

## FIBER INDEXING TERMINAL

### 1. About this installation instruction

This installation instruction describes the installation of the fiber indexing terminal of both housings, the DLX connector housing and the full size hardened connector housing, and their different applications: the standard indexing terminal with splitter (1:4 or 1:8), the indexing only terminal, the branch terminal and the multi-use terminal.

The instruction will explain how to handle the stubbed cable, how to mount the terminal in different situations (hand hole, pedestal, pole and aerial), how to connect and maintain the different connector types (DLX, full size hardened connector and HMFOC) and how to test the installed chain of terminals.



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## 2. General safety precautions

2.1. Fiber optic cables may be damaged if bent or curved to a radius that is less than the recommended minimum bend radius. Always observe the recommended bend radius limit when installing fiber optic cables and patch cords.

2.2. Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned off or that the fiber is disconnected at the other end. Looking into the ends of any optical fiber is entirely at your own risk.

## 3. List of acronyms and abbreviations

MST	Multiport Service Terminal
FTTX	Fiber To The X
DLX	Dual Locking Connector
HMFOC	Hardened Multifiber Optical Connector
MPO	Multi-fiber Push On
FDH	Fiber Distribution Hub
UMB	Universal Mounting Bracket
VAM	Value Added Module
CO	Central Office
VFL	Visual Fault Locator

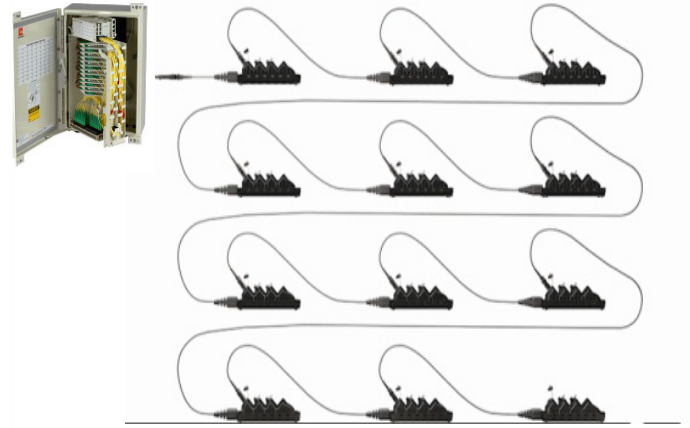
Lead	a single chain of terminals
Upstream	a position closer to the CO or head end
Downstream	to a position closer to the end of a lead

## 4. Fiber indexing

### 4.1. Fiber indexing building blocks

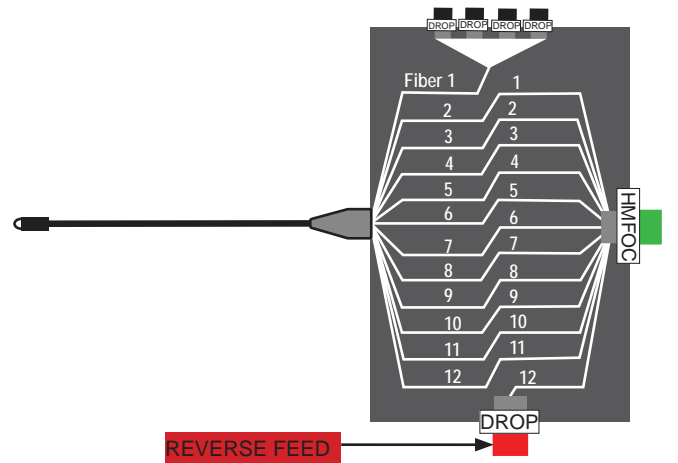
CommScope's fiber indexing system consists of terminals and connectorized 12 strand fiber cables using hardened connectivity. It allows to build the FTTX network in the outside plant environment faster, with plug and play installation.

The exact same components (fiber indexing terminal and the corresponding drops to the homes) are installed between a fiber distribution hub (FDH) and subscribers (homes) in a daisy chain architecture. Several daisy chains are connected to the hub. Each chain consist of up to 12 fiber indexing terminals and distributes services to up to 96 subscribers (homes). Drop cable assemblies transport the optical signal from the fiber indexing terminal to the home.



### 4.2. Reverse feed

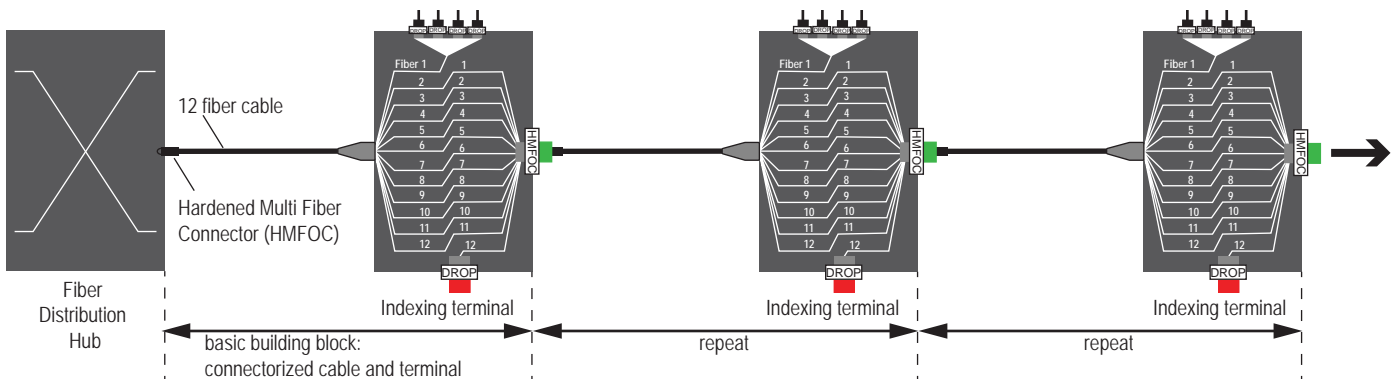
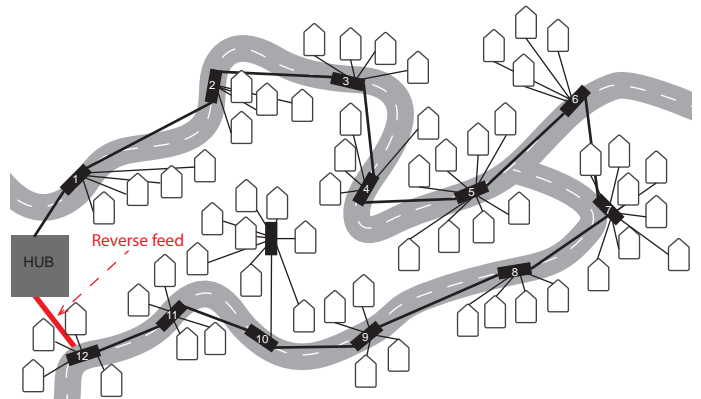
When a second cable is connected from the hub (FDH) to the last terminal, the signal runs "backwards" toward the first terminal. This makes additional fibers available that can be used to add subscribers or roll out new services. More information on how to make this installation, can be obtained in section 7.2.5.



### 4.3. Fiber indexing technology

Indexing refers to the shifting of a fiber's position - from one multi-fiber connector to the other - within each terminal.

- The process begins with a 12 fiber cable from the fiber distribution hub (FDH) entering the first fiber indexing terminal.
- Inside the terminal, the fibers divide and the signal on the fiber on the first position is routed to a splitter (1:4 or 1:8) for servicing local customers.
- All other fibers are indexed - advanced one position in the order - so that the number 2 fiber shifts to the number 1 position, ready to be routed to the subscribers at the next terminal.
- The fibers are re-combined using a 12 fiber HMFOC. The last fiber position of the 12 fiber HMFOC becomes accessible via the reverse path optical port.



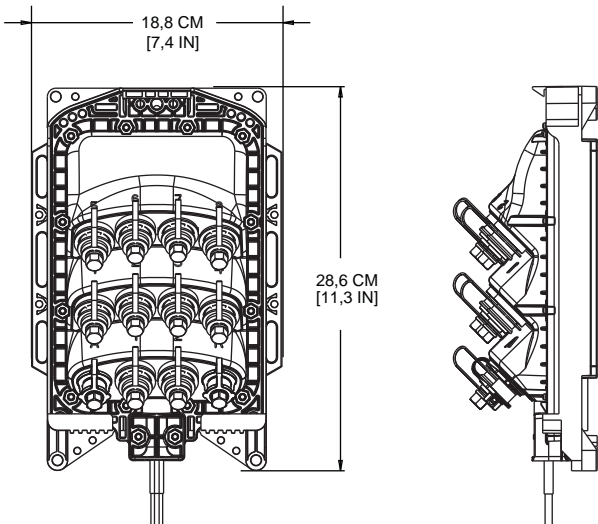
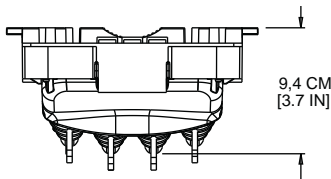
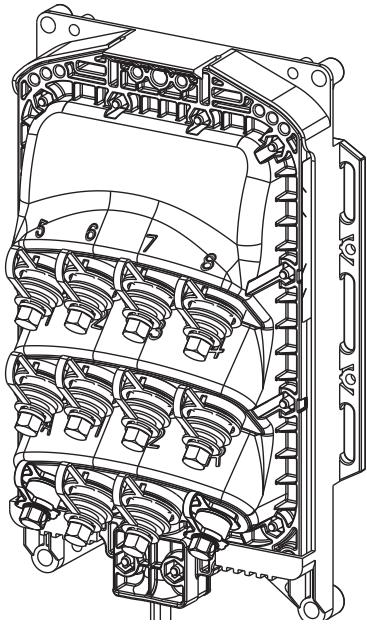
## 5. Fiber indexing terminal

All indexing terminals have a hardened, weather resistant plastic housing. The housing type depends on the adapter type of the single-fiber drop port, either full size hardened or DLX. Both housing types use HMFOC adapter(s) for the multi-fiber connection.

### 5.1. Housings

#### 5.1.1. Full size hardened connector housing

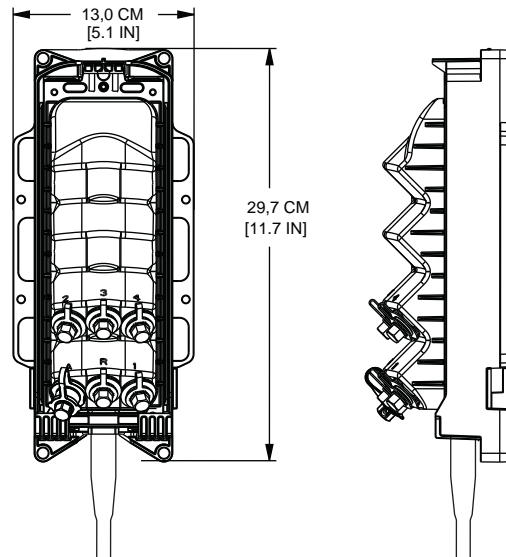
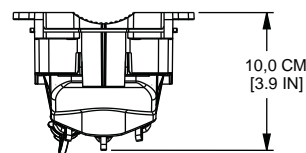
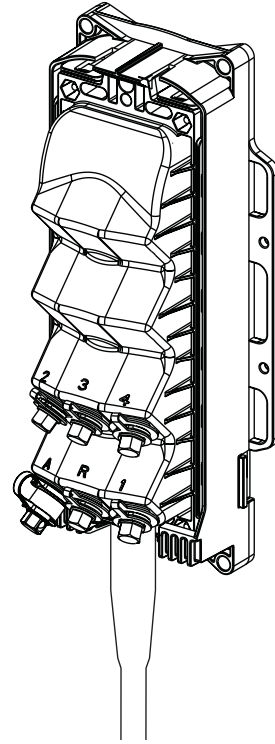
This housing contains full size hardened adapters (see chapter 12 for installation guidelines) for the single-fiber drops and an HMFOC adapter (male) to connect the terminal to the next terminal. (See chapter 10 for installation guidelines). The input for these adapters is a 12 fiber cable that enters the terminal through a sealed opening located at the bottom of the terminal. The stub cable is terminated with an HMFOC connector (female). The terminal ships with its UMB.



#### 5.1.2. DLX connector housing

This housing contains DLX adapters. (See chapter 11 for installation guidelines) for the single-fiber drops and an HMFOC adapter (male) to connect the terminal to the next terminal. (See chapter 10 for installation guidelines). The input for these adapters is a 12 fiber cable that enters the terminal through a sealed opening located at the bottom of the terminal. The stub cable is terminated with an HMFOC connector (female). The terminal ships with its UMB (Universal Mounting Bracket).

This housing is also used for the branch terminal configuration that doesn't contain single-fiber drops. Only 2 HMFOC ports are available in this model (see section 5.2.4)



### 5.1.3. Specifications

PARAMETER	SPECIFICATION US	SPECIFICATION IEC
Environmental	GR-771-CORE, and GR-3120-CORE (HMFOC)	IEC 61753-1 Ed2 CAT A&G
Operation Temperature	-40°F (± 3.6°) to 150°F (± 3.6°)	-40°C (± 2°) to 65°C (± 2°)
Installation temperature	23°F to 113°F	- 5°C to 45°C
Humidity	0% to 100%RH	
Water resistance	NEMA 6 (10-foot water head for 7 days without leakage)	IEC 60529-IP 68 (till 3 meters for 7 days)
Flammability	UL94-5VA	
Color	Black	

Both housings are designed to meet aerial and pedestal conditions. For hand-hole application, the housings are designed to meet the conditions for hand-holes located up to 3 meters (10 feet) under ground.

## 5.2. Configurations

To build the network, each housing type is available in 4 configurations:

- Standard indexing terminal with 1:4 splitter
- Standard indexing terminal with 1:8 splitter
- Indexing only
- Branch terminal

### 5.2.1. Color code (ports)

To ensure correct installation, the terminal ports are color-coded:

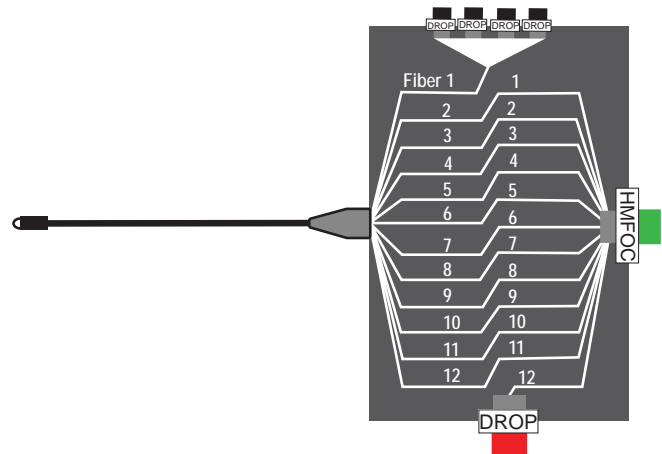
<b>BLACK</b>	forward feed DLX or full size hardened connector single-fiber drop (split signal)
<b>ORANGE</b>	forward feed DLX or full size hardened connector single-fiber drop (unsplit signal)
<b>RED</b>	reverse feed DLX or full size hardened connector single-fiber drop or HMFOC
<b>GREEN</b>	HMFOC 12 fiber cable output to the next terminal
<b>BLUE</b>	HMFOC-branching only 12 fiber cable output that route a portion of the 12 input fibers to another terminal



### 5.2.2. Standard indexing terminal 1:4 splitter with reverse port

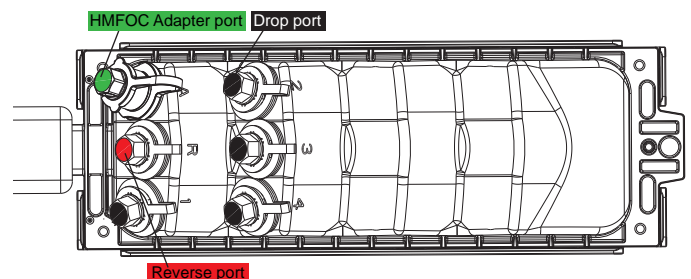
In this configuration, the terminal will drop the first fiber from the incoming 12 fiber strand. This fiber will be routed to an integrated 1:4 splitter. The outputs of this splitter are DLX adapters or full size hardened adapters (depending on the housing type). The others 11 fibers from the incoming 12 fiber strand cable will proceed unsplit and be terminated on a HMFOC adapter port, together with the fiber coming from the reverse port. The fiber coming from the reverse port will take # 12 of the outgoing 12 fiber HMFOC, the incoming fiber # 2 will take # 1 of this outgoing 12 fiber HMFOC. The HMFOC adapter port is colored green and indicated with an 'A' on the terminal. The reverse port is colored red and indicated with a 'R' and the terminal.

Image below shows the schematics inside the terminal.



The 12 fiber strand cable terminated on a female HMFOC of this terminal is connected to the green HMFOC adapter port of its up-stream terminal (to the FDH in case of the first terminal of the chain), a forward feed path is created. 4 subscribers (homes) can be fed around this indexed terminal by connecting a connectorized drop cable (DLX or full size hardened) to one of the 4 black dust cap adapter ports. Up to 12 indexed terminals can be connected one after the other (link installation).

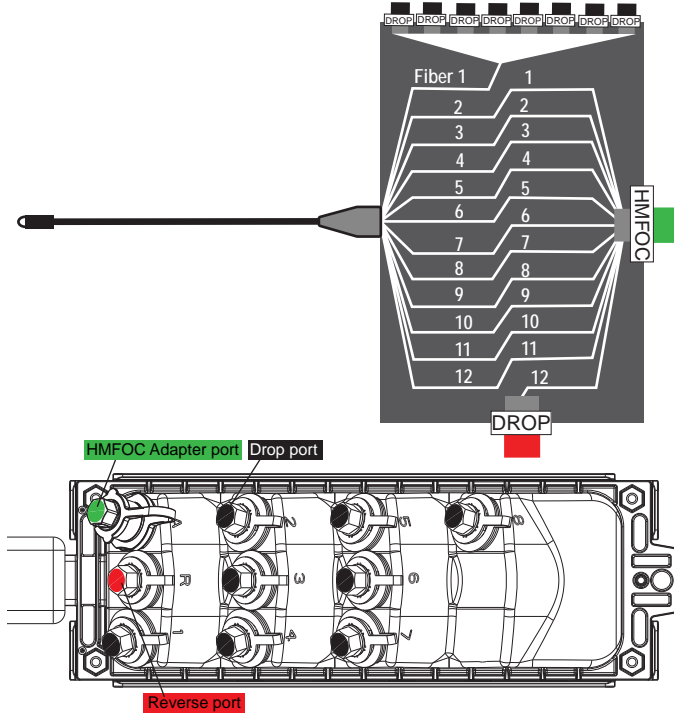
Image below shows the available ports and color code of the adapters of this terminal configuration:



### 5.2.3. Standard indexing terminal 1:8 splitter with reverse port

If there are more subscribers (homes) around the indexing terminal to feed, the terminal can have a 1:8 splitter instead of a 1:4 as described in section 5.2.2. 8 homes can be fed (passed) from this terminal.

