Fibre Optics and Avid

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Introduction to Fibre Optics

Fibre Optic technology is the art of sending signals down hair-thin strands of glass or plastic as pulses of light, guided down the centre of the fibre, known as the “core”. This core is surrounded by an optical material called “cladding” which traps the light in the core. The core and cladding materials are usually ultra-pure combinations of optical glass or glass and plastic. The inner fibre (core and cladding) is coated with a protective coating called the “buffer” and more protection is provided by an external “cable covering”. This assembly is then further clad with fibre and strength members and coated in an outer “Jacket” material.

Measurements for the specifications of Fibre Optic cables are expressed in units of Microns. The Unit of the Micron is 1 millionth of a meter and is sometimes written as micrometres or um. To give you a better view of this measure, 25 microns equals approximately 0.001 inches. 125 microns, the diameter of most optic fibres, is slightly larger than the diameter of the average human hair! You may also see the term Nanometre or nm used in specifications for Fibre Optic technology; this is the measurement used to describe the wavelength of the light beam being transmitted over the fibre optic cable. 1 Nanometre is one billionth of a metre.

Multi-mode fibre and Single-mode fibre are the two types of optic fibre in common use today in networking. The terms Multi-mode and Single-mode refer to the method of light transmission used in modern fibre optic cables with mode being a single electromagnetic field pattern or ray of light travelling in the fibre. The significant physical difference between the two types of fibre is the diameter of the core material. Both types of fibre have an overall diameter (core and cladding) of 125 microns. However each has a different core diameter.

Multi-mode fibre (MMF) is normally either 62.5 um or 50 um in diameter. You may see this indicated as 62.5/125 micron and 50/125 micron fibre which indicates the core diameter versus the overall fibre diameter. MM fibres are typically used with 850 and 1300 nm LED light sources or 850 and 1310 nm LASER light sources and are typically used for shorter runs of fibre optic cables up to hundreds of meters. Multi-mode fibre optic cables normally have orange outer jackets.

Single Mode fibre (SMF) normally has an 8 or 9 micron core diameter and a 125 Micron overall diameter. Again you may see this expressed as 9/125 um. Single mode fibres are typically used with 1300 nm and 1550 nm LASER light sources in higher bandwidth and longer distance applications. Single Mode fibre cables normally have yellow outer jackets.

Avid’s Use of Fibre Optic Technology

Avid currently uses fibre optic cabling in two distinct product areas and each product has its own requirements of the technology:

- Avid Unity MediaNet
- Avid Unity ISIS

Avid Unity MediaNet

Avid Unity MediaNet uses fibre optic cabling for the two different technologies that this product supports:

- Fibre Channel based connections.
- Ethernet based connections.

Fibre Channel Based Connections
Avid Unity MediaNet only supports the use of multi-mode fibre cable for its Fibre Channel connections. If Single-mode cables are used you may get errors such as “File system busy” “drive not accessible” and a general degradation in fibre link performance.

Three distinct Fibre Channel infrastructure speeds have been used over the life of the Unity MediaNet product range; 1 Gbit, 2 Gbit and the current speed of 4 Gbit. The following table illustrates the maximum optical fibre cable lengths supported by each infrastructure.

	1 Gbit Fibre Channel Infrastructure	**2 Gbit Fibre Channel Infrastructure**	**4 Gbit Fibre Channel Infrastructure**
MMF 50/125 um Fibre Optic cable	500 Metres	300 Metres	150 Metres
MMF 62.5/125 um Fibre Optic cable	175 Metres	150 Metres	70 Metres

Ethernet based connections
Fibre optic Avid MediaNet Ethernet connections are supported and the devices qualified by Avid use multi-mode fibre interfaces. Generally this kind of connection will be used for extending the reach of Gigabit Ethernet connections beyond the capabilities of standard copper UTP cabling. Examples of where this connection is supported are between a Port Server Pro (or LANshare EX) and the Gigabit Ethernet Switch, between Ethernet attached Avid Unity MediaNet clients and the Gigabit switch, and between Transfer Manager platforms and the Video Server being used for Ingest or Playback in an Avid Unity MediaNet based production system. Each of the interfaces in these examples will require the selection of a suitable Avid supported Optical Network Interface adapter for the computer platform and a suitable optical GBIC for use in the Gigabit Ethernet Switch.

Avid Unity ISIS
Avid Unity ISIS uses fibre optic cabling for its 10Gbit Ethernet links to 3rd party switches and for extension of 1 Gbit copper Ethernet links using Media Converters.

The following are two switches supported for use with Avid Unity ISIS 10 Gbit Ethernet connectivity applications:

- The Cisco Catalyst 4948 Gigabit Ethernet Switch
- The Foundry Networks FESX424 Gigabit Ethernet Switch.

Both switch models are shipped from Avid fitted with a single 10 Gigabit Ethernet optical transceiver module fitted, and both have the capacity to accommodate a further module which can be ordered as an option. Two distinct technologies are utilised by ISIS to provide the 10 Gbit connections: X2 “Xenpak” optical transceiver modules are used by the Cisco switch, and XFP optical transceiver modules are used by both the ISIS ISS module and the Foundry Networks switch. Each module type has two different formats that are supported for use with ISIS: SR or Short Range for shorter haul connections, and LR or Long Range for long haul connections between devices.

