

Applications and Innovations for Battery-powered Remote Monitoring

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Introduction

Today, when it comes to the monitoring of cathodic protection, automation is making its way as a leading solution. Several issues are coming together to make this a more mission critical need than ever before. These include: the need for better efficiency in the deployment of human assets; mitigation not only measurement; increased scrutiny on how well the assets entrusted are being monitored and protected; and the increased penetration of development into remote locations and with the growing population forcing infrastructure development needs more broadly, while penetrating already developed areas.

Several communication technologies are available for remote monitoring applications – the most common of which are drive by, cellular and satellite. A relative new comer to the automated/remote monitoring of cathodic protection functions is the use of licensed and spread spectrum wireless data radios that collect mission-critical data. These data radios can be used in even the most remote locations, without the monthly and reoccurring fees that many other solutions require. In addition, having the benefit of real-time data has proven to be essential in protecting assets.

These new technologies offer more secure proprietary networks than the established communication solutions. Their Frequency Hopping Spread Spectrum (FHSS) technologies, by their nature, offer more secure communication than their communication brethren. Now, the same wireless FHSS radio is available for pipe-to-soil applications in a submersible battery-powered option. This new product was developed due to customer demand. Customers wanted a less conspicuous deployment suitable for pipe-to-soil monitoring to help reduce theft, vandalism, use in target practice, and tampering.

Today, in difficult environments, users can implement these new submersible radios for their monitoring needs. The radios are placed underground, with only the antenna above ground, making them less conspicuous and reducing the attractive hazard nature of shiny solar panels. They require battery placements about once every two years and are ideal for a polling requirement of once a week or less.

Advantages of New Battery-powered Remote Monitoring

Spread spectrum remote wireless systems are a recent entry to the options for remote monitoring. They share the benefits of other systems within a wholly owned, dedicated proprietary communication network. Operators are trying this option more frequently, because it provides real-time access and reporting, which is making substantial

improvement as one of the best approaches to understanding protection activity of these important assets.

Operators who are focusing on remote monitoring want to go beyond measurement and mitigate their cathodic protection issues so they can do a better job of protecting their assets. With battery-powered remote monitoring, users can do this in extremely difficult environments, due to the submersibility of the technology. This increases efficiency and provides valuable cost savings. Rather than spending time taking measurements manually, the focus can be on resolving problems and taking steps forward in improving effective protection mitigation.

In addition, the battery-powered option allows for a limited amount of human intervention. Essentially, if there are no problems, users only have to be on site once every two years to change the battery. While most will want to ensure annual visits along right of ways, in addition to that annual visit, one now can have trend data over time that will aid in deploying attention where protection problems are beginning to emerge.

This type of product becomes crucial for areas with limited access. Battery-powered remote monitoring also offers the flexibility that some users need to mitigate vulnerable radio locations. In addition, this unit allows a broader range of deployment options where until now, electronics were not an option. With a new submersible option, valuable electronics can be kept safe, secure and operational because of its waterproof protection..

Depending on each user's monitoring needs, battery-powered remote monitoring may provide an additional tool to keep on top of the protection status. However, there are several factors to take into consideration.

Additional options include:

- Manual systems, which are the most traditional, require a field technician to physically access the monitoring point to collect data. This is a time-consuming process, especially when assets are located in remote or limited access locations. In addition, this makes the resources devoted to mitigation become scarce as time and efforts are spent on measurement.
- Wired systems, although free of monthly fees, can become one of the most expensive options. A completely wired system may simply be too expensive depending on the nature of the deployment of assets to be protected. Costs can include wire or cable, trenching, labor and installation. The costs for hard wiring alone can range from \$14 to \$20 per foot. Conversely, with wireless, the break-even point can be at 60 to 120 feet of a wired solution.
- Satellite systems have broadband capabilities, but have monthly recurring costs (based upon the amount of bandwidth used each month) and generally are quite reliable once they are set up.

- Cell phone systems function in a similar fashion as satellite systems in that they use an existing network of communication devices and have monthly charges – either for a connection or connection and data usage fee. If users are within range of a cell tower, cell phone systems are very much ‘plug and play’ in their simplicity. Monthly recurring costs associated with satellite or cell phone systems can become a burden on the operating budget of a department that is held accountable for yearly productivity improvements and both satellite and cell systems costs pay for a non-public network in three to five years.
- “Drive By” systems – can be appealing because they keep the process of the field visit intact without the need to leave a vehicle. One can simply drive up and get their measurements, making it very efficient. A benefit to a Drive By system is the reduction or elimination of any connection fee. However, the drawback is the amount of time and man hours required to simply get within range.

