OptoTest

Your Partner in Fiber Optic Test Solutions

TESTING MTP®/MPO ASSEMBLIES:

SETUPS, TROUBLESHOOTING & WHAT TO EXPECT

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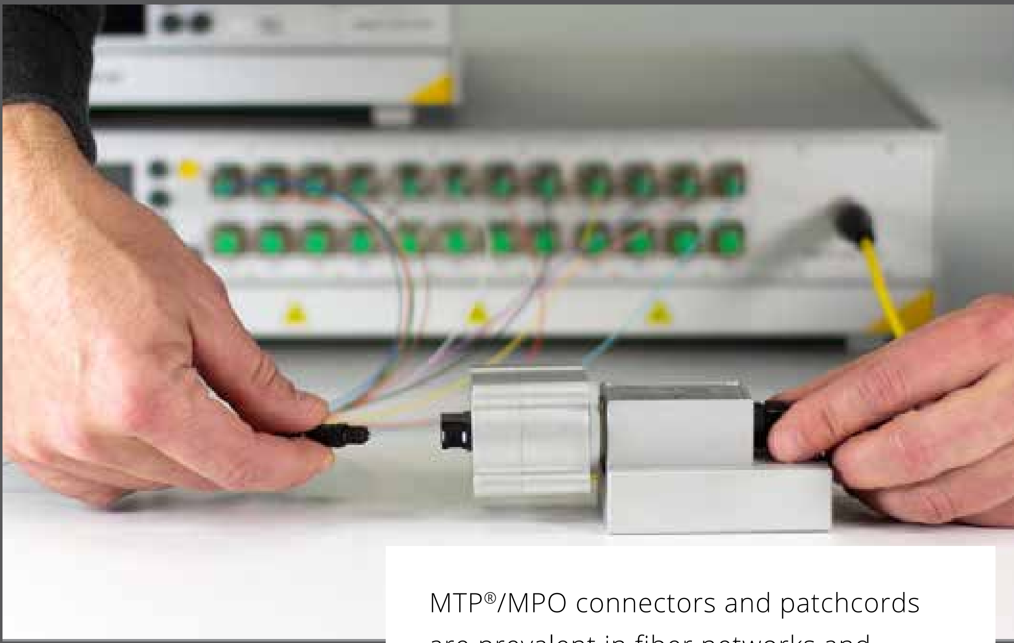
MTP®/MPO

online resources

OVERVIEW

TESTING MTP®/MPO ASSEMBLIES



MTP®/MPO connectors and patchcords are prevalent in fiber networks and their quantities continue to grow as demand for greater capacity and efficiency increases. These multifiber connectors present unique challenges when it comes to assessing their quality and performance. OptoTest is proud to present this complete guide to MTP®/MPO testing. In this guide, you will learn all there is to know about the different test methods, equipment options, troubleshooting, and best maintenance practices to ensure that you have the best testing experience.

CONTENT

TESTING MTP®/MPO ASSEMBLIES:
SETUPS, TROUBLESHOOTING & WHAT TO EXPECT

Return Loss Measurement Methods
- Why Use A Pulse-Based Method?

The two main methods to measure return loss (RL) on fiber optic cable assemblies are the continuous wave (CW) method and the OTDR pulse-based method. While the CWRL test equipment is less expensive than its pulse based courntерpart, it is more time consuming and requires more steps for testing MPO assemblies. With the CW method, to properly measure RL, it is necessary to reduce stray reflections caused by subsequent connectors and fiber contributions. This additional step typically means that insertion loss (IL) and RL must be measured as separate steps: one step with the device under test (DUT) connected to the OPM to measure IL and one step with the DUT mandrel wrapped or terminated to measure RL.

To reduce the additional reflections on a fiber optic cabling assembly, the operator can wrap the cable around a mandrel or press the open connector into a matching block. For bend-insensitive cabling, mandrel wrapping is not an option as the cable cannot be bent tight enough to reduce the stray reflections. Using a matching block is also not an ideal solution, especially for MTP®/MPO connectors. Matching blocks can collect debris if left exposed in a production environment, which can then transfer onto the connector and cause damage. For male (pinned) MTP®/MPO connectors, the pins will damage the block and the matching substance can adhere to the pins and prevent proper mating.

Figure 1 - Mandrel wrapping and using a matching block are not recommended for MTP®/MPO connectors.

- Why Use A Pulse-Based Method?

The pulse-based (OTDR) method of measuring RL allows the operator to measure IL and RL in the same test step. With a pulse-based measurement system there is no need to terminate the back connector in order to isolate the measurement to the front connector. The diagram below shows how the front connector is measured independently of the back connector.

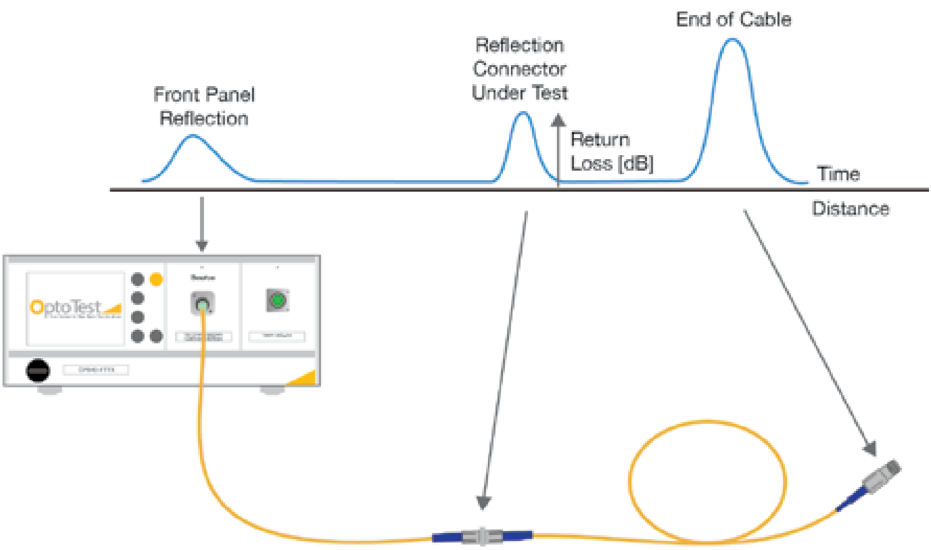


Figure 2 - OTDR method can measure the front connector independent of the back connector.

Automated Solutions

The MPO test process involves many different steps and generates a lot of data during referencing and measurement. For instance, a 12 fiber MPO assembly has 12 ports on each side for a total of 24 ports to test. The typical IL and RL test is performed at two separate wavelengths. That is 96 total measurements for the 12 fiber MPO assembly! A software package is highly recommended to automate the test process and manage all this data. The software guides the instrument and user through the referencing and measurement processes efficiently and stores data to ensure there are no errors and to generate reports.

For multifiber connectors such as MPO assemblies, it is beneficial to include an optical switch in the setup that has at least as many channels as the DUT has fibers. This allows the user to perform one connection of the DUT per test, which limits the amount of times it can be damaged. A simplex system would require the technician to perform many more connect/disconnects adding uncertainty and inaccuracy to the measurement.

A switch-based instrument setup coupled with automation software allows for easy testing and data management. The software guides the instrument from channel to channel, performs the corresponding measurements, and records them to the proper location.

OPL- CLX

Figure 3 - OptoTest offers a number of automation solutions ideal for multifiber testing.

Automated Solutions

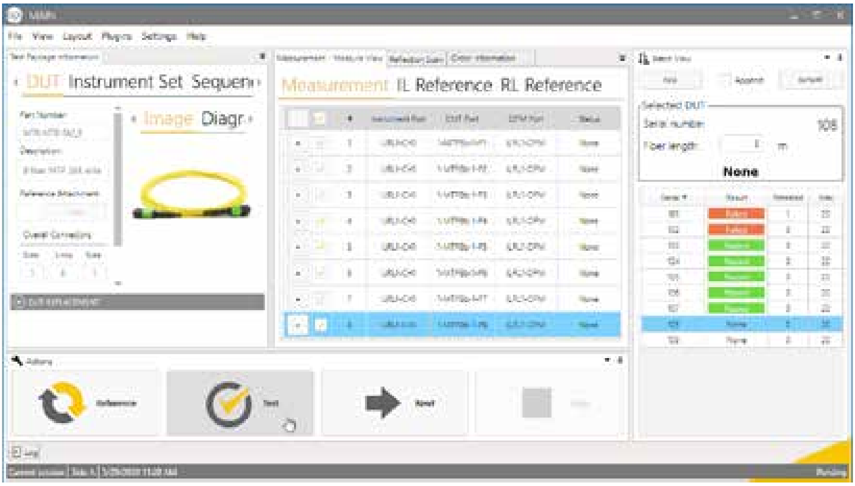


Figure 4 - OPL-CLX automates the MPO test process.

