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Modular Media Converter Installation Guide
(includes 10 Mbps Ethernet, 100 Mbps Fast Ethernet and Protocol-Independent Fiber Mode Conversion Modules)

LE740-TPSTM	LE740-TPSTS20	LE740-TPBNC	LE7408A
LE740-BNSTM	LE740-SMMM2	LE740-SMMM	LE7404A
LH740-TPSCM	LH740-TPSTS	LH740-TPSCS	LE7401A
LH740-TPSTS20	LH740-TPSCS20	LE7412A	LE7401A-R2
LE7412A-DC	LE7412A-2DC	LH740-TPSTM	LE7412A-2
LE740-TPSTS			

Modular *Media Converters* are designed to convert between 100Base-TX, 100Base-FX and 100Base-FX-SingleMode Fast Ethernet cabling, 10Base-2, 10Base-T, 10Base-FL and 10Base-FL-SingleMode Ethernet cabling or protocol-independent single/multi-mode fiber optic cabling.

About Media Converter Chassis

Media Converter modular chassis are user-configurable, provide power to the media conversion module and are available with one, four, eight or 12 slots for installing any combination of interchangeable media conversion modules that include 10 Mbps Ethernet Modules, 100 Mbps Fast Ethernet Modules and *S2MM Module Sets* (protocol-independent single/multi-mode fiber). For example an 8-Port *Media Converter* can be configured with one to eight *10 Mbps Modules* and *100 Mbps Modules* or one to four *S2MM Module Sets* in any combination.

> *Note: S2MM Module Sets consist of two modules and require two media conversion module slots so they can not be used in a 1-Port chassis.*

1-Port *(LE7401A and LE7401A-R2)* and **4-Port** *(LE7404A)* **Media Converters** are stand-alone chassis that include one or four media conversion module slots, respectively, and a fixed 95/240 VAC power supply. **8-Port Media Converters** *(LE7408A)* are 1U high, rackmountable, include eight media conversion module slots and a fixed 95/240 VAC power supply. There are two **12-Port Media Converter** chassis; both are rackmountable and include 12 media conversion module slots and either a 95/240 VAC or -48 VDC Power Supply Module with an additional slot for installing a second fault-tolerant Power Supply Module. The basic differences between the two are the chassis' height and location of the Power Supply Modules. The *12-Port Media Converter 1U (LE7412A and LE7412A-DC)* has the power on the rear side of the chassis with media conversion module slots on the opposite side, and is 1U high. The *12-Port Media Converter 2U (LE4712A-2 and LE7412A-2DC)* has both power and media conversion module slots on the front of the chassis and is 2U high.

About 10 Mbps Media Conversion Modules

Media conversion modules for 10 Mbps Ethernet have two different types of ports on them and require one slot in a *Media Converter* chassis for a single 10 Mbps Ethernet conversion. The following versions of *10 Mbps Modules* are available:

10BT (RJ-45) - 10BFL Module (half- or full-duplex) — converts 10Base-T (RJ-45) to 10Base-FL 850 multi-mode fiber; includes one pair ST (LE740-TPSTM) connectors

10BT (RJ-45) - 10BFL SM Module (half- or full-duplex) — converts 10Base-T (RJ-45) to single-mode fiber; includes one pair ST (LE740-TPSTS) connectors

10BT (RJ-45) - 10BFL SM/PLUS Module (half- or full-duplex) — same as above only with higher power budget; includes one pair ST (LE740-TPSTS20) connectors

10BT (RJ-45) - 10B2 (BNC) Module — converts 10Base-T (RJ-45) to 10Base-2 (LE740-TPBNC)

10B2 (BNC) - 10BFL Module — converts 10Base-2 to 10Base-FL multi-mode fiber; includes one pair ST (LE740-BNSTM) connectors

About 100 Mbps Media Conversion Modules

Media conversion modules for 100 Mbps Fast Ethernet have two different types of ports on them and require one slot for a single 100 Mbps Fast Ethernet conversion. The following *100 Mbps Modules* are available:

