

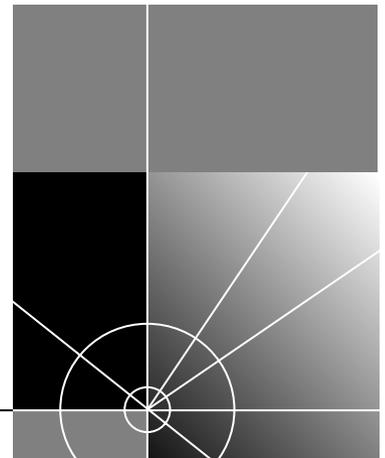


SUPERSTACK II SWITCH 2000 TR TOKEN RING-IN-FAST ETHERNET MODULE

For SuperStack II Switch 2000 TR

<http://www.3com.com/>

Part No. 99045
Published October 1997



3Com Corporation ■ 5400 Bayfront Plaza ■ Santa Clara, California ■ 95052-8154

© **3Com Corporation, 1997.** All rights reserved. No part of this documentation may be reproduced in any form or by any means or used to make any derivative work (such as translation, transformation, or adaptation) without permission from 3Com Corporation.

3Com Corporation reserves the right to revise this documentation and to make changes in content from time to time without obligation on the part of 3Com Corporation to provide notification of such revision or change.

3Com Corporation provides this documentation without warranty of any kind, either implied or expressed, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. 3Com may make improvements or changes in the product(s) and/or the program(s) described in this documentation at any time.

UNITED STATES GOVERNMENT LEGENDS:

If you are a United States government agency, then this documentation and the software described herein are provided to you subject to the following restricted rights:

For units of the Department of Defense:

Restricted Rights Legend: Use, duplication or disclosure by the Government is subject to restrictions as set forth in subparagraph (c) (1) (ii) for restricted Rights in Technical Data and Computer Software clause at 48 C.F.R. 52.227-7013. 3Com Corporation, 5400 Bayfront Plaza, Santa Clara, California 95052-8145.

For civilian agencies:

Restricted Rights Legend: Use, reproduction or disclosure is subject to restrictions set forth in subparagraph (a) through (d) of the Commercial Computer Software - Restricted Rights Clause at 48 C.F.R. 52.227-19 and the limitations set forth in 3Com Corporation's standard commercial agreement for the software. Unpublished rights reserved under the copyright laws of the United States.

If there is any software on removable media described in this documentation, it is furnished under a license agreement included with the product as a separate document, in the hard copy documentation, or on the removable media in a directory file named LICENSE.TXT. If you are unable to locate a copy, please contact 3Com and a copy will be provided to you.

Unless otherwise indicated, 3Com registered trademarks are registered in the United States and may or may not be registered in other countries.

3Com, AccessBuilder, Boundary Routing, CardFacts, LanScanner, LinkBuilder, NETBuilder, NETBuilder II, NetFacts, Parallel Tasking, ViewBuilder, EtherDisk, EtherLink, EtherLink Plus, EtherLink II, SmartAgent, SuperStack II, TokenLink, TokenLink Plus, TokenDisk and Transcend are registered trademarks of 3Com Corporation. 3TECH, CacheCard, FDDILink, FMS, NetProbe and Star-Tek are trademarks of 3Com Corporation. 3ComFacts, is a service mark of 3Com Corporation.

CompuServe is a registered trademark of CompuServe, Inc.

Other brand and product names may be registered trademarks or trademarks of their respective holders

Guide written by Ken Wisman.

ABOUT THIS GUIDE

- Introduction 1
- Terminology 1
- Finding Information in this Guide 2
- Conventions 2

1 OVERVIEW

- About the SuperStack II Switch 2000 TR TR-in-FE Module 1-1
- TR-in-FE Benefits 1-2
- Summary of TR-in-FE Module Features 1-3
 - Hardware 1-3
 - Software 1-3

2 TR-IN-FE CONCEPTS

- What is Token Ring-in-Fast Ethernet (TR-in-FE)? 2-1
- TR-in-FE Compared to Traditional Methods 2-2
- 3Com Token Ring-in-Fast Ethernet System 2-2
 - Token Ring-in-Fast Ethernet Module 2-2
- How TR-in-FE Works 2-3
- Tunneling 2-5
 - Requirements 2-5
 - Token Ring Frames 2-5
- Virtual LANs (VLANs) 2-7
 - What is a VLAN 2-7
 - Advantages of VLAN 2-7
 - Port-Based Distribution 2-7

3 INSTALLING AND SETTING UP THE MODULE

- Following Safety Information 3-1
- Pre-installation Procedure 3-1

- Installation 3-2
- Post-Installation Checks 3-3
 - LED Summary 3-3
 - Checking the Power Supply 3-4
 - Checking that the TR-in-FE Module is Installed Correctly 3-5
 - Checking the Physical Connections 3-5
- Jumper Settings 3-6

4 ACCESSING MANAGEMENT FEATURES

- The VT100 Console 4-1
 - Choice Field 4-1
 - Entry Field 4-1
 - Button 4-2
 - List Boxes 4-2
 - Key Board Shortcuts 4-2
 - Correcting Text Entries 4-2
 - Default Users 4-3
- Console Menu Map 4-3
- The LCD Console 4-5
- Logging On 4-6
- Logging Off 4-7
 - Automatic Logout 4-7

5 CONFIGURING THE TR-IN-FE MODULE

- TR-in-FE Module Configuration Map 5-1
- Setting Up a Module 5-2
 - Bridge Parameters 5-3
 - Spanning Tree** 5-3
 - Source Routing 5-4
- Setting Up a VLAN 5-5
 - TR VLAN Info Setup Screen 5-5

TR VLAN Setup Screen 5-5

Returning Products for Repair D-3

6 MONITORING THE TR-IN-FE MODULE

TR-in-FE Module Statistics Map 6-1

Statistics Overview 6-2

Port Statistics (Traffic) 6-3

Clearing Screen Counters 6-4

3COM CORPORATION LIMITED WARRANTY

A SAFETY INFORMATION

Important Safety Information A-1

L'information de Sécurité Importante A-1

Wichtige Sicherheitsinformationen A-2

B SCREEN ACCESS RIGHTS

C TR-IN-FE MODULE TECHNICAL SPECIFICATIONS

Environmental Specifications C-1

TR-in-FE Cable Specification C-1

Does the Cable Provide Sufficient Bandwidth? C-2

Example C-2

D TECHNICAL SUPPORT

Online Technical Services D-1

3Com Bulletin Board Service D-1

Access by Modem D-1

Access by ISDN D-1

World Wide Web Site D-1

3ComForum on CompuServe D-2

3ComFacts Automated Fax Service D-2

Support from Your Network Supplier D-2

Support from 3Com D-3

ABOUT THIS GUIDE

Introduction

This guide provides the information needed to install and configure the SuperStack II Switch 2000 TR Token Ring-in-Fast Ethernet (TR-in-FE) Module. For more information about the switch itself, see the *SuperStack II Switch 2000 TR User Guide*.

The *SuperStack II Switch 2000 TR Token Ring-in-Fast Ethernet Module Guide* is intended for use by network administrators responsible for installing and setting up networking equipment. It assumes a basic working knowledge of Local Area Networks, Token Ring Networks, and Ethernet. Basic TR-in-FE concepts are explained within this guide.



The Release Notes shipped with the TR-in-FE Module may contain information that updates or overrides information in this guide. You should always follow the information in the Release Notes if it is different from the information given in this guide.

Terminology

In this manual the term ***TR-in-FE Module*** is used when referring to the SuperStack II Switch 2000 TR Token Ring-in-Fast Ethernet Module.

The device into which the TR-in-FE Module is fitted, is known simply as the ***Switch***. An example of a Switch is 3Com's SuperStack II Switch 2000 TR. This type of switch is often referred to as an ***edge-device, edge-switch*** or ***boundary switch***.

Name used in guide:	Includes:
Switch 2000 TR	SuperStack II Switch 2000 TR

Finding Information in this Guide

The following table shows you where to find specific information within this guide.

Task	Location
Learning features, benefits, and concepts	Chapter 1, "Overview" Chapter 2, "TR-in-FE Concepts"
Planning your network	Chapter 1, "Overview" Chapter 2, "TR-in-FE Concepts" Chapter 3, "Installing And Setting Up The Module" Appendix C, "TR-in-FE Module Technical Specifications"
Installing the TR-in-FE Module	Chapter 3, "Installing And Setting Up The Module" Chapter 5, "Configuring The TR-in-FE Module" Appendix A, "Safety Information"
Accessing screens	Chapter 4, "Accessing Management Features" Appendix B, "Screen Access Rights"
Monitoring the Module	Chapter 6, "Monitoring The TR-in-FE Module"
Getting Technical Support	Appendix D, "Technical Support"

Conventions

Table 1 and Table 2 list icon and text conventions that are used throughout this guide.

Table 1 Notice Icons

Icon	Type	Description
	Information Note	Important features or instructions.
	Caution	Alerts you to personal safety risks, system damage, or loss of data.
	Warning	Risk of severe personal injury.

Table 2 Text Conventions

Convention	Description
Screen display	This typeface is used to represent information as it appears on the screen.
The words "Enter" and "Type"	The word "enter" means type something and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says "type."
[Key] names	Key names appear in text in one of two ways: <ul style="list-style-type: none"> ■ Referred to by their labels, such as "the Return key" or "the Escape key". ■ Enclosed within brackets, such as [Return] or [Esc]. If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). For example: Press [Ctrl]+[Alt]+[Del].
Words in bold	Bold text denotes key features.



OVERVIEW

This chapter describes the major features and benefits of the SuperStack II Switch 2000 TR TR-in-FE Module, including:

- About the SuperStack II Switch 2000 TR TR-in-FE Module
- TR-in-FE Benefits
- Summary of TR-in-FE Module Features

About the SuperStack II Switch 2000 TR TR-in-FE Module

The SuperStack II Switch 2000 TR TR-in-FE module combines Token Ring and Fast Ethernet (FE) for the purpose of utilizing FE as a backbone and method of high-speed server attachment for TR networks. TR-in-FE complements ATM and FDDI methods of high-speed integration by providing an option to help TR users evolve their network's core infrastructure while preserving their existing equipment and applications.

TR-in-FE uses Fast Ethernet to transport natively formatted Token Ring frames. Both source route and transparent TR frame addressing information is maintained through the FE infrastructure. This allows standard TR workstations and servers to use the fast transport without modification, or special FE servers to communicate to the native TR community.

