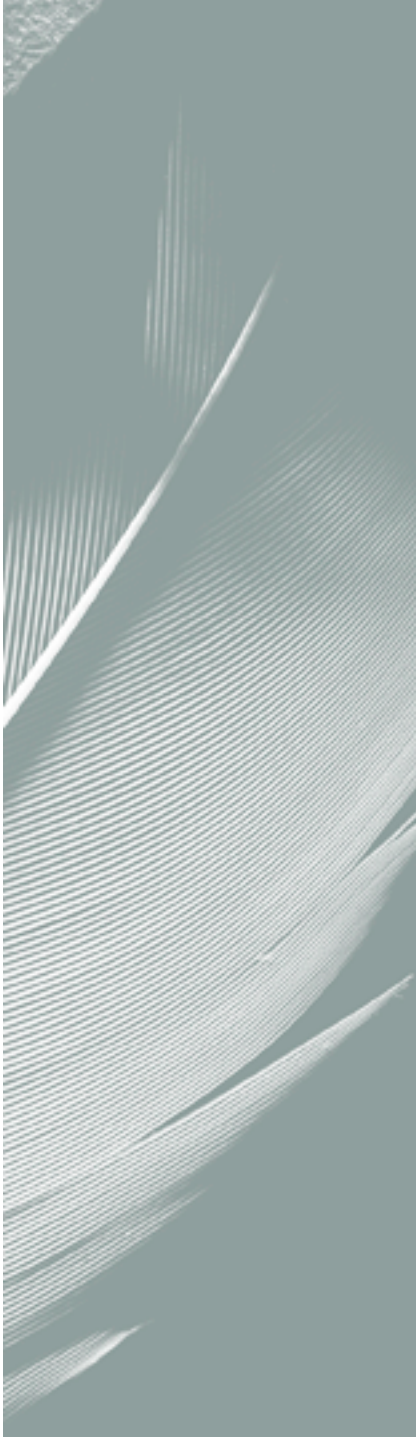




WHITE PAPER

# Implementing Power over Ethernet with 3Com<sup>®</sup> Network Jacks



# Why Implement Power over Ethernet?

*Power over Ethernet (PoE) provides major benefits to corporate networks—saving both time and costs. And perhaps these benefits are never realized more than when using this revolutionary technology with 3Com® Network Jacks. These unique “in the wall” port-expansion switches can leverage PoE’s capability to power devices at the edge of the network over the existing LAN cabling.*

*This guide introduces the concepts of PoE and the standard-based approach to PoE known as IEEE 802.3af. It is designed to help you determine whether using PoE with 3Com Network Jacks makes strategic sense for your Ethernet network. Plus, it provides insights into why 3Com is committed to providing IEEE 802.3af-compatible solutions, how to install them, and how to best extend this functionality to your existing network infrastructure.*

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Power over Ethernet isn’t a new concept. PoE is simply an efficient way to provide power over existing Ethernet cabling, so that distributed devices such as network jacks, IP telephones, and wireless access points can be powered without local AC power adapters.

The only real issue with PoE has been the lack of a standard way of implementing it. The explosive growth of IP telephony and wireless networking products using PoE has resulted in a number of different, and often incompatible, power solutions currently being offered on the market. To address this issue, the IEEE has drafted a standardized specification for PoE called P802.3af. This proposed standard will affect Ethernet-based communications in almost every aspect of the network, including the deployment of network jacks, IP telephony, and wireless LANs. It will also generate the development of entirely new lines of products—not typically associated with networking today—that will be able to receive power from the existing data infrastructure.

3Com Network Jacks are unique because not only do they support the IEEE P802.3af draft PoE specification, they can forward this power to another device such as an IP phone or wireless access point. PoE implemented using network jacks propels Ethernet networking a quantum leap forward by providing an innovative way to power more devices at the network’s edge. This clean, reliable, and out-of-the-way power scheme opens entirely new possibilities for networking infrastructures and configurations. Numerous business applications can benefit from being powered over existing network wiring: hospital diagnostic equipment, building-maintenance systems, dorm rooms, hotel rooms, conference rooms, and security sites.

3Com has been a major leader in the PoE standards effort and was one of the first vendors to launch networking products that are compatible with the P802.3af draft standard. The forthcoming ratification of the IEEE standard—after which P802.3af becomes 802.3af—indicates how rapidly PoE is gaining importance in the market. Even companies that currently offer only proprietary PoE solutions are publicly stating that they will start offering standard-based versions of their products. Simply put, the IEEE 802.3af standard will continue to gain favor and ultimately be the only accepted way to power devices at the network edge. That’s why as early as the year 2000, 3Com has placed such an emphasis on offering 802.3af-compatible products and power converters that extend the value of customers’ PoE investments.