Images below shows the schematics inside the terminal and the color code of the adapters of this terminal.



### 5.2.4. Indexing only terminal with reverse port

The indexing terminal is also available without an integrated splitter. In this case the unsplit signal of the first fiber of the incoming chain, goes to a single drop (black dust cap). This single drop can be connected to a more peripheral terminal where splicing and or splitting is performed. This topology enables a greater spatial coverage though the possible number of drops remains the same for each chain.

Images below shows the schematics inside the terminal and the color code of the adapters of this terminal.

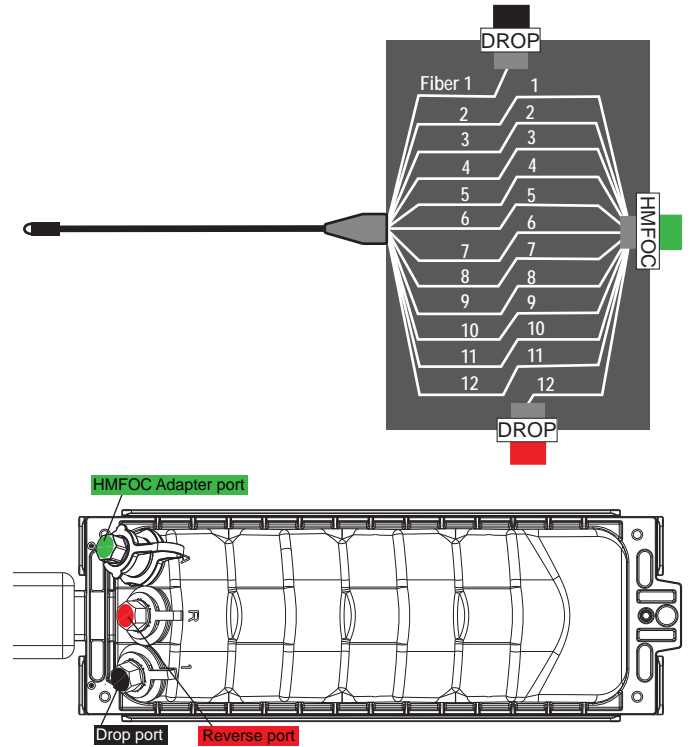
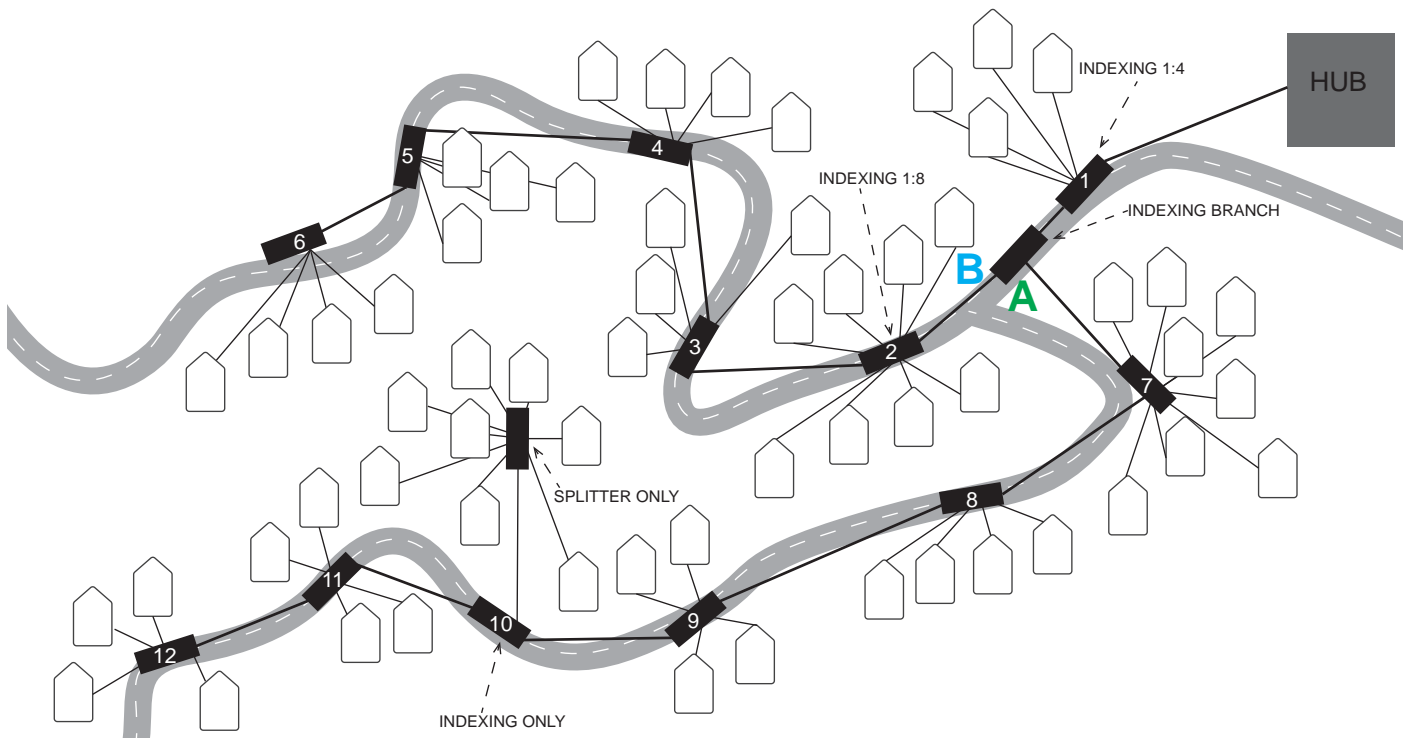
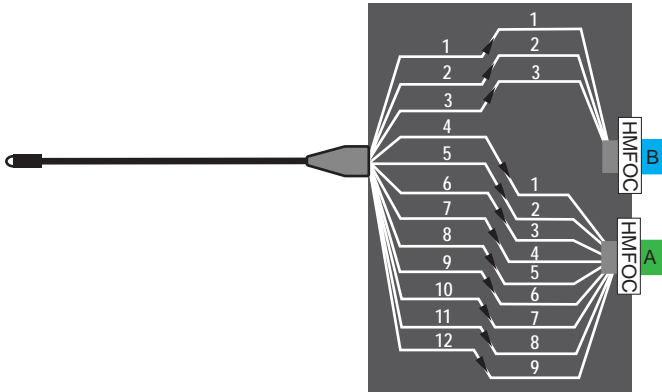


Image below illustrates the positions of the different terminal configurations in the network:



### 5.2.5. Indexing branch terminal

The indexing branch terminal enables dividing the incoming 12 fibers into 2 HMFOC adapter ports. This configuration provides more flexibility in the distribution network as greater spatial coverage area can be achieved. Neither the reverse feed port nor the single drop ports are included on an indexing branch terminal. The image below shows the schematic inside the terminal:



The first fibers from the incoming 12 fiber tail are always routed to the blue HMFOC connector, indicated with letter B, the other fibers are routed to the green HMFOC, indicated with letter A.

The fibers always take in the first fiber positions in the multi fiber connector. Image above illustrates the first 3 fibers from the incoming 12 fiber tail (input) routed to the first 3 positions in the blue HMFOC connector, the last 9 fibers from the incoming 12 fiber tail routed to the first positions in the green HMFOC connector. The remaining positions of the green and blue HMFOC are unused.

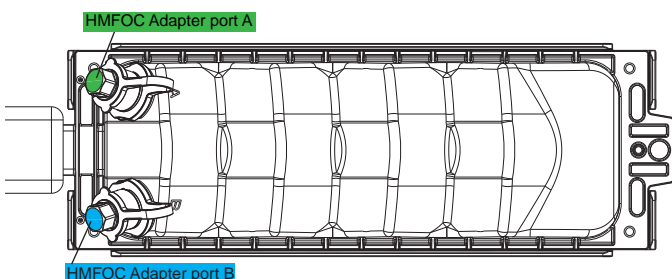
The Indexing branch terminal can be delivered with following division of the incoming 12 fibers.

B (blue)	A (green)
1,2	3 to 12
1 to 3	4 to 12
1 to 4	5 to 12
1 to 5	6 to 12
1 to 6	7 to 12

The model number (catalogue number) indicates the quantity of fibers going to the blue HMFOC:

For example **NDX-B3** indicates that the first 3 fibers of the incoming 12 fiber strand are routed to the blue HMFOC and the last 9 fibers are routed to the green HMFOC taking in the first positions (position 1-9) in the connector.

The image below shows the color code and the letter code of the 2 HMFOC adapter ports.



The daisy chaining installation can continue from each HMFOC adapter port, but with a reduced chain in either direction as defined by the fiber branch quantity. Although this terminal has no reverse feed adapter port, the reverse feed functionality is still available in the reduced chains.

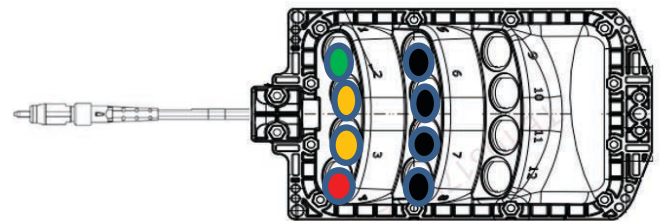
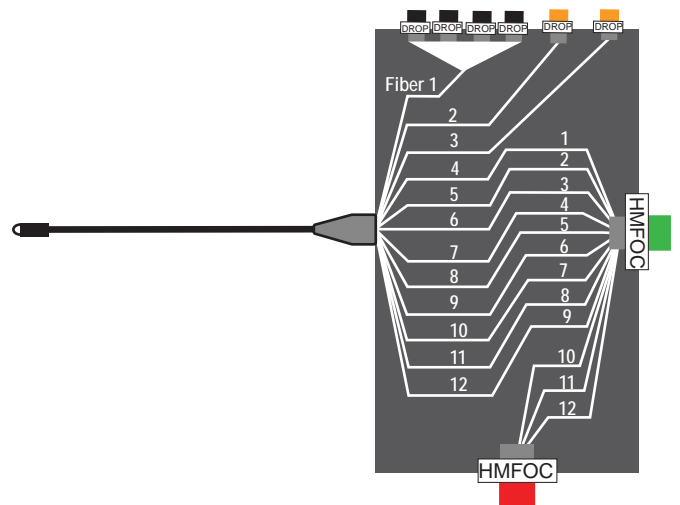
### 5.2.6. Multi-use

#### 5.2.6.1. Internal splitter with pass-thru fibers

Multi-use fiber terminals are designed to deliver splitter based services and/or traditional "unsplit" services. The splitter (if present) is always connected to the first fiber of the incoming 12 fiber stand. The outputs of the splitter are indicated with a black dust cap. Adapters with an orange dust cap indicate a straight pass-thru fiber. It is a fiber dropped of from the incoming 12 fiber chain, but unsplit (it is a regular fiber coming from the hub).

Example below shows the first fiber dropped of routed to an integrated 1:4 splitter and the second and the third fiber dropped of directly routed to the adapter port. The other 9 fibers from the incoming 12 fiber strand continue via the green HMFOC adapter port where fiber 4 of the incoming strand will take in position 1 in the adapter port. 3 fibers from the red reverse port will take in positions 10,11 and 12 in the green HMFOC port. In this case the reverse port is also an HMFOC adapter port.

In this example, link installation decreases to 4 terminals in a chain.

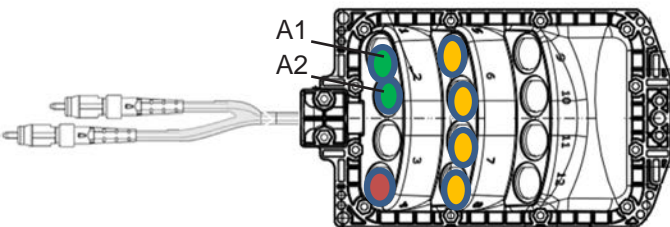
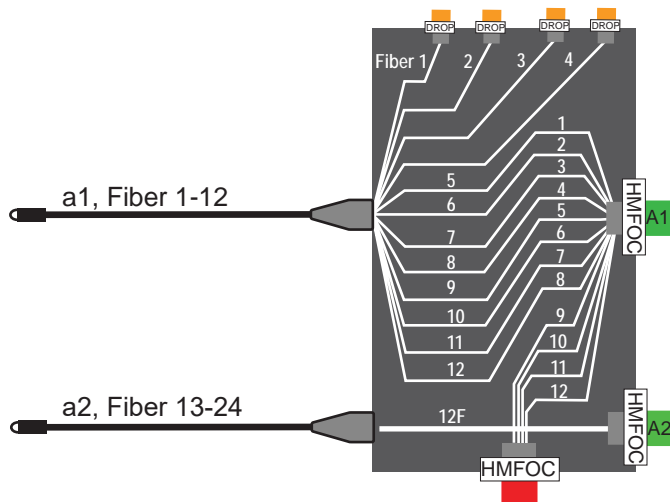


### 5.2.6.2. 24 fiber Indexing terminals

Twenty-four fiber Indexing terminals are designed to deliver bulk fiber into a distribution area where split and unsplit services are needed. On board splitters have been removed in favor of external splitters. Fibers are allocated into two groups. Fibers 1-12 are configured to the standard indexing model. Fibers 13-24 are configured as pure pass-thru without indexing. This segregation allows for the express delivery of fibers independent of indexing architectures when necessary and replenishment of fiber when the indexing string becomes exhausted.

Example below shows the first 4 fibers dropped off. The signal is unsplit. The fiber in each of these drop off port is a straight pass-thru fiber. The dust cap is orange. Fiber 5 of the incoming 12F strand takes in position 1 of the outgoing HMFOC adapter port (A1). 4 fibers of the reverse port take in position 8,9,10, 11 and 12 in that adapter port.

Indexing terminals exhaust themselves once 12 fibers have been allocated. This may happen in as few as three links or as many as 12 links dependent on how the fibers are distributed along the way. Twenty-four fiber terminals have the capacity to replenish an indexing string by harnessing the express group on the "A2" port. This is achieved by attaching the next indexing terminal to the "A2" port. If the next terminal is a twenty-four fiber terminal then the tail connectors will be swapped (e.g. "a1" tail connector to "A2" port and "a2" tail connector to "A1" port).



### 5.3. Cable stub

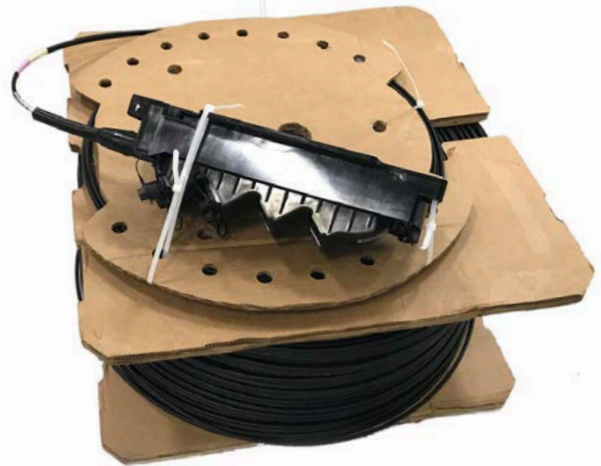
#### 5.3.1. Cable type and length

The cable stub on the terminal is an all-dielectric flat drop cable terminated with a female (non-pinned) HMFOC.

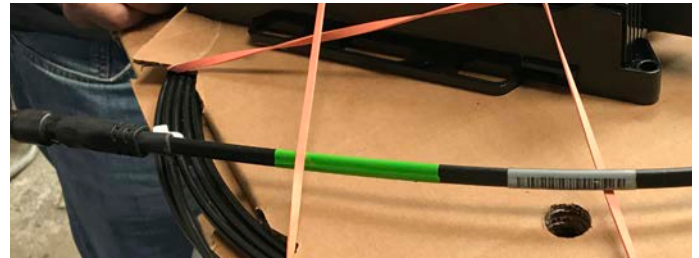
The cable outer dimensions are 8 x 4,3 mm (0.3x0.2 IN).

Cable length that can be ordered, range from 3 to 609 m (10 to 2000 feet). See ordering guide for details.

Terminals with cable stub lengths less than 30.5 m (100 feet) are shipped coiled. When the cable stub is 30.5 m (100 feet) or longer, the terminal is shipped on a spool, with the terminal secured on the spool flange as shown in the image below:



A **serial number label** is applied on the cable approximately 0.2 m (8 inch) from the connector body. See image below.





## 5.4. Universal Mounting bracket

Each terminal is supplied with the Universal Mounting Bracket (UMB) which is used for mounting the fiber indexing terminal. The UMB may be attached to various mounting surfaces using a variety of fasteners as will be explained in section 9.

The UMB is housing specific and exist for the full size hardened housing as well as for the DLX housing.

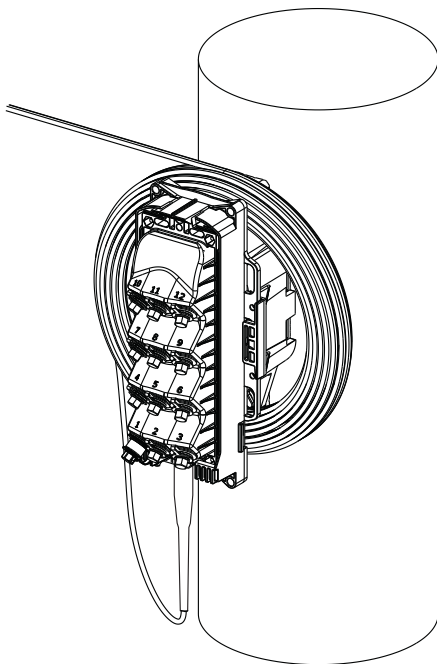
## 5.5. Accessories

### 5.5.1. Strand mounting kit

To secure the terminal to a strand, a strand-mount bracket kit is available and must be ordered separately. Refer to Universal Mounting bracket Strand-Mount Installation Instructions ADCP-96-124 for the installation procedure. Section 9.5 provides some info about how to use this strand mounting kit.