- Focus on switch-based multichannel testing
  - MPO testing just too difficult with a simplex setup
- Software package to automate the process
  - Automated from one channel to the next
  - Data management controlled by software and not the technician

Immediate and Future Needs

When investing in MPO test equipment, it is best to understand current needs and anticipate future needs of your cable production. Expanding the channel count capabilities of an existing system typically includes upgrade cost and opportunity cost as the equipment is unavailable for use during the upgrade. In addition, some equipment cannot be upgraded or the cost to do so is comparable to a new system. For instance, not every power meter capable of testing 12 fiber MPO connectors can do the job for 16 fiber connectors. When preparing a production floor to meet current and future needs, it is important to weigh the pros and cons of making a higher initial investment and the hidden costs of failing to do so.

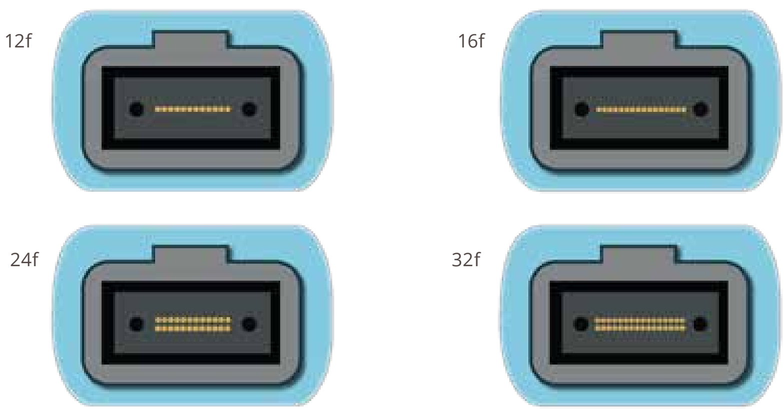


Figure 5 - 12, 16, 24 & 32F MPO Connectors.

- Prior to purchasing equipment, first, understand the immediate and future needs
- Expandability? If current requirement calls for 12f, is there a future need for 24, 16, 32, etc.?

Optical Power Meter

When selecting a system for testing MPO assemblies, one needs to pay careful attention to the optical power meter. Choosing the wrong OPM may reduce accuracy and limit expandability if it cannot accommodate larger channel counts. This is a problem with MPOs due to the spacing between the outermost fibers.

For 12/24 fiber MPOs this distance is 2.75mm and for 16/32 fibers it is 3.75mm. A detector that does not provide full coverage will not capture light from the outermost fibers, and a detector that works for the 12/24 fiber connector may not for 16/32 fibers (see figure 5).

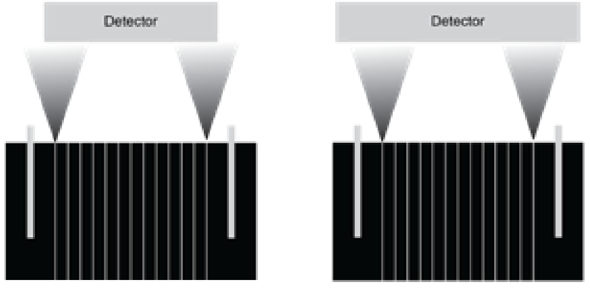


Figure 6 - 12/24 fibers with different size detectors.

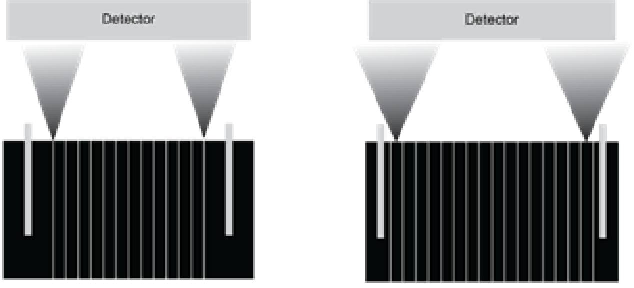


Figure 7 - The same detector captures light from 12/24 fibers but not 16/32.

Given the wide pitch of fibers in MPO assemblies, an integrating sphere with a large aperture or a large area detector (5mm or 10mm) is necessary. InGaAs is recommended for standard telcom wavelengths (1310, 1550, etc.). For 850nm only applications (OM2 and up) an inexpensive Silicon detector can be used.

OPM Form Factor

Remote Head Vs. Panel Mount Detector

There are two housings that a detector can come in. They come as either a remote head or a panel mount detector.

Panel mount detectors are mounted on the front panel of the instrument

- Requires the user to connect the back end of their test assembly to the panel of the instrument every time
- Sometimes this can be very cumbersome especially with rigid cabling

Figure 8 - Panel Mount Detector.

A **remote head detector** has the detector in a small semi-portable housing.

- Tethered to the instrument
- Allows for a wide range of movement
- For stiff assemblies or hard-to-route assemblies, the detector can be brought to the DUT

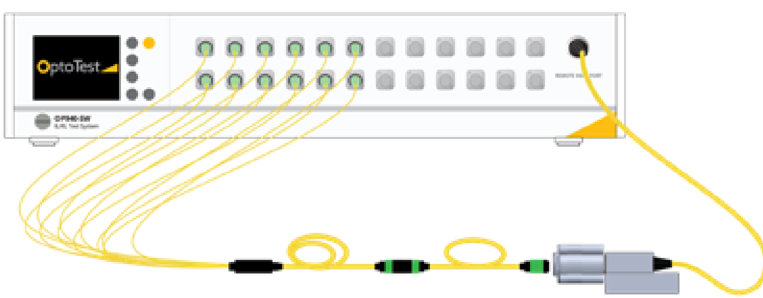


Figure 9 - Remote Head.

Creating a Multichannel ILRL System

- Method 1: Simplex ILRL System and External optical switch

There are three options to achieve a multichannel insertion loss and return loss test setup.

The first option for a multichannel IL and RL test setup is pairing a single channel ILRL meter with an external switch to increase the channel count (Figure 9). Multiple switches can increase channel counts further by cascading (Figure 10). It is important to note that these setups can lead to a crowded work space due to the volume of equipment and cables required. Optical switches are also not accounted for during the standard calibration of the ILRL meter which can impact the test accuracy.

Pros:

- Expandable by adding more switches (figure 10)
- The ILRL meter can function alone for simplex testing and pair with the switch for MPO testing.

Cons:

- Complicated setup
- Possibly affects calibration due to additional external losses in the switch

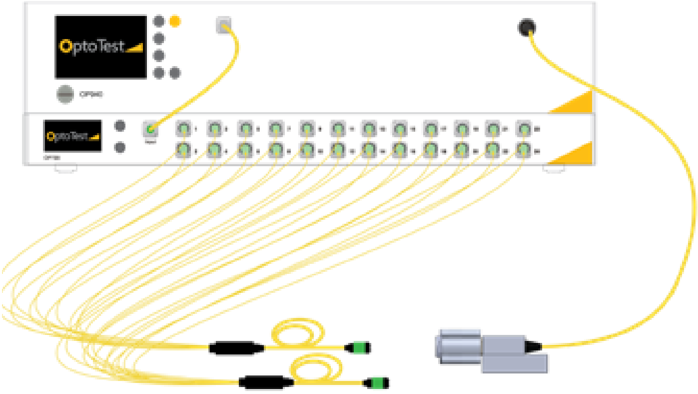


Figure 10 - 24 Channel ILRL System with a Simplex OP940 cascaded through a 24Ch switch.