The IEEE detection scheme is known as *Resistive Power Discovery*, and relies on a 25 K  $\Omega$  resistor that's integrated into each 802.3af-compliant network device. Before the PSE injects the full 48 VDC onto the network, it sends out a low-voltage "discovery" signal to measure the resistance of the powered devices connected through its ports. The PSE then conducts a second test using a slightly higher voltage. Both voltages are low enough so they won't damage a device with a resistance of less than 25 K  $\Omega$ . After the second test, the PSE has enough information to inject full power into the ports connected to 802.3af-compliant devices. The PSE does not send full power to any powered devices that fail the first or second resistance test.

#### **Power Management**

It's possible for multiple devices to create a cumulative power drain that exceeds the maximum output available from the PSE. To prevent this from causing a major network disruption, the PSE uses a power management system to monitor power usage and "gracefully" handle excessive power demands.

3Com's P802.3af draft-compliant, multiport PSE (3CNJPSE24) has a power management system that prevents its total power output from exceeding 200 W. The 3CNJPSE24 distributes power through its ports on a "first-come-first-served" basis. If the output is at maximum, attempting to connect another device creates an "out of power budget" event. The power management system will not allow the 3CNJPSE24 to power any additional ports until the power drain is decreased—which can be accomplished by either disconnecting powered devices (reducing the device number) or lessening their power draw (reducing the cumulative output).

If the power budget is exceeded because an unchanged number of devices start drawing more power, the power management system begins switching off 3CNJPSE24 ports. Starting with port 24, it continues switching off ports until the power output falls under the maximum limit. As power budget becomes available again, these ports resume operation in reverse order of how they were switched off.

For redundant power protection, the 3CNJPSE24 can be hooked up to an uninterruptible power supply (UPS). Providing a discrete power backup solution for each PSE helps ensure the high availability of the 802.3-af network. Be sure to consider the additional electrical and cooling requirements of installing any centralized UPS.

## Deploying 802.3af Power over Ethernet

PoE can be delivered over the network by one of the following sources:

- 3Com multiport midspan solution (3CNJPSE24)
- 3Com single-port midspan solution (3CNJPSE)
- An end-span integrated PoE switch

The following sections briefly describe how to get a 3Com Network Jack Multiport Power over Ethernet Midspan Solution (3CNJPSE24) powered up, connected, and ready for operation. For detailed setup and configuration information, refer to the *3CNJPSE24 User Guide*.

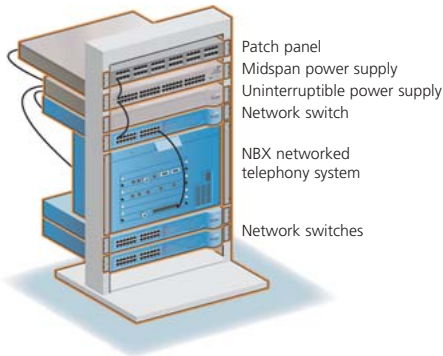


FIGURE 2: The rack-mountable 3CNJPSE24 is installed in the wiring closet that houses the central network switch and UPS.

### Powering Up the PSE

The 3CNJPSE24 is a 24-port midspan PSE that occupies 1.5 U in a standard 19-inch wiring-closet rack. For redundant power backup, connect the 3CNJPSE24 to a UPS that can service at least 200 W.

### ⚠ CAUTION

*3CNJPSE24 has no ON/OFF switch. To connect or disconnect, insert or remove the power cable from the power socket at the rear of the PSE.*

**Step 1:** Insert the power cord into the power socket located at the rear of the PSE.

**Step 2:** Insert the other end of the power cord into the UPS's power receptacle.

After the 3CNJPSE24 powers up (listen for the internal fans), it runs through a power-on self-test (POST) and LED testing sequence. During the POST, which takes less than 10 seconds, all PSE ports are disabled.

### Connecting the Cables

**Note:** All of the following cable configurations require industry standard Category 5 or 5e straight-through unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable, with all 8 wires (4 pairs).

#### At the PSE

The 3CNJPSE24 can power as many as twenty-four 3Com Network Jacks. It is connected to the UPS and Ethernet switch/hub as the last device in the wiring closet.

All 3CNJPSE24 ports (data-in, data-/power-out) are configured as “route-through” ports for all data wires (pins 1, 2, 3, and 6). This means data traffic passes through the PSE without being altered or changed by the addition of power. 3CNJPSE24 delivers power to the Ethernet cabling over the two spare pairs (pins 4, 5, 7, and 8).

#### Data-In Ports

Connect each Ethernet switch/hub port to a data-in port at the back of the PSE.

