

SpeedNet™ Radios



Mesh radios that allow for high-volume data transmission with minimal delays are required for self-healing power systems.

Introduction

Utilities are tasked with restoring power quickly following an event. Even the smallest outage can have a big impact on a factory operation and create an annoying inconvenience for a residential customer. As the grid continues to grow and become more complex, utilities are seeking ways to further automate their systems to improve reliability, and communication with automated devices is playing a key role.

But how can a utility best go about making its network more automated? Let's start with what most utilities have today, which is an integrated system of smart meters, communication networks, and data management, known as an advanced metering infrastructure (AMI). With this infrastructure already in place, a utility may consider using its existing network to build its distribution automation. On the surface, this option appears to be a cost-effective solution, but it may have a negative impact on the utility's business and service reliability, not to mention extend the time it will take it to restore power.

Some utilities have tried to use AMI networks for distribution automation, but with little success. They've experienced periods where field devices become unresponsive. They've also seen grid reconfigurations take much longer than expected, and sometimes no reconfiguration takes place at all, especially during an outage.

One utility performed a study on AMI-network behavior during an outage. It found there is about a 5-minute period during which the AMI network becomes overwhelmed and unresponsive to distribution-automation needs. Then, the network recovers and returns to normal. The problem with this long delay is it penalizes all automation. No real-time updates from switches occur and, because of this excessive delay, the distribution-automation system cannot restore power quickly to affected customers, causing outages that normally would be momentary to become sustained. This negatively impacts a utility's outage metrics and lowers its reliability ratings.

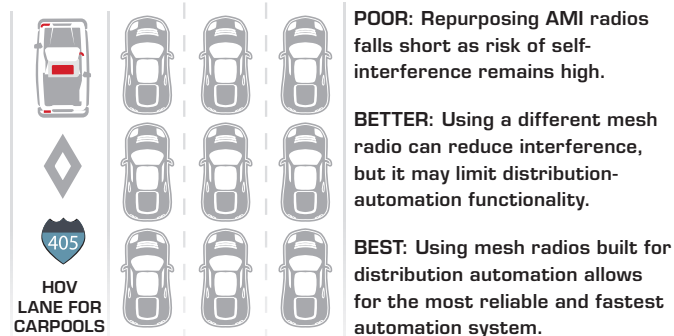


A CONGESTED AMI NETWORK COULD CAUSE A FIVE MINUTE DELAY TO RESTORATION*

When a meter senses a loss of power, it sends out an alarm known as a last-gasp message to an outage-management system. One feeder losing power will cause several hundred meters to send out last-gasp messages at the same time. This sudden influx of messages overwhelms the AMI system. **80% of messages are lost during this period.** Automation just can't operate like that.

AMI NETWORKS LOSE UP TO 80% OF MESSAGES WHEN CONGESTED*

Utilities can overcome this congestion by building a separate radio network for distribution automation that avoids the congestion created by meters on AMI networks. This separate network minimizes radio interference with an express lane for automation commands.



With a separate radio network installed, utilities can deploy rapid self-healing. Rapid self-healing isolates the faulted sections and restores service to non-faulted sections in seconds by closing a single switch, significantly decreasing response time by minimizing switch operations.

SpeedNet Radios are a great option for rapid self-healing. They have 1000% more capacity and 10x the speed of AMI radios.

1000% MORE CAPACITY than AMI networks



SpeedNet Radios are designed to overcome challenging radio environments found along feeders.



SpeedNet Radios can handle large volumes of messages, allowing for rapid self-healing.



SpeedNet Radios have a minimal delay time and process 10x more packets of information per second than an AMI network.

SpeedNet Radios vastly improve the performance of utility radio systems by combining secure long-range communication, high-volume data transmission, and flexible mesh networking to provide benchmark performance for automation and control applications.

* Electric Light and Power, elp.com. "What ComEd's Outage Testing Revealed About Its AMI Network." 2/1/2012.

SpeedNet Radios can be applied to any distribution-automation device along the feeder, creating a dedicated path for communications.

SpeedNet Radios' ability to perform as a repeater or as well as a radio provides alternative routes for communications, improving connectivity. SpeedNet Radios intelligently learn existing routes, reducing the complexity of initial configurations.

IntelliTeam® CNMS Communication Network Management System is used to monitor and manage SpeedNet Radio networks, providing utilities with a comprehensive view of network configurations and performance.

