



ELECTROLINE EQUIPMENT INC.

**Benefits of a DOCSIS® based status
monitoring solution for Standby Power
Supplies, Optical Nodes, and other
Network Elements**

- a white paper

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To increase reliability an existing network, it must be determined which elements to monitor and manage, and to select the most efficient and future proof standards-based method of doing so.

As HFC network reliability takes on increased importance due to the adaptation of VoIP for residential customers as well as data and voice for commercial market, it is important to both monitor and manage the most important contributors to network interruption. The power network is among the most significant point of concern due to local events such as construction, fire, accidents, or regional power generation problems. The best safeguard to date is the incorporation of battery backup standby power supplies. With the inherent presence of batteries as the alternate source of energy in these systems the need to track the condition of these non-static devices is necessary.

An effective monitoring strategy should be adopted that: (1) efficiently uses existing infrastructure, (2) is autonomous, so that it does not create its own single point of failure, (3) is standards-based, and (4) should not require additional staff to implement.

Historically the approach to status monitoring/element management has taken a variety of routes with a broad range of technical offerings. The lack of synergy between these legacy technologies, standards and methods has resulted in: (1) an absence of interoperability, (2) an inconsistent performance record, and (3) the promise unfulfilled.

Cable operators today can now benefit from the development of this new class of monitoring technology and realize the benefits promised by prior methods. Additionally, benefits not possible from previous methods can be realized and will be discussed here-in.

The concept

The concept of status monitoring, better referred to as remote management, has long been a probable model for lowering costs, adding efficiency in response to plant issues, and providing traceable plant performance data not typically visible through the testing, analysis and data storage methods used in the past.

The gathering of diverse plant data points, either instantly in the case of equipment hard failures or trending over time, were two of the goals historically put forth as a justification for the effort to establish a workable model.

The unfortunate reality has been that the approaches taken in the past have been less than successful in their ability to deliver information and to reliably operate over time. This is compared to systems employed by other industries such as the power generation and telephony that rely on status monitoring to maintain their claimed level of reliability.

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What was needed that did not exist in the broadband market was: (1) a communications platform that was sufficiently robust to withstand the harsh environment of outside CATV plant. (2) a set of standards based on industry accepted criteria. This would allow for uniformity of the physical and communications variables.

SCTE Standards

Device interconnectivity

An outgrowth of this desire for standards was the establishment of a sub-committee sponsored by the SCTE to provide a forum for discussion and development of a standard that would provide uniformity of element management network side and device side interfaces.

It was the HMS Committee that established a standard SNMP MIB structure by which all devices in this category would communicate to/from the monitored equipment as well as to/from the back office data structure. This was considered a phase one activity and generally referred to as legacy interconnectivity in preexisting equipment.

Included in this effort was the establishment of an additional standard originally known as HMS022 (now identified by SCTE document number: [SCTE 25-3 2005](#)) which defined the physical, electrical, and data exchange interconnectivity of the monitoring and monitored standby power supply. This standard was the forward thinking criterion which allows manufactures to provide a standard interface between the monitoring device (a transponder) as well as the device monitored (a power supply).

Communication

Predictability and reliability

As the world of DOCSIS® descended upon the CATV industry, another major milestone in standardization was achieved. This allowed manufacturers to offer products that would interoperate regardless of brand. Thru the maturation process of the DOCSIS® standard we have enjoyed the rise of a data delivery system that has proven itself to be one of the finest and most cost effective available for this market.

One interesting by-product of this development was the realization that it would be possible to perform remote data gathering and even remote control of equipment if this new method of communication were employed for this purpose.

The melding of standards

It all comes together

It became apparent that these two standards based activities could be integrated and would result in a standards based monitoring device that would out perform any of the previously offered solutions to date. An HMS transponder with an embedded DOCSIS® cable modem was developed to meet the challenge of the current and future need for reliable and detailed remote management of plant facilities. This new technology is defined in SCTE standards efforts identified as HMS 147 and HMS 151.

Justification

Return on investment

As with any decision to venture into new technologies, a sound justification should be in place to support this endeavor. The following will be presented in light of the potential cost savings, system reliability and availability improvements, and experience to date that is a testament to the maturity of this technological approach.

DOCSIS® and euroDOCSIS® transponders can operate autonomously and don't require new additional NOC hardware, software, or personnel. They can be incrementally added in a very cost effective, phased or targeted manner. This, enhanced by their capability to forward alarms to multiple IP addresses, including the NOC, local systems, and on-call technicians, allows for a greater flexibility in adaptation to the existing facilities than was previously enjoyed by the older legacy offerings.

Operational cost savings viewed as a return on investment have been shown to be the most appropriate manner in which to analyze this system's value. In that light, one must consider the on-going costs associated with an effective program of preventative and demand maintenance associated with standby powering.

- Demand Activity

Today's consideration to implement standby powering is typically driven by a desire to enhance the network reliability in support of VOIP service and to competitively position it against the traditional POTS of the existing Telco's. Since the power supply for the network is an easily definable point of potential failure, becoming proactive in the tracking of its well-being rather than being reactive, can result in a much greater increase in system uptime. Depending on the level of reliability required to successfully compete in the market, remote monitoring can provide the visibility to posture resources, staff and equipment, to react to outage events which could exceed the capability of the battery plant.

Knowing when and exactly where to deliver alternate generation to specific locations as well as the knowledge of when the utility mains returns can avoid interruptions due to battery deficiencies. This also works to limit the exposure of these resources to potential loss due to theft as they only remain in the field for the time required.