- Method 1: Continued

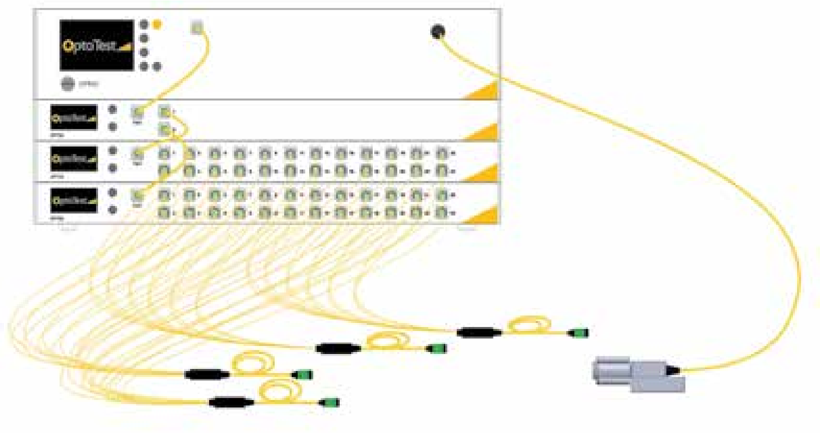


Figure 11 - 48 Channel test setup using a 1x2 switch cascaded through two 1x24 switches.

- Method 2:   ILRL System with Internal Switch

The second method is a multichannel ILRL meter, combining the elements of the first method in one machine. The all-in-one system allows for a simplified test setup with a smaller footprint than a multi-unit setup requires. Since the optical switch is integrated into the system, the added loss is accounted for during calibration. On the other hand, this also makes the use of external switches for expandability more complicated.

Figure 12 - 24 Channel all-in-one ILRL test set.

Pros:

- All-in-one
- Easier to manage
- Optical switch is included in the unit calibration

Cons:

- Adding external switches makes the setup more complicated

Method 3: Compact Dedicated MTP® Test System

The third system is a compact, dedicated MPO test system. This option is great if the system will be used for MPO assembly testing only. The OP940-CSW has a compact footprint, and the MTP® connector at the front panel makes cable management minimal by eliminating the need for fanout cables. However, expandability is difficult since an external switch cannot be cascaded. This system is also the least flexible with no single fiber connectors for more varied applications.

Figure 13 - CSW compact MPO test setup.

Pros:

- Small footprint
- Simple cabling

Cons:

- Expandability is difficult
- Not optimized for simplex testing
- Fanouts are complicated with such a set

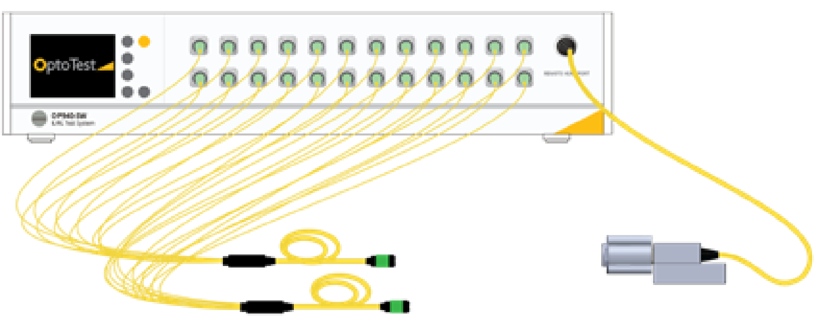
Reference Cord Setups

- Equipment cord:

When setting up an MPO testing station, pay careful attention to the reference cord setup.

An equipment cord connects directly to the instrument and is intended to not be replaced often. It is typically a fanout cord that combines simplex connectors into a single MPO connector. These cables are relatively expensive and as such should be treated with care.

- Typically, a fanout type cord to take multiple simplex connectors and route into a single MTP®
- Expensive assembly and difficult to replace
- Stays attached to equipment



Equipment cord

Figure 14 - 12f fanout cords connected to a 24 channel ILRL test set.

Reference cord setups
- Launch Cord:

A launch cord interfaces directly with the DUT. It is connected to the MPO connector of the equipment cord via a mating adapter. The open connector of the launch cord will be mated to the DUT. This open connector is considered the reference connector and as such should be maintained and cleaned routinely.

Note, for typical MPO assembly test setups it is recommended to keep all equipment and launch cords as type A cords as well as all mating adapters should be type A. Type A mating adapters are key up to key down and are typically black in color. Gray adapters are typically B type adapters. Using a type A setup maintains 1 to 1 mapping, which keeps maintaining results simple.

Intermediate connections such as the connection between the equipment cord and launch cord need to have low insertion loss and high return loss. This maintains a high level of accuracy on the DUT measurements. When connecting the launch cord to the equipment cord, the IL and RL should be verified. Not verifying this connection could result in inaccurate measurements.

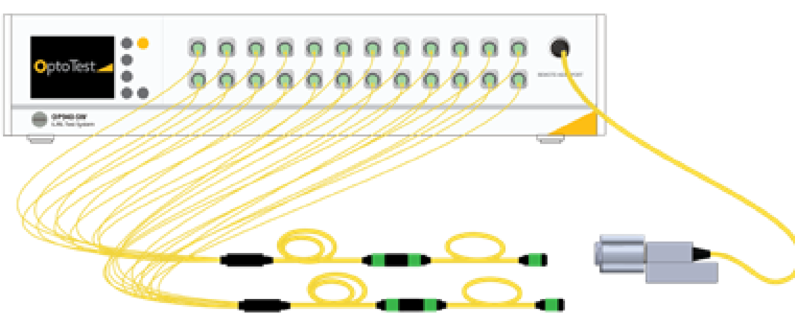


Figure 15 - two launch cords connected to the equipment cords of a system.

12 and 24 Fiber Setups

When using the same test setup for testing both single and dual row MPOs, such as 12 vs 24 fiber, we recommend using two fanout cords as the equipment cords. This allows for easy transitioning between single row testing and dual row testing.

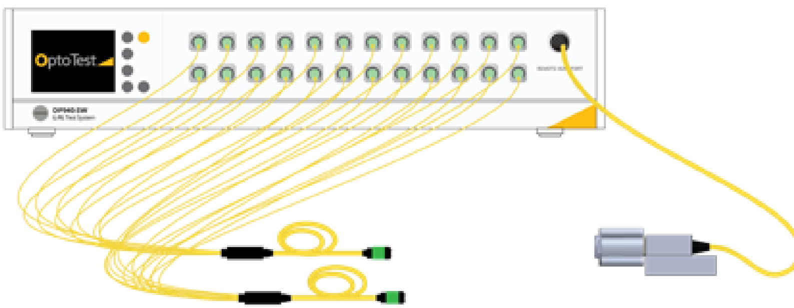


Figure 16 - Two 12f equipment cord connected to a 24 channel OP940.

- Use two 12f fanout cords to allow for easy transitions between 12 and 24f testing.

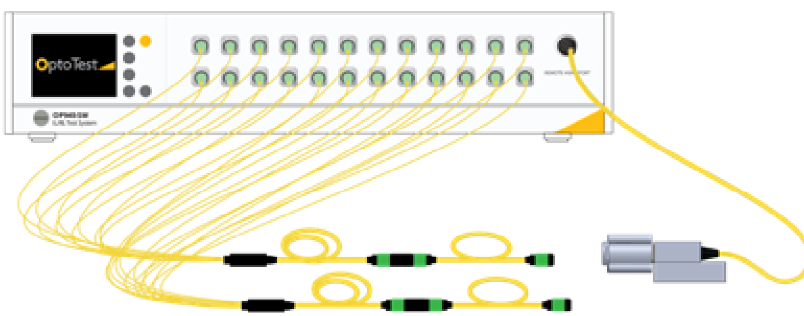


Figure 17 - Two 12f launch cords connected to the 2 12f equipment cords.

- For single row assembly testing, attach a single row launch cord to the equipment cord.

12 and 24 Fiber Setups

For dual row connectors (24 or 32) use a secondary fanout cord to convert from two single row connectors to 1 dual row connector. This cable enables the ability to test dual row cable assemblies. Figure 18 shows an example of a 24f setup employing 2 12f MPOs to 1 24f MPO.

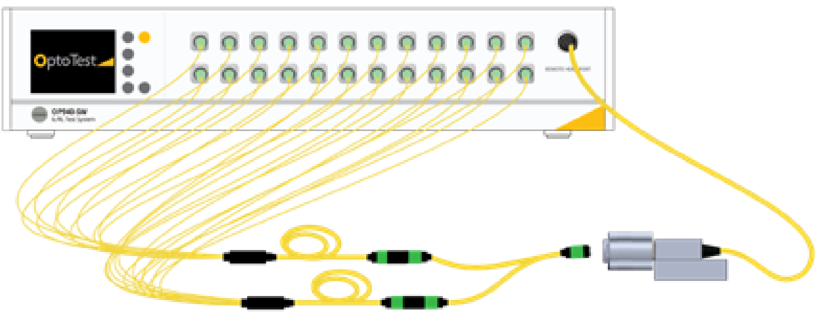


Figure 18 - A dual 12f fanout to single 24f cable is connected to the equipment cords.

