Lithium batteries = smart savings

Smart meters are key to cutting domestic energy consumption. Dr Thomas Dittrich of Tadiran Batteries explains how his production line plays a vital role in the value chain, offering durability and cost efficiency through sophisticated technology

Smart meters make it possible to cut energy consumption by as much as 10-15%, making a huge contribution towards energy efficiency and climate protection. To guarantee a reliable, low-maintenance life-cycle of up to 20 years requires high-quality, reliable small parts, including batteries.

Tadiran batteries are sealed by means of a hermetic glass-to-metal seal. The battery's suitability can be verified within a reasonable space of time using various tests. Test results are supported by practical experience with batteries that have been in use for more than 20 years.

Batteries for back-up and RTC

Smart electricity meters require a real-time clock (RTC) that continues to run in the event of a power cut – a function that requires a back-up battery.

Batteries for meter functions

Smart meters for gas, water and heat work electronically and require an independent power source.

One typical application is an electronic gas meter using a lithium battery as the voltage source. The minimum voltage is 3.2 volts. The electronics have a basic current of 80 µA. The ultrasonic sensor requires current pulses of 10 mA for 11 ms every two seconds. This gives rise to an average current requirement of 160 µA and a capacity requirement of 16.2 Ah in 11.5 years. A temperature range of -20 °C to +60 °C is also required. These specifications can only be met by the lithium thionyl chloride (LTC) system with a single cell.

Figure A shows the result of a long-term test on the lithium battery, carried out over 13 years. In this test, the current profile was simulated by a resistive load, slightly higher than in the meter, with superimposed current pulses.

Batteries for prepayment meters with a RF module

One way of forwarding the measured values of a smart meter for analysis and display, entails transmitting them a short distance to a data collector or communication module using low-power radio waves (as displayed in figure B).

An electronic prepayment gas meter with a radio module and shut-off valve, for instance, could typically have an average current of 140 µA and a minimum voltage of 3 volts. It must work in a temperature range of -20 °C to +60 °C, and consumes 14 Ah in 11.5 years. The shut-off valve requires a current of 25 mA for 50 s once a week.

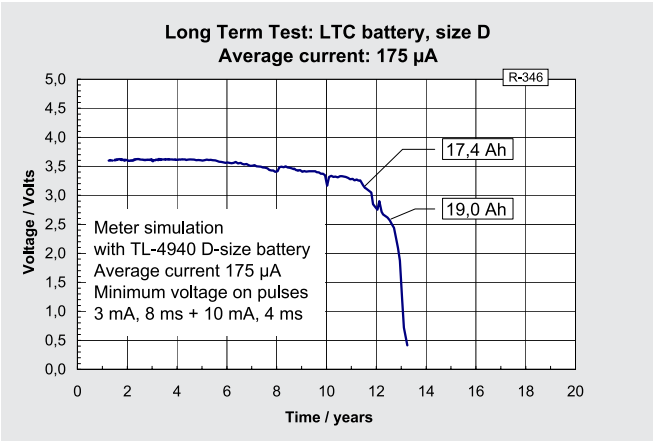

Figure A

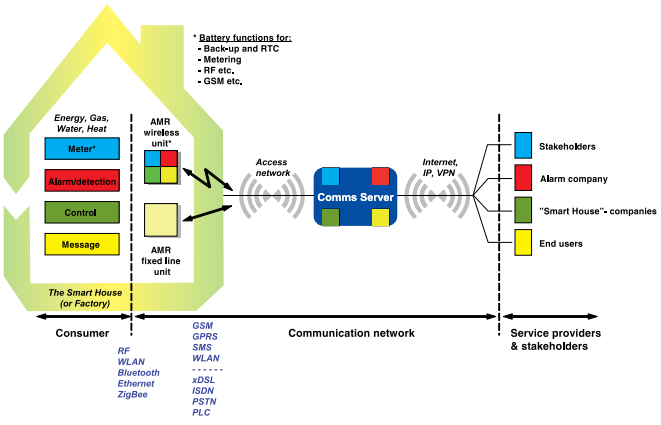

Figure B

Such requirements can only be met by a single cell with an LTC system battery. In this case, analysis shows that the battery voltage will probably fall below the minimum value of 3 volts after around 10 years, although the battery capacity would be sufficient for another two to three years. This is due to the rise in internal resistance. The situation is improved if a capacitor of a suitable size is connected in parallel. The pre-calculated discharge curve is shifted upwards to such an extent that the expected service life is now about 12 years.

The proposed capacitor has a relatively high limit of 2,000 mF. It puts an additional load on the battery through the residual charge current (sometimes also referred to as the leakage current). In order to ensure the battery life, the residual charge current of a 470 mF capacitor was determined at a voltage of 3.67 volts. After 10 days, the capacitor current decreased to around 2 µA, and then proceeded to continue falling. As a result, it can be ignored when calculating the battery life.

Batteries for GSM radio modules

In the case of smart meters that are not operated in a closely meshed network, the measured data must be transmitted over large distances. Nowadays, the GSM network, which is also used to operate mobile phones, is highly suitable for this purpose. Current peaks of around 2 A occur in the process every 4.6 ms, for a duration of 0.577 ms.

One typical application is a GSM add-on module that can be mounted on an existing meter. It could typically have no continuous current, but must be able to transmit for half a minute around 80 times a year. During the battery life of 11.5 years, the module requires a total capacity of 3.5 Ah.

The tricky aspects of this application profile are to be found in the extremely dynamic nature of the current profile (five powers of ten) and the high lifetime requirement.

The solution to this problem is a PulsesPlus battery, which uses a hybrid layer capacitor (HLC). A size AA hybrid layer capacitor has a capacity of 155 mAh and, in the required temperature range, covers the entire power requirement of the radio module during the 30-second transmission duration. As a result, a comparatively small primary battery can be used, in this case, consisting of two AA cells. This solution is compact and very cost effective. ■

Tadiran standard lithium batteries and custom battery packs are ideal for remote locations and challenging environmental conditions. For further information, visit www.tadiranbatteries.co.uk