

What is a fiber optic splitter?

Nowadays PON (Passive Optic Network) architecture is indispensable in the First Mile from the customers' point of view. In this topology, fiber optic splitter plays a critical role. Today we'd like to talk about the basic knowledge of fiber optic splitter.

What is PON?

PON is first proposed by British Telecommunications in 1987, aiming at reducing installation and operating cost through eliminating active components between the transmitting terminal and the subscriber.

Often referred to as the last mile from the point of view of ISP (Internet service provider) , PON architecture implements a point-to-multipoint topology by using passive fiber optic splitters to ensure some end-users could share one a single fiber, greatly reducing the cost.

PON consists of OLT (optical line terminal) located at the central office of the ISP, a host of ONUs (optical network units) or ONTs (optical network terminals) located at end-users' premises, and and the fibers and splitters between them, called ODN (optical distribution network). ONT is an ITU-T (the Telecommunication Standardization Sector of the International Telecommunication Union) term describing a single-tenant ONU.

As you can see, PON significantly reduces the number of fibers and central office equipment needed if using point-to-point architectures.

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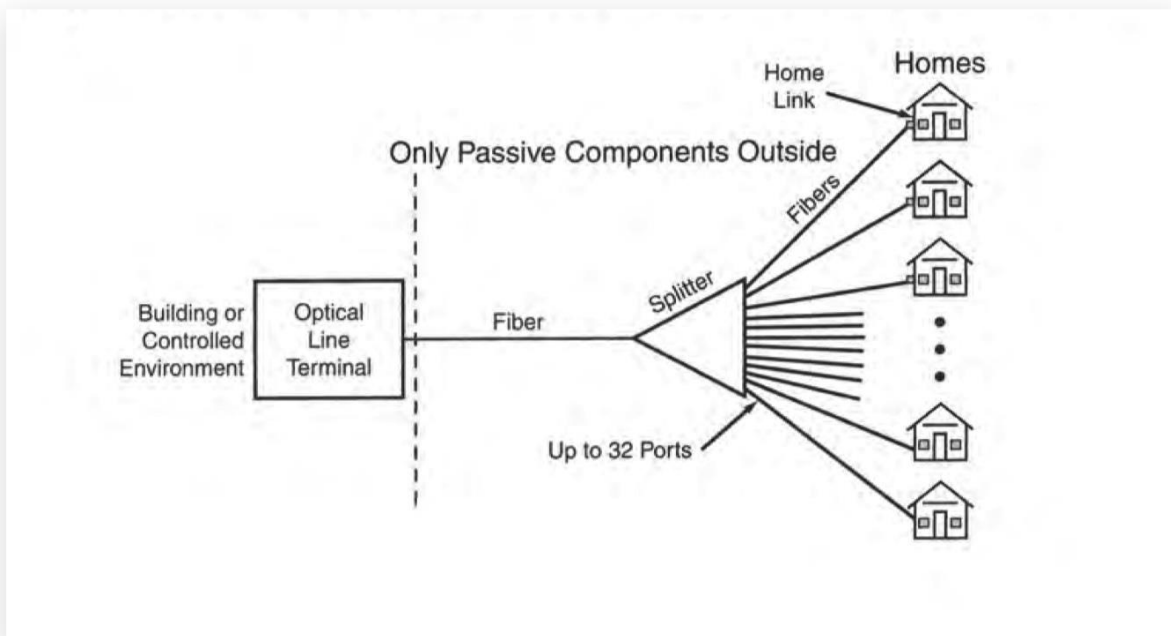


Figure 1: Passive Optical Networks architecture

What is a fiber optic splitter?

As the key link of FTTH (fiber to the home) PON system, fiber optic splitter serves as part of ODN, dividing the power in an optical signal into a number of different branches. More or less, fiber optic splitter acts like a medium and a housekeeper simultaneously. As a medium, it redistributes the transmission from the central office to all the ONUs served by it. As a housekeeper, it splits the power into as many parts as the number of ONUs,

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up to 128, depended on manufacturers. The splitting ratio is either customized, or evenly divided.

There're different configurations of splitting ratio, including 4, 8, 16, 32, 64, even 128. Although large split ratios are required by GPON (Gigabit PON) and EPON (Ethernet PON), for instance, 128 for GPON, up to 32,768 for EPON, usually most PONs are installed with a split ratio of 1:32 or smaller. Also, two small splitters can be arranged in series, so each output of a 1 X 4 splitter could be followed by a 1 X 8 splitter, yielding a total of 32 possible outputs. 28 dB corresponds to about 20 km with a 32-way split.

Normally fiber splitters use box package or stainless tube package.

Fiber optic splitter vs coupler vs combiner: what's the difference?

You may wonder, why sometimes people call ODN equipment a fiber optic splitter, sometimes call it a fiber coupler, or combiner?

The answer is it depends.

When a component is used to divide optical signals, then it functions as a splitter, and vice versa. When it is used to combine optical signals, then it functions as a combiner. Furthermore, a given component may combine and divide optical signals simultaneously, as in two-way transmission over a

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single fiber. ¹ Therefore, wavelength insensitive couplers are also power splitters and combiners.