TR-in-FE Benefits

Increasingly, Token Ring users are deploying switches to segment their networks and to increase available bandwidth to their workgroups. This has resulted in a demand for more server bandwidth as well as high-speed aggregation and switching. Previously, those users wanting their Token Ring server bandwidth increased beyond 32 Mbps faced limited options. They could add either FDDI or ATM downlinks to their Token Ring switches—options that proved costly and complex. The Token Ring-in-Fast Ethernet (TR-in-FE) system offers a new, simpler option at a much lower cost. TR-in-FE offers improvement in the following areas:

- Scalability
 - TR switching
 - High-speed technologies
 - Wire-speed performance
- Flexibility
 - High-speed flexibility (choice of D/L technology)
 - Desktop flexibility (TR, Ethernet)
 - Common high-speed infrastructure
- Managability
 - Simple to configure and administer
- Cost effective

TR-in-FE allows both Token Ring and Ethernet to share the same Fast Ethernet physical wiring infrastructure and server base without impacting network

performance. TR-in-FE accomplishes this by introducing routing or Source-Route to Transparent translational bridging.

Fast Ethernet is relatively well understood and easy to configure. The TR-in-FE operates in both copper or fiber optic environments. Additionally, many tools exist to manage and administer Fast Ethernet due to its wide acceptance in the industry and its similarity to Ethernet.

TR-in-FE benefits those MIS managers most interested in:

- Preserving existing investments in TR infrastructure
- Seeking low-cost, high-speed connectivity
- Combining Ethernet and Token Ring for common server access

Fast Ethernet is less expensive than other options, such as FDDI and ATM. Using FE, the price per port for server attachment is 20% that of ATM and FDDI.

TR switching allows the install base of TR equipment and its configuration to remain intact and operational while allowing for an upgrade to higher performance through microsegmentation and interfaces to higher speed technologies. TR-in-FE represents one option for integrating Fast Ethernet into the TR switched environment.

Summary of TR-in-FE Module Features

The following lists summarize the features of the SuperStack II Switch 2000 TR TR-in-FE module.

Hardware

- Multimode fiber attachment using duplex connectors or copper cable attachment using standard RJ-45
- Full duplex operation
- Flow control
- LEDs to indicate link integrity and link activity
- Compliance with FCC Class A, CISPR A, and CE
- 4544 byte frame size for improved performance
- Easy jumper-setting for crossover switch (copper version only)

Software

- Software configurable hardware
- 16 VLAN hardware support
- IEEE 802.1q compatible
- Frame size limiter of 1500 bytes for standard infrastructure





TR-IN-FE CONCEPTS

This chapter provides an introduction to Token Ring-in-Fast Ethernet concepts for users who are unfamiliar with this technology. The following sections cover:

- What is Token Ring-in-Fast Ethernet (TR-in-FE)?
- TR-in-FE Compared to Traditional Methods
- 3Com Token Ring-in-Fast Ethernet System
- How TR-in-FE Works
- Tunneling
- Virtual LANs (VLANs)

What is Token Ring-in-Fast Ethernet (TR-in-FE)?

Token Ring-in-Fast Ethernet is a 3Com developed technology that encapsulates Token Ring frames in Fast Ethernet frames. Bridging the gap between Token Ring and Ethernet, this technology offers a more cost-effective integration than traditional bridging and routing, and allows Token Ring users to expand their bandwidth while preserving their TR infrastructure.

Using Token Ring-in-Fast Ethernet technology, Fast Ethernet can be used as a cost-effective and scalable aggregation point for multiple Token Ring switch connections. In addition, because both Token Ring and Ethernet technologies can coexist in the same Fast Ethernet infrastructure, both can share to less costly Fast Ethernet connections.

Through a process known as *tunneling* (see the “Tunneling” section below), TR-in-FE uses Fast Ethernet to transport natively formatted Token Ring frames. This means that both source route and transparent TR frames addressing information is maintained through Fast Ethernet (FE) so that it may be interpreted and utilized by either a destination Token Ring (TR) switch or FE server.

TR-in-FE Compared to Traditional Methods

Traditional means of combining Token Ring, Ethernet, and Fast Ethernet include bridging and routing. With routing, frame forwarding decisions are made in software by looking into the network layer of each frame and modifying the frame to reflect the standard format of the media for which it is destined.

Similarly, bridging between these media may be accomplished using Translational Bridging, sometimes referred to as SRTB or SRTG. This is necessary with non-routable protocols like SNA and Netbios. This type of bridging deals with all the differences between Token Ring and Ethernet frame formats such as:

- Address fields
- Variable length source-route fields
- Functional address to multicast address mapping

NetBuilder provides both routing and SRTG functionality. The decisions are, again, made in software and the result is conversion of the source frame to a standard destination frame format. The benefit of the traditional means listed above is that all frames are converted from media to media using standard frame formats, which allows for simple mixing and matching of products from multiple vendors. The downside is that these bridges and routers are typically slow, expensive, and more difficult to manage than switch products.

TR-in-FE technology works, not by providing frame conversion, but by using the Fast Ethernet as a transport for the Token Ring frames. This means that every frame does not need to be parsed deeply, nor does source route to transparent frame mapping need to happen.

Presently, TR-in-FE is based on developing standards and requires that FE server connections and Switch 2000 TR Downlink Modules are 3Com products. Once approved, TR-in-FE will be able to be integrated with other vendors. FE switching infrastructure may be from any vendor.

3Com Token Ring-in-Fast Ethernet System

The 3Com Token Ring-in-Fast Ethernet includes:

- SuperStack II Switch 2000 TR
- SuperStack II Switch 2000 TR Token Ring-in-Fast Ethernet Module
- Fast Ethernet Switch (SuperStack II Switch 3000)
- 3Com Fast Ethernet network interface cards (NIC)

Token Ring-in-Fast Ethernet Module

This slide-in module provides a 200 Mbps Full-duplex Fast Ethernet interface, which enables the Switch 2000 TR to become part of a Fast Ethernet switched infrastructure. This module allows wire-speed transmission of Token Ring-in-Fast Ethernet frames. Fast Ethernet can be used to connect Token Ring clients to Fast Ethernet servers or as an aggregation point for multiple Token Ring switched connections.

How TR-in-FE Works

Figure 2-1 shows a diagram of a basic TR-in-FE system. The illustration depicts three Switch 2000 TRs interfacing with a Switch 3000 through the Token Ring-in-Fast Ethernet Module. In this example, the Switch 3000 acts as an 800 Mbps point of aggregation for this system with multiple FDX Fast Ethernet pipes feeding it.

Traffic that enters a port on the Token Ring switch and that is not destined for another port on the same switch is directed at the TR-in-FE Module. Subsequently, the module puts a Fast Ethernet *wrapper* (see “Tunneling” section below) on the native Token Ring frame, and forwards the modified packet as a Fast Ethernet frame to the Switch 3000.

The Switch 3000 handles the frame as it would any other FE frame and forwards it to the appropriate port. If the destination address is another TR end station located on another switch, the destination TR-in-FE Module strips the frame of the Fast Ethernet information and sends the native TR frame to the appropriate destination port. If the destination is a Fast Ethernet attached server, the Fast Ethernet NIC with a TR-in-FE driver interprets the frame before providing it to upper level applications. The fact that the application communicates using TR-in-FE is transparent to the user.

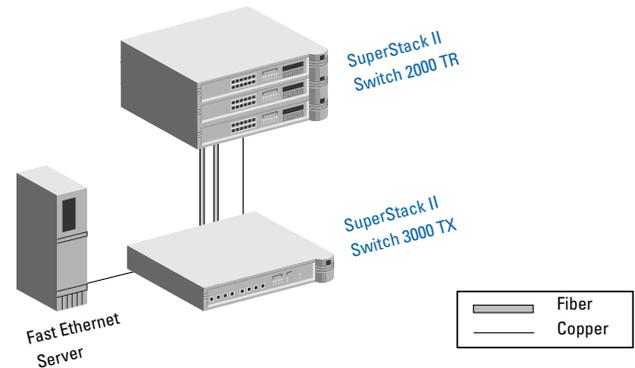


Figure 2-1 A Simple Token Ring-in-Fast Ethernet Configuration

Figure 2-2 illustrates another example of Token Ring-in-Fast Ethernet, but one on a scale more exemplary of what a real user configuration looks like as part of an integrated system.

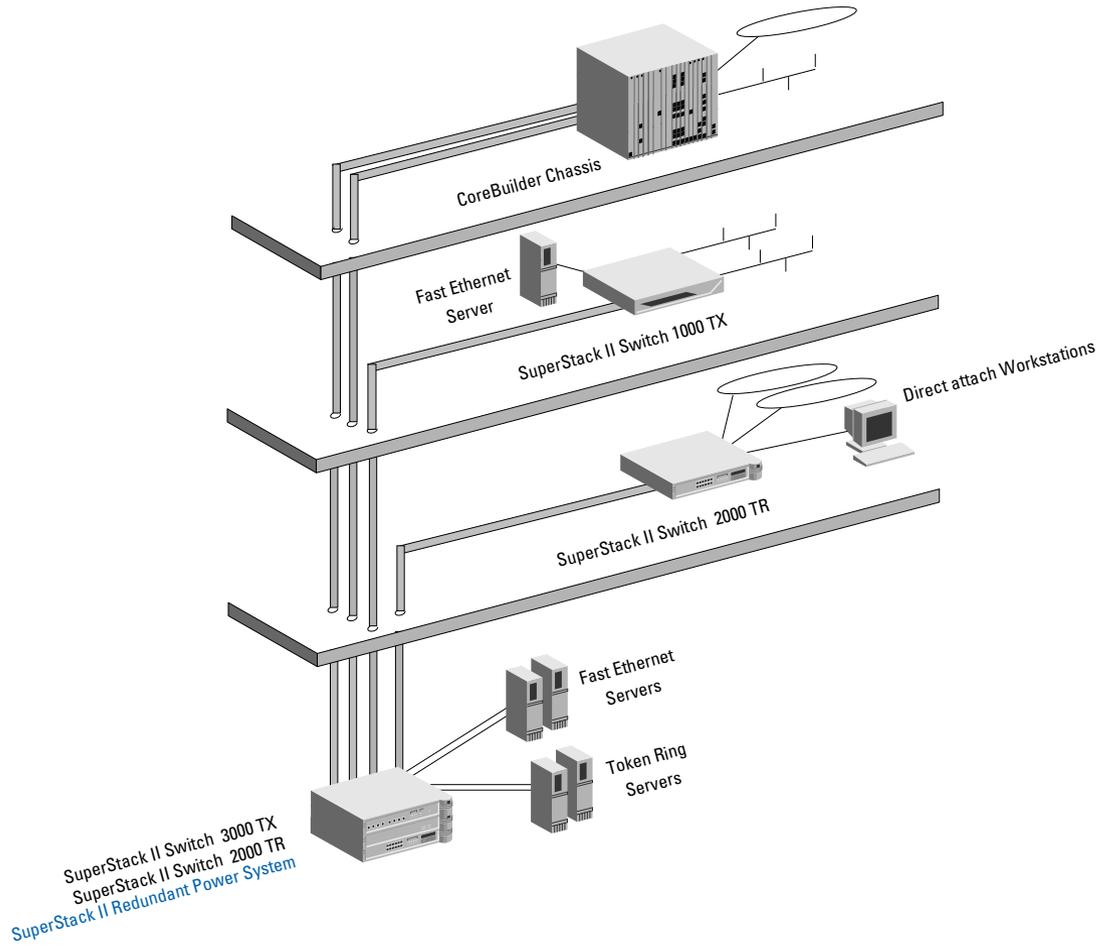


Figure 2-2 Large scale example of a TR-in-FE configuration.

