T R A N S I T I O N

n e t w o r k s
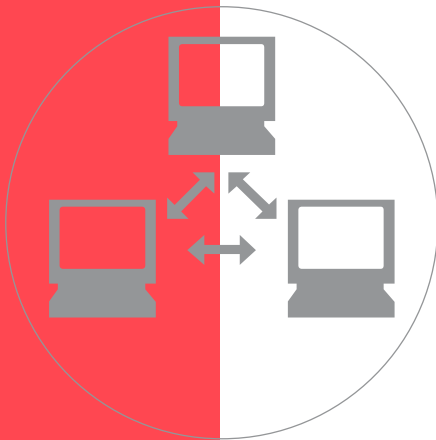
The Conversion Technology Experts

Choosing a
Fast Ethernet
Media Converter

Table of Contents

Introduction

Converting copper to fiber seems simple. Using a media converter, you plug a copper cable into one port and a fiber line into the other port, and you have conversion.

If only it was that easy. Media conversion is a cost-effective and simple-to-use tool if used correctly. The key is to use the right product for the right application. As experts in the field of media conversion, Transition Networks has designed a suite of media conversion options from which to choose, so you can be confident that networks will perform seamlessly and at full capacity. Transition Networks offers a broad range of media converters from feature rich to a more basic, cost effective solution.

The following pages outline the various applications that show how to incorporate optical fiber into your network while managing the obstacles and challenges presented by Fast Ethernet.

See page 15 for a complete Fast Ethernet Media Conversion Application Reference Table.
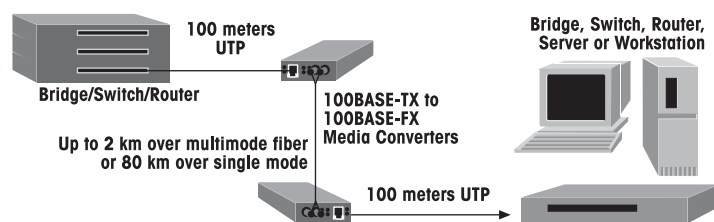
Extend Distance in a Full-Duplex Environment

When extending distance in Fast Ethernet environments, Transition Networks' offers two solutions, depending on your requirements. Transition's feature rich solution, E-100BTX-FX-05, offers features such as Auto-Cross, Auto-negotiation, Link Pass Through, Far End Fault and Pause (See page 5 for descriptions). With connections for 100BASE-TX and 100BASE-FX this media converter is intended exclusively for the Fast Ethernet environment. It converts twisted pair to optical fiber and can be used to extend a Fast Ethernet network segment.
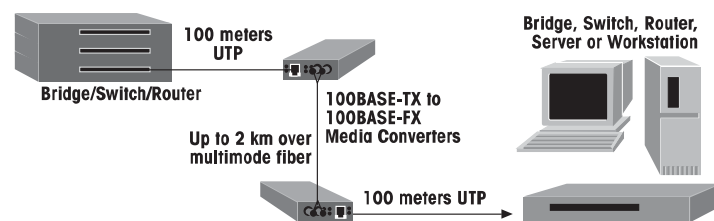
The typical application for the E-100BTX-FX-05 is extending network distances in full-duplex networks between two full-duplex devices such as switches, bridges or another full-duplex device, but it can work in a half-duplex environment. The E-100BTX-FX-05 Media Converter can extend distances between two twisted pair devices up to 2 km over multimode fiber or up to 80 km over single mode fiber. **(Figure 1)**

In addition to its full featured product, Transition Networks offers a media converter for users that do not require as many features. The J/FE-CF-03 (Just Convert-IT series) is an inexpensive easy-to-use 100BASE-TX to 100BASE-FX media converter, use specifically for the Fast Ethernet environment. The J/FE-CF-03 Media Converter converts twisted pair to optical fiber, and, typically, would be used to extend a Fast Ethernet network in a full-duplex environment up to 2 km. **(Figure 2)**

