



▶▶ Ruggedized
Application & Product Guide
For Today's Harsh Network Environments



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▶▶ Connecting Today's Harsh Environments to a Higher Standard

The growth in digital information and adoption of Ethernet networks and IP-based devices means that network connections exist in more places than ever before. Whether it's connecting student laptops in a school laboratory, a digital imaging display in a hospital mobile MRI unit, security cameras in an outdoor parking lot, or a point-of-sale machine at a poolside eatery, the world is continuing to digitize at a rapid pace.

Many manufacturing environments have rapidly migrated to Industrial Ethernet in recent years to deliver information for industrial automation and control systems, while also integrating factory environments within the corporate LAN. But what about environments that fall somewhere in between? Not quite severe enough to be considered fully "industrial", but in need of something more rugged than what exists in everyday commercial offices. These types of locations are appearing more frequently and require adapted network cabling infrastructure that is designed to maintain long-term network reliability and prevent the need to replace components due to corrosion and damage from a variety of elements.

As a leading global manufacturer of low-voltage copper and fiber optic cabling systems, Siemon understands the use of network cables and connectors in harsh environments which call for Ruggedized solutions offering increased protection while still delivering a high level of performance to reliably handle vast amounts of data.



Connecting more people, places and things inherently requires networks to expand into harsh environments that call for Ruggedized cables and connectivity.



▶▶ Why Do You Need Ruggedized Connectivity?

With more IP-based devices in a wider range of environments and Ethernet becoming the communication protocol of choice for industrial automation and control, Information Technology (IT) and Operational Technology (OT) networks are increasingly exposed to harsher environments that are subject to a variety of stresses, including:

- **Mechanical stresses** such as vibration, shock, tensile force, crushing, impact, bending, flexing, and torsion
- **Ingress of particulates (dust) and liquids** via exposure to moisture and rainwater or even total immersion
- **Climatic elements** including temperature extremes, humidity, UV/sunlight, and temporary flooding (up to 1 meter for 1/2 hour)
- **Chemical pollutants**, petroleum and chlorine based solvents, oils, and gases, and a variety of other chemicals
- **Electromagnetic Interference (EMI)**, also called Radio-Frequency Interference (RFI) when in the radio frequency spectrum, are caused by electrostatic discharge, transients, magnetic fields and wireless radio frequencies from antenna, motors, variable frequency drives and other devices
- **Physical Tampering** with outlets or other network components due to more network devices increasingly located in public spaces



Ruggedized-grade thermoplastic for superior protection and durability

Features an IP66/67-rated seal that prevents dust and moisture ingress

Available in shielded versions for superior protection against interference

Quarter-turn bayonet-style mating presents a unique, tamper-resistant interface

Ruggedized Copper Patch Cord mated with Ruggedized Outlet Installed into IP44-Rated Stainless Steel Faceplate

Harsh Environments and Components Classification

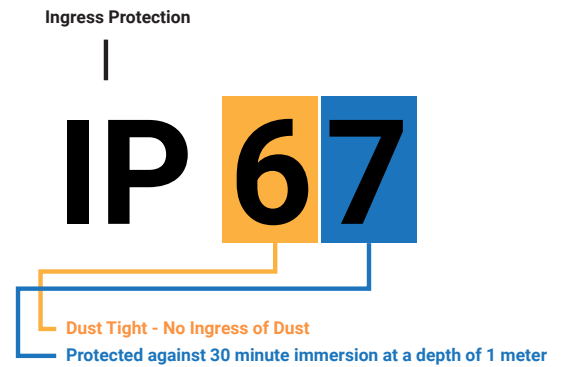
MICE

ISO/IEC and TIA and industry standards for industrial premises incorporate the MICE method for classifying environments in which networks reside. MICE stands for Mechanical, Ingress, Climatic, and Electromagnetic and includes three levels of severity—Level 1 for commercial/office, Level 2 for light industrial and Level 3 for industrial. It's important to note that rarely is an environment exclusive to one MICE classification. For example, an environment exposed to liquid only may be classified as $M_{1}I_{3}C_{1}E_{1}$. When planning cabling systems, it is recommended to consider the worst case scenario and applicable level parameter, regardless of the other parameters in scope.

INCREASING SEVERITY			
Mechanical (shock, vibration, crush, impact)	M ₁	M ₂	M ₃
Ingress (particulars and liquid)	I ₁	I ₂	I ₃
Climatic (temperature, humidity, contaminants)	C ₁	C ₂	C ₃
Electromagnetic (ESD, RFI, transients, magnetic fields)	E ₁	E ₂	E ₃

Ingress Protection (IP)

Developed by the European Committee for Electro Technical Standardization (CENELEC), and sometimes referred to as an IP code, the IP rating consists of the letters "IP" followed by two digits—the first digit classifying protection against solids and the second classifying protection against liquids. A common IP rating for network components in wet environments is IP67, which indicates total protection against dust and liquid ingress.



NEMA Enclosures

Another standard used to classify network enclosures based on environment is the rating system used by the National Electric Manufacturer Association (NEMA). NEMA-rated enclosures can include cabinets, surface mount boxes, floor and ceiling boxes, junction boxes, and even network equipment housings. NEMA ratings for enclosures also have IP code equivalents.

