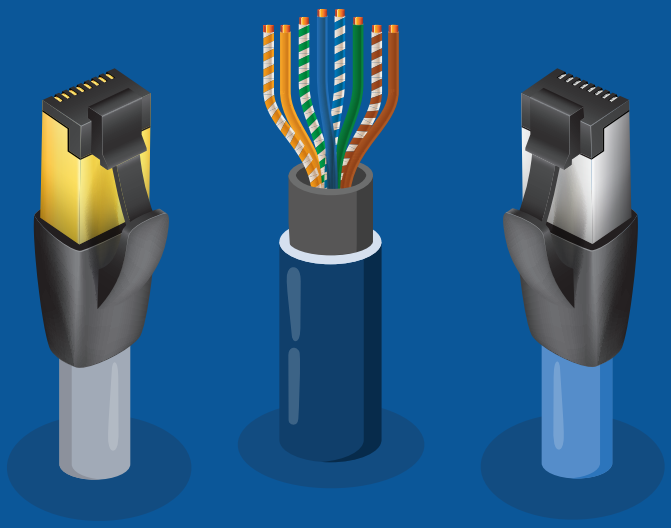
The fact about cable performance



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DESIGN

INSTALL

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Cable is more than a connection. It is a critical part of every IP security network. Its Construction, length, condition and installation can affect both Ethernet performance and the power available to connected devices.

A camera, switch or extender may meet its published specifications, yet the complete system can still underperform if the installed cable cannot support the required data rate or PoE load.

The standard 100-meter (328-foot) copper Ethernet channel is based on specified cabling and installation conditions. Many security projects, however, must reuse existing coax, two-wire or older twisted-pair cable, or operate beyond standard distances. These projects require the cable and the transmission equipment to be evaluated together.



MYTH : All Category cables Perform the same.

The Reality

Category cables differ in their supported data rates, conductor size, construction, shielding and installation requirements. They also differ in power loss and heat management when carrying PoE.

Design rule: Select cabling based on the complete application: required speed, camera power, distance, installation environment and future expansion.

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Category cable, data rate and PoE

PoE standards define the power available at the source (PSE) and the power guaranteed at the powered device (PD). Cable loss accounts for the difference.

PoE standard	PSE power	PD power
IEEE 802.3af (Type 1)	15.4 W	12.95 W
IEEE 802.3at (Type 2)	30 W	25.5 W
IEEE 802.3bt (Type 3)	60 W	51 W
IEEE 802.3bt (Type 4)	90 W	71.3 W

Higher-power PoE does not automatically reduce the Ethernet distance below 100 meters on a compliant installation. It does increase the importance of conductor resistance, connector quality, temperature and cable-bundle design. Category 5e can support standards-compliant high-power PoE when properly specified; larger conductors can reduce power losses.

Typical copper Ethernet applications

Cable	Typical data application	Design consideration
Cat 5E	1 Gb/s up to 100 m	Common for many IP-camera links
Cat 6	10 Gb/s reach 1 Gb/s up to 100 m; 10 Gb/s may work over shorter, tested channels	10 Gb/s reach depends on installation and crosstalk
Cat 6A	10 Gb/s up to 100 m	Good choice for new high-bandwidth runs
Cat 8	25/40 Gb/s up to 30 m	Specialized short-reach links; rarely needed for cameras

Selection tip: For higher-power PoE or new 10 Gb/s installations, consider a properly rated cable with suitable conductor gauge, thermal performance and installation practices.

UTP/ CAT Cable Solution

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MYTH : If my existing cable carried analog signals, it can support any IP camera.

The Reality

Not necessarily. A cable's frequency rating, the Ethernet data rate it supports, and the actual application throughput are different measurements. A 10 Mb/s Ethernet link does not provide 10 Mb/s of usable video payload under every operating condition.

Category 3 cabling was designed for older, lower-speed applications, including 10BASE-T Ethernet under suitable conditions. It is not a general replacement for Cat 5e or Cat 6 when installing modern 100 Mb/s or 1 Gb/s IP cameras.

A low-bit-rate camera stream might operate on a suitable 10 Mb/s link, but video compression, network overhead, multiple streams and camera events all affect the bandwidth needed. Performance must be verified instead of assumed.

