
TotalSwitch 6 10-Mbps Module

Installation Guide and Users Reference Manual

LB6010-TP8	LB6011-FO	LB6011-FOSC	LB6010-BNC4
LB6012-FO	LB6012-FOSC	LB6013-FO	LB6013-FOSC
LB6013P-FO	LB6013P-FOSC	LB6014-TPFO	LB6014-TPFOSC
LB6015-TP-FO	LB6015-TPFOSC	LB6016-TPFO	LB6016-TPFOSC
LB6016P-TPFO	LB6016P-TPFOSC		

This manual contains information to help with the installation and operation of Black Box Corporation's *TotalSwitch* line of modular 10 Mbps Ethernet multi-port switches.



Black Box Corporation

The World's Source for ConnectivitySM

1000 Park Drive • Lawrence, PA 15055-1018 USA

TEL: (724) 746-5500 • FAX: (724) 746-0746

www.blackbox.com

Disclaimer

Black Box Corporation makes no warranties with respect to this document and disclaims any implied warranties of merchantability or fitness for a particular purpose. Black Box Corporation assumes no responsibility for any errors that may appear in this document or for incidental consequential damages in connection with the performance or use of this material.

This document contains proprietary information which is protected by copyright. No part may be reproduced in any way without prior consent of Black Box Corporation.

Copyright

© 1998 Black Box Corporation. All rights reserved.

Trademarks

Brands or product names may be trademarks and are the properties of their respective companies.

Contents

Chapter 1 Introduction

About <i>TotalSwitch 6 10-Mbps Modules</i>	1.1
--	-----

Chapter 2 Hardware Installation

Jumper Settings	2.1
FiberAlert Jumpers	2.3
Half-Duplex/Full-Duplex Jumpers	2.4
Factory Test Jumpers	2.4
Installing <i>TotalSwitch Modules</i> in <i>Modular Concentrator Hubs</i> ..	2.4
Installing <i>TotalSwitch Modules</i> in <i>TotalSwitch 6</i>	2.5
BNC Port Termination	2.6
LEDs	2.6
LEDs on Twisted Pair Ports	2.7
LEDs on Fiber Ports	2.7
LEDs on Thin Coaxial Ports	2.8

Chapter 3 User Guidelines

<i>TotalSwitch</i> Installation Examples	3.1
--	-----

Chapter 4 Technical Specifications

Fiber Optic Power Specifications	4.1
Fiber Optic Cleaning Guidelines	4.1
Electrostatic Discharge Precautions	4.2
Specifications	4.3
Environmental	4.3

Chapter 5 General Information

Customer Service Information	5.1
Warranty	5.1
Federal Communications Commission Radio Frequency Interference Statement	5.1
Safety Certifications	5.2

Chapter 1

Introduction

TotalSwitch 6 10-Mbps Modules[™] are IEEE 802.3 multi-port switches that provide eight 10Base-T (Half- or Full-Duplex), four 10Base-2 (Half-Duplex), four 10Base-FL (Half- or Full-Duplex) or four 10Base-T (Half- or Full-Duplex) and two 10Base-FL (Half- or Full-Duplex) switched segments.

TotalSwitch 6 10-Mbps Modules use non-blocking switching architecture, provide wire speed switching (14,880 pps) for each segment and ensure extremely low latency.

Each *TotalSwitch 6 10-Mbps Module* features Store-and-Forward switching, a self-learning mechanism with advanced address recognition that holds eight thousand addresses and includes a 1MB packet buffer for high performance.

About TotalSwitch 6 10-Mbps Modules

TotalSwitch 6 10-Mbps Modules are designed to be installed in any *TotalSwitch 6*[™] or *Modular Concentrator*[™] hub.

