



The Fibreoptic Industry Association

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PLASTIC OPTICAL FIBRE

IS IT FINALLY BECOMING A REALISTIC TELECOMMUNICATIONS MEDIUM?

by

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For many years, plastic optical fibres have been used in a wide variety of non-mainstream telecommunications applications (remembering that the FIA view "telecommunications" to mean all forms of information transmission - not just long-haul operator networks). Two obvious examples are its applications for data networking within automobiles and in certain industrial process monitoring, control and automation (PMCA) networks. Domestic consumers are also familiar with plastic optical fibres in the audio-visual area where they are used to interconnect hi-fi subsystems and DVD equipment.

This "application-by-application" growth of plastic optical fibres has led to the creation of a plethora of different specifications. Many people may be surprised to find that there is an IEC standard covering these products but there is - IEC (and BS EN) 60793-2-40. There are currently eight different constructions/specifications specified in the standard and these are designated Types A4a to A4h. These are shown in the top table within Figure 1. It will be noticed that there is a range of core/cladding solutions, operating wavelengths and conditions under which the parameters are to be measured.

However, until recently, plastic optical fibre has failed to break into what would be considered to the areas served by high-bit rate balanced cabling or all-silica optical fibre. This has started to change and this White Paper provides details of these changes.

The first references to plastic optical fibre within generic cabling standards came in ISO/IEC 24702 Ed.1 (2006): *Information technology - Generic cabling for industrial premises*. This specified two plastic optical fibres which it designated as OP1 and OP2 (in the same way as ISO/IEC 11801 uses the terminology OM1, OM2 etc.) OP1 and OP2 were specified to come from Types A4d and A4f respectively. The cabling channels constructed from these products were of restricted length and were only expected to support relatively low data rates. Identical requirements are detailed in BS EN 50173-3:2007 (which was actually developed in advance of the international standard).

The inclusion of the plastic optical fibre in the standards reflected their use in the process monitoring, control and automation (PMCA) applications in industrial networks as discussed above - rather than a true expectation of future support. However, moves are underway to include two different selections from IEC 60793-2-40 within the residential environment via amendments to the standards ISO/IEC 15018 and EN 50173-4 (both of which specify generic cabling in homes). The two alternative selections actually push the performance requirements in opposite directions. OP1 will be re-specified to a lower bandwidth performance level using Type A4a2 (a yet-to-be-published subset of A4a) but OP2 will be re-specified to the much better performing Type A4g.

These changes will also be reflected in a forthcoming amendment to ISO/IEC 24702 and EN 50173-3.

We are now seeing claims in the cabling press of 1000Mb/s Ethernet transmission over 100 metres of plastic optical fibre - this suggests the use of A4f, g or h products since only they have the required bandwidth and correct operating wavelengths.

The key advantage exploited by plastic optical fibres has always been the ease of termination - when compared to all-silica optical fibres. However, within the 100 metre channel environment, the improved bandwidths provided by A4f, g and h make the technology an interference-free competitor for balanced cabling as well.

| | A4a1 | A4a2 | A4b | A4c | A4d | A4e | A4f | A4g | A4h | |
|------------------------|----------------------------------|---------------|---------------|-------------|---------------|----------------|-----------------|-------------|-------------|--|
| Core diameter (µm) | (Cladding diameter - 25) ± 10 | | | | | | 200 ± 10 | 120 ± 10 | 62.5 ± 5 | |
| Cladding diameter (µm) | 1000 ± 60 | 1000 ± 60 | 490 ± 10 | 500 ± 30 | 1000 ± 60 | 750 ± 45 | 490 ± 10 | 490 ± 10 | 245 ± 5 | |
| NA | 0.5 ± 0.15 | 0.5 ± 0.03 | 0.5 ± 0.15 | | 0.3 ± 0.05 | 0.25 ± 0.07 | 0.19 ± 0.015 | | | |
| Attenuation (dB/100 m) | | | | | | | | | | |
| @ 650 nm | - | | | | | | - | ≤ 10 | ≤ 10 | |
| @ 650 nm overfilled | ≤ 40 | ≤ 18 | ≤ 40 | | | | | | | |
| @ 650 nm equilibrium | ≤ 30 | ≤ 18 | ≤ 30 | | | | | | | |
| @ 650 nm 0.3 NA | - | | | | | | ≤ 18 | | | |
| @ 850 nm | - | | | | | | ≤ 4 | ≤ 3.3 | ≤ 3.3 | |
| @ 1300 nm | - | | | | | | ≤ 4 | ≤ 3.3 | ≤ 3.3 | |
| Bandwidth (MHz.100m) | | | | | | | | | | |
| @ 650 nm | ≥ 10 | | | | - | | ≥ 800 | ≥ 800 | | |
| @ 650 nm 0.3 NA | - | - | - | - | ≥ 100 | ≥ 200 | | | | |
| @ 850 nm | - | | | | | | ≥ 1500 | ≥ 1880 | ≥ 1880 | |
| @ 1300 nm | - | | | | | | ≥ 1500 | ≥ 1880 | ≥ 1880 | |

Generic cabling standards selection - today

| Category | OP1 | OP2 |
|------------------------|-------|--------|
| Attenuation (dB/100 m) | | |
| @ 650 nm | ≤ 20 | ≤ 10 |
| @ 850 nm | - | ≤ 4 |
| @ 1300 nm | - | ≤ 4 |
| Bandwidth (MHz.100m) | | |
| @ 650 nm | ≥ 100 | ≥ 800 |
| @ 850 nm | | ≥ 1500 |
| @ 1300 nm | | ≥ 1500 |

Generic cabling standards selection - future

| Category | OP1 | OP2 |
|------------------------|------|--------|
| Attenuation (dB/100 m) | | |
| @ 650 nm | ≤ 18 | ≤ 10 |
| @ 850 nm | - | ≤ 3.3 |
| @ 1300 nm | - | ≤ 3.3 |
| Bandwidth (MHz.100m) | | |
| @ 650 nm | ≥ 10 | ≥ 800 |
| @ 850 nm | | ≥ 1880 |
| @ 1300 nm | | ≥ 1880 |

Figure 1: Plastic optical fibres

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