Tunneling

This section describes *tunneling*, the method by which Token Ring frames are encapsulated (embedded) within Ethernet frames.

Frames are sets of bits that form an elementary block of data to be sent over a communications channel. A frame contains its own control information, including the transmission address and data for error detection. This header information makes certain that the frames arrive with their payload (user data) intact and at the right destination. Simply put, what tunneling does is to take a Token Ring frame and embed it into an Ethernet frame to be sent over a Fast Ethernet network.

Requirements

The tunneling scheme must be compatible with Fast Ethernet networks so that a mix of Ethernet, 802.3, and the Ethernet/Token Ring (E/TR) frames may reside on the same segment without interference. It is also important that any end station (server, bridge, router) be able to reassemble the original TR frame. Source routing from Token Ring to Ethernet and back to Token Ring should be supported.

Token Ring Frames

Figure 2-3 shows a simplified drawing of a Token Ring frame.

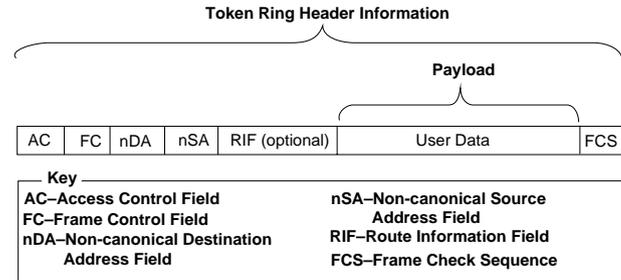


Figure 2-3 Token Ring Frame.

The Token Ring frame must be specially tagged when preparing it for embedding inside the Ethernet frame. Tagging allows an Ethernet frame to carry:

- User priority information over media types otherwise unable to signal priority information
- Token Ring data in native format (802.5) over non-802.5 media
- VLAN identification information

Tagging requires the addition of a tag header to each frame. This header is inserted immediately following the Destination Address (DA), Source Address (SA), and, if present, the Routing Information Field (RIF). If the source and destination media differ, tagging the frame may involve translation or encapsulation of the frame remainder. Tagging also requires re-computation of the Frame Check Sequence (FCS), which are extra characters added to frames for error control purposes.

The Tag Header carries a Tag Protocol Identifier (TPID) that identifies the frame as a Tagged Frame. The Header also carries Tag Control Information (TCI), which consists of the following fields:

- User Priority
- TR-encap
- VLAN Identifier (VID)

The User Priority field allows the tagged frame to carry user priority information across bridged LANs where individual LAN segments may not be able to signal for priority information. An 802.3/Ethernet represents such a segment.

The primary purpose of the TR-encap flag is to permit tunneling of Tagged Frames between two 802.5 LAN segments across a VLAN tagged region. It also allows an end station on an 802.5 subnetwork to communicate with an end station on an 802.3 subnetwork.

The VLAN Identifier (VID) field uniquely identifies the VLAN to which a frame belongs. See the next section, “Virtual LANs (VLANs),” for a complete explanation of VLANs and the VLAN Identifier (also known as VLAN ID or VID). The Route Control field is added to the frame to carry TR specific information such as Transparent or SR information. The payload is TR specific in content.

Once the tunneling process is complete, the combined Token Ring-in Fast Ethernet frame resembles the frame shown in Figure 2-4 (simplified). The process is reversed to de-encapsulate the frame.

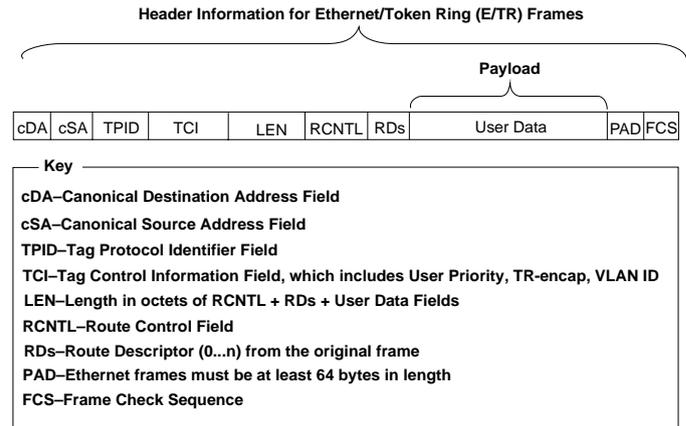


Figure 2-4 Token Ring-in-Fast Ethernet Frame.

Virtual LANs (VLANs)

What is a VLAN

A VLAN is defined as a group of location- and topology-independent devices that communicate as though they were on the same physical LAN. This means that they are not restricted by the hardware that physically connects them, and segments are defined by flexible user groups created by the user. For example, with VLANs, the user can define a network according to:

Department Groups—A VLAN could be created for the Marketing Department, another VLAN for the Finance Department, and still another for the Development Department.

Hierarchical Groups—A VLAN could be created for directors, another for managers, and still another for general staff.

Usage Groups—A VLAN could be created for Email users, another for multimedia users, and so on.

Advantages of VLAN

All 802 media and shared media support VLANs. In addition, implementing VLANs:

- Eases the change of devices
- Helps control broadcast traffic
- Provides extra security

VLANs facilitate the administration of logical groups of stations that can communicate as though they were on the same LAN. VLANs also facilitate moves, adds, and changes of members of logical groups.

Traffic between VLANs is *firewalled*. This limits the propagation of multicast and broadcast traffic between VLANs.

Each distinct VLAN is uniquely identified throughout the bridged LAN. A consistent representation of a VLAN exists across a VLAN fabric (including FE and ATM). This means that the shared VLAN knowledge of a particular packet remains the same as the packet travels from one point to another.

Port-Based Distribution

The switch uses a *port-based approach* to VLAN functionality. This approach allows bridges to classify all received tagged and untagged frames as belonging to a particular VLAN.



NOTE: In port-based VLAN operation, the VLAN classification of an untagged frame is **implicitly determined** and bases on the port of arrival of the frame. This facility requires association of a VLAN ID with each of the bridge's ports. Only received frames lacking an explicit VLAN ID are subject to this implicit classification.

Using the port-based approach, a specific VLAN ID is associated with each bridge port. This VLAN ID, known as a Port VLAN Identifier (PVID), provides the VLAN classification for frames received through that port. This value may be manager configured.

3

INSTALLING AND SETTING UP THE MODULE

This chapter includes important safety and configuration information, including:

- Following Safety Information
- Pre-installation Procedure
- Installation
- Post-Installation Checks

Following Safety Information



WARNING: Before installing or removing any components of a device, or carrying out any maintenance work, you must read the safety information provided in [Appendix A](#), “Safety Information” of this guide. Disconnect the device from the main power supply.



AVERTISSEMENT: Il faut lire les notices de sécurité dans l'appendice A de ce guide avant d'installer ou d'enlever les parties de l'unité ou faire le travail d'entretien. Débrancher la pièce de raccordement d'alimentation.



WARNUNG: Bevor Sie Ein - oder Ausbau des Gerätes vornehmen, bitte lesen Sie die Anweisungen in Appendix A genau durch. Das Gerät darf nicht ans Stromnetz angeschlossen sein.



CAUTION: Only hold the TR-in-FE Module by the edges to avoid damage from static. Do not touch the top or bottom of the circuit board.

Pre-installation Procedure

Before installing the TR-in-FE Module familiarize yourself with the module and the Switch into which it will be installed.

Installation

This section explains how to install the TR-in-FE Module into a SuperStack II Switch 2000 TR device. Installation is similar for all devices compatible with the TR-in-FE Module.



CAUTION: Always follow Electro Static Discharge (ESD) procedures when installing an I/O Module.

- 1 If the Switch is connected to the network, turn off the power and disconnect the switch from the main power supply and the network.
- 2 Place the Switch on a flat, clean, hard, work surface.
- 3 Locate and remove the blanking plate that covers the switch Module slot. See Figure 3-1. Retain the blanking plate and the screws for future use.

To locate the slot where the TR-in-FE Module resides, refer to the manual that accompanies your device .

- 4 Use the guide rails within the Switch slot to align the TR-in-FE Module. The location of the guide rails and the correct positioning of the plate is shown in Figure 3-1.
- 5 Slide the TR-in-FE Module into the slot without touching the top or bottom of the circuit board, which positions upside down on the plate. Ensure that the module is pushed fully into the unit.
- 6 Use the thumb screws attached to the TR-in-FE Module to fix the module firmly into place.
- 7 Connect the cable to the TR-in-FE port.
 - **For fiber:** 3Com supports multi-mode fiber 50/125 μm and an SCduplex connector. The

maximum inter-station distance (including device-to-network connectors) should not exceed two kilometers (1.25 miles) for full duplex. For half duplex, the maximum inter-station distance should not exceed 300 meters.

- **For copper:** 3Com supports Category 5 type UTP cable at distances up to 100 m for both half and full duplex.

For more on cable specifications, see [Appendix C](#), “TR-in-FE Module Technical Specifications”.

- 8 Connect the cable to the module. Connect the Rx connector to the port’s Tx socket. Connect the Tx connector to the port’s Rx socket. Do the same at the other end of the connection.
 - **For fiber:** Each end of the fiber cable has a transmit (Tx) and receive (Rx) connector.
 - **For copper:** A crossover cable may be required for operation, which requires a jumper setting on the module. See “Jumper Settings” in this chapter.
- 9 Connect the downlink port to a Fast Ethernet repeater, server, or switch. If you plan running full duplex, ensure that the other end of the link supports it. A repeater will not support full duplex whereas a switch such as the SuperStack 3000 will.