- For dual row assembly testing, use a fanout that has two single row connectors combined into 1 dual row connectors.

LAUNCH/REFERENCE CORDS

When setting up the testing space, use reference cords that match your requirements. There are space constraints as well as handling requirements. Your reference cords need to be able to withstand normal handling practices in the manufacturing environment.

A jacketed cord is rugged and durable, but does not allow for easy gender changing. A bare ribbon cord allows for easy gender swapping, but it is fragile and the binding material can break causing the cable to fray. An MTP® Pro cord is the best of both worlds. It allows for gender swapping and it is rugged and able to withstand rough handling.

Jacketed cord

- Rugged and durable
- Gender not changeable

Bare ribbon cord

- Easily change gender
- Ribbon fiber fragile so needs to be handled accordingly

MTP® Pro cord

- Rugged and durable
- Gender swappable
- **Best of both worlds**

Figure 19 - Pictured is a gender-swapping tool for MPO assemblies. This tool is best used on ribbon fiber.

LAUNCH/REFERENCE CORDS

Multimode 50µm Reference Cables

Multimode reference cords throughout, should be constructed of non bend insensitive fiber (Non-BIMMF). Non bend insensitive fiber allows for launch conditions to be better maintained as the light passes through intermediate connections. This is ideal for encircled flux compliance.

OptoTest can supply reference cords built from non-bimmf reference grade 50µm fiber. This fiber has a controlled core of +/-1µm. The controlled core helps to maintain the encircled flux compliance launch through connections. When testing with encircled compliance launch OptoTest believes non-bend insensitive fiber is a must to maintain compliance.

As the source travels through fiber optic connections, the launch conditions can be altered. To maintain the launch, such as an encircled flux compliant launch, high quality connectors should be used on the equipment cords, and launch cord matings.

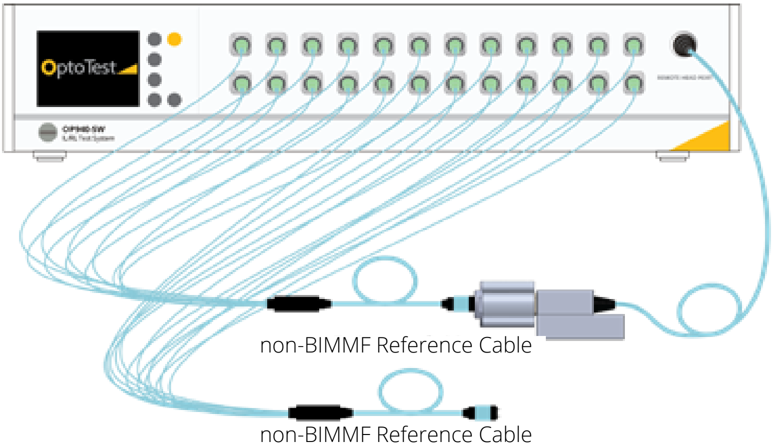


Figure 20 - Non-BIMMF fiber helps to maintain launch conditions when testing MM fiber.

- Cords should be non bend insensitive hroughout: equipment cord, launch cord, etc.
- IEC allows for using both BIMMF and non-BIMMF launch cords
- OptoTest believes non-BIMMF launch cords are necessary to obtain accurate EF compliant measurements and OptoTest can supply such launch cords
- Encircled Flux must be maintained through connections

Insertion Loss Reference Method

An insertion loss reference records the powers of each port in the launch cord. These powers will be used to calculate insertion loss during the measurement process.

	1310	1550
1	-2.15	-2.35
2	-2.01	-2.35
3	-2.00	-2.07
4	-1.95	-2.17
5	-2.05	-2.09
6	-1.99	-2.10
7	-2.20	-2.25
8	-2.11	-2.18
9	-2.07	-2.12
10	-1.99	-2.04
11	-1.90	-1.99
12	-2.02	-2.13

Figure 21 - Sample IL reference values for a single mode system.

- A reference is taking a baseline optical power measurement for each channel and each source wavelength
  - For a 12f dual wavelength test there will be 24 optical power measurements stored for the reference
  - These will be used to calculate insertion loss

Return Loss Reference Method

An RL reference with OptoTest equipment is done using the pulse-based method to find the location where the RL will be measured. This is usually at the position of the reference connector.

A pulse is sent out to find the open connector of the launch cord and light reflects back towards the source from this open connector. Based on the magnitude of the returned pulse and the time it takes to return, the location and the reflection size are determined. In the example below, the reflection is at 3.0m as measured from the front panel. Because this is a flat connector, the reflection is about 14.7dB.

Single mode MPO connectors are typically angled and as such have a small, undefined reflection value. Angled open connectors can have a range of values from the mid 50dBs to high 70dBs depending on the polishing process. The undefined nature of this reflection presents challenges when referencing RL. One way to address this is to use a short APC to open PC reflector stub to introduce a defined reflection during the referencing process. This stub would only be used for RL referencing on angled assemblies and would be removed for IL referencing and when measuring DUTs.

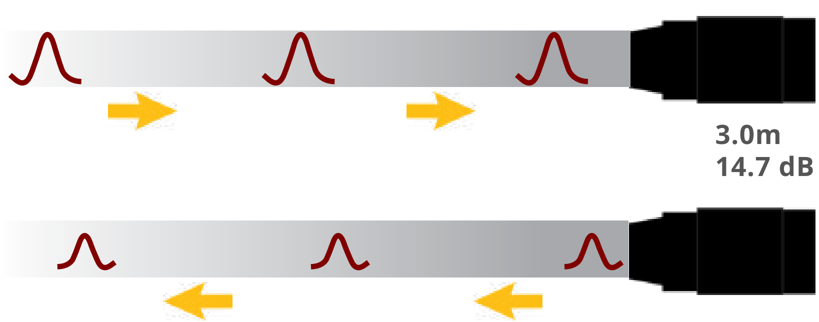


Figure 22 - Pulse-based method for Return Loss referencing and Measurement.

General Rules for Referencing

- For IL referencing always re-reference when the cabling setup changes
  - If the launch cord is exchanged
  - Equipment cord needs to be replaced
- Develop a schedule for referencing
  - Sources drift slightly with temperature and time
  - This may affect the insertion loss reference
  - It is common to re-reference a setup once every hour or two even when the setup has not changed
- The same rules apply for RL referencing
  - When the length of the reference setup changes re-reference RL
  - Need to find the new position
- If nothing changes with the cabling setup, it isn't necessary to re-reference return loss at the same frequency as an insertion loss reference
- SM MPO connectors are typically angled and have a low, undefined reflection value.
  - Suggest a short APC to PC MPO cable for a well-defined reflection
- System needs to zero out insertion loss along the length of cable up to the point where the return loss will be measured

Cleaning and Inspection Guidance

There should be clear guidance for cleaning and inspection for technicians working on an MPO assembly line. Due to MPO assemblies possibly having male pins, it is necessary to use dedicated MTP®/MPO cleaning tools. These help to protect the various features of the MPO endface.

When it is difficult to remove debris, using some alcohol can loosen the debris so that it can be wiped away.

The guide pins and guide pin holes are essential to a properly mated MPO connection. These should be routinely cleaned on the reference connector. This can be done with compressed air or a dental brush.

Figure 23 - Cleaning tools help ensure the performance and longevity of optical connectors.

Cleaning and Inspection Guidance

Cleaning an end face does not guarantee that all the contaminants are removed, so connectors should be inspected before and after cleaning to prevent damage when mating. Contaminants on one connector can transfer to another, so both the reference cord connector and DUT connector should be inspected, cleaned, and inspected again prior to mating.

Since cleaning and inspection is a pain point for many technicians, choose tools that make the process simple and smooth. Some inspection scopes require the user to iterate through each fiber on the MPO connector. This is time consuming and painful. Instead, use tools that can inspect all fibers at once. The manta W+ system from Sumix can see all fibers at once, up to 96. It has a wide field of view allowing the user to see all 16f of a single row of a 16f ferrule.

