

Network Extenders for Industrial Environments

What is a Network Extender?

A network extender, also known as Power over Ethernet (PoE) Extender, is the simplest and most cost-effective method to extend data, and optionally PoE power, beyond the 100-meter limitation of a traditional switch using standard twisted-pair cabling. In fact, with the Panduit network extender, distances of up to 2,000 feet at a speed of 100 Mbps can be achieved.

The network extender's hardware, transmitter, and receiver is used to extend the Ethernet signal. When using a PoE powered switch, the power can be extended as well. Panduit network extenders are powered using a PoE-port on a switch or with a local DC power supply. The extender work by converting the standard ethernet to a long-range signal and then converts it back to standard ethernet. The sourcing switch and end device are unaware the extender is being used and therefore maintain operation with standard ethernet protocol. The extenders do not require any configuration setup which makes for easy installation. The figure below shows the basic components of a network extender system. For more details on the Panduit network extender product line and general specifications refer to the standard Panduit PoE Extender Application Guide.

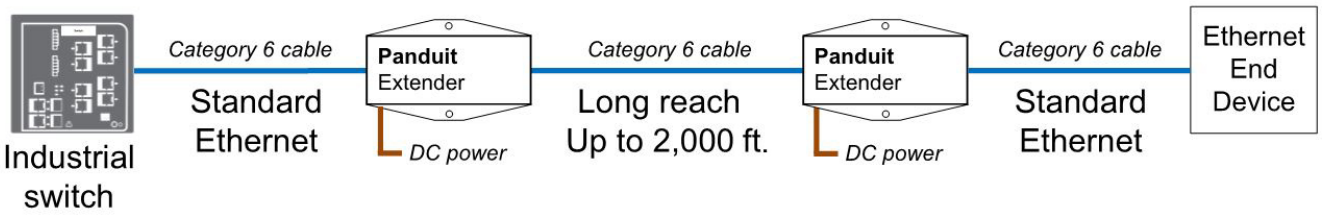


Figure 1: Basic Network Extender deployment for a single device

What are Network Extenders used in Industrial Applications?

Network extenders are used in a wide array of applications including industrial environments. Anywhere with an Ethernet connection (speeds up to 100 Mbps and cable distances exceeding 328 feet) is a potential network extender application. Industrial devices benefiting from network extender technology include:

- Remote input/output modules
- Remotely mounted motor controls
- Video cameras for equipment monitoring
- Security cameras
- Access card readers

These types of devices are typically spread out over wide areas and not always within proximity to a network switch. Installing a device that is far from a network switch is easily accomplished with a network extender and standard category cable.

Network extenders are also used when replacing or supplementing legacy networks that are deployed on the plant floor. Most legacy networks are proprietary and there are many installations still running on production lines around the world. With the acceptance of Ethernet in the industrial space, most new installations are being installed with Ethernet based networks. However, in the case of replacing a legacy network, there are differences with the architecture that relate to the maximum distances for the media. For example, legacy-based networks over single pair cable and coaxial cable media can both run much longer distances than standard Ethernet. This presents a challenge when replacing these legacy networks with Ethernet architecture. It is often cost prohibitive to add a switch or repeater for devices that are out of standard Ethernet range.

There are various options available for extending a network connection; a common method is using fiber optic cable. However, end devices typically have copper-ports for connections and therefore require media converters. This architecture is similar to the Panduit network extender solution because the signal can be converted, transmits a longer distance, and then converts it back. A fiber optic solution requires two media converters and the installation of fiber optic cable. When considering fiber use, plan to address:

- The skill and experience required to install and terminate
- Compare the cost of components verses copper
- Verifying the connection bandwidth requirements

For some connections, fiber may be the only way to achieve the speeds required. Fiber may also be a preferred solution in high Electromagnetic Interference (EMI) environments. Network extenders are a viable alternative in applications up to 100 Mbps. In a direct comparison of time and materials cost, the Panduit network extender system provides significant cost savings and simplicity over a fiber system.

PANDUIT®

What are the Architectures of PoE Extenders?