Figure 1:
Extending Distance Between Two Copper Devices

100 meters UTP

Bridge/Switch/Router

Up to 2 km over multimode fiber or 80 km over single mode

100BASE-TX to 100BASE-FX Media Converters

Bridge, Switch, Router, Server or Workstation

100 meters UTP

Figure 2:
Easy-to-Use Just Convert-IT Extends Distance Between Two Devices in a Full-Duplex Network

100 meters UTP

Bridge/Switch/Router

Up to 2 km over multimode fiber

100BASE-TX to 100BASE-FX Media Converters

Bridge, Switch, Router, Server or Workstation

100 meters UTP

Extend Distance in a Full-Duplex Environment

Either of these devices could also be used to connect a legacy device to and existing 100BASE-FX fiber switch. The legacy device can be placed anywhere from 2 km to 80 km (up to 20 km for the J/FE-CF-03), depending on the port on the existing fiber switch. **(Figure 3)**

Figure 3:
Extending Distance from an Existing
Fiber Switch to A Legacy Copper
Device
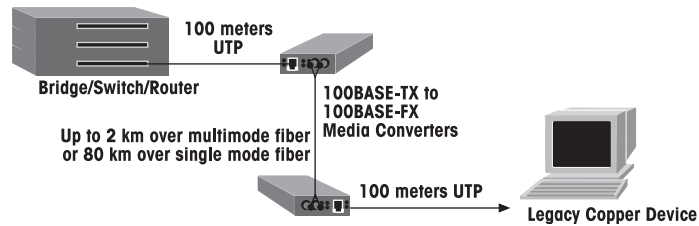
Advanced Features

Transition's feature rich E-100BTX-FX-05 media converter incorporates AutoCross™, Auto-Negotiation, Far End Fault, Link Pass Through, and Pause. The brief summary for the features previously mentioned is provided below.

AutoCross™ technology eliminates an entire category of network troubleshooting by sensing the polarity of the signals on the pins and automatically configuring the port to MDI or MDI-X.

Auto-Negotiation Auto-Negotiation allows each end of the link to exchange information about their individual capabilities, and then to negotiate and select the most favorable operational mode they are both capable of supporting.

Link Pass Through was designed to make troubleshooting easier. When a link on one side of the media converter fails it will also shut down the link on the opposite end of the converter to ensure that down link failures are properly detected.

Pause is a flow control feature that communicates congestion between the receiving device and the transmitting device. Transition's E-100BTX-FX-05 converter allows this feature to function unhindered between devices.

Far End Fault ensures that link failures are reported properly to all devices on the network so that network problems can be diagnosed and quickly corrected.

Extend Distance in a Half-Duplex Environment

When extending distance in a half-duplex environment you need to understand collision domain constraints. Half duplex refers to how the circuit communicates. In a half duplex environment, communication in both directions is allowed, just not simultaneously. In order to extend the distance between two devices it is often necessary to separate the collision domains using bridging or switching. If this is not done, the network's performance may suffer.

The Bridging Media Converter is an excellent product to use when trying to reduce network congestion. It provides a simple way to separate collision domains in a hub-based, shared media, half-duplex network. With its 10/100BASE-TX twisted pair interface it can connect to legacy 10BASE-T hubs, and future-proof the network when 100BASE-TX equipment is installed.

Transition Networks Bridging Media Converters:

- J/E-PSW-FX-01
- CBFTF101X-1X0
- SBFTF101X-1X0

Transition Networks' 10/100BASE-TX to 100BASE-FX Bridging Media Converters (See side note) provide several benefits for this type of application. Its primary function is to separate collision domains. It has the added benefit of extending the distance between network devices up to 2 km. Similar to our Fast Ethernet converters, Transition offers two bridging options, depending on your requirements. For more advanced feature needs such as AutoCross™, Auto-Negotiation, Far End Fault, Source Address Change, and Read/Write management features Transition offers CBFTF101X-1X0 & SBFTF101X-1X0 media converters. The J/E-PSW-FX-01 model is a lower cost option for situations where advanced features are not necessary.