- Develop clear guidance for cleaning and inspection for your technicians
  - Inspect the DUT every time it is connected to the reference connector
  - Always inspect the reference connector to reduce damage
  - Assume that if a connector has dust and contamination then the connector it was mated to, also has contamination

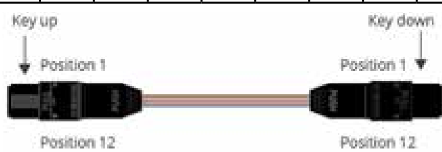
- Make the inspection process simple and smooth for your technician
  - Inspect all fibers at once
  - Manta W+ system
  - Can see up to 96 fibers
  - All 16f in a row

How Fibers are Routed

Polarity describes how fibers are routed from one side of the DUT to the opposite side. For MPO assemblies there are 3 main types:

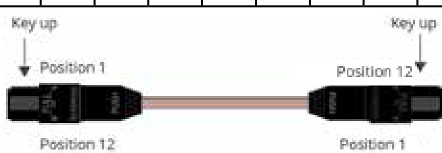
1. Type A

Near / Far End	Fiber sequence (viewing the array connector plug end-face with key up)											
Near	1	2	3	4	5	6	7	8	9	10	11	12
Far	1	2	3	4	5	6	7	8	9	10	11	12



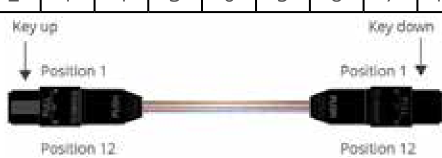
2. Type B

Near / Far End	Fiber sequence (viewing the array connector plug end-face with key up)											
Near	1	2	3	4	5	6	7	8	9	10	11	12
Far	12	11	10	9	8	7	6	5	4	3	2	1



3. Type C

Near / Far End	Fiber sequence (viewing the array connector plug end-face with key up)											
Near	1	2	3	4	5	6	7	8	9	10	11	12
Far	2	1	4	3	6	5	8	7	10	9	12	11



When testing MPO assemblies, one must be cognizant of the polarity types being mated. One of the most common errors is a type A to type B mating error. This is a simple mistake to make by inserting the ferrule into the housing upside down.

MEASUREMENT PROCESS
– POLARITY VERIFICATION

- Prior to testing an MPO assembly for IL and RL, it is advisable to **verify polarity first**
  - A standard large area detector or integrating sphere cannot differentiate polarity
  - This should be a quick scan of the assembly
  - The OP415 can scan 24 fibers within one second
  - Most common polarities are **Type A (key up-key down), Type B (key up – key up)**
  - **TIA TSB-5069** gives guidance on polarity and various components that affect polarity in a system

Figure 24 - OP415 Polarity Analyzer.

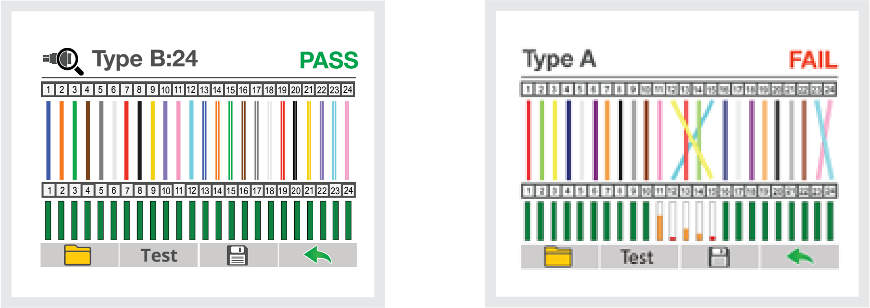
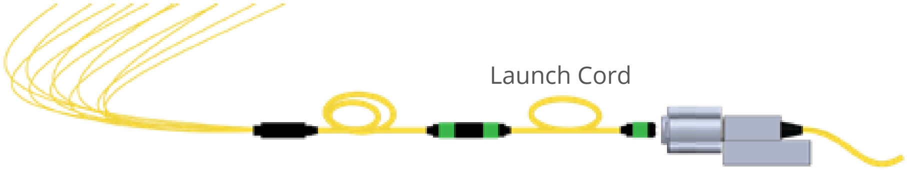


Figure 25 - Passing and Failing Polarity Verification on the OP415.

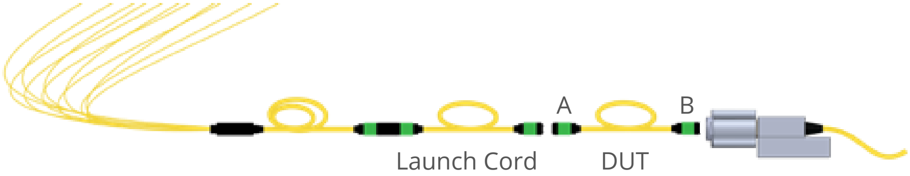
MEASUREMENT PROCESS
– INSERTION & RETURN LOSS

Basic Measurement process for MPO to MPO assemblies
(standard one-sided method TIA-455-171B, Method D or Method C2 of IEC 61300-3-4)

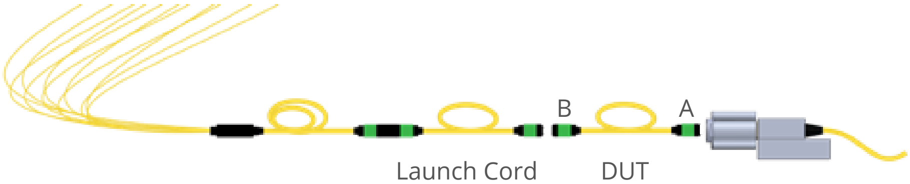
- To reference connect launch cord to OPM
  - References powers for all ports



- Connect side **A** of DUT to launch cord and side **B** to OPM
  - Measures IL and RL on side **A** connector



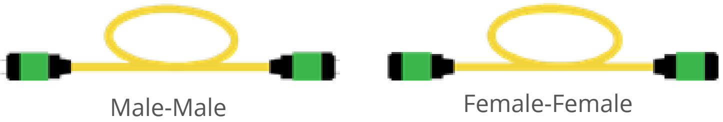
- Connect side **B** of DUT to launch cord and side **A** to OPM
  - Measures IL and RL on side **B** connector



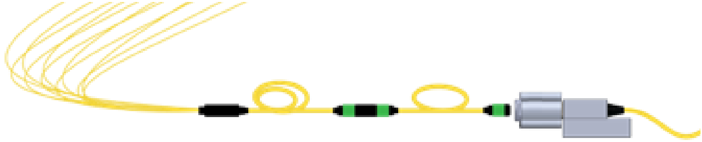
Dealing with Gender

Gender on MPO cables can be difficult to manage. Mating connectors of the same gender can damage connectors (male to male mating) or may result in poor alignment (female to female mating)

- When testing assemblies with "like" gender on each side: male-male or female-female, a single gendered launch cord can be used.



Example: Testing male-male MPO assemblies
To reference: Connect the launch cord to the OPM (female connector)



To measure: Connect side A to the launch cord and side B to the OPM. This measures IL and RL on Side A. To measure side B for IL and RL, flip the cable and connect side B to the launch cord and side A to the OPM.

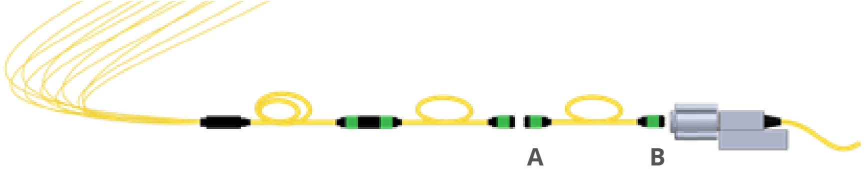


Figure 26 - IL & RL for Side A.

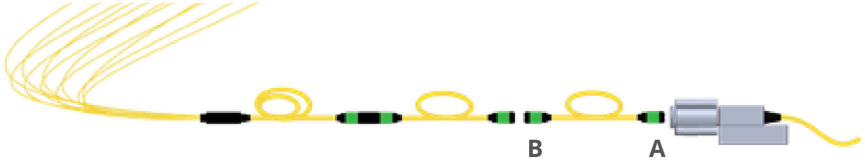


Figure 27 - IL & RL for Side B.