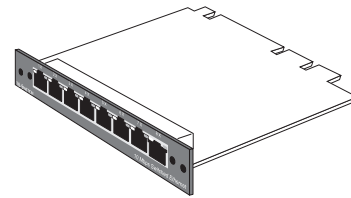


Figure 1.1 *TotalSwitch 6 TP/8 Module*

The following versions of *TotalSwitch 6 10-Mbps Modules* are available:

TotalSwitch 6 10-Mbps Module, TP/8 — (LB6010-TP8)
includes eight RJ-45 connectors; Half- or Full-Duplex on each port

TotalSwitch 6 10-Mbps Module, BNC/4 — (LB6010-BNC4)
includes four BNC connectors; Half-Duplex

TotalSwitch 6 10-Mbps Module, FO/4 — includes four pair ST (LB6011-FO) or SC (LB6011-FOSC) connectors; 850 nm multi-mode; Half- or Full-Duplex on each port

TotalSwitch 6 10-Mbps Modules, FO/4-1300 — includes four pair ST (LB6012-FO) or SC (LB6012-FOSC) connectors; 1300 nm multi-mode; Half- or Full-Duplex on each port

TotalSwitch 6 10-Mbps Modules, FO/4-SingleMode — includes four pair ST (LB6013-FO) or SC (LB6013-FOSC) connectors; 1300 nm single-mode fiber; Half- or Full-Duplex on each port

TotalSwitch 6 10-Mbps Modules, FO/4-SingleMode/PLUS — as above except supports longer distances; includes four pair ST (LB6013P-FO) or SC (LB6013P-FOSC) connectors

TotalSwitch 6 10-Mbps Modules, TP4+FO2 — includes four RJ-45 connectors and two pair ST (LB6014-TPFO) or SC (LB6014-TPFOSC) connectors; Half- or Full-Duplex on each port; 850 nm multi-mode fiber

TotalSwitch 6 10-Mbps Modules, TP4+FO2 — includes four RJ-45 connectors and two pair ST (LB6015-TPFO) or SC (LB6015-TPFOSC) connectors; Half- or Full-Duplex on each port; 1300 nm multi-mode fiber

TotalSwitch 6 10-Mbps Modules, TP4+FO2-SingleMode — includes four RJ-45 connectors and two pair ST (LB6016-TPFO) or SC (LB6016-TPFOSC) connectors; Half- or Full-Duplex on each port; single-mode fiber

TotalSwitch 6 10-Mbps Modules, TP4+FO2-SingleMode/PLUS — includes four RJ-45 connectors and two pair ST (LB6016P-TPFO) or SC (LB6016P-TPFOSC) connectors; Half- or Full-Duplex on each port; single-mode fiber; supports longer distances

Please contact Black Box Corporation for further details and ordering information on *TotalSwitch 6* chassis and *Modular Concentrator* hubs.

Chapter 2

Hardware Installation

This chapter provides configuration and installation information for *TotalSwitch 6 10-Mbps Modules* (referred to as *Total Switch Modules* throughout the rest of this manual).

Jumper Settings

TotalSwitch TP/8, *TotalSwitch FO/4* and *TotalSwitch TP/4+FO/2* have several jumpers that may need to be configured. It is necessary to power down the unit before adjusting the jumper settings.

NOTE: To change the settings once a TotalSwitch Module is installed, it is necessary to remove the PCB from the chassis. To do this, loosen the thumbscrews on the face of the chassis, then slide the PCB out of the chassis. After configuration is complete, slide the PCB back into the chassis and tighten the thumbscrews.

The following diagrams show the jumper locations and default settings on the various *TotalSwitch Modules*.

NOTE: Ports are labeled on the PCB as well as on the front of the module. The HDX/FDX jumpers at JA1 on TotalSwitch TP/8 are numbered in reverse order (i.e jumper 1 corresponds to Port 8, jumper 2 corresponds to Port 7, etc. Refer to the diagram of TotalSwitch TP/8)

