



205 Westwood Ave
Long Branch, NJ 07740
1-877-742-TEST (8378)
Fax: (732) 222-7088
salesteam@Tequipment.NET

White Paper

Certifying Power over Ethernet to Ensure Service Success

As you roll out a service that uses Power over Ethernet, how much time and money would you save if you knew in advance that the cabling fully supports PoE? You cannot assume it does. And how much more confident would you be if the cabling was certified to meet all industry standards?

This paper describes important subtleties unique to Power over Ethernet. It also shows how a critical Ethernet diagnostic test, the Wiremap, can certify the foundation for applications using Power over Ethernet, and preclude future problems.

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The role of Power over Ethernet

IP and Ethernet link the world. This ubiquitous connectivity supports services that let businesses do more, more efficiently. Some of the newest and most exciting of these services are Voice over IP (VoIP) telephony, wireless LANs, network-based security and mobile data capture.

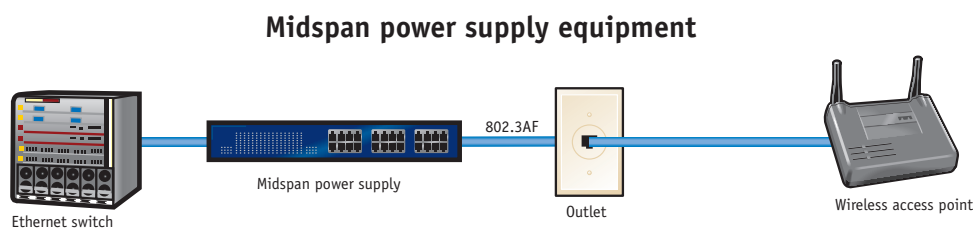
These services add devices to the enterprise network, but often in locations where there are no power outlets. One solution is to install 110/220 VAC outlets at every potential location of a VoIP phone, wireless access point, webcam, RFID reader, etc. In the real world, though, this is impossible due to cost, aesthetics and structure.

The networking industry understood this challenge and addressed it in an IEEE standard, 802.3af. The 802.3af standard defines the characteristics for sending electricity to power network devices over the Category 5/5e and 6 Ethernet cabling as it also transports data. The Power over Ethernet (PoE) standard is now a linchpin for many network services.

PoE solutions: Endspans and Midspans

To implement PoE, power must be injected into the Ethernet cabling. One way to do this is to use an 802.3af-compliant Ethernet switch, also called Endpoint Power Sourcing Equipment or a “PSE” switch. An Endpoint PSE switch has Ethernet ports that send power in accordance with the 802.3af standard over Ethernet cables. Many Ethernet switch vendors offer Endpoint PSE functionality as an option. Endpoint PSEs are a logical way to implement PoE when installing new network infrastructure.

When writing the 802.3af standard the IEEE also defined an alternative to address the millions of Ethernet switches that are already in place. Economics prevent network owners from replacing these switches just to implement PoE. In these situations, the 802.3af standard includes an alternative solution called a Midspan PSE. A “Midspan” is a patch panel-like device installed between the Ethernet switch and endpoint devices. Midspans insert power into the Ethernet cable while data passes through unhindered.



A Midspan solution has many advantages over an Endspan PSE in addition to preserving the investment in hardware:

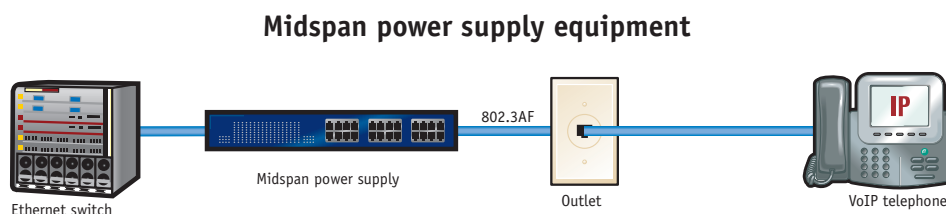
- Lower cost per port
- Less support and maintenance
- Lower power consumption
- Less disruptive to network traffic on installation
- Greater flexibility in PoE delivery to the endpoint devices that need it

There are many manufacturers of Midspans and they come in assorted sizes and configurations. Millions of Midspan ports are installed and analysts expect shipments to grow.