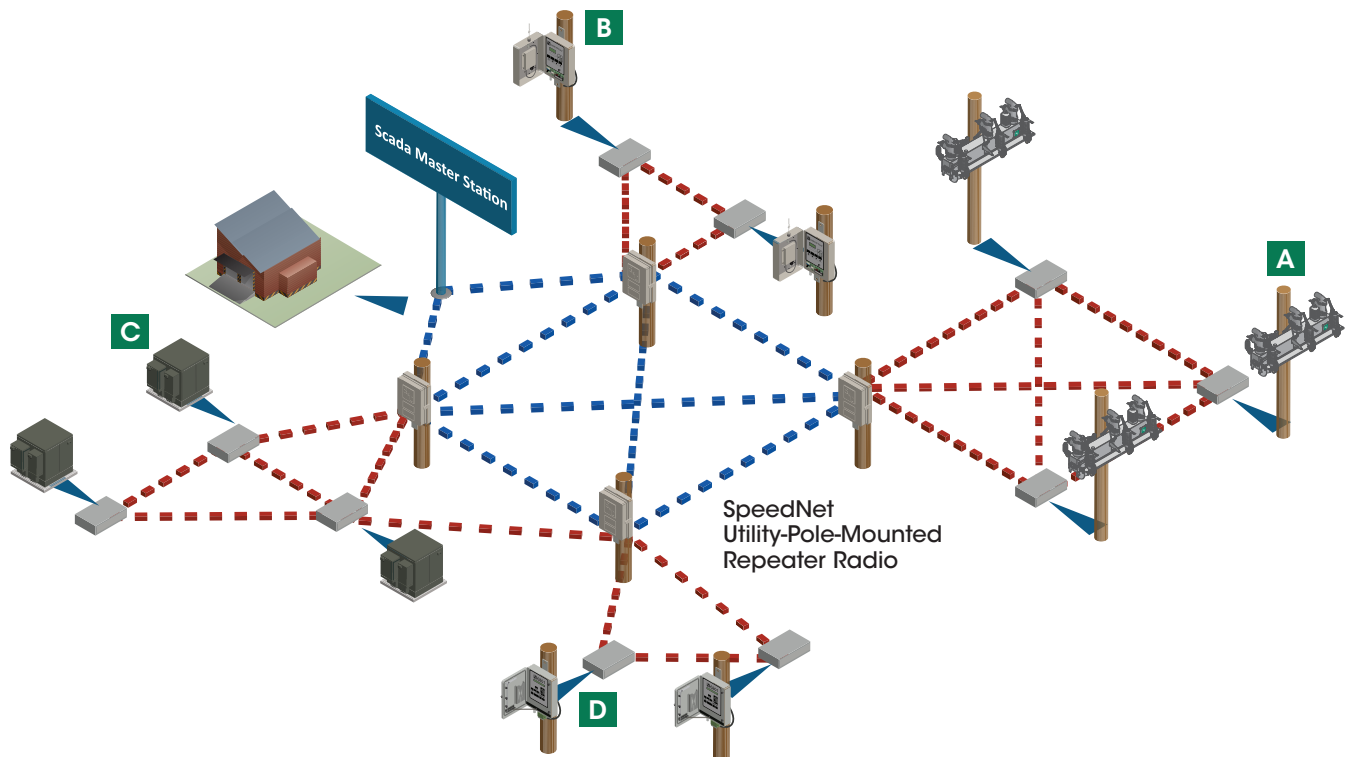


Figure 1. SpeedNet Radios supporting distribution automation applications, applied with SpeedNet Utility-Pole-Mounted Repeater Radios.

As illustrated in Figure 1, SpeedNet Radios can be used in:

- A** An IntelliRupter® PulseCloser® Fault Interrupter
- B** An IntelliCap® 2000 Automatic Capacitor Control
- C** An IntelliNode™ Interface Module—Applied with intelligent electronic device of other manufacture
- D** A 6801 Automatic Switch Control—Applied with the Scada-Mate® Switching System; see Figure 2 on page 4

SpeedNet Radios also work with the IntelliTeam® SG Automatic Restoration System. The IntelliTeam SG system automatically reconfigures the distribution system after a fault and quickly restores service to segments of the feeder not affected by the fault. With the IntelliTeam SG system, power is restored to critical loads as quickly as possible.