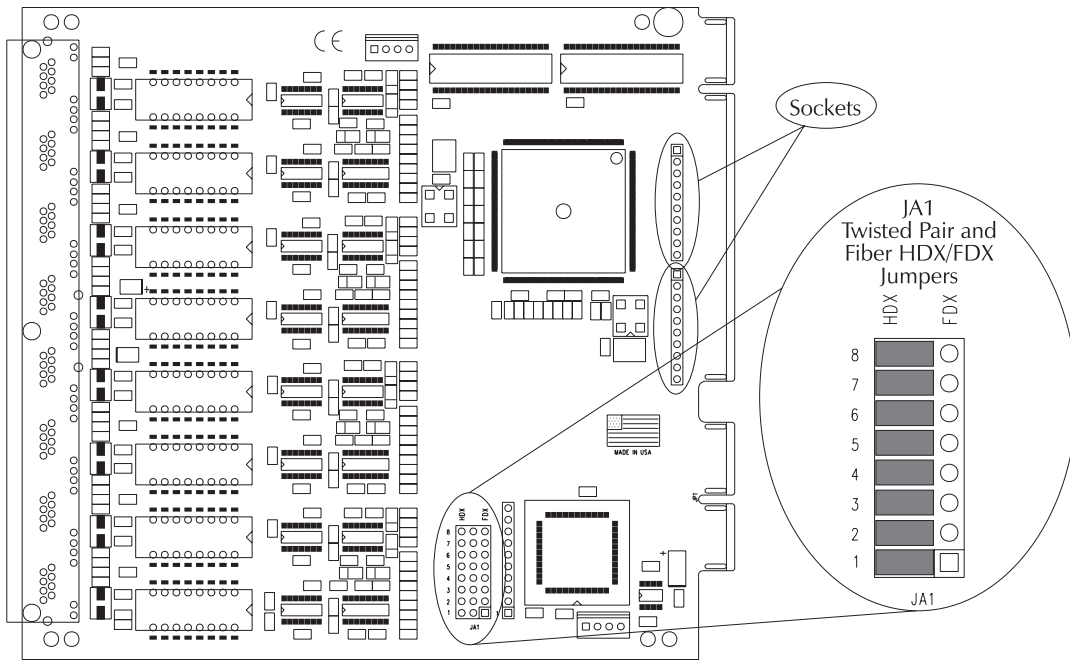


Figure 2.1 Jumper Locations and Default Settings for TotalSwitch TP/8

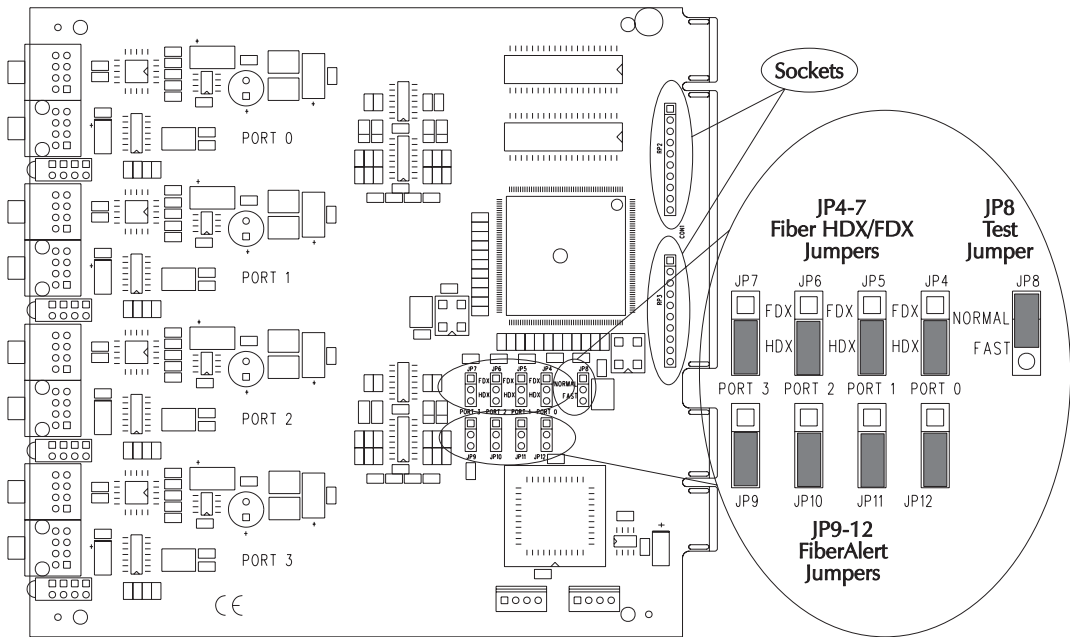


Figure 2.2 Jumper Locations and Default Settings for TotalSwitch FO/4

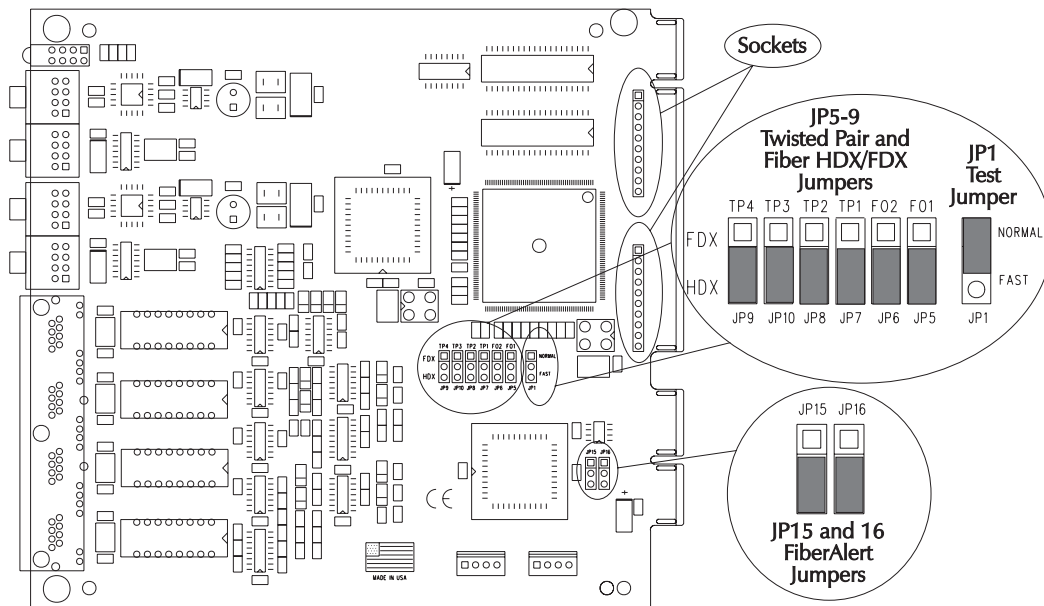


Figure 2.3 Jumper Locations and Default Settings for TotalSwitch TP/4+FO/2

FiberAlert Jumpers

TotalSwitch FO/4 Modules (board revisions -20 and higher) and TotalSwitch TP/4+FO/2 Modules feature FiberAlert. When a fiber optic receive fault is detected, FiberAlert makes the link LED for the opposite end of the fiber conversion pulse, signifying there is a problem and thus eliminating “silent failures.”

FiberAlert is enabled/disabled on each fiber port of a TotalSwitch Module by repositioning the shunts on the 3-pin, FiberAlert jumper blocks on the PCB. TotalSwitch Modules are shipped from the factory with FiberAlert disabled on each port.

The FiberAlert jumper blocks on TotalSwitch TP/4+FO/2 Modules are located at positions JP15 (Port 1) and JP16 (Port 2). The FiberAlert jumper blocks on TotalSwitch FO/4 Modules are located at positions JP12 for Port 1 (labeled Port 0 on the PCB), JP11 for Port 2 (labeled Port 1 on the PCB), JP10 for Port 3 (labeled Port 2 on the PCB) and JP9 for Port 4 (labeled Port 3 on the PCB).

Enable FiberAlert by positioning the shunt over the top and center pins. Disable FiberAlert (factory default) by positioning the shunt over the center and bottom pins.

Half-Duplex/Full-Duplex Jumpers

Each twisted pair and fiber optic port on a *TotalSwitch Module* can operate in either Half-Duplex (HDX) or Full-Duplex (FDX) mode. *TotalSwitch Modules* are shipped from the factory with HDX selected on each port. HDX/FDX is selected on *TotalSwitch Modules* by repositioning the shunts on the 3-pin, HDX/FDX jumper blocks on the PCB.

