

Aclara AMR systems still operating after 25 years

By Charles Sternau, Tadiran Batteries

Battery-powered automatic meter reading (AMR) devices manufactured over a quarter century ago by Aclara™ (formerly Hexagram, Inc.) continue to perform on their original batteries. Meanwhile, ongoing refinements in AMR system design and enhanced lithium battery technology enable Aclara STAR® Network meter-reading devices to deliver robust data capture and reporting capabilities without sacrificing battery life.

When a battery-powered AMR device reaches its silver anniversary, there is a cause for celebration. First, the AMR system manufacturer can take pride in attaining incredible longevity and reliability. More importantly, utility managers who



demonstrated the intelligence and foresight to “buy smart” can feel secure in the knowledge that their purchasing decision has resulted in decades of financial benefits, including a high return on investment and reduced cost of ownership.

In 1984, Aclara pioneered the development of remote sensor networks by introducing battery-powered automatic meter reading (AMR) devices for the utility market. Hundreds of thousands of these devices were deployed worldwide, each powered by a single Tadiran TL-2100 AA-size lithium thionyl chloride battery. Amazingly, almost all of these early AMR devices still remain in service, still going strong on their original battery. Recent laboratory tests also confirmed that these decades-old batteries have retained nearly 25% of their capacity.

The past two decades have also seen major advancements in AMR system de-

sign as well as lithium battery technology. In 1996, STAR Network wireless fixed-network AMR systems were introduced with meter transmitter units (MTUs) capable of providing multiple daily readings using narrow-band radio frequency to communicate with data collection units (DCUs) strategically positioned on buildings or utility poles located approximately 1 to 2 miles apart.

STAR MTUs are powered by Tadiran TL-4903 “XOL” (eXtended Operating Life) AA-size lithium thionyl batteries that feature 33% higher capacity (2.4AH vs. 1.8 AH) and lower self-discharge (approximately 1% per year) compared to older model TL-2100 batteries. To reduce energy consumption, STAR MTUs do not require a receiver to listen for a “wake-up” transmission. Instead, a timer initiates data transmission at programmed intervals. Use of one-way transmission also results in a less complex, lower cost system.

According to Glenn Emelko, Executive Director of Technology for Aclara, “In addition to choosing the right battery, designing an AMR device to last 20 years demands a complete technology solution involving enhanced reliability and energy-saving features. Utility customers

demand robust solutions that offer the lowest total cost of ownership. Long life and system reliability are both essential, so a major design requirement is that the battery be permanently soldered to the circuit board. Our units also feature a watertight seal to avoid moisture infiltration and corrosion problems that can occur with battery holders. Battery replacement is never an option, so from a design perspective, we need to get it right.”

Compared to typical drive-by or walk-by AMR systems that typically offer a maximum service life of 5 to 7 years, Aclara STAR Network units combine intelligent energy-saving design with advanced lithium thionyl chloride battery chemistry to deliver proven 20-year service life. The potential life cycle savings achievable with a 20+ year AMR unit can be substantial compared to systems with an expected service life of 7 to 10 years, as cost savings begin to accrue in year 7 and continue throughout the product life cycle of approximately 20 years. For example, a utility with 5,000 service connections could realize up to \$200,000 in total cost savings over a ten year period by eliminating all battery changeouts during that 10 year period, assuming that the cost of each battery changeout is





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approximately \$40 per site. If a second round of battery change-outs was eliminated over a 20-year period, the potential savings would reach \$400,000 for every 5,000 service connections. These savings are in addition to the long-term cost reductions associated with eliminating visual meter reading.

Aclara chose the Tadiran TL-4903 lithium thionyl chloride battery for its superior performance characteristics, including higher energy density, higher capacity, extended temperature range, and the longest possible service life. According to Emelko, "Aclara performed comprehensive in house and independent tests on competing battery technologies claiming to offer equivalent battery performance, but to date we have not qualified any other brand because no one could match the quality of construction and electrolyte purity of Tadiran batteries."

Tadiran lithium thionyl chloride cells are ideal for AMR applications because they feature the highest energy density and the highest open-circuit voltage (3.6V) of any battery type. The



purity



chemistry is also non-aqueous, enabling a wider temperature range of -55°C to +125°C. Tadiran employs fully automated manufacturing techniques to ensure unparalleled lot-to-lot consistency, even in large volume production. Product quality is further verified by ISO-9001:2000 certified quality systems, including fully documented and verifiable test results for parameters such as battery pulse, low-temperature pulses, discharge

and repeatability.

Through comparative analysis, Aclara confirmed that lithium thionyl chloride batteries are not created equal, as the performance of a lithium thionyl chloride cell can vary based on the self-discharge rate, which is governed by the chemical composition of the electrolyte, the manufacturing processes used, as well as mechanical and environmental considerations. Self-discharge can be negatively affected by high levels of impurities in the electrolyte. Extreme temperatures can also reduce battery performance by affecting voltage and self-discharge rate. Battery performance can be further hindered by impedance, which results from the internal resistance created by the electrolyte, the anode, and the cathode. Experienced battery manufacturers like Tadiran control impedance by blending special additives into the electrolyte.

Aclara's remarkable feat of attaining 25+ year service life for a battery-powered AMR device demonstrates how innovative product design can be combined synergistically with advanced lithium battery technology to reduce the total cost of ownership, resulting in enhanced productivity and higher ROI. **WW**

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STAR network meter transmitter units (MTUs) are capable of providing multiple daily readings using narrow-band radio frequency to communicate with data collection units (DCUs) strategically positioned on buildings or utility poles located approximately 1 to 2 miles apart. These units combine intelligent energy-saving design with advanced lithium thionyl chloride battery chemistry to deliver proven 25-year service life. To conserve energy, STAR MTUs do not employ a receiver to listen for a "wake-up" transmission. Instead, a timer initiates data transmission at programmed intervals. Use of one-way transmission also results in a less complex, lower cost system.

