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The Newsletter for Data Acquisition and Control
Issue 278 January 2022

Welcome to the first issue of 2022. This month - measuring temperatures of themal runaway and exploding batteries.. You can download a pdf copy of the newsletter here.

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Measuring temperatures of exploding batteries

As electric vehicles become widespread, the demand for lithium-ion batteries is forecast to expand exponentially over the next three years. To prevent accidents, batteries are equipped with safety mechanism. However, fire and explosions have been known to be caused by batteries.

Researchers in Malaysia are studying the conditions in which batteries fail and cause thermal runaway - an uncontrollable increase in temperature.

They subjected batteries to a variety of electrical, themal and mechanical conditions and compared the characteristics of thermal runaway.

For measuring temperatures, the engineers used type-K Inconel sheathed thermocouples to measure temperatures inside an oven. The data was recorded at a frequency of 1 Hz with a resolution of 0.001 ^{0}C by using Microlink 751 data logging interface and Windmill data acquisition software.

They placed a battery inside two ceramic pots. They then enclosed the pots in a stainless steel holder. This was to prevent damage to the oven.

Inside the pots they connected three thermocouples which would measure the temperatures around the battery. Two further thermocouples measured the temperature of the oven air and of the base of the steel holder.

The Windmill system continually logged temperatures as the oven heated to

When the researchers later investigated the batteries, they found evidence of a violent explosion of battery contents.

Thermal runaway hazard of lithium-ion batteries stems from a combination of highly reactive electrodes and flammable organic electrolytes. It doesn't necessarily need high temperatures to occur but can also be triggered by, for example, charging and discharging beyond the specified limit or physical impact inducing an internal short-circuit.

Further Reading

Microlink 751: Multi-Function USB Unit: Voltage, Temperature, Strain, pH, Current, Counting, Control, etc
https://www.microlink.co.uk/751.html

Mohamad Syazarudin Md Said, Mohd Zahirasri Mohd Tohir, Characterisation of thermal runaway behaviour of cylindrical lithium-ion battery using Accelerating Rate Calorimeter and oven heating, Case Studies in Thermal Engineering, Volume 28, 2021, 101474, https://doi.org/10.1016/j.csite.2021.101474

Your Data Acquisition Questions Answered:

Question

> We have to manage an on-field acquistion of 16 strain gauges applied on the exhaust system of a boat. We don't need a very high frequency, 10 Hz is enough, but we expect quite a low level strain signal (100 - 150 με): as you can understand white noise around 40 microepsilon should be a bit too powerful. I have seeen that model 770 has 10 sample/second/channel, that could be right for us: it's possible to use 594 with 770 or have you any other suggestion for us? 10sample/second/channel and noise less than 10 με for a signal around 100 με is our target.

Answer

> There are 2 options for doing this.
>
> 1. Using a Microlink 851-SG you can log 16 channels 10 times per second into memory. The memory will hold 64K scans.
>
> 2. Using a Microlink 770 and 594 you could log at say ten times

The Microlink 770

Further Reading

Microlink 770: High Speed Data Acquisition
https://www.windmillsoft.com/daqshop/high-speed.html

Microlink 851-SG: Strain Data Logger
https://www.windmillsoft.com/daqshop/strain-data-logger.html

Understanding strain measurement
https://www.windmill.co.uk/strain-measurement.html

DAQ News Round-up

Welcome to our round-up of the data acquisition and control news. If you would like to receive more timely DAQ news updates then follow us on Twitter - @DataAcquisition - or grab our rss feed.

Detecting crop nitrogen with hyperspectral sensors on planes

The sensing technique is not only very fast, it also provides much higher spectral and spatial resolution of nitrogen status and photosynthetic capacity than similar studies using satellite imagery.
Source: Future Farming
https://www.futurefarming.com/

Miniaturised sensor can analyse the chemical content of milk and plastics.

Near-infrared sensor could fit in a smartphone and is ready for immediate use in industrial process monitoring and agriculture.
Source: Eindhoven University of Technology
https://www.tue.nl/

Ultra thin solar cells can go anywhere

Lightweight and flexible, they can be moulded to irregular shapes - a car roof, an airplane wing or the human body.
Source: Stanford University