When separating collision domains, the Bridging Media Converter can be teamed up with other media converters to complete this networking function. Since each Bridging Media Converter provides the necessary switching ability to separate collision domains, it is not always necessary to use them in pairs. The following is a rule of thumb to follow when incorporating Bridging Media Converters.

Between two hubs	(2) Fast Ethernet *Bridging* Media Converters.

Between a hub and a switch	(1) Fast Ethernet *Bridging* Media Converter on the hub side and (1) Fast Ethernet media converter on the switch side.

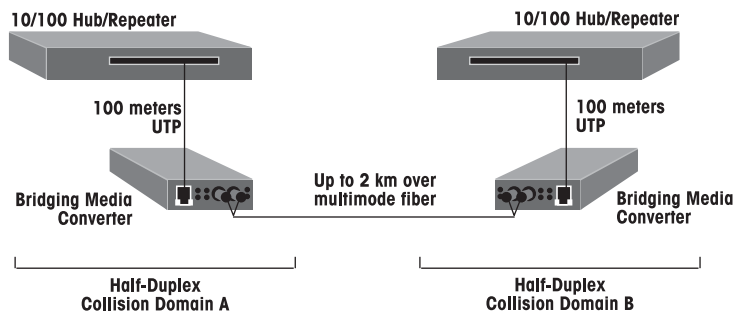|	
Between two switches	(2) Fast Ethernet Media Converters.

Extend Distance in a Half-Duplex Environment

Figure 4 shows the Bridging Media Converter extending network distance between two half-duplex networking devices up to 2 km over a multimode optical fiber link. Because the Bridging Media Converter separates the collision domains, the network performance will improve, and provides backbone style features to legacy 10/100BASE networks.
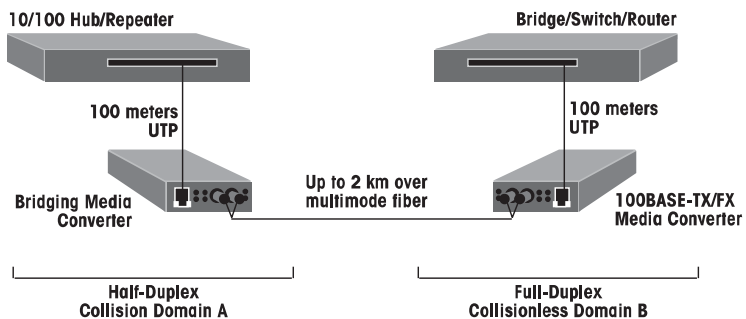
Figure 5 shows a Bridging Media Converter teamed up with the E-100BTX-FX-05 Media Converter to extend the network.

Figure 6 shows how to extend the network distance between two devices, but since these are two switches, the Bridging Media Converter solution is not necessary. The switches have eliminated the collision domain constraint, and this is actually a full-duplex solution. In our illustration we are using two E-100BTX-FX-05 Media Converters (refer to Extend Distance in A Full-Duplex Environment section.)
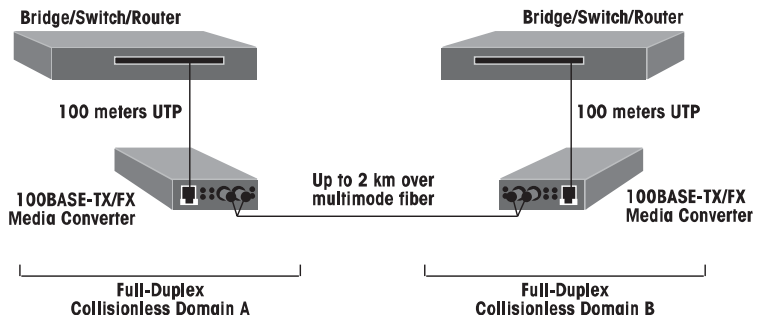
Figure 4:
Extend Distance Between Two Hubs
Using Two Bridging Media Converters