### 5.5.2. NDX-POLE-BRKT

To store excess cable in aerial applications (pole mounting), an NDX-POLE-BRKT kit is available and must be ordered separately. If using the full size hardened connector housing, an adapter bracket must also be ordered when using the excess cable storage bracket (part number NDX-4X3-ADPT-BRKT). Refer to Installation instructions 660000100. Section 9.6 provides instructions how to install the excess cable brackets.



### 5.5.3. 216B key tool

The opening to each optical port is sealed with a threaded dust cap that prevents the entry of dirt and moisture. A standard 216B security tool can be ordered to remove the dust cap.

### 5.5.4. Cleaning kit FHD-ACC-CLNKIT1

To clean the drop ports adapters and connectors (both full size hardened and DLX), a cleaning kit can be ordered. How to use this is explained in chapter 14 maintenance.

### 5.5.5. Cleaning kit HMFOC

To clean the HMFOC adapter and connector, a **US Conec HMFOC connector cleaning tool (PN 15639)** can be ordered at US Conec.

## 6. Network design with the indexing terminals

The different configurations of the indexing terminals can be combined to provide all the necessary flexibility and maximize the capacity of the distribution network. First splitting level occurs typically in a Mini-FDH 3000 with 96 ports or an OSP closure (FOSC/FIST/TENIO) with additional HMFOC connectors. The second splitting level occurs within the indexing terminals, the different configurations are explained in section 5.2.

Indexing chains always start with terminal one and build outward in procession to a value no greater than twelve. Indexing chains always provide the next fiber to the next terminal (i.e. Terminal 1 will use fiber 1 within the "chained" assembly).

In order to build an optimized network utilizing indexing terminals, the following items should be considered prior to beginning the network design:

- Locate and identify all Customers to have an overview of all area to be covered/deployed.
- Clear up all drawing nomenclature: hand holes, poles, ducts, terminals, etc.
- Identify feeder fiber cables availability. If available, define the fiber count & type of cables.
- Locate nearest CO, Node or HUB to determine the maximum distance allowed within the optical budget
- Take into consideration, drop cable distances/routes
- Identify any network deployment restriction: Poles, aerial capacity, underground ducts
- Discuss the best location for Indexing Terminals (aerial, pole, wall, manhole)
- Consider the maximum number of services per indexing terminal
- Split ratio: Specified by project

## 7. Installation

### 7.1. Tools and materials required

The following basic tools, auxiliary equipment, and materials are required for the installation of the indexing terminals:

- Vertical roller reel (if the terminal is mounted on a cable spool)
- **216B key tool** (used to open optical port dust cap)
- Hardened connector/adapter cleaning kit (FHD-ACC-CLNKIT1)
- US Conec HMFOC connector cleaning tool (PN 15639)
- Utility knife
- Cable pulling equipment
- Appropriate fasteners to mount the UMB and tools to install the fasteners
- "P" clamps for self supporting aerial installations. Cable routing rings or fasteners (see local practices). Cable can be lashed for messenger applications.

**Note:** If using an enclosure such as a hand-hole or pedestal, refer to the instructions provided with the enclosure for any additional tools or equipment required.

## 7.2. Installation overview

To install the indexing terminals in the network and to build the indexing network, following main tasks must be performed:

**1. Mounting the terminal** (refer to section 9)  
The terminal must be mounted on or within a suitable support base or enclosure. The UMB allows the terminal to be mounted in a variety of applications including the following:

- Hand-Hole (below ground)
- Pole-Mount (aerial)
- Strand-Mount (aerial)
- Pedestal (at final grade)

**2. Link installation (installing the HMFOC)**  
The terminals connect to one another via a Hardened Multi-Fiber Optic Connector (HMFOC). The non-pinned tail connector (HMFOC) is routed to the up-stream component like an FDH or a previous terminal for termination. The “green” capped MPO (pinned, male) in the body of the terminal housing receives the downstream tail connector (non-pinned, female). For the indexing branch terminal, the blue adapter port is a capped MPO (pinned) which can receive the downstream tail from another chain. Refer to section 8 for cable handling recommendations and refer to section 10 for making the HMFOC connection.

**3. Testing the indexing chain** (refer to section 13)  
After installing the indexing chain, the signal on the drop ports should be tested to ensure a correct installation of the chain.

**4. Drop cable installation and connection**  
After the indexing chain is set up, the single drop connection can be made. Follow local practice for pulling and installing drop cables. Refer to the instructions provided with the mounting system for drop cable entry and routing. Service is enabled by connecting the drop cable connectors to the black dust cap adapter ports on the terminal (see section 11 and 12).  
In the Indexing Only configuration, a splitter only terminal can be installed to the single black dust cap adapter port. The subscribers will be connected to this splitter only terminal.

**5. Reverse feed installation**  
If all indexing terminals are installed, a FO cable with HMFOC connectors at both ends can be connected to the green dust cap adapter port of the last terminal and to a 2<sup>nd</sup> HMFOC connector of the FDH. Now, all RED ports from all Indexing terminals can be connected to subscribers. The red adapter port is a DLX or full size hardened connector, depending on the housing. For installation, refer to section 11 or 12).

**6. Maintenance**  
Maintenance for the indexing terminal is limited to cleaning the hardened adapters as needed to maintain optimal performance. Refer to section 14.

## 7.3. Unpacking and inspection

Open the shipping carton(s) and carefully inspect the terminal and the attached cable. If there are damages, contact CommScope product support at: <http://www.commscope.com/SupportCenter>.

With each terminal a test report (VAM/Splitter Module Assembly Performance Sheet) of the optical ports is delivered:

VAM/Splitter Module Assembly Performance Sheet

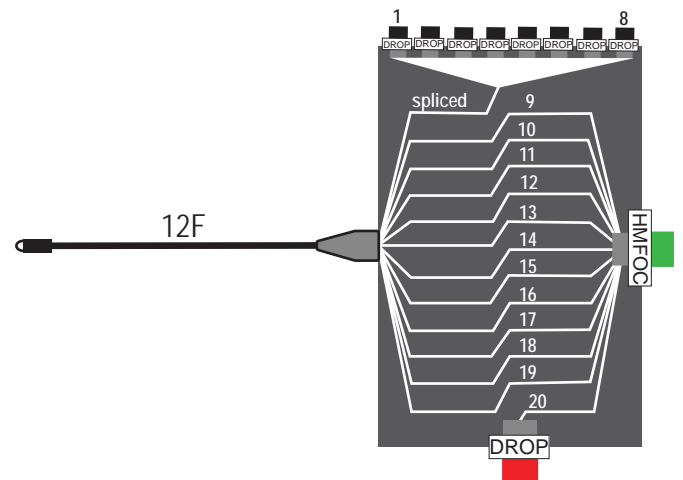
Catalog Number: NDX-10BTMOU-A0010F  
Serial Number: 71171926081

Test	Port										Summary	
	1	2	3	4	5	6	7	8	9	10	Max	Min
IL @ 1310nm	9.905	9.849	9.863	9.509	9.571	9.629	9.575	9.496	0.207	0.204	9.905	0.204
RL @ 1310nm	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65
IL @ 1550nm	9.858	9.759	9.715	9.47	9.515	9.603	9.529	9.645	0.128	0.198	9.858	0.128
RL @ 1550nm	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65

Test	Port											Summary	
	11	12	13	14	15	16	17	18	19	20	Max	Min	
IL @ 1310nm	0.367	0.285	0.131	0.113	0.233	0.038	0.31	0.10	0.254	0.632	0.632	0.038	
RL @ 1310nm	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	
IL @ 1550nm	0.354	0.222	0.091	0.092	0.154	0.025	0.253	0.089	0.209	0.481	0.481	0.025	
RL @ 1550nm	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	> 65	

Insertion Loss (IL) as well as Return Loss (RL) are tested on 2 different wavelengths before shipment. IL is the insertion loss between the female (non-pinned) HMFOC on the tail and the output ports. RL is the return loss on the output ports itself.

For an indexing terminal with a 1:8 splitter, port 1 to 8 are the results for the forward feed adapters (ports with black dust cap indicated respectively with number 1 to 8). Port 9 to 19 are the results for the first 11 individual fibers in the HMFOC adapter (green dust cap, indicated with A). Port 20 is the test result for the reverse feed adapter (red dust cap). Image below illustrates the port numbering in case of a 1:8 splitter.



For an indexing terminal with a 1:4 splitter, port 1 to 4 are the results for the forward feed adapters (ports with black dust cap indicated respectively with number 1 to 4). Port 5 to 15 are the results for the first 11 individual fibers in the HMFOC adapter (green dust cap, indicated with A). Port 16 is the test result for the reverse feed adapter (red dust cap).

## 8. Cable handling recommendations

Each terminal is equipped with an optical cable. Depending on the length of the cable, the dielectric cable may be coiled up and placed in a box or it may be coiled on a spool.

**Coiled Cable Handling:** Leave the terminal on top and in the center of the coil. Locate the free end of the cable and then carefully uncoil the cable from around the terminal.

**Spooled Cable Handling:** If the dielectric cable is coiled on a spool, remove the spool from the box. Leave the terminal on top of the spool and place the spool on a vertical arbor. Locate the free end of the cable. Carefully pull the cable away from the spool allowing the spool assembly to rotate about the vertical arbor. CommScope does not recommend using a broomstick or other similar handles as a substitution for the vertical arbor. Improper equipment may result in the cable getting wrapped around the stick/handle and breakage.



**Cable Bend Radius Limits:** Take care to observe the recommended minimum bend radius limits for the cable. Always maintain a minimum bend radius of 7,5 cm (3 inch).

**Pulling the cable:** When pulling the cable into place, do not exceed a pulling force of 445 N (100 lbs) on the optical cable. Pulling on the cable should be done through the pulling cap, see picture below. A properly rated breakaway swivel should be used between the pull rope and the pulling cap.



When the connector is mated – in service, pulling force is max 111 N (25 lbs).

**Span rating:** the recommended span width is as followed:

	Span width		Sag	
	m	ft	m	ft
NESC Light load Destrict	125	410	3,75	12.3
NESC Medium load Destrict	70	230	2,1	6.9
NESC Heavy load Destrict	39	128	1,2	3.8

These calculations are provided for guidance purposes only and should not be used or in any way relied upon without consultation with and supervision of experienced network design specialists. CommScope makes no representations or warranties of any kind, express or implied, including any representation or warranty regarding the quality, content, completeness, suitability, adequacy or accuracy of the data contained herein. CommScope is under no obligation to issue any upgrades or updates to notify customers/users of these calculations that changes have been made to the calculations. The user of these calculations assumes all risks associated with such use, and CommScope Hereby disclaims any and all liability for damages of any kind resulting from such use.

### Coupling coils:

To relieve strain on the HMFOC connection, CommScope strongly recommends component coupling. Component coupling in optical cables is important to harmonizing the movement of the various cable components created by stresses during installation, through thermal cycling and environmental loading.

Some terminal stubs may have fiber lock technology factory-installed which can be identified by observing an extra heat-shrink on the cable as shown in picture below; if a fiber lock is installed, a coupling coil at this section of the cable is not required. However, to add additional strain relief measures in the network, CommScope recommends implementing the coupling coil method.

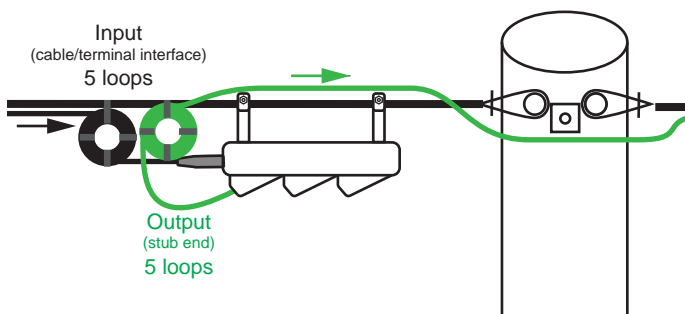
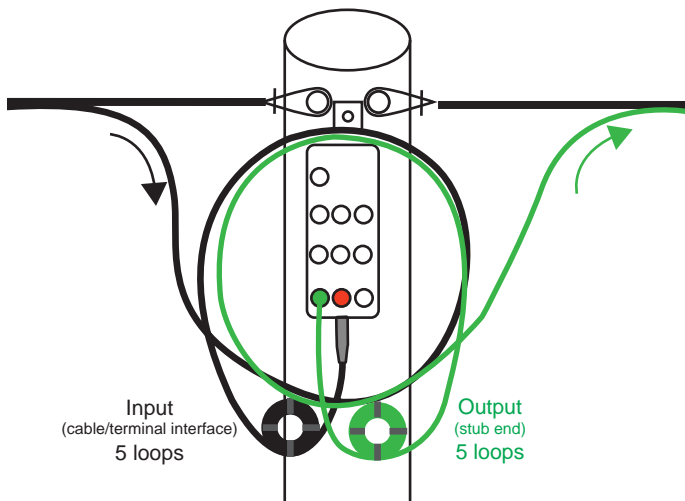


For terminals with lengths longer than 500 feet, CommScope recommends mid-span coupling coils every 500 feet and mid-span coupling coils for all lengths in locations with extreme elevation changes.

**Input (terminal/cable interface):** Loop the cable tail before the terminal/cable interface. Make 5 loops with a diameter of 15 cm (6 inch).

**Output (stub end):** Also on the output component coupling is recommended, looping the cable 5 loops (with diameter 15 cm (6 inch)) adequately enhances the coupling to prevent buffer tube movement.

Images on the next page showing pole mounting with input and output coupling coils and strand mounting with input and output coupling coils.



**Note:** For applications where the cable is pulled into duct, remove the midspan coupling coils and coupling coil at the stub end (output) and reinstall them when cable pull is completed. **Make sure there is a coupling coil at the terminal/cable interface before pulling.**

#### Overlength:

Always store overlength near the terminal where the cable leaves the terminal. For pole mounting the NDX-pole-BRT bracket can be used.

#### Cable pay off:

1. Determine the terminal's final location. Mount the spool on a vertical arbor on that location and pull the tail to the upstream network element (hub or terminal). Maximum pulling force 445 N (100 lbs).

2. Secure the cable at the location of the upstream network element (for example with a flat drop clamp attached to a J-hook in aerial application).



The cable length from this securing point to the connector should be long enough to make the HMFOC link installation with correct cable bend and 5 loops to relieve strain on the connection.

3. Make the link installation (chapter 10) to the upstream network element and go back to the terminal.

4. Mount the UMB or NDX-pole-BRKT and secure the cable (for example with a flat drop clamp attached to a J-hook in aerial applications).

5. Store overlength near the terminal where the cable leaves the terminal. For pole mounting the NDX bracket can be used.

**Note:** The reverse option (cable spooled in opposite way to pay off the cable in the reverse direction - from upstream component to terminal's final position) is available.

## 9. Mounting the terminal

### 9.1. Disconnect the terminal from its UMB

To install the terminal in several situations, the terminal is supplied with its UMB (universal mounting bracket). The UMB can be attached to various mounting surfaces using a variety of fasteners. Multiple holes and slots are provided in the UMB to accommodate these variety of fasteners. To reach these holes and slots, the terminal should be disconnected from its UMB. This can be done by lifting the snap fit.

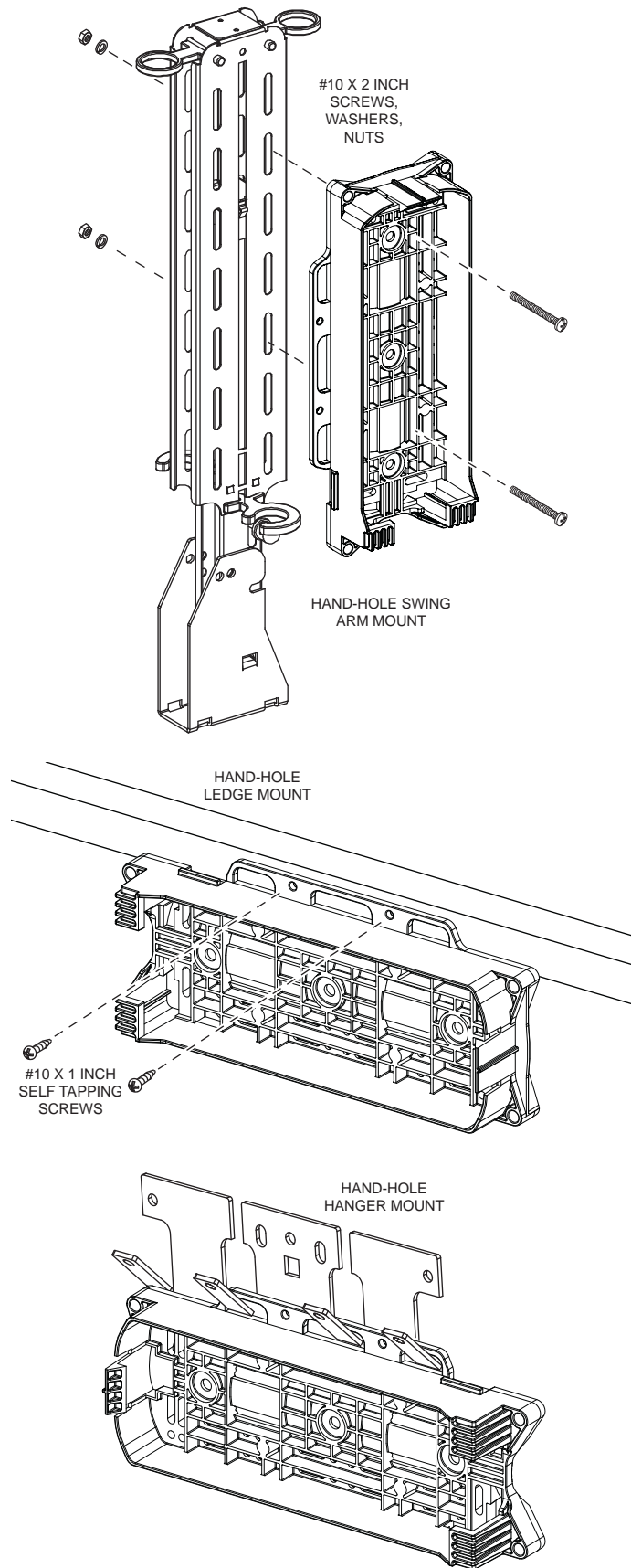
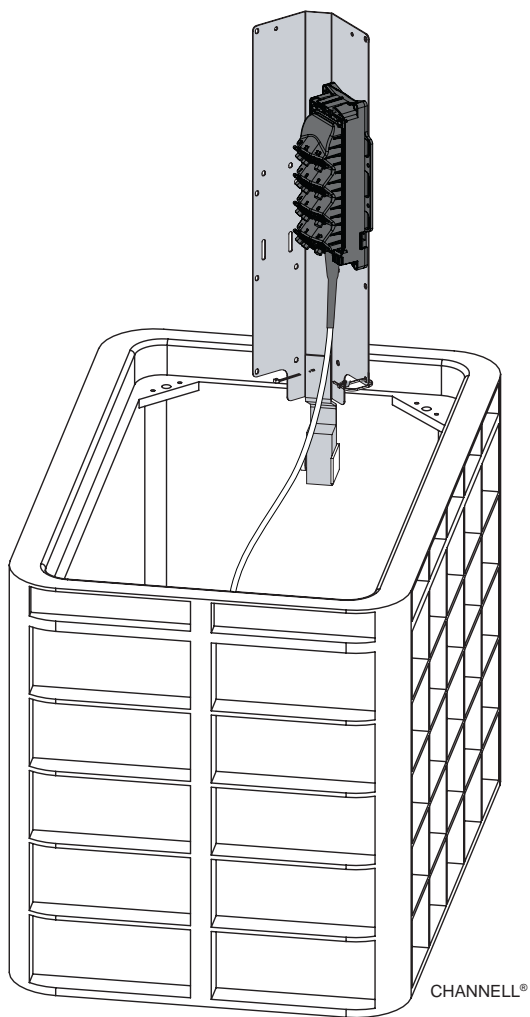
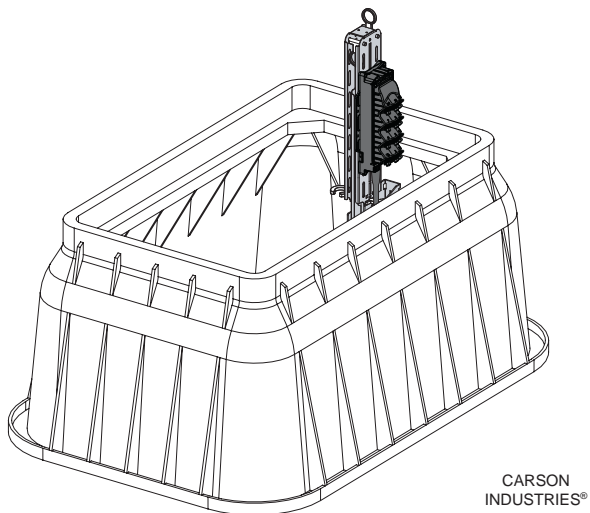


