

Case Study

HIGH ACCURACY IN HIGH VOLTAGE BATTERY MANAGEMENT TESTING



Country: Germany
Industry: Automotive - E-Mobility
Client: Deutsche ACCUotive / Daimler AG

Vertrieb durch



AMC – Analytik & Messtechnik GmbH Chemnitz

Heinrich-Lorenz-Str. 55
09120 Chemnitz

Tel.: +49/371/38388-0
Fax: +49/371/38388-99
Web: www.amc-systeme.de

E-Mail: info@amc-systeme.de

Gantner Instruments specializes in data acquisition of electrical, thermal and mechanical measurements in test automation. The Q.series product range offers best performance and high isolation for the evaluation of components of hybrids, plug-ins and all-electricals. For our German client ACCUMOTIVE, a subsidiary of Daimler AG, specialized in research and development of batteries used in e-drives, we delivered the testing application solution for their high voltage battery management system.

What was tested and how?

Developing batteries that are delivering enough power to expand an electric vehicle's range, allowing faster charging, and are also safer to use, are only a few of the industry's top challenges. Using high voltage batteries in e-drives is promising, since they deliver remarkably more power. They also contribute to a longer battery life, since less current is doing the same amount of work.

But even the best batteries need a solid battery management system, that is enabling a safe and reliable use, protecting the battery and is also helping to provide a longer battery lifetime.

In this application the testing of a high voltage battery management system focused on the simulation of temperature profiles and thermo-mechanical load conditions to prove the suitability of all new materials and components. We tested high density battery packs. Measured parameters were voltage, current, and temperature cycles, with a logging speed from 1Hz to 1kHz - all on a potential of +/-500V which required permanent channel to channel isolation.

What was the configuration of the testing setup?

The testing set up consisted of 15 DAQ systems with different measurement modules for voltage, resistance, temperature and more. Each of these 15 systems offered 30-50 input channels with interface to our customer's own DAQ software.



Picture sources: daimler.com

Which
GI products
were used?



Each of the 15 DAQ systems used different combinations of the following 3 Q.series X modules and each unit was controlled by 1 Q.station, collecting data from 4 battery packs.

Q.bloxx A105 for measuring temperature and resistance

The A105 offers 4 input channels for temperature sensor Pt100 or resistance in 3- or 4-wire-technique. The high measurement accuracy with a deviation of max. 0.05°C and its high digitalization accuracy helped delivering the most precise results. The key features of the module Q.bloxx A105 are:

- High accuracy with deviation of max. 0.05°C, temperature influence 0.02/10K
- 4 input channels Pt100 or resistance in 3- or 4- wire technique
- High accuracy digitalization: 24 bit ADC, 10 Hz sample rate per channel
- Signal conditioning: linearization, digital filter, average, scaling, min/max storage, arithmetic, alarm
- Galvanic isolation: channel to channel to power supply and to interface Isolation voltage 500 VDC



Q.bloxx 107 universal measurement module:

The module A107 is a real multi-talent. Whether you are measuring voltage or resistance, temperature or AC/DC bridges - the module's 4 universal analog input channels can handle it all. The key features of the module Q.bloxx A107 are:

- 4 universal analog input channels for voltage, current, resistance, potentiometer, Pt100, Pt1000, thermocouples, measuring bridges
- Fast high accuracy digitalization: 24 bit ADC, 20 kHz sample rate per channel
- Signal conditioning: 16 virtual channels, linearization, digital filter, average, scaling, min/max storage, RMS, arithmetic, alarm
- Galvanic isolation: channel to channel to power supply and to interface Isolation voltage 500VDC



Q.bloxx A128 the permanent high isolation module for dynamic high voltages:

- 4 high galvanic isolated input channels:
- differential voltage, isolation voltage 1200 VDC permanent
- 4 measuring ranges selectable each channel ±40 V; ±120 V, ±400 V, ±1200 V
- Fast high accuracy digitalization:
- 24 bit ADC, 50 kHz sample rate per channel with 4 active channels, 100 kHz sample rate per channel with 2 active channels
- Signal conditioning: linearization, digital filter, average, scaling, min/max storage, RMS, arithmetic, alarm
- Galvanic isolation: channel to channel to power supply and to interface
- Isolation voltage 1200 VDC / 858 VACrms
- Test capital 5 kVDC over 1 minute

All modules share the following features:

- Connectable to any Q.controller e.g. Q.station, Q.gate or Q.pac
- RS485 fieldbus interface: up to 48 Mbps - LocalBus, up to 115.2 kbps - Modbus-RTU and ASCII
- Electromagnetic Compatibility: according EN 61000-4 and EN 55011
- Power supply 10...30 VDC
- DIN rail mounting (EN 60715)



Q.station 101 the test controller:

The Q.station 101 is the perfect edge controller for high-performance monitoring. It offers very high data rates for precise data acquisition, interfaces to different protocols and can be connected with up to 64 Q.bloxx modules.

- High data rates of up to 100 kHz at 8 channels (2 each UART line), 10 kHz at 128 channels
- Connectable with 64 Q.bloxx modules
- Ethernet interface for configuration and data output (1 Gig-E, TCP/IP, UDP, up to 16 MB/s Modbus TCP/IP, ASCII, High Speed Port Web server, web client and e-mail)
- Fieldbus interface:
 - EtherCAT-Slave, 1024 variables read and write at 10 kHz 1 x CAN, 2 x USB 2.0, 4 MB/s
 - Synchronization and time stamp of measurement values:
 - IRIG 2 based master slave principle on RS485 standard system synchronization $\pm 1 \mu\text{s}$ applicable
- Data buffer memory dyn. 500 MByte, stat. 4 GByte (expandable over USB (up to 1000000 measurements/s) and SD card)
- 8 digital inputs / 4 digital outputs (direct connection of encoder for fast angle measurement frequency, PWM and countermeasures, state signals)

This testing application solution for a HV battery management system scores with its very high accuracy of every measurement module used and with permanent channel to channel isolation of 500VDC and 1200VDC.

For our client DAIMLER AG we also delivered 12 test beds for the monitoring of fuel cell systems and were trusted again to provide the exact and accurate battery testing solution for this product innovation in e-mobility. We are thankful for the renewed confidence and proof once again that we are ready to deliver test and measurement solutions that are able to keep pace with changing trends in any field of mobility.

For more detailed technical information on the Q.series, high isolation DAQ modules and just anything you need in testing in electromobility, please visit:

<https://www.gantner-instruments.com/product-group/q-bloxx-xl/>

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09120 Chemnitz Fax: +49/371/38388-99
E-Mail: info@amc-systeme.de Web: www.amc-systeme.de

Gantner Instruments GmbH

Montafonerstrasse 4
6780 Schruns
Austria

info@gantner-instruments.com
www.gantner-instruments.com

Austria | Germany | France | Sweden | India | USA | China | Singapore



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