NEMA Rating	Description
1	Indoor enclosure that protects against incidental contact with the enclosed equipment and falling dirt
3R	Indoor or outdoor enclosure that protects against incidental contact with the enclosed equipment and falling dirt, rain, sleet, snow, and ice formation
4	Indoor or outdoor enclosure that protects against incidental contact with the enclosed equipment and falling dirt, rain, sleet, snow, and ice formation, as well as windblown dust, splashing water, and pressurized water (i.e., wash down)
4X	All of the same capabilities of NEMA 4 but with the added benefit of resistance to corrosion
12	Indoor enclosures without knockouts that protects against incidental contact with the enclosed equipment, falling dirt, circulating dust, dripping and light splashing of non-corrosive liquids



▶▶ Risks of Using Commercial-Grade, Non-Ruggedized Components

When commercial-grade, non-Ruggedized network components are deployed in these demanding environments, there are several risks that can adversely impact network performance, shorten component life-cycles and/or cause network connections to fail.

1. Use of non-shielded components in noisy environments causes disturbing frequencies to couple onto cable conductors and contacts, preventing proper transmission of data signals.
2. Temperature extremes can soften and break down plastics used in connector housings and cable jacketing materials.
3. Liquids, moisture or chemicals infiltrating network connections can cause the corrosion of plug and outlet contacts, diminishing current or preventing continuity that can render connections unusable.
4. Dust infiltrating network connections can create poor contact, overheating or arcing that damages plug and jack contacts. Dust also traps heat and moisture that can lead to corrosion and signal integrity issues.
5. Vibration can cause commercial-grade connections to come loose as well as pitting of contacts, while flexing and torsion can change the geometry of the cable and impact its signal carrying capacity.

Part of Siemon's ConvergeIT™ Intelligent Building Solutions

This Ruggedized Application and Product Guide is just one in a series for all the low-voltage applications that fall under Siemon's Digital Building Solutions and Services. Our ConvergeIT program brings together Siemon's advanced cabling systems and intelligent building expertise with a team of like-minded innovative building system partners and certified Digital Lighting Partners (DLPs) to help customers around the world build profitable intelligent buildings.

Visit www.siemon.com/en/solutions/intelligent-buildings to learn more.

Harsh Environments Are Everywhere

While some environments such as industrial manufacturing facilities, waste water treatment plants, oil and gas refineries, and food processing facilities clearly present challenges for network components, the proliferation of digital technology means that harsh environments now exist in many non-factory facilities across several vertical markets.



Restaurants, commercial kitchens, and cafeterias require network components to be protected from cooking heat, dust and liquids ingress, oils, and cleaning solvents.



Universities, primary/secondary education schools, and medical laboratories require protection against chemicals, gases, and other contaminants, as well as vibration protection for some equipment.



Locker rooms, gymnasiums and fitness centers are moist, humid environments and may be exposed to chemicals like chlorine. Exercise equipment can also require protection against vibration.



Resorts, stadiums, theme parks, and other outdoor environments are subject to sunlight, temperature extremes, humidity, dust, and rainwater. Connections in theme parks also often require protection against vibration, torsion as well as tampering.



Hospitals, healthcare facilities, and mobile medical units demand protection against liquids and solvents as they undergo frequent washdowns. These critical environments are susceptible to EMI from medical equipment and typically require shielded cabling and connectivity.



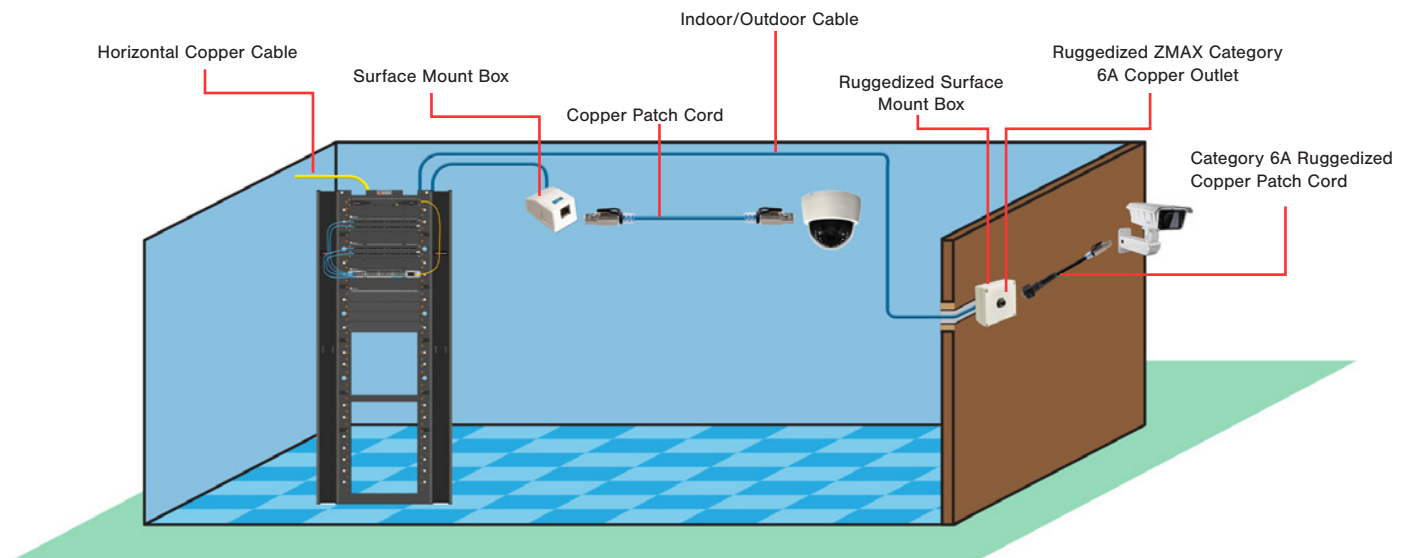
Warehouse and distribution centers are dusty environments that demand NEMA enclosures and IP67-rated connectivity, as well as cables that offer better abrasion and impact resistance. These environments may also have conveyor belts and other equipment that can cause EMI.