The HDX/FDX jumper blocks on *TotalSwitch TP/8 Modules* are located at position JA1 and labeled 1 - 8. The HDX/FDX jumper blocks on *TotalSwitch TP/4+FO/2 Modules* are located at positions JP5-10 (and labeled with the corresponding port). The HDX/FDX jumper blocks on *TotalSwitch FO/4 Modules* are located at positions JP4 for Port 1 (labeled Port 0 on the PCB), JP5 for Port 2 (labeled Port 1 on the PCB), JP6 for Port 3 (labeled Port 2 on the PCB) and JP7 for Port 4 (labeled Port 3 on the PCB).

Select FDX by positioning the shunt over the top and center pins. Select HDX (factory default) by positioning the shunt over the center and bottom pins.

Factory Test Jumpers

The jumper blocks located at position JP1 on *TotalSwitch TP/4+FO/2 Modules* and at position JP8 on *TotalSwitch FO/4 Modules* are for factory test purposes only. These jumpers are configured at the factory and should not be changed. The default setting is with the shunt positioned on the top two pins.

Installing TotalSwitch Modules in Modular Concentrator Hubs

TotalSwitch Modules can be installed into any available slot in any collision domain on any *Modular Concentrator* hub (e.g.: *Modular Concentrator/12*, *Modular Concentrator/5* and *Modular Concentrator/2*). For specific installation and operation information on *Modular Concentrator* hubs, please refer to the manual included with the hub.

NOTE: TotalSwitch Modules are not capable of being managed even when installed in a Modular Concentrator hub using SNMP management.

To install a *TotalSwitch Module*, remove the blank bracket covering the slot where the module is to be installed by removing the two screws located closest to the outside edge of the bracket.

NOTE: TotalSwitch Modules cannot be installed in Slot 1; this disables SNMP for the Modular Concentrator's NMS.

Next, slide the module into the chassis until it is seated securely in the connector on the backplane. Secure the module to the chassis by tightening the thumbscrews.

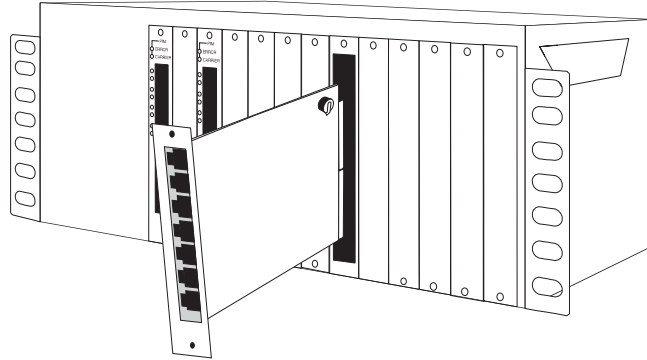


Figure 2.4 Installing a TotalSwitch Module in a Modular Concentrator Hub

To complete the installation of a *Modular Concentrator* hub, refer to the manual included with the hub for more information.

Installing TotalSwitch Modules in TotalSwitch 6

TotalSwitch Modules can be installed into any available slot in any modular *TotalSwitch 6*. Before installing a *TotalSwitch Module* in a *TotalSwitch 6* chassis, the resistor packs on the module must be removed from the sockets on the rear of the PCB (lift the resistor pack from the socket). Refer to the diagrams of the modules earlier in the chapter for socket location.

NOTE: The sockets are located in the same general location on TotalSwitch BNC/4.

To install a *TotalSwitch Module*, remove the blank bracket covering the slot where the module is to be installed by removing the two screws located closest to the outside edge of the bracket.

Next, slide the module into the chassis until it is seated securely in the connector on the backplane. Secure the module to the chassis by tightening the thumbscrews.

To complete the installation of a *TotalSwitch 6*, refer to the *TotalSwitch 6 Installation Guide* included with the chassis.

BNC Port Termination

When using the BNC port, the port termination may need setting. *TotalSwitch BNC/4* features a 2-position switch next to each BNC connector that allows a thin coaxial segment to be terminated at the hub/chassis without an additional ‘T’ connector and terminator.

