Evaluating your Video Network Infrastructure Requirements

Once you know your system requirements, you would need to evaluate your system components. Reading specifications is your guide. However, often time specifications can be misleading and difficult to understand. While they are truthful, it is how they are applied that makes the difference.

The standard distance for networking is 328 feet (100m). When applied to Cat 5 cable, defines the type and cable resistance required to transmit both bandwidth and PoE power. Applying this standard distance over standard cable will result in bandwidth of 10Mbps to 1000Mbps at one end of cable will be present at the other end. For PoE, it defines the amount of PoE available at the remote device based on the power applied at the other end by the source. A 15.4 watts PoE source provides 12.95 watts applied to the camera and 30 watts provides 25.5 watts. Once we go beyond this distance, additional equipment is required and no such standards applied.

When reading specifications for extending IP/PoE transmission over Cat cables or other cable types, it is important to know the difference between a “statement of fact” and a “statement of performance”. These two are very different. A statement of fact might read “Our products can transmit up to 6,000 feet”, whereas a statement of performance will define the actual performance at 6,000 feet. Your camera might require 25.5 watts and 100Mbps at 6,000 feet, while the actual transmission performance at this distance might be 1Mbps and 1 watt. Even though the statement is true that the product in question actually does transmit IP/PoE at that distance, it will not provide neither the bandwidth nor PoE necessary for your requirement. The situation becomes more complex when we are considering coax, which was never considered for IP/PoE transmission. Cat 5e and Cat 6 are the most commonly used cables for network transmission and have fixed performance standards, whereas coax is not. The differences in quality may result in a variety of different results. The most common mistake is not reading the fine print.

Let's start with the statement “Our products can transmit over coax at 6,000 feet.” Again, this is a true statement, but the fine print states to achieve this performance requires the usage of a RG6 coax cable. In most analog video security applications, RG59 was the standard cable used. The main reason for maintaining the existing coax cable is to avoid the extra costs of reinstalling the cables while keeping the existing positions of cameras, and recording and monitoring equipment. Having to replace these existing coax cables with another coax cable in order to achieve your performance requirements makes no sense at all.

Test	Test Type		Bandwidth(Mbps)	Port	TxPackets	RxPackets	TxPPS	RxPPS	TxBPS	RxBPS	RxPayload Errors	Latency (us)
3	Reference	1518	100	0	518811	518797	8086	8086	12274548	12290720	0	4.76
	Reference	1518	100	1	518855	518869	8086	8086	12274548	12290720	0	4.8
					100%	100%	100%	100%	100%	100%		
					100%		100%		100%			

Make certain bandwidth testing completely shows all part of the transmission process that can affect performance and is provided for both UTP and coax cables to establish specifications for both.

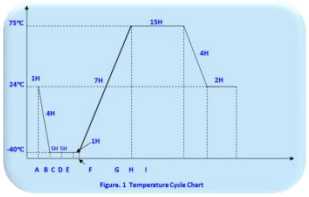
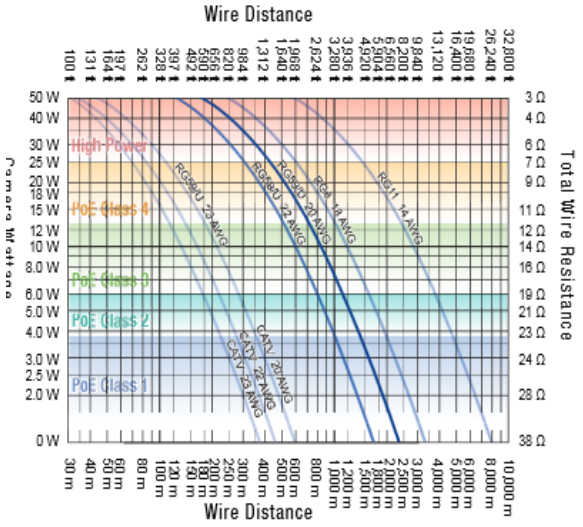


Figure. 1 Temperature Cycle Chart

Where testing is done to known standards, those standards should be noted. The above is an example of temperature testing performed to NEMA-TS2 temperature cycle standards.



Be aware of the conditions required for performance claims and do not assume they will apply for your specific applications.

Confusion over the application specifications is not limited to extended transmission equipment. Network switches are designed for data transmission in the form of small file documents such as word files and accounting spreadsheets. Video is an afterthought. Network switches and most network transmission equipment is tested with packet sizes of 64 bytes. Yet even the small 1-2 megapixels camera has a packet size greater than 1,024 bytes. Today, camera resolution can range from 5 to 35 megapixels, putting it far beyond the range of the packet size used to establish network switch performance. To make matters worse, most network switches cannot handle packet sizes greater than 1,518 bytes when it's operating at 100Mbps. In networking, the output speed of the camera port which is at 100Mbps must match the switch port of 100Mbps. At that speed, a typical network switch port is limited to 1,518 bytes.