Airports, transportation hubs and marinas are subject to a wide range of mechanical stresses, ingress of dust and liquids, climatic elements, chemicals, pollutants, EMI and RFI.

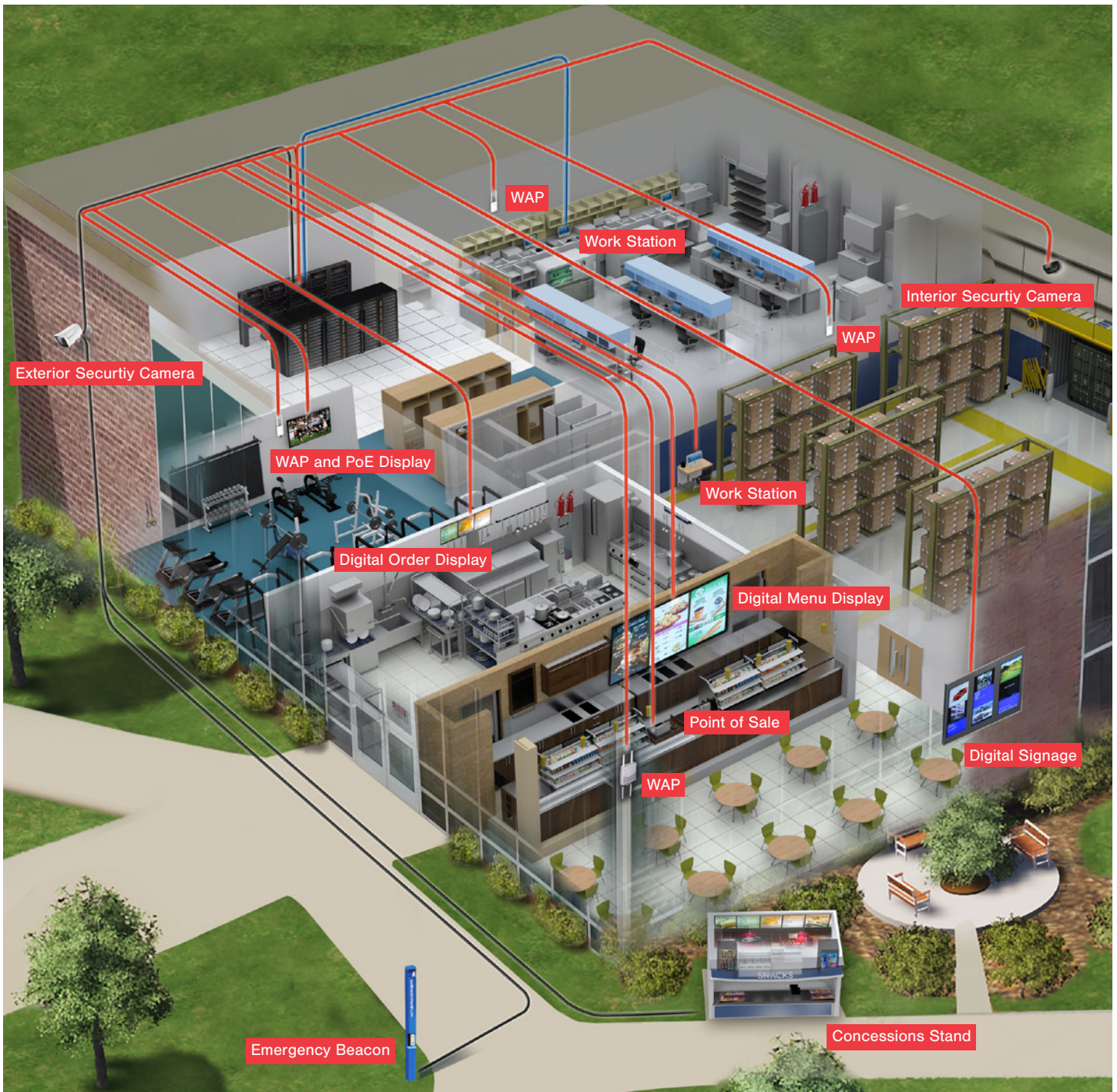
Siemon Category 6A Connectivity within a Building

Even when combining Siemon Ruggedized and non-Ruggedized systems, performance levels can still remain consistent throughout the entire building.