100B TX - 100B FX Module (half- or full-duplex) — converts 100Base-TX (RJ-45) to 100Base-FX multi-mode fiber; includes one pair ST (LH740-TPSTM) or SC (LH740-TPSCM) connectors

100B TX - 100B FX SM Module (half- or full-duplex) — converts 100Base-TX (RJ-45) to single-mode fiber; includes one pair ST (LH740-TPSTS) or SC (LH740-TPSCS) connectors

100B TX - 100B FX SM/PLUS Module (half- or full-duplex) — as above with higher power budget; includes one pair ST (LH740-TPSTS20) or SC (LH740-TPSCS20) connectors

About Protocol-Independent Fiber Mode Conversion Module Sets

To do a fiber mode conversion, *S2MM Module Sets* are used. Unlike *100 Mbps Modules* and *10 Mbps Modules*, each *S2MM Module Set* consists of two modules and requires two slots in a *Media Converter* chassis to do a single conversion. One module in the set has a single-mode receive (RCV) port and a multi-mode transmit (XMT) port. The other module has a multi-mode receive (RCV) port and a single-mode transmit (XMT) port. The single-mode port is identified by a solid white bar on each of the modules.

S2MM Module Sets use LED transmitters and are available for the following conversions:

**S2MM1300 Module Set** (LE740-SMMM2) — converts 1300-nm single-mode to 1300-nm multi-mode fiber (ST)

S2MM1300/PLUS Module Set (LE740-SMMM) — same as above only single-mode has higher power budget

> NOTE: *10 Mbps Modules, 100 Mbps Modules and S2MM Module Sets will be referred to as "Media Conversion Modules" throughout the rest of this document except where differences need to be indicated.*

Configuring Media Conversion Modules

Before installing, media conversion modules with twisted pair ports may be configured for *LinkLoss* and/or either a crossover workstation or pass-through repeater/hub connection (10 Mbps only). Media conversion modules with fiber ports may be configured for *FiberAlert*. Port termination may need setting on *10 Mbps Modules* with BNC ports. *10BT (RJ-45) - 10BFL Modules* have two additional jumpers, one for shielded/unshielded twisted pair and one for longer twisted pair distances. 100 Mbps modules may be configured for *Autonegotiation*. *S2MM Modules Sets* come ready to install.

The following diagrams show where the jumpers and switches are located on the various media conversion modules.

10B2 (BNC) - 10BFL

10BT (RJ-45) - 10B2 (BNC)

10BT (RJ-45) - 10BFL

100BTX - 100BFX
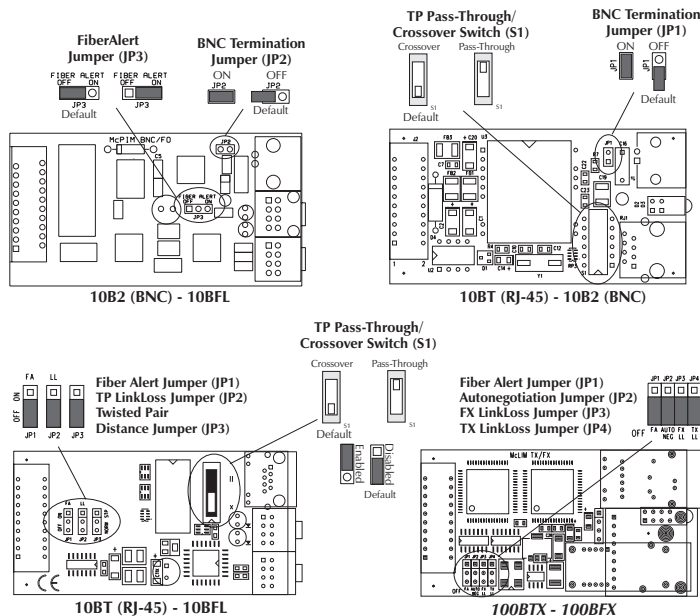
> NOTE: *Some features may not be available on all versions of media conversion modules.*

Twisted Pair Crossover/Pass-Through Switch

All *10 Mbps Modules* with twisted pair ports have one RJ-45 connector for a single shielded or unshielded twisted pair link segment. Each twisted pair port features a 2-position switch, located at position S1, for selecting a crossover workstation connection or pass-through repeater/hub connection.

