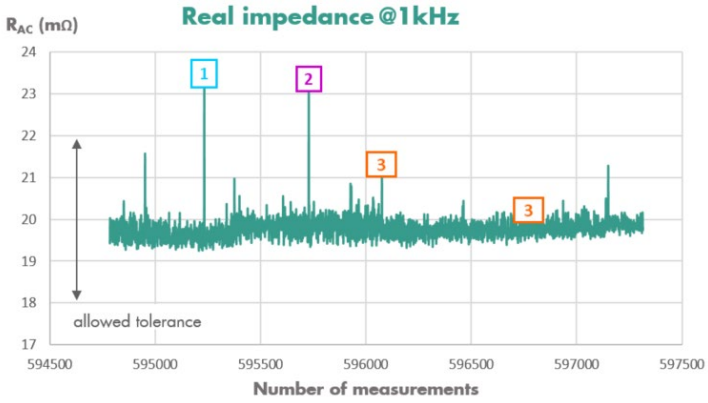
Internal AC and DC resistance measurement

Combined AC/DC internal resistance measurement

Example: 100% Li-ion round cell testing in mass production







1 = Offset error on cell **NOK** (cause → poor contact; measure → reject, investigate)

2 = Electrolyte (ohmic) in cell **NOK** (cause e.g. corroded terminals, poor conductivity; measure → reject)

3 = Electrodes (ohmic) on cells **NOK** (cause e.g. change in the electrode microstructure of the active mass; measure → reject)

The open circuit voltage (OCV) measurement alone is not always meaningful! Only the measurement of both real impedance values (at 10 Hz and 1 kHz) can provide informationabout the battery quality!

Measurement method AC/DC internal resistance measurement

Focus on cost-effectiveness, certainty and quality

Possible consequences

- Fire hazard
- Premature aging
- Capacity losses
- Impact on battery life
- Differences in operating performance

Therefore: Quality assurance by identifying weak points

- Check at **an early stage of the process** (BoL, incoming goods inspection)
- General OK/NOK result

How?

- **Internal AC and DC resistance measurement**
  - Additional measurement method for open circuit voltage measurement
  - High-speed multi-channel measurement technology
  - Complete production control

Model 2511