

Re-enterable Plug and Play Fiber Access Terminals

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ABSTRACT

In modern FTTx builds, connectorized fiber access terminals are commonly the last point of interconnection between distribution, or F2, fibers and the service drop to the customer premises. During initial installation or over the service-life of the product, fiber access terminals sometimes require maintenance or repair. Though this need is commonly recognized by users of this technology, many fiber access terminals in the industry are factory sealed and not designed for re-entry. This paper discusses the advantages of re-enterable “plug and play” fiber access terminals from a cost, labor and long-term reliability perspective.

INTRODUCTION

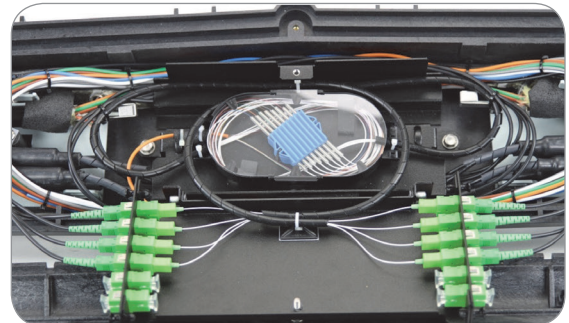
During the early-years of initial FTTx deployments, either utilizing PON or Ethernet technologies, the connection from F2 distribution fiber cabling to the service drop at the customer premises was completed via fusion splicing within splice closures (aerial weathertight or sealed) or fiber pedestals. As the FTTx deployment rate continues to increase across North America the availability of experienced labor, especially splicer labor, has decreased dramatically. Providers are seeing increasing demands which is leading to less time for dedicated training, leaving complex deployment methods as a thing of the past.

COMMON TYPES OF FIBER ACCESS TERMINALS

Distribution cable plant and access terminals typically reside in one of three environments: aerial, at grade or below grade. Aerial access terminals are often preferred when used in conjunction with aerial cable plant for many reasons, including: lower material cost (generally due to less complex sealing mechanisms versus fully sealed closures) and ease of re-entry. Typical grommet technologies for these types of closures aren't designed to withstand water submersion, so adding new drop cables into the closure is relatively simple. Customer service drops can either be spliced into the F2 fiber or plugged into connector adapters that are spliced into the F2 fiber during initial construction. The plug-and-play style terminal utilizing connector adapters only requires the technician to plug in a drop cable to turn up service. The drop cable can either be pre-connectorized with a factory-installed connector or may be field-terminated with a field installable connector technology.



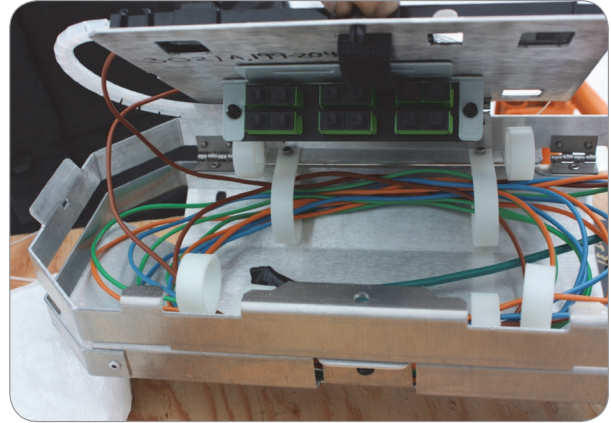
Weathertight Aerial Splice Closure Terminal



Weathertight Aerial Splice Terminal with SC/APC Connectivity

For below-grade cable installation, terminals can come in the form of either at-grade pedestals or below-grade sealed splice closures. Drop installation into the closure is similar to that of a weathertight closure with regard to fusion splicing or plug and play connectivity. Due to the constant need for re-entry when customer connections or disconnections are required, it is imperative that the installation technicians are adequately trained to assemble and test the sealed closure correctly. This is the only way to ensure the long-term reliability of not only the drop connection, but also any downstream connections within the network. F2 cable with a mid-span access requires an expert level of craftsmanship to guarantee the integrity of the entire system.

Hardened connector stubbed multiports are factory terminated OSP fiber terminals designed to increase speed of installation when used in conjunction with Hardened Fiber Optic Connectors. The terminal as well as the connector/adaptor interface is sealed and allows for long-term reliability when installed anywhere in the network—underground, in pedestals, on poles, on aerial strand or on ADSS cables. The terminal is stubbed with a preconfigured length of cable that is run to a splice closure where the terminal is spliced into the F2 cable. As the installer now doesn't need to repeatedly access a closure containing F2 fibers to install drops, long-term reliability is enhanced versus traditional closure terminal options, especially reliability of expressed fibers serving additional terminals downstream.