10/100 Hub/Repeater   10/100 Hub/Repeater

100 meters UTP   100 meters UTP

Bridging Media Converter   Up to 2 km over multimode fiber   Bridging Media Converter

Half-Duplex Collision Domain A   Half-Duplex Collision Domain B

Figure 5:
Extend Distance Between a Hub and a
Switch Using One Bridging Media
Converter and One E-100BTX-FX-05
Media Converter

10/100 Hub/Repeater   Bridge/Switch/Router

100 meters UTP   100 meters UTP

Bridging Media Converter   Up to 2 km over multimode fiber   100BASE-TX/FX Media Converter

Half-Duplex Collision Domain A   Full-Duplex Collisionless Domain B

Figure 6:
Extend Distance Between Two
Switches Using Two E-100BTX-FX-05
Media Converters

Bridge/Switch/Router   Bridge/Switch/Router

100 meters UTP   100 meters UTP

100BASE-TX/FX Media Converter   Up to 2 km over multimode fiber   100BASE-TX/FX Media Converter

Full-Duplex Collisionless Domain A   Full-Duplex Collisionless Domain B

Extend Distance with Redundant Copper to Fiber Links

Transition Networks Redundant Bridging Media Converters:

- CBFTF10XX-140
- SBFTF10XX-140

When network reliability is an issue and the integrity of a link is mission-critical to the network, redundancy is a consideration. Transition Networks' full-featured Redundant 10/100BASE-TX to 100BASE-FX Media Converter (xBFTF10XX-140) is targeted at the market segment that requires reliability in their network. Transition's bridging media converter provides stable and affordable fiber redundancy in critical Ethernet and Fast Ethernet environments.

The redundancy option is activated by a dip switch. When redundancy mode is on, one fiber connection is active (primary) at a time. This primary connection is in the forwarding stage while the other fiber connection (secondary) is put in the disabled state.

If a failure on the primary fiber occurs it is detected by the converter and the secondary fiber is activated, becoming the primary link. The original (primary) fiber is put into a disabled state and becomes the secondary fiber until a failure on the primary fiber occurs.

A similar type of redundancy could be achieved using a Spanning Tree Protocol bridging scheme. The redundant media converter is better, in some cases, because its auto-failover circuit switches faster than the redundant bridging scheme using the Spanning Tree algorithm. It takes several moments for the Spanning Tree algorithm to redirect the network path, potentially losing data, momentarily disrupting traffic flow. Transition Networks recommends using Bridging Media converters with fiber redundancy option in back-to-back configuration.

Figure 7 shows a typical installation to a network with redundant fiber links. Distances can be extended between two full-duplex networking devices up to 2 km over a multimode optical fiber, or 80 km using single mode optical fiber.

Figure 7: Fiber Redundancy in Fast Ethernet Networking
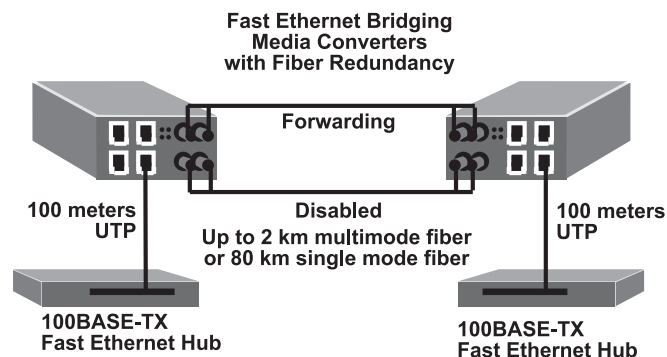
Fiber Performance in Horizontal Network Applications

Future-proofing the media in a network is a problem people face in today's networks. Fast Ethernet requires Category 5 copper cabling and Gigabit Ethernet requirements are even higher. Because of these requirements, new media is often required to accommodate the bandwidth. By installing fiber in the horizontal segments of your network, you can future-proof your network and take advantage of fiber's nearly unlimited bandwidth for years to come. Media conversion plays nicely into this migration plan, because, unlike expensive switches, you can cost-effectively upgrade the links that require the extra bandwidth as they need it.

