

Miniature **Outside Plant** Plug-and-Play Solutions



A new class of miniature fiber optic connectors provides a plug and play interface between fiber optic cables and consumers in FTTP applications. These miniature connectors are hardened to protect against extreme temperature, moisture, UV, chemical exposure and other harsh conditions typically found in the outside plant. Key advantages over previous generations of hardened connectors include the following:

- Their smaller size facilitates the installation of drops through smaller holes in structures.
- Their smaller size also allows for smaller terminals, which take up less space on a pole, hand-hole, side of a building, or wherever else they are installed.
- Backward compatibility with existing hardened and non-hardened connector/adapter systems.

The miniature fiber optic connectors may be used to connect Multiport Service Terminals located at the street with Optical Network Terminals (ONTs) located at the premises. The miniature hardened connectors are mounted on the external surface of the enclosures so that connections can be completed without opening the enclosure. The overall impact of this connectorized solution is to allow economic and rapid interconnection of optical networks once customers request service.

Advantages of Hardened Connectors

Hardened fiber optic connectors provide a cost effective solution for connecting Outside Plant (OSP) fiber networks. The hardened connectors improve the speed and ROI for connecting residential services. Connectors are strategically located in the distribution network to facilitate service connection and maintenance of subscriber services. Hardened connectors are typically installed in terminals at the street outside a residence to facilitate easy access and connection to the residence once the subscriber requests service. Hardened connectors provide a watertight seal which protects the fiber optic cables and strands against moisture while still providing easy access.

Hardened connectors may also be installed in the Optical Network Terminal (ONT) equipment located at the premises. This enables a technician, who need not be an expert in fiber splicing to complete connections at both the street and the residence. The hardened connector system includes preconnectorized drop cable assemblies and terminals. This provides a plug-and-play solution for connecting between terminals at the street and at the residence.

However, first-generation hardened connectors have some drawbacks, chief among them being size and compatibility. First generation connectors require larger profiles to provide adequate strength and sealing. The larger profiles for first generation connectors and adapters require more space for terminals and drops. In addition the larger size of previous generation connectors may create problems with duct access and in some cases rule out the use of hardened drops because they won't fit in available ducts. In cases where hardened drops are routed just inside a dwelling, first generation connectors require a large hole to be drilled in the side of the structure—often larger than necessary. Finally, when a drop is routed inside a structure, early generation hardened connectors are not compatible with standard SC adapters found on many ONT units. The next generation of hardened connectors address these shortfalls.

Next Generation Connector Attributes

New innovative next generation hardened connectors are available that offer a smaller size profile and improved compatibility over first generation connectors. The next generation system includes connectors, adapters, converters, terminals and preconnectorized cable assemblies. The next generation adapter offers a significantly smaller footprint. This enables the construction of smaller closures and smaller multiport service terminals making it easier to mount terminals at the street. Smaller terminals result in the reduction of space required on poles, in hand holes and in an ONT. The smaller size of the connectors also allows for drop installation in smaller ducts. The connectors require a much smaller hole for passing drops through walls, thus the next generation connector is much less intrusive when routing through walls in structures. The next generation connectors are also backward compatible with previous generation hardened and non-hardened connector systems. Connectors are available with a variety of cable options allowing the user to easily specify the appropriate cable for aerial, underground or indoor/outdoor application.

When combined with rugged yet flexible indoor/outdoor cable, the next generation connectors offer a complete solution for situations that call for a transition from outdoor to indoor environments. The cable can withstand the outdoor environment and also handle the tight turns of an indoor environment. The same connector can be used to connect to the terminal outdoors, with connector at the other end of the drop able to pass through the smaller spaces often found indoors and connect to an SC adapter in an indoor ONT. This saves substantial installation time and money by eliminating the need for a junction or transition point. Key attributes and benefits of next generation connectors include:

Attribute	Benefits
Smaller Adapter	Enables smaller closure and smaller multiport terminal, takes up less space on poles, in hand holes and in an ONT.
Smaller Connector	Drops fit in smaller conduit, requires smaller hole in dwelling, less intrusive entry into the residence, easier and more secure connection.
Hardened Converter	Backward compatible with previous generation hardened connectors using simple field converters.
SC/APC Converter	Backward compatible with SC connectors and adapters, using a simple field converter, allows flexibility in MDU cabling. Reduces time and cost for connecting residential fiber.
Variety of Cable Options	Connectors designed to be adaptable to different cable types; allows cabling choice to be aerial, underground, indoor/outdoor, or other applications.