Release the terminal and move it slightly upwards. Now the cable end can be taken out of the bracket:



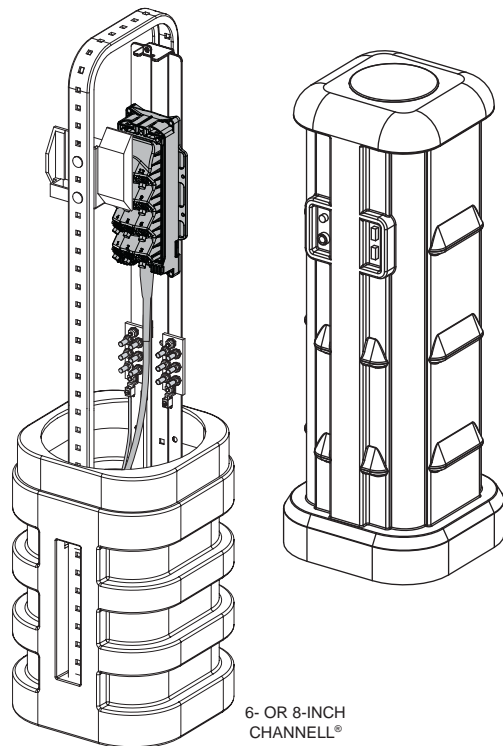
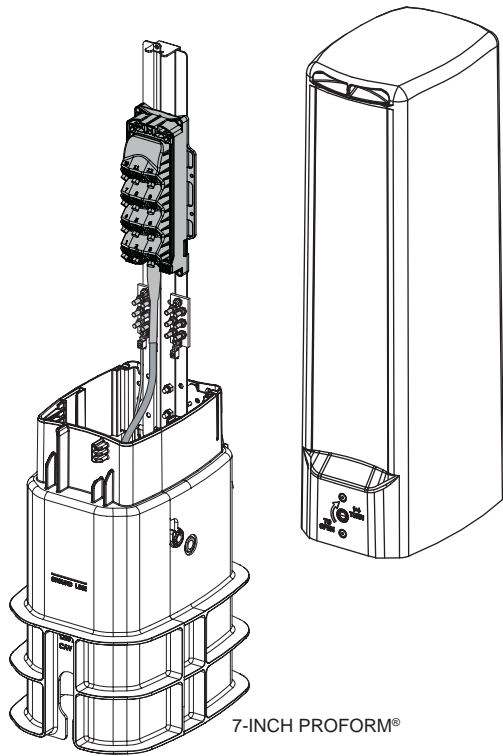
## 9.2. Hand-Hole mounting

Hand-Hole Mounting (below ground) – A hand-hole enclosure (examples shown in Figure below) is an OSP below-ground mounting system that may be used for any indexing terminal or other similar products. When installed, the top of the hand-hole enclosure is flush with the top of the ground. Hand-hole enclosures consist of a base unit and a top cover. The base unit mounts in the ground. Cables and conduit enter the base unit from the bottom.

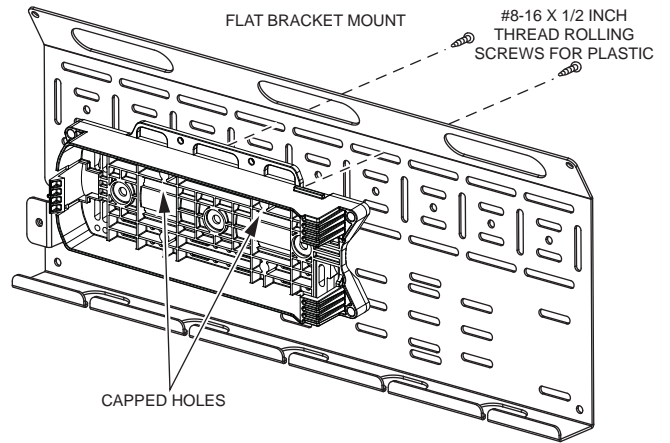


### 9.3. Pedestal mounting

Pedestal Mounting (at final grade) – Pedestal enclosures (examples shown below) may be used for mounting the indexing terminal at ground level. Pedestal enclosures consist of a base assembly and a top cover. The base assembly mounts partly in the ground. Cables and conduit enter the base assembly from the bottom.

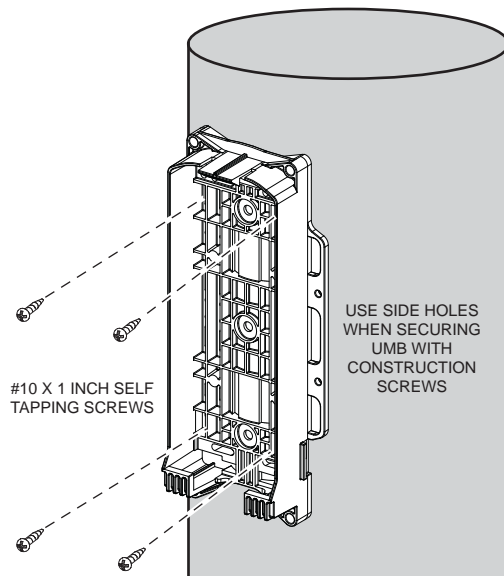
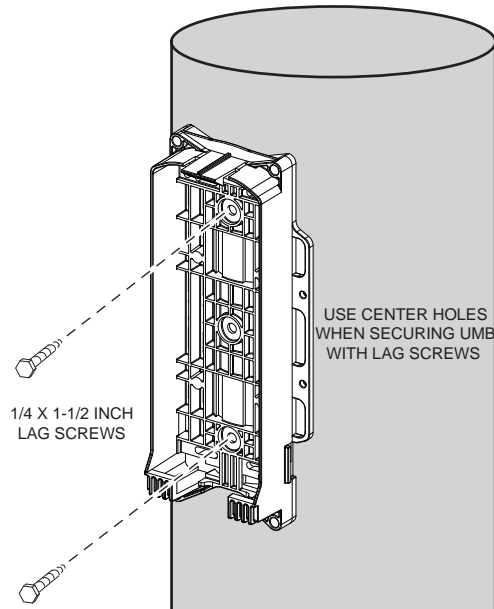


An example to attach the UMB to the pedestal infrastructure is shown below. Use local practice to mount the UMB to the pedestal infrastructure.

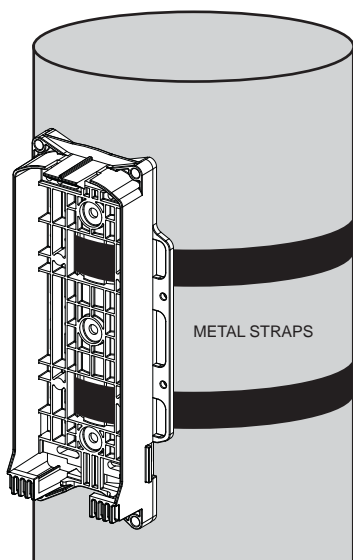


### 9.4. Pole-mounting

Pole-Mounting (aerial) – The indexing terminal may be mounted on a utility pole. The UMB may be attached to the pole with lag screws or construction screws.

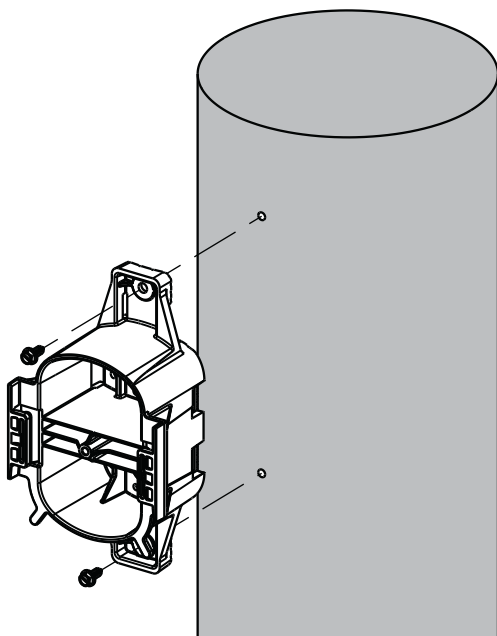


Also metal straps can be used to mount the UMB to a pole, for instance in case of a metal pole.



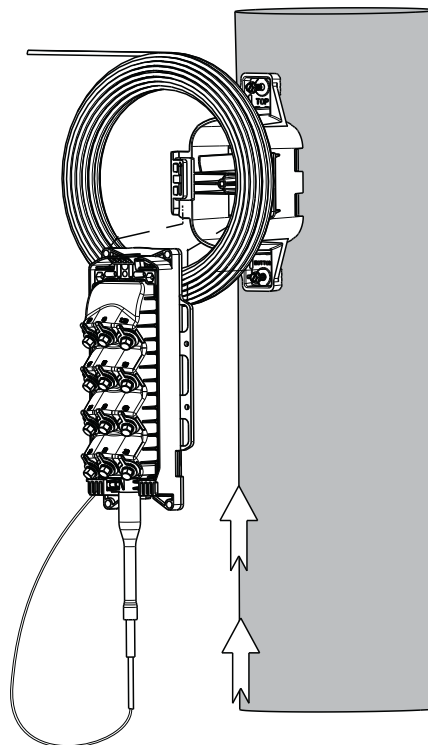
### 9.5. Excess cable bracket

The excess cable bracket (NDX-POLE-BRKT) is secured with 1/4 inch thread size hardware to a pole (not included in the kit).



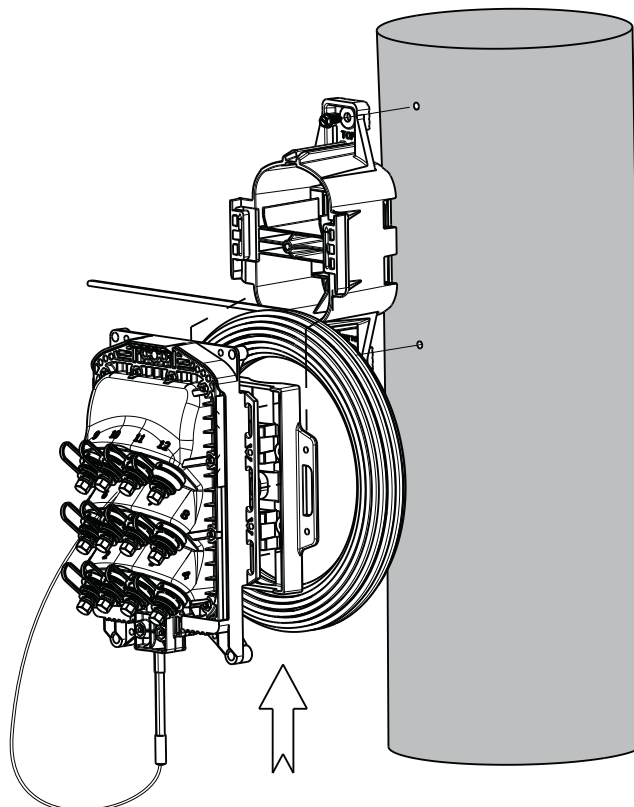
#### 9.5.1. DLX connector housing

Excess cable can be looped around the bracket. To secure the terminal to the excess cable bracket, the terminal with its UMB must be slid in an upward direction into this excess cable bracket.



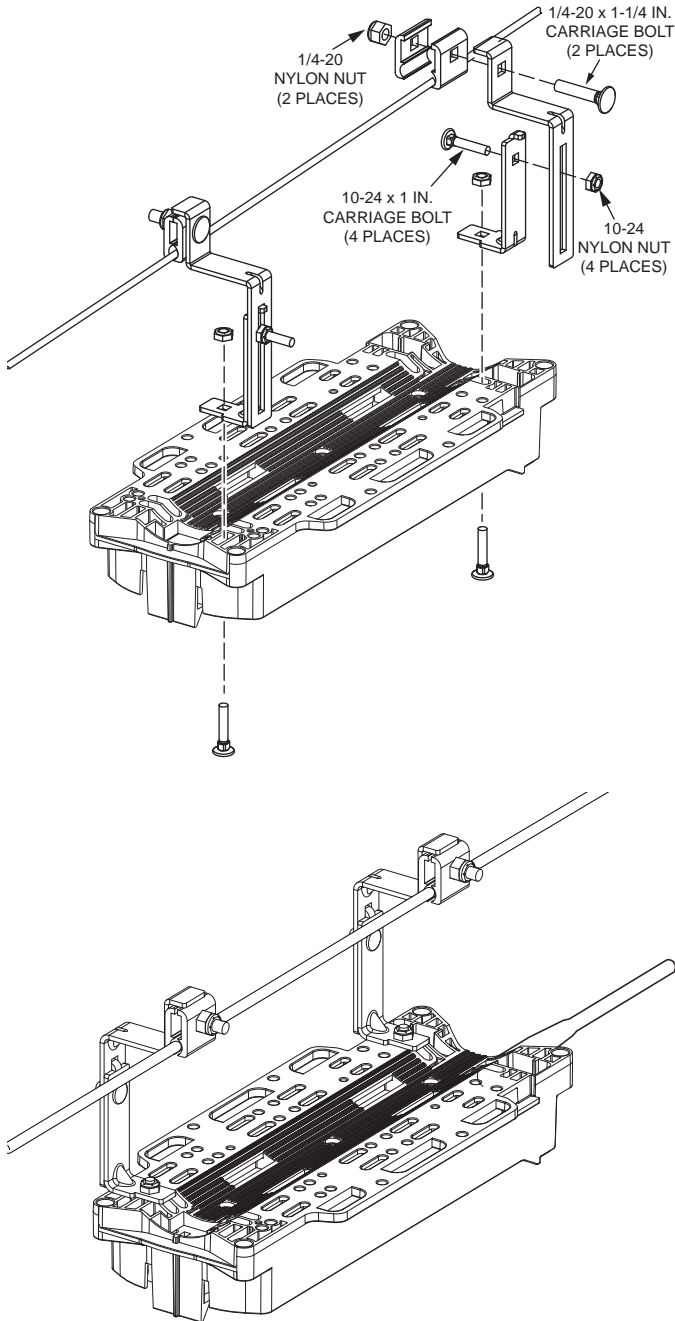
#### 9.5.2. Full size connector housing

First an adapter bracket (NDX-4X3-ADPT-BRKT) snaps onto the terminals UMB. This part can slide in the same way into the cable excess bracket. Excess cable is looped around the bracket.

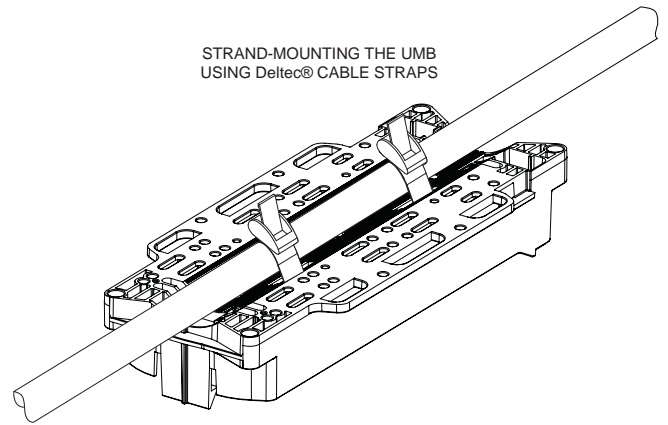


## 9.6. Strand-mounting

Strand-mounting (aerial) – A strand-mount bracket kit is available for aerial mounting the indexing terminal from an overhead strand as shown. The brackets mount on the UMB and are then clamped to the strand. Refer to Universal Mounting bracket Strand-Mount Installation Instructions ADCP-96-124 for the installation procedure.