Transition Networks Fast Ethernet Media Converters:

- CSETF101X-20X
- SSETF101X-20X

Transition Networks' 10/100BASE-SX to 10/100BASE-TX Media Converters (See side note) are designed to extend distances between copper devices. By using lower cost 850 nanometer opt-electronics, the 10/100BASE-SX converter provides compatibility with legacy 10BASE-FL devices. It provides the lowest cost solution for fiber installation of up to 300 meters (100BASE-SX). This makes it ideal for building backbone and horizontal cabling applications where cost and 10/100 auto-negotiation are critical.

The 10/100 SX Media Converter can be used to connect existing network device to the horizontal fiber cable. With 10/100 SX Media Converter's Auto-negotiation and parallel detection feature, it transparently allows the end devices to establish a link at its peak performance. The Auto-negotiation and parallel detection feature is key to providing an ease-of-migration path for the end devices.

Figure 8 shows an application for the 10/100 SX Media Converter. When fiber is installed in the horizontal segment, the 10/100 SX Media Converter can be used to interface the legacy equipment with the fiber link. When used in pairs, the 10/100 SX Media Converter can extend distances between two twisted pair networking devices in a full-duplex environment up to 300 meters over multimode fiber. A distance of 300 meters is more than adequate for almost all horizontal fiber segment applications.

Media converters can be removed and used in other locations as the network evolves and the legacy equipment is upgraded.

Figure 8: Typical Example of Horizontal Fiber Installation
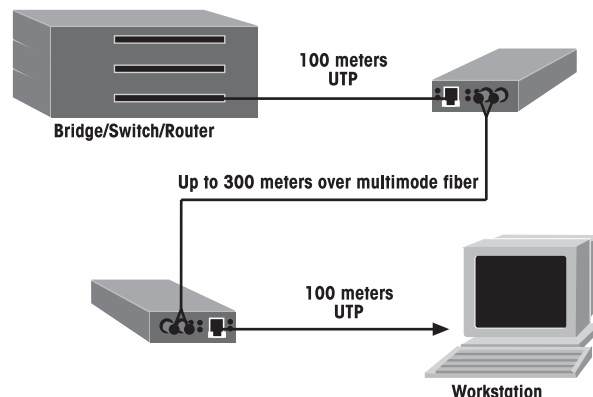
Single Mode to Multimode Conversion

Not all optical fiber cable is the same, creating problems when trying to connect a single mode device to a multimode device. Transition Networks' Multimode to Single Mode Fast Ethernet Media Converter (See side note) is designed to solve this problem. It converts single mode to multimode fiber, providing the conversion necessary for the connection. Another benefit of using the Single Mode to Multimode Fast Ethernet Media Converters is extending distance between devices. By converting multimode to single mode, the media converter can take advantage of single mode's optical characteristics. With single mode optics, network distances can be extended up to 80 km between two devices.
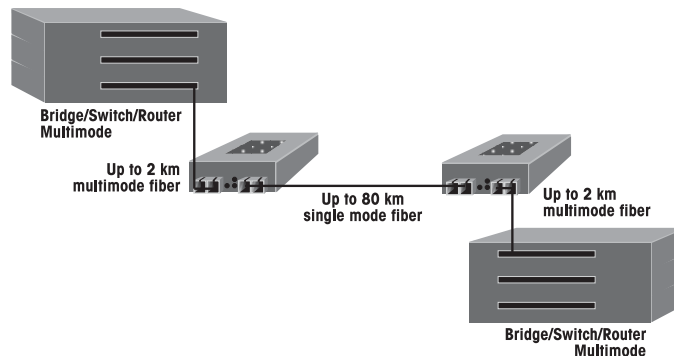
Figure 9 shows two unlike devices being connected. Used in pairs, the Single Mode to Multimode Fast Ethernet Media Converter can extend distance between two like devices. **(Figure 10)**
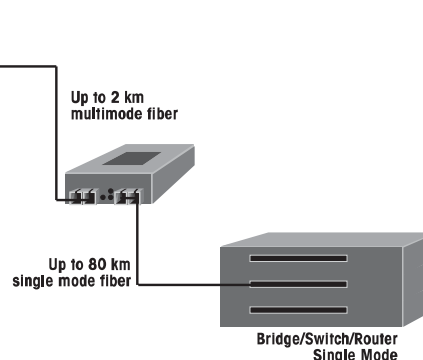
Single Fiber