Recommended approach: Identify the installed wire, measure the cable length and condition, confirm the camera's peak data rate and PoE demand, and select suitable transmission equipment.



Cable installation does not affect performance.

Reality

Installation quality matters. Termination defects, pair untwist, damaged conductors, excessive tension, sharp bends and poor connectors can reduce signal margin. For PoE, undersized conductors, long runs and poor connections can also increase voltage drop and heating.

Protect the cable's minimum bend radius

The minimum bend radius is the smallest curve recommended by the cable manufacturer. It is often expressed as a multiple of cable diameter. For example, a cable with a 10 mm outside diameter and a specified minimum bend radius of 4x its diameter should not be bent tighter than a 40 mm radius..

Excessively tight bends or kinks can deform the pairs or shielding and degrade signal integrity. This can increase reflections, crosstalk and packet errors. A normal compliant bend does not automatically increase conductor resistance or reduce Ethernet speed.

Plan for real camera power consumption

IP cameras can draw more power when infrared LEDs, heaters, blowers or PTZ motors are operating. Design using the manufacturer's specified maximum power requirement, not only the camera's normal operating consumption.

A reliable installation should account for:

- PoE power available at the camera after cable and connection losses.
- Cable conductor gauge, material, length and installation temperature.
- Minimum bend radius, pull tension and termination quality.
- Possible simultaneous operation of camera accessories and other connected loads.

Bottom line: Preserve cable geometry and allow adequate data and power margin.

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MYTH : A larger or higher-category copper cable automatically extends Ethernet beyond 100 meters.

The Reality

A larger conductor can reduce DC resistance and PoE voltage drop, but it does not by itself change the normal 100-meter channel limit for standard twisted-pair Ethernet applications.

Long-distance security links can be engineered using suitable Ethernet extenders, fiber-optic transmission or other purpose-built technologies. Some extended-reach systems maintain high throughput over shorter extended distances and reduce the data rate as distance increases. Performance depends on the equipment and cable used.

Questions to answer before selecting a long-distance solution

- What is the installed cable type, gauge, condition and length?
- How much data throughput is required, including camera bursts and network overhead?
- What is the device's maximum PoE demand at the far end?
- Will the system pass the required packet sizes and maintain acceptable packet loss?
- Is local power available, or must power be carried over the same cable?

Design rule: Evaluate distance, data and power together. A cable-only upgrade should not be treated as a substitute for a properly designed extended-distance transmission system.

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MYTH : I can replace my analog camera on Coax with a PoE IP camera without changing anything else.

The Reality

Existing coax can often be reused, but an IP camera does not connect directly to coax as if it were a standard Ethernet cable. Compatible Ethernet-over-coax equipment is needed to convert the signals at the network and camera ends.

Coax transmission performance depends on cable type, quality, length, data rate and the selected extender. If power must also be delivered over the coax, the available PoE at the camera depends on those conditions and the system's power design.

Example: Vigitron Vi2401A published distance ratings

Date Rate	Data Only	With PoE
100 Mb/s	Up to 1,800 ft (549 m)	Up to 1,800 ft (549 m)
10 Mb/	Up to 5,000 ft (1,515 m)	Up to 3,000 ft (914 m)

These are model-specific published ratings, not universal coax limits. The available PoE wattage, installation assumptions and compatible equipment must be verified for the exact system.

Vigitron solution: Ethernet-over-coax extenders can help migrate existing analog-camera wiring to IP while avoiding unnecessary cable replacement.

Coax Solutions

MYTH : My existing analog fiber link will automatically support IP video and PoE.

The Reality

Fiber can carry Ethernet data over long distances, but it does not conduct electrical PoE to a remote camera. PoE must be supplied locally or by a compatible powered media converter, switch or other device at the camera end.

Before reusing fiber, identify its type, core size, connector condition and optical loss. Choose compatible optics based on the required data rate, wavelength, fiber type and distance.