Example: employing a PoE Midspan

"ABC Company" needs advanced voice communications. It is replacing a traditional PBX with a VoIP-based telephony solution. IP telephones will be installed in offices, warehouse locations and on the factory floor. Many of these locations do not have a convenient source of AC power, so PoE will be used to power a large proportion of the new telephones.

ABC Company has a stable IP/Ethernet network with ample switch port capacity to support the new IP telephones. Rather than replace its current Ethernet switches with Endspan switches, PoE Midspans will be coupled to the existing network infrastructure.

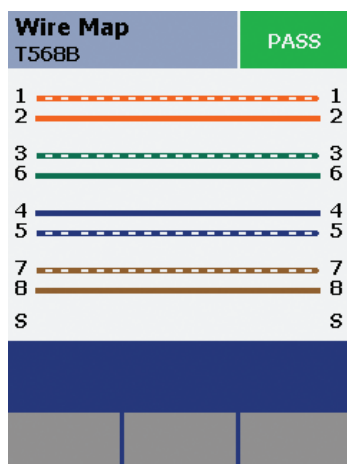


Certification using a "Wiremap"

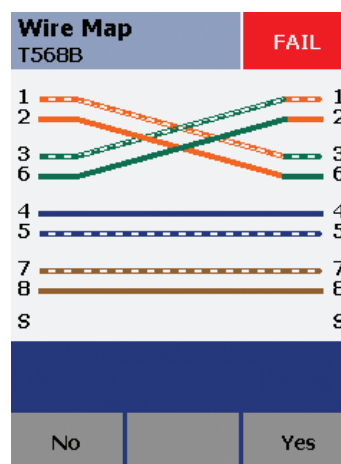
Reliable VoIP communication demands that the Ethernet cabling be flawless. One critical test to ensure the quality of Ethernet cabling is done by injecting DC signals onto each pair of copper wires in the cable and sensing their return. The result of this test is called a "Wiremap." The Wiremap test shows how the copper pairs in an Ethernet cable are terminated within each RJ-45 connector. A Wiremap is a requirement in ISO and TIA cabling certification standards.

To create a Wiremap, the technician selects a configuration parameter on their cable analyzer. This parameter describes the correct termination for every pair in the cable. The Wiremap is executed and the results are compared to the selected configuration. The graphic depiction of the wiring is the actual Wiremap. If the Wiremap results match the selected configuration, the connections are verified as correct. If there is a discrepancy, potential faults are noted. The Wiremap test is a best practice component of network installation and testing because it ferrets out the all-too-common problem of mis-wired connectors.

Midspan PSEs make conventional Wiremapping impossible. They do this because Midspans have protection capacitors that prevent errant power backflow to the Ethernet switch. This protects ports on the switch from accidental "burn out," but it also blocks receipt of the DC signals that a cable analyzer needs to create its Wiremap. As a result, ABC Company cannot do an essential test for certifying its Ethernet cabling used with the VoIP telephony solution.



The DC Wiremap test analyzes each individual wire and shows the connectivity of each wire in the cable. This test ensures proper continuity as well as pairing of the wires.