Copper to single fiber media converters allow network planners to increase the backbone capacity or further divide workgroup connections and assign a separate strand for mission critical applications.

Transitions copper to single fiber media converters allow traffic to travel on one strand of fiber, thus doubling fiber capacity. This represents considerable cost savings to enterprises and service providers. Transition Networks offers a broad range of copper to single fiber products supporting Fast Ethernet, 10/100 bridging, Gigabit and more.

Figure 9:
Extend Network Distance Between
Unlike Devices

Bridge/Switch/Router Multimode

Up to 2 km multimode fiber

Up to 80 km single mode fiber

Up to 2 km multimode fiber

Bridge/Switch/Router Multimode

Figure 10:
Extend Network Distance

Bridge/Switch/Router Multimode

Up to 2 km multimode fiber

Up to 80 km single mode fiber

Bridge/Switch/Router Single Mode

Form Factors

Once the decision to use media conversion is reached, it is important to decide what kind of media converter platform will be used for the application. Transition Networks' media converters come in a variety of form factors and options to consider.

- Desktop Applications
- Wiring Closet Applications
- Network Management
- Redundancy
- Optical Fiber Connectors

Desktop Applications

When you need small form factor devices to either sit on a desktop or mount in a remote location where space is a premium, Transition Networks has the right solution. Both the Stand-Alone Media Converter and the Slide-In-Module product offerings from Transition Networks provide a small form factor that can sit on the desktop or can be wall-mounted.

Stand-Alone Media Converters

These free-standing units have their own external power supplies and are typically placed at the desktop or other remote locations. In large networks or campus environments, they may be used to make a backbone connection between floors or buildings. Wall Mount Brackets can be added to these units for yet another mounting option. **(Figures 11, 12, 13, & 14)**

Stand-Alone Media Converters

Figure 11:
Stand-Alone Media Converter

Figure 12:
Optional Wall Mount Brackets

Figure 13:
Stand-Alone Unit with Brackets

Figure 14:
Stand-Alone Unit with Din Rail
Mounting Bracket
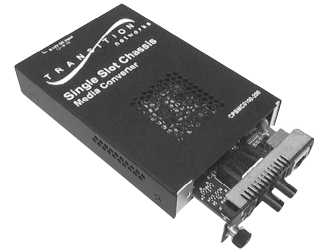
Form Factors

*Figure 15:
Slide-In-Module*

*Figure 16:
Slide-In-Module with Single Slot
Converter Chassis*

Slide-In-Module Media Converters

The Slide-In-Module is intended for use with either the Point System Chassis or the Single Slot Converter Chassis. For desktop or remote applications, the Slide-In-Module can be used with the Single Slot Converter Chassis. The Single Slot converter chassis comes with its own power supply and can be wall-mounted. Now you can purchase just one media converter form factor - the Slide-In-Module - and decide later if you will use it in the multi-slot chassis or on a stand-alone basis. **(Figures 15 & 16)**

Wiring Closet Applications

Wiring closet applications can provide some challenges with space and organization. Transition Networks makes two different solutions for the wiring closet application: the 12-Slot Media Converter Rack and the Point System Chassis. Each of these solutions provides slightly different features. Both of options are space-saving, rack-mountable and consolidate power connections, assisting wiring organization.

