



Plugging into the Power of PoE Technology

INTRODUCTION

[Power over Ethernet](#), or simply PoE, is a widely used term to refer to any technology that enables an Ethernet device to receive and send power over the same cable as data.

With this white paper, Antaira will provide a quick and easy overview of PoE technology to help determine which PoE solution(s) are compatible with their network application.

POWER OVER ETHERNET: A BRIEF HISTORY

In the 1990s, prior to the IEEE stepping in, “power injection” was the label used to describe the concept of supplying electricity over an Ethernet cable. So-called “power injectors” had no intelligent protocol or safety considerations. They only worked by supplying the power over ethernet, either AC or DC current, utilizing the spare pairs that 100Base-TX Ethernet did not use. In doing so, power injectors basically emulated how traditional PSTN (public switched telephone network) landline phones operate.

Standardizing Power over Ethernet was first proposed by the IEEE 802.3 Working Group in 1999. The group’s original standard, IEEE 802.3af, was ratified in 2003 thus ensuring interoperability across a broader range of connected devices.

IEEE 802.3af established a uniform, safer way to deploy PoE. It defined Powered Devices (PDs) as equipment that received power and Power Sourcing Equipment (PSE) as those that supplied power. PDs and PSEs would operate within a voltage range of 44–57V with a maximum power output of 15.4W per port. Power could be sent to a PD using two of the four twisted pairs that are available in typical Category 5 (Cat 5) cable by pins 4 and 5 or pins 7 and 8, or by data using four twisted pairs by pins 1 and 2 or pins 3 and 6.

Importantly, a system to safeguard connected devices that do not support PoE was also included in the IEEE 802.3af standard. Specifically, a 25-kW resistor is placed in between the power pairs of the powered device, so that transmit power is only supplied by the power source if something close to that resistive value is detected.

INCREASED POE POWER DEMANDS

As mentioned, IEEE 802.3af specifies a maximum output of 15.4W per port. Yet due to cable power loss, the minimum guaranteed power available at the PD is only 12.95W per port. While that may be plenty of power for simple devices, it falls short of the higher power and power consumption needs of the new higher wattage devices that are being deployed in Smart City and Industrial Internet of Things (IIoT) applications.

To remedy this situation, the IEEE 802.3 Working Group approved IEEE 802.3at, its second PoE standard, in 2009 that included a new power class that could deliver up to 30W on the port and maximum guaranteed power of 25.5W to a PD. Although this altered the existing standard, IEEE 802.3at still supplied power over two pairs and it topped out at a safe 57V port voltage. IEEE 802.3at allowed for higher power end devices, such as PTZ cameras, alarm systems and [wireless access points](#), to be powered by a nearby PoE [industrial Ethernet switch](#), injector or media converter. IEEE 802.3at is also backward compatible with the original standard..

The newest PoE standard, IEEE 802.3bt: Type 3- 45W or 60W (PSE); Type 4- 75W or 90W (PSE), was ratified in 2018. IEEE 802.3bt was designed around increased power demands.

Unlike previous standards, IEEE 802.3bt focuses on using all four twisted-pair cables within a standard Ethernet cable rather than two. The standard includes support for 2.5GBASE-T, 5GBASE-T, and 10GBASE-T. Previous PoE standards have a maximum speed of 1-Gbps.

Because of IEEE 802.3bt, the ongoing shift to Ethernet-based industrial control systems and the merging of IT and data lines in OT networks is certain to be accelerated. Having data and [90W PoE](#) supplied by a single Ethernet connection is ushering in a new era for industrial networks.

IEEE PoE Specifications								
Standard	802.3af			802.3at	802.3bt		802.3bt	
Type	Type 1			Type 2	Type 3		Type 4	
Name / Year	PoE / 2003			PoE+ / 2009	Hi PoE / 2018		Hi PoE / 2018	
Voltage	44V/50V				50V		52V	
Supported PD Class	1	2	3	4	5	6	7	8
PSE Output Power to Single PD	4W	6.7W	14W	30W	45W	60W	75W	90W-100W
PD Input Power	3.84W	6.49W	13W	25.5W	40W	51W	62W	71.3W
Ethernet Pairs	2-Pair			2-Pair or	4-Pair			
				4-Pair				

ACTIVE POE VS PASSIVE POE

With a better handle on PoE standards, here are two other terms that are often misunderstood: active PoE and passive PoE.

Active PoE, also referred to as standard PoE, is any form of PoE in which Powered Devices (PD) and Power Sourcing Equipment (PSE) negotiate the proper voltage via a handshake procedure to ensure a valid PD is connected. During the handshake, the active PoE switch (PSE) applies voltage to verify the presence and value of a resistor within the

PD. It then delivers the amount of power based on the response of the PD. Should the handshake not be completed successfully for any reason, the PD won't receive the maximum power delivered from the PSE, protecting the PD from harm.

Passive PoE is the non-standard form. Passive PoE switches, adapters, [injectors](#) or other PSE have no negotiation or communication procedure and therefore do not conform to any of the IEEE standards discussed. In general, a passive PoE PSE will supply electricity on the spare wire pairs of the twisted pair cable it is connected to at a specific fixed voltage, whether the connected end-devices supports PoE or not. However, since there is no standard, it is possible for passive PoE to be implemented with gigabit Ethernet despite all four pairs of wires being used for data transmission.