MEASUREMENT PROCESS
– INSERTION & RETURN LOSS

- When an assembly has unlike genders, male-female, there are a few options:
  - If twice the channels are available, have two breakouts setup, one with a male connector and the second with a female connector
  - All male connectors of the DUT will be tested against the female breakout and all female connectors will be tested against the male breakout

The referencing process occurs in two steps:

First, launch cord 1 is connected to the OPM and a reference is performed.

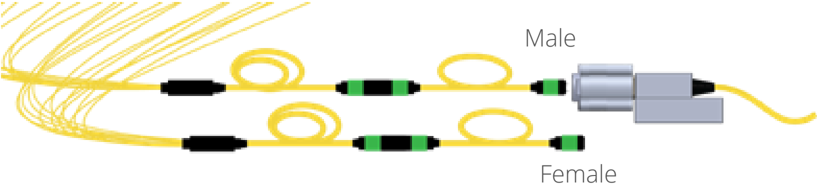


Figure 28 - Reference male launch cord.

Second, launch cord 2 is connected to the OPM and a reference is performed

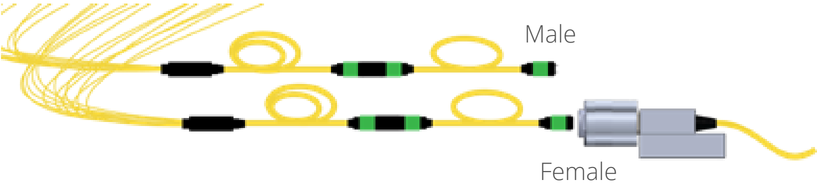


Figure 29 - Reference female launch cord.

Measuring the DUT

To measure IL and RL on each connector, the proper gendered connector of the DUT needs to mate to the corresponding launch cord.

The measurement process occurs in two steps:
Side A of the DUT is connected to launch cord 1 with corresponding gender

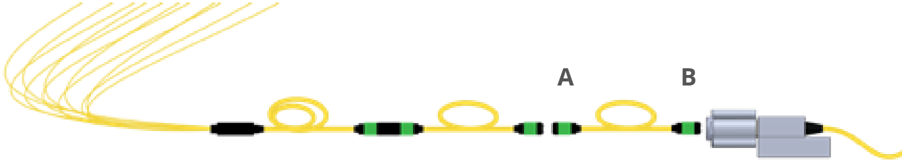


Figure 30 - Side A is tested against the correctly gendered launch cord.

Side B of the DUT is connected to launch cord 2 with the corresponding gender

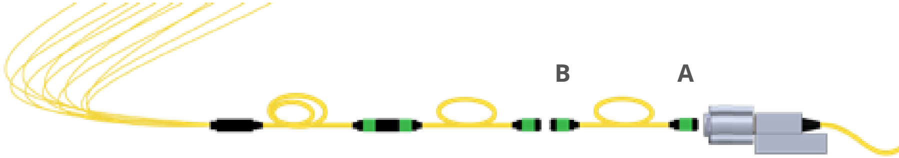


Figure 31 - Side B is tested on the second breakout cable corresponding to its gender.

Dealing with Gender

- When an assembly has unlike genders, male-female, but the instrument set does not have enough ports to accommodate multiple launch cords, there are a few options:
  - Test all sides of DUTs that have same gender, then exchange the launch cord, swap genders, etc. and test the other side of the DUTs

To reference: Connect the launch cord to the OPM.

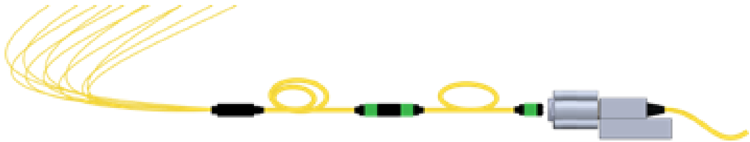


Figure 32 - Male-gender launch cord mated to OPM for reference.

To measure: Connect the DUT side with appropriate gender, for example female, to the launch cord, which in this example would be a male connector, and the opposite side to the OPM. In this case, after testing side A do not flip the cable and test side B. The side B gender (male) can not mate to the launch cord. It is best to continue testing the "side A's" of the DUTs until all have been tested. These are the sides that match the appropriate gender of the launch cable.

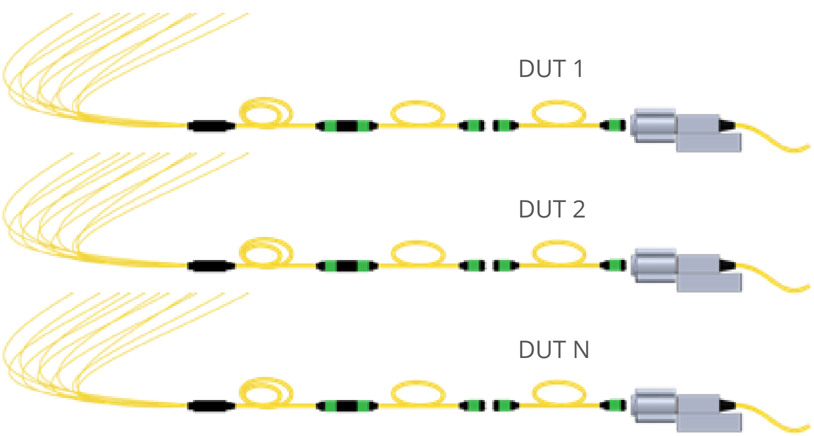


Figure 33 - Female-gender connector of the DUTs (side A) is mated to the launch cord and tested first.

Dealing with Gender

Once, all "side A's" have been tested, replace the launch cord with a launch cord of the appropriate gender to interface with side B, which, since side B is male in this example, the cord would need to have a female interface. (Note: When exchanging this cord, it is a good practice to verify a "quality" connection between the equipment cord and new launch cord.)

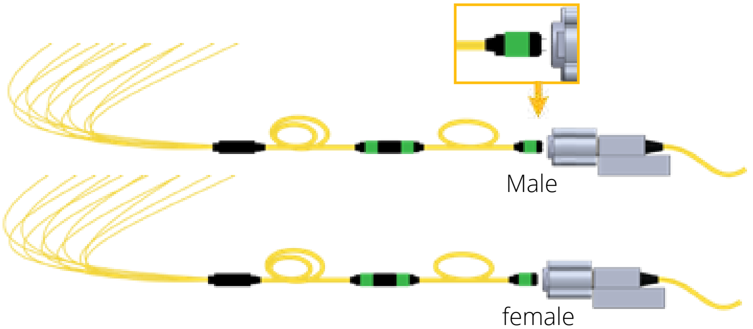


Figure 34 - The male-launch cord is swapped out for a female-launch cord. This allows us to test side B.

When the female launch cord is connected, the system needs to be re-referenced.
Once re-referenced, test all side B's of the DUTs. At this point both ends of all the DUTs have been tested.

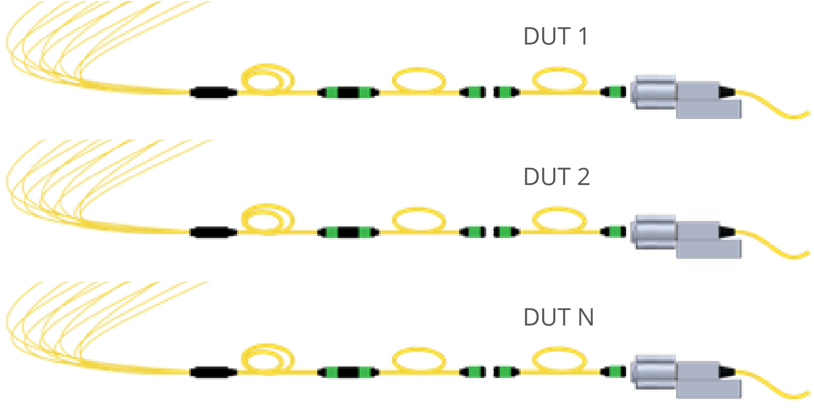


Figure 35 - The male-gender connector of the DUTs (side B) are tested using the female launch cord.

Unidirectional Method

The previous methods show one standard way for testing fiber optic patchcords. Another method is typically referred to as the unidirectional method.