This is where the confusion starts as many network switches claim to handle packet sizes up to 10,000 bytes, which is commonly considered as the limit for Jumbo Frames defined as frames above the 1,518 bytes. Looking at the fine print will show that Jumbo Frame handling is available only when the port speed is set to 1000Mbps (1 Gbyte). In many cases, port speed for a switch will automatically sense as the input speed. So the 100Mbps bandwidth speed from the camera will fix the network speed port speed at 100Mbps and affect the packet size limitation. You could force the switch port at 1000Mbps; however that would result in asynchronous transmission and the potential loss of information.

PoE specifications applied to network switching can be even more confusing. PoE specifications applied to a specific PoE class can be within a range for both voltage and wattage. The voltage part is what wakes up the camera and senses its presence. The wattage powers the camera. Most camera manufacturers express their devices power requirements in terms of PoE classes, ranging from 0 to 3 for 802.3af with the highest power level to class 4 for 802.3at at 30 watts. The classification can be for any voltage and wattage within that range, regardless if it's at the lowest or highest level. Technically, a source providing PoE can be called class 3 if it provides as little as 37 volts and over 6.49 watts. The problem is your class 3 camera can require the maximum 48 volts at 12.95 watts. Again, this is the difference between a statement of fact and a statement of performance. To make matters more complex, there are no standards accounting for the number of ports that can provide the maximum amount of power at the same time. So a network PoE switch can state its class 3 (15.4 watts) or class 4 (30 watts), but when all of the ports are operating, each port can provide just a little more than class 2 power at 6.49 watts.

Features	PoE (802.3af)	PoE Plus (802.3at)
Cable Requirement	Category 3 or better	Type 1: Category 3 or better Type 2: Category 5 or better, with DC loop resistance < 25Ω
Cable Current (A) PSE & PD	0.35 A	Type 1: 0.35 A Type 2: 0.6 A
PSE Output Voltage (Vdc)	44 - 57 Vdc	Type 1: 44 – 57 Vdc Type 2: 50 – 57 Vdc
PD Input Voltage (Vdc)	37 - 57 Vdc	Type 1: 37 – 57 Vdc Type 2: 42.5 – 57 Vdc
Maximum PD Wattage (W)	Class 0, 3: 12.95 W Class 1: 3.84 W Class 2: 6.49 W Class 4: Unused	Type 1: Class 0, 3: 12.95 W Class 1: 3.84 W Class 2: 6.49 W Type 2: Class 4: 25.5 W
Classification Requirements	1-Event Classification is optional for PSEs and Mandatory for PDs	Type 1: 1-Event Classification is optional for PSEs and mandatory for PDs Type 2: PSEs can deliver 2-Event Classification only, LLDP only, or 2-Event Classification and LLDP PDs must respond to 2-Event Classification AND LLDP

PoE class exists in a range of voltages and wattages. A PoE class rating can be valid at the top or bottom of range, even if your devices require top of the range performance.

Network PoE switches may not provide what is known as a PoE budget. This specific statement of the total power available for PoE. Instead, they only provide the total switch power supply. There are two reasons that account for the differences between the total switch power supply and the PoE budget. The first is some power must be allocated to operating the switch and its functions separately from providing PoE. The second is if the PoE budget is too close to the total switch power, when the switch is fully loaded with all the ports providing PoE, the switch can overheat.

How will I know what infrastructure products will meet my system requirements with all of these considerations?

1. You should start with the product specifications. Be cautious of statements that lean towards advertising and go directly to the product specifications. Always look at the fine print. And most importantly, look for the terms and conditions that are defined in creating the specifications.

2. If you are still confused, call the manufacturer or the manufacturer's product representative to ask about the conditions used to establish the equipment specifications.

3. Ask to see the test results that led to creating the specifications. Keep in mind that there are no real specifications for creating specifications for applications without standards. In this case, it's easy to be misled. The most important point is that manufacturer can provide test results that justify their claims. The results must be based on tests that yield results in support of your application. For example, if you are dealing with 5 megapixels cameras, you need network infrastructure products that can handle Jumbo Frames over the 1,518 bytes limitation. If your application requires coax cables instead of UTP, they need to provide test results done with RG59 coax cables. It's important that the tests confirm the conditions of your installation.

4. If you are dealing with extended distance applications, make sure at the end of your cable at the remote site, you will have both the required bandwidth and PoE power using the cable. This requirement must comply with the type of cable you are going to install or is already installed.

There are two important points in considering infrastructure. The first is that every component in your networking infrastructure interacts with each other. The weakest link in the chain approach applies. Secondly, unlike cameras or even graphical interfaces to NVR, where acceptance can be a matter of opinion transmission is based on physics. Improper specifications are the difference between working and not working. In infrastructure as in physics, there is very little middle ground.

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