MAKING THE GRID SMARTER

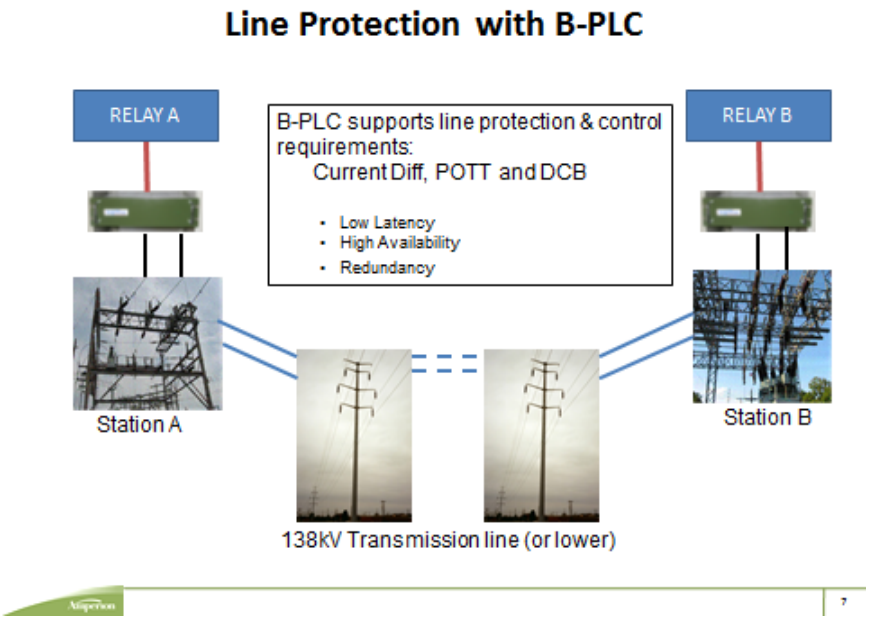
Smart Grid Communications

Amperion is a leader in providing secure smart grid communications infrastructure solutions for electric utilities. Amperion has a standards based modular architecture providing flexibility and plug and play installation that is required for rural and large public utilities. Amperion's solutions are targeted for the utility looking to build a private, secure, and highly reliable smart grid communications infrastructure to support differential line protection, grid reliability, distributed generation, distributed automation, AMI back hauling, automated Volt/VAR control and many other grid monitoring and control applications.

At the foundation of each Amperion product is a cyber-secure IP protocol stack that runs over its high voltage patent protected Broadband Power Line Carrier technology (B-PLC™) that supports multiple protocols (Sonet TDM and Ethernet IP) and multiple connectivity options (RF, Ethernet and Serial).

Amperion is an established supplier and technical innovator in powerline communications with over 100 patents granted and pending in its 10 year history. Unique to Amperion is its ability to run over medium voltage distribution and high voltage transmission lines, scaling from low voltage all the way up to 138KV high voltage, using a dynamic real time rate adaption OFDM technology that controls latency and jitter and optimizes throughput.

Communication reliability and availability is crucial to any smart grid communications infrastructure solution and Amperion's products were specifically developed to meet this requirement. NERC-CIP compliant cyber-security features are providing end-to-end AES based encryption with IP Sec VPNs, and RADIUS password authentication.



Products

The Amperion product line includes the Phoenix SG5000 Gateway, the Griffin MV1000 Hybrid Gateway, the Eagle WR1000 Wireless Gateway, and the Amperion NMS. Each gateway supports Amperion's patented Switcher™ technology providing built-in intelligence for instant fail over to a backup link when the primary link either fails or is experiencing significant performance degradation. Each gateway also supports a battery backup option providing a minimum of 8 hours of operation during a power failure.

