Connectix Cabling Systems™

White Paper

Higher Power over Ethernet

What the new PoE++ will mean to modern building infrastructure design

The next generation of PoE, PoE++ or 4PPoE, ieee 802.3bt will offer 60W+ Powering over all four pairs across structured cabling links. Consequently, M&E Design documentation is now even more critical in its accuracy within modern building design. More and more IP-Connected devices are providing several different services within modern buildings, and Power over Ethernet is enabling end-device manufacturers to offer remotely powered intelligent equipment. This White Paper discusses the implications of PoE on future design philosophies and the additional considerations to be made when specifying intelligent building infrastructures.

New Power over Ethernet Standard expected 2017/18

Since 2013, equipment manufacturers have been working towards a Power over Ethernet requirement around 50W – almost more than double the current PoE+ standard which provides 25.5W to remotely powered connected devices.

This has seen a drive by an increasing number of IP-device manufacturers to make use of the proposed increased power levels to produce IP Connected devices that can both enhance the range of products available and maximise opportunities to place products within modern building design specifications.

Current PoE Standards

There are currently two PoE standards:

i**eee802.3af** - PoE Type 1 – 15.4W Powering, 12.95W Powered
Published 2003 350mA Per Pair

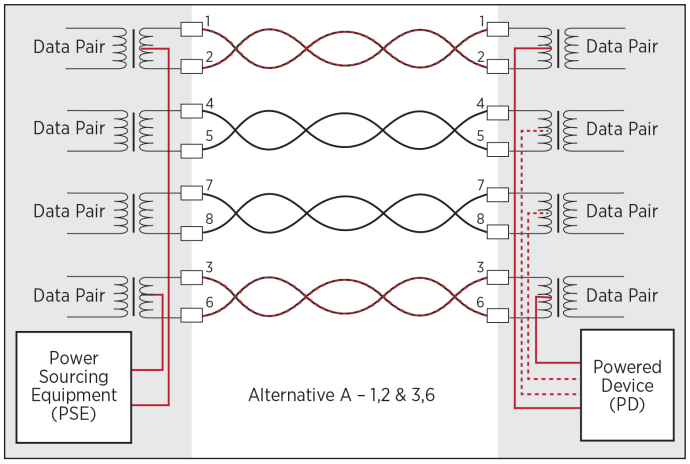
ieee802.3at - PoE+ Type 2 – 34.2W Powering, 25.5W Powered
Published 2009 600mA Per Pair

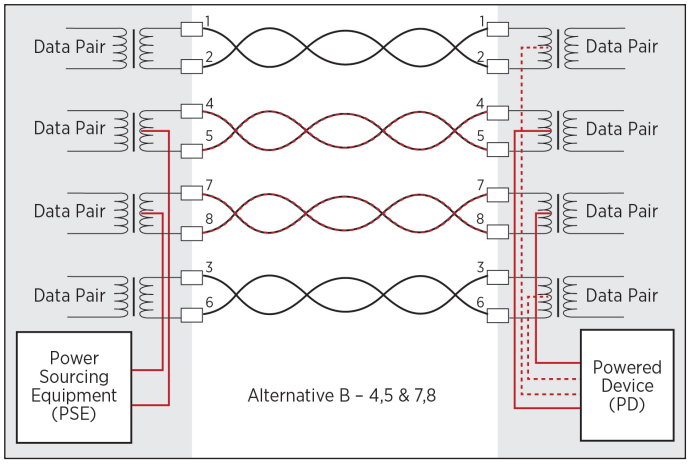
The Current PoE standards are limited to 2-Pair powering, with two alternative methods - A & B:

At this point, the current standard states that Type 1 or Type 2 PoE operation requires Class D cabling or better.

It also states that "A PSE (Power Sourcing Equipment) device shall implement Alternative A or Alternative B, or both. However PSEs shall not operate Alternative A or Alternative B on the same link simultaneously."

ieee802.3bt PoE is expected to be ratified late 2017/early 2018, and will utilise 4-Pair Powering – so what does this mean when specifying the correct solution?