Illustrative Ethernet optical distances

Fiber type	Example optic	Typical maximum reach
OM1 multimode (62.5/125 um)	1000BASE-SX, 850 nm	275 m (902 ft)
OM2 multimode (50/125 um)	1000BASE-SX, 850 nm	550 m (1,804 ft)
OM3 multimode (50/125 um)	10GBASE-SR, 850 nm	300 m (984 ft)
OM4 multimode (50/125 um)	10GBASE-SR, 850 nm	400 m (1,312 ft)
Single-mode (OS2)	Matching 1G/10G optics	Depends on optics and link loss; 10 km or 40 km optics are available

Distances are illustrative for the stated transceiver types; the link must also meet the optical power budget. Connector loss, splices and fiber condition can reduce the usable distance.

Vigitron solution: Select media converters or fiber-capable switches with compatible transceivers, speed and power arrangements.

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MYTH : A single pair of existing wires can carry as many IP cameras as I need.

The Reality

A two-wire system may support one or more IP cameras when paired with appropriate conversion and distribution equipment. However, the connected cameras share the available data capacity, and the total power demand must remain within the system's supported limits.

Real-world performance depends on conductor gauge, twisted or untwisted construction, cable length, splices, environmental noise and the source power arrangement. The fact that a wire has two conductors does not establish a universal maximum data rate or PoE wattage.

For example, Vigitron's Vi27000 series is designed for Ethernet and PoE over existing two-wire cable. The product family supports rates up to 100 Mb/s under suitable conditions, but the achievable rate and PoE available at the camera change with the type and length of cable. The Vi27000/Vi27001 product specifications list a maximum 36 W PoE output; that rating should not be mistaken for power guaranteed at every distance.

Design rule: Add together the cameras' peak data requirements and maximum power demand. Then check both against the selected two-wire system's performance curves at the actual cable distance.

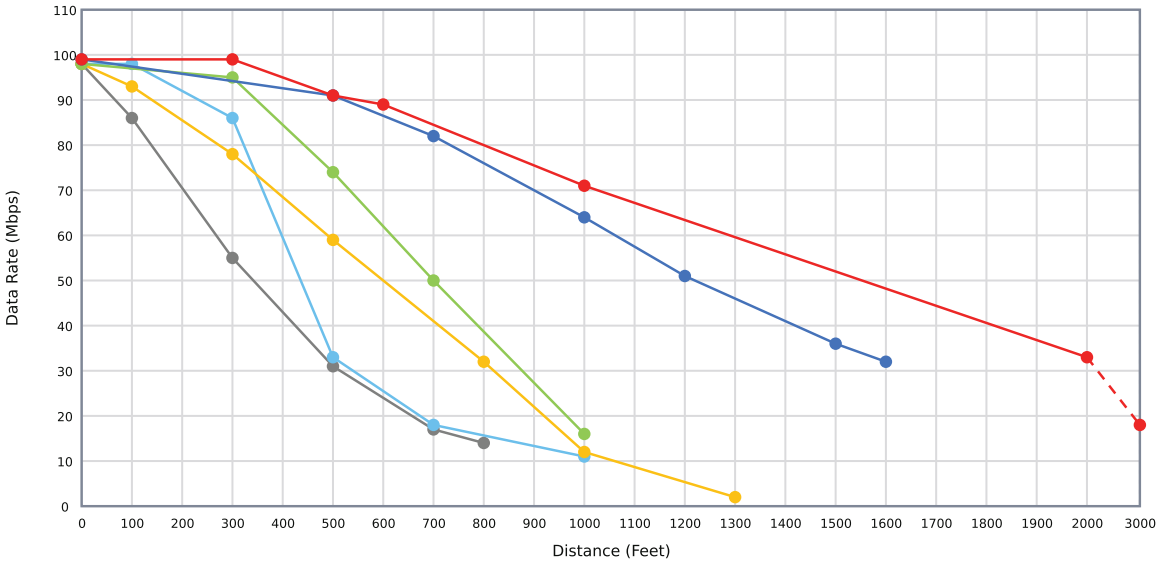
Single Pair Solutions

Understanding two-wire performance charts

Vi27000 Series: Data Rate vs. Distance

As cable length increases, the maximum usable Ethernet data rate may decrease. Wire gauge alone does not tell the full story: twisted and untwisted construction, wire condition and noise can produce very different results at the same distance.

