

## Power over Ethernet (PoE) Frequently Asked Questions

### What is Power over Ethernet?

Power over Ethernet or PoE is a method of direct current (DC) power and data delivery to remote devices over standard twisted pair data cabling.

### What are the applicable standards for PoE?

The IEEE (Institute of Electrical and Electronics Engineers) defines the standards for Power over Ethernet (PoE) applications. These standards are as follows;

**IEEE 802.3af-2003 (Type 1 PoE)** was the first PoE standard to be developed by the IEEE. It provides 15.4 watts at 48 volts DC over two (2) pairs with 12.95 watts assured to be available at the powered device (PD) and has a maximum current rating of 350mA per pair. 802.3af requires the use of category 3 or higher rated cable to support it.

**IEEE 802.3at-2009 (Type 2 PoE+)** was developed to meet the need of devices that require more power than 802.3af. 802.3at provides 30 watts at 48 volts DC over two (2) pairs with 25.5 watts assured to be available at the PD and has a maximum current rating of 600mA per pair. 802.3at requires the use of category 5e or higher rated cables to support it.

**IEEE 802.3bt (4-pair PoE or 4PPoE)** is the latest generation of the PoE standard that was released in September of 2018. This new standard added Type 3 (60W at the Power Sourcing Equipment) and Type 4 (99W at the Power Sourcing Equipment).

### What are some of the typical PoE applications?

- Access control and security surveillance cameras
- Wireless Access Points (WAPs)
- LED Lighting
- Building Management Systems including air control valves
- Fire alarm and protection systems
- Clocks and time clocks
- Automated window shades
- Retail Point of Sale (PoS) terminals

What cable is recommended for PoE applications? Refer to “TG77 Cable Selection for Power over Ethernet (PoE) Applications” for additional information.

Category	TIA Maximum Bandwidth	Common Ethernet Applications	Approved PoE Application(s)
Category 3	16 MHz	10BASE-T	802.3af
Category 5e	100MHz	1000BASE-T	802.3af, 802.3at, 802.3bt
Category 6	250 MHz	1000BASE-T	802.3af, 802.3at, 802.3bt
Category 6A	500 MHz	10GBASE-T	802.3af, 802.3at, 802.3bt
PowerWise® 1G	100 MHz	1000BASE-T	802.3af, 802.3at, 802.3bt
PowerWise® 10G	500 MHz	10GBASE-T	802.3af, 802.3at, 802.3bt

## What is -LP cable listing?

In late 2015, Underwriters Laboratories (UL) developed a new cable certification for **Limited Power (-LP)** communications cable to simplify the cable choice and installation considerations.

From UL Website...

*“Over the past decade, Power-over-LAN cable technologies such as Power-over-Ethernet (PoE) have become a viable powering option for a wide range of applications. Anticipating future standards, device manufacturers are pushing the envelope and designing more sophisticated equipment that demands increased power.*

*As the power is increased, the heat generated within the cable increases as well. This is especially true when the cables are bundled. The additional heat generated by the increased current could push the cables beyond their rated temperatures.*

*To address this concern, UL has introduced a Limited Power (LP) Certification to simplify the cable choice and installation considerations. The “-LP” cable designation indicates that the cable has been evaluated to carry the marked current under reasonable worst-case installation scenarios without exceeding the temperature rating of the cable. The certification takes into account large bundle sizes, high ambient temperatures and other issues related to environmental effects, such as enclosed spaces or conduits.”*

## Are -LP listed cables required for PoE applications?

No, -LP listed cables are not currently required per the National Electric Code (NEC) for PoE applications. This is an optional listing that indicates the cables have been evaluated by UL to carry the marked current without exceeding the temperature rating as listed on the cable. For cables not carrying the -LP listing, the designer must refer to the table in NEC Article 725.144 for bundle sizing.

## Does Superior Essex offer cables with a -LP listing?

Yes, Superior Essex offers several products that carry the -LP listing.

1. PowerWise 10G 4PPoE CMP-LP
2. PowerWise 1G 4PPoE CMP-LP, CMR-LP
3. 10GainXP Category 6A CMR-LP, CMR-LP

## What is temperature rise?

Anytime power is delivered over copper cabling, heat is going to be generated due to the current flowing in the conductors. This heating is due to the internal resistance of the conductors and results in a loss of energy at the powered device as it is dissipated along the length of the cable.

## What about temperature rise, cable temperature rating/listing and bundle sizing?

Cables are listed with an operating temperature and cannot be installed in an environment where this temperature is exceeded. The UL -LP listing and the NEC take the heat rise into account and base the bundle size on the ambient temperature plus the anticipated heat rise. Below are some of the recommended bundle sizes based on the cable design and PoE application.

Superior Essex 4 pair copper data cables are available in an FEP jacketed CMP/CMX listing with a 200°C temperature rating, a CMR listing with a 75°C temperature rating, a CMP listing with a 90°C temperature rating, and a CMR/CMX listing with a 60°C temperature rating. These temperature ratings apply to both the insulation and the jacket.

Cable Type	PoE/PoE+ Max. Bundle Size	PoE++ type 4 Max. Bundle Size**
Cat6 28 AWG (patch cords)	48	24
Cat6A 28 AWG (patch cords)	48	24
Cat6A 26 AWG	100*	24
Cat5e 24 AWG	100*	52
Cat6 23 AWG	100*	64
Cat6A 23 AWG	100*	74
PowerWise® 1G I/O	192	19
PowerWise® 1G	192	192
PowerWise® 10G	192	192
CMP Rated FEP Jacketed	192	192

\* - Cable bundles were only tested up to 100 cables per bundle

## What does the NFPA 70 (National Electric Code) say about PoE and bundle size?

The NEC is only concerned with SAFETY and does not cover the application, power usage or performance of the cable.

- Section 840.160
  - Nothing required if less than 60 watts is used
  - If more than 60 watts is used it must comply with section 725.144 or have an OPTIONAL UL -LP Listing

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating					
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C			
26	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2.0	2.0	2.0	1.0	1.4	1.6	0.8	1.0	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3.0	3.0	3.0	1.4	1.8	2.1	1.0	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.7	0.8	0.5	0.6	0.7

\* The values within the table represent amps.

## What does the TIA say about PoE and bundle size?

The Telecommunications Industry Association (TIA) has published a technical service bulletin TSB-184A "Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling" that provides recommendations for installing cable to support PoE applications. This document should also be referred to for bundle size guidance.

## Final note on bundle size

All of the information above is for cables that are bundled together. There is no limit to the number of cables laying within a cable tray.