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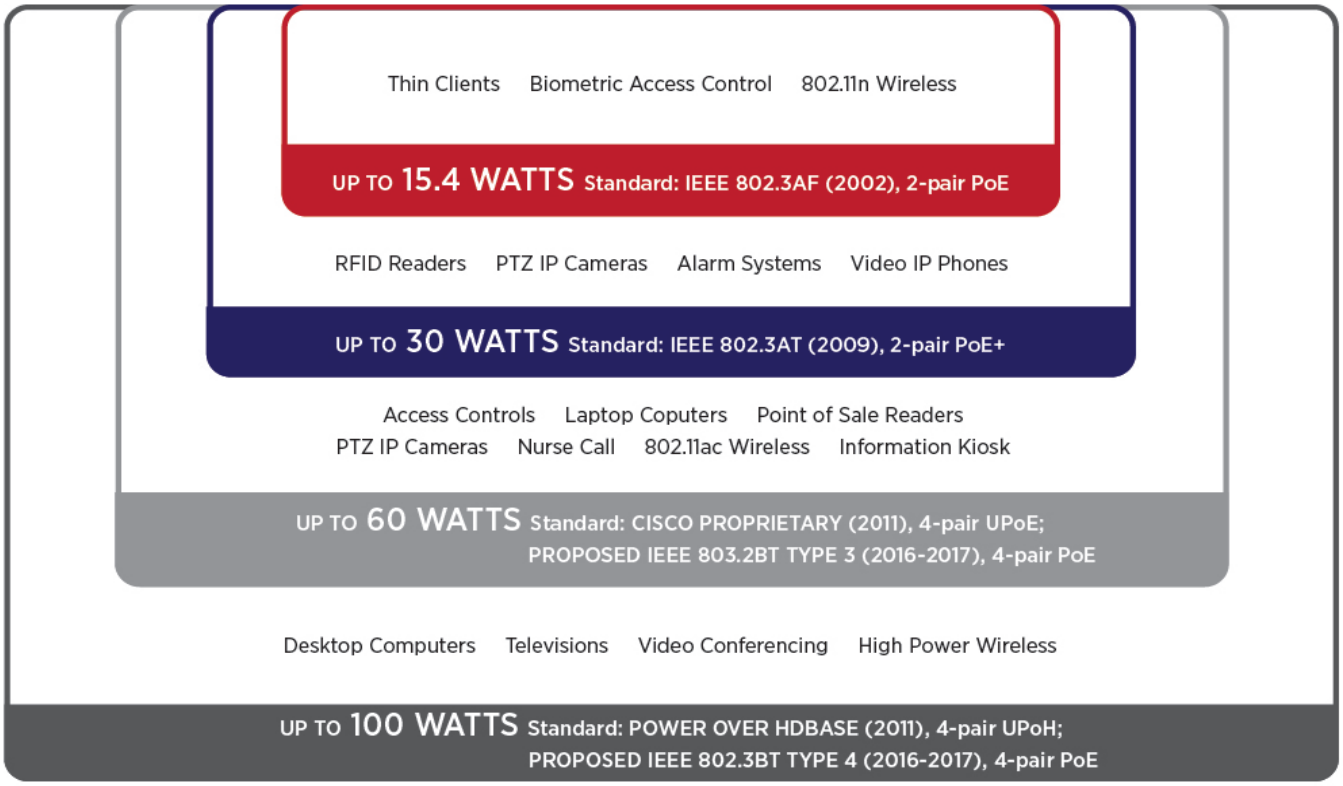


POE – Power Over Ethernet – Applications Chart

PoE Connected Building Systems

- Computer Networks
- VOIP Telephone Systems
- Wireless Access
- IP CCTV
- Access Control Systems
- IP Digital Signage
- Building Management Systems
- IP TV Systems
- IP Lighting
- Sensor Technology

What is ieee802.3bt?

ieee802.3bt will introduce two new types of PoE, both utilising all 4-Pairs within the cable to deliver the higher power requirements. It is often referred to as PoE++, but has been alternatively referred to as 4 Pair PoE.

ieee802.3bt – PoE ++ Type 3 – 60W Powering, 51W Powered Expected late 2017/early 2018 600mA Per pair

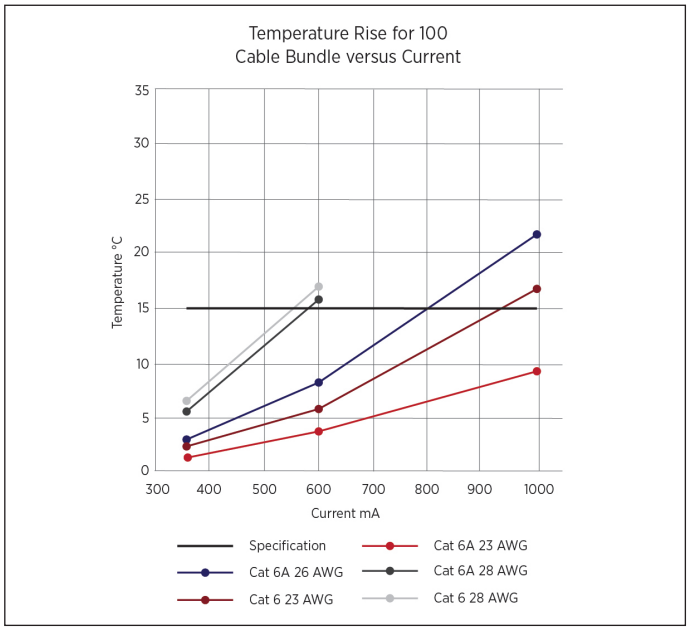
ieee802.3bt – 4PPoE Type 4 – 90W Powering, 71.3W Powered Expected late 2017/early 2018 960mA Per Pair

What will 802.3bt mean to Cabling Specifications?

As we have said, the current standard states that Class D cabling or better is suitable for PoE. However, we are now energising all 4 Pairs at a much higher power level, and so further consideration should be made to the design of the infrastructure solution because of the additional factors that will present the M&E Design Engineer.