Sealed Fiber Splice Closure with SC/APC Connectivity



Hardened Pre-Terminated Multiport Terminal

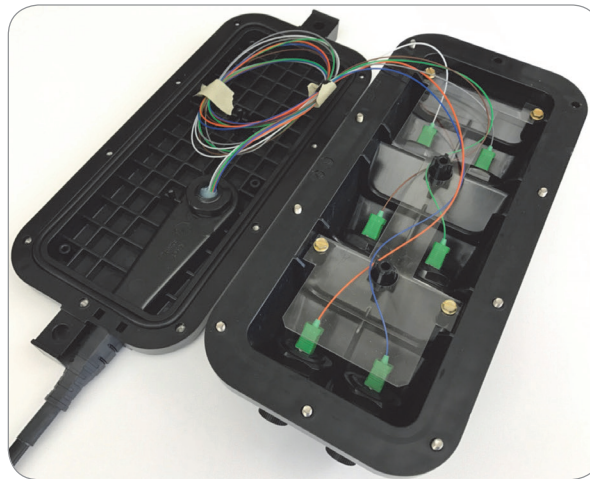
REPAIR CONSIDERATIONS

Most hardened terminals available on the market today are factory sealed with no option for re-entry. While this avoids unwanted tampering, it also greatly reduces flexibility for repairs in the field in the unfortunate case of broken ports or connectors. In some situations ports can be damaged by extreme environmental conditions or mistakenly damaged through mishandling by installers. In other instances, contaminants introduced to the end face of the factory terminated connectors on the backside of the adapter (potentially due to improper cleaning practices or dusty/dirty installation environments) could cause permanent damage. In the case of damaged ports, most terminals do not have a provision for replacement. When dealing with damaged connectors behind the port, some hardened terminals have a

two-piece adapter, the front of which can be removed, providing access to the rear connector. However, often the terminal is provisioned with minimal slack to perform a repair. Without adequate fiber, the process of fusion splicing a pigtail or installing a field installable connector makes repairs difficult.

Some hardened multiport terminals, such as AFL's TITAN RTD® multiport terminal, are designed to allow for re-entry should repair be needed in the case of broken ports or damaged connectors. While re-entry and repair is possible, it is advised that only experienced, trained technicians re-enter, repair and reseal hardened multiport terminals to ensure long-term reliability of the terminal. Once opened, approximately one meter of fiber slack is available for re-termination via either field installable connectors or pigtail fusion splicing.

In the case of the AFL TITAN Multiport Terminal, re-entry was a design consideration. The risk of unwanted tampering is lowered through the use of tamper-resistant pin-in-hex security screws. Once opened, the technician has access to the connectors and fiber slack for re-termination. The terminal adapters were designed with a hex locknut to be unscrewed and easily removed in the event of a damaged port. Upon completion of the repair, the cover and base is re-mated taking care not to excessively bend or pinch fibers, and the pin-in-hex security screws are torqued hand-tight.



AFL 6-port TITAN Multiport Terminal Opened for Repair

COST AND LABOR CONSIDERATIONS

While the best way to ensure long-term “factory terminated reliability” is typically full replacement, costs to remove and reinstall hardened multiport terminals can be high, especially for longer length stubs. The below analysis demonstrates the labor costs associated with full replacement versus repair of a damaged 12-port, 1,000 foot hardened multiport terminal installed in a lashed aerial environment. The total cost is dependent upon the tail length as well as the method of tail placement. In most situations, if the tail is pulled in a dedicated duct, installation costs would be less. However, in the case of a direct-buried multiport tail, costs can well exceed the example shown below.

LABOR ITEM	QUANTITY	EST. PRICE PER QUANTITY	EXTENDED PRICE
De-lash Tail	1,000	\$1.30	\$1,300.00
Unmount Terminal	1	\$25.00	\$25.00
Lash Tail	1,000	\$1.30	\$1,300.00
Mount Terminal	1	\$55.00	\$55.00
Terminal Tail Cable Prep	1	\$50.00	\$50.00
Splice 12 Fibers	12	\$10.00	\$120.00
Testing	12	\$15.50	\$186.00
Total			\$3,036.00

Estimated Labor Costs to Replace 1,000 Foot, 12-Port Terminal¹

LABOR ITEM	QUANTITY	EST. PRICE PER QUANTITY	EXTENDED PRICE
Unmount and Access Terminal	1	\$35.00	\$35.00
Field Installable Connector Install	1	\$9.50	\$9.50
Mount Terminal	1	\$55.00	\$55.00
Testing	1	\$15.50	\$15.50
Total			\$115.00

Estimated Labor Costs to Repair One Internal Terminal Connector¹

The above costs ignore variances in material which can increase or decrease the cost difference between replacement and repair even further. In the 1,000 foot, 12-port example, the replacement terminal can cost a few hundred dollars where a single field installable connector generally ranges anywhere from \$10-20 depending on vendor and connector type. Another item to note is testing. If a terminal is replaced, it will likely be fully tested after placing and splicing. When repaired, it is up to the operator if the terminal needs to be fully tested. If there is already traffic on undamaged ports of the terminal, it may be wise to leave traffic undisturbed and only retest the repaired connector. If the terminal has no active subscriber connections, it may be beneficial to test all ports after reassembly to ensure no macro- or micro-bends were induced to the fibers during the repair process.

CLOSING

Network operators building FTTx have a wide variety of options when selecting connectivity technologies in the “Last Mile” portion of the system. Hardened multiport solutions are great for plug and play connectivity while ensuring top-notch reliability. Furthermore, replacing damaged terminals can prove costly. When selecting a hardened fiber optic access terminal, it is imperative to choose a terminal designed with repair in mind in order to lower operating expense.

AUTHOR

Will Miller is the Product Line Manager for outside plant connectivity products with AFL’s Cable and Connectivity division. Will has 10 years of experience in fiber optic cable and connectivity manufacturing, holding various roles in engineering and product line management.

¹Note: Costs are based off local labor averages. Exact costs will be subject to market variation.



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