►► Ruggedized Solutions Are Everywhere

There are many places where it's advantageous both inside and outside of buildings to deploy Ruggedized connectivity. In these instances Ruggedized connectivity will provide the network protection needed against not only the infiltration of dust, cleaning chemicals, weather, and other particulates, but also help prevent network interruptions caused by noisy environments or vibration.



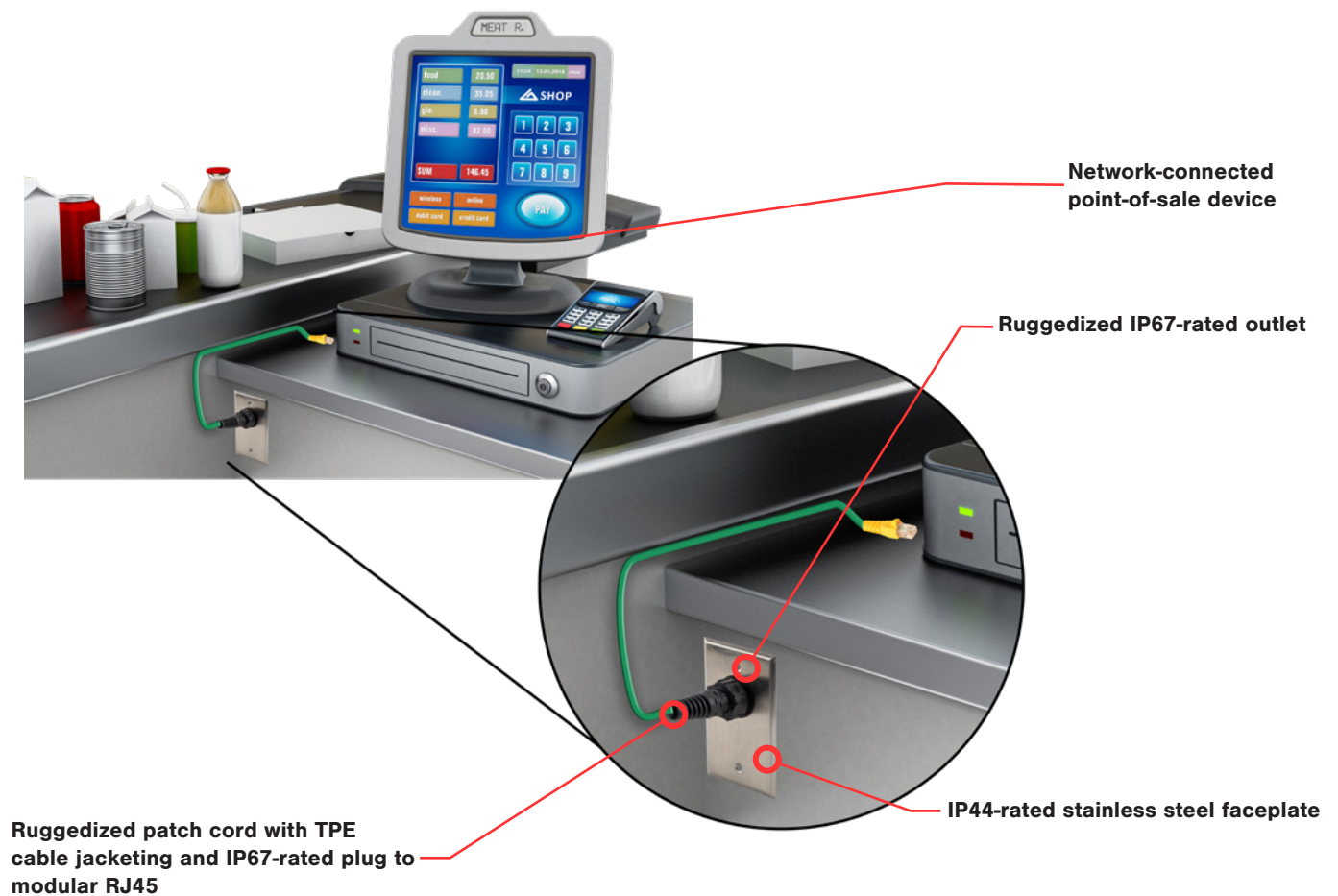
Key: ■ Indoor Fiber ■ Outdoor Fiber ■ Copper Cable

▶▶ Ruggedized Application Examples

Ruggedized cabling and connectivity solutions can be deployed in a wide range of application environments, with the severity of the conditions and device requirements dictating the level of protection, connector type, and performance level.

Enterprise Application (MICE Level 1/2)

Many enterprise facilities contain food service environments that may be subject to heat, liquids, and other elements but where devices still need to be connected to the network. For example, cafeterias exist in most schools, universities, hospitals, and even commercial businesses. In addition, restaurants, shopping malls, stadiums, and many other spaces include food service environments. Over the past two decades, point of sale (POS) systems for these spaces have evolved to become digital devices on the network, improving productivity and the customer experience while providing the means to access and analyze data from multiple registers to synchronize and streamline financial and product data, as well as acquire insight into customer behavior.