The switch is labeled with "X" for a crossover connection (factory default) and a "ll" for a pass-through connection. To select the appropriate setting, simply move the switch to the proper position before installing the media conversion module. If uncertain whether crossover or pass-through is needed, set the switch to the position that makes the link LED glow.

Twisted Pair Cable Type

The twisted pair port on *10BT (RJ-45) - 10BFL Modules* features a 2-position jumper, located at position JP3, for selecting either a shielded or unshielded twisted pair link segment. The jumper is labeled with "STP IN" and "UTP OUT". An unshielded twisted pair link segment (factory default) is selected when the shunt is removed or on only one pin. Place the shunt over both pins for a shielded twisted pair link segment.

Twisted Pair Cable Distance

The twisted pair port on *10BT (RJ-45) - 10BFL Modules* features a 2-position jumper, located at position JP2, for selecting longer twisted pair cable distances (distances greater than 100 meters). The jumper is labeled with "NORMAL IN" and "LONG OUT". Place the shunt over both pins for distances up to 100 meters (factory default). Remove the shunt or place it on only one pin for distances of 100 meters or more.

> NOTE: *The product on the other side of the conversion must be able to support longer cable distances as well.*

About LinkLoss and FiberAlert

Some of the aforementioned media conversion modules come with the following troubleshooting features:

- *FO/FX LinkLoss* (a.k.a. "*Fiber LinkLoss*" or "*LinkLoss*")
- *TP/TX LinkLoss* (a.k.a. "*Twisted Pair LinkLoss*" or "*Reverse LinkLoss*")
- *FiberAlert*

FiberAlert and *LinkLoss* are advanced troubleshooting features that can help you locate "silent failures" on your network. However, it is vital that you understand exactly how *FiberAlert* and *LinkLoss* work, and how they will react in your network configuration, before attempting to install the enclosed module(s).

⚠️ **Installing modules without understanding the effects of *FiberAlert* and *LinkLoss* can cause perfectly functioning units to appear flawed or even dead**.

About Link Integrity

During normal operation, link integrity pulses are transmitted by all point-to-point Ethernet devices. When an media converter module receives valid link pulses, it knows that the device to which it is connected is up and sending pulses, and that the copper or fiber cable coming from that device is intact. The appropriate "LNK" (link) LED is lit to indicate this.

The media converter modulealso sends out link pulses from its copper and fiber transmitters, but normally has no way of knowing whether the cable to the other device is intact and the link pulses are reaching the other end. The combination of *FiberAlert* and *LinkLoss* allows this information to be obtained, even when physical access to a remote device (and its link integrity LED) is not available.
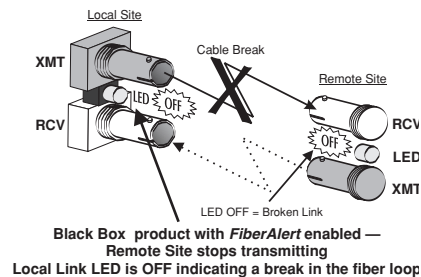
What Is FO/FX LinkLoss?

FO/FX LinkLoss is a troubleshooting feature. When a fault occurs on the fiber segment of a conversion, *FO/FX LinkLoss* detects the fault and passes this information to the twisted pair segment. If a media converter is not receiving a fiber link, *FO/FX LinkLoss* disables the transmitter on the media converter's twisted pair port. This results in a loss of link on the device connected to the twisted pair port.

What Is TP/TX LinkLoss?

TP/TX LinkLoss is another troubleshooting feature. When a fault occurs on the twisted pair segment of a conversion, *TP/TX LinkLoss* detects the fault and passes this information to the fiber segment. If a media converter is not receiving a twisted pair link, *TP/TX LinkLoss* disables the transmitter on the media converter's fiber port.

What Is FiberAlert?