12-Slot Media Converter Rack

Stand-Alone Media Converters can be placed in the 12-Slot Media Converter Rack, providing a 19" rack-mountable solution. Rack-mounting media converters are ideal for wiring closet applications. The 12-Slot Media Converter Rack supports up to twelve Transition Networks' Stand-Alone Media Converters. Its unique enclosure design makes multiple connections and consolidates them into a single device with a single internal universal power supply. It eliminates the need for multiple power connections, cutting down on wiring in the closet. **(Figure 17)**

*Figure 17:
12-Slot Media Converter Rack
(E-MCR-03)*
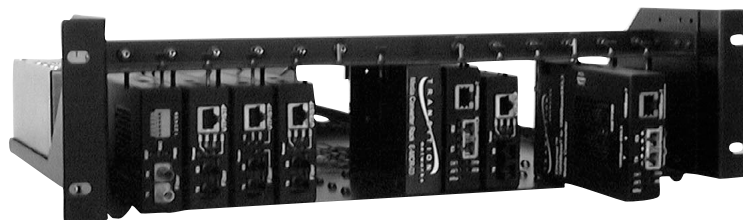
Form Factors

The Point System Chassis

The Point System Chassis is available in 19, 18, 13, 8, Dual or Single Slot models. The Point System allows you to incorporate multiple Slide-In-Modules in a single 19″ rack-mountable unit. The Point System offers the same kind of convenience in the wiring closet as the 12-Slot Media Converter Rack does, but it is based around the Slide-In-Modules. The Point System offers additional optional features with network management and power supply redundancy. **(Figure 18)**
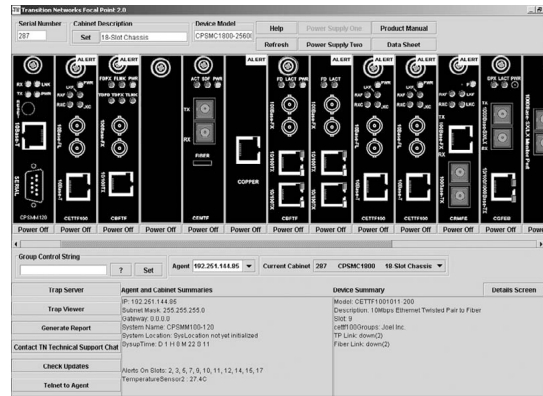
Network Management

Network management is always an issue, and even more so in large LAN installations. Transition Networks' enhanced management software allows customers to monitor, configure, and control their media converters using SNMP management. Transition's Focal Point software offers full SNMP read/write capabilities via a GUI, a web-based format or Command Line Interface (CLI). **(Figure 19)**

The management platform supports HP OpenView on HP-UNIX, Sun Solaris and Windows NT platforms.
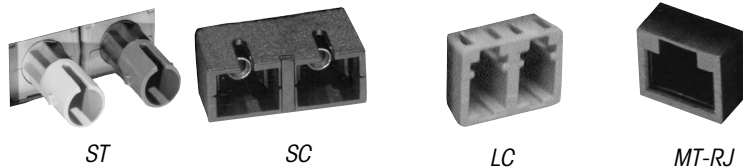
Form Factors

Redundancy

Some network installations are mission-critical, and cannot experience down-time. Transition Networks offers a complete redundant Fast Ethernet solution. The Redundant Fast Ethernet Media Converter provides redundant management, redundancy to the link, and the Point System Chassis can be equipped with an optional redundant power supply. The combination of these products provides a truly mission-critical backup solution. Since all of the Point System's components are hot-swappable, this means virtually zero downtime.

Another feature of the Point System's redundant power supplies is that they can be either universal power supplies (120/240VAC) or −48VDC power supplies. The −48VDC power supplies are intended for Telco-type applications where the primary power is −48VDC.

Optical Fiber Connectors

ST   SC   LC   MT-RJ

Having the right optical fiber connector can help cut down on link loss. Unlike a fiber switch that has only one connector type, media conversion, with its small individual form factor, provides greater flexibility. Transition Networks provides a wide selection of media converters, each with a variety of connector options to choose from. Having the option of a different connector on each media converter can help reduce, if not eliminate, the need for patch panels or cords.