Vi27000 Series Data Rate Vs. Distance Chart



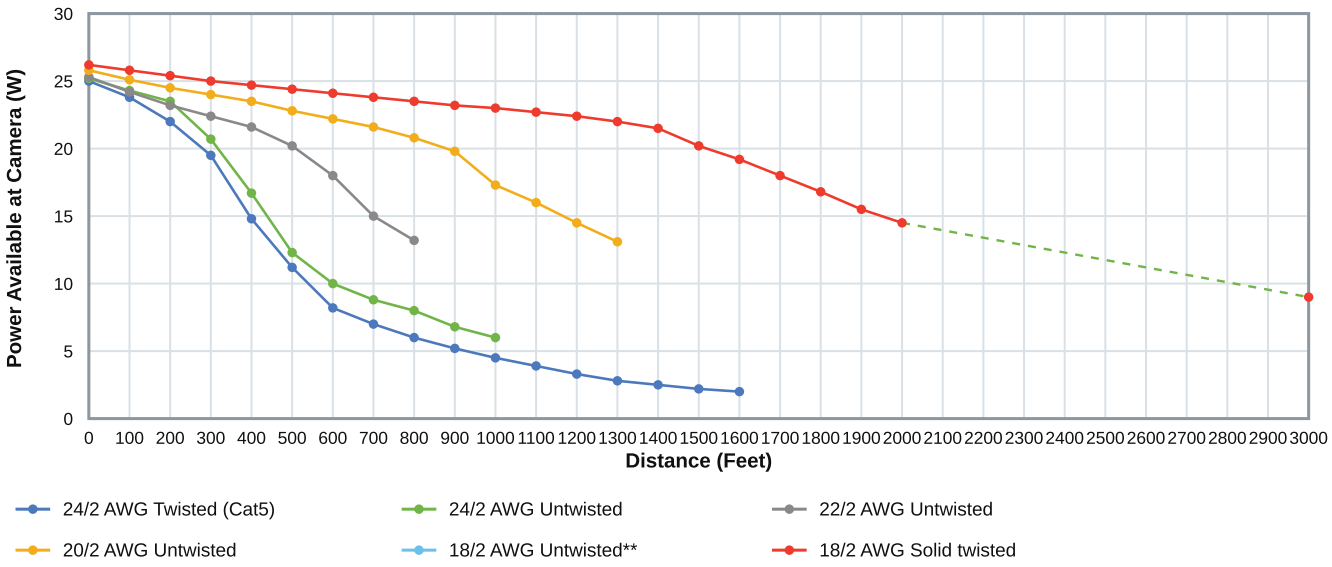
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Vi27000 Series: PoE Power Available at the Camera vs. Distance

Available PoE at the remote camera generally decreases as cable resistance and transmission distance increase. The source voltage, power equipment and actual cable construction affect how much power reaches the camera.

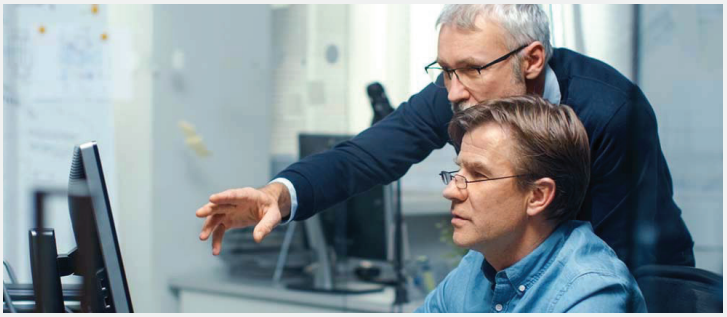
Vi27000 Series PoE Power Vs. Distance



What the charts mean for system design

- **First:** locate the installed cable type and approximate distance.
- **Second:** confirm the data rate supports the camera's required traffic with margin.
- **Third:** confirm that the power curve supports the camera's maximum operating load.
- **Finally:** check the equipment configuration and test performance before installation approval.

Important: These curves describe the specified Vigitron test configuration. Cable splices, connections, supply voltage, interference and field conditions can change the results.



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