There are several different architectures to consider when deploying a network extender solution in an industrial application. Figure 2 shows a typical architecture for connecting the Network Operations Center (NOC) to a camera mounted on a conveyor line in the warehouse exceeding the standard ethernet 328-foot cable limitation. The network extender equipment and cable infrastructure are all that is needed, making the installation simpler and faster. This example shows the network extender connecting to a network switch mounted in an Industrial Distribution Frame (IDF). The connection from the network extender transmitter to the network extender receiver can reach up to 2,000 feet, depending on how the network extenders are powered. The system is typically run overhead or sometimes underground in conduit. For outdoor and underground connections in conduit, it is recommended to use Outside Plant (OSP) cable.

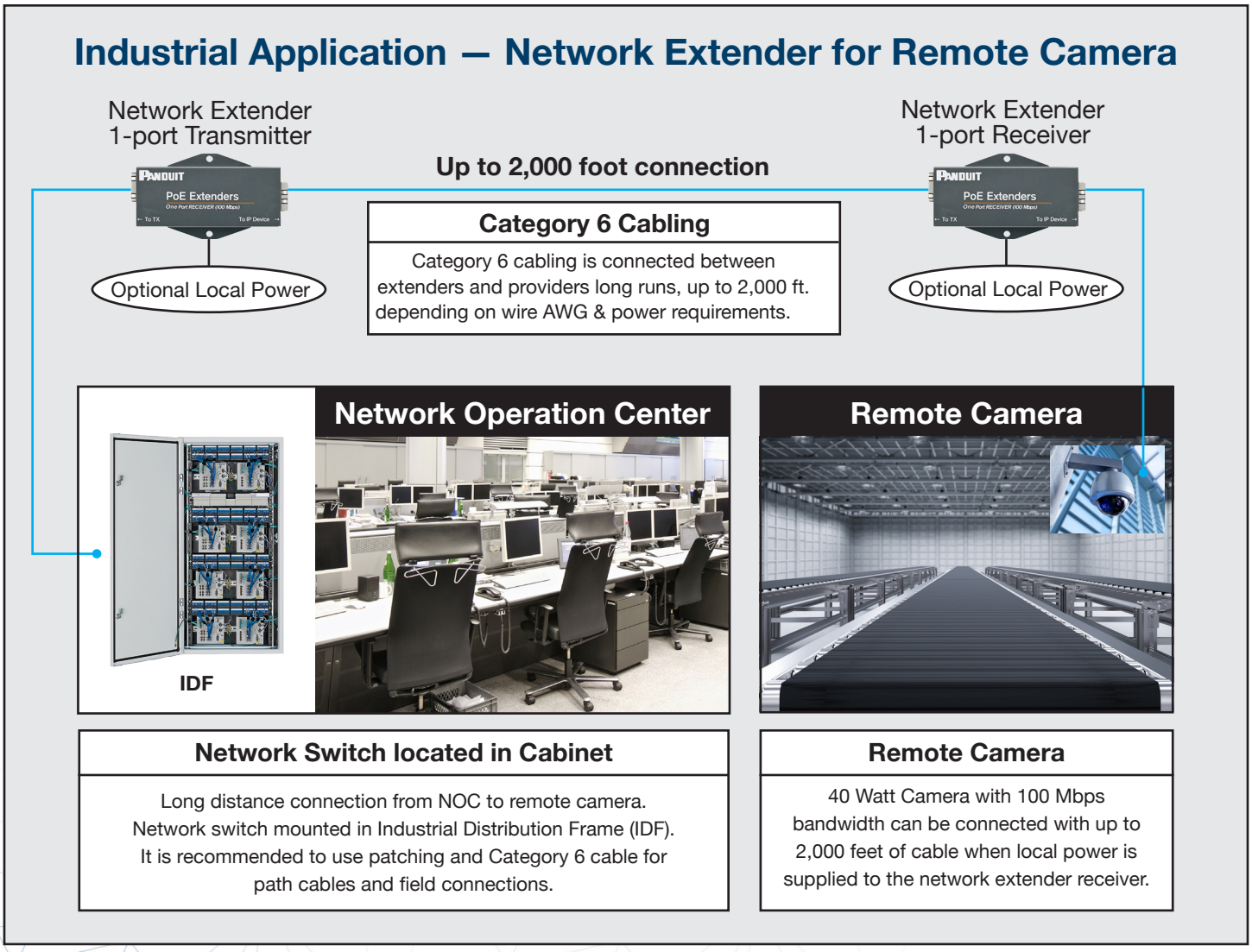


Figure 2: Network Extender in an industrial application for a single remote camera on a conveyor line