NOTE: The Fast Ethernet switch does not have to be a SuperStack II 3000. However, due to the 3000’s capability of handling frame sizes larger than 1500 bytes as well as its cost efficiency, the 3000 is the switch of preference for anchoring the system.

- 10 Power up the switch. The link status LED turns green once a valid connection is made.

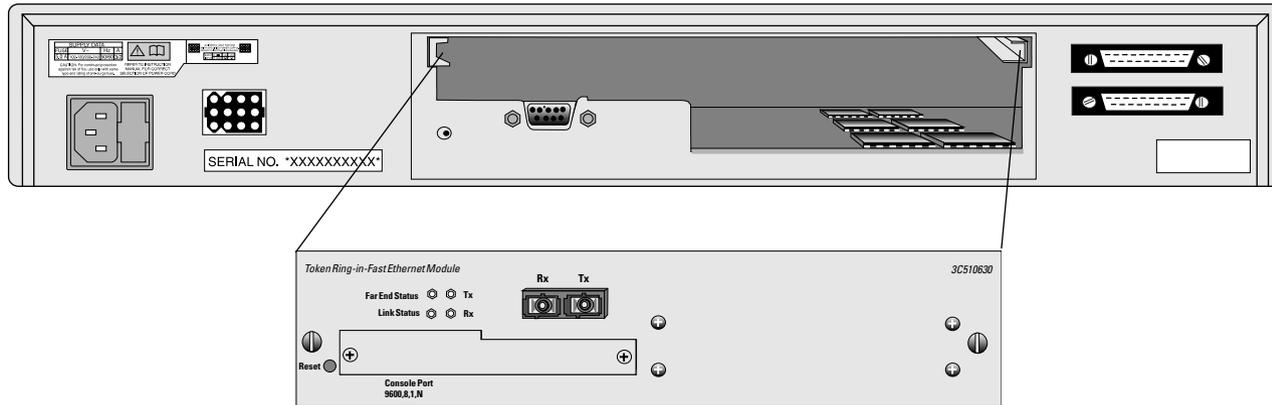


Figure 3-1 Installing the TR-in-FE Module

Post-Installation Checks

This section describes the LEDs and basic checks used to verify your installation, and to ensure that the Switch and TR-in-FE Module operate correctly.

LED Summary

This section describes the LEDs that provide status and troubleshooting information.

- LEDs on the Switch are described in Table 3-1.
- LEDs on the TR-in-FE Module are described in Table 3-2.

Table 3-1 Front Panel LEDs on the Switch 2000 TR

LED Name	Color/State	Indicates
MGMT (On the front of the Switch)	Green ON	Switch and TR-in-FE Module are operating normally.
	Green fast flashing	Software download taking place.
	Green slow flashing	The Switch and TR-in-FE Module are initializing (for example, undergoing a Power On Self Test).
	Yellow	The Switch failed its Power On Self Test (POST).
	Yellow flashing	TR-in-FE Module failed its Power On Self Test (POST).
Downlink Status (On front of the Switch)	OFF	No power to the Switch.
	Green ON	TR-in-FE port enabled and a link is present.
	Green flashing	Link present but TR-in-FE port disabled.
	Yellow ON	Switch has not recognized the TR-in-FE Module.
	Yellow flashing	The TR-in-FE Module has failed the Power On Self Test (POST).
	OFF	A link is not present on the TR-in-FE port.

The following table describes the LED functions on the TR-in-FE Module.

Table 3-2 LEDs on the TR-in-FE Module Panel

LED Name	Color/State	Indicates
Full Duplex (On TR-in-FE Module)	Green ON	Full duplex link is on (port configured for full duplex operation).
	Green OFF	Half duplex link is on.
Port Status (On TR-in-FE Module)	Green ON	A link is present on the Ethernet port.
	Green OFF	The Link is not present on the Ethernet Port.
TX (On TR-in-FE Module)	Yellow ON	The TR-in-FE port is transmitting.
	OFF	The TR-in-FE port is not transmitting frames.
RX (On TR-in-FE Module)	Yellow ON	The TR-in-FE port is receiving frames.
	OFF	The TR-in-FE port is not receiving incoming frames.
MDIX (copper only)	Green ON	RJ-45 configured as a crossover.
	Green OFF	RJ-45 configured as a static connector.

Checking the Power Supply

Check the MGMT LED on the Switch. If the MGMT LED is not lit, there is a power supply problem. Try the following troubleshooting procedures, restarting the Switch after each step:

- a Check that the power supply is plugged into the device using a power outlet that is known to be working or that the RPS is powered.
- b Check that the main power supply switch on the wall is set to the ON position.
- c Check and, if necessary, change the fuse on the Switch or plug. See the user guide that accompanies your Switch device for details about fuses.
- d Replace the power cable with a cable known to be working.
- e Contact 3Com Technical Support.

Checking that the TR-in-FE Module is Installed Correctly

Power up the Switch and check that the Downlink Status LED on the front of the Switch is lit Green.

If the MGMT LED is not lit Green, remove and then re-install the TR-in-FE module.

You can confirm that the TR-in-FE Module is installed correctly by accessing the local management screens or the LCD panel. If the TR-in-FE Module is installed correctly, the TR-in-FE Configuration option appears in the Main Menu.

If the TR-in-FE Configuration option does not appear, It could be that the TR-in-FE Module is still initializing. If the TR-in-FE Module is still initializing, the MGMT LED flashes GREEN.

Checking the Physical Connections

This section assumes that the TR-in-FE Module is correctly installed.

Check that the Link Status LED on the TR-in-FE Module is lit GREEN. If the LED is not lit, there is a problem with the physical connection. Follow the troubleshooting information below:

- a Ensure that both devices are powered up, and that the ports at both ends of the link are enabled.
- b Ensure that the cable is securely connected to the port at both ends of the link.
- c If using fiber, check each end of the cable to ensure that each of the fiber connectors is correctly connected. If your cable connectors can be reversed, you may need to reverse the TX and RX cable connectors at one end of the link.
- d If using copper, the TX and RX pairs may need to be swapped. This requires changing the jumper setting on the module. See "Jumper Settings."
- e Ensure that the fiber connection is not broken.



Some cable connectors have been designed so that they cannot be fitted incorrectly. Never use excessive force to connect cables.

- f If you are running full duplex, make certain that the Fast Ethernet switch supports this mode. A repeater will not support full duplex whereas a switch such as the SuperStack 3000 will.
- g Remove any objects obstructing the cable and straighten out any kinks in the cable.

- h Check that your cable meets Fast Ethernet specifications. See Appendix C.
- i Replace the cable, and check the Link Status LED again.
- j Contact 3Com Technical Support; see “Support from 3Com”, in [Appendix D](#).

Jumper Settings

The Module can be easily damaged by electrostatic discharge. Before handling the module, please observe safety and electrostatic discharge precautions.

You can configure the TR-in-FE module to operate as MDI (default) or MDIX. Follow the rules and procedure below. See Figure 3-2.

- MDI—If TR-in-FE module is connected to another switch with an MDIX port.
- MDIX—If TR-in-FE module is connected to an end-station or server.

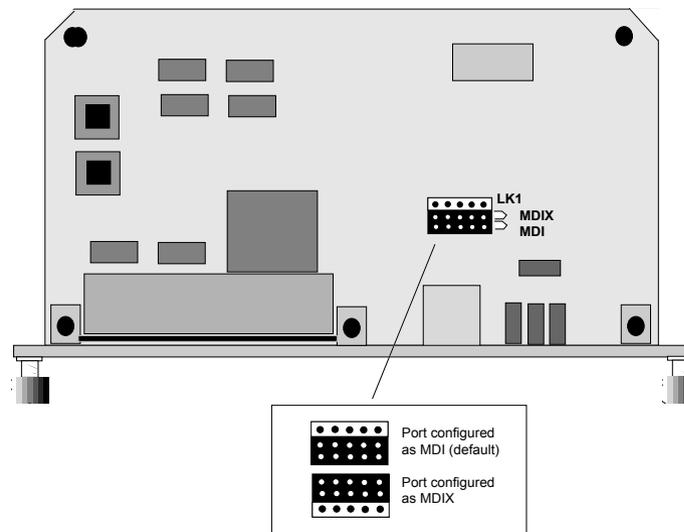


Figure 3-2 TR-in-FE Module Jumper Settings



The MDIX setting provides a crossover, the MDI setting does not. A crossover cable can be used to connect two MDI or two MDIX ports together.



ACCESSING MANAGEMENT FEATURES

The menu-driven user interface built into the device is known as the VT100 or Local Management interface. The VT100 management interface has a forms-based structure with pre-defined security levels, enabling access to be restricted to particular users. This chapter provides information on the following:

- The VT100 Console
- Console Menu Map
- The LCD Console
- Logging On
- Logging Off

The manual that accompanies your SuperStack II Switch 2000 TR describes accessing and navigating local screens.

The VT100 Console

This section describes the screen conventions used in the Switch 2000 TR VT100 console interface. The VT100 interface allows you to set and/or view these switch parameters:

- IP and associated addresses and management
- Port personality, speed, and state
- Bridge type, bridge number, and Spanning Tree state
- Switch 2000 TR status and hardware and software version numbers

Choice Field

Example display:

`*text*`

Text enclosed with asterisks is a list from which you can select one option. Press [Space] to cycle through the options. When your choice is highlighted, press [Down Arrow] or [Return] to move to the next field. Refer to Figure 4-1, "VT100 Console Menu Map with I/O Module Detail."

Entry Field

Example display:

`[text]`

Text enclosed in square brackets on the screen indicates a text entry field. This field may be text, numeric data, or hexadecimal data.

Password fields are hidden; the text you type is not shown on the screen.

In some cases an Entry field has a default entry. To change the default value, simply type in a new value for this field and the default entry will be erased. Press [Down Arrow] or [Return] to move on to the next field.

Button

Example display:

OK

Text for button is always shown in uppercase letters. Buttons carry out actions. For example OK: or CANCEL. To select a button, move the cursor to the button and press [Return].

List Boxes

Example display:

monitor, manager, or security

A list box allows you to select one or more items from a list. These keys allow you to select from a list:

- [Return]—moves the cursor to the next field. Carries out a button's action.
- [Space Bar]—moves through a text list for a field. Use it to highlight the item or value you want.