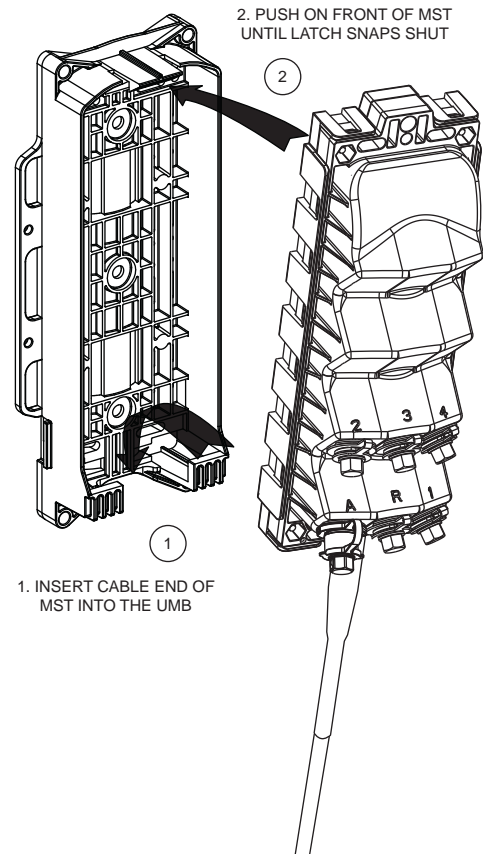


Or alternatively, cable straps can be used to mount the UMB to a strand



## 9.7. Installing the terminal in its UMB

After the UMB is mounted, install the indexing terminal in the UMB as shown in Figure 11. Insert the cable end of the terminal into the UMB first and then push the front of the terminal into the UMB until the latch snaps closed.





## 10. Link installation (HMFOC)

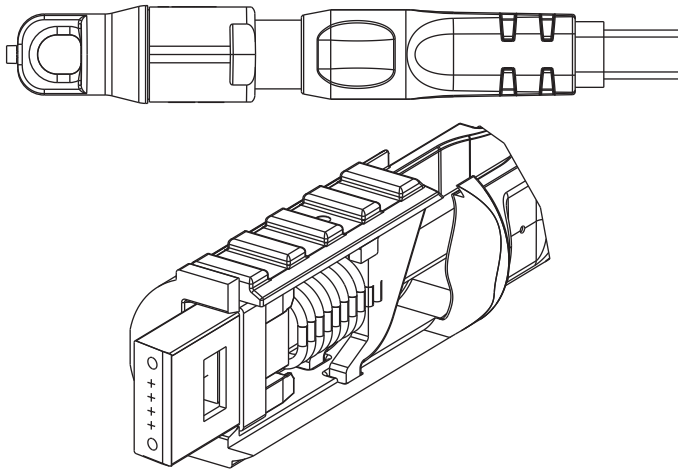
### 10.1. Connector components

The HMFOC connector at the end of the terminal's tail is a hardened 12 fiber connector that can be used for many applications. The primary application is to connect indexing terminals in cascade or to connect an indexing terminal to the Fiber Distribution Hub (FDH) or Closure, to extend the distribution network.

The connector on the tail is the non-pinned female type. The connector is protected by a dust cap. The O-ring on the connector body provide a water tight seal when the dust cap is in place. A pulling eye is provided in the end of the dust cap for pulling the drop cable.

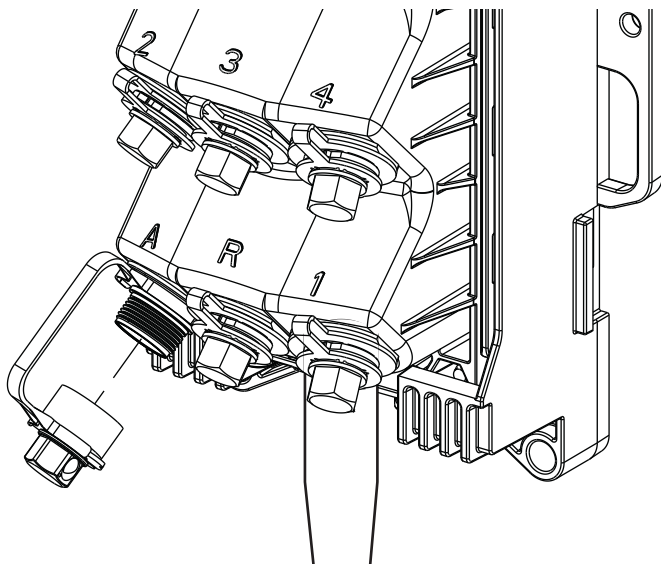
**Do not exceed a pulling force of 445N (100 lbs) and when connected, don't exceed cable pull of 111 N (25 lbs).**

**A properly rated breakaway swivel should be used between the pull rope and the pulling cap.**



### 10.2. Adapter components

On the indexing terminal up to 2 ports are HMFOC adapter ports, the **green** present on all the terminals and the **blue** only present on the indexing branch terminal. The connector inside the adapter is the pinned, male type. It is a captured Multi-fiber Push On (MPO) connector.



### 10.3. HMFOC specifications

#### HMFOC Intermateability:

Compatible with Corning Optitip®

#### HMFOC:

Per GR 3120 and

IEC 61753-1 Ed2 CAT G (hardened connector)

### 10.4. Connecting the HMFOC (making the link installation)

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

#### 10.4.1. Remove dust caps

10.4.1.1. Field personnel must take care when proceed to remove dust caps at the HMFOC at the adapter plugs or cables, to prevent contaminant particles entering to the adapters or connector end-face.

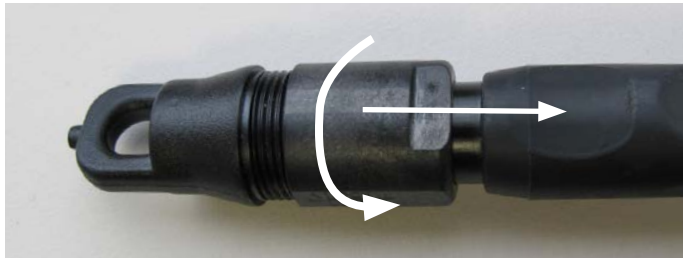
10.4.1.2. Before removing dust cap, be sure to turn the terminal to a position where adapters are protected (i.e. for aerial application, adapters will face down), helping to prevent any particle/ dust to fall down and contaminate the adapter. Before removing the terminals optical port dust cap, clean any debris from around the indexing terminal optical ports, preferably using compressed air, to minimize the risk of introducing contaminants into the optical port.

10.4.1.3. Use the 216B key tool (accessory) to unscrew the dust cap from the indexing terminal optical port. This is the green port, indicated with a letter A or the blue port, indicated with letter B.



10.4.1.4. For the cables, before taking out the dust cap, take in consideration all possible precaution to prevent any particle to contact the end-face connector and, keep the terminal with the adapters facing down to insert and tight the drop cable. Before removing the cable's connector dust cap, clean any debris from around the cable connector housing, preferably using compressed air, to minimize the risk of introducing contaminants onto the ferrule.

10.4.1.5. Unscrew the coupling nut from the cable connector dust cap in the direction of the arrow.

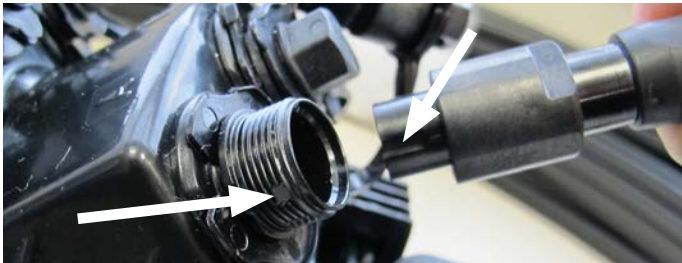


### 10.4.2. HMFOC cleaning

**Note:** The connectors and adapters are cleaned at the factory, however inadvertent contact and/or dust can still occur during transport, storage and installation. CommScope recommends all connector interfaces be cleaned prior to every mating. To clean the connector interface, follow the procedure as described in section 14.1.

### 10.4.3. Install the connector

10.4.3.1. Find the alignment keys on the adapter port (square notch in the thread area) and on the connector (groove). And push the plug connector in the jack of the adapter port until it seats.



10.4.3.2. Thread the cable connector's coupling nut onto the thread of the adapter port until it is finger tight.



10.4.3.3. Thread the optical port dust cap into the drop cable dust cap and tighten both dust caps finger tight. This ensures that both dust caps will stay clean when not in use.



## 10.5. Disconnecting the HMFOC

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

10.5.1. Before removing the connector dust cap, clean any debris from around the dust cap, preferably using compressed air, to minimize the risk of contaminants being introduced onto the ferrule. Unscrew the optical port dust cap from the drop cable dust cap.

10.5.2. Before removing the drop cable connector, clean any debris from around the connector housing and the terminal optical port, preferably using compressed air to minimize contaminants from being introduced onto the connector ferrule or into the optical port.

10.5.3. Unscrew the drop cable connector coupling nut until the thread of the adapter port is completely free.

10.5.4. Grasp the connector and pull it straight out of the adapter. The pull out force to remove the connector should be minimum once the coupling nut is fully disengaged.

10.5.5. Uncouple the two dust caps.

10.5.6. Thread the optical port dust cap into the optical port and tighten until finger tight.

10.5.7. Thread the drop cable connector coupling nut into the drop cable dust cap and tighten until finger tight.

## 11. DLX connector installation

Indexing terminals with the DLX connector housing use DLX technology to connect a subscriber to the drop adapter ports (black dust cap) and to connect the reverse feed (red dust cap).

CommScope DLX hardened connectors and adapters provide sealed environmental protection for the subscriber drop cable connector, SC connector, and adapter mounted within the indexing terminal optical port. The following sections provide a description of the connector and adapter components and provide instructions for connecting or disconnecting the drop cable to/from the optical ports. Also a section describing the cleaning procedures for both connector and adapter is integrated.

### 11.1. Connector components

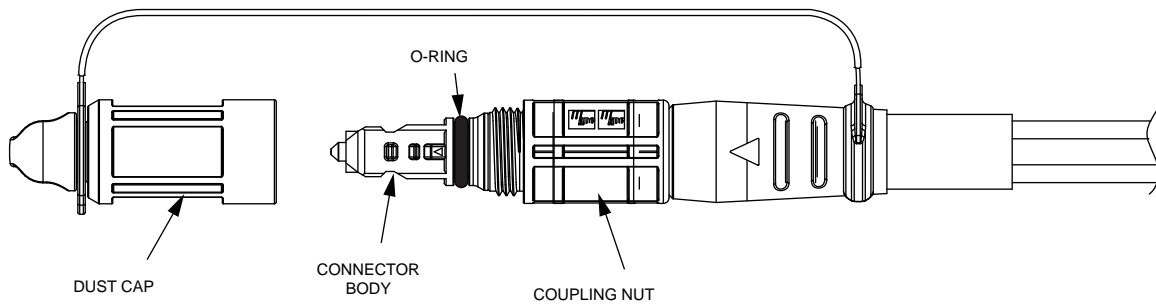
The DLX connector can be mated with any SC adapter to provide a low loss optical connection. It can also mate

a standard SC connector using the DLX adapter (which is the case in the indexing terminal drop adapter ports). The connector design is based on standard SC single mode ferrule and spring assembly in a miniature rugged body. The connector is designed with a dual-locking feature that includes a 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 8-degree APC ferrules.

The basic components of the drop cable connector are shown in figure below. The connector coupling nut threads onto the dust cap. The O-ring on the connector body provide a water tight seal when the dust cap is in place. A pulling eye is provided in the end of the dust cap for pulling the drop cable.

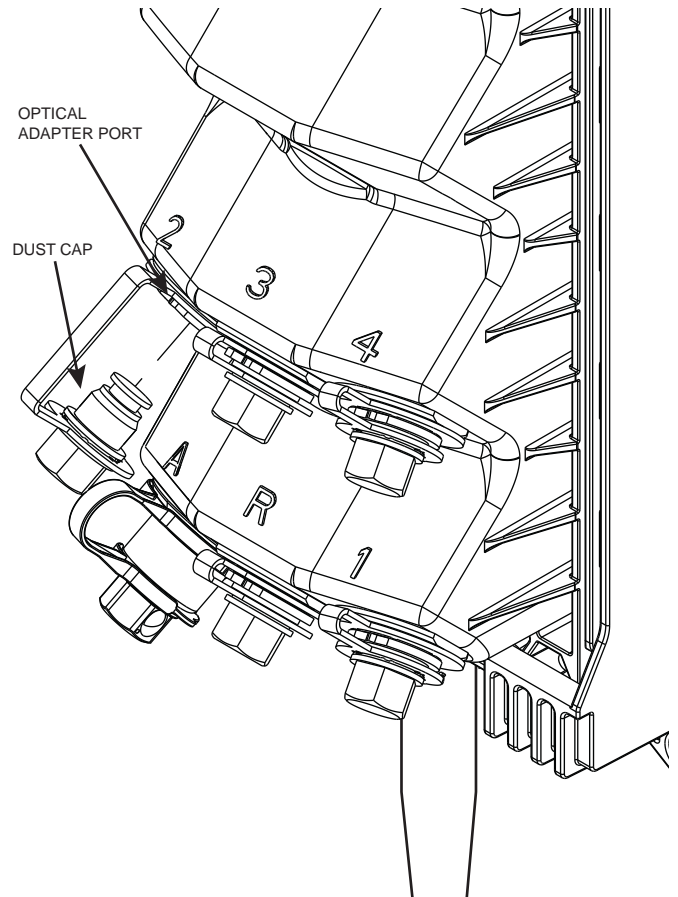
**Do not exceed a pulling force of 445 N (100 lbs) and when connected, don't exceed cable pull of 111 N (25 lbs).**

**A properly rated breakaway swivel should be used between the pull rope and the pulling cap.**



### 11.2. Adapter components

The DLX adapter on the DLX connector housing (black and red port) is a heavy duty plastic case environmentally sealed for extreme weather conditions. One side of the adapter receives the hardened DLX connector and the other side is designed to receive a standard SC connector plug. The SC side of the adapter provides a rugged stationary SC receptacle per standard industry specifications. The DLX adapter has an opening designed specifically to receive the DLX connector and to provide a sealing surface for the connector O-ring. The adapter's inner body holds two retainers and a split sleeve using snap latches and provides the plug with both push-pull and twist-lock engagement. The inner body also contains detent latch and alignment features that guide and hold the DLX connector inside the adapter. The basic components of a typical indexing terminal optical port hardened adapter are shown in Figure below. The dust cap threads into the adapter housing. An O-ring on the dust cap provides a water tight seal when the dust cap is in place. The 216B key tool is required to remove the dust cap.



### 11.3. DLX specifications

Designed to GR-326 generic requirements for SM optical connector.

Designed to GR-3120 / IEC 61753-1 Ed2 Category G generic performance requirements for hardened fiber connector.

TIA EIA 604-3a / IEC 61754-4 and IEC 61755-3-2 optic connector intermateability standard type SC.

GR-20 / IEC 60794-3-10 generic requirements for single mode fiber optic cables.

*Minimum Hole Size for Connector:* 15,9 mm (0.63 inch)

*Latching:* Keyed alignment dual latching, push-pull detent, twist-lock secure long term connection.

*Physical Contact:* Angled Polished Contact (APC), standard 8-degree angle

*Retention Force:* 445 N (100 lbs)

*Cable pull when connected:* 111 N (25 lbs)

### 11.4. Connecting the drop cable to the indexing terminal (DLX connector housing) adapter port

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

#### 11.4.1. Remove dust cap

11.4.1.1. Field personnel must take care when proceed to remove dust caps at the DLX at the adapter plugs or cables, to prevent contaminant particles entering to the adapters or connector end-face.

11.4.1.2. Before removing dust cap, be sure to turn the terminal to a position where adapters are protected (i.e. for aerial application, adapters will face down), helping to prevent any particle/ dust to fall down and contaminate the adapter. Before removing the terminals optical port dust cap, clean any debris from around the indexing terminal optical ports, preferably using compressed air, to minimize the risk of introducing contaminants into the optical port.

11.4.1.3. Use the 216B key tool (accessory) to unscrew the dust cap from the indexing terminal drop port: one of the black ports with number 1 to 8 or the red port (reverse feed).

11.4.1.4. For the cables, before taking out the dust cap, take in consideration all possible precaution to prevent any particle to contact the end-face connector and, keep the terminal with the adapters facing down to insert and tight the drop cable. Before removing the cable's connector dust cap, clean any debris from around the cable connector housing, preferably using compressed air, to minimize the risk of introducing contaminants onto the ferrule.

11.4.1.5. Unscrew the coupling nut from the drop cable connector dust cap. (See figure on pg 18).

### 11.4.2. DLX cleaning

**Note:** The connectors and adapters are cleaned at the factory, however inadvertent contact and/or dust can still occur during transport, storage and installation. CommScope recommends all connector interfaces be cleaned prior to every mating. To clean the connector interface, follow the procedure as described in section 14.2

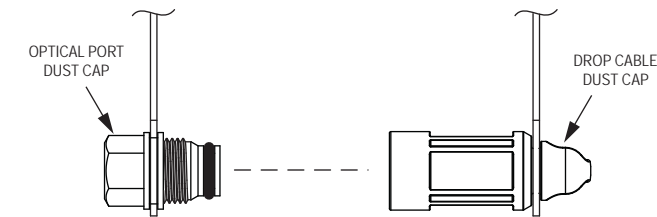
### 11.4.3. Install the connector

11.4.3.1. Align the drop cable connector with the optical port as shown in Figure below. The protrusions on the drop cable connector should line up with the arrow on the optical port.

11.4.3.2. Insert the drop cable connector into the optical port until it slides freely into place and latches.

11.4.3.3. Thread the drop cable connector coupling nut into the optical port and tighten coupling nut until finger tight.

11.4.3.4. Thread the optical port dust cap into the drop cable dust cap as shown below and then tighten both dust caps finger tight. This ensures that both dust caps will stay clean when not in use.



