

Case Study: Battery Monitoring and Management with the Strato Pi CAN Server

The modern technology landscape sets difficult challenges on a regular basis. Having access to standard off-the-shelf hardware does not always prove to be enough. Pressures to optimise operation as much as possible and to fit in with specific application criteria often mean the modifications to existing products will be necessary. On numerous occasions, Sfera Labs has shown that it can adapt items from its product portfolio to suit customers' exacting requirements. As we will see, the work that it undertook for battery manufacturer Redflow is a prime example.



Figure 1: Z-cell battery in housing; Sfera Labs' technology deployed in a Redflow battery energy site

Based on a zinc-bromine chemistry, with a proprietary structural design, Redflow produces the ZBM2 - which is recognised as the world's smallest hybrid redox flow battery. With 845mm x 823mm x 400mm dimensions, this advanced energy storage unit is suitable for a wide variety of potential uses - from telecommunication infrastructure through to industrial equipment and renewable energy generation sites. Featuring a 48VDC output, it has a 10kWh storage capacity. It supports a far greater depth of charge (DoC) than competing batteries employing either lead-acid batteries or lithium-based chemistries, and has exceptional charge retention properties. Furthermore, it can deal with much higher ambient temperatures.

The Redflow ZBM2 batteries are typically deployed in clusters of up to 60 units. Pivotal in maintaining performance levels and assuring high availability for these clusters is having an effective battery management system (BMS) to accompany them. Through this, real-time performance data can be acquired. The data can then be passed back to the cloud in order that operational parameters can be monitored and any functional issues that might occur can be attended to quickly.