Key Features	Utility Benefit
• Hybrid Communications PLC and Wireless	• Cost effective – optimal use of utility's own assets
• Flexible Architecture	• Connects to utility devices on the wire and off the wire
• Redundancy of multiple PLC phases and multiple transport technologies	• High system availability for utility's most demanding critical applications
• Low latency and low jitter network performance	• Supports network requirements of all utility's smart grid applications including real time protection and control
• Standards based	• Interoperable with other equipment • Utility is not locked to one vendor
• End to end cyber security	• Utility is protected and in full control of its own operational private network
• Plug and play serial protocol conversions. Supports legacy TDM Sonet and Ethernet IP	• Integrates with legacy equipment providing utility with a migration path to a future smart grid network
• Multiple applications on the same platform with QoS	• Reduces equipment costs and simplifies device and network management
• Powerline Communications • HV B-PLC and MV B-PLC	• Leverages distribution and transmission power lines that are already being maintained. • Significantly less expensive than stringing fiber. • No line of sight issues or weather related performance impairments.
• Scalable HV Coupling	• Works on power lines up to 138KV
• OFDM Rate Adaption	• Dynamically conditions the B-PLC transmitter in real-time to EMI disturbances on the power lines.
• B-PLC Differential Coupler	• Improves SNR by 10dB • Reduces EMI • Provides redundancy for single line faults
• B-PLC Frequency Agility	• Allows for coexistence of multiple B-PLC channels when extending the reach of a single link and for multi-terminal applications
• Switcher™	• Maintains backhaul connectivity in cases of a power line breakage.
• Repeating architecture	• Extends the reach of B-PLC communications.
• Battery Backup	• Continued operation of communications during power outage.
• QoS	• Priorities mission critical applications such as line protection.

Phoenix

The "Phoenix" is a substation class gateway providing communications for Sonet TDM serial devices and Ethernet IP devices using B-PLC over existing wires. The Phoenix product is specifically targeted for protection and control applications such as Current Differential and POTT, and grid monitoring and management applications such as SCADA. It can also be used for station security and data backhaul of other inside-the-fence applications.

Griffin

The "Griffin" product is a utility grade outdoor pole mounted hybrid gateway providing communications between Ethernet, Serial, and Wireless devices to a B-PLC backhaul. The Griffin also supports an optional wireless backup link that can be activated when the BPLC link goes down due to a break in the power cable. Included in the Griffin are a low latency B-PLC repeater and Wireless repeater (optional) to extend the communications reach.

Eagle

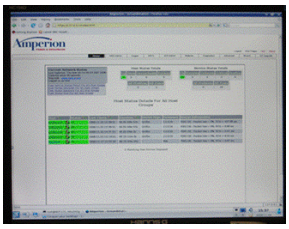
The "Eagle" is an outdoor pole mounted wireless gateway providing communications between Ethernet, Serial, and Wireless devices to a Wireless backhaul. The "Eagle" also provides a low latency Wireless repeater to extend the reach of the wireless backhaul. The Eagle is the ideal solution where clear unobstructed line of site exists for connecting remote wireless devices to the smart grid infrastructure.

Powerline Couplers

The Amperion powerline couplers are used to connect the B-PLC interfaces on the Phoenix or Griffin to the utilities power line. The couplers are customized to pass the high frequency signal from the BPLC modem interface to the power line with a minimum of signal loss. The arrester couplers also provide lightning protection that protects the systems' electronics and also provides additional protection to the grid. The couplers are passive devices requiring no maintenance, are safe and easy to install, and require no special training.

Amperion NMS

The Amperion NMS is a web-based network management system for managing and monitoring the gateways. The Network Management System has a powerful Graphical User Interface and report generation capabilities for real-time monitoring and control of the Amperion provided communications infrastructure.



The Amperion NMS can continuously monitor and manage all the devices in real time, and create historical data reports on a daily, weekly, monthly, and yearly basis. Alerts can be generated when preprogrammed events are triggered.

Application Summary

With the Amperion B-PLC System utilities can accelerate their **"Smart Substation"** modernization projects by extending SCADA coverage, implementing better protection at low cost, and expanding substation automation capabilities. B-PLC can be used as an alternative to fiber, as an extension of an existing fiber backbone, and as a secondary backup to fiber. It can also be used by the utility to reduce their monthly communications costs by replacing costly leased lines and leased pilot wires.

Utilities can also backhaul Smart Grid and AMI data to the nearest substation for concentration back to the utilities operation center. Applications like distributed automation, remote sensing of grid health, asset monitoring, implementation of grid efficient improvements like automated Volt/VAR control are all enabled by the Amperion Smart Grid communications infrastructure.