- [Down Arrow]—moves down a list item by item and starts over again at the top.
- [Ctrl] + [U]—moves the cursor one screen up the list box.
- [Ctrl] + [D]—moves the cursor one page down the list box.

Key Board Shortcuts

Here are some shortcuts you can use to navigate within the console screens:

- [Tab]—Moves from one field on a form to the next on any screen without making a change.
- [Return]—Moves you to the next form field after you have made an entry.
- [Left Arrow]—Moves you to the previous field on the screen or the previous character in an editable field.
- [Right Arrow]—Moves you to the next field on the screen or the next character in an editable field.
- [Ctrl] + [R]—Refreshes the screen.
- [Ctrl] + [B]—Moves the cursor to the next button.
- [Ctrl] + [P]—Returns to the previous screen.
- [Ctrl] + [N]—Moves to the next screen after implementing current screen settings.
- [Ctrl] + [K]—Displays list of key strokes.

Correcting Text Entries

Use [Delete] on a VT100 terminal or [Backspace] on a PC. This key moves the cursor one space to the left

and deletes a character. To delete more than one character, press the key once for each character.



Check carefully before using the Control keys. If you are using Telnet or a terminal emulation program you may find that some Control keys do not work the same or that they control other functions. Refer to the documentation that accompanies your Telnet or terminal emulation software.

Default Users

The resident management console allows three default user types. They cannot be deleted or altered by the network administrator. Refer to Table 4-1 for default names and passwords. Refer to Appendix B for a listing of screen access rights.

Table 4-1 Default User Names and Passwords

Table 2

Default Name	Password	Access Level
monitor	monitor	monitor
manager	manager	manager
security	security	security

Console Menu Map

Figure 4-1 provides a map of available I/O Module local management screens. The I/O Module screens are shaded gray and appear when the TR-in-FE Module is installed. If these screens do not appear, your TR-in-FE Module is not installed correctly.

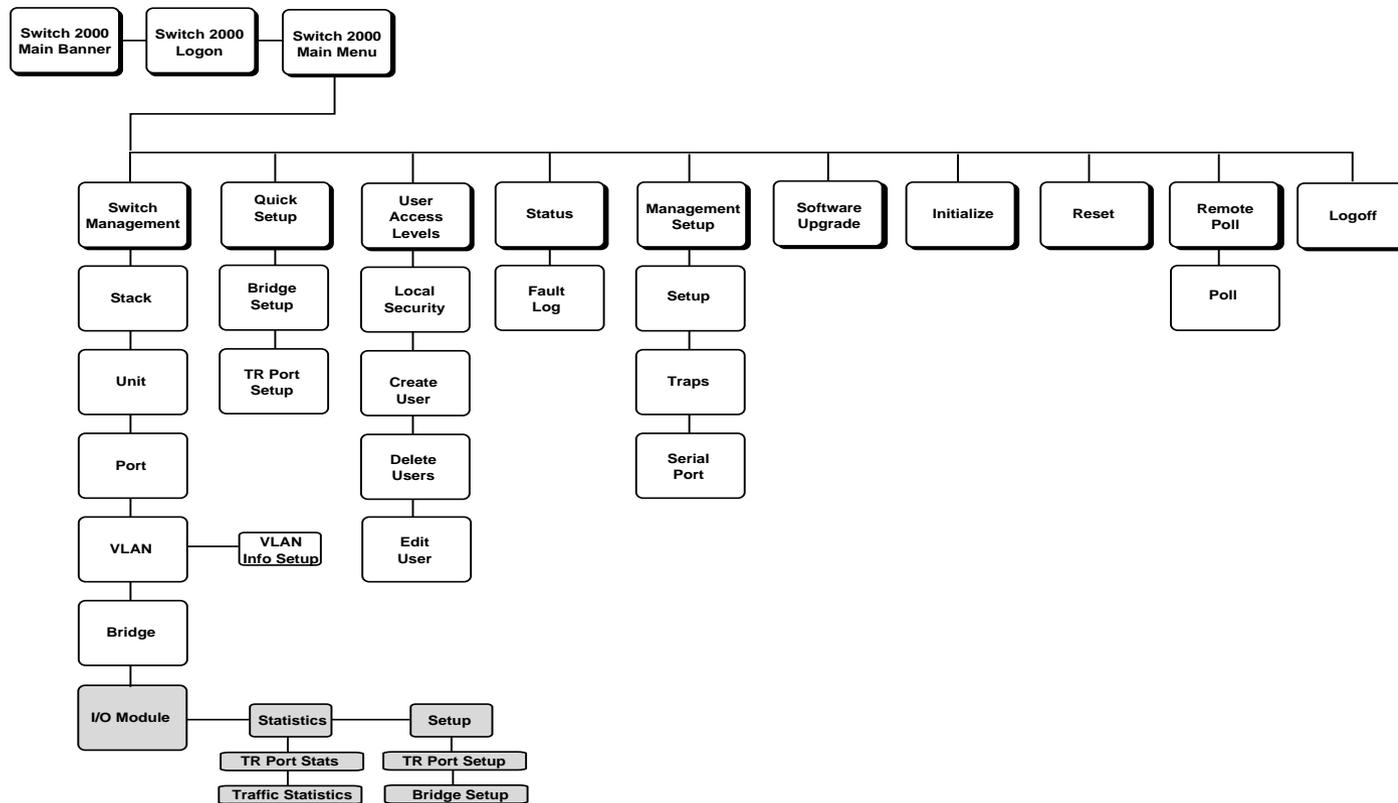


Figure 4-1 VT100 Console Menu Map with I/O Module Detail

The LCD Console

The SuperStack II Switch 2000 TR has an LCD console located on the front panel. Use this console for reading and setting the Switch and module parameters. Refer to the “SuperStack II Switch 2000 TR User Guide” for a menu map and for specific information and uses of the console.

The console provides a quick method for viewing the type of module in the Switch as well as the hardware and software versions of the module. See Figure 4-2.

The menus of the LCD module are circular. Press [Enter] until the menu you wish to view appears. For more information refer to Chapter 5 of the Switch 2000 TR User Guide that accompanies your switch.

To view the module status, proceed as follows from the top LCD menu which displays the **Switch 2000 TR** banner:



Figure 4-2 I/O Module LCD Menu

- 1 Press [Enter] to view the next level.
- 2 Press [Down Arrow] until **Switch 2000 TR > I/O Module** appears.
- 3 Press [Enter]. **I/O Module > Module Type** appears.
- 4 Press [Enter]. **STATUS > Module Type** appears.
- 5 Press [Down Arrow] to scroll down through the I/O Module menus.
- 6 Press [Enter] at any one of the following fields to view the information described below. Press [Down Arrow] to move through the circular menus.
 - **Module Type**—module type
 - **Module State**—current state of module (UP, DOWN)
 - **HW Version**—current version of hardware

Logging On

- 1 Connect your terminal to the Console port on the rear panel of the Switch 2000 TR using a cross-over cable for a serial line connection. Refer to the Switch 2000 TR User Guide for more information.

The Console port automatically detects the line-speed (baud rate), and uses the following default settings:

- auto-baud
- 8 character size (data bits)
- 1 stop bit
- no parity

Character size, stop bit, flow control, and parity values cannot be changed.

- 2 Press [Return] two or more times until the Switch 2000 Main Banner appears (shown in Figure 4-3).

```

3Com SuperStack II, Switch 2000 TR

  SSSS  W  W  I  TTTT  CCCC  H  H  22222  00000  00000  00000
S  SSS  W  W  W  I  T  C  H  H  2  2  0  0  0  0  0  0  0
  SSS  W  W  W  I  T  C  H  H  H  H  H  22  0  0  0  0  0  0
  S  W  W  W  I  T  C  H  H  2  0  0  0  0  0  0  0
SSSS  WW  WW  I  T  CCCC  H  H  22222  00000  00000  00000

Press Enter to Continue ...
  
```

Figure 4-3 Main Banner

If your terminal is already set up with these values, the Main Banner appears as soon as power-up is complete.

- 3 Press [Return] to display the Logon screen at the Main Banner.
- 4 Type in your user name and password. Note that they are both case-sensitive:
 - If you are logging on for the first time (after installation or initialization), use a default user name and password to match your access requirements. We recommend that you use the default user "security" so that you can access all functions. The defaults are shown in Table 4-3.
 - If you have been assigned a user name, access level and password, type in these details.

Table 4-3 Default Users

User Name	Default Password	Access Level
monitor	monitor	monitor - this user can view, but not change all manageable parameters
manager	manager	manager - this user can access and change the operational parameters but not special/security features
security	security	security - this user can access and change all manageable parameters

When you have logged on, the Main Menu screen displays, as shown in Figure 4-4.

- 5 Select task or logoff.

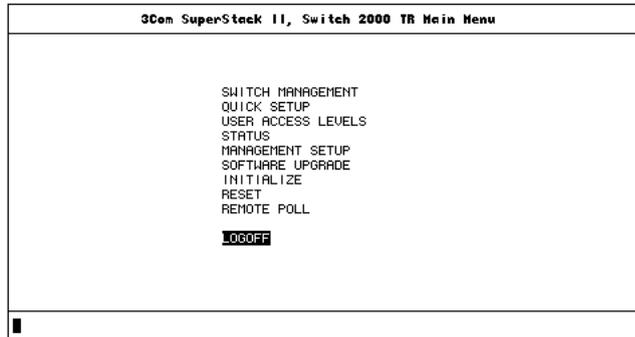


Figure 4-4 Main Screen

Logging Off

If you accessed the facility using a Telnet session or modem, the connection closes automatically. If not:

- 1 Select the LOGOFF option from the bottom of the Main Menu.
- 2 Press [Return].

Automatic Logout

There is a built-in security timeout on the VT100 interface. If you do not press any keys for three minutes, a message warns you that the inactivity timer is about to expire. If you do not press a key within 10 seconds, the timer will expire and the screen will be locked. All displayed data continues to update. When you next press a key, the display changes to the Auto Logout screen.

The Auto Logout screen prompts you to enter your password again. If the password is correctly entered, the screen that was active when the timer expired is re-displayed. If you make a mistake entering your password, you will be returned to the Logon screen.

5

CONFIGURING THE TR-IN-FE MODULE

This chapter describes how to configure the TR-in-FE Module, including:

- TR-in-FE Module Configuration Map
- Setting Up a Module
- Setting Up a VLAN

Figure 5-1 shows the TR-in-FE Configuration Menu Map.