Typical applications using the Panduit solution extends from one to four devices while utilizing the standard hardware. This type of architecture is point to point and simplistic for connecting the hardware. However, the Panduit network extender system is capable of daisy-chaining devices together to accommodate more end devices from a single switch connection. Figure 3 illustrates how to connect seven devices from a single-port on the network switch. Connecting one-port of the receiver to another transmitter module provides the 'daisy-chaining' that enables the use of more end devices. Because conveyors span long distances and have sections that are not easily visible, multiple cameras are used for conveyor monitoring. Installing multiple cameras helps monitor all sections of the conveyor using network extenders. This daisy-chain system lowers the installation cost by reducing the number of switch-ports needed. Connecting the network extender system in this way does not require any additional configuration or setup.

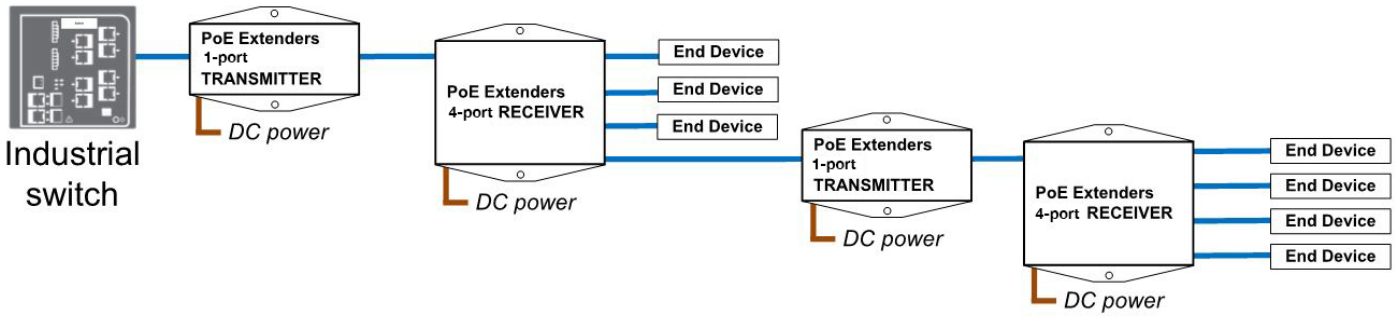


Figure 3: PoE Extender System for connecting to seven devices from a single switch-port

How do you Deploy Shielded Cable and Patching for Network Extender Applications?

Industrial environments are often more demanding for network transmission due to nearby electrical noise that can interfere with the integrity of the signal. In some cases, shielded cable is recommended to protect the network transmission from Electromagnetic Interference (EMI). When running a cable long distance in an application fit for the extenders, it is best to avoid areas where EMI is present. But, because avoiding EMI is not always possible, mitigation methods such as shielded cable, can help reduce EMI. Panduit recommends installing the cabling system using patch panels. Using patch panels require additional physical infrastructure as shown in Figure 4. 'Patching' refers to interconnecting the cables through patch panels so that standard patch cables can be used. It also makes it possible for structured cable to be setup to connect the patch panels. Structured horizontal cable is typically a solid conductor and can be conveniently tested with handheld test equipment. Patching can be setup with shielded or unshielded copper cabling, and it is recommended to follow structured cabling standards such as ANSI/TIA-1005-A.

