Background information:

Glass fiber optics

Basics

Optical fiber transmission routes are the medium of choice when you need to realize interference-free and secure data transmissions over long distances and/or in environments which are prone to interference.

Optical glass fiber cables

As regards their physical structure, optical glass fiber cables can be subdivided into three categories:

- **Multimode step-index fibers** are fibers having a constant refractive index within the fiber core. The light is transmitted by total reflection of the light on the marginal layer between the core and sheath of the fiber. Step-index fibers have the demerit that the light inside the cable has varying propagation times over different paths and the useful signal is significantly distorted on account of this effect. For this reason, step-index fibers are no longer used frequently these days.
- **Multimode graded-index fibers** are fibers having a variable refractive index within the fiber core. On account of the variable refractive index, the light is directed toward the center of the fiber core. The core diameter is 50 or 62.5 µm
- **Single-mode fibers** have a step-index profile and an extremely small fiber core diameter of just 9µm. This cable construction allows the light (in contrast to the cable types described above) to propagate in just one direction through the cable. Signal distortion is reduced to a minimum and connections can be implemented over long distances with high bandwidths at the same time. But this comes with the price that single-mode fibers due to their small core diameter place great demands on the processing procedure, and components having single-mode interfaces are correspondingly expensive .

W&T interfaces currently only support the use of multimode graded-index fibers.

Connectors

A variety of connection styles has become established for connecting glass-fiber cables to the terminal devices. The most common types are:

- **ST connector (with bayonet lock)**

- **SMA connector (threaded)**

- **SC connector (connector with automatic locking)**

W&T interfaces are equipped standard with the widely used ST connectors, but SMA versions are generally available with short delivery as special versions. Please inquire!

Optical budget and cable length

By using the optical budget of glass-fiber optic transmission devices you can calculate the allowed attenuation between the two terminal devices and thereby indirectly the maximum permissible cable length.

In any case you should start from an estimation of the minimum values of the components given in the data sheet to ensure

function of the transmission segment under all conditions (e.g. over the entire temperature range or given supply voltage fluctuations).

In addition, the optical budget should not be totally used up by the projected transmission segment. A safety margin of 1.5...2dB is recommended in order to allow for any aging effects of the components. The data sheet specifications for the output power of glass-fiber emitters differ for example by around 1dB, depending on whether the output power is considered at the BOL (beginning of life) or EOL (end of life).

Wavelengths used

Glass-fiber cables have the property of not being consistently transparent for every wavelength of light. There are preferred ranges (the so-called "optical windows" in which the medium is characterized by an especially low attenuation and which are used for data transmission:

- **850 nm:** First optical window, attenuation < 2.7dB with a 50 µm multi-mode fiber
- **1300nm:** Second optical window, damping < 0.8dB with a 50µm multi-mode fiber
- **1550nm:** Third optical window, used only in the single-mode area

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