FiberAlert minimizes the problems associated with the loss of one strand of fiber. If a strand is unavailable, the device at the receiver end notes the loss of link. The device will then stop transmitting data and the link signal until a signal or link pulse is received. The result is that the link LED on BOTH sides of the fiber connection will go out indicating a fault somewhere

Local Site
XMT
Cable Break
LED OFF
RCV
Remote Site
RCV
OFF
LED
XMT
LED OFF = Broken Link

**Black Box product with *FiberAlert* enabled —
Remote Site stops transmitting
Local Link LED is OFF indicating a break in the fiber loop**

in the fiber loop. Using *FiberAlert*, a local site administrator is notified of a fault and can quickly determine where a cable fault is located.

> *FiberAlert should only be enabled on one side of a media conversion. Enabling it on both sides would keep both transmitters off indefinitely.*

Using FiberAlert and LinkLoss

In a typical central site to remote site media conversion, the manufacturer recommends you enable your media converters' troubleshooting features as follows:

FO/FX LinkLoss:	Main Site Only
TP/TX LinkLoss:	Remote Site Only
FiberAlert:	Remote Site Only

This will ensure that any faults, no matter where they occur, can be detected by an administrator located at the central site.

If you are unsure of how best to implement these features in your configuration, please contact customer service.

Troubleshooting with LinkLoss and FiberAlert

If *LinkLoss* is enabled and you lose the connection between the *Media Converter* and the hub/switch to which the *Media Converter* is connected, disable *LinkLoss* to assist in pinpointing whether the fault is on the twisted pair or fiber optic segment. After disabling *LinkLoss*, if the link is reestablished with the hub/switch, the problem resides with the fiber segment. If *LinkLoss* is disabled and the connection between the *Media Converter* and the hub/ switch is NOT reestablished, the failure resides with the twisted pair segment. When a failure occurs, check that cables are properly connected. You can also try using another port on the hub/switch or another cable.

As discussed earlier, *FiberAlert* stops the fiber optic transmissions as well as the link LED for the opposite end of the fiber conversion when a problem occurs with the fiber optic segment. When *FiberAlert* is enabled and a fault is detected, disable *FiberAlert* to determine which side of the fiber has stopped receiving. When a failure occurs, check that cables are properly connected. You can also try using another cable.

Configuring Autonegotiation on 100 Mbps Modules

When *Autonegotiation* is enabled, the media converter negotiates as a 100 Mbps Full-Duplex device; if the device the media converter is connected to can operate at 100 Mbps Full-Duplex, a link will be established. If the twisted pair port on the other device does not have the ability to autonegotiate, or if a 100 Mbps Half-Duplex connection is desired, *Autonegotiation* on the media converter must be disabled. Half-

and Full-Duplex settings must be manually set and match on both devices the media converters are connected to (see below). The diagram below show a typical application, followed by a table with three possible configurations.
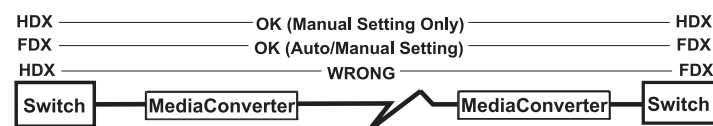
| End to End Connection	Switch	TX/FX
Half-Duplex	Manually configure HDX	Autonegotiation Off
Full-Duplex	Manually configure FDX	Autonegotiation Off
Full-Duplex	Autonegotiation On	Autonegotiation On

Autonegotiation is configured with a 3-pin jumper block located at position JP3 on *100 Mbps Modules*. Enable *Autonegotiation* by placing the shunt over pins 1-2. Disable *Autonegotiation* (factory default) by placing the shunt over pins 2-3.

BNC Port Termination

10 Mbps Modules with BNC ports feature a 2-pin jumper block located at position JP1. This jumper block allows a thin coaxial segment to be terminated at the *Media Converter* without an additional 'T' connector and terminator. If a thin Ethernet segment is to be terminated at the BNC port on the *Media Converter*, attach the cable directly to the BNC connector and set the termination jumper to the ON (enabled, factory default) position by placing the shunt over both pins.

If the BNC port on the *Media Converter* is attached to a midpoint of a thin Ethernet segment, attach a 'T' connector to the BNC port and set the termination jumper to the OFF (disabled) position by placing the shunt on only one pin or by removing the shunt.