Measuring insertion loss and return loss in a unidirectional manner

- The unidirectional method
  - This is referred to as “unidirectional” because the IL and RL are measured from one side
  - There is no flipping the DUT
  - Performs an IL measurement across the entire assembly
  - Gives return loss measurements for each connector

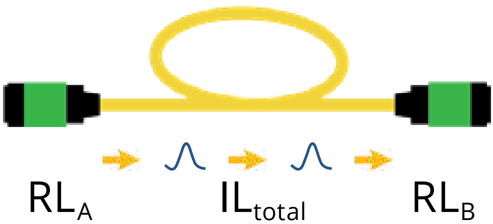


Figure 36 - The unidirectional test method produces total IL and connector-level RL results.

Unidirectional Method
- Cable Setup and Process

The cable setup for the unidirectional method is fairly simple. The reference process is similar to the standard one-side test method. The power is referenced across all fibers and the position of the launch cord's reference connector is found. This only gives the position of the front connector of the DUT. In this method we also want to measure RL on the second connector, so this position needs to be known as well.

The measurement is performed by connecting the DUT to the launch cord and then connecting a receive cord on the back end of the DUT. The receive cord is then connected to the OPM. The IL is measured through the entire link, the return loss is measured on the front side of the DUT. To measure RL on the back side of the DUT, the DUT length either needs to be known, or the RL instrument needs to perform a scan to find the back end of the DUT.

In this method the DUT has two connections, one to the launch cord and one to the receive cord. Both of these connections have insertion loss.

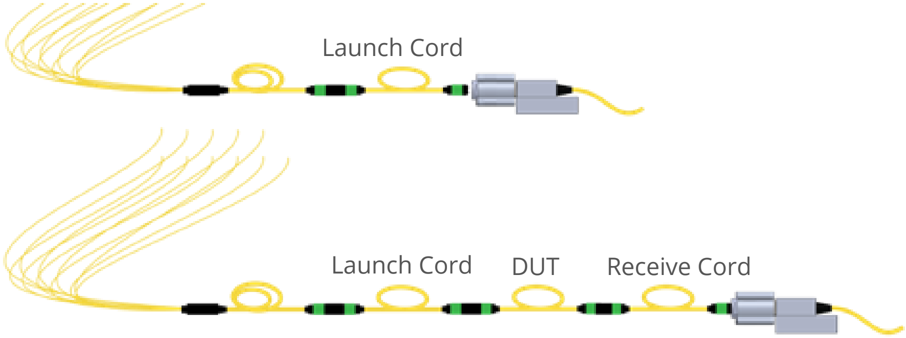


Figure 37 - The use of both a launch cord and a receive cord make the unidirectional test method possible.

Pros:

- Gives all measurements without needing to flip the cable

Cons:

- IL measurements of each connector aren't independent of each other
- If an assembly fails for IL, it is not directly known which connector is failing
- Need further single sided testing for troubleshooting

Unidirectional Method
- vs Standard One-sided Method

Each test method yields a different set of results

Comparing results:

- Standard method yields 4 results per fiber optic link
  - IL_A
  - IL_B
  - RL_A
  - RL_B

Figure 38 - The standard method yields connector-level results for IL and RL.

- Unidirectional yields 3 results per link
  - IL_{total} (This is a combination of IL_A and IL_B)
  - RL_A
  - RL_B

Figure 39 - The unidirectional method yields connector-level RL and throughput IL results.

Fanouts

Fanout cables require a more complicated test process, similar to testing hybrid simplex cables. This process usually requires a lot of cable movement and OPM adapter changes due to the different connector types.

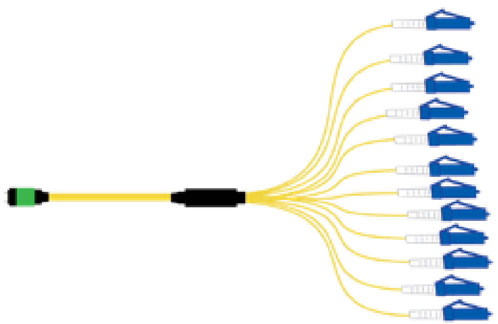


Figure 40 - 12-channel fanout cable with an APC polish MPO connector fanning out to 12 simplex LC-PC connectors.

- Fanouts require a difficult testing process similar to simplex hybrid DUTs
- An MPO launch cord and simplex launch cord are necessary

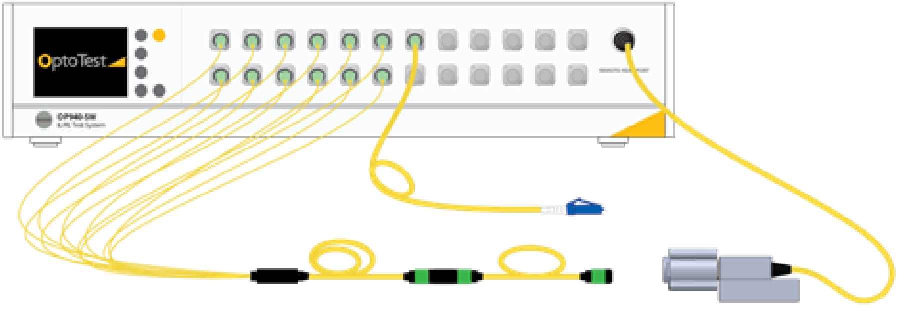


Figure 41 - Recommended launch cable setup for testing the fanout shown in Figure 40.

Fanouts
– Reference Process

The referencing process requires two steps:

First, connect the MPO to the OPM port and reference the MPO channels. Second, connect the simplex launch cord to the OPM port and reference the simplex port. (Note: one needs to change the OPM adapter from an MPO adapter to a simplex LC adapter for this step)

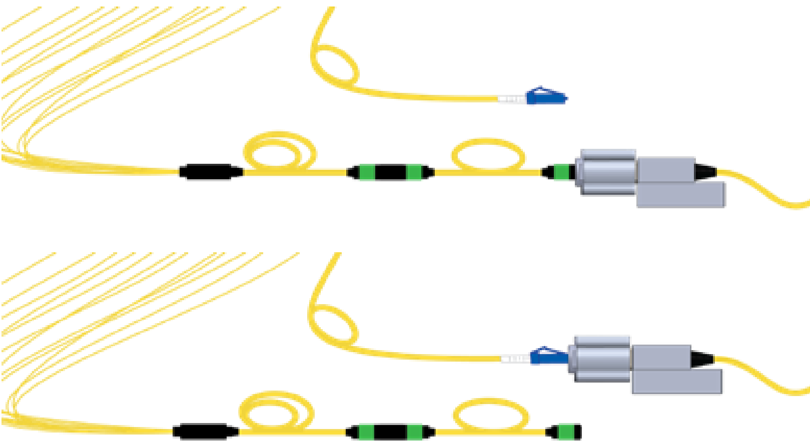


Figure 42 - The MPO and simplex reference steps for fanout testing.

Fanouts
Measurement MPO Side

The measurement process requires the user to manually step through each channel.

First, to test the MPO side of the DUT, connect the launch cord to the MPO connector of the DUT and then connect Ch1 of the fanout to the OPM. Continue this process for all channels.

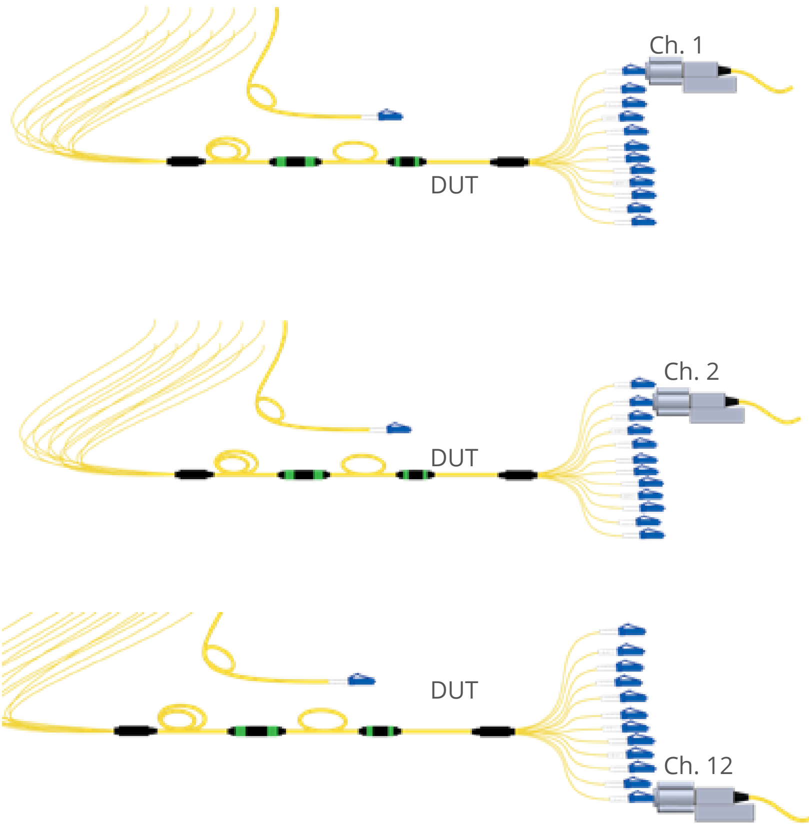


Figure 43 - Step through the simplex connectors to test each port of the MPO side of the fanout DUT.