Passive PoE PSEs are mainly divided into 12V, 24V, and 48V fixed output voltages. If you are planning on using Passive PoE as a power source, it is important to match the exact voltage of the passive PoE PSE to the exact voltage of the data terminal equipment or powered device. Passive PoE can serve as a simple, cost-effective way of powering IP, security cameras, Wi-Fi, wireless access points, VoIP phones, and other IoT devices.

ADDING POE TO NETWORKS

The simplest method of adding these PoE powered devices to a network is via a [PoE enabled industrial switch](#). In that case, all that is required is to run an Ethernet cable from the industrial switch port that delivers power to the PD. But what if there is no PoE enabled Ethernet switch on the network to supply power? Here are a few PSE options:

- [PoE injectors](#) are deployed with a PD and the non PoE enabled networking switches. It typically features an RJ45 Ethernet in, an RJ45 Ethernet out and a Power in that goes to a wall outlet or power source.
- PoE midspans are a type of injector used to power devices at distances within the traditional 100-meter limit of Ethernet cables.
- [PoE media converters](#) transparently link two different media, such as fiber to copper, supplying both power and distance extension when the PD is far away from the nearest available network cable or industrial switch.
- PoE splitters are commonly used for deploying remote non-PoE devices with no power loss and no nearby AC outlets. PoE splitters are used together with [industrial PoE switches](#) and PoE injectors. They supply power by separating the power from the data and feeding it to a different input that a non-PoE compliant device can utilize, as opposed to accepting both data input and power input and combining them into a single output.

CONFIGURING POE ON AN ANTAIRA INDUSTRIAL SWITCH

Antaira offers a variety of industrial network devices that deliver Power over Ethernet with some models supplying up to [90W per port](#). These include our best-of-breed [industrial managed network switches](#), [industrial unmanaged switches](#), [industrial media converters](#), [injectors](#), as well as low voltage switches supporting a power input range of 9VDC to 55VDC for specialized industrial applications only.

As with all Antaira solutions, a careful balance of technical performance with ease of installation is a part of the design so that configuring Power over Ethernet is intuitive. Antaira web-based software not only guides the user through setting up a device step by step, but it also monitors a device's performance and provides a graphical representation of available power to maximize the overall system.

Antaira makes Power over Ethernet simple. In most cases, the PoE will work straight out-of-the-box without any modifications. If a unique application is required, however, Antaira web-based software allows fast easy configuration to optimize performance. In addition, each port can be assigned a priority: low, high or critical. In the event a remote PD requires more power than the PSE switch can deliver, the industrial switch port with the lowest priority will be turned off so the critical PD can continue operating.

Antaira's PoE devices are equipped with numerous special features designed to enhance functionality and efficiency delivering power out, such as PoE Ping Alive with PoE Auto Reboot, PoE Scheduling, Safe PoE Disconnect, Power Remote Reset Technology, and Persistent PoE.

PoE Auto Reboot with Ping Alive is an exceptional feature that pings a remote powered device (PD) at set time intervals.

If the communication ping fails, the industrial switch will automatically reboot the single PoE port, which in turn power cycles the remote device which oftentimes brings an end device back online.

PoE Scheduling allows for scheduled reboot of PoE connected devices by a user set schedule.

[Safe PoE Disconnect](#) is a patented hardware safety feature where network engineers can easily turn on or off power to a single PoE port using the front panel DIP switch on an industrial managed or industrial unmanaged Antaira IEEE 802.3bt PoE++ switch powering up to 90W per port. Disabling the PoE port adds a further level of protection when disconnecting the device.

[Power Remote Reset Technology](#) allows network engineers to remotely reboot and reset a connected powered device from an Antaira unmanaged IEEE 802.3bt PoE++ switch or media converter. PRRT is especially valuable for installs supporting a large geographical area with remotely connected devices.

[Persistent PoE](#) is designed into Antaira managed IEEE 802.3bt PoE++ switches. This feature provides powered devices with uninterrupted PoE power, keeping the network stable while securely capturing critical moments in the event of a firmware upgrade or switch reboot.

These advanced technology features are available on various models of Antaira [IEEE802.3bt industrial network switches and media converters](#), providing robust solutions for industrial networking needs.

Need more convincing? Check out Antaira's **iPoE Budget Control**, a patented technology that prevents devices from overrunning a PoE budget. This feature is implemented on the [LNP-C501G-SFP-bt-24-T](#) unmanaged PoE network switch. On a standard industrial PoE switch, powered by the 48~55VDC power, there is a single PoE power budget. Antaira's low-voltage industrial PoE switch can be powered from as low as 9VDC up to 55VDC. If the PoE budget is overrun, the industrial Ethernet switch will turn off the port. iPoE Budget Control dynamically changes the set power budget of the switch based upon the input voltage being supplied.

CONNECT WITH ANTAIRA – THE POE SWITCH EXPERTS

Since its introduction, power over Ethernet has been a game-changer in the world of connectivity and has greatly simplified the installation and operation of a variety of devices, from surveillance cameras and sensors to access points and HVAC. It has evolved to support today's high-density, widely distributed industrial networks that increasingly rely on edge connectivity. IEEE 802.3bt PoE++ systems can now deliver up to 90W per port, enough to operate the latest and most power-hungry network IoT sensors, devices and controllers, reducing the dependence on traditional power outlets.

Antaira can help you in developing infrastructure strategies and solutions to leverage the full potential of PoE. Contact our team today at sales@antaira.com to learn more about our industrial networking equipment.

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