> *Note: Thin Ethernet segments must be properly terminated at both ends and grounded at one end. If the BNC port is not terminated correctly, the ACTIVITY light on the front panel will not glow.*
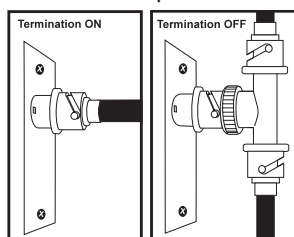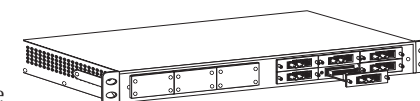
Installing Media Conversion Modules

Media conversion modules can be installed in any available media conversion module slot. Media conversion modules are hot-swappable.

> *Note: S2MM Module Sets can be installed in any two available slots, but still must be used as a set to provide a complete conversion. We recommend that each S2MM Module Set be installed side-by-side (left-to-right or top-to-bottom) to prevent mismatching module sets. It is necessary to power the unit down before configuration.*

Media conversion modules are shipped with brackets for securing them to the *Media Converter* chassis. Media conversion modules attach to a connector inside the *Media Converter* chassis. To install a module, simply unscrew the blank bracket covering the slot where the module is to be installed, slide the module into the chassis, via the cardguides, until the module is seated securely in the connector. Secure the module to the chassis by tightening the screws. Then connect the cables.

> *NOTE: Media Converter chassis are shipped from the factory with all but one media conversion module slot covered with "blank" brackets. Be sure to keep unused slots covered for EMI containment. It is a good idea to save any "blanks" removed during installation for future use if configuration requirements change.*

Measuring for Oversaturation

The high power fiber transmitters used on *SingleMode/PLUS* media conversion modules can overdrive the receivers and cause data loss if used in installations where cable power losses are low. To verify this, measure the optical power at the receiver. The measured power should be no greater than -14dBm and no less than the Average Receive Sensitivity (listed in the chart above). If measured power is greater than -14dBm, install an optical attenuator to bring power within specification. Ideally, *SingleMode/PLUS* should be used only where total attenuation of fiber, connectors and patch cords is greater than 7dB.

Determining Your Power Budget

The maximum distance for a fiber link is determined by the module installed. The following chart shows the specifications for each of the available modules:

Description	MAX. Fiber Segment Distance (Km)[1]		Wavelength (nm)	Fiber Operating Power[2] Budget		
	HDX	FDX		Avg. Launch Power (dBm)	Avg. Rcv. Sensitivity (dBm)	Avg. Power Loss Budget (dB)
10BT (RJ-45) - 10BFL MM	2	10	850	-12.55	-32.0	19.5
10BT (RJ-45) - 10BFL SM	2	20	1300	-18.0	-36.5	18.5
10BT (RJ-45) - 10BFL SM/PLUS	2	40	1300	-14.0	-36.5	22.5
10B2 (BNC) - 10BFL MM	2	n/a	850	-14.0	-34.5	20.5
10B2 (BNC) - 10BFL SM	2	n/a	1300	-18.0	-37.0	19.0
100BX TX - 100B FX	0.4	4	1300	-18.0	-31.0	13.0
100BX TX - 100B FX SM	0.4	20	1300	-19.0	-31.0	12.0
100BX TX - 100B FX SM/PLUS	0.4	40	1300	-15.0	-31.0	16.0
S2MM/1300 1300 nm SM-MM	2/3	4/20	1300/1300	-23.0	-31.5	8.5
S2MM/1300 1300 nm SM/PLUS-MM	2/3	4/40	1300/1300	-14.0	-31.5	17.5

[1] Distances listed are estimates and can vary with application. Distance limitations are determined by a combination of power budget fiber characteristics, number of connections and other physical parameters. Subtract 3 dB from Power Loss Budget for 50/125µ multi-mode fiber. Half-Duplex (HDX) distance is limited by IEEE specifications.

[2] Values are averages and have been determined under factory conditions. Actual field application values may vary.