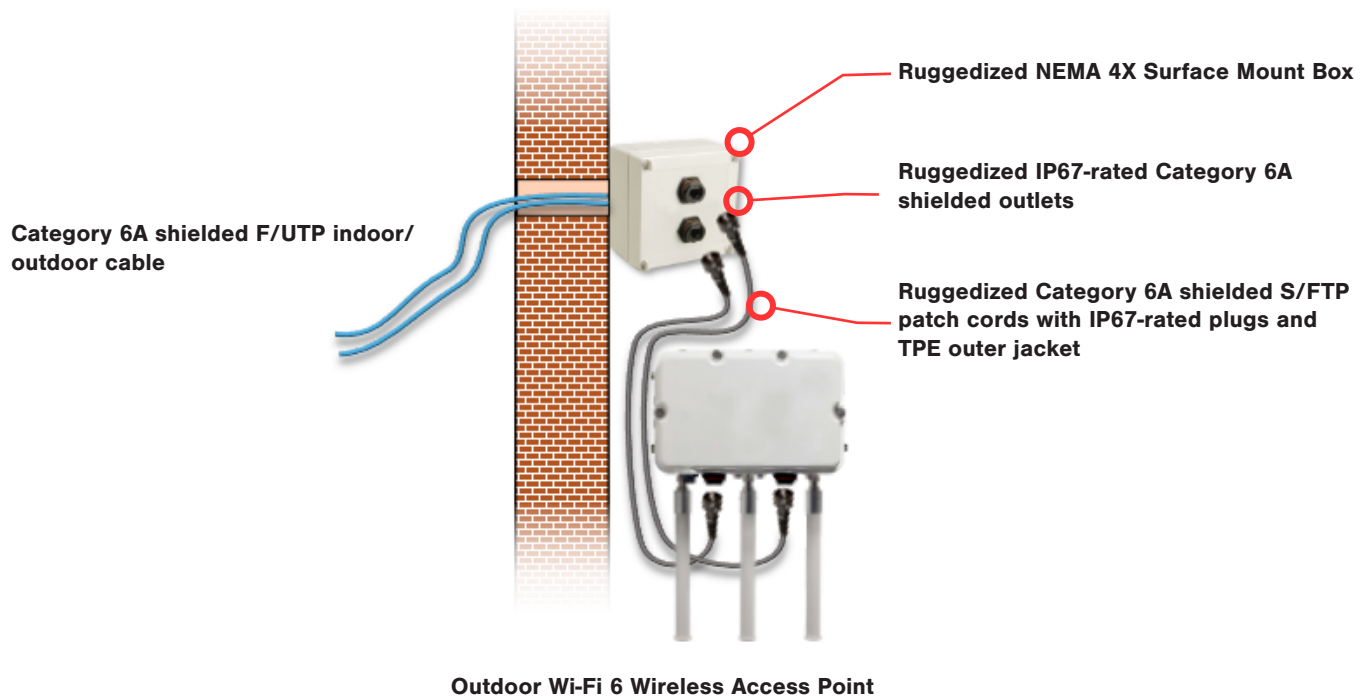
POS Terminal Connected Via Ruggedized IP67-rated Outlet/Plug Interface and IP44-rated Stainless Steel Faceplate

Outdoor Deployment (MICE Level 2)

With applications like Wi-Fi and video surveillance now found across most environments and vertical markets, the demand for outdoor devices has increased significantly, especially where large numbers of people congregate outdoors, such as universities, amusement parks, city centers, stadiums, and resorts. Connecting network devices outdoors and protecting those connections from the elements requires Ruggedized cable and connectivity.

Indoor/outdoor cable can be used to connect outdoor devices mounted on a building exterior or in parking garages, while harsher environments, such as when cables are deployed in a direct burial, lashed aerial or underground conduit application, may require outside plant (OSP) cable that transitions to indoor cable at the building entrance.

When it comes to selecting Ruggedized cable and connectivity solutions for harsh environments, it's important to consider both copper and fiber components. There are many applications outside of telecommunication spaces where fiber is used to provide greater bandwidth over longer distances. Because fiber is completely immune to EMI, it is also ideal for noisy environments that can adversely impact performance of copper cabling systems.