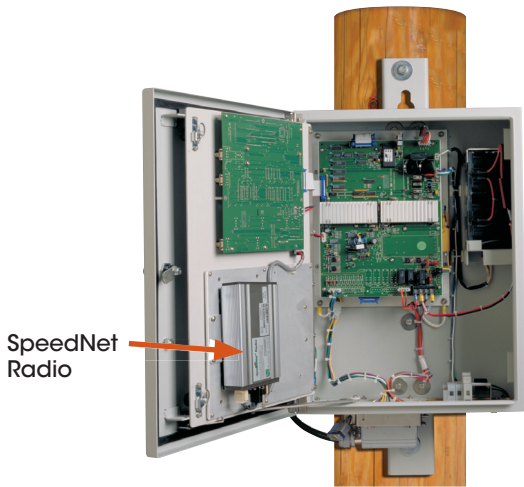


Figure 2. An example of a SpeedNet Radio inside a 6801 Automatic Switch Control.

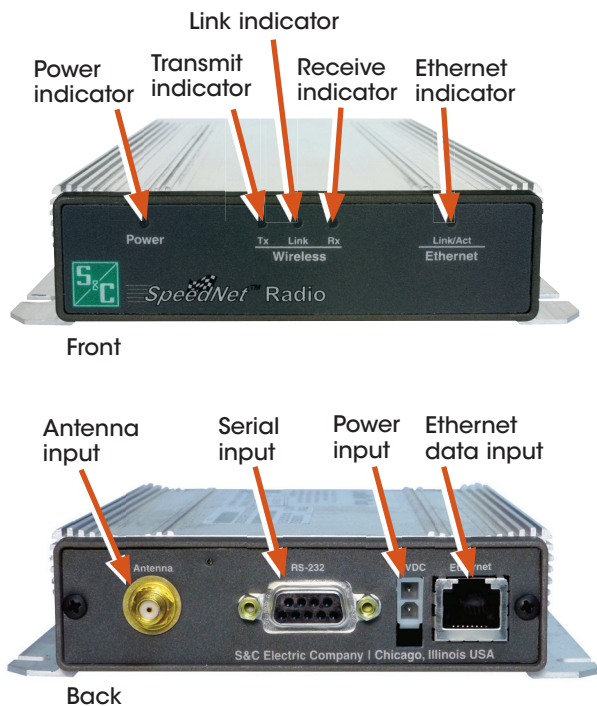


Figure 3. Indicators and inputs on a SpeedNet Radio.

Features

Reliable Transmission

A mesh network of SpeedNet Radios is easy to set up and maintain. The radios automatically build routing tables that define message paths. If a connection point is lost, a new path will be quickly established. Redundancy for head-end radios and gateways improves communication reliability and is important for head-end radios because they are the link to the customer enterprise network.

Operating in the unlicensed 900-MHz ISM band, a SpeedNet Radio furnished with an omnidirectional antenna has a typical range of several miles, depending on the terrain and clutter. If needed, a SpeedNet Repeater Radio can be installed to increase transmission range and provide alternate points for message routing.

Powerful Multi-Level Security

SpeedNet Radios provide frequency-hopping spread-spectrum transmission that is inherently difficult to intercept and jam. Its 10-millisecond dwell time on a particular frequency is 60 times faster than other systems, making each transmission a very small target for jamming and much less susceptible to interference. Address filtering denies network access to unauthorized radios, and 128-bit encryption protects mission-critical data.

System Scalability

SpeedNet Radios allow up to 16 co-located networks by using different hopping patterns (network IDs). Multiple SpeedNet Radio mesh networks operating on different network IDs can be linked together using SpeedNet Radios configured as inter-mesh gateways. This mechanism is an effective architecture strategy when node density is high. SpeedNet Radios configured as enterprise gateways facilitate communication from the SpeedNet Radio mesh to the enterprise network.

SpeedNet Radio

For installation in a user-furnished enclosure, the radio requires a 12-Vdc power source. The antenna can be whip mounted on the enclosure. A remotely mounted omnidirectional or Yagi antenna also can be used.

SpeedNet Streetlight-Mounted Repeater Radio

Built in a cast-aluminum weatherproof enclosure that mounts on a streetlight arm, this radio extends the communication range and expands the network area. The radio can be powered from a photocell socket or 110-240 Vac, 50 or 60 Hz, and it includes a battery back-up. A whip antenna is mounted on the bottom of the enclosure. See Figure 4.