Converting Single/Multi-Mode Fiber Optic

The illustrations below show three typical cabling configurations — (1) a single-mode connection between an 850nm multi-mode fiber device and a 1300 nm single-mode fiber device, (2) a single-mode connection between two 850nm multi-mode fiber devices and (3) a single-mode connection between two OC-3 multi-mode fiber devices.
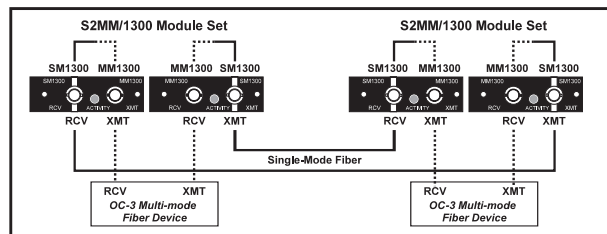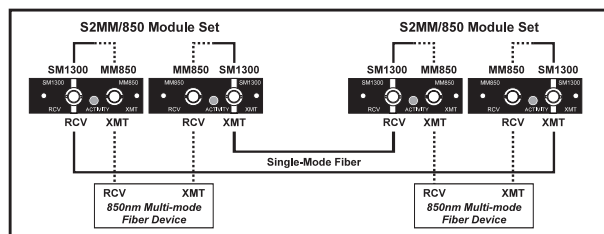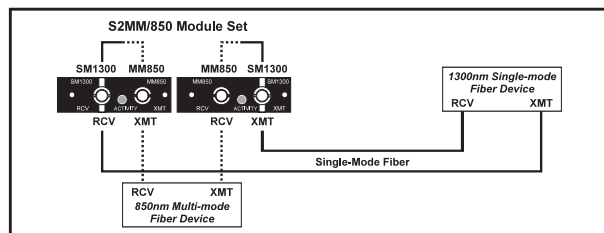

LED Functions on Media Conversion Modules

Media conversion modules feature diagnostic LEDs that provide information to help determine where failures reside when they occur in your network.

LEDs on 10-BT (RJ-45) - 10BFL and 100B TX - 10B FX Modules

The LED locations and functions are virtually the same on *10-BT (RJ-45) - 10BFL Modules* and *100B TX - 100B FX Modules*. The following diagram shows the LEDs on *10-BT (RJ-45) - 10BFL Modules*.
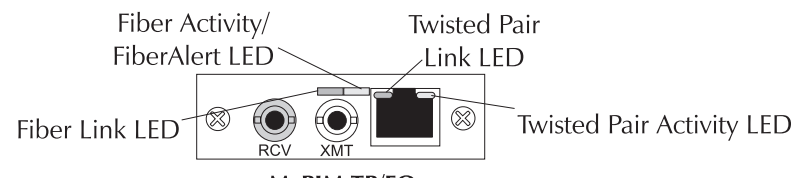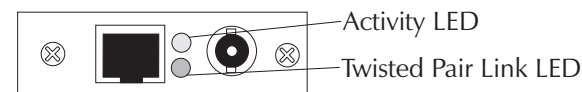

The Fiber Link LED glows green when a link is established with the fiber optic port. The function of the LED next to the Fiber Link LED depends on whether *FiberAlert* is enabled. If *FiberAlert* is disabled, this LED functions as an Activity LED and flickers amber when activity is detected on the fiber port. If *FiberAlert* is enabled, this LED glows amber upon power up, then flickers when activity is detected on the fiber port. The Twisted Pair Link LED glows green when a link is established with the twisted pair port. The Twisted Pair Activity LED flickers amber when activity is detected on the twisted pair port.