A final consideration for selecting the type of fibre optic cabling for use with Avid Unity ISIS 10 Gbit Ethernet is the fibre’s Effective Modal Bandwidth. This specification attempts to characterise the data carrying capacity (Its bandwidth) over a given length of fibre and will determine a particular fibre’s suitability for longer lengths of fibre runs.

The following table illustrates the specifications of each connection.

Module	Application	Optic Fibre termination	Light Source	Fibre Optical cable compatibility
XFP SR	ISIS ISS module and Foundry FESX424 Switch	Duplex LC MMF	850 nm LASER	MMF 62.5/125 um to 33 M (@ 200 Mhz/KM modal) or MMF 50/125 um to 300 M (@1500 Mhz/KM modal)
XFP LR	ISIS ISS module and Foundry FESX424 Switch	Duplex LC SMF	1310 nm LASER	SMF 9/125 um up to 10KM
X2 SR	Cisco 4948 Switch	Duplex SC MMF	85 nm LASER	MMF 62.5/125 um to 33 M (@ 200 Mhz/KM modal) or MMF 50/125 um to 300 M (@1500 Mhz/KM modal)
X2 LR	Cisco 4948 Switch	Duplex SC SMF	1310 nm LASER	SMF 9/125 um up to 10KM

The maximum length of Category 5e or Category 6 UTP cables supported for use in ISIS Zone 1 connections is 100 metres. This limit also applies to ISIS client computers connecting to 3rd party switches supported by Avid. Avid does however support the use of Media Converters to extend the length of these connections. Media Converters are essentially copper UTP RJ45 connectors to optical fibre transceivers used back to back and connected with Duplex optical fibre Cables. They allow the extension of a Copper UTP connection up to the maximum distance supported by the optical fibre connection used.

Max Client distance to Media Converter - 100 m / 328 ft using CAT-5e/6 copper cable

Max Media Converter distance to ISS - 100 m / 328 ft using CAT-5e/6 copper cable

Media Converter Extension Distance:

- 275 m / 902 ft with MMF 62.5/125 (850 nm laser)
- 550 m / 1804 ft with MMF 50/125 or MMF 62.5/125 (1310 nm laser)
- 10 km / 6.2 miles with SMF 9/125 (1310 nm laser)

General Fibre Optic Recommendations

- Dust and dirt are the enemies of successful fibre optic connections. When working with Fibre optic connections, ensure that your work area is clean and dust free. Only remove the dust caps from transceivers and cables at the very last minute prior to connection. Never be tempted to touch the optical tip of an optic fibre termination or connector, since the oils in your skin will attract dirt. If a connector has been exposed to contaminants it may be possible to wipe the optical surface gently with a lint free wipe that has been moistened with isopropyl alcohol.
- Take great care not to over radius coils of fibre optic cable which is easily damaged if bent beyond a certain point or kinked in any way.
- When pulling fibre optic fibre runs be sure not to over stress the cable. Ensure that cable is dispensed from a spool by carefully rotating the spool rather than spinning the fibre off the spool end, since this will form loops which can twist the fibre excessively.
- When bundling fibres together, be sure not to over-tighten any restraining ties or jacketing since this can damage the delicate fibre optic core.
- Protect any fibre cables running under floor tiles or anywhere where they may be exposed to damage from excessive weight being placed on top of or against them. Consider running the fibre in trays or tubing if you are in any doubt.
- It is generally not advisable to join lengths of fibre to form a longer length since each join in the cable will introduce loss into the light transmission path. If a join

is unavoidable, use the highest quality connectors possible to ensure that the optical faces of the joining cables are mated with the minimum of loss.

- Never attempt to join different gauges of fibre optic cable, for example 62.5/125 MMF to 50/125 MMF, or multimode fibre to single mode fibre, since this will introduce significant losses into the light path. Since most fibre optic patch bays rely on the physical mating of the two joining fibres this includes not mixing of gauges of fibre used with fibre optic patch bays as well.
- One place where a joined cable length may be worthwhile is in the case of a long fibre optic run between a fibre connected switch and a client computer that is mobile in any way i.e. in a rolling rack unit or cabinet. Place a short length of fibre optic cable and a junction box between the client computer and the longer length of optic fibre. Should any over enthusiastic plugging and unplugging occur at the client end causing damage or wear to the connector, or accidental stress be placed on fibre due to the cabinet being moved, the shorter run of optic fibre will be a lot less expensive to replace than re-terminating or replacing the longer run of fibre.
- Do not be tempted to use multimode fibre with devices designed for single mode fibre and vice-versa.
- For larger installations do not be tempted to use fibre that has no rating code printed on the outer jacket. Building Standards Inspectors will not certify installations where the cable type cannot be identified.
- In order to comply with building regulations it may be necessary to use Riser or Plenum quality cabling. Riser quality cabling ensures a certain degree of fire resistance (Since vertical cables feed flames more than horizontal) and Plenum quality cabling ensures that if exposed to high temperatures, as in the case of a fire, it will not give off poisonous fumes and can therefore be used in or near ventilation ducting.

Fibre optic cabling and termination is a highly specialised field. If you are installing longer runs of fibre or would like to install custom lengths of fibre, you are advised to seek the advice of a fibre installation specialist who will be able to recommend the best solution for a given situation.