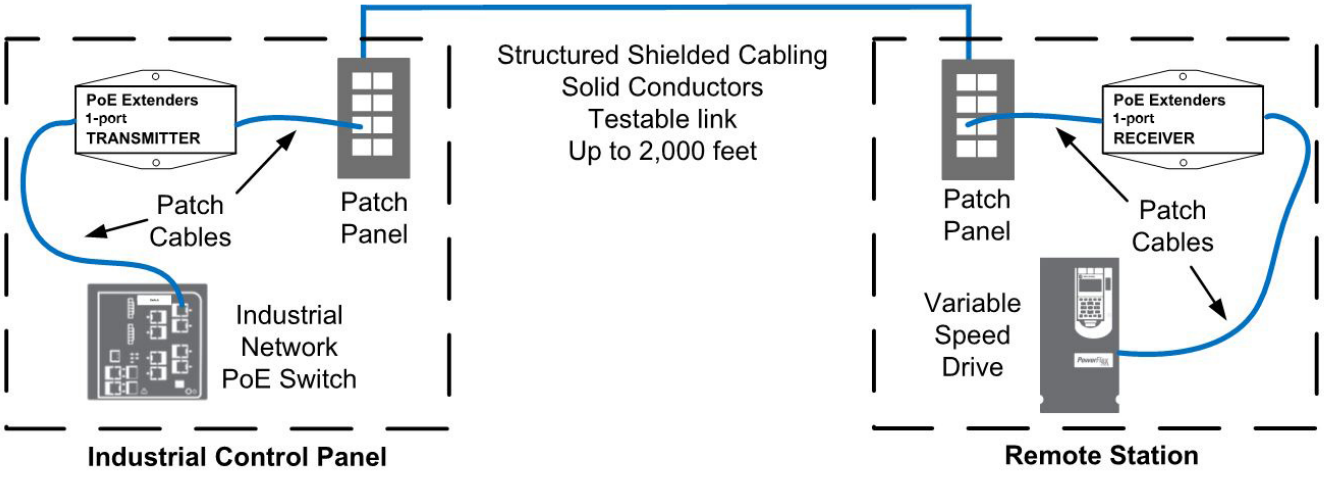


Figure 4: Network Extender Application demonstrating cable patching

What Products are Needed for Installing Panduit Network Extenders?

The essential parts of the network extender system are the transmitter and receiver. Receivers are available in 1-port or 4-port and the transmitter is available in 1-port. Although the parts are described and labeled as PoE Extenders, the actual use of PoE is optional. Table 1 shows the basic offering of hardware and kits. Table 2 shows the accessories which include different types of power supplies and cables. For industrial applications, the AC power brick can be replaced with a 48 V DC feed (power consumption for transmitter or receiver is 1.5 watts per device) from a DIN rail power supply or similar type device.

In addition to the extender hardware, several other parts are needed to install the physical infrastructure, shown in Table 3. The physical infrastructure can be setup with a shielded (STP) or unshielded (UTP) cable system, based on the application. Table 3 provides a sampling of parts often used for a UTP and STP system. When installing cable outdoor or below grade in conduit, it is recommended to use Outside Plant (OSP) rated cable. OSP cable is designed to withstand exposure to sunlight, wind, moisture, and extreme temperatures. For example, connecting video cameras often have the cable exposed to outdoor elements. When mounting outside, or any type of challenging environment, the network extender module must be mounted in an enclosure that is rated for that area.



Transmitter

Part Number	Description
POEXTX1	1-port Transmitter, 1-port RJ45 to 1-port RJ45 interface on each side





Receivers

Part Number	Description
POEXRX1	1-port Receiver, 1-port RJ45 to 1-port RJ45 interface on each side
POEXRX4	4-port Receiver, 1-port RJ45 to 4-port RJ45 interface on each side



Kits

Part Number	Description
POEXKIT1	Kit: (1) Transmitter, (1) 1-port Receiver, (1) Power supply with power cord (for North America)
POEXKIT4	Kit: (1) Transmitter, (1) 4-port Receiver, (1) Power supply with power cord (for North America)
POEXKIT1-NP	Kit: (1) Transmitter, (1) 1-port Receiver, (1) Power supply with power cord sold separately (for use outside of North America)
POEXKIT4-NP	Kit: (1) Transmitter, (1) 4-port Receiver, (1) Power supply with power cord sold separately (for use outside of North America)

Note: Power cords are sold separately. See the power cord table below.

Table 1: Panduit Network Extender parts and kits

What Products are Needed for Installing Panduit Network Extenders?