Implementing a Battery-powered Remote Monitoring System

Before installing a battery-powered remote monitoring system, the operator must evaluate and understand the company’s specific measurement needs. Questions they should ask themselves are:

- How frequently does the system need to be polled?
- How often can the unit be accessed?
- What are the barriers to access?
- What are the data requirements?
- How many pipe-to-soils are in proximity to the communication device?
- Will the best/logical placement of the communication device expose the electronics to moisture?
- What is the strength of the communication link between the remote monitoring unit and its communication partner in the network design?
- Is your system an attractive hazard? Should you reduce the visible portions of your remote monitoring components by installing them underground or in a vault to avoid theft, vandalism, etc.?

A battery-operated remote monitoring system requires that the user have access to the radio once every two years. In terms of polling, they will need a frequency of once a week or less. Also, depending on visibility they may need to bring the cable and antenna out of the ground. Battery-powered pipe-to-soil units are going to be driven by strong network design because the battery cannot tolerate weak RF links. So, proper antenna and cable selection, network design and path studies are recommended for successful battery-powered installation.

When implementing battery-powered remote monitoring, there are a variety of options for increasing convenience, efficiency and cost savings. Users should consider whether they will be bringing their cathodic protection data into an existing SCADA reporting system or if they will be using available software solutions for a standalone remote monitoring system tool.

It is very easy to install an automated cathodic protection system if a company has a SCADA system in place. However, it is not necessary to have one to implement remote monitoring of cathodic protection. Many companies own and operate their own SCADA network and can leverage their existing capital investment in SCADA through extending the data communication network further to include cathodic protection. For companies that do not currently own a SCADA system, small-scale cathodic protection SCADA systems are implemented with minimal investment in readily available software, off-the-shelf personal computers and the services of internal or external local integration companies.

A Real-life Application of Battery-powered Remote Monitoring

A purveyor at a major international airport was one of the first to be interested in a battery-powered remote monitoring system. Due to security difficulties to access monitoring points, it was very difficult and time-consuming to do an appropriate pipe-to-soil measurement. In addition, adding to the time required for a proper pipe-to-soil measurement was the inconvenient fact that the CP inspection vaults filled up with a combination ground water, precipitation, or deicing chemicals requiring pumping activity per site that could extend to two hours or more. Cathodic protection professionals seeking a solution went back to their wireless provider asking for help to resolve their time and money dilemma. Because of these various access difficulties, remote monitoring seemed to be a solution.

However, the added complexity of needing a waterproof solution as well as solar power provisioning not being acceptable, and the fact that a large proportion of the units had to be virtually flush with runway, made for a daunting design task. The company completed a successful two-year-long trial with the core technology to validate the long-term viability of remote monitoring and asked for its final solution. It wanted a submersible radio with a two-year battery life that required less than weekly measurement of pipe-to-soil potentials.

This new product is being brought to market as we speak with battery-powered, submersible, pipe-to-soil units being integrated into the existing test network. In the future, employees only need to clear security if there is an issue or to change batteries. No more two-hour water pumping sessions but a commitment to mitigation, remote monitoring and measurement, which is saving both time and money.

The Option of Hybrid Networks

When it comes to preparing a solution, there isn't always a unilateral answer. Hybrid networks also are something to take into consideration. Sometimes it makes sense to integrate multiple communication technologies into an overall network design. Is this link worth the monthly fees required by a cellular system? Can I afford the lower prioritization a non-proprietary system allocates to my data? Does the radio link require a tower infrastructure to maintain line of sight? Would an existing public network be a

better decision? These questions and others all belong in a consideration set when a network design is being contemplated.

In the case of this International airport and this user, they decided upon a proprietary radio solution that met their unique needs. By combining technologies, the user can create a seamless data stream. If properly evaluated and combined, hybrid technologies can create an extremely effective and efficient management of a network, as well as increased reliability through reduced downtime. This tends to offer a more cost-effective and efficient solution, through cheaper unit costs, reduction of the number of stations needing monthly satellite or cell connection fees, and choosing lower power-consuming technologies to thereby reduce power provisioning costs.

Conclusion

In conclusion, automation of pipeline integrity management has never been more needed, more available or more affordable. As the popularity of this type of monitoring increases, we see the need for different wireless options. Now, there is a submersible, pipe-to-soil battery-powered option for remote monitoring that can be used in areas that require a waterproof solution or are threatened in some way, due to vandalism, target practice, or anything else that might put the technology at risk. With proper evaluation, this option may be the most suitable solution. With each new option, operators have a new way to address the ever-increasing issue of pipeline integrity before it becomes a mission-critical matter.