TR-in-FE Module Configuration Map

The following map displays the path of the TR-in-FE Port Configuration screens. Configuration screens are shaded gray.

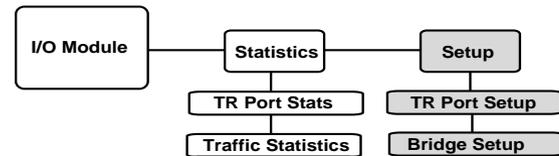


Figure 5-1 I/O Module TR-in-FE Configuration Map

Setting Up a Module

The Module Configuration Screen displays the settings used by the TR-in-FE Module to communicate with other devices on the network.



It is unlikely that you will need to change the value of these settings once they have been set.



CAUTION: *If you need to change the value of any of the settings, you may experience a temporary loss of communication while the values are reset. If you do not need to make any changes, select the CANCEL button and not the OK button. Selecting the OK button resets the device.*

To configure a module, log on to the Switch 2000 TR and proceed as follows:

- 1 Select SWITCH MANAGEMENT from the Main Menu.
- 2 Press [Space Bar] and select *I/O Module*.

The I/O Module screen appears. The I/O Module screen allows you to view statistics and set up the TR-in-FE module. See Figure 5-2.

If the I/O Module option does not respond, your TR-in-FE module is not installed correctly. Refer to Chapter 3 for information on installation.

- 3 Enter the *Unit ID* of the unit with the module installed.
- 4 Select SETUP.

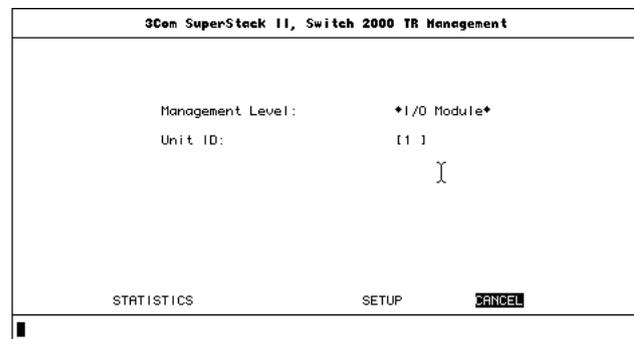


Figure 5-2 I/O Module Screen (CONFIG)

- 5 Press [Return].

The Port Setup screen appears. See Figure 5-3.

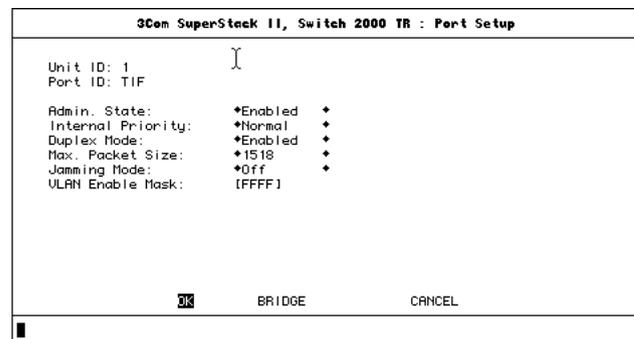


Figure 5-3 Port Setup Screen

The following fields are shown on the screen:

Unit ID—Identifies the currently selected Switch unit.

Port ID—Displays the current module type. It should read TIF.

Admin. State—This field allows you to **Enable** or **Disable** the TR-in-FE port.

Internal Priority—This field allows you to distribute the available bandwidth among the ports. **High** priority ports are given priority access to internal resources, taking priority over **Normal** priority ports.

Full Duplex—The TR-in-FE Module works with either a Full Duplex or Half Duplex mode of operation. The Full Duplex field allows you to **Enable** or **Disable** Full Duplex mode. Disabling Full Duplex automatically puts the TR-in-FE Module in Half Duplex mode.

Max Packet Size—This field allows you two choices for setting the maximum packet size.

- 1518—Use this value in traditional Fast Ethernet environments.
- 4544—Use this value for larger packets when configured with a SuperStack II Switch 3000.

Jamming Mode—This field allows you to restrict the amount of packet loss allowable when configured with conventional switches. Jamming provides a variable parameter for determining the number of collisions. This feature is most helpful in networks using lots of repeaters. Choose from J6 through J13 where

J6 indicates the least amount of effort by the port to back off collisions. A value of J13 indicates more effort on the port. This feature is reserved for qualified and knowledgeable network managers.

VLAN Enable Mask—This field allows you to restrict or allow for membership in specific VLAN groups. Each bit in the two-byte field represents a VLAN denomination from 1 to 16 in hexadecimal. Refer to “Setting Up a VLAN” on page 5-5 for more information.

It is strongly recommended that you do not alter these settings.

Bridge Parameters

This section describes how to set bridge parameters for the TR-in-FE.

Spanning Tree

Spanning Tree is an algorithm designed to eliminate loops in networks. The algorithm detects and logically prohibits redundant paths by placing some bridge ports in the blocking state so that only one route exists between any two LANs and therefore any two stations. After Spanning Tree eliminates redundant paths, the network reconfigures and stabilizes. Any time the network topology changes, the algorithm automatically relearns the new configuration and adjusts the bridge ports accordingly. This guarantees that all stations are connected.

- **Priority**—Priority determines the choice of port when the Switch 2000 TR has two ports connected to the same LAN, creating a loop.

Ports with a lower value have a higher priority and will be blocked only after ports with a higher value and a lower priority have been blocked.

- **Path Cost**—Path cost determines the amount of overhead required to forward packets to the root through this port.

The higher the path cost, the less likely Spanning Tree will use a port for forwarding. The lower the cost, the more likely Spanning Tree will use a port for forwarding.



NOTE: *It is always recommended that, in the case of a loop formed with a low speed port, the high-speed ports do not block. The switch automatically provides this function with default settings (port speed is part of the spanning tree calculations). Be aware of this, if the spanning tree values are modified.*

- **Fast Fwd**—Frames are forwarded as soon as the destination address is received and verified.

Source Routing

Source Routing is a method of allowing a ring station (node) on a Token Ring network to communicate with another ring station on a different ring interconnected by bridges. The “source” ring station, which is the node initiating the communication, is responsible for dynamically determining and then maintaining information about the “route” to the destination ring station. A route is simply the path a packet takes through a source route bridged network from the source ring station to the destination ring station.

In the case of TR-in-FE, a virtual LAN ID must be assigned to the FE cloud. This allows Source Routing to proceed as though the FE media supported TR natively. The entire FE transparently forwarded cloud appears as a single “ring” and hence a single hop to attached TR endstations. This also allows FE servers to participate in source routing.

- **Attached Lan Id**—A unique number that identifies the segment to which the port connects. This value can be set between 0 and FFF (0-4095). A value of FFFF (65535) indicates that no segment number has been assigned to this port.
- **Max Route-Desc**—This value describes the number of routing descriptions allowed in All Route Explorer (ARE) or Spanning Tree Explorer (STE) frames. This is also referred to as “hop count” limit since it limits the number of rings a packet can traverse.
- **STE Mode**—This value determines how this port responds when presented with Spanning Tree Explorer (STE) packets. Set the field accordingly by pressing the [Space Bar].
 - **Disabled**—Indicates that the port will not accept or propagate STE packets, and any packets received will be discarded.
 - **Forced**—Indicates that the port will always accept and propagate STE packets.
 - **Auto-Span**—Indicates that the port will accept and propagate STE packets when its Spanning Tree state is forwarding.

Setting Up a VLAN

This section describes how to extend VLANs into the TR-in-FE network. A TR-in-FE port can be in one or more (up to 16) VLANs.

TR VLAN Info Setup Screen

To set up a TR-in-FE VLAN, proceed as follows from the main menu:

- 1 Use the [Space Bar] to scroll to VLAN.
- 2 Select VLAN INFO.
- 3 Press [Return].

The VLAN Info Setup screen appears. See Figure 5-4.

Figure 5-4 TR VLAN Info Setup Screen

- 4 Select the VLAN that you wish to configure. Enter the number associated with the VLAN in the VLAN ID field.



Each time you complete the entry fields for a VLAN you must select APPLY to invoke the changes. As soon as you select a different VLAN using the VLAN field, any edits not already applied are lost.

Included in this screen are the following fields:

- **VLAN Name**—Name assigned to identify each (up to 16) VLANs.
- **802.1q VLAN ID**—A 12-bit ID used to identify a particular VLAN's frames for routing across FE media. This ID defines which frames should be received and forwarded to a VLAN via the TR-in-FE module. If TR ports on separate boxes are to be connected via TR-in-FE, then this parameter must be identically configured on both boxes. By default, all TR ports are assigned to VLAN 1, and the 802.1q VLAN ID is identical to the VLAN number assigned to the box.

TR VLAN Setup Screen

Use this screen to assign VLANs to the TR-in-FE port, and to associate a backbone port (the place to which unknown unicasts are forwarded) with each VLAN.

To set up, proceed as follows from the I/O Module menu:

- 1 Use the [Space Bar] to scroll to VLAN.
- 2 Select SETUP.
- 3 Press [Return].

The VLAN Info Setup screen appears. See Figure 5-5.

6

MONITORING THE TR-IN-FE MODULE

This chapter describes how to monitor the status and performance of your TR-in-FE Module and explains the meaning of the statistics.

- TR-in-FE Module Statistics Map
- Statistics Overview
- Port Statistics (Traffic)

TR-in-FE Module Statistics Map

Figure 6-1 shows the screen map. Monitoring screens are shaded gray.

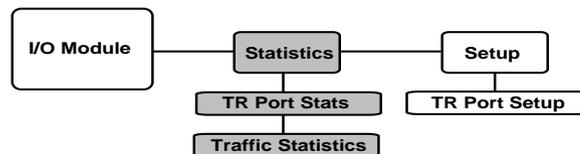


Figure 6-1 Status Screen Map

Statistics Overview

The TR Port Statistics screen provides a top level summary of TR-in-FE Port statistics. You can use the summary to estimate the amount of traffic on your network backbone, and to check the health of the incoming connection. To view the summary, proceed as follows from the I/O Module menu:

- 1 Enter the *Unit ID* number of the unit you wish to view.
- 2 Select the STATISTICS button.

The TR Port Statistics screen appears. See Figure 6-2.

3Com SuperStack II, Switch 2000 TR Port Statistics	
Unit ID:	1
Port ID:	TIF
Link State:	Broken
Current Utilization	0 %
Frames Forwarded:	0 %
Broadcast Frame Bandwidth:	0 %
Error Frames:	0 %
TRAFFIC STATISTICS CANCEL	

Figure 6-2 TR Port Statistics Screen



The figures shown for each statistic on this screen include TR-in-FE management traffic and normal Token Ring traffic.