#### Data-/Power-Out Ports

Connect each data-/power-out port at the front of the PSE to the LAN cable leading out of the wiring closet and toward the network jack.

**Note:** Be sure the port numbers match when connecting the data-in and data-/power-out ports.

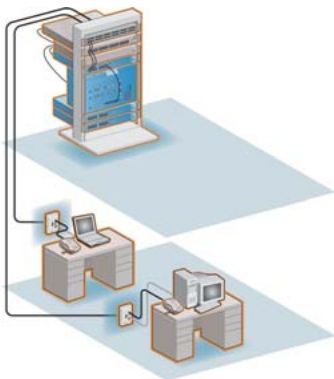


FIGURE 3: The 3CNJPSE24 is connected last in the wiring closet, injecting 48 VDC to the cabling that goes out to the network.

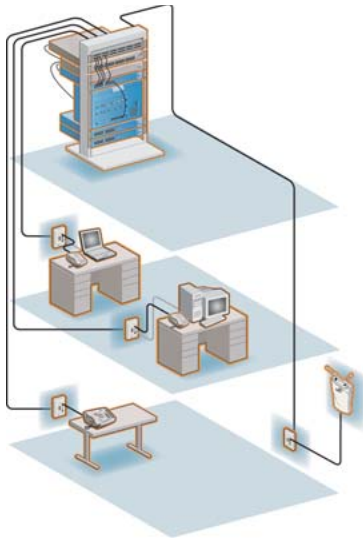


FIGURE 4: The 3CNJPSE24 uses Resistive Device Discovery before sending PoE to network jacks at the edge of the network.

#### At the Network Jack

In the wiring closet, network-jack switch ports should be configured as standard MDI-X device ports. At the network jack, the Ethernet uplink port connecting it to the LAN is located in the back of the device. The network jack should power up as soon as the uplink connects to the PSE and network switch.

**Note:** Each model of 3Com Network Jack has its own power-up sequence. Refer to the *Network Jack Installation Guide* for more information.

**Note:** 3Com Network Jacks support PoE delivered on either the data-pair (pins 1, 2, 3, and 6) or spare-pair wires (pins 4, 5, 7, and 8).

CHART 1: Correct Ethernet cable pin-outs for Category 5 cabling.

#### TIA Outlet Color Codes

Pin #	T-568-A	T-568-B
1	White/Green	White/Orange
2	Green/White	Orange/White
3	White/Orange	White/Green
4	Blue/White	Blue/White
5	White/Blue	White/Blue
6	Orange/White	Green/White
7	White/Brown	White/Brown
8	Brown/White	Brown/White

#### Power Forwarding

What really makes 3Com Network Jacks stand out from other products compliant with the P802.3af draft is that a network jack can forward power from its port #1 to another compliant device. Power forwarding adds a whole new dimension to the PoE network by expanding power availability at the edge of the network—without having to add power hardware or reconfigure devices.

Please visit the Network Jack product FAQ for more information on power forwarding: [www.3com.com/networkjacks](http://www.3com.com/networkjacks).

In some cases, an external module can be used to give a device PoE compatibility. For instance, to smooth our customers' critical transition of their 3Com NBX® networked telephony solutions to standard-based PoE, 3Com sells a add-on module (3CNJVOIPMOD-NBX). This power module enables voice-over-IP (VoIP) NBX phones, which operate on 24 VDC, to be powered by 3Com Network Jacks or any P802.3af draft-compliant PSE. Please visit [www.3com.com](http://www.3com.com) for more information on the 3Com Network Jack to NBX Phone Power Module.

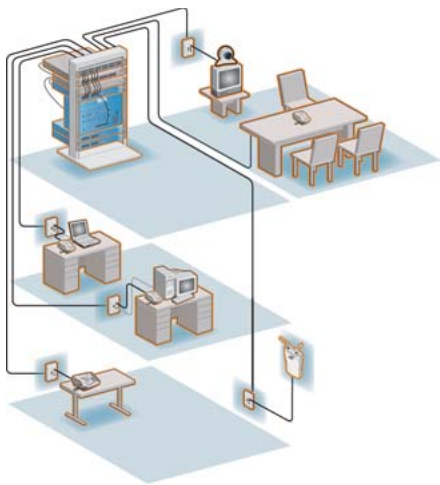


FIGURE 5: 802.3af-compliant power forwarding adds configuration flexibility to the PoE network.