Fanouts
– Measurement Simplex Side

Second, to test the simplex connectors of the DUT, connect the simplex launch cord to Ch1 on the fanout side of the DUT and then connect the MPO connector of the DUT to the OPM. (Note: This requires changing the OPM adapter.) Continue this process for all simplex channels.

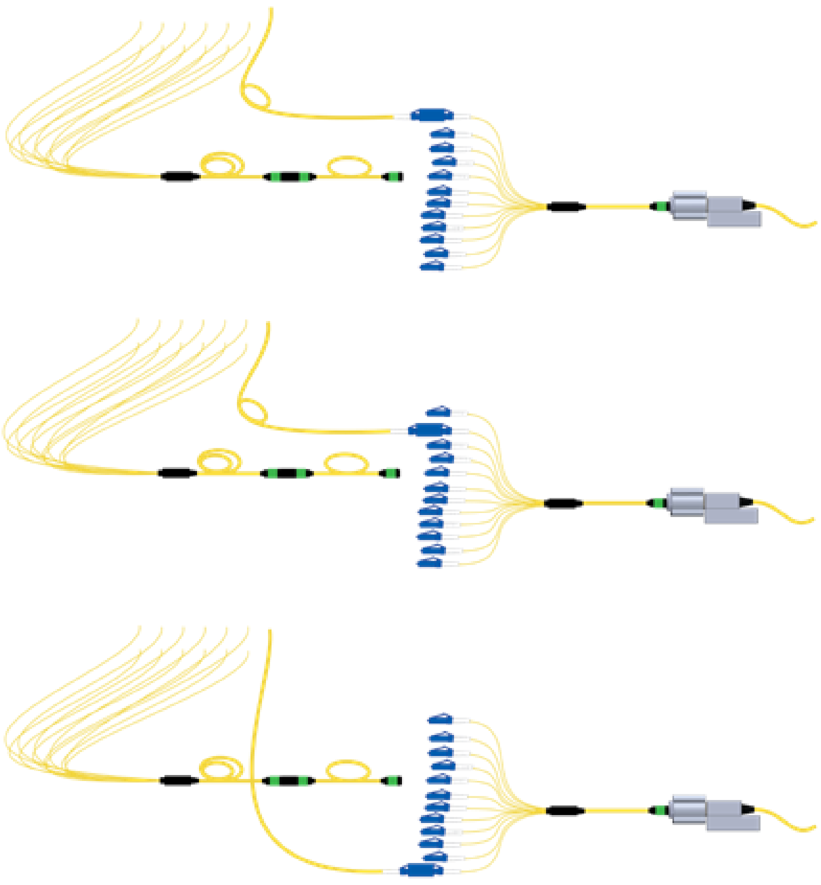


Figure 44 - Connect the simplex connectors to the launch cord one by one to test each simplex connector of the DUT.

Fanouts

The unidirectional method can also be used to test fanout DUTs. The result is a simpler test setup with less moving parts.

Reference setup

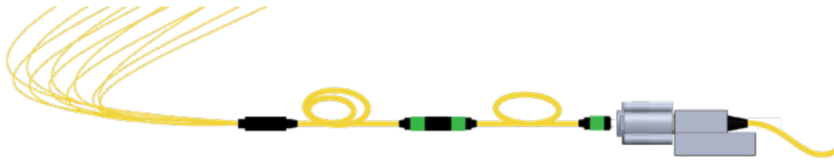


Figure 45 - The launch cord is mated to the OPM for the reference step.

Measurement setup

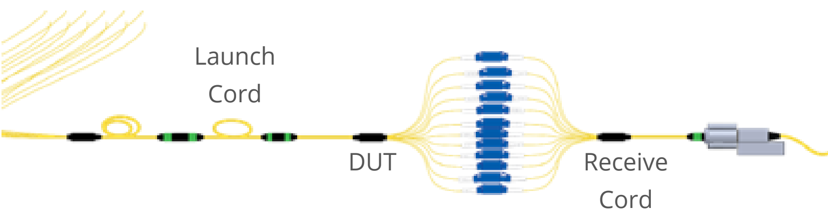


Figure 46 - Another fanout cable is used as a receive cable for the unidirectional test method.

Troubleshooting

Help! My RL is always reporting at less than 20dB for my multimode MPO cables.

MPO cables that have been used frequently can buildup contamination. This contamination can be stuck in the guide pin holes or at the base of guide pins of the reference connector on the launch cord. This contamination may be outside the field of view of the inspection scope.

If MPO measurements are consistently measuring below 20dB for MM, this might be a cause. Clean the base of the guide pins and guide pin holes of the reference connector and DUT. Contact your connector or cable vendor for the best methods to do this.

Note: For SM assemblies, return loss values in the mid 50dBs to low 60dBs might be a result of poor fiber contact from contamination on the ferrule or guide pin area. Cleaning the guide pins and/or guide pin holes may fix this issue.

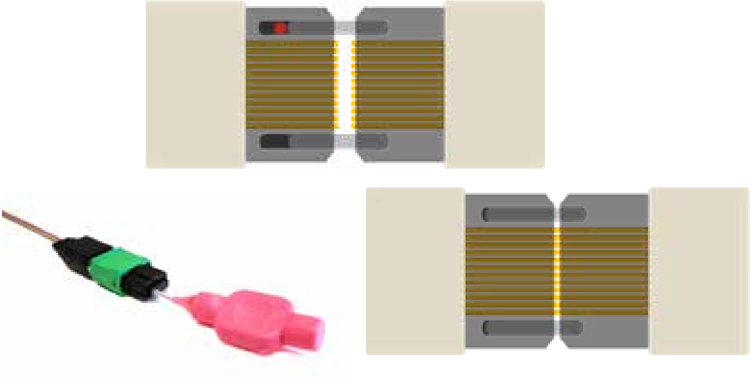


Figure 47 - Dirt can impede proper mating of connectors.

Troubleshooting

Help! My RL is always reporting at less than 20dB for my multimode MPO cables.

Another potential cause of this issue is core dips. Core dips can cause an air gap between the two cores when mating and large core dips can cause lower RL. For the reference cord, it is best to keep core dips low. OptoTest suggests core dips <30nm.

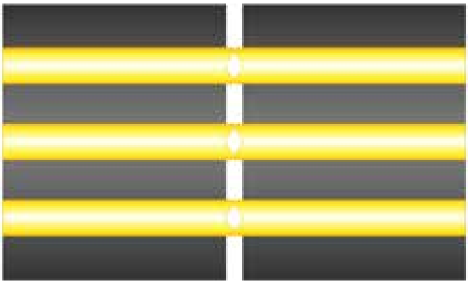


Figure 48 - Core dips prevent the cores from physically mating when two connectors are mated to each other.

General Rules

- When failures occur during MPO assembly testing, it is best to retest the entire connector after rework is done. If fibers that previously tested well suddenly fail, this could indicate a mating or cleanliness issue in the setup.

- Mating adapters can get dirty too. The dust and debris in mating adapters can dislodge and land on the end face of connectors. If the technician cleans both connectors being mated but dirt continues to be present, this may be the cause.

  - Routinely clean mating adapters. This can be done with compressed air or placing the mating adapters in an ultrasonic bath.

- OPM adapters can also get dirty. This dirt can transfer onto the DUT or the launch cord connector. Dirt on the OPM adapter can also impede light exiting the mated fiber from reaching the detector properly, causing unreliable power measurements that affect IL results. Contact your equipment vendor for best methods to clean OPM adapters.

Notes

For Application Notes, more detailed Testing Instructions, and the most up-to-date OptoTest News go to ***www.optobuzz.com***

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