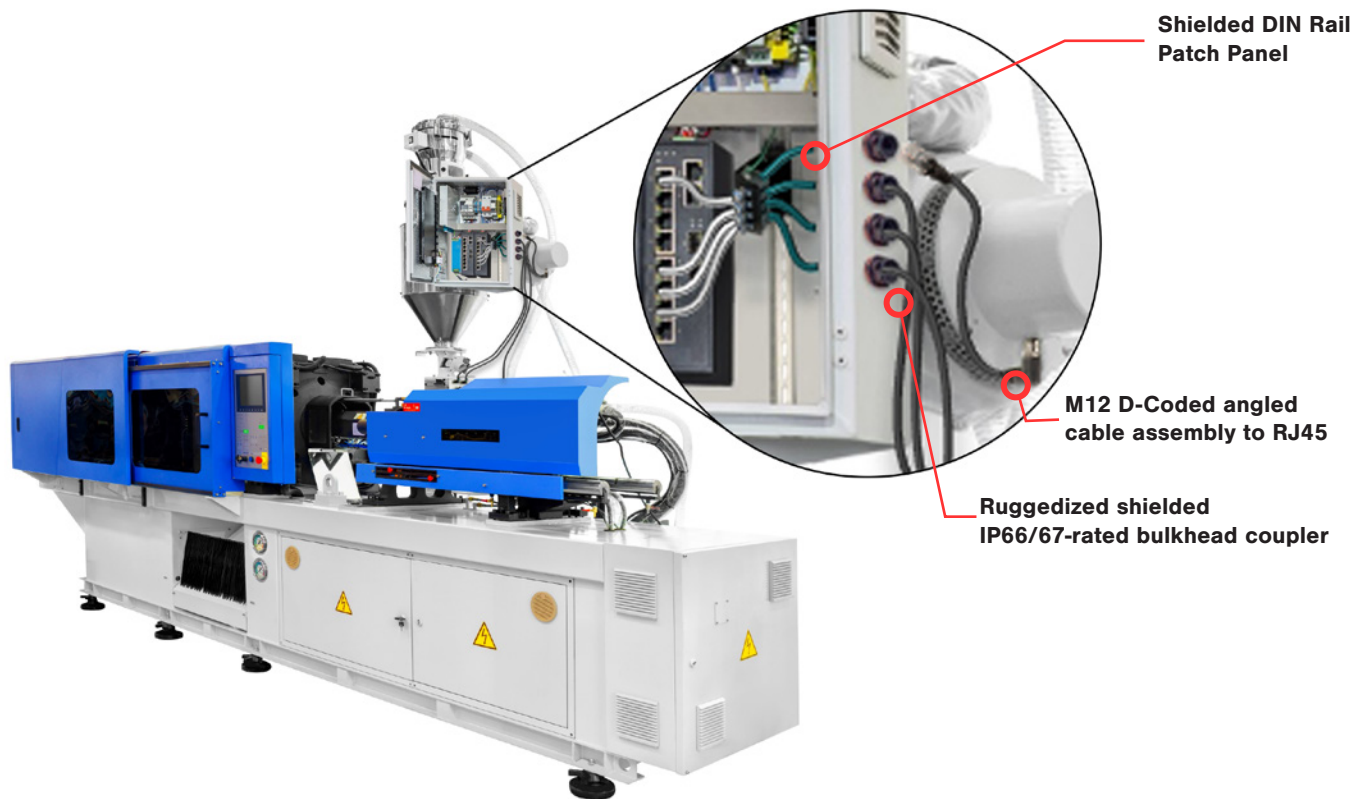


**Outdoor Wi-Fi Access Point Connected via Ruggedized Patch Cords
to Ruggedized Outlets Housed in an NEMA 4X Surface Mount Box and
Terminated to Indoor/Outdoor Cable**

Industrial Ethernet Application (MICE Level 3)

More severe factory environments where Industrial Ethernet protocols like PROFINET, EtherCat, and EtherNet/IP are now the dominant communication method for automation, control, and robotics, network connections need to withstand even harsher elements. M12 connectors are the connectors of choice for industrial applications because they feature a locking threaded interface that locks easily and securely to prevent loosening due to machine vibration. They are also coded to prevent accidental mis-mating and offer an IP67-rated degree of ingress protection.

Within these environments, Industrial Ethernet switches, programmable logic controllers, circuit breakers, relays and other components are typically DIN rail mounted within protective control panel enclosures. DIN rail patch panels are ideal for facilitating network connections within control panels, while bulkhead couplers provide an IP67-rated transition point into the control panel for connecting to machinery via M12 D-Coded cable assemblies.



Industrial Ethernet Switch Connected to Machinery via DIN Rail Patch Panel, Bulkhead Coupler and M12 D-Coded Angled Cable Assembly

Only shielded cabling can prevent EMI/RFI and ensure superior support for today's PoE-enabled devices.

▶▶ Category 6A or Higher Shielded Cabling is the Best Choice for Noisy Environments and Power over Ethernet Applications

When it comes to supporting the latest applications in challenging environments, not only is it important to ensure protection and follow ISO and TIA structured cabling standards, but support for remote powering technology is critical as many IP-based devices are powered via PoE over the same twisted-pair copper cabling that connects them to the network. There have been significant advancements in PoE that support the delivery of higher levels of remote power to support more sophisticated devices, such as advanced outdoor thermal and night vision surveillance cameras, high-throughput Wi-Fi 6/6E wireless access points, and high-efficiency LED lighting—all of which reside in unforgiving environments.

Considering industry standards and the impact of higher-level PoE for powering capable security devices, Category 6A/Class EA shielded cabling systems should be the minimum twisted-pair cabling system deployed for copper-based applications. Furthermore, shielded construction offers the best protection for copper cabling against EMI/RFI.

Deploying a cabling infrastructure for today's converged networks that delivers remote power to a wide range of devices requires cable and connectivity designed to provide superior remote powering support—that's where Siemon's end-to-end range of connectivity solutions comes in:

- Siemon's Ruggedized Z-MAX® outlets with PowerGUARD™ technology feature a patented crowned jack contact shape, allowing plugs to connect and disconnect to the latest remote powering applications with zero risk of connector damage from electrical arcing.
- Shielded Category 6A/Class EA or higher cabling systems with PowerGUARD™ technology offers improved heat dissipation to reduce heat build-up within cable bundles delivering remote power that can lead to performance degradation.
- Siemon shielded Category 6A/Class EA and Category 7/7A/Class FA systems provide maximum support of remote powering applications with a higher 75°C operating temperature qualified for mechanical reliability in high temperature environments.



