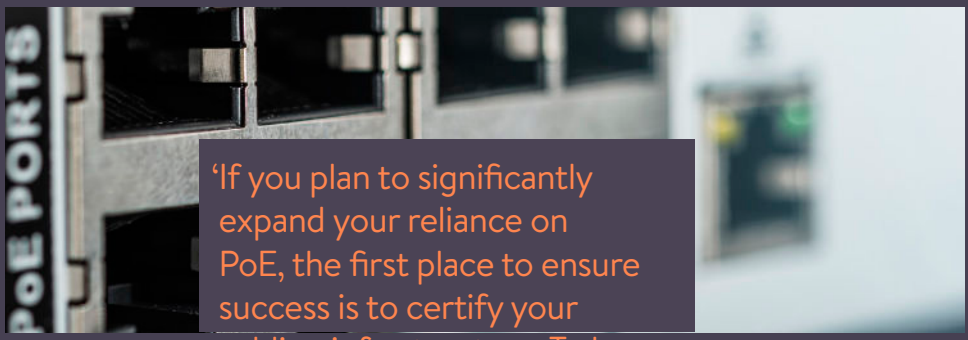
Practice makes perfect

Lisa Schwartz of AEM identifies best practices for assuring successful power over Ethernet (PoE) device deployment



'If you plan to significantly expand your reliance on PoE, the first place to ensure success is to certify your cabling infrastructure. To be certain that both new and existing cable runs will meet your needs, thorough testing is an absolute must.'

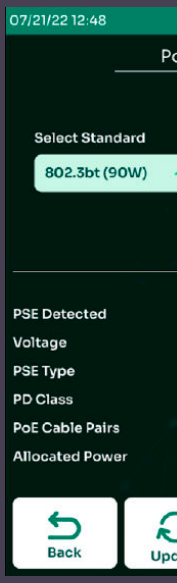
Looking at the challenges of a typical internet of things (IoT) rollout, the biggest hurdle usually isn't how to connect IoT devices to the LAN. Instead, getting power cheaply and reliably to the device is often a bigger problem. For example, installing AC power outlets next to every IoT device is laborious and cost prohibitive. It's also overkill considering the relatively low amount of voltage required by most IoT endpoints. Therefore, PoE has become a must have technology for virtually every enterprise and industrial IoT rollout. That said, PoE installations come with their own set of unique challenges.

NEED TO KNOW

Cable professionals, integrators and administrators must possess a certain level of knowledge when it comes to understanding what is needed from a power delivery perspective. Additionally, because PoE standards and use cases are constantly expanding, deploying and managing PoE endpoints and IoT devices requires a tool that provides granular visibility into whether a PoE device will be able to draw sufficient power across copper cabling for extended periods of time.

When an IoT rollout requires the assurance that PoE across twisted pair cabling will operate in production as expected, three unique testing phases emerge throughout the lifecycle of the deployment:

- During new cable installs – and when no PoE power sourcing or PoE endpoint devices currently exist to test against



– cable installers must use test equipment capable of verifying DC resistance unbalance measurements within a pair and across pairs. This will provide assurance that proper power and data delivery should be able to be achieved over every twisted pair in the cable run.

- Once the cabling and PoE switches/midspans are installed, further testing should be performed to verify that the power sourcing equipment (PSE) is delivering power to PoE endpoints that satisfies the endpoint's load requirements. In this situation, test equipment acts as the PoE endpoint and will run power load tests to provide assurance that the required level of PoE at the powered device (PD) can be achieved.

- PoE load testing is useful to IoT integrators, cable installers and network administrators, as it helps to eliminate any finger pointing between these groups when a problem does arise. It's also a great opportunity for the cable installer or integrator to create additional revenue by adding this critical step into their cable plant installation, verification or device integration process.

Let's drill down a bit further to understand the types of PoE tests that should be run, the different types of cabling to choose from based on PoE needs, the importance of cable certification for new installs and how to choose a test tool.

SCRATCHING THE SURFACE

According to the IEEE, PoE comprises three components – PSE, the PD and the cabling used to deliver power to the device. Examples of PSE are the switch or midspan power injector and an example of a PD is a security camera.

Twisted pair copper cabling is dual purpose in the fact that it not only carries electricity to power the device but is also used to also used for Ethernet data transport. There are several IEEE twisted pair PoE standards that exist today and each one delivers varying power levels from the PSE to the PD.