Transition Networks provides various form factors for your consideration. Each form factor provides its own unique solution to the network environment.

Conclusion

Media converters provide unique solutions for difficult problems. They offer flexibility, cost savings and are easy to install. Media converters are a viable option and need to be considered when designing your network.

Transition Networks offers a wide range of Fast Ethernet conversion products. For more complex applications, Transition offers feature rich converters with features such as Far End Fault, Link Pass Through, Auto-negotiation, Pause, and AutoCross^{TM}. Transition also offers a basic cost effective Fast Ethernet converter for simpler applications. Whether you require the critical management features of the Point System Chassis or a more simple conversion product, Transition Networks has the the solution for you.

Fast Ethernet Media Conversion Application Reference Table

All products are Class A compliant unless otherwise noted.

Part Number	Form Factor	Environment	Class*/Feature	Port 1	Port 2	Application
CFETF101X-105	Point System Slide in Module	FDX/HDX	• AutoCross™ • Auto-Negotiation • Link Pass Through	100BASE-TX	100BASE-FX	Extend Distance in Full Duplex Environment
CFETF101X-205	Point System Slide in Module	FDX/HDX	**Class B** • AutoCross™ • Auto-Negotiation • Link Pass Through • Far End Fault • Pause • Automatically re-establish link	100BASE-TX	100BASE-FX	Extend Distance in Full Duplex Environment
J/FE-CF-03	Stand Alone	FDX	• Auto-Negotiation on TP port • LEDs for monitoring • AutoCross™	100BASE-TX	100BASE-FX	Extend Distance in Full Duplex Environment
CBFTF101X-1XX	Point System Slide in Module	FDX/HDX	• AutoCross™ • Auto-Negotiation • Link Pass Through (on -100 models) • Far End Fault • Ability to manage each port • Individual switches for both TP ports (on -100 models) • LEDs • Source Address Change • Up to 5TX ports • Optional 2nd FX port with 4TX port • Port mirroring	10/100BASE-TX	100BASE-FX	Extend Distance in Half Duplex Environment
CBFTF101X-150	Point System Slide in Module	FDX/HDX	• AutoCross™ • Auto-Negotiation • Far End Fault • LEDs • 10Mbps or 100Mbps • Read & Write management features	10/100BASE-TX	100BASE-FX	Extend Distance in Half Duplex Environment
SBFTF101X-1X0	Stand Alone	FDX/HDX	• AutoCross™ • Auto-Negotiation • Link Pass Through (on -100 models) • Far End Fault • Individual switches for TP ports • Up to 5TX ports • Optional 2nd FX port with 4TX port • Port Mirroring	10/100BASE-TX	100BASE-FX	Extend Distance in Half Duplex Environment
J/E-PSW-FX-01	Stand Alone	FDX/HDX	• Fiber port SM or MM • Retiming & Regeneration of packets • 100BASE -TX port is auto-negotiation enabled	10/100BASE-TX	100BASE-FX	Extend Distance in Half Duplex Environment
CSETF101X-20X	Point System Slide in Module	FDX/HDX	• AutoCross™ • Auto-Negotiation • Link Alert™ • Efficient and Reliable with increased loads	10/100BASE-TX	10/100BASE-SX	Fiber Performance in Horizontal Network Applications
SSETF101X-20X	Stand Alone	FDX/HDX	• AutoCross™ • Auto-Negotiation • Link Alert™ • Efficient and Reliable with increased loads	10/100BASE-TX	10/100BASE-SX	Fiber Performance in Horizontal Network Applications
CFMFF1XXX-200	Point System Slide in Module	FDX/HDX	• Convert SM to MM • Convert 100BASE-SX on Gigabit Ethernet switch to 100BASE-LX port by port • Multimode signal detect • Hardware/software mode • Fiber port enable/disable multimode & single mode	Single Mode Multimode	Single Mode	Single Mode to Multimode Conversion