Fibre-Optic Extender 160
Application Guide

1.0 Overview

The purpose of the Fibre-Optic Extender 160 product is to extend the range of a SSA 40MB/s serial link from 25m, which is the specified limit for a copper link, to a maximum of distance of 3km using multimode optical fibres (50/125um and 62.5/125um) and up to 10km using single mode optical fibres (9/125um). Although designed for SSA40, this product will also operate at SSA20 speeds on supported products. On the optical connection, a Fibre-Optic Extender 160 (OE) unit can only be connected to another matching device and cannot be used with any other fibre optic extender product.

The Fibre-Optic Extender 160 does not provide any retiming or frame buffering of the SSA data, consequently the maximum bandwidth of 40MB/s will only be maintained over fibre distances where the propagation delay of the fibre link does not exceed the time taken to fully unload the packet buffers of the SSA devices connected to the OE. Above this fibre length, the bandwidth will reduce as the fibre length increases up to the maximum distance specified for the fibre type. This product supersedes the SSA Fibre-Optic Extender which operated at SSA 20MB/s speeds, providing a maximum link distance of 2.4km, and supported multimode optical fibres only.

The maximum fibre length is set by the packet acknowledge (ACK) timeout of the devices driving the OE. On the SSA 20MB/s generation of IBM products this was set at 25 microseconds which translates to maximum fibre length of 2.4km. In the case of SSA 40MB/s IBM products, the timeout is set at 110 microseconds which will support a maximum fibre distance of 10km. This distance is set by the return path propagation time for a light within the optical fibre and is therefore a fixed value. However in a multimode fibre optic system, other factors, such as dispersion, restrict the maximum fibre length achievable before the ACK timeout limit and therefore singlemode fibre is required to achieve the 10km distance.

The maximum data rate which is achievable on a fibre optic link also decreases past a certain distance, which is less than the maximum fibre distance, due to the limited frame buffering which exists within current SSA systems. Presently two frames are buffered on the transmit and receive ends of the link which means that, at 20MB/s, the bandwidth will reduce after approximately 320m as the data in flight along the fibre exceeds this limit. In the case of a SSA 40MB/s link then this distance is reduced to approximately 160m due to the doubling of the data rate.

The Fibre-Optic Extender 160 product consists of two optical extenders which plug into SSA external micro-D sockets, this connector supplies +5V and ground for the OE, the serial SSA data connections and two option pins which signal SSA40 capability and the presence of an optical extender. The two OEs are connected by twin optical

fibre cables and emulate a copper SSA serial link without the need for any additional hardware or software.

1.1 Optical Fibre Cable Definition

The Fibre-Optic Extender 160 incorporates a 1310nm wavelength laser source and is designed to operate with multimode fibres up to a maximum distance of 3km and with singlemode fibre up to a maximum distance of 10km.

Multimode Fibres

The Fibre-Optic Extender 160 will operate with multimode optical fibres with a size of 50um/125um or 62.5um/125um, the full specification of these fibres is given below. Different fibre sizes must not be mixed along a single path otherwise an unacceptably high attenuation will result at the interface between the fibres. The connector used between the cable and the OE is of the ST[1] standard.

TABLE 1. Multimode Optical Fibre Specification

Parameter	MIN	MAX	Units	Notes
Length		3000	m	
Loss on a single path		8.0	dB	
Attenuation		0.8	dB/km	At 1310nm wavelength
Bandwidth	600 800		MHz.km	<= 2.4km > 2.4km
Connector Loss		0.5dB		for each connection
Temperature	-10	60	degC	

Note: There will be differences between 50/125um and 62.5/125um fibre specifications, particularly in the area of attenuation and bandwidth. Generally, 50/125um fibre will have the highest performance, the above specification shows the minimum acceptable values for either fibre type.

Singlemode Fibres

The Fibre-Optic Extender 160 is designed for singlemode optical fibres with a size of

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9um/125um, the full specification of these fibres is given below:

TABLE 2. Singlemode Optical Fibre Specification

Parameter	MIN	MAX	Units	Notes
Length		10000	m	
Loss on a single path		8.0	dB	
Attenuation		0.5	dB/km	At 1310nm wavelength
Dispersion		5.0	ps/nm.km	At 1310nm wavelength
Connector Loss		0.5dB		for each connection
Temperature	-10	60	degC	

