LUMITEX™

Light Guide vs. Fiber Optic Light Pipe

What's the Difference?

Introduction

Technology that enables more vibrant electronics comes in a variety of forms. There are terms as well as technologies that embrace the illumination industry.

Their characteristics are similar yet different.

The objective of this article is to discuss product enhancement through the use of backlighting. And to determine when it is best to use a light guide versus light pipe technology. Although similar in technology (both solutions are used to channel light), they have marked differences in their applications.

Backlighting Concept - Term and Usage

Backlighting is a form of illumination often used in different types of electronic applications. Backlights are often utilized to add function (i.e. indicator lights, display lighting) or to enhance aesthetics (i.e. branding, ambient/mood).

Backlights are used in small displays, such as digital watches, to increase readability in low light conditions. They are also used in common applications such as smart phones, computer displays, and LCDs.

Since these applications do not produce light themselves, they **need illumination to produce a visible image**.

Types of Backlighting

There are two types of backlighting that are commonly used:

1. Light Guide
2. Light Pipe

We will discuss each by definition, applications and attributes.

What is a Light Guide

A light guide is a “thin filament of a transparent material, such as glass or plastic, which is capable of transmitting light signals through successive internal reflections. In order for such a fiber to guide light, the proper relationship between the refractive index of the core and its surrounding cladding must be maintained.” Light guide. (2015) In DictionaryofEngineering.com Retrieved from http://www.dictionaryofengineering.com/definition/light-guide.html

Light guides are used to distribute light from the source to a particular area that requires illumination, and where overall assembly height needs to be at a minimum.

A light guide uses the mechanism of reflection caused by two materials with a different refractive index. It transports light from one location to another, by using total internal reflection of light at the boundary to the surrounding medium.

Light guides are also able to take the focused light from an LED and spread it evenly and change its shape or distribution to achieve a desired end result. This can be seen with illumination of logos, overlays, or other large areas.

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Advantages of Light Guide Technology

Design: thinness of the product, fits in tight spaces, efficient

Performance: uniformly lit appearance

Cost: cost savings in energy consumption

Light Guide Applications

Light guide applications can include keypads, accent lighting, human machine interface, and medical devices.

Light guides are better used to illuminate larger surface areas when keeping a low profile is important.

What is a Light Pipe

A light pipe is a "conduit made of transparent material, such as glass or plastic, which is capable of channeling light from one end to the other through successive internal reflections. Such a pipe may be flexible or rigid, and an optical fiber is an example." Light pipe. (2015) In DictionaryofEngineering.com Retrieved from http://www.dictionaryofengineering.com/definition/light-pipe.html

Flexible light pipes are typically used in custom applications where light needs to carefully navigate through existing components.

Rigid light pipes are capable of redirecting the LED's light output to the desired location with minimal loss of concentration. This makes them ideal if the LED is mounted on an intermediary board behind a front panel.

Advantages of Light Pipe Technology

Design: design flexibility, easy to install, efficient (the light's source is almost always a LED)

Performance: uniform illumination, low glare, can diffuse or re-direct light. Light pipes transmit up to 80% of emitted light with excellent visual performance.

Cost: low cost

Light Pipe Applications

Light pipes are used in a large variety of markets.

Because of its ability to transmit up to 80% of emitted light, it is useful for a broad range of applications including security equipment, medical devices, and communications equipment.

Light pipes are used to illuminate small areas. For example, light from a small LED to a switch indicator or a small graphic.

Typically, a light pipe would go from a circuit to the area that requires illumination.

4 Things to Consider When Choosing Backlighting Technology

Not all backlighting technology is created equal. You want to consider many factors when choosing your backlight and determine which are most important to your overall application design.

1 Brightness Requirements

How bright do you need the light on your application to be? Certain backlighting options can be brighter than others and some you can control the light output.

2 Space Requirements

How much space do you have in your application to include a backlight? Length and width are important, but consider depth as well. Knowing these can help you choose the best technology.

3 Illumination Area and Uniformity

How large of an area do you want to illuminate and does uniformity of the light matter? Some backlighting technologies work better with smaller areas, but if uniformity is important you may need to consider other options.

4 Cost Requirements

How much are you willing to pay for your backlight? There are backlighting solutions that are less expensive, but they may not always provide the best light.

Conclusion

There is often confusion around light guide and light pipe and sometimes they are even used interchangeably. Understanding that they are different and have their own advantages is key when deciding how to backlight your application.

Lumitex manufactures both light pipes and light guides. We utilize the light pipe properties of fiber optics to direct the light from the source to the area requiring lighting. We utilize light guide technology to extract the light and distribute where it is required. We use both stranded fiber optics (Uniglo® and Woven™) and fiber optic film (Clad Flat Fiber™).