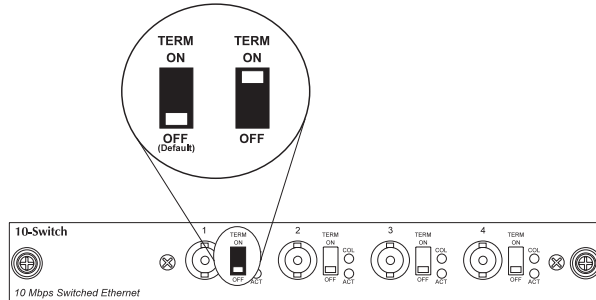


Figure 2.5 BNC Termination Switch

If the *TotalSwitch Module* is attached to the mid-point of a thin Ethernet segment, attach a ‘T’ connector to the BNC port. Termination must be OFF (disabled – factory default). Termination is disabled when the toggle is in the down position.

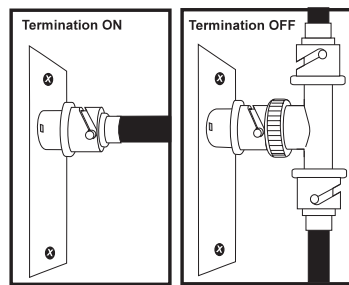


Figure 2.6 BNC Termination

If a thin Ethernet segment is to be terminated at the *TotalSwitch Module*, attach the cable directly to the BNC connector and set the termination switch to ON (enabled) by moving the toggle to the up position.

NOTE: When the BNC port is not being used, Black Box recommends the toggle be set to ON and a 50 Ω terminator be connected to the port.

LEDs

TotalSwitch Modules feature diagnostic LEDs per port. The following diagrams show the LEDs on *TotalSwitch TP/8*, *BNC/4* and *FO/4 Modules*. Refer to the sections “*LEDs on Twisted Pair Ports*” and “*LEDs on Fiber Ports*” for LED information on *TotalSwitch TP/4+FO/2 Modules*.

LEDs on Twisted Pair Ports

The LED functions for twisted pair ports are as follows:

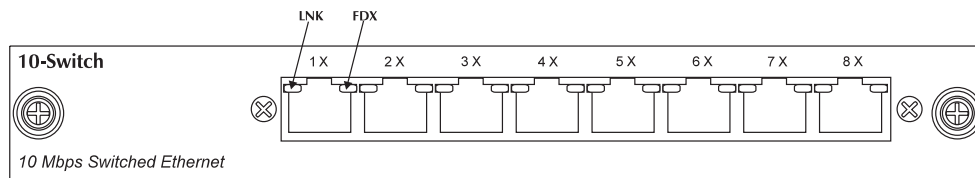


Figure 2.7 LEDs on TotalSwitch TP/8 Module

- FDX** Glows amber when Full-Duplex is selected on the port
- LNK** This LED provides three port status functions:
- Glows green constantly in normal operation
 - Blinks green once every few seconds when there is a Link failure
 - Blinks green twice every few seconds if the port has been partitioned

LEDs on Fiber Ports

The LED functions for fiber optic ports are as follows:

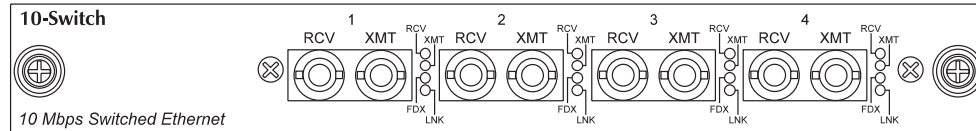


Figure 2.8 LEDs on TotalSwitch FO/4 Module

- RCV** Flickers amber when port is receiving data
- XMT** Flickers green when port is transmitting data
- FDX** Glows amber when Full-Duplex is selected on the port
- LNK** This LED provides three port status functions:
- Glows green constantly in normal operation
 - Blinks green once every few seconds when there is a Link failure
 - Blinks green twice every few seconds if the port has been partitioned

LEDs on Thin Coaxial Ports

The LED functions for thin coaxial ports are as follows:

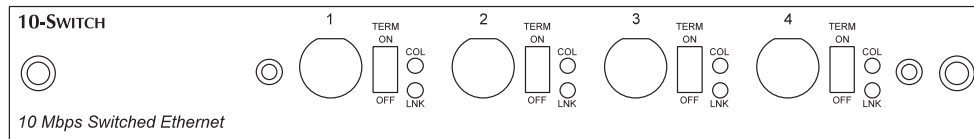


Figure 2.9 LEDs on TotalSwitch BNC/4 Module

- ACT** Flickers green in normal operation indicating activity (traffic) on the BNC segment
- COL** Flickers red in normal operation indicating normal collisions are being detected on the BNC segment