The Port Statistics screen displays the following fields:

Unit ID—Identifies the currently selected unit.

Port ID—Identifies the currently selected port. It should read TIF.

Link State—Displays the current state of the unit. The states include:

- **Listening**—The state in which all ports are placed while Spanning Tree configures the network topology. Ports remain in this state until the root bridge is selected. This period should be long enough for a port to hear from all other ports on the switch.
- **Learning**—The state in which ports receive data on the topology of the network for the purpose of learning the stations attached to the port. If the port receives no information that would force it into the blocking state, then it moves on to the forwarding state.
- **Forwarding**—This state allows the port to perform standard switching and bridging functions. Packets are received and the port either forwards or discards them based on the address of the packet and the switch's address table.
- **Blocking**—In this state, the port continues to receive data on the status of the network topology but does not transmit them. The port neither receives packets nor learns the addresses of stations for forwarding or receiving.
- **Disabled**—The state in which Spanning Tree has been turned off. Port is disabled by management.

- **Broken**—No cable attached.

Current Utilization—The percentage of bandwidth usage for the port you are currently viewing. This value indicates the general traffic level on the individual port. Ideally, this figure should be below 60%, which indicates that the port is responsible for a reasonable amount of traffic relative to the entire ring.

High utilization values suggest that you should adjust the network topology by reducing load on that port through segmentation.

Frames Forwarded—A running average of the proportion of the received frames forwarded. This value is expressed as a percentage of all received frames, based on a sampling interval of 20 seconds.

Broadcast Frame Bandwidth—A running average of the broadcast frame bandwidth. This value is expressed as a percentage of theoretical maximum bandwidth availability, based on a sampling interval of 20 seconds.

Error Frames—This field displays a running average of the percentage of error frames with CRC errors and is based on a sampling interval of 20 seconds.

Traffic Statistics—Select this category to view the Port Statistics (Traffic) screen. See the next section.

Port Statistics (Traffic)

The TR Port Statistics (Traffic) screen provides a detailed display of statistics for the port you are viewing. To view the Port Statistics screen, proceed as follows from the TR Port Statistics screen:

- 1 Select TRAFFIC STATISTICS button in the lower left-hand corner of the screen.

The TR Port Statistics screen appears. See Figure 6-3.

3Com SuperStack II, Switch 2000 TR : Port Statistics (Traffic)			
Unit ID:	6		
Port ID:	TR 1		
Frames Received:	0	Octets Received:	0
Frames Transmitted:	0	Octets Transmitted:	0
Multicast Frames:	0	Line Errors:	0
Broadcast Frames:	0	Frames Forwarded:	0
Cut-thrus Received:	0	Errors:	0
		Lost Frames:	0
		Abort Frames:	0
Frame Size Analysis:			
18 to 63 Octets:	0 %	64 to 127 Octets:	0 %
128 to 255 Octets:	0 %	256 to 511 Octets:	0 %
512 to 1023 Octets:	0 %	1024 to 2047 Octets:	0 %
2048 to 4095 Octets:	0 %	GT 4095 Octets:	0 %
CLEAR SCREEN COUNTERS		CANCEL	

Figure 6-3 Sample TR Port Statistics (Traffic) Screen

The Port Statistics screen displays the following fields:

Unit ID—The identifying number of the unit you are viewing.

Port ID—The identifying name of the port you are viewing. Should read TR-in-FE.

Frames Received—The total number of frames that have been received by the port including frames with errors.

Frames Transmitted—The total number of frames transmitted by the port, including frames with errors.

Multicasts Frames—The number of frames successfully received with a multicast destination address. This number does not include frames directed to a broadcast address or frames received with errors.

Broadcast Frames—The number of frames received that have a broadcast destination address. This number does not include frames with errors.

Octets Received—The number of octets received by the port, including the MAC header and CRC. Octet counters are accurate to the nearest 256-byte boundary.

Octets Transmitted—The number of octets transmitted by the port, including the MAC header and CRC. Octet counters are accurate to the nearest 256-byte boundary.

Jam Counts—

Frames Forwarded—The total number of frames received by this port and then forwarded to their destination address.

Cut-thrus Received—The total number of cut-thru packets received on the port.

Errors—Total of both line errors (CRCs) and lost frames.

Frame Size Analysis—A series of counters that represent the composition of the traffic on the Switch 2000 TR. The counters display the percentage of packets categorized by received length as represented by the following octet parameters:

- 18 to 63 octets
- 64 to 127 octets
- 128 to 255 octets
- 256 to 511 octets
- 512 to 1023 octets
- 1024 to 2047 octets
- 2048 to 4095 octets
- Packets greater than 4095 octets

Clearing Screen Counters

To make it easier to note the changes in statistic values, you can reset the value of statistics shown on the screen to zero. Resetting the values shown on the screen does not reset the statistic values stored on the device.

Select the CLEAR SCREEN COUNTERS button to reset the counters on the screen to zero.



SAFETY INFORMATION

You must read the following safety information before carrying out any component installation or removal, or any maintenance procedures.

This information should be read in conjunction with the safety information supplied with the Switch.

Important Safety Information



WARNING: Warnings contain directions that you must follow for your personal safety. Follow all instructions carefully.

Please read the following safety information thoroughly in conjunction with the safety information supplied with the Switch before installing the TR-in-FE Module.

- Installation and removal of the module must be carried out by qualified personnel only.
- This module operates under SELV (Safety Extra Low Voltage) conditions, according to IEC 950, the conditions of which are maintained only if the equipment to which it is installed is also operational under SELV.
- Optical Safety. Under normal viewing conditions there is no hazard from the Transmit LED. It is recommended however that the LED is not viewed through any magnifying device while it is powered

on. It is advisable that the fiber TX port and fiber cable ends are never viewed directly when powered on.



WARNING: *Do not remove the downlink module or transceiver module blanking plate with the power still connected.*

L'information de Sécurité Importante



AVERTISSEMENT: *Les avertissements contiennent les directions que vous devez suivre pour votre sécurité personnelle. Suivez toutes les directives avec soin.*

Veillez lire à fond l'information de la sécurité suivante avant d'installer le TR-in-FE Module.

- L'installation et l'enlèvement de l'unité doivent être faits seulement par un personnel qualifié.
- Cette unité marche sous les conditions SELV (Safety Extra Low Voltage) conformément à IEC950, ces conditions sont maintenues seulement si le matériel auquel elle est branchée, est aussi en exploitation sous SELV.
- La sécurité optique. Il n'y a pas de risques du Transmit LED, vu sous conditions normales. Cependant il est recommandé de ne pas regarder le matériel avec l'aide d'une verre grossissant quand il est allumé. Il est aussi conseillé que la port marqué

Fibre TX et les cables fibre ne soient jamais regardés quand l'unité est allumé.



ADVERTISSEMENT: Ne pas enlever le Module Downlink ou la plaque d'occultation de module d'émetteur-récepteur avec le courant encore branché.



WARNUNG: Die Austastplatten der Downlink Module- oder Sendeempfänger-Module nicht entfernen, solange die Einheit ans Stromnetz angeschlossen ist.

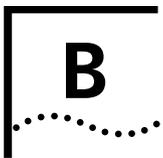
Wichtige Sicherheitsinformationen



WARNUNG: Warnungen enthalten Anweisungen, die zur eigenen Sicherheit unbedingt zu beachten sind. Bitte befolgen Sie alle Anweisungen sorgfältig und genau.

Bitte unbedingt vor dem Einbauen des TR-in-FE Module Einheit die folgenden Sicherheitsanweisungen durchlesen.

- Ein- und Ausbau des Gerätes ist nur von Fachpersonal vorzunehmen.
- Das Gerät wird mit Sicherheits-Kleinspannung nach IEC 950 (SELV = Safety Extra Low Voltage) betrieben. Angeschloßen werden können nur Geräte, die ebenfalls nach SELV betrieben werden.
- Optische Sicherheitsmassnahmen. Unter normalen Umstaenden besteht keine Gefahr durch die sendende Lumineszenzdiode (LED). Es wird jedoch empfohlen diese LED, wenn sie im Betrieb ist, niemals mittels irgenwelcher Art von Vergroesse-rungsgeraeten zu betrachten. Es ist ratsam mit dieser Glasfaser Sendeleitung und den Lictwellen-leiter Enden keinen direkten Augenkontakt zu haben wenn sie im Betrieb sind.



SCREEN ACCESS RIGHTS

This appendix lists the security access level for accessing the TR-in-FE Module local management screens, and lists the type of action performed for each security level.



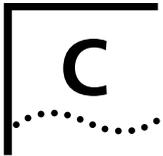
This appendix only covers screens specifically associated with TR-in-FE functionality. See the user guide which accompanies your SuperStack II Switch for additional screen access rights.

The general actions that can be performed by users for each of the security access levels is as follows:

Security/Specialist - read and write
Manager - read and write
Monitor/Secure Monitor - read only

The following table shows the access rights required for each of the ATM screens.

Screen	Access level required
TR-in-FE Port Setup	Security Manager Monitor
TR-in-FE VLAN Setup	Security Manager
TR-in-FE Port Statistics	Security Manager Monitor



TR-IN-FE MODULE TECHNICAL SPECIFICATIONS

Environmental Specifications

Environmental Requirements

Operating Temperature	0 to 50° C (32 to 122°F)
Operating Humidity	10 to 95% relative humidity, non-condensing
Standards	EN60068 (IEC68)

Safety

Agency Certifications	UL 1950, EN60950, CSA 22.2 No. 950, ECMA 97
-----------------------	--

Electromagnetic Emissions (Agency Certification)	EN55022 Class B, FCC Part 15 Class A, C108.8-M1983 Class A, EN 50082-1 (IEC801 Parts 2-5), EN60555 Part 2
---	---

TR-in-FE Cable Specification

The TR-in-FE cable you connect to the TR-in-FE Module must conform to the Multi-Mode Fiber (MMF-PMD) standard defined by ANSI x.3-166-1992.

3Com supports multi-mode fiber (MMF-PMD) 62.5/125 mm for full duplex mode. The maximum inter-station distance (including device-to-network connectors) should not exceed 2 kilometers (1.25 miles).

For half duplex mode, the cable length should not exceed 300 meters.

