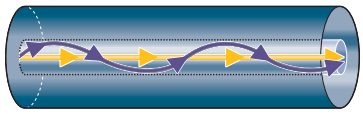
FLUKE networks™

Wrap Your Fiber for Better Measurements: Advantages of Using Fiber Mandrels

Multimode fiber mandrels offer a simple, cost effective way to improve repeatability and consistency of multimode optical loss/power testing. Per TIA/EIA-568-B, a mandrel is used when testing multimode power loss in the field with an LED source. A key advantage of fiber mandrels is that they allow the use of economical overfilled LED light sources to certify both 50 µm and 62.5 µm fiber links for current and planned high bit rate applications including Gigabit Ethernet and 10 Gigabit Ethernet.

High-order vs. low-order modes

A characteristic of multimode fiber is the simultaneous transmission of light along multiple modes, or paths. Some of these modes are located near the center of the fiber core while other modes are closer to the cladding interface. The innermost "low-order" modes are relatively stable as compared to the "high-order" modes.



High-order modes are susceptible to extinction due to fiber bending, connections and normal transmission. This multimode fiber characteristic has implications with regards to fiber testing. To achieve repeatable, consistent optical power measurements, it is desirable to use a light source that excites only the relatively stable low-order modes of the fiber under test.

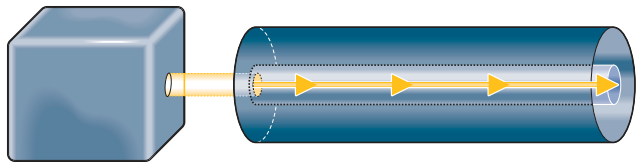
To obtain a low-order mode launch you can either use:

- An optical source that excites only low-order modes
- An optical source that excites all modes and an exterior conditioning cable that removes the unwanted high-order modes

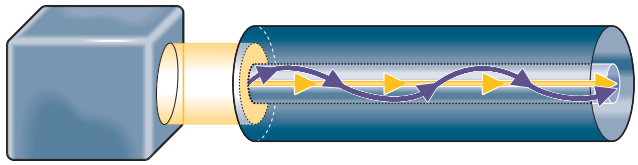
Source selection and conditioning affects mode excitement

The light emitted from a VCSEL source is concentrated within a small spot located near the center of the fiber core, exciting only low-order modes. VCSELs emitting at 850nm are common, especially since the introduction of Gigabit fiber networks. An LED source emits light over an area that is larger than the typical multimode fiber core. When the core is "overfilled" with light from an LED, both low and high-order modes are excited. You can alter the launch condition by adding a special conditioning cable to the LED source. The conditioning cable removes the unwanted high-order modes so only low-order modes are launched into the fiber under test.

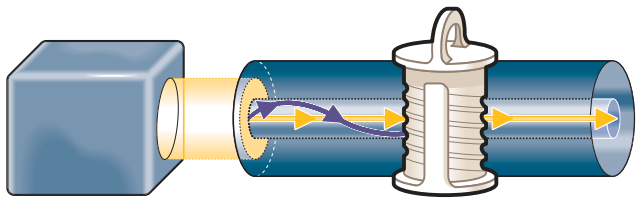
VCSEL light source



LED light source



LED light source with fiber mandrel



Application Note

Look to Fluke Networks' Mutimode Fiber Mandrels for more accurate and consistent measurements.

Extinguish high-order modes with fiber mandrels

By adding a special conditioning cable to an LED source, only the low-order modes will be excited when the launch cable is connected to the fiber under test. It is simple and inexpensive to build a special LED mode conditioning cable. The simplest method of removing, or stripping off, the high-order modes is to tightly bend the launch cable around a round mandrel, or rod. The tight bends extinguish the high-order modes so that only low-order modes emanate from the launch cable.

Multimode Fiber Mandrels expand Fluke Networks fiber vision solutions

Fluke Networks now offers multimode fiber mandrels that provide a foolproof, cost-effective method of improving the repeatability and consistency of multimode optical power and loss measurements when using an LED source. Our new mandrels guarantee the correct number of wraps of the appropriate diameter as specified by the TIA/EIA-568-B standard while protecting 3 mm fiber cables from damage and preventing unwanted microbends.

Two different TIA-568-B compliant color-coded mandrels are available: a 22 mm mandrel for 3 mm 50 µm multimode fiber cables and a 17 mm mandrel for 3 mm 62.5 µm multimode fiber cables. Also available is a kit containing two mandrels of each type to complement many of our fiber test products.

For more information on light source launch conditions and fiber mandrels, visit **www.cabletesting.com** - an online resource that reports the latest standards data and information on testing, management and documentation, and the latest news and events in the copper and fiber cabling industry.

TIA-568-B mandrel guidelines

The mandrel diameter and number of mandrel wraps is specified in TIA/EIA-568-B.1 clause 11.3.3. The diameter varies depending upon the fiber core size and launch cable diameter.

TIA/EIA-568-B.1 Mandrel Diameters

Fiber core size (µm)	**Mandrel diameter for buffered fiber** (mm [in])	**Mandrel diameter for 3 mm jacketed cable** (mm [in])
50	25 (1.0)	22 (0.9)
62.5	20 (0.8)	17 (0.7)

Per TIA/EIA-568-B.3 clause 7.1, a mandrel is used when testing multimode power loss in the field with a Category 1 light source. The mandrel is installed on the launch cable that is connected to the source. Once installed, it should not be removed until testing is complete.

Note: *ISO/IEC TR 14763-3 specifies a 20 mm mandrel for 62.5 µm fiber and a 15 mm mandrel for 50 µm fiber.*

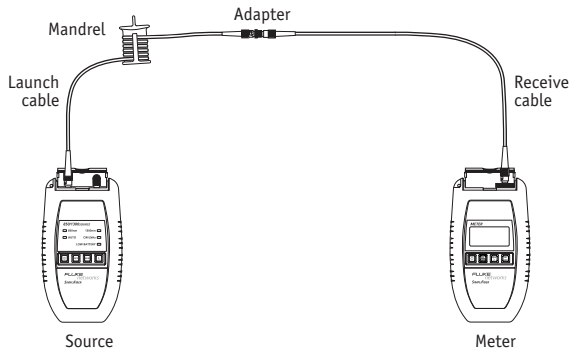


Figure 1 *- Reference Measurement*

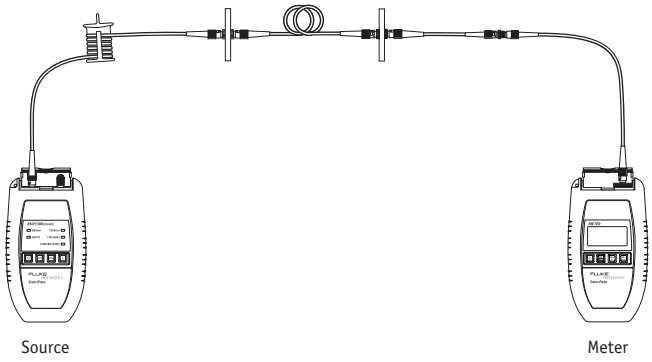


Figure 2 *- Link Testing*

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