Chapter 3

User Guidelines

As stated earlier, *TotalSwitch Modules* are 10 Mbps Ethernet, multi-port switches that provide eight 10Base-T (Half- or Full-Duplex in any combination), four 10Base-2 (Half-Duplex) or four 10Base-FL (Half- or Full-Duplex in any combination) or four 10Base-T (Half- or Full-Duplex) and two 10Base-FL (Half- or Full-Duplex) switched segments. This chapter discusses how to use a *TotalSwitch Module* in a network.

TotalSwitch Installation Examples

PROBLEM 1: Your network performance is suffering because you have too many nodes creating too much traffic.

SOLUTION: By installing a *TotalSwitch Module*, as illustrated in Figure 3.1, you will decrease traffic congestion and, at the same time, increase your network's performance.

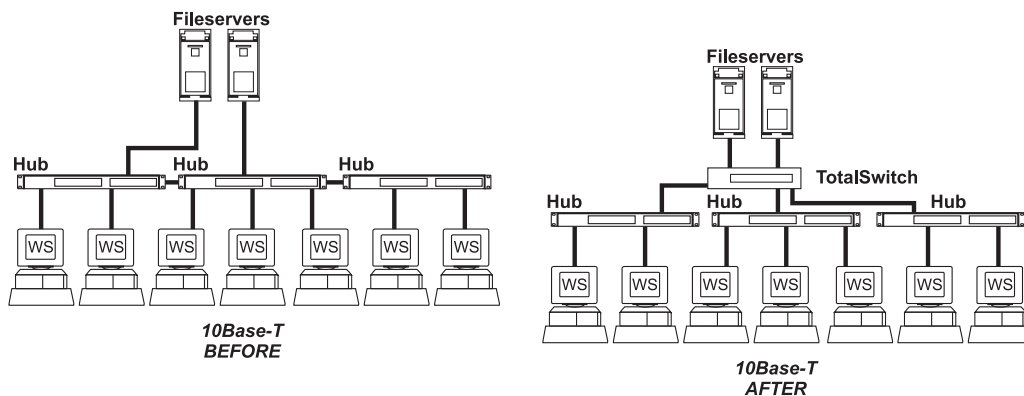


Figure 3.1

PROBLEM 2: You need to connect two 10 Mbps Ethernet networks located in different buildings. The buildings are farther apart than the IEEE 802.3 specification allows (e.g.: maximum distance is 2 km on a fiber optic link segment).

SOLUTION: In order to make a connection beyond the IEEE 802.3 specification, you need to eliminate the collisions that are inherent in Ethernet. This can be done by using Full-Duplex. Each UTP port on *TotalSwitch TP/8 Module*

can operate in either Half- or Full-Duplex. By placing a *TotalSwitch TP/8 Module* in each building, selecting FDX on one of the TP ports, and attaching this link segment to a *Media Converter TP/FO*, you can make long distance (up to 40+ km in the case of TP/FO Single-Mode/PLUS), Full-Duplex, 10 Mbps Ethernet fiber connections between buildings, as illustrated in Figure 3.2.

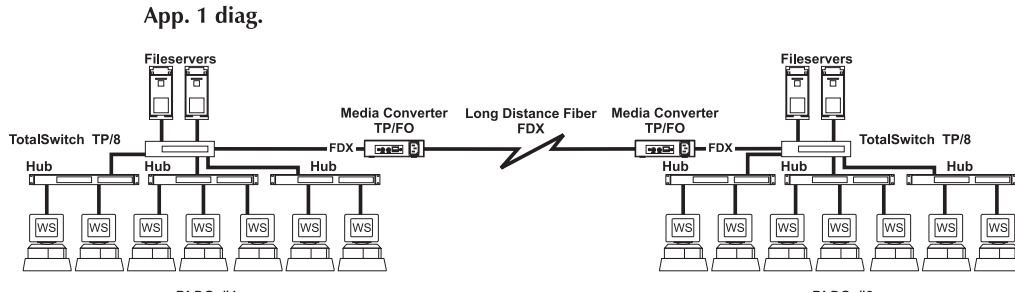


Figure 3.2

PROBLEM 3: You have the same situation as Problem 2, but you have four buildings you need to connect.