DIN Rail installations using shielded cabling supports PoE applications.



▶▶ Industry Leading Solutions and Support

As an industry leader, Siemon participates in global cabling standards development initiatives and is dedicated to understanding and supporting the unique needs of the market. Siemon offers technical support and expert guidance on designing and deploying high performance, reliable cabling systems for the latest IP-based applications across a wide range of commercial and industrial environments and spaces.

With high performance copper cabling and innovative, easy-to-deploy Ruggedized connectivity solutions, Siemon delivers standards-based end-to-end cabling systems with the performance and reliability to support today's extending networks into demanding environments. Siemon's advanced Ruggedized fiber solutions also support extended distance connections, while our full range of infrastructure solutions support all network cabling and connectivity needs across LANs, data centers, and intelligent building spaces.



▶▶ Ruggedized Copper Solutions for Harsh Environments



Ruggedized G2 Z-MAX® UTP AND F/UTP Outlets and Dust Caps

Available in Category 5e shielded, Category 6 UTP, and Category 6A UTP and shielded, Ruggedized G2 Z-MAX outlets combine the premium performance and termination process of Siemon's Z-MAX outlets with durable, proven IP66/IP67 and Ruggedized shells to provide a best-in-class connectivity solution for harsh and unforgiving environments.

go.siemon.com/RuggedizedG2ZMax



Ruggedized Bulkhead Coupler

The Ruggedized Bulkhead Coupler provides back-to-back shielded Category 5e outlets to enable IP66/IP67-rated plug-to-plug connections. The coupler is made of chemical-resistant industrial-grade glass filled polybutylene terephthalate (PBT) and features Siemon's quarter-turn bayonet-style mating.

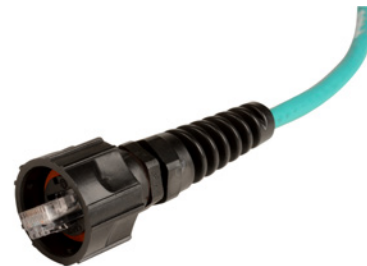
go.siemon.com/RuggedizedBulkHead



Z-PLUG™ Field-Terminated Plug with Protective Gland

Siemon's patented Category 6A Z-PLUG Field-Terminated Plug offers quick, reliable high-performance field terminations for custom length direct connections to devices. For outdoor environments, Siemon's Z-PLUG Protective Gland is available in multiple thread types with a rubber seal to protect the plug-outlet device connection against ingress of dust and moisture.

go.siemon.com/RuggedizedZPlug



Ruggedized Patch Cords

Ideal for facilitating connections to devices, Siemon offers an extensive range of Category 5e UTP and shielded, Category 6 UTP, and Category 6A Ruggedized patch cords designed to withstand the rigors of harsh network environments.

go.siemon.com/RuggedizedUTP



Ruggedized Angled Category 5e Shielded Patch Cords

Siemon's overmolded 90-degree Category 5e SF/UTP RJ45 Ruggedized patch cables are designed for low profile applications where space is a premium, such as industrial control panels and enclosures.

go.siemon.com/RuggedizedAngled



Ruggedized M12 D-Coded Category 5e Shielded Cable Assemblies

Siemon's M12 D-Coded connector is an industry standard interface for Ethernet and PROFINET industrial automation environments or other harsh environment applications where a compact, robust, reliable connection is needed.

go.siemon.com/RuggedizedM12



DIN Rail Mounted Patch Panels

DIN Rail Mounted Patch Panels provide an effective patching solution for industrial networks inside control panels and distribution cabinets where DIN mounted equipment is being used. Siemon offers shielded and UTP panels supporting both copper and fiber connectivity.

go.siemon.com/RuggedizedDINRail



Category 6A F/UTP Shielded Indoor/Outdoor Cable

Siemon's Category 6A F/UTP shielded indoor/outdoor cable delivers ISO/IEC and TIA performance requirements for Category 6A/Class EA.

go.siemon.com/RuggedizedCat6AFUTP

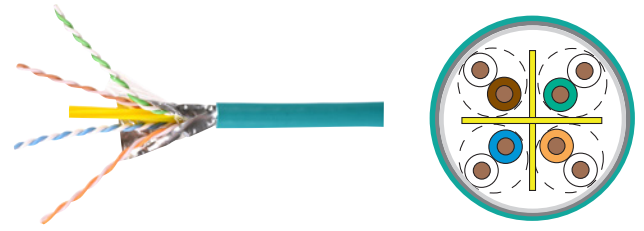


Category 6A F/FTP Shielded LS0H Indoor/Outdoor Cable

Siemon's Category 6A F/FTP indoor/outdoor cable delivers ISO/IEC and TIA performance requirements for Category 6A/Class FA and features a low-smoke, zero-halogen jacket that meets ISO/IEC 60332-1 standards and EuroClass CPR Class D.

Coming Soon!