## Power over Ethernet at a Glance

### Standards Compliance

The 3Com Network Jack Multiport Power over Ethernet Midspan Solution (3CNJPSE24) is fully compliant with the IEEE P802.3af draft standard, including:

- **Voltage:** 48 VDC
- **Maximum available power:** 15.4 W @ 44 V to 57 V, per port
- **Power introduction:** two spare pairs (pins 4, 5, 7, and 8) or two data pairs (pins 1, 2, 3, and 6)
- **Signal detection:** Resistive Power Discovery with a 25 K  $\Omega$  resistor connected to the voltage line
- **Maximum operating distance:** 100 m (328 ft)

### Power Sourcing

3Com currently offers two types of PoE sources—a multiport or single-port midspan solution. These power source equipment (PSE) products are installed as the last devices in the wiring closet, leading out to an existing Ethernet infrastructure.

### Cabling

Cabling for an 802.3af PoE network must be standard Category 5/5e shielded or unshielded twisted-pair (UTP or STP) LAN cable, capable of delivering 48 VDC to a powered device up to 100 meters (328 ft) away.

### Powered Devices

Powered devices may include IP phones, network jacks, wireless LAN access points, and web cameras. P802.3af draft-compliant devices can receive PoE forwarded from a network jack's port #1.

### Central Power

Centrally deployed PoE using existing LAN cabling is more cost-effective and reliable than distributed sources. Combining PoE with a centralized uninterruptible power supply (UPS) helps ensure continuous operations of business-critical devices, such as IP phones, during power failures.

### Power Budget

Power budget represents a PSE's total available power and is affected by both the total number and power draw of connected devices. For example, the power budget for the 3CNJPSE24 is 200 W. Although each port is capable of delivering 15.5 watts, the cumulative output for all active ports cannot exceed 200 W.

### Summary

IEEE 802.3af Power over Ethernet is ideal for powering a vast array of computing devices. In fact, virtually any enterprise Ethernet network can benefit from the cost-savings, high availability, and configuration flexibility of PoE running over existing LAN cabling.

3Com delivers end-to-end PoE solutions that simplify device installation and deployment, as well as create outstanding opportunities for consolidating data and power networks over a standard-based infrastructure. In addition, our world-class expertise provides the right answers to your networking questions, including how to leverage legacy and nonstandard PoE products.

## 3Com Power over Ethernet Product List

3Com offers a full range of IEEE P802.3af draft-compatible devices, including midspan solutions, network jacks, wireless access points, and VoIP phones. For additional information on these products—such as technical tips, product data sheets, technology white papers, frequently asked questions, user guides, and more—visit [www.3com.com](http://www.3com.com).

### Network Jack Power Source Equipment

3Com Network Jack Multiport Power over Ethernet Midspan Solution (3CNJPSE24)

3Com Network Jack Single-Port Power over Ethernet Midspan Solution (3CNJPSE)

### Devices That Forward P802.3af Power over Ethernet

Network Jacks	3Com NJ100 Network Jack	3CNJ100-BLK, 3CNJ100-CRM
	3Com NJ200 Network Jack	3CNJ200-BLK, 3CNJ200-CRM

### Devices That Receive P802.3af Power over Ethernet

Network Jacks	3Com NJ95 Network Jack (available in Europe only)	3CNJ95
	3Com NJ100 Network Jack	3CNJ100-BLK, 3CNJ100-CRM
	3Com NJ200 Network Jack	3CNJ200-BLK, 3CNJ200-CRM
Wi-Fi Wireless	3Com 11 Mbps Wireless LAN Access Point 8000	3CRWE80096B
	3Com 11 Mbps Wireless LAN Access Point 8200	3CRWE820096A
	3Com 11 Mbps Wireless LAN Access Point 8500	3CRWE850096A
	3Com Wireless LAN Building-to-Building Bridge	3CRWE91096B
	3Com 11 Mbps Wireless LAN Outdoor Bridge Solution	3CRWEASY96A
Voice over IP (VoIP)	3Com Network Jack to NBX Phone Power Module	3CNJVOIPMOD-NBX
	<i>The following products can receive P802.3af draft-compliant PoE when modified using the phone power module listed above (3CNJVOIPMOD-NBX).</i>	
	3Com NBX 1102 Business Phone	3C10121
	3Com NBX 1102B Business Phone	3C10281B
	3Com NBX 2101 Basic Phone	3C10248B
	3Com NBX 2102 Business Phone	3C10226A
	3Com NBX 2102-IR Business Phone with IR	3C10228IRA
	3Com NBX 2102B Business Phone	3C10226B
	3Com NBX 2102-IRB Business Phone with IR	3C10228IRB

3Com Corporation, Corporate Headquarters, 5500 Great America Parkway, P.O. Box 58145, Santa Clara, CA 95052-8145

To learn more about 3Com solutions, visit [www.3com.com](http://www.3com.com). 3Com Corporation is publicly traded on Nasdaq under the symbol COMS.

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