Heat – The Major factor

The increased power across the cable has been proven across several studies to increase the temperature of single and bundled cables. Bundled cables are the most practical way to assess the impact of temperature increases as this is the most typical application throughout a building. BICSI published the following graphic in November 2016 to demonstrate a practical application of temperature increase in a realistic environment:



As the power budget rises for each application, so does the temperature of the bundle. Smaller, or "Thin Conductor" cables are likely to perform the worst in higher power operation because resistance will be higher, generating more heat in the cable bundle as a result.

M&E Specification Design issues

The difficulty for the M&E Engineer at the design stage is that there is no guidance on which links specified on the system will be High PoE and which will be utilising lower PoE operation. All buildings will be operating multiple PoE devices and systems simultaneously in the future, and the power levels are only determined by the PSE when the device is attached to the network.

Design Mitigation Strategies

The intelligent building design now has to take more and more factors into consideration due to the latest developments in PoE technology. Ensuring the delivery of the required amount of power to an increasing range of devices means it is essential during the design & specification stage to research the building requirement. This will mean:

> *Mitigation Strategies could be required*
> *Containment Designs will be influenced*
> *Link Models may be affected*

Design Assistance – A Trusted Manufacturer

It is important at this stage to engage with trusted structured cabling system manufacturer to assist with the mitigation strategy in the specification. The anticipated High PoE Applications soon to be ratified will have more of an impact than the current standards because of the effects of heat, but the mitigation strategies will probably include, but not be limited to:

- Shorter Horizontal Cable Runs
- The use of Mid-Span Devices
- Shorter Final Cables
- Larger Containment Fields
- Reduced Bundle Sizes
- Bundle Separators
- Segregated Containment Fields
- Use of Multiple Cabling Types

Where to Start?

All published studies point toward the specification and use of Category 6A Screened solutions as the most suitable cable type for PoE++ applications. The construction of the cable includes a 23AWG conductor size which performs well in terms of heat and insertion loss (signal loss) characteristics. Other gauge sizes can still be utilised under current standards, but bundle sizes, link lengths and containment requirements may be limited as a result.

Standards Compliance

The most important criteria to include in the Specification Document is to be compliant to the relevant Standards. Any specified product should be compliant at *Component Level* to ISO11801, backed up by a current Independent 3rd Party certification. Meeting the Construction Products Regulation for the cable, and including testing under PoE load for the connectors are other important considerations. Ask for current documentation from the manufacturer as early as possible when creating the specification *and* request it in the specification itself.


Compliance Statement

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Selecting a Compliant System - Beware Thin Conductor Cables

The global structured cabling market produces a large number of different cabling constructions. In recent years, a move towards "Zone Cabling", a type of cabling that was manufactured from a thinner AWG conductor size copper, CCA (Copper Clad Aluminium), or CCS (Copper Clad Steel) became popular to either reduce the diameter of the cable, or to reduce costs. Raw copper pricing is globally inconsistent which can also be a major factor in the introduction of these cable types.

However, it is vitally important to understand the implications of these types of construction should they be implemented in a building infrastructure solution that will be utilising PoE.

Thin Conductors and PoE – food for thought

Originally, the manufacturers introducing this type of Thin Conductor Solution marketed the system as a "Reduced Length" solution suitable for small networks, or indeed early Datacentre Applications – typically between 50-70m maximum end-to-end. Typical conductor size in these solutons was 25-26 AWG, but it is important to understand that these cables are ***Not Compliant to current Industry Standards***. Insertion Loss (Attenuation, or Signal Loss) is increased by up to 50% using these conductor sizes, hence the reduction in link length.

When you factor in the addition of PoE across all current standards (12.95-25.5W) on thin conductor cables, more heat is generated because of the resistance across the conductor, which increases the level of power lost across the length of the link in an increased level of heat of several times that of a standards-compliant cable.

As the PoE Power increases over Thin Conductor Cables, the length is dramatically reduced below 90m.

What is the Maximum and How to Calculate

In short, whilst it is possible to implement a calculation of the maximum link length based on PoE effects in terms of DC Loop Resistance, Insertion Loss and Volt Drop, the specification of a ***Standards Compliant*** solution at the appropriate level of performance will remove the requirement to do so, and save the deliberation of whose responsibility the calculation is – the Manufacturer, the M&E Designer, or the Installer?

In conclusion PoE, PoE+ and the upcoming PoE++ and 4PPoE are now an important consideration in the development of a Structured Cabling Specification for all M&E Design Engineers.

More and more remotely powered IP devices are being developed and many will take advantage of the new higher PoE levels, making the task of creating a design document fit for the purpose of the building increasingly difficult.

ISO & EN Standards Compliance should be the Minimum acceptable requirement for the specification, with each Standard clearly highlighted and set out to leave no uncertainty as to what the requirements are for the project, in detail, and if required specifying conductor size and construction. Independent Third Party Certification should be sought from the outset, with no exceptions.

M&E Consulting Engineers should engage with Trusted Manufacturers to qualify which Structured Cabling Systems are standards-compliant for the production of a design specification, and the manufacturer should also be able to understand the standards and discuss the detailed project requirements and establish which cable type is the best fit for the project.

Installers should also take note of the upcoming requirements in the industry, and make sure they carry out their own diligence in understanding a specification requirement when preparing tender responses.