### 11.5. Disconnecting the drop cable from the indexing terminal (DLX connector housing) adapter port

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

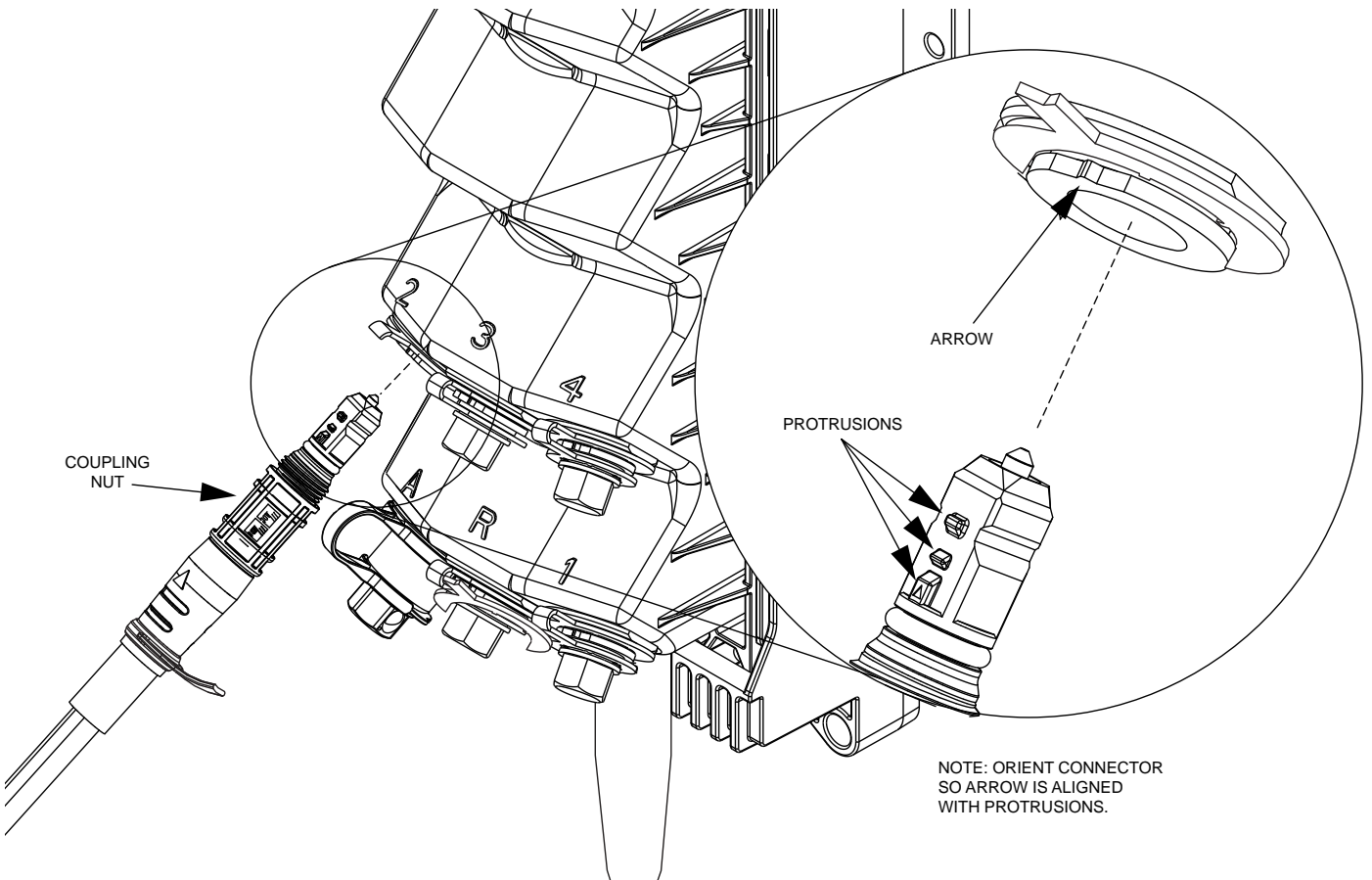
11.5.1. Before removing the connector dust cap, clean any debris from around the dust cap, preferably using compressed air, to minimize contaminants from being introduced onto the ferrule. Unscrew the optical port dust cap from the drop cable dust cap.

11.5.2. Before removing the drop cable connector, clean any debris from around the connector housing and the terminal optical port, preferably using compressed air to minimize contaminants from being introduced onto the connector ferrule or into the optical port.

11.5.3. Unscrew the drop cable connector coupling nut until the thread of the adapter port is completely free.

11.5.4. Grasp the connector and pull it straight out of the adapter. 5 Lbs. of force or less is required to extract the connector.

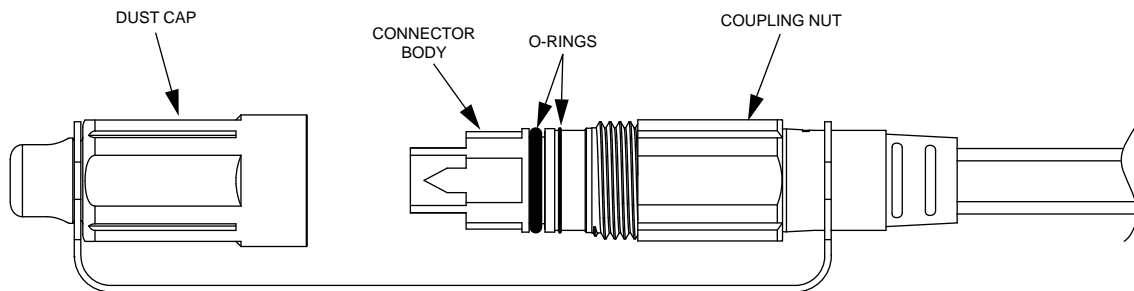
11.5.5. Uncouple the two dust caps. Thread the optical port dust cap into the optical port and tighten until finger tight. Thread the drop cable connector coupling nut into the drop cable dust cap and tighten until finger tight.



## 12. Full size hardened connector installation

Indexing terminals with the full size hardened connector housing use full size hardened connector technology to connect a subscriber to the drop adapter ports (black dust cap) and to connect the reverse feed (red dust cap).

CommScope full size hardened connectors and adapters provide sealed environmental protection for the subscriber drop cable connector and the SC adapter mounted within the full size hardened connector housing optical adapter port. The following sections provide a description of the connector and adapter components and provide instructions for connecting or disconnecting the drop cable to/from the optical ports. Also a section describing the cleaning procedures for both connector and adapter is integrated.



### 12.1. Connector components

The basic components of the drop cable connector are shown in Figure below. The dust cap threads onto the connector coupling nut. A pair of O-rings on the connector body provide a tight seal when the dust cap is in place. A pulling eye is provided in the end of the dust cap for pulling the drop cable through conduit.

**Do not exceed a pulling force of 445 N (100 lbs) and when connected, don't exceed cable pull of 111 N (25 lbs).**

### 12.2. Adapter components

The basic components of the optical port hardened adapter (black and red dust cap) on the full size hardened connector housing are shown in the Figure to the right. The dust cap threads into the adapter housing. An O-ring on the dust cap provides a tight seal when the dust cap is in place. The 216B key tool is required to remove the dust cap.

### 12.3. Full size hardened connector specifications

Designed to GR-3120 / IEC 61753-1 Ed2 Category G generic performance requirements for hardened fiber connector.

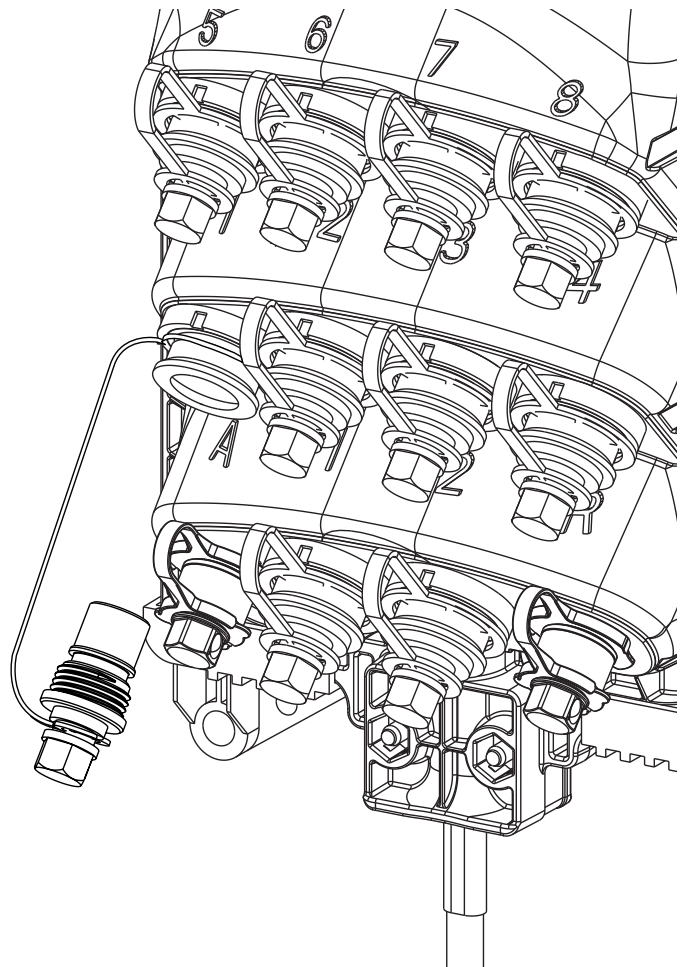
GR-20 / IEC 60794-3-10 generic requirements for single mode fiber optic cables.

*Latching:* Twist-lock secure long term connection.

*Physical Contact:* Angled Polished Contact (APC), standard 8-degree angle

*Retention Force:* 445 N (100 lbs)

*Cable pull when connected:* 111 N (25 lbs)



## 12.4. Connecting the drop cable to the indexing terminal (full size hardened connector housing) adapter port

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

### 12.4.1. Remove dust cap

12.4.1.1. Field personnel must take care when proceed to remove dust caps at the Full size hardened connector at the adapter plugs or cables, to prevent contaminant particles entering to the adapters or connector end-face.

12.4.1.2. Before removing dust cap, be sure to turn the terminal to a position where adapters are protected (i.e. for aerial application, adapters will face down), helping to prevent any particle/ dust to fall down and contaminate the adapter. Before removing the connector dust cap, clean any debris from around the drop cable connector housing, preferably using compressed air, to minimize contaminants from being introduced onto the ferrule.

12.4.1.3. Use the 216B key tool (accessory) to unscrew the dust cap from the indexing terminal drop port: one of the black ports with number 1 to 8 or the red port (reverse feed).

12.4.1.4. For the cables, before taking out the dust cap, take in consideration all possible precaution to prevent any particle to contact the end-face connector and, keep the terminal with the adapters facing down to insert and tight the drop cable. Before removing the cable's con-

connector dust cap, clean any debris from around the cable connector housing, preferably using compressed air, to minimize the risk of introducing contaminants onto the ferrule.

12.4.1.5. Unscrew the coupling nut from the drop cable connector dust cap.

### 12.4.2. Full size hardened connector cleaning

**Note:** The connectors and adapters are cleaned at the factory, however inadvertent contact and/or dust can still occur during transport, storage and installation. CommScope recommends all connector interfaces be cleaned prior to every mating. To clean the connector interface, follow the procedure as described in section 14.3.

### 12.4.3. Install the connector

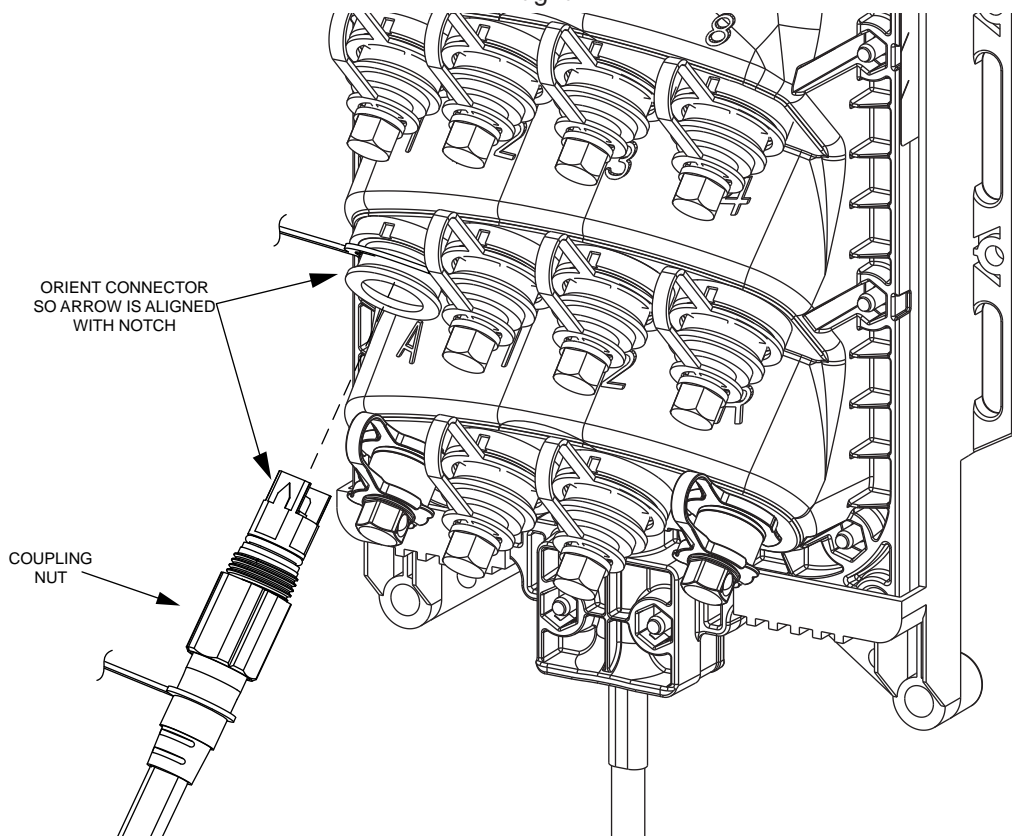
12.4.3.1. Inspect the optical port dust cap O-ring and the drop cable connector O-rings for dryness and apply O-ring lubricant (MST-ACC-LUBE1) to the O-ring if dry. Refer to Section 12.6 for the procedure.

**Note:** The optical port dust cap O-ring and the connector O-ring is pre-lubricated by the factory and should not require additional lubrication for the initial assembly.

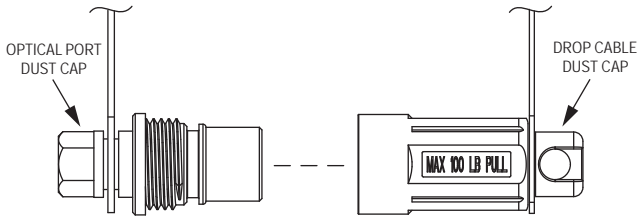
12.4.3.2. Align the drop cable connector with the optical port. The pointer on the drop cable connector should line up with the notch on the optical port.

12.4.3.3. Insert the drop cable connector into the optical port. If the drop cable connector does not insert all the way to the bottom of the port, rotate drop cable connector slightly to either side until it slides freely into place.

12.4.3.4. Thread the drop cable connector coupling nut into the optical port and tighten coupling nut until finger tight.



12.4.3.5. Thread the optical port dust cap into the drop cable dust cap as shown below and then tighten both dust caps finger tight. This ensures that both dust caps will stay clean when not in use.



## 12.5. Disconnecting the drop cable from the indexing terminal (full size hardened connector housing) adapter port

**Danger:** Exposure to laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not assume the laser power is turned-off or that the fiber is disconnected at the other end.

12.5.1. Unscrew the optical port dust cap from the drop cable dust cap.

12.5.2. Unscrew the drop cable connector coupling nut from the optical port and pull the connector straight out the adapter.

12.5.3. Inspect the optical port dust cap O-ring for dryness and apply O-ring lubricant (MST-ACC-LUBE1) to the O-ring if dry. Refer to Section 12.6 for the required procedure.

12.5.4. Thread the optical port dust cap into the optical port and tighten using the 216B key tool.

12.5.5. Inspect the drop cable connector O-rings for dryness and apply O-ring lubricant (MST-ACC-LUBE1) to each O-ring if dry. Refer to Section 12.6 for the required procedure.

12.5.6. Thread the drop cable dust cap onto the drop cable connector coupling nut and tighten until finger tight.

## 12.6. Applying O-ring lubricant

The O-rings used on the hardened connector and on the optical port dust cap are lubricated when shipped from the factory to prevent damage during installation. If the O-rings become excessively dry, they may require additional lubrication to prevent damage. Remove the O-rings from the connector or dust cap and apply a small amount of lubricant directly to each ring. Then reinstall the O-rings on the connector or dust cap. Apply only the recommended O-ring lubricant (MST-ACC-LUBE1).

**Note:** Excessive lubricant on the o-ring may cause contamination of fiber endface.

## 13. Testing

Testing fiber indexing terminals is dependent on many factors including the architecture of its end user. This chapter will address a variety of methods suitable to test a lead prior to and after it is in service.

The reader should consider some terminology within like; “Lead” refers to a single chain of terminals.

“Upstream” refers to a position closer to the CO or head end or the direction light would be flowing from a piece of equipment.

“Downstream” refers to a position closer to the end of a lead or the direction light would be flowing from a piece of test equipment.

Indexing chains always start with terminal one and build outward in procession to a value no greater than twelve. Indexing chains always provide the next fiber to the next terminal (i.e. Terminal 1 will use fiber 1 within the “chained” assembly).

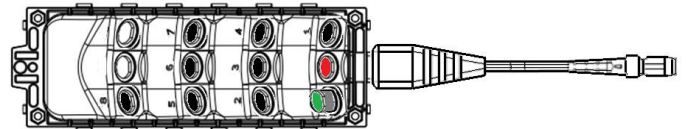
**Note:** Branching terminals can offset a sequence but do not interfere with the indexing process in given “chains”.

### 13.1. Conformance Testing

#### 13.1.1. Testing with VFL – (Recommended)

Testing with “light” flowing down stream is the simplest way to verify lead continuity as it only requires a dust cap removal on the far end to verify all links are connected.

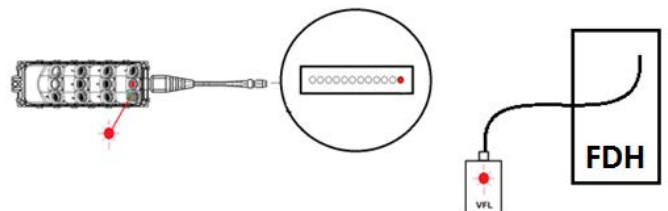
**SAFETY NOTE:** Laser driven VFL’s are powerful and should not be looked a directly to evaluate beam. Use caution when searching for light with you naked eye and maintain a safe distance. Refer to VFL documentation for safe defused viewing distance.



