

## Power over Ethernet in Industrial Applications

Add low-voltage devices  
and network equipment  
in industrial environments  
without running power.



PoE Switches



Hardened Switches



Converters

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We're here to help! If you have any questions about your application, our products, or this white paper, contact Black Box Tech Support at 0118 965 6000 or go to [www.blackbox.co.uk](http://www.blackbox.co.uk) and click on "LiveChat" You'll be live with one of our technical experts in seconds.

## Introduction

The Power over Ethernet (PoE) standard, which was adopted in June 2003, enables users to power devices over Ethernet cabling. It was originally developed to provide both power and networking capability in areas where it was previously cost prohibitive or physically impossible to run electrical wiring. PoE has contributed to VoIP and wireless market growth because it simplifies the RF survey task: Access points can be easily moved because the requirement of locally-accessible AC power is removed.

PoE has important repercussions for industrial applications, too. The simplicity of combining data signals and power in one Ethernet cable connection contributes to the already-rapid transition to Ethernet-based industrial control systems. Wireless access devices, IP phones, surveillance cameras, and a growing number of specialty devices are available, demonstrating how PoE can help solve industrial information and control systems application problems in innovative ways. PoE industrial sensor and controller devices are on the drawing board. Although the available power in a PoE-connected device is limited to about 13 watts, the vast majority of modern industrial sensors take less than 10 watts. It may soon be possible to power a full Supervisory Control and Data Acquisition (SCADA) system from ports on Ethernet switches, along with non-traditional devices such as phones and cameras and PCs. PoE offers the potential for an economical, standards-based, high-performance industrial network far beyond what is available today.

This first part of this paper is devoted to the implications of PoE for industrial applications and predictions for the adaptation timetable. The second part of this paper briefly addresses the technology behind PoE.

## PoE in Industrial Applications

PoE technology brings power, as well as data transfer, to devices via standard twisted-pair Ethernet cabling in a network. In effect, PoE provides a new standards-based way for Power Sourcing Equipment (PSE) to provide power to a wide variety of Powered Devices (PDs) in areas where it is physically or financially prohibitive to offer AC power. The cost savings and reliability improvements involved in not having to install and maintain power wiring in addition to Ethernet cabling, especially in remote locations, provide the incentive for many industrial users to consider this technology.

Today, the major use of PoE is for the new generation of VoIP phones. The phone system's PSE is in a wiring closet in an office area, and the PDs are the IP phones on individual desks. The data signal and high-availability power to the IP phone are both provided by a single cable from the wiring closet to the desk, rather than requiring a separate AC power source at each desk. The power to the phone is the -48VDC that has been used to power telephones for decades.

A device called a Midspan Power Source (MPS) has been developed for use in some office applications to "inject" PoE power into an existing Ethernet network where the Ethernet switch is not configured as a PSE. The MPS box sits between an existing Ethernet switch and the target PDs. Although perhaps more cost-effective than replacing an existing Ethernet switch with a PoE switch, MPSs provide another point of failure in a system that may require high availability.

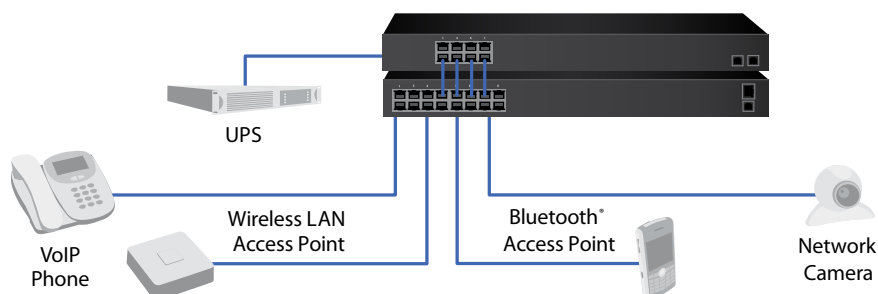


Figure 1: Typical Enterprise PoE Applications

The classic challenge in extending new Ethernet standards to industrial markets is: Why build switches to the new PoE standard when there are no devices available to take advantage of it, and its companion: Why build devices that use the new PoE standard when there are no switches to support them?

By integrating Ethernet switching, PoE power sourcing, and industrial-hardened components, Black Box delivers a single unit that supports industrial-strength PDs. Integrated PSE/MPS devices, in the form of PoE power-sourcing Ethernet switches for industrial Ethernet applications change the network design possibilities.

The 4-port PoE Power Source Switch (LP004A) saves money and space, and it increases reliability for a wide spectrum of industrial applications. OEMs and industrial equipment suppliers have welcomed this switch as a means to extend their service area. The switch's integrated PoE and plug-and-play capability come in a small package that is ideal for remote substations and other locations with limited available real estate. Black Box continues to expand its line of switches that supports PoE-enabled PDs with the LPH240A series of hardened switches.

