



Redefining distribution.

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OM3 LASER OPTIMISED FIBRE

With new applications being developed over recent years the type of optical fibres that are required to drive these applications have changed. Within the TIA/EIA-568-B and the ISO 11801 standards the different classes of optical fibre have now been characterised into groups. This paper gives the basic information currently available for trouble free cable design to the relevant standards.

THE CAUSE FOR CHANGE

The largest type of fibre installed in Europe is 62.5/125 micron fibre and up until recently this was believed to be sufficient for the future. However as Gigabit Ethernet was developed this was proved not to be the case. This new application is bandwidth hungry and reduced the distance available down to as little as 220mtrs and possibly less if there is high attenuation within the cables, splices and the connectors. This led to the development of new multimode optical fibre types.

When 10 Gigabit Ethernet was developed even greater bandwidth was required reducing distances down to as little as 33mtrs on standard 62.5/125 optical fibre.

OPTICAL FIBRE SPECIFICATIONS

ANSI/TIA/EIA-568-B.3-1-2002, ISO 11801 ISS2 and EN 50173: 2002 all specify the new laser optimised fibres. The first change that we notice is the progression from the 62.5 micron diameter core, to 50 micron cores. For this document we will utilise the ISO 11801 standard which as far as bandwidth is concerned is identical to the TIA document.

PERFORMANCE OF OPTICAL FIBRE CABLING

The selection of an optical fibre channel design for use within a generic cabling system should be made with reference to Annex F of the ISO standard. This standard specifies the following classes for optical fibre cabling and suitable distances:

Class OF-300 channels support applications over the optical fibre types referenced in clause 9 (Table 2) to a minimum of 300 m

Class OF-500 channels support applications over the optical fibre types referenced in clause 9 (Table 2) to a minimum of 500 m

Class OF-2000 channels support applications over the optical fibre types referenced in Clause 9 (Table 2) to a minimum of 2000 m





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Optical fibre channels shall be comprised of components that comply with clauses 9 (Optical fibre cables) and 10 (Connecting hardware). These clauses specify physical construction (core/cladding diameter and numerical aperture) and transmission performance. Within the reference implementations of this clause, the optical fibres used in each cabling channel shall have the same specification.

The channel attenuation shall not exceed those shown in the following table; the values are shown with a 1.5dB allocation for connecting hardware.

Channel Attenuation dB				
Channel	Multimode		Singlemode	
	850nm	1300nm	1310nm	1550nm
OF-300	2.55	1.94	1.80	1.80
OF-500	3.25	2.25	2.00	2.00
Of-2000	8.5	4.5	3.50	3.50

Table 1 Channel attenuation

Four types of optical fibre are specified to support various classes of applications, three multimode optical fibre types (OM1, OM2, and OM3) and one singlemode type (OS1). The optical fibre attenuation for each of these is laid out in the following table.

Maximum cable attenuation dB/km				
	OM1,OM2 AND OM3 Multimode		OS1 Singlemode	
Wavelength	850nm	1300nm	1310nm	1550nm
Attenuation	3.5	1.5	1.0	1.0

Table 2 Cable attenuation





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MULTIMODE OPTICAL FIBRE CABLE

There are three parts too the requirements of multimode optical fibre cables, they are the optical fibre, the cable transmission performance and the physical cable requirements.

a) **Optical fibre requirements**

The optical fibre shall be multimode, graded-index optical fibre waveguide nominal diameter of 50/125 μm or 62.5/125 μm core/cladding and a numerical aperture complying with A1a or A1b respectively of IEC 60793-2-10.

b) **Cable performance transmission performance requirements**

Each optical fibre within the cable shall meet the performance requirements as stated in the table 3 below. Attenuation and modal bandwidth shall be measured in accordance with IEC 60793-1-40 and IEC 60793-41 respectively.

c) **Physical cable requirements**

The indoor and outdoor optical fibre cable shall meet the environmental and mechanical requirements specified in IEC 60794-2 and IEC 60794-3 respectively.

Wavelength		Minimum modal bandwidth MHz.km		
		Overfilled Launch Bandwidth		Effective Laser Launch Bandwidth
Wavelength		850 nm	1300 nm	850 nm
Optical fibre type	Core diameter in μm			
OM1	50 or 62.5	200	500	Not Specified
OM2	50 or 62.5	500	500	Not Specified
OM3	50	1500	500	2000

NOTE: Effective laser launch bandwidth is assured using differential mode delay (DMD) as specified in the draft document IEC 60793-1-49. Optical fibres that meet only the overfilled launch modal bandwidth may not support some applications specified in Annex F (see standards document

Table 3 Modal Bandwidth

Transmission distance limitations are laid down in the relevant IEEE documents, the table below states distances stipulated in these standards as a minimum achievable distance.





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Maximum Distance Optical Budget		
Core/Cladding diameter	62.5/125	
Bandwidth @ 850/1300nm	160/500MHz (TIA) [#]	200/500MHz (OM1)
1000BASE-SX	220m / 2.38dB	275m / 2.6dB
1000BASE-LX	550m / 2.35dB*	550m / 2.35dB*
10GBASE-S (850nm)	2 to 26 / 1.6dB	2 to 33 / 1.6dB
10GBASE-LX4 (1300nm)	2 to 300 / 2.0dB	2 to 300 / 2.0dB
*With 2 Mode Conditioning Patch Cords		
[#] The TIA specifies 160MHz in ANSI/TIA/EIA-568-B.3-1		

Maximum Distance Optical Budget		
Core/Cladding diameter	50/125	
Bandwidth @ 850/1300nm	400/400MHz	500/500MHz (OM2)
1000BASE-SX	500m / 3.37dB	550m / 3.56dB
1000BASE-LX	550m / 2.35dB*	550m / 2.35dB*
10GBASE-S (850nm)	2 to 66 / 1.7dB	2 to 82 / 1.8dB
10GBASE-LX4 (1300nm)	2 to 240 / 1.9dB	2 to 300 / 2.0dB
*With 2 Mode Conditioning Patch Cords		

Maximum Distance Optical Budget	
Core/Cladding diameter	50/125 OM3
Bandwidth @ 850/1300nm	1500 (2000 [#])/500MHz
1000BASE-SX	500m / 3.56dB
1000BASE-LX	550m / 2.35dB
10GBASE-S (850nm)	2 to 300 / 2.6dB
10GBASE-LX4 (1300nm)	2 to 300 / 2.0dB
[#] Laser Optimised figure	

Table 4

1000BASE-LX Will transmit up to 5km using Singlemode Optical fibres with a loss budget of 4.57dB.

The importance of selecting the correct grade optical fibre for the application has become more complex, singlemode may appear to be a reasonable option but cost of the network equipment needs to be examined closely. Also with singlemode fibre this will not support existing equipment.





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The best option if distance allows is to install OM3 Laser optimised fibre this will support future applications up to and including 10 Gigabit Ethernet and is backwards compatible with legacy equipment.