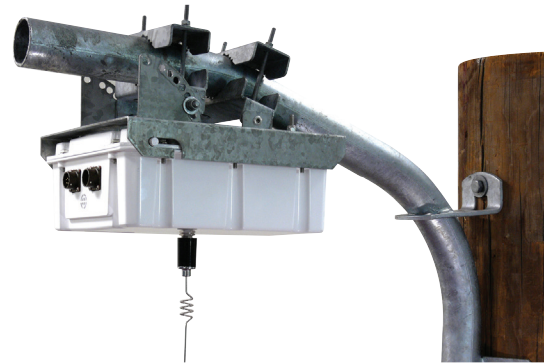


Figure 4. SpeedNet Streetlight-Mounted Repeater Radio.

SpeedNet Utility-Pole-Mounted Repeater Radio

Built in a padlockable plastic weatherproof enclosure that mounts directly on a utility pole, this radio extends the communication range and expands the network area. Powered from 110-240 Vac, 50 or 60 Hz, it includes a battery back-up. The antenna can be a whip mounted on the enclosure, or a remotely mounted omnidirectional antenna can be used. See Figure 5.



Figure 5. SpeedNet Utility-Pole-Mounted Repeater Radio.

SpeedGate™ Radio Interface System

Built in a padlockable plastic weatherproof enclosure that mounts directly on a utility pole, the system includes provision for a gateway communication device, permitting data exchange with a different communication system. Powered from 110-240 Vac, 50 or 60 Hz, the system includes a battery back-up. The antenna can be a whip mounted on the enclosure, or a remotely mounted omnidirectional or Yagi antenna can be used.

SpeedNet Radios cannot communicate directly with other types of radios because of differences in frequency selection, spread-spectrum frequency hopping patterns, channel use, and network-management algorithms. A SpeedGate Radio Interface System, with an appropriate gateway communication device, is required to overcome this communication issue. See Figure 6.



Figure 6. SpeedGate Radio Interface System.

Table 1. SpeedNet Radio Specifications

Wireless	Frequency	Unlicensed 900-MHz ISM operating band with selectable regions. North America: 902–928 MHz, Brazil: 902–907.5 and 915–928 MHz, New Zealand: 921–928 MHz, Australia: 915–928 MHz
	Power Consumption	2.28 watts average receiving, 6.92 watts average transmitting @ +12 Vdc and 1-watt transmit power, 740-mA inrush current on power-up; peak power occurs on transmit
	Sensitivity	–100 dBm (10-5 bit error rate)
	Transmit Power	User-selectable +30, +25, +20, or +10 dBm; +30 dBm default
	Transmission	Frequency-hopping spread-spectrum
	Physical Layer Data Transmission Rate	650 kbps
	Hopping Patterns	16, user-selectable
Encryption	—	128-bit, advanced encryption standard (AES) with user-defined keysets created using supplied keygen tool
Data	Wireless Network Routing Protocol	Modified Ad-Hoc On-Demand Distance Vector (AODV)
	Ethernet Interface Protocols	IPv4, TCP, UDP, ICMP, SNMPv3, ARP, VRRP
	Wireless Interface Protocol	Modified Carrier Sense Multiple Access (CSMA-CA)
Network Management	—	Simple Network Management Protocol version 3 (SNMPv3) and supplied Windows®-based SpeedNet Client tool to set parameters and monitor status. IntelliTeam CNMS Communication Network Management System available.
Mounting & Power Supply	—	Molex Mini-Fit Jr.™ 2-pin male connector (pin 1 = ground, pin 2 = +12 Vdc), for regulated +9 to +36 Vdc
Certifications	—	FCC in the USA, IC in Canada
Interfaces	Serial Data	DB9 female, asynchronous RS-232 at 115.2 kbps max, DNP/UDP/IP or DNP/TCP/IP tunneling
	Ethernet	RJ45 connector, 10/100 Base-T, with auto-negotiation and auto-cross
	Antenna	50-ohm SMA connector, standard polarity
General	Dimensions	6.30 in. (160 mm) L × 4.25 in. (108 mm) W (5.25 in. (133 mm) W with mounting flanges) × 1.29 in. (33 mm) H, excluding connectors
	Weight	0.88 lb (0.40 kg)
	Ambient Temp	–40°F to +158°F (–40°C to +70°C), operating and storage