The basic concept of 1×2 configuration optical splitter, 2×1 configuration optical combiner, and 2×2 configuration optical coupler is shown in Fig. 7.43.

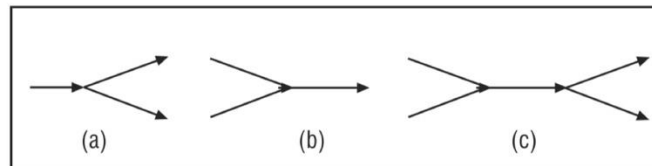


Fig. 7.43 (a) 1×2 configuration optical splitter; (b) 2×1 configuration optical combiner; (c) 2×2 configuration optical coupler

Figure 2: optical splitter, combiner, coupler

Its workings

The working principle of the fiber optic splitter lies in the reallocation technique of optical signal, that is, when two fibers are close enough, the light traveling along one fiber can spread into another fiber.

¹ "Passive Optical Network," Wikipedia (Wikimedia Foundation, January 10, 2022), https://en.wikipedia.org/wiki/Passive_optical_network.

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Passive And Active Splitters

We can classify fiber optic splitter into two basic kinds, i.e., active and passive splitters. In this context, "passive" means unpowered, and passive devices are optical components that require no electronic control for their operation. Thus, a passive splitter avoids conversion of signals between optical and electronic formats. Conversely, an active splitter uses electrical power to split or combine the signal electrically.

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Figure 3: Active Optical Splitter Cable

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Operating wavelength

Single-mode fiber splitter often works at 1310 and 1550nm wavelength, whereas multimode splitter usually works at 850 and 1310nm wavelength, for longer the wavelength, better the performance, however, higher the cost.

There're also single and dual window fiber splitters, using one operating wavelength or two respectively.

FBT splitter vs PLC splitter

FBT refers to Fused Biconical Taper, and PLC stands for Planar Lightwave Circuit, these are two manufacturing technologies. FBT is an older technology, and PLC is a more recent one. As shown in below, the main differences between FBT splitter and PLC splitter lie in fabrication method, performance, design, and cost.

	FBT Splitter	PLC Splitter
Fabrication Method	Similar to fusion splice. two or more fibers are bound, put on a fused-taper fiber device,	one optical chip with its both ends are coupled with several optical arrays

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	FBT Splitter	PLC Splitter
	with one fiber being singled out as the input. Rather easy.	depending on the output ratio. Rather complicated.
Operating Wavelength	830, 1310, 1550nm	1260-1650nm (full wavelength)
Performance	Up to 1:8 – reliable. For larger splits reliability will be reduced, and installation space is restricted	Good for all splits. High level of reliability and stability.
Input/Output	One or two inputs with an output maximum of 32 fibers.	One or two inputs with an output maximum of 64 fibers.
Splitter ratios	Customized	Equal
Operating temperature	-5 to 75°C.	-40 to 85 °C.

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	FBT Splitter	PLC Splitter
	Insertion loss varies with temperature variation is greater (TDL)	
dimension	multi-demultiplexer (e.g., 1 × 16, 1 × 32) volume is relatively large.	Compact and smaller, meaning small occupation space
Cost	inexpensive	costlier



Figure 4: 1x2-fbt-splitter-singlemode

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Specification

Package Style	Steel Tube, Bare Fiber	Configuration Type	1×2
Fiber Grade	Singlemode G.657A1	Connector Type	None
Fiber Type	Ribbon Fiber	Temperature	Operating 20~70°C Storage -40~85°C
Fiber Diameter	250μm	Input/Output Fiber Length	1.5m
Insertion Loss	≤4.0dB	Return Loss	≥50dB
Loss Uniformity	≤0.4dB	Directivity	≥55dB
Polarization Dependent Loss	≤0.2dB	Temperature Dependent Loss	≤0.5dB

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Wavelength Dependent Loss	≤0.3dB	Operating Bandwidth	1260~1650nm
Split Ratio	50/50	Steel Tube Dimensions (HxWxD)	0.16"x1.57"x0.16" (4x40x4mm)

Which splitter to choose?

FBT splitter and PLC splitter are the most popular type. Which one can best suit your requirements?

In a word, FBT splitter is cost-effective in smaller ratios, such as when the ratio is below 1:8, because FBT splitter is easy to produce, using regular fibers, on the contrary, PLC splitter has high technique threshold and complicated production process.

Correspondingly, when large ODN equipment are needs, such as in GPON, the required ratio is above 1:8, then the PLC splitter is the best option.

Besides, from future upgrade perspective, PLC splitter is preferred due to its excellent performance and smaller size.

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Figure 5: 1x16-ABS-Box-PLC-Splitter

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References

Hecht, Jeff. Understanding Fiber Optics. Auburndale, MA: Laser Light Press, 2015.

Singal, Tarsem Lal. Optical fiber communications: principles and applications. Delhi: Cambridge University Press. 2016.

Keiser, Gerd. Fiber Optic Communications. Singapore: Springer Singapore, 2021.

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