**Note:** Testing requires test leads to be attached to the terminals and ports. At every mating, the connector interface should be cleaned per the procedure described in section 14.

##### 13.1.1.1. Lead Continuity

- From an upstream position like an FDH, place your VFL on the 12th fiber\* of the lead you are testing.
- At the last terminal in the lead, remove the green HMFOC dust cap and look for red light. If no light, remove any black dust cap and look for red light\*\*. If no light still, the chain is “open”.



\* 12th fiber continuity testing relies on all fibers being spliced or connected prior to the first terminal.

\*\* Applies to twelfth link in chain



If the first terminal or “chain” link is known to be good you can use the reverse port on the first terminal to test continuity for the remainder of the lead as follows:

- Connect VFL to reverse port on first terminal
- At the last terminal in the chain, remove the green HMFOC dust cap and look for red light. If no light, the chain is “open”.

**Note:** Testing requires test leads to be attached to the terminals and ports. At every mating, the connector interface should be cleaned per the procedure described in section 14.

#### 13.1.1.2. Terminal Continuity

Terminal continuity is fiber specific.

- Attach VFL on target fiber.
- Look for red light at work order defined end point.
- 

Black dust cap adapters on a given terminal associate to the same single fiber up stream.

#### 13.1.2. Testing with a power meter

As with the VFL continuity test, Power Meters (master/satellite) can be attached in a similar way depending on the architecture of the deployment. Generally this means connecting one test unit at an upstream location like a hub or CO and the other test unit to the last terminal in the lead being tested. Power Meter testing will require FDH compatible test cords, DLX test cord or Full size TEST CORD, and possibly an HMFOC test cord or other assembly (FST) if testing via the “multi-fiber ports”.

##### 13.1.2.1. Lead Continuity

- From an upstream position like an FDH or CO, attach one of the test units to the target fiber in the lead you are testing. The target fiber should be the fiber assigned to the last terminal in the lead you are testing.
- At the last terminal in the lead, connect the other test unit to any black dust cap DLX/full size hardened port and take readings.

##### 13.1.2.2. Terminal Continuity

- From an upstream position like an FDH or CO, attach one of the test units to the fiber associated with the terminal you are wanting to test.
- At the target terminal, connect the other test unit to any black dust cap and take readings. If any ports show light, continuity is confirmed.

##### 13.1.2.3. Terminal Performance

- From an upstream position like an FDH or CO, attach one of the test units to the fiber associated with the terminal you are testing.
- At the target terminal, connect the other test unit to each black dust cap port and take readings. Readings across all ports should be similar.

#### 13.1.3. Testing with an OTDR

##### 13.1.3.1. Lead continuity

From an upstream position like a CO or FDH, attach the OTDR test lead to a fiber associated with the last terminal in the lead you are wanting to test. Ideally this would be a fiber without a splitter. Attach a reflective device like a hybrid patch cord to the same fiber at the far end. Confirm reflection, move to next lead.

##### 13.1.3.2. Terminal continuity

From an upstream position like a CO or FDH, attach the OTDR test lead to a fiber associated with the terminal in the lead you are wanting to test. Ideally this would be a fiber without a splitter. Attach a reflective device like a hybrid patch cord to the same fiber at the far end. Confirm reflection, move to next lead.

##### 13.1.3.3. Terminal performance

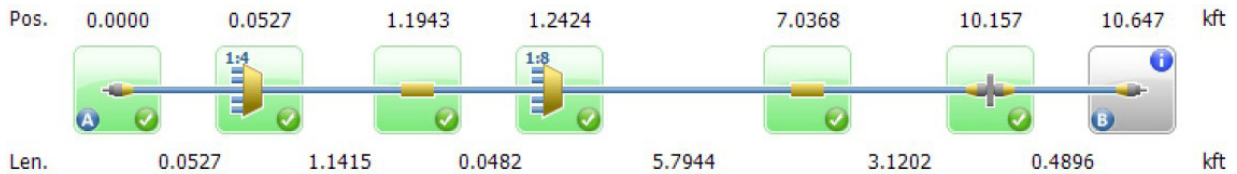
At the terminal location test all single fiber connectors, record trace(s). Caps sharing same color code should share same characteristics. QR code can be used to access terminal data.

##### 13.1.3.4. Upstream Testing with IOLM

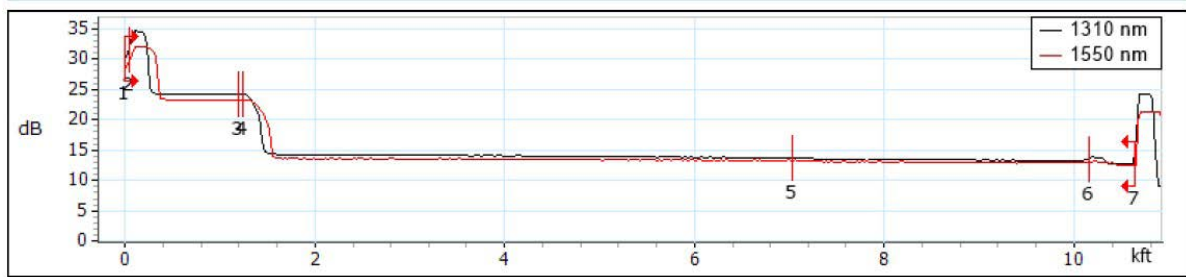
OTDR's must look upstream to see beyond splitters properly. They must have a dynamic range sufficient to register multiple cascading events. OTDR's with IOLM software are specialized to distinguish splitter type, mechanical connections, and fusion splices. Use a known reflective event like that of a hybrid SC/APC to SC/UPC launch box to confirm the end-of fiber/far end test point.

- Connect a qualified OTDR to any port on the target terminal.
- Connect a reflective event upstream to the fiber associated with the targeted terminal record test readings.

**Note:** Testing requires test leads to be attached to the terminals and ports. At every mating, the connector interface should be cleaned per the procedure described in section 14.



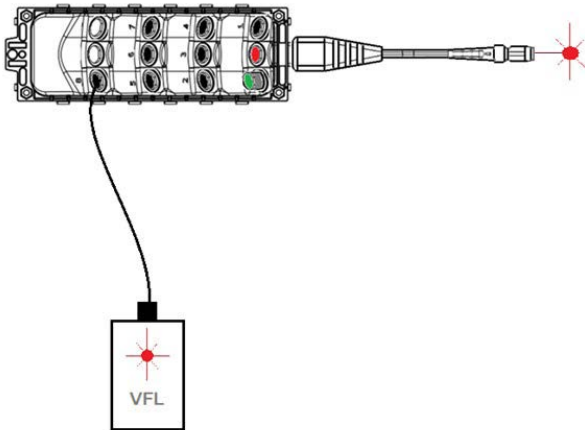
**OTDR Graph**



## 13.2. Bench Testing

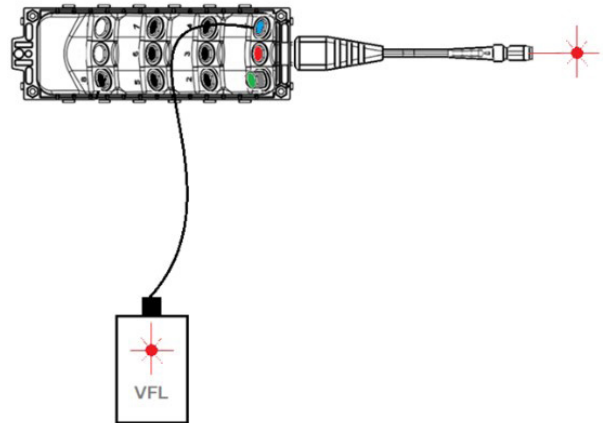
### 13.2.1. Primary port verification

Injecting red light into black dust cap service ports will disperse red light in the female (non-pinned) HMFOC connector on the tail of the terminals.



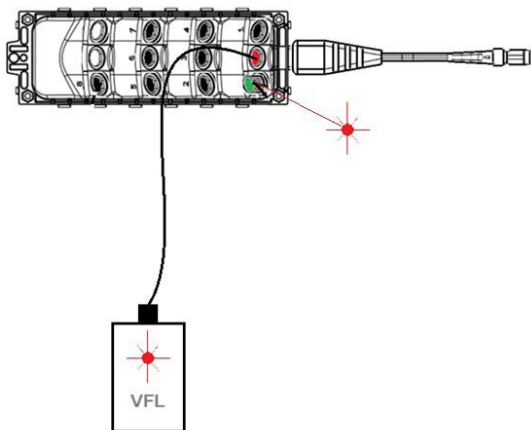
### 13.2.3. Branching port verification

Injecting red light into the blue cap HMFOC port will disperse red light in the female (non-pinned) HMFOC connector on the terminal tail.



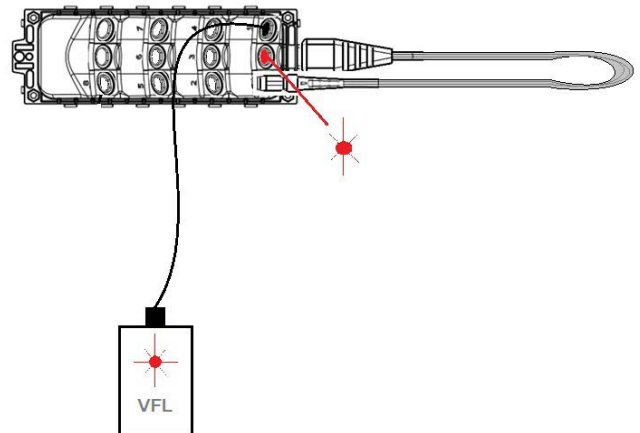
### 13.2.2. Reverse port verification

Injecting red light into red cap reverse ports will disperse red light in the male (pinned) HMFOC connector on the body of the terminal body.



### 13.2.4. Cable testing

Injecting red light into the black capped port(s) when the terminal tail HMFOC connector is plugged back into itself via the green capped HMFOC on the body, will allow red light to travel through all fiber in the assembly to the red capped reverse port.



Using an OTDR in this fashion will allow the technician to see through all fiber and connections of the cable assembly in one trace (best results when connected to the reverse port).



### 13.2.5. Splitter Performance

Splitter performance can only be tested as part of the terminal assembly. It will be a combination of splitter loss, connector losses (2), and an integral splice. All black dust cap ports on a terminal\* shall have similar readings in relation to their shared input fiber. See loss tables.

\* Index only terminals are excluded as they do not have built in splitters.

## 13.3. Trouble Shooting

### 13.3.1. Decision making

- Start at the ONT and work upstream.
- Confirm adjacent ports on terminals are experiencing same trouble.
- Determine status of adjacent terminals
- Understand the cable leads and their counts.
- Do not disconnect multi fiber connectors until you can physically see its other end or damage.

### 13.3.2. Loss expectations

Insertion loss and ORL values are recorded and included with each indexing terminal. Refer to these for “chain” performance expectation.

### 13.3.3. Cleaning

Refer to section 14.1 HMFOC cleaning

## 13.4. Restoration

### 13.4.1. Spare parts

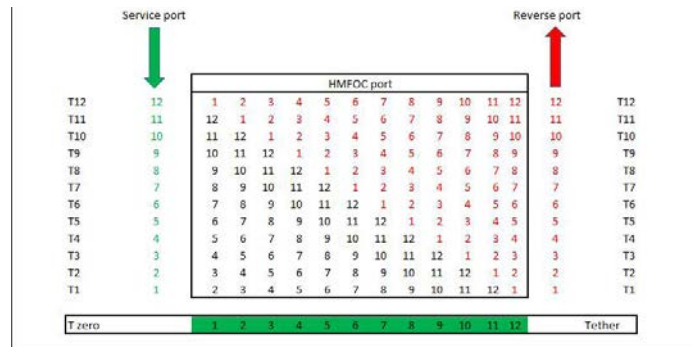
Areas deploying fiber indexing terminals should consider stocking a couple spare terminals for tear downs and dig-ups. All four port indexing terminals are interchangeable so stock a length that will cover your needs. Likewise, all eight port indexing terminals are interchangeable. Index only terminals are fiber specific but interchangeable in relation to fiber count. As an example, if you have a 2f indexing terminal it will interchange with all 2f terminals.

### 13.4.2. Splicing

Indexing terminals use 12f stranded drop. No special splicing requirements. Suggest using GATOR splice closure, FDSC-GATOR-12F-T.

## 13.5. Appendix

### 13.5.1. HMFOC Fiber map



ABS (n-13)= position of first reverse fiber in HMFOC  
n=terminal position in the chain

### 13.5.2. Loss Table - MONTE-CARLO

Average Loss Comparison												
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6	Terminal 7	Terminal 8	Terminal 9	Terminal 10	Terminal 11	Terminal 12
Indexing	17.36	17.52	17.68	17.85	18.01	18.17	18.33	18.5	18.66	18.82	18.99	19.15
Pre-Terminated Cables	17.33	17.38	17.44	17.48	17.53	17.59	17.64	17.7	17.75	17.8	17.86	17.91
Delta	0.03	0.14	0.25	0.36	0.48	0.58	0.69	0.8	0.91	1.02	1.13	1.25

99.9% Confidence (+3 sigma)												
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6	Terminal 7	Terminal 8	Terminal 9	Terminal 10	Terminal 11	Terminal 12
Indexing	18.26	18.46	18.67	18.85	19.05	19.25	19.44	19.64	19.83	20.02	20.22	20.42
Pre-Terminated Cables	18.38	18.43	18.49	18.54	18.58	18.64	18.7	18.75	18.79	18.85	18.91	18.96
Delta	-0.12	0.03	0.18	0.31	0.48	0.61	0.74	0.9	1.04	1.17	1.31	1.46

### 13.5.3. Indexing terminal Insertion loss

#### 13.5.3.1. Optical Performance

Splitter Configurations	1x4	1x8
Max Loss*:	7.2 dB	10.2 dB
Typical Loss*:	6.6 dB	9.7 dB
Uniformity:	0.8 dB	1.0 dB
Return Loss:	≥55 dB	≥55 dB
Directivity:	≥60 dB	≥60 dB
PDL:	0.2 dB	0.2 dB
Wavelength Range:	1260-1635 nm	1260-1635 nm

\* Includes PDL and WDL. Does not include connector loss

#### 13.5.3.2. Connector

Insertion Loss: < 0.4 dB

#### 13.5.3.3. Cable

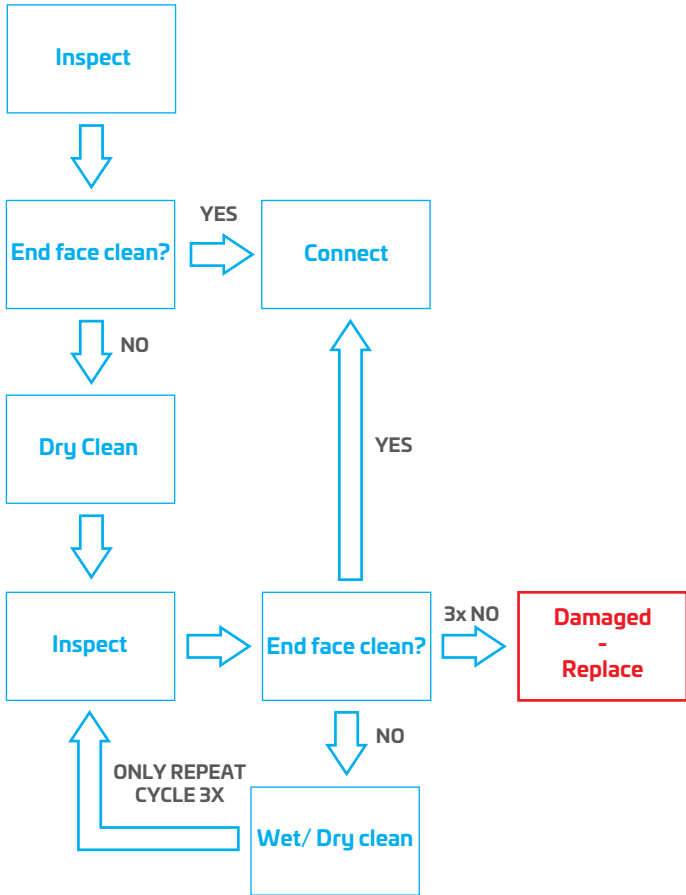
Attenuation: 1310 nm = 0.40 dB/km max  
1550 nm = 0.30 dB/km max

Compliance: Meets GR-771 generic requirements for Fiber Splice Closures

# 14. Maintenance

Follow specific cleaning instructions outlined for each specific connection type using the below Inspect/Clean Cycle.

**Always inspect and clean both connectors to be mated**



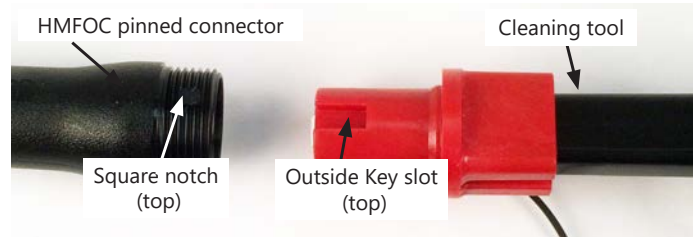
CommScope® is not responsible for damage caused by cleaning.

## 14.1. HMFOC cleaning

### 14.1.1. Cleaning the Pinned HMFOC Connector

14.1.1.1. Inspect the pinned HMFOC connector with a low-resolution microscope (e.g. VIAVI FBP-P5000i Probe; VIAVI FBPT-COD-MTA Inspection Tip) as specified in IEC 61300-3-35 or equivalent. Inspect the complete ferrule surface including the area around the pins for dirt or guide pin damage. If dust, dirt or contaminants are detected, proceed to step 14.1.1.2.

14.1.1.2. The following are directions for cleaning an HMFOC pinned connector using US CONEC IBC brand cleaning tool - MT Series (PN 15639).



HMFOC Pinned Connector and Cleaning Tool

Locate the red adapter on the cleaning tool and place it on the tip of the cleaning tool. Orientate the red adapter on the cleaning tool so that the outside key slot is on the top. Locate the square notch on the threaded portion of the pinned HMFOC connector. Hold the connector so the square notch is facing up. Insert the cleaning tool into the pinned HMFOC until the cleaning tool is flush against the connector end face. Push the cleaning tool forward into the HMFOC connector until a click is heard, then release the tool. Repeat this cleaning motion as required\*.