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Another benefit is the ability to police the security of the system by way of tamper detection. By instantaneously reporting a breach of the enclosure, battery loss and pilfer can be reacted to immediately rather than being discovered during a power loss or an attempt to operate the power supply remotely.

- Proactive

Remote monitoring can evaluate the overall health of the power system and determine if it is capable of meeting the minimum operating guidelines set forth by the operator. This is accomplished through the ability of the monitoring system to force the unit to operate from the batteries remotely. In so doing it is now possible to gather operational data from the battery plant while it is under load. This data can then be used to assist in predicting the amount of run time for that particular combination of supply, batteries and load profile. This empirical data cannot be gathered manually in a cost effective manner.

It has been shown that the regular visitation to powering locations is the best way in which to ensure the reliability of these systems. However, most of the data gleaned from these visits can be collected remotely thus reducing the number of physical visits to as little as once annually. Additionally, this remote, and in some cases automated data collection, is typically more accurate and uniform as compared to manual collection techniques.

Additional operational parameters such as enclosure temperature, charge current, input mains voltage, output voltage, and the critical output current data can be visible if made available to the monitor by the supply. In some cases an external accessory can be used to gather this data independently of the power supplies communication capabilities or lack thereof.

It is worth noting that the output current, when monitored, can be a strong reference point in plant operations. This measurement should stay within a typical window over time. If the normal swing of this measurement starts to fall or rise out of this norm it can be an indication the actives are failing and that repair could be accomplished prior to an actual failure of the plant.

DOCSIS®

Data communication reliability realized

Since these devices use the DOCSIS® platform within the plant to communicate, they also function as a DOCSIS® monitoring device as well. Since the appropriate method of powering these devices is via the DC voltage inside of a standby power system, they remain ON constantly and therefore become DOCSIS® performance reference points. The potential use of the AC output to provide the power for these devices is not appropriate since this requires the interruption of power to the network during the installations process. This is not the case with a DC powered device.

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Additionally, any loss of communications with these devices is naturally regarded as a major issue requiring action on the part of plant personnel. Now the power supply transponder not only monitors the power supply but the HFC plant health as well.

To carry this always-on feature to the next level, providers of these types of products can enable them to monitor many of the typical QOS performance criteria to assist in determining the call carrying quality of the plant associated to a particular powering location. Tests such as MOS, Loop Back, QAM Constellation display, to name a few are now available for viewing and analysis remotely and can duplicate many of the testing functions that previously were only visible by way of test equipment carried by field staff.

At this point in our discussion a venture into this new world of monitoring is truly a venture offering very real functionality and performance never before realized in legacy systems.

The appendix accompanying this document is a brief and simplistic exercise to show the value of this approach when general operations assumptions are made. A more accurate result can be achieved by supplementing the assumptions with more accurate individual data.

Conclusion

It is clear that with this new era in monitoring dawning on the cable industry, profound advantages beyond those pointed out here can be enjoyed. This document has endeavored to introduce the concept and its real and potential application. Additionally the monitoring of standby power supplies is one of the earliest and most cost effective measures that can be taken to increase system availability in support of VoIP and commercial services.

At this writing there are over 100,000 devices of this category are in operation in North America alone. This is evidence of the reality that this new product category delivers on its promise and is rapidly becoming the standard method for network monitoring.

For additional information contact,

Marty de Alminana

Business Development Manager, Transponders
martyde@electroline.com

Off 407.862.2757
Mbl 321.277.2764
Fax 407.786.7425

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Appendix: Return on Investment Calculations

A brief and simplistic evaluation of the benefits realized are assembled below to show the real tangible cost savings that can be derived from this approach.

Assumptions:

- 1) Number of recommended visits to powering locations per year, four (4)
- 2) Ability to respond to an extended loss of mains power, no hard data available. Response based on the accumulation of various other plant data such as a loss of communications with a specified group of set-top and DOCSIS® devices.
- 3) Detection of failing battery plant. No hard data, other than cursory information derived from physical visits.
- 4) Ability to detect mains presence condition. No hard data. No visibility of mains power return can risk the loss of alternate generation resources.
- 5) Ability to detect enclosure tamper. No hard data. Potential loss of battery resources.

If we assign conservative average values to the previous assumptions we can start to see the potential ROI that exists with this monitoring solution.

- 1) \$50.00 each visit
- 2) \$65.00 per month per subscriber, potential loss of customer base on service interruptions.
- 3) In keeping with #2 above.
- 4) \$2000.00, loss of one generator per year.
- 5) \$300.00 per occurrence for a three-battery system.

Calculations for a 500 power supply population, 500 homes per node

- 1) $500 \times \$50.00 = \$25,000$ annually
 - 2) At 250 subscribers served per power supply a 3% loss of subscriber revenues = \$243,750.00
 - 3) In keeping with #3 above.
 - 4) \$2000.00
 - 5) A 2% loss of battery plant due to pilfer = \$3000.00
- Total costs per year based on this scenario = \$271,050.00
 - Average cost to monitor the above assumed, \$162,500.00 for equipment and installation costs.
 - Software has been intentionally omitted from these calculations owing to the pre-existence in many situations of a back office data backbone that would be capable of having these devices integrated into it. Additionally back office software ranges greatly in cost and functionality and therefore requires little or no incremental investment.

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It can be seen from the above that a .59 year return on investment could be realized. This much generalized model does not consider many of the soft cost savings that are realized also.