2.0 Reliability, Availability and Serviceability (RAS)

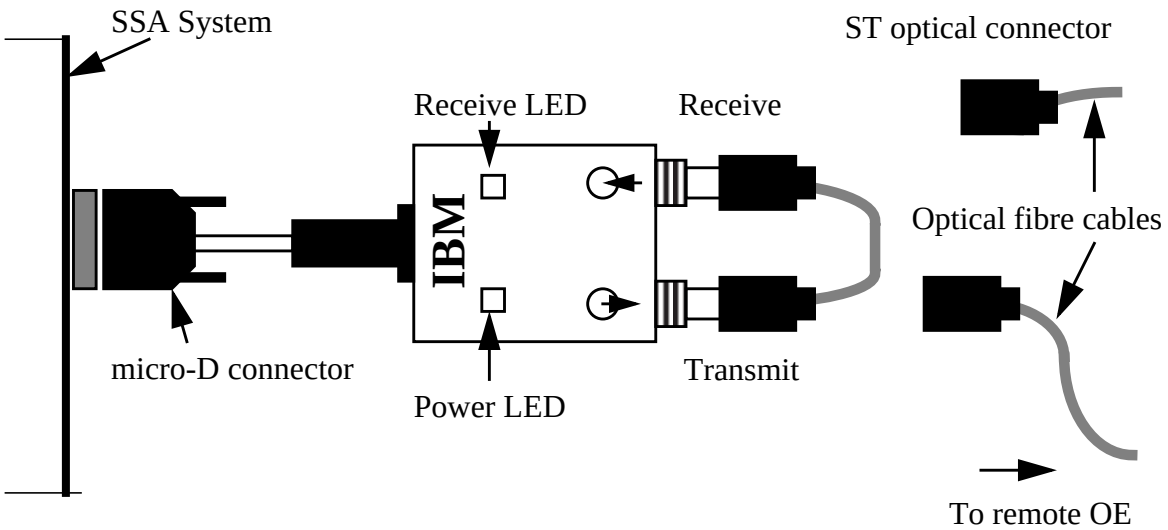
- Error Rate: The error rate will conform to the SSA specified value of better than 1E-13 for a link at maximum distance over the full environmental range.
- Serviceabilty:The OE has no serviceable parts.
- System Life: 5 Years.
- Diagnostic Aids: Line Fault Detection, Power on LED, Receive optical light LED.

2.1 LED States

The Power LED is coloured green and is illuminated if the power supply to the OE has been above the minimum value for correct operation of the OE for a fixed time interval. The threshold voltage and time interval is set by the internal circuitry of the OE.

The Receive LED is coloured green and is illuminated if the average optical input power to the receive optical input of the OE is above a threshold value. This threshold is set by the internal circuitry of the OE and the LED should always be illuminated during normal operation of the OE.

Cable Connections for RAS Purposes.



The above diagram illustrates an OE in wrap mode where the transmit data is connected back to the receive input. This allows the identification of the failing OE or send/receive optical fibre cable, however it does not necessarily indicate full functionality of the OE.

2.2 Environment Limits

Operation

- Temperature[1]: +10 to +55 degC
- Humidity: 8 to 80%, non-condensing
- Altitude: 0 to 7000 feet
- Cooling: Natural convection
- Vibration: V3
- Shock: S3
- EMC: Conforms to FCC class A and CISPR 22 class A operating at 20MB/s with the 7133-020 disk file subsystem. The OE has also been designed to conform to FCC class B and CISPR 22 class B when operating at 40MB/s with compliant disk file subsystems.

Storage

- Temperature: -40 to +60 degC
- Humidity: 5 to 80%, non-condensing
- Altitude: -1,000 to 40,000 feet
- Vibration: V3
- Shock: S3

2.3 ESD

Standard ESD precautions need to be utilised when handling the OE to ensure no electrical damage to internal electronic devices.

1. The upper temperature limit is set by the Class C ambient temperature limit of +40degC together with an uplift of 15 degC since the OE will be located at the back of the system. Under these conditions, the OE could be subject to the exhaust temperature of the system which is accounted for by this uplift.

RFI and EMC considerations are only pertinent to the short length of copper cable from the SSA ports to the OE body as the fibre cable is not susceptible to either RFI or EMC.

- ESD protection: Safe up to 3 kV discharge with standard human body model.

2.4 Package Description

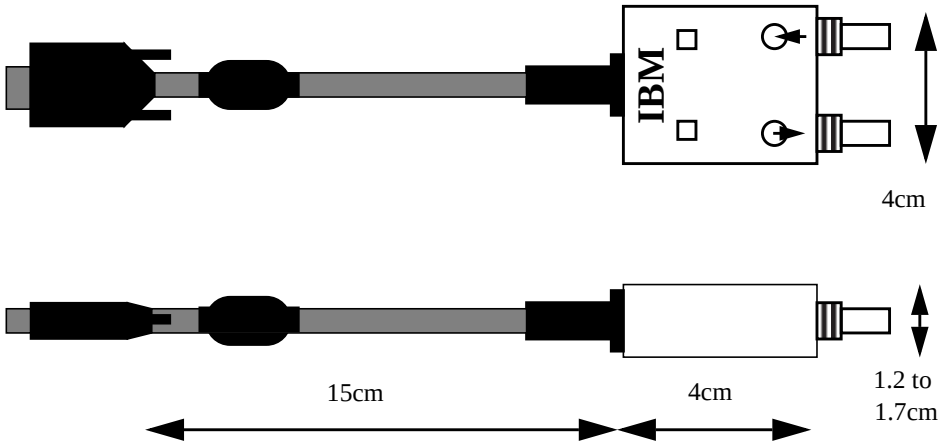


Diagram of optical extender showing approximate dimensions

2.5 Operation

The Micro ‘D’ type connector should be inserted into the external socket of the associated SSA port and the optical cable connected to the ST optical connector on the OE. On connection to a powered-up system, the ‘Power LED’ should illuminate indicating the OE has power. The ‘Receive LED’ will only illuminate when the OE is receiving light from the OE at the remote end of the optical link. The ‘Receive LED’ will still be on even if there is no SSA data running across the link since under these conditions the remote OE will be providing a continuous light output.

The order of connection of the extender and optical cable is unimportant. No damage can be caused to either the OE or the connecting system. The OE is also “hot-pluggable”, so it is not necessary to power down the system to connect the OE.

2.6 Safety

The optical extender is a Class 1 laser product. No single component failure can result in output power exceeding that for a Class 1 device.