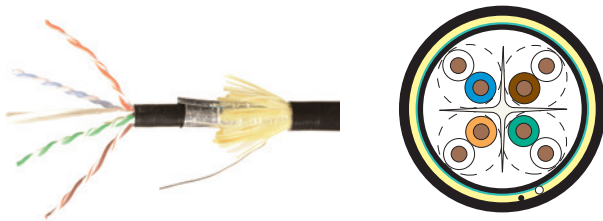
go.siemon.com/RuggedizedCat6AFFTP



Category 6A UTP Indoor/Outdoor Cable

Siemon's Category 6A UTP indoor/outdoor cable delivers ISO/IEC and TIA performance requirements for Category 6A/Class EA.

go.siemon.com/RuggedizedCat6AUTP



Category 6A F/UTP Shielded Outside Plant Cable

Siemon's Category 6A F/UTP shielded OSP cable is designed for outside wet environments and is suitable for direct burial, lashed aerial, duct, and underground conduit installations.

go.siemon.com/RuggedizedCat6AShieldedOSP



Category 6 UTP Outside Plant Cable

Siemon's Category 6 UTP outside plant (OSP) cable delivers ISO and TIA performance requirements for Category 6/Class E.

go.siemon.com/RuggedizedCat6UTPOSP

▶▶ Ruggedized Fiber Solutions for Harsh Environments



Ruggedized LC Fiber Adapters

The Ruggedized G2 LC fiber adapters available in Multimode and Singlemode feature Siemon's quarter-turn bayonet-style mating.

go.siemon.com/RuggedizedG2Fiber



Ruggedized LC Fiber Connectors

Ruggedized LC Plug connectors available in Multimode and Singlemode offer a robust fiber connection in virtually any harsh environment. When used with Ruggedized fiber adapters, they provide IP66/IP67 protection.

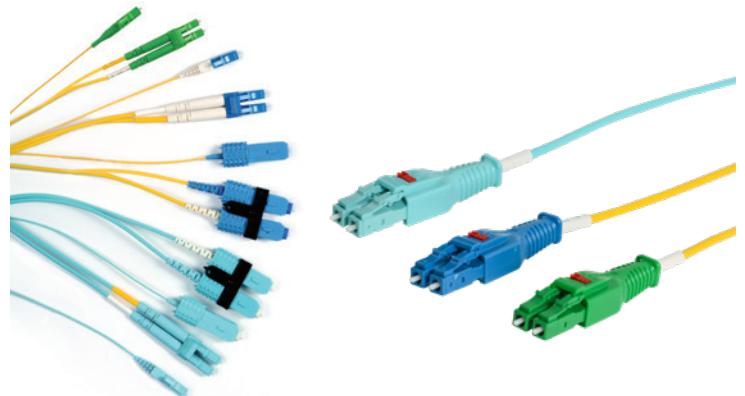
go.siemon.com/RuggedizedLCFiber



Fiber Cable

Siemon offers a full line of indoor, indoor/outdoor, and outside plant bend-insensitive bulk singlemode and multimode cables available in tight buffer and loose tube varieties.

go.siemon.com/RuggedizedFiberCable



LC BladePatch® and XGLO Fiber Jumpers

LC BladePatch OM4 jumpers offer an innovative push-pull action for high-density environments and are available in multimode and singlemode LC versions. XGLO Fiber Jumpers, primarily used for connecting switches and devices, are available in both standard SD and LC versions.

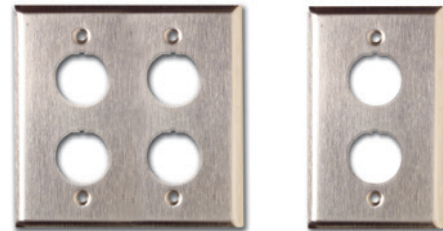
go.siemon.com/RuggedizedLCBlade



Ruggedized Surface Mount Boxes

The Siemon Ruggedized Surface Mount Box mounts either Siemon copper or fiber Ruggedized outlets. Available in 1-, 2-, 3-, and 4-port versions, these boxes provide an IP66/IP67 (NEMA 4X) seal and can be mounted on virtually any flat surface.

go.siemon.com/RuggedizedSurfaceBox



Ruggedized Stainless Steel Faceplates

Ruggedized Stainless Steel Faceplates accept Siemon copper or fiber Ruggedized outlets and are available in 1-, 2-, 3-, and 4-port options. These faceplates feature a rear sealing gasket and carry an IP44 rating for a protective seal from moisture and debris in harsh environments.

go.siemon.com/RuggedizedFacePlates



Cabling Tools & Testers

From cable prep and easy-to-use, innovative termination tools for Siemon copper and fiber connectivity, to visual fault locators and versatile hand-held testers, Siemon offers a variety of cabling tools and testers to ensure fast, easy, and reliable cabling systems for security deployments.

go.siemon.com/RuggedizedTools



Z-TOOL

Using the Z-Tool, the Z-PLUG termination process offers user-friendly, best-in-class termination time and repeatable performance.

go.siemon.com/RuggedizedZTOOL



Want to Learn More About Ruggedized Cabling?



Visit the Siemon.com Ruggedized Cabling application page:
go.siemon.com/RuggedizedGuide



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Because we continuously improve our products, Siemon reserves the right to change specifications and availability without prior notice.

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