NOTE: On 100 Mbps Modules, the Fiber Activity LED does not reflect whether FiberAlert is enabled; this LED functions only as an Activity LED.
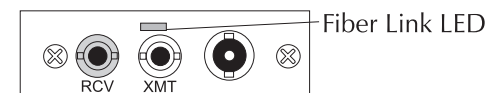
LEDs on 10BT (RJ-45) - 10B2 Modules

The following diagram shows the LEDs on *10BT (RJ-45) - 10B2 Modules:*

The Twisted Pair Link LED glows green when a link is established with the twisted pair port.
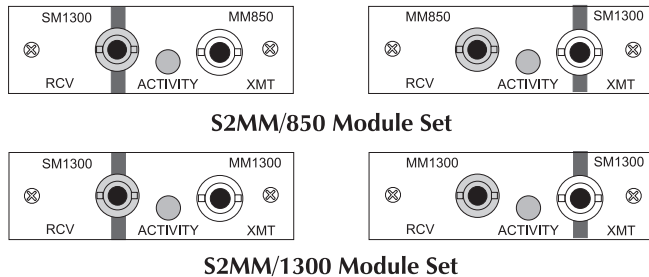
LEDs on 10B2 - 10B FL Modules

The following diagram shows the LEDs on *10B2 - 10B FL Modules*.

The Fiber Link LED glows green when a link is established with the fiber optic port.

LEDs on S2MM

The following diagram shows the LEDs on an *S2MM:*

S2MM/850 Module Set

S2MM/1300 Module Set

Each module in *S2MM Module Sets* has one Activity LED. This LED glows green in normal operation.

Fiber Optic Cleaning Guidelines

Fiber optic transmitters and receivers are extremely susceptible to contamination by particles of dirt or dust which can obstruct the optic path and cause performance degradation. Good system performance requires clean optics and connector ferrules.

1) Use fiber patch cords (or connectors, if you terminate your own fiber) only from a reputable supplier; low quality components can cause many hard-to-diagnose problems in an installation.

2) Dust caps are installed at the factory to ensure factory-clean optical devices. These protective caps should not be removed until the moment of connecting the fiber cable to the device. Assure that the fiber is properly terminated, polished and free of any dust or dirt and that the location is as free from dust and dirt as possible.

3) Store spare caps in a dust free environment such as a sealed plastic bag or box so that when reinstalled they do not introduce any contamination to the optics.

4) Should it be necessary to disconnect the fiber device, reinstall the protective dust caps.

5) If you suspect that the optics have been contaminated, alternate between blasting with clean dry compressed air and flushing with methanol to remove particles of dirt.

Electrostatic Discharge Precautions

Electrostatic discharge (ESD) can cause damage to your add-in modules. Always observe the following precautions when installing or handling an add-in module or any board assembly.

1) Do not remove unit from its protective packaging until you're ready to install it.

2) Wear an ESD wrist grounding strap before handling any module or component. If you do not have a wrist strap, maintain grounded contact with the system unit throughout any procedure requiring ESD protection.

WARNING! Integrated circuits and fiber optic components are extremely susceptible to electrostatic discharge damage. Do not handle these components directly unless you are a qualified service technician and use tools and techniques that conform to accepted industry practices.

3) Hold boards by the edges only; do not touch the electronic components or gold connectors.

4) After removal, always place the boards on a grounded, static free surface, ESD pad or in a proper ESD bag. Do not slide the board over any surface.

Customer Service Information

Call: (724) 746-5500 Phone orders 24 hours a day, 7:00 AM Monday to midnight Friday; 8:00 AM to 4:00 PM Saturday (EST)

Fax: (724) 746-0746 or in North America **1-800-321-0746**

Mail order: Black Box Corporation, 1000 Park Drive, Lawrence, PA 15055-1018

Technical Support and fax orders 24 hours a day

Federal Communications Commission Radio Frequency Interference Statement

This equipment generates, uses, and can radiate radio frequency energy that may cause interference to radio communication if not installed and used in strict accordance with the manufacturer's instructions. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.

Safety Certifications

UL: Listed to UL1950 and CSA 22.2, No. 950, Safety of Information Technology Equipment, Including Electrical Business Equipment.

TUV/GS: Certified to EN 60 950, Safety of Information Technology Equipment, Including Electrical Business Equipment.

CE: The products described herein comply with the Council Directive on Electromagnetic Compatibility (89/336/EEC) and the Council Directive on Electrical Equipment Designed for use within Certain Voltage Limits (73/23/EEC). For further details, contact Black Box Corporation.

NOTE: Modules are FCC approved and UL, TUV/GS and CE certified when installed in a Black Box chassis only.

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