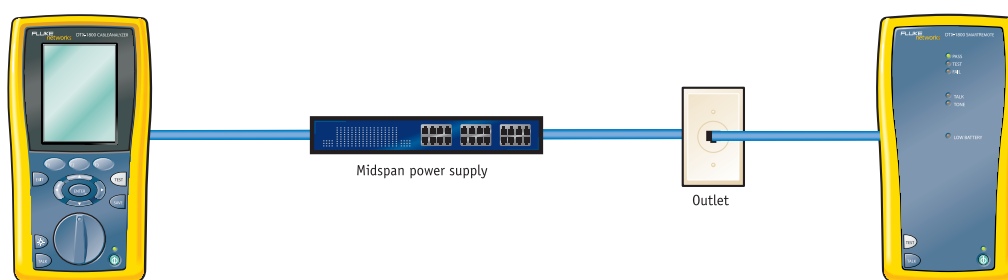
The DC Wiremap identifies any miswiring error in the cable. This example shows a reversed pair which can only be used as a 10BASE-T or 100BASE-TX "cross-over cable."

AC Wiremap: the solution for PoE Midspans

Fluke Networks developed a new test specifically to certify cabling with Midspan PoE controllers. This test uses alternating current rather than direct current for discovering defects and failures. Where direct current flows in one constant direction, alternating current oscillates in a sine wave pattern with the direction reversing every half cycle. This property of AC makes its signals transparent to the Midspan's protection capacitors that block DC. AC signaling accurately Wiremaps a cable and its connectors even if a Midspan controller is in the link.

Creating the Wiremap using AC signals is more challenging than standard Wiremapping. DC-based Wiremap fixes each wire to a particular potential and then tests all the other wires in the cable for that voltage. AC Wiremapping operates on a similar principle, but entails additional complexity. The AC test excites signals on a twisted pair and then analyzes the effect on all other pairs at each connector. If the link contains a wiring failure or a cable defect, identifying this fault requires further examination. For example, to identify a fault that occurs between two pairs, such as a cross-pair short or a split pair, the test must distinguish between a direct path from one pair to another and AC coupling between the pairs.

The AC Wiremap test is fast, accurate, and reliable. The DTX CableAnalyzer™ is the only cable analyzer that can perform AC Wiremapping.



Wiremap for testing through Midspan controllers

Creating the AC Wiremap using the DTX CableAnalyzer™ begins with a selection on its SETUP screen. Once chosen, the Wiremap will be generated using AC signals and the technician or installer can perform an Auto Test. After selecting the Test Limit, Cable Type, and Outlet Configuration, the link is ready to test.

Once testing is complete, Fluke Networks' LinkWare software can be used to organize, edit, view, print, and archive the results. In short, certifying a cable plant that uses Midspans is as easy as certifying a standard cable plant.

Certifying cable for VoIP

A technician for ABC Company would connect a DTX CableAnalyzer™ to the Ethernet cable serving each IP telephone on the upstream side of the Midspan PSE, and then select the AC Wiremap function. The DTX searches for patterns to identify specific faults. It will locate and identify common wiring failures, if they exist. If multiple faults are discovered, the Wiremap screen displays the pairs involved and the location of the nearest fault. If, for example, an open pair is found, the failure can be repaired before the IP telephone is installed. When all faults are repaired or if no faults are found, the VoIP service can be turned up with confidence that it will run reliably.

The future of PoE

The IEEE is enhancing Power over Ethernet by doubling the power to 30 watts and adding new management capabilities in a forthcoming standard, 802.3at. Greater power will increase the popularity of PoE by supporting new types of devices, such as higher speed wireless access points. Midspan controllers will be a common way to roll out 802.3at, also called "PoE Plus," because they offer the most economical means to upgrade one or more ports to the higher power standard.

Summary

Power over Ethernet is burgeoning in enterprise networks. Midspan PSEs are an efficient way to upgrade the Ethernet infrastructure to support PoE. Because Midspans are in the center of data traffic flow, it is imperative to certify the cabling through PoE controllers to ensure the success of PoE-based services. Fluke Networks anticipated this need and enhanced the DTX CableAnalyzer™ with AC Wiremap test to meet this growing requirement of network owners and network installers.

For more information about our Network SuperVision Solutions, call **800-283-5853** (US/Canada) or **425-446-4519** (Other locations) or email **info@flukenetworks.com**



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Printed in U.S.A. 9/2007 3107338 H-ENG-N Rev A