SOLUTION: As in the solution to Problem 2, using a combination of a *TotalSwitch Module* and *Media Converter TP/FO*, you can make multiple long distance fiber runs from one central point. Simply install a *TotalSwitch FO/4* in one building and place a *Media Converter TP/FO* on each link segment, as illustrated in Figure 3.3.

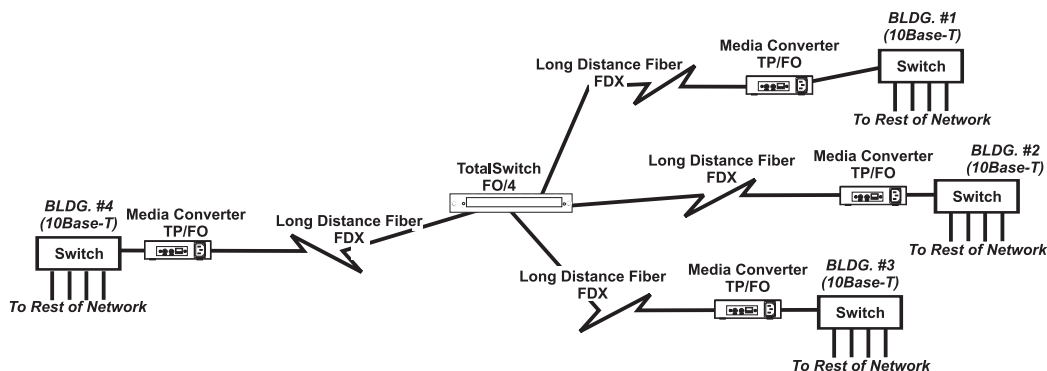


Figure 3.3

Chapter 4

Technical Specifications

Fiber Optic Power Specifications

The maximum distance between any two fiber optic devices is determined by a number of factors, including the *TotalSwitch Modules* used in the configuration. The following table shows the specifications for each of the available *TotalSwitch Modules* and will assist in determining which *TotalSwitch Module* is best for your installation.

Description	Maximum Fiber Segment Distance ¹ (Km)		Wave-length (nm)	Fiber Transmitter Average Power ²		
	HDX	FDX		Avg. Launch Power (dBm)	Avg. RCV Sensitivity (dBm)	Avg. Power Loss Budget (dBm)
Total Switch, FO/4	2	10	850	-14.0	-28.0	14.0
Total Switch, FO/4-SingleMode	2	20	1300	-18.0	-32.0	14.0
Total Switch, FO/4-SingleMode/PLUS	2	40	1300	-15.5	-32.0	16.5
Total Switch, FO1300/4	2	10	1300	-18.0	-31.0	13.0
Total Switch, TP/4+FO/2	2	10	850	-14.0	-28.0	14.0
Total Switch, TP/4+FO/2-SingleMode	2	20	1300	-22.0	-32.0	10.0
Total Switch, TP/4+FO/2-SingleMode/PLUS	2	40	1300	-15.5	-32.0	16.5
Total Switch, TP/4+FO1300/2	2	10	1300	-18.0	-31.0	-13.0

¹ Distances listed are estimates and can vary with application. Distance limitations are determined by a combination of fiber characteristics, number of splices and other physical parameters. Subtract 3 dB from Power Loss Budget for 50/125μ multi-mode fiber.

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

³ Half-Duplex (HDX) distances are limited by IEEE specifications.

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 are 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.

Specifications

Environmental

Operating Temperature: 32° - 122° F (0° - 40° C)

Storage Temperature: 22° - 160° F (-6° - 71° C)

Humidity: 5 - 95% non-condensing

Chapter 5

General Information

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

Warranty

Contact Black Box Corporation for warranty information.

Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A computing device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which chassis the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

The use of non-shielded I/O cables may not guarantee compliance with FCC RFI limits.

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.



Black Box Corporation
The World's Source for ConnectivitySM