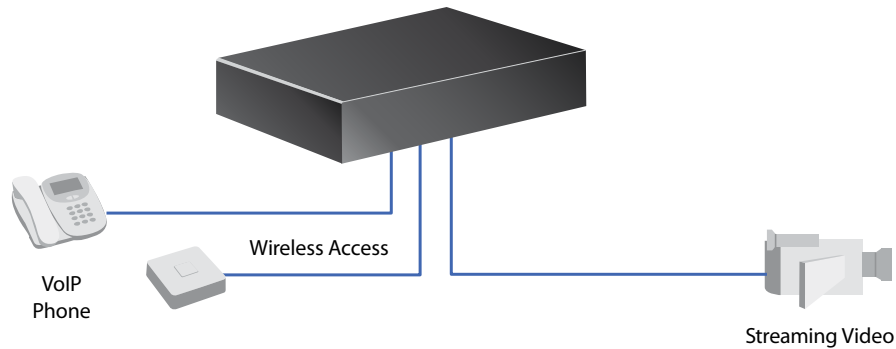


Figure 2: Possible Industrial Application

By incorporating enterprise PDs as well as building new industrial products such as sensors and controllers, a growing number of vendors in industrial markets are taking advantage of the benefits of PoE as an extension of the global Ethernet standard, thus extending Ethernet LANs further into high-availability industrial systems. For example, Black Box® SmartPath PoE-enabled wireless access points (LWN602AE, LWN602HAE) and PoE security cameras are hardened for deployment in remote industrial and traffic applications.

## The Technology behind Power Over Ethernet

Like the traditional telephone system, Power over Ethernet provides power and networking over a single cable. PoE's advantage over the other protocols is the ubiquity of Ethernet, which encourages the development of products to support the standard — not only in the enterprise market where it was born, but in a broadening range of applications in industrial environments. Increasingly in new industrial system implementations and in system upgrades, the benefits of an all-Ethernet network are winning over specialised local networks.

Ethernet data transmission requires two of the four twisted pairs that are available in a standard CAT5 Ethernet cable. CAT5 cable is the most widely used Ethernet connectivity medium on the market today. PoE also uses two twisted pairs, and the IEEE 802.3af standard allows either the unused pair or the data pair for power transmission. Figures 3 and 4 show these two approaches.

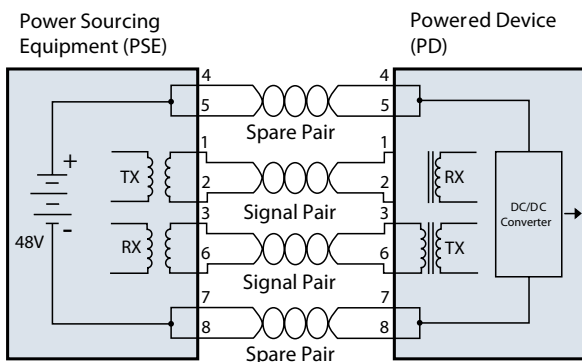


Figure 3 diagrams the use of the spare pairs in a CAT5 cable.

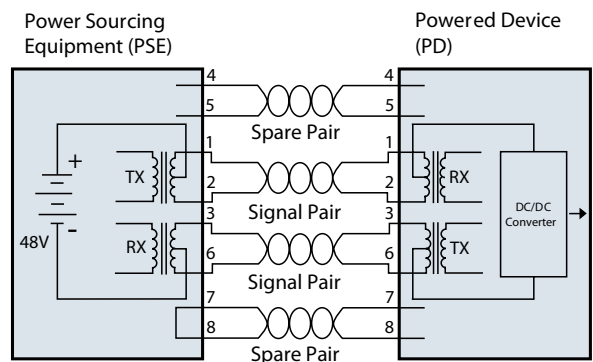


Figure 4 shows the use of the data pairs.

As noted earlier, a Midspan Power Source was developed to “inject” power into the cables in current Enterprise Ethernet deployments. The MPS is positioned between the central switch and the target PDs. In the PDs, a “picker” or “splitter” extracts the power current from the wires in the cable, while enabling the data signal to proceed as normal.

Products such as the Black Box® 4-Port PoE Switch (LP004A) and 6-Port Hardened Switches (LPH240A-H) bypass the need for an extra MPS box by building the “injector” into the switch itself. At only a few hundred pounds for 4-port hardened LP004A switch units, these switches are a great way to take advantage of the inherently increased reliability of a single unit to provide both data transmission and power.

Under the PoE standard, features such as remote power-down or remote reset can be implemented using a system management package, such as the Simple Network Management Protocol (SNMP). This provides additional flexibility in deploying PDs at the edge of the industrial network.

### Summary

With the introduction of PoE, industrial Ethernet suppliers – and users – have a beneficial new technology for heavy-duty environments such as utility substations, mines and quarries, transportation systems, factory facilities, and warehouses. In large industrial campuses or factories where configurations change on a frequent basis, the ability to decouple expensive electrical rewiring from the placement of PDs is highly advantageous. In an environment where budgets are tight and demand for increased productivity is constant, the simplicity of PoE makes it a strong candidate for high acceptance in system upgrades. With both PoE-enabled industrial switches and PDs coming onto the market, Black Box predicts rapid adaptation as both vendors and industrial users recognise the cost savings and reliability, as well as the inherent installation convenience.

### About Black Box

Black Box Network Services is a networking and connectivity solutions provider, serving 175,000 clients in 141 countries with 195 offices throughout the world. The Black Box® Catalogue and Web site offer more than 118,000 products, including the SmartPath Enterprise Wireless System that has the speed, range, security, adaptability, and manageability to replace wired networks at an enterprise level.

Black Box also offers a wide range of networking devices, as well as cabinets, racks, cables, connectors, and other connectivity and data infrastructure products. To view Black Box's comprehensive offering, go to [www.blackbox.co.uk](http://www.blackbox.co.uk).

Black Box is known as the world's largest technical services company dedicated to designing, building, and maintaining today's complicated data and voice infrastructure systems.

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