These standards also provide the necessary signalling that both the PSE and PD will understand. The signalling is used to detect whether the PD indeed needs power, as well as a negotiation process to determine the amount of power the PD requires for operation. Currently, there are eight different power classes available as defined by the IEEE. The power delivered by the PSE ranges from 4W in a Class 1 device to 90W in a Class 8 device.

PLAN OF ACTION

When planning for PoE rollouts, it's important that both the PSE and cabling be thoroughly tested to verify proper operation within the various PoE classes. This includes not only peak wattage capacity but also sustained power delivery over time and whether the cabling can succumb to DC resistance unbalance issues.

Extended testing for DC resistance unbalance has become an essential step within the IoT deployment process, as devices that require PoE++ levels of power at 60W or higher are more prone to causing significant interference problems with data delivery. Thus, for IoT implementations that require higher power delivery levels such as modern wireless access points (WAPs) and pan-tilt-zoom (PTZ) cameras, thorough testing of DC resistance unbalance is highly

recommended. Finally, both PoE load and negotiation testing will ensure a smooth PoE endpoint rollout with far fewer issues related to long-term power delivery use and wattage mismatches.

SETTING THE STANDARD

IEEE standards define different levels of powering. PoE also follows the same distance limitation of 100m that twisted pair cabling runs follow, as power level will decrease as it traverses the wire. This is why the standards define power levels at both the PSE and PD.

There are several Ethernet cable standards that PoE can operate across. Some cable types are better than others depending on the wattage the PDs require. Within common office and manufacturing deployment environments, you'll likely come across existing Category 5, Category 5e and Category 6 copper cabling. PDs requiring lower wattage can utilise this older cabling.

However, it's highly recommended that when powering devices that require 60W or higher sent over the cabling, newer Category 6A and higher cabling should be run. These types of cables use thicker conductor diameters and this helps reduce resistance. This is critical so that power is not lost due to compounding resistance over longer cable runs.

Category 6A and higher cabling is also better insulated and can handle the added heat produced by the higher power loads being sent across the wires. This is especially important when running higher wattage PoE in large cabling bundles. Lastly, thicker cables are far more capable

PoE Type	IEEE Standard	Power @ PSE	Power @ PD
PoE	IEEE 802.3af	15.4 W	12.95 W
PoE+	IEEE 802.3at	30 W	25.5 W
PoE++	IEEE 802.3bt (Type 3)	60 W	51 W
PoE++	IEEE 802.3bt (Type 4)	90 W	71.3 W
PoDL / SPoE	IEEE 802.3bu IEEE 802.3cg	79 W	52 W

End Point Network Device	Re
VoIP Phones, Wireless Access Points	
PTZ Surveillance Camera	
Video Conferencing, Multi-Band WAP	
Building Lighting Systems, TV	
Building Automation, Sensors, Actuators	

in delivering higher power and faster Ethernet transmission speeds for multi-gigabit connections over twisted pair copper. Thus, running newer cabling future proofs an IoT investment.

To increase the likelihood that your cabling won't be an issue when running PoE, it's necessary for cabling contractors to certify cabling to meet the cable manufacturer's strict standards. This is true not only in terms of ensuring that the cabling can operate at multi-gigabit speeds but also to test and ensure proper power load capacity for IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt standards.

FIRST THINGS FIRST

If you plan to significantly expand your reliance on PoE, the first place to ensure success is to certify your cabling infrastructure. To be certain that both new and existing cable runs will meet your needs, thorough testing is an absolute must. The best way to avoid problems down the road is to use a multifunction test solution that can not only certify the cabling infrastructure but can also verify both data transport performance and assure power load at the end device. Then you can be sure that your cabling is ready for a production environment. ■

Max Power quirements	Max Reach	Applicable Standard
12.95W	100m	IEEE 802.3af
25.5W	100m	IEEE 802.3at
51W	100m	IEEE 802.3bt (Type 3)
71W	100m	IEEE 802.3bt (Type 4)
7W	1000m	IEEE 802.3bu

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Lisa Schwartz is director of product marketing at AEM. She has worked in the test and measurement industry for 30 years, spanning five major brands of test equipment for cable certification and network connectivity testing. The primary capacities Schwartz has served in have been product management, business development and marketing. In her current role at AEM, she oversees product marketing, working closely with sales and engineering to ensure AEM's test solutions are competitive and innovative.