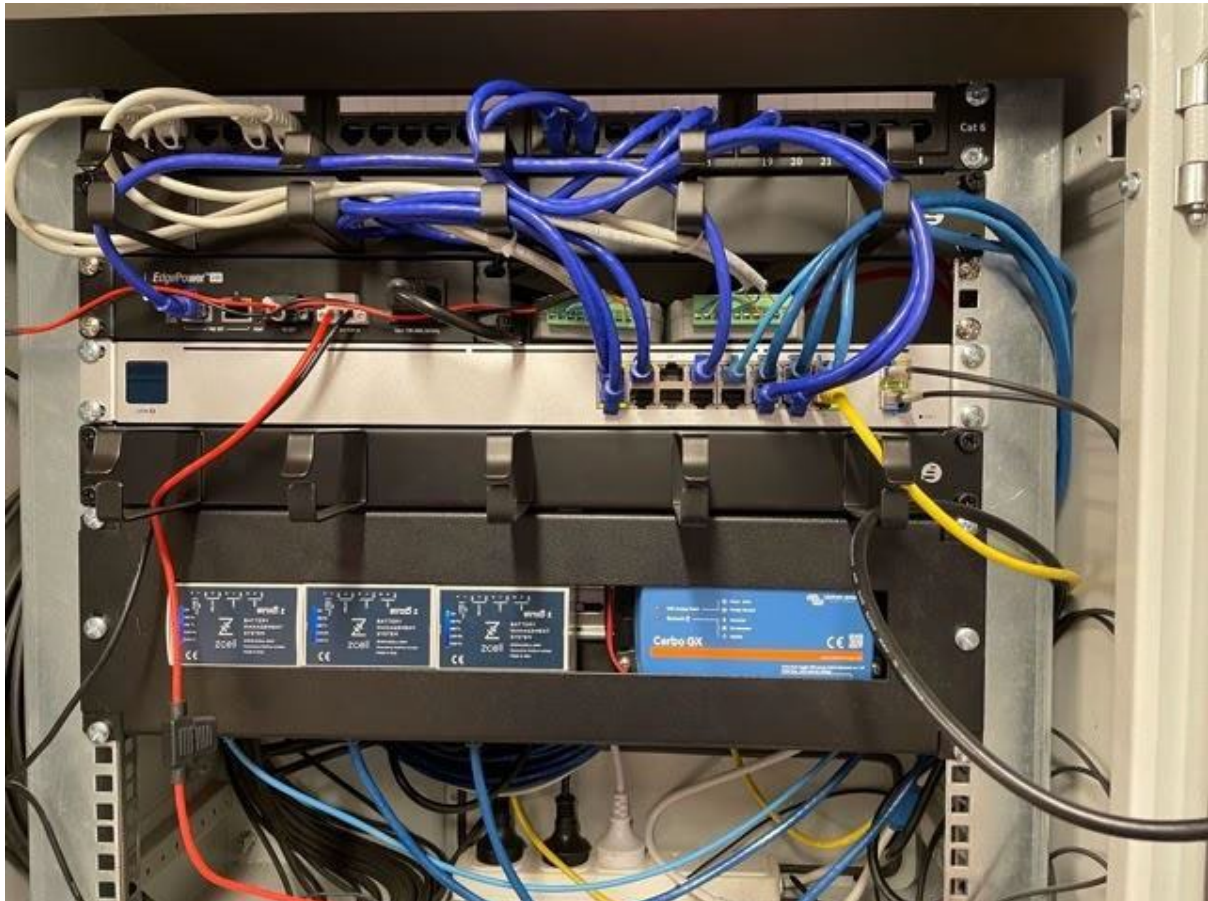


Figure 2: Redflow's Battery Management System (BMS) efficiently monitors and manages ZBM2 batteries

The Redflow engineering team needed a suitable hardware platform to utilise in conjunction with the company's BMS software, which they had developed in-house. For convenience, they wanted this platform to be based on Raspberry Pi technology. The Raspberry Pi main board needed to be housed in a DIN-rail enclosure, and complemented by robust industrial-grade interfaces that would be suitable for deployment in uncompromising application environments. Via these interfaces a wide-range of input voltages could be accommodated. Having a CAN interface was seen as essential, as this would facilitate integration of Redflow battery clusters into industrial and renewable energy installations where a more conventional battery technology would have otherwise been used. In addition to this, a RS485 serial port, watchdog circuitry and a real time clock (RTC) all needed to be built into the design.

Redflow engineers realised that collaborating with an experienced hardware specialist would be a much better strategy than trying to work on this BMS project themselves. Having looked at what prospective solutions were available from different vendors, it soon became apparent that Sfera Labs' widely-deployed [Strato Pi server](#) was capable of ticking all of the relevant boxes. After carrying out extensive trials on a sample, Redflow engineers entered into dialogue with their counterparts at Sfera Labs in order to discuss some of the more specific needs they had, and what could be done to enable these to be met.

“Strato Pi stood out as the best fit for our needs. There was nothing else on the market that even came close to offering the same functionality and performance,” states Simon Hackett, system Integration Architect at Redflow Limited. “We were also impressed by how promptly Sfera Labs' staff dealt with any technical queries we had and addressed any areas of concern.”

Thanks to the Strato Pi, data emanating from the BMS may be checked by an operative through their mobile handset, using an intuitive web-based portal. It also offers provision for push notifications to be sent if there is a situation arising that needs immediate action to be taken. At first, Redflow had to ship the hardware along with a voltage adaptor and a USB-to-CANBus bridging dongle. This added unwanted expense to the overall solution however, as well as making things more complicated for the installer. Consequently, the engineers at Redflow and Sfera Labs started to discuss how the Strato Pi might be modified - thereby streamlining the BMS solution and making it more cost effective too.

The result was [Strato Pi CAN](#), which is now available to all Sfera Labs' customers. It comes with the CANBus interface (capable of transferring data at a 1Mbit/s data rate) directly incorporated. For data protection purposes, a Microchip ATECC608A secure element chip is included. In addition, an opto-isolator mitigates the threat posed by electro-static discharge (ESD) strikes.



Figure 3: Sfera Labs' Strato Pi CAN is a Raspberry Pi server tailored for industrial and automotive applications where reliability and service continuity are key

As well as adding a CANbus interface into the Strato Pi units, Sfera Labs were able to offer several supplementary services that would be of huge benefit to the customer. Redflow's software was pre-loaded onto these servers, and each was then fully tested prior to shipping. A custom logo was created and applied to the products when they left the Sfera Labs' production line and custom labelling was also added to the shipment boxes.

"Everything ran really smoothly, and we soon started to receive shipments of pre-loaded, properly labelled, fully tested BMS units, direct from Sfera Labs," Simon Hackett continues. "This arrangement has required zero effort from Redflow, as everything has successfully been offloaded onto the Sfera Labs team. Our system integration partners are provided with a plug-in solution that is incredibly simple to install."

Utilising Sfera Labs technology, the Redflow BMS is now fitted as standard in every site deployment of Redflow batteries. The reliability of the hardware has been underlined by the fact that the company has not witnessed a single field failure in any of its many installations. It has meant that Redflow clients can have complete confidence in the ongoing operation of their energy storage system - with both elevated performance and the highest degrees of safety always being a certainty.



Figure 4: Redflow batteries being used by Vodafone New Zealand for remote energy storage