Cleaning Tool Pushed into HMFOC Pinned Connector

\* Always follow the cleaning tool manufacturer's cleaning instructions for best results.

14.1.1.3. Inspect the connector. If there are still contaminants, use a small amount of non-isopropyl alcohol solvent (e.g. Chemtronics PX Wash, Sticklers MicroCare Cleaning Fluid FPF, etc.) on one or more 2.5mm fiber optic swabs (e.g. Chemtronics Coventry, Sticklers Clean Stixx MCC-S25, etc.) to remove any remaining dust, dirt or contaminants from the ferrule end face and/or from around the guide pins. Always use a new swab for each connector and always follow-up with a dry clean using the cleaning tool procedure from step 14.1.1.2.



Cleaning Swab for Pinned HMFOC Connector

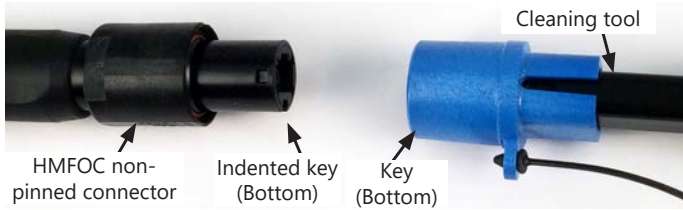
14.1.1.4. Connect the pinned connector to a non-pinned HMFOC or assemble the dust cap back on to the pinned connector until ready to install.

### 14.1.2. Cleaning the Non-Pinned HMFOC Connector

#### General cleaning instructions

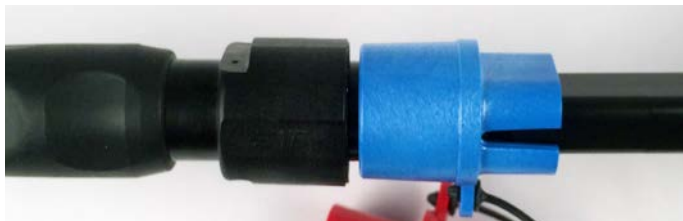
14.1.2.1. Inspect the non-pinned HMFOC connector with a low-resolution microscope (e.g. VIAVI FBP-P5000i Probe; VIAVI FBPT-COD-MTA Inspection Tip) as specified in IEC 61300-3-35 or equivalent. If dust, dirt or contaminants are detected, proceed to step 14.1.2.2.

14.1.2.2. The following are directions for cleaning an HMFOC non-pinned connector using US CONEC IBC brand cleaning tool - MT Series (PN 15639).



HMFOC Non-Pinned Connector and Cleaning Tool

Locate the blue adapter on the cleaning tool and place it on the tip of the cleaning tool. Orientate the blue adapter so that the key on the bottom inside is facing downward. Locate the outside indented key on the non-pinned HFMOc connector and hold the connector so this indent is also facing downward. Insert the cleaning tool over the non-pinned connector until it stops. Push the cleaning tool forward into the HMFOC connector until a click is heard, then release the tool. Repeat this cleaning motion as required\*.



Cleaning Tool Pushed into HMFOC Non-Pinned Connector

\* Always follow the cleaning tool manufacturer's cleaning instructions for best results.

14.1.2.3. Inspect the connector. If there are still contaminants, use a small amount of non-isopropyl alcohol solvent (e.g. Chemtronics PX Wash, Sticklers MicroCare Cleaning Fluid FPF, etc.) on one or more 2.5mm fiber optic swabs (e.g. Chemtronics Coventry, Sticklers Clean Stixx MCC-S25, etc.) to remove any remaining dust, dirt or contaminants from the ferrule end face. Always use a new swab for each connector and always follow-up with a dry clean using the cleaning tool procedure from step 2.1.2.

14.1.2.4. Connect the non-pinned connector to a pinned HMFOC or assemble the dust cap back on to the non-pinned connector until ready to install.

### Cleaning the Pinholes on the Non-Pinned HMFOC Connector

**Note:** Cleaning the pinholes on HMFOC connectors is the last resort for trouble-shooting a high loss connection, and only applicable for experienced personnel.

14.1.2.5. Inspect the connector with 50x inspection scope (e.g. Dino-Lite brand AM4815ZTL handheld digital microscope or equivalent). If there are contaminants around the pinholes, they may need to be cleaned according to the following procedure.



Example of HMFOC Endface with Dirty Pinholes

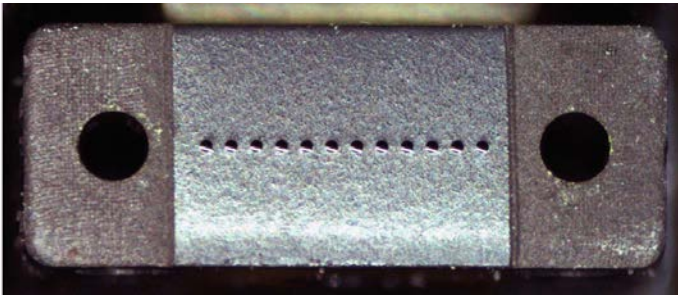
14.1.2.6. Wet the pink (0.4 mm) TePe brand dental (pinhole) brush with MicroCare FCC2 connector cleaner or equivalent cleaning solution and insert the brush into the pinhole while turning the brush 90 degrees. The brush will bottom-out before the handle reaches the ferrule end-face.



14.1.2.7. Pull the brush out of the hole while rotating 90 degrees and then inspect the pinhole with an inspection scope. With the scope at 50x magnification, inspect the leading edge of the pinhole for debris. Then focus down the pinhole (at least to the inner step diameter) for any remaining contamination. If additional cleaning is needed, verify that the cleaning solution has not dried on the brush. If it has, apply more solution and proceed with the cleaning.

14.1.2.8. With the brush bottomed-out in the pinhole, rotate the handle back and forth at least three times (180 degrees in each direction).

14.1.2.9. Pull the brush out of the hole while rotating 90 degrees and then inspect the pinhole with a scope. With the scope at 50x magnification, inspect the leading edge of the pinhole for debris. Then focus down the pinhole (at least to the inner step diameter) for any other contamination.



Example of a Clean HMFOC Endface with Clean Pinholes

14.1.2.10. Connect the non-pinned connector to a pinned HMFOC or assemble the dust cap back on to the non-pinned connector until ready to install.

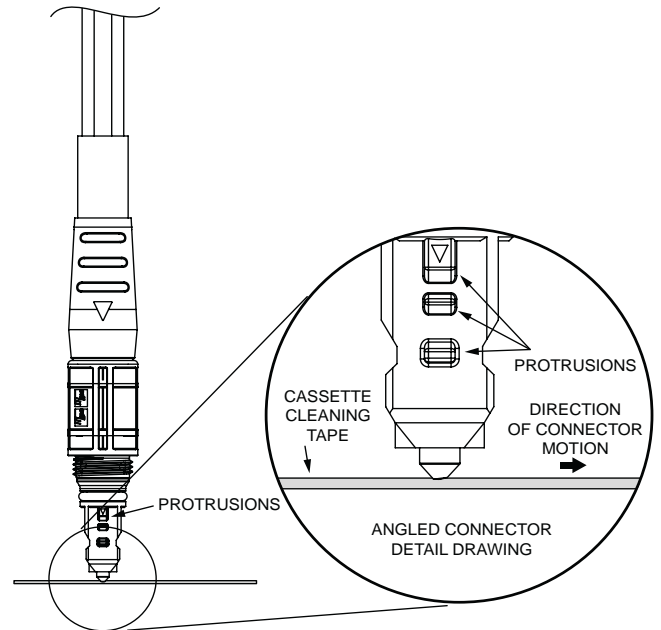
## 14.2. Cleaning DLX connector and adapter

### 14.2.1. DLX connector cleaning

14.2.1.1. Clean both the optical port adapter and the drop cable connector (requires accessory kit FHD-ACC-CLNKIT1) as specified in ADCP-96-163.

14.2.1.2. Examine the end of the drop cable connector, note the position of the protrusions on the connector.

14.2.1.3. Locate the cleaning tape cassette that is provided with the cleaning kit.



14.2.1.4. Open the tape shutter by squeezing the lever on the underside of the cassette and then keep the shutter open by continuing to squeeze the lever.

14.2.1.5. Hold connector facing you with the protrusions perpendicular to the length of the cleaning cassette, tilt the connector to the right (no more than 8-degrees) this places the connector in the correct position for cleaning.

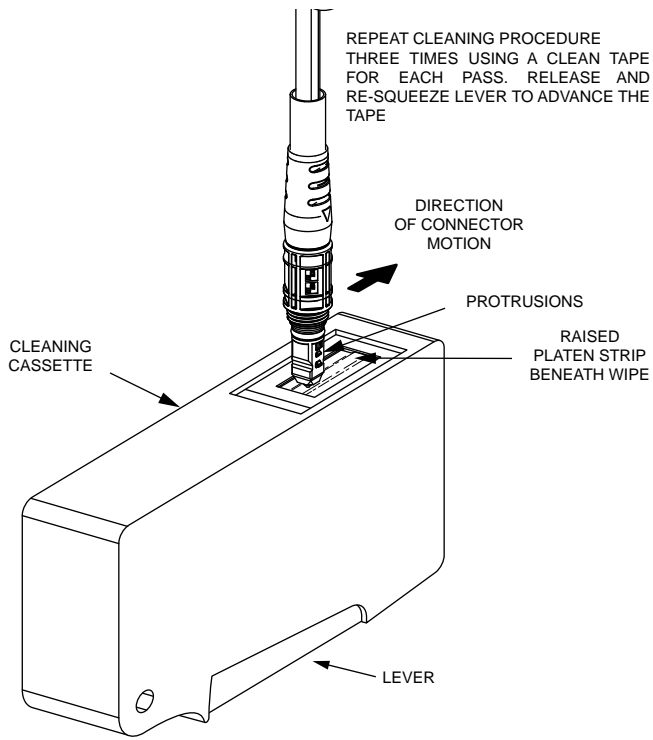
**Note:** The drop cable connector uses angled SC type connectors. Make sure the connector end-face is pointing in the correct direction before starting the cleaning motion.

14.2.1.6. With light pressure, slide the connector end-face once across the tape in the direction shown using a smooth linear motion. Do not press too hard and do not repeat the cleaning motion with the same tape.

14.2.1.7. Release the lever on the underside of the cassette to close the tape shutter.

14.2.1.8. Repeat Step 11.4.2.3 through Step 11.4.2.6 until the connector has been cleaned three times.

14.2.1.9. When the connector and the adapter are clean, install the connector into optical port.



### 14.2.2. DLX adapter cleaning

14.2.2.1. Cleaning kit (FHD-ACC-CLNKIT1) is required for this procedure.

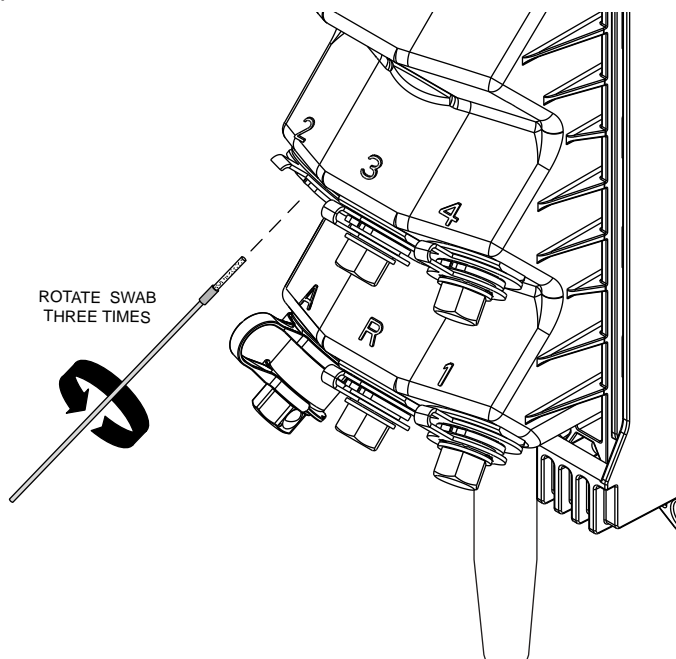
14.2.2.2. Locate the dry swabs that are provided with the connector/adapter cleaning kit.

14.2.2.3. Insert a dry swab into the adapter as shown below. **Note: Do not apply alcohol to the swab or the adapter.**

14.2.2.4. While applying light pressure against the connector end-face, rotate the dry swab 360° three times.

14.2.2.5. Dispose of the dry swab after use.

14.2.2.6. When connector end-face and adapter are clean, install the drop cable connector into the optical port.



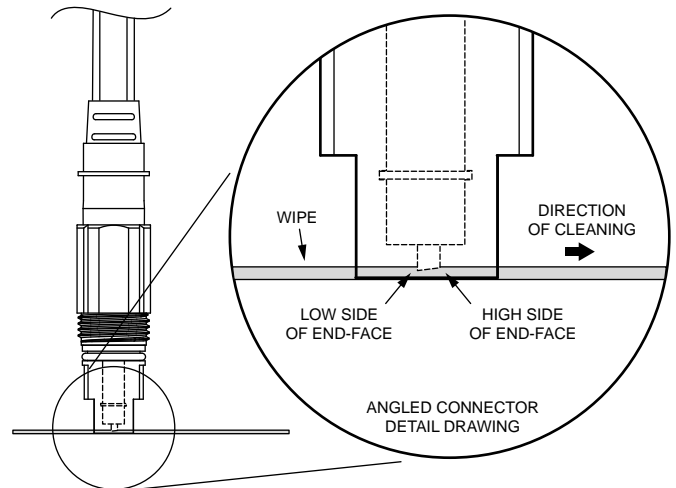
## 14.3. Cleaning full size hardened connector and adapter

### 14.3.1. Full size hardened connector cleaning

14.3.1.1. Clean both the optical port adapter and the drop cable connector (requires accessory kit FHD-ACC-CLNKIT1) as specified in ADCP-96-067.

14.3.1.2. Examine the end of the drop cable connector and determine which is the high side which is the low side of the connector end-face.

14.3.1.3. Locate the cleaning tape cassette that is provided with the cleaning kit.



14.3.1.4. Open the tape shutter by squeezing the lever on the underside of the cassette and then keep the shutter open by continuing to squeeze the lever.

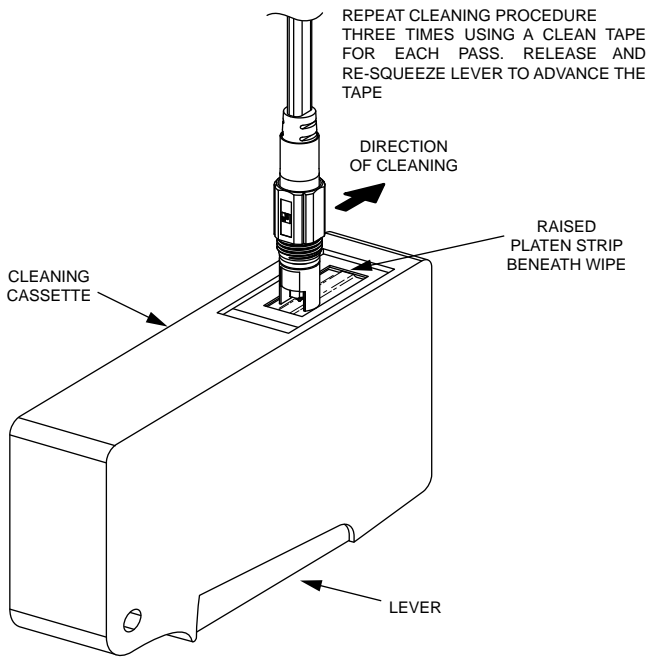
14.3.1.5. Hold the end-face of the drop cable connector perpendicular to the cleaning tape and with the high side of the connector pointing in the direction of cleaning.

14.3.1.6. With light pressure, slide the connector end-face once across the tape in the direction shown using a smooth linear motion. Do not press too hard and do not repeat the cleaning motion with the same tape.

14.3.1.7. Release the lever on the underside of the cassette to close the tape shutter.

14.3.1.8. Repeat Step 12.4.2.3 through 12.4.2.6 until the connector has been cleaned three times.

14.3.1.9. When the connector and the adapter are clean, install the connector into optical port..



### 14.3.2. Full size hardened adapter cleaning

14.3.2.1. Cleaning kit (FHD-ACC-CLNKIT1) is required for this procedure.

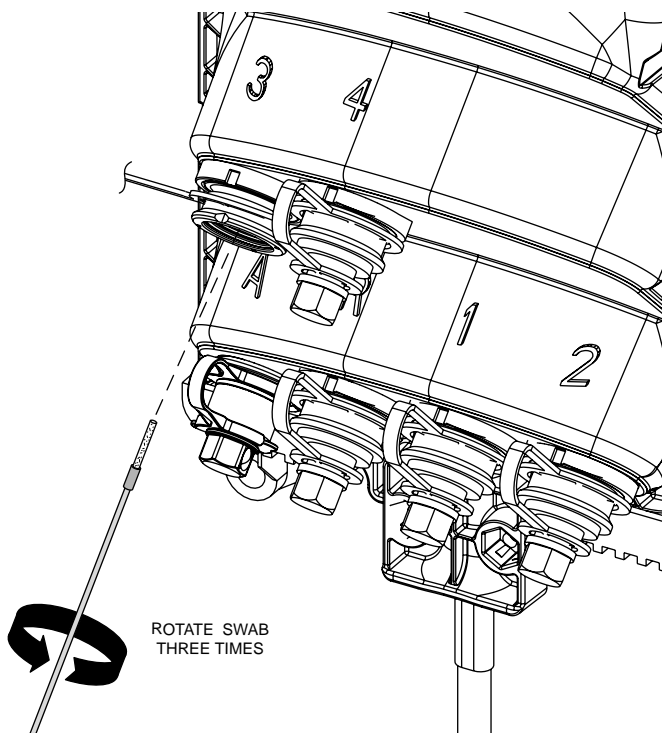
14.3.2.2. Locate the dry swabs that are provided with the connector/adapter cleaning kit.

14.3.2.3. Insert a dry swab into the adapter as shown below. **Note: Do not apply alcohol to the swab or the adapter.**

14.3.2.4. While applying light pressure against the connector end-face, rotate the dry swab 360° three times.

14.3.2.5. Dispose of the dry swab after use.

14.3.2.6. When connector end-face and adapter are clean, install the drop cable connector into the optical port.



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