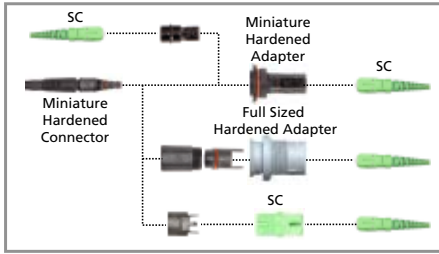
Miniature Hardened Connector

The next generation connector system consists of a new miniature hardened connector and adapter designed to mate with standard SC connectors in hardened adapters. In addition the miniature connector can plug into any standard SC adapter to provide a low loss optical connection. The connector design is based on a standard SC/APC singlemode ferrule and spring assembly in a miniature rugged body. The connector is designed with a dual-locking feature that includes push-pull detent engagement and twist-lock secure retention. The connector has a keying feature to allow it to be fully seated in the adapter in only one orientation therefore ensuring proper alignment and mating of APC ferrules. Once the connector is pushed inside the adapter and past the detent latch the user will feel a distinctive latching engagement within the adapter. Screwing the coupling nut to the adapter provides a firm and long term secure connection. The connector contains an O-ring to provide a water tight seal when engaged with the adapter. The connector is supplied with a protective cap with integrated pulling eye to protect the end face during installation. The connector design is offered with a choice of cables providing the user with flexibility in selecting the appropriate cable for the application, and is readily adaptable to a wide range of additional cable types to support users' requirements.



Miniature Hardened Adapter

The next generation hardened connector system also includes a new miniature hardened adapter. The adapter design is a heavy duty plastic case environmentally sealed for extreme weather conditions. One side of the adapter receives the hardened miniature connector and the other end receives a standard SC connector plug. The SC side of the adapter provides a rugged stationary SC receptacle per standard industry specifications. The hardened side of the adapter has an opening designed specifically to receive the miniature hardened connector and to provide a sealing surface for the connector O-ring. The adapter inner body holds two retainers and a split sleeve using snap latches to provide the plug with both push-pull and twist-lock engagement. The inner body also contains a detent latch and alignment features that guide and hold the hardened connector inside the adapter. A jam nut and O-ring are used to mount the adapter onto a panel or bulkhead. Keying features on the outside of the adapter keep it from rotating in a panel.



Next Generation Connector System – Compatibility

Compatibility and Intermateability

The next generation connector system is compatible and intermateable with previous generation hardened connector systems and with the SC non-hardened connector system. Intermateability is achieved through the use of simple converters that may easily be installed in the field. The hardened converter housing is threaded onto the miniature connector to secure it in the proper position for interface to the previous generation hardened adapter. The next generation system also includes a converter housing that easily allows a miniature hardened connector assembly to be connected to a standard SC adapter.

Miniature Terminals

The next generation connector system is supported by terminals that take advantage of the small size of the miniature hardened adapters. New next generation terminals incorporating miniature hardened adapters are much smaller than those using previous generation adapters. Miniature terminals are environmentally sealed terminals that withstand the rigorous OSP environment. The terminals are factory-terminated with individual

connectors and provided with a stub cable for splicing in the field. The terminal connector ports are clearly marked with numbers for quick drop cable connections, and the miniature hardened adapters are factory cleaned and compatible with miniature hardened connectors.



Miniature Hardened Connector to SC Adapter Converter



Miniature Hardened Connector to Full Sized Hardened Adapter Converter



SC Connector to Miniature Hardened Adapter Converter



Miniature Hardened Connector



Miniature Hardened Adapter

Attribute	Benefits
Miniature Terminal	Miniature terminals with miniature hardened adapters are much smaller than previous multiports, and take up less space on poles, in handholes, or in other installation locations
Factory Terminated	High quality and high performance connectors reduce installation time/cost and OPEX relative to a spliced solution
Reduced Bend Radius Fiber	The miniature terminals are terminated using reduced bend radius fiber to ensure high performance of tightly packed miniature package
Universal Mounting	Optional universal mounting bracket facilitates pole, strand and hand-hole mounting

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