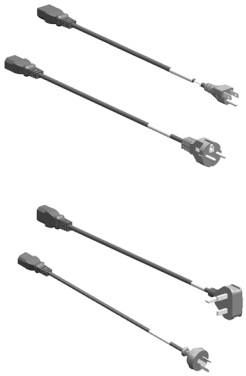
Power Supplies



Part Number	Description	Power
POWER-60W	Use with 1-port transmitter or receiver	60 W
POWER-110W	Use with 4-port receiver	110 W
POWER-190W	Use with POEXPANEL Supplies to (4) 1-port transmitters or receivers	190 W

Note: Power cords are sold separately. See the power cord table below.

Power Cords



Part Number	Description	Power	Length	Pin
C13CORD-B	IEC320-C13 to GB2099 (Americas)	10A	2m	3
C13CORD-F	IEC320-C13 to CEE 7/7 (EU)			
C13CORD-G	IEC320-C13 to BS1363A (UK)			
C13CORD-I	IEC320-C13 to GB2099 (China)			

Panels

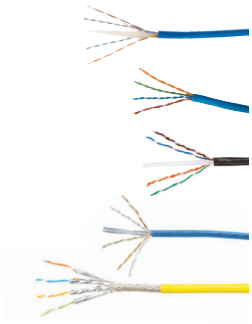




Part Number	Transmitters Accepted	Power Accepted	Color
POEXPANEL-BL	Up to eight long-reach PoE extender rack accepts up to eight transmitters for the PoE 1-port or 4-port extenders. Fits in all standard 19-inch rack units leaving at least 1 RU in space to ensure panel is secured. Holds Panduit cables, power supplies, and materials for the PoE product.	Accepts (2) POWER-190 W	Black
POEXPANEL-WH			White

Table 2: Panduit Network Extender accessories

What Products are Needed for Installing Panduit Network Extenders?



Copper Cables

Part Number	Cable Type	Description	Gauge (AWG)	Jacket	Color
PUP6C04BU-UQ	Plenum (CMP)	Category 6, 4-pair, U/UTP	23 AWG	PVC	Blue
PUR6C04BU-UQ	Riser (CMR)			PE	Black
PUO6C04BL-CEQ	Outside Plant (OSP)			Polyolefin (LSZH)	Gray
PUL6004GY-EDY	Low Smoke Zero Halogen (LSZH)	Category 6, 4-pair, UTP			
ISX6004AYL-LED	Shielded	Category 6, 4-pair, S/FTP	24/7 AWG	PUR	Yellow



Copper Jacks

Part Number	Jack Type	Performance Level	Termination Style	Color
CJ6X88TGBL	Unshielded RJ45 Jack	Category 6	TG-Style	Black
CJS6X88TGY	Shielded RJ45 Jack	Category 6A		Gray



Patching

Part Number	Description	Color
CADIN1IG	Mini-Com® DIN Rail Mount Adapter, Single-Port	International Gray
CDPP8RG	IndustrialNet™ 8-port DIN Rail Mount Copper Patch Panel	Rock Gray
CADIN1IG-S	Shielded Mini-Com® DIN Rail Mount Adapter, Single-Port	International Gray
CDPP8RG-S	Shielded IndustrialNet™ 8-port DIN Rail Mount Copper Patch Panel	Rock Gray



Copper Patch Cords

Part Number	Cord Type	Cable Diameter In. (mm)	Conductor Gauge (AWG)	Flammability Rating
UTP28SP7BU	Unshielded	0.150 (3.8)	28 AWG	CM; LSZH
STPCH1MBBU	Shielded	0.200 (5.1)	26 AWG	CM; LSZH



Field Term Plugs

Part Number	Plug Type	Performance Level	Termination Style	Color
FP6X88MTG	UTP Straight Field Term	Category 6A	TG-Style	Black
FPUD6X88MTG	UTP Angled Field Term			
FPS6X88MTG	Shielded Straight Field Term			Silver

J-Pro™ Hooks

Part Number	Description	Color
JP2W-L20	Cable support system; one 1/4" (M6) mounting hole, 2" max. bundle, nylon with metal attachments	Black

Table 3: Panduit Network Extender physical infrastructure parts (unshielded/shielded patch cords, cables, jacks, and patching)

© 2021 Panduit Corp.
ALL RIGHTS RESERVED.
CPAG25--WW-ENG
2/2021