See the following table for cable specifications:

Specification	Description
Core	62.5 μm diameter
Cladding	125 μm diameter nominal 122 μm minimum 128 μm maximum
Numerical aperture	0.275
Maximum attenuation	11 dB (including 1 db allowed for reflection and dispersion penalties)
Modal bandwidth	500 MHz.km
Maximum distance between nodes	2 km (1.25 miles)

Specification	Description
Output power (from transceiver)	-20 dB minimum -14 dB maximum
Receiver power	-31 dB minimum sensitivity -14 dB maximum sensitivity



Maximum attenuation includes attenuation and the loss induced by other components such as connectors, splices, and the mating of unlike fiber types. Although some 2 km (1.25 miles) cables have a total attenuation of less than 11.0 dB, the 2 km (1.25 miles) inter-station distance must be maintained to comply with modal bandwidth requirements.

The maximum attenuation value in this table is based on a cable diameter of 62.5, 80 or 100 μm .

The following table shows alternative Multi-Mode fiber types that can be used.

Core (mm)	Cladding (mm)	Numerical Aperture
50	125	0.20
50	125	0.22
85	125	0.28
100	140	0.29

If you are using fiber with a diameter of 50 μm and have 3Com equipment at both ends of the link, substitute 8.0 dB for the maximum attenuation. If 3Com equipment is only at one end, substitute 6.0 dB for the maximum attenuation value.

If you are using equipment at the end of the link from a vendor other than 3Com, you must perform a separate loss budget analysis. Contact the vendor(s) for values to use in your analysis.

Does the Cable Provide Sufficient Bandwidth?

Bandwidth for multi-mode fiber is referred to as modal bandwidth because it varies with the modal field (or core diameter) of the fiber.

Modal bandwidth is specified in units of MHz.km, which indicates the amount of bandwidth supported by the fiber for a 1 km (0.625 miles) distance. Your cable must have a Modal bandwidth of 500 MHz, which allows the cable to support end-to-end bandwidth of 250 MHz at the maximum 2 km (1.25 miles) distance.

To check that the bandwidth of your fiber is within an acceptable range:

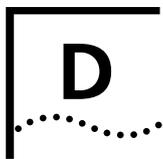
- 1 Divide the amount of bandwidth available according to the fiber specification by the total length of fiber (km).
- 2 If the result is lower than 250 MHz, the link may be prone to bit errors. You should shorten the length of the fiber or use a different fiber until the result of the calculation reaches 250 MHz.

Example

A cable with modal bandwidth of 500 MHz.km will have 250 MHz of bandwidth at 2 km (1.25 miles).

The same cable would have a 500 MHz of bandwidth at 1 km (0.625 miles).

A fiber cable with a bandwidth specification of 200 MHz.km would have only 100 MHz of bandwidth at 2 km (1.25 miles), which would not support TR-in-FE. In this case, another type of fiber which has a bandwidth of 155 MHz would be required.



TECHNICAL SUPPORT

Online Technical Services

3Com offers worldwide product support seven days a week, 24 hours a day, through the following online systems:

- 3Com Bulletin Board Service (3ComBBS)
- World Wide Web site
- 3ComForum on CompuServe®
- 3ComFactsSM automated fax service

3Com Bulletin Board Service

3ComBBS contains patches, software, and drivers for all 3Com products, as well as technical articles. This service is available via modem or ISDN seven days a week, 24 hours a day.

Access by Modem

To reach the service by modem, set your modem to 8 data bits, no parity, and 1 stop bit. Call the telephone number nearest you:

Country	Data Rate	Telephone Number
Australia	up to 14400 bps	(61) (2) 9955 2073
Brazil	up to 14400 bps	(55) (11) 547 9666
France	up to 14400 bps	(33) (1) 69 86 69 54

Country	Data Rate	Telephone Number
Germany	up to 28800 bps	(49) (89) 627 32 188
Hong Kong	up to 14400 bps	(852) 2537 5608
Italy (fee required)	up to 14400 bps	(39) (2) 273 00680
Japan	up to 14400 bps	(81) (3) 3345 7266
Mexico	up to 28800 bps	(52) (5) 520 7835
P. R. of China	up to 14400 bps	(86) (10) 684 92351
Singapore	up to 14400 bps	(65) 534 5693
Taiwan	up to 14400 bps	(886) (2) 377 5840
U.K.	up to 28800 bps	(44) (1442) 278278
U.S.	up to 28800 bps	(1) (408) 980 8204

Access by ISDN

ISDN users can dial in to 3ComBBS using a digital modem for fast access up to 56 Kbps. To access 3ComBBS using ISDN, dial the following number:

(408) 654 2703

World Wide Web Site

Access the latest networking information on 3Com's World Wide Web site by entering our URL into your Internet browser:

<http://www.3Com.com/>

This service features news and information about 3Com products, customer service and support, 3Com's latest news releases, selected articles from 3TECH™ (3Com's award-winning technical journal) and more.

3ComForum on CompuServe

3ComForum is a CompuServe-based service containing patches, software, drivers, and technical articles about all 3Com products, as well as a messaging section for peer support. To use 3ComForum, you need a CompuServe account.

To use 3ComForum:

- 1 Log on to CompuServe.
- 2 Enter **go threecom**.
- 3 Press [Return] to see the 3ComForum main menu.

3ComFacts Automated Fax Service

3Com Corporation's interactive fax service, 3ComFacts, provides data sheets, technical articles, diagrams, and troubleshooting instructions on 3Com products 24 hours a day, seven days a week.

Call 3ComFacts using your touch-tone telephone. International access numbers are:

Country	Telephone Number
U.K.	(44) (1442) 278279
U.S.	(1) (408) 727 7021

Local access numbers are available within the following countries:

Country	Telephone Number	Country	Telephone Number
Australia	800 123853	Netherlands	06 0228049
Belgium	0800 71279	Norway	800 11062
Denmark	800 17319	Portugal	0505 442607
Finland	98 001 4444	Russia (Moscow only)	956 0815
France	05 90 81 58	Spain	900 964445
Germany	0130 8180 63	Sweden	020 792954
Italy	1678 99085	U.K.	0800 626403

Support from Your Network Supplier

If additional assistance is required, contact your network supplier. Many suppliers are authorized 3Com service partners qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- Diagnostic error messages
- A list of system hardware and software, including revision levels
- Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

Support from 3Com

If you are unable to receive support from your network supplier, technical support contracts are available from 3Com.

In the U.S. and Canada, call **(800) 876-3266** for customer service.

If you are outside the U.S. and Canada, contact your local 3Com sales office to find your authorized service provider:

Country	Telephone Number
Australia*	1 800 678 515
Belgium*	0800 71429
Brazil	(55) (11) 546 0869
Canada	(416) 498 3266
Denmark*	800 17309
Finland*	0800 113153
France*	05 917959
Germany*	0130 821502
Hong Kong	(852) 2501 1111
Ireland*	1 800 553117
Italy*	1678 79489
Japan	(81) (3) 3345 7251
Mexico	(525) 520 7841

Country	Telephone Number
Netherlands*	06 0227788
Norway*	800 11376
Singapore	(65) 538 9368
South Africa	(27) (11) 807 4397
Spain*	900 983125
Sweden*	020 795482
Taiwan	(886) (2) 577 4352
United Arab Emirates	(971) (4) 349049
U.K.*	0800 966197
U.S.	(1) (408) 492 1790

* These numbers are toll-free.

Returning Products for Repair

A product sent directly to 3Com for repair must first be assigned a Return Materials Authorization (RMA) number. A product sent to 3Com without an RMA number will be returned to the sender unopened, at the sender's expense.

To obtain an RMA number, call or fax:

Country	Telephone Number	Fax Number
U.S. and Canada	(800) 876 3266, option 2	(408) 764 7120
Europe	31 30 60 29900, option 5	(44) (1442) 275822
Outside Europe, U.S., and Canada	(1) (408) 492 1790	(1) (408) 764 7290

Numbers

3Com Bulletin Board Service (3ComBBS) D-1
 3Com sales offices D-3
 3ComFacts D-2
 3ComForum D-2

A

Automatic logout 4-7

B

Bandwidth
 Calculation C-1
 Blocking, description of 6-2
 BRIDGE SETUP
 Setting Bridge Parameters 5-3
 Broadcast Frame Bandwidth, description
 of 6-3
 Bulletin board service D-1

C

Cables
 Technical Specification C-1
 Cautions in text 2
 Clearing screen counters 6-4
 CompuServe D-2
 Connections
 Troubleshooting 3-5
 Conventions in text 2
 Current Utilization, description of 6-3

D

Default Users, management console 4-3
 Disabled, description of 6-2

E

Environmental Specifications C-1
 Error Frames, description of 6-3

F

Fax service. See 3ComFacts
 Forwarding, description of 6-2
 Frames Forwarded, description of 6-3

I

Installing the TR-in-FE Module 3-1

L

Learning, description of 6-2
 LEDs
 Summary 3-3
 Listening, definition of 6-2
 Logging off 4-7

M

Manual
 Finding information 2

N

Network supplier support D-2
 Notice conventions 1

O

On-line technical services D-1

P

Passwords
 Default passwords 4-6
 Port
 Configuration 5-2
 Port Statistics
 Broadcast Frame Bandwidth 6-3
 Current Utilization 6-3
 Error Frames 6-3
 Frames Forwarded 6-3

Link State

 Blocking 6-2
 Disabled 6-2
 Forwarding 6-2
 Learning 6-2
 Listening 6-2
 Traffic Statistics 6-3
 Port Statistics (Traffic) 6-3
 Broadcasts Received 6-4
 Cut-thrus Received 6-4
 Errors 6-4
 Frame Size Analysis 6-4
 Frames Forwarded 6-4
 Frames Received 6-4
 Frames Transmitted 6-4
 Multicasts Received 6-4
 Octets Received 6-4
 Octets Transmitted 6-4
 Port ID 6-3
 Post installation checks 3-3
 Power supply 3-4

R

Returning products for repair D-3

S

Safety information 3-1
 English A-1
 French A-1
 German A-2
 Screen access rights B-1
 Statistics
 Clearing screen counters 6-4
 Screen map 6-1

T

Technical Specifications
 Bandwidth calculation C-2
 Cabling C-1
 Environment C-1

Terminology 1
Traffic Statistics, description of 6-3
TR-in-FE
 Concepts 2-1
 Statistics 6-1
TR-in-FE Module
 Installing 3-1
 Power supply 3-4
TR-in-FE Port
 Configuration 5-2
Troubleshooting
 Using LEDs 3-3

U

User guide
 Finding information 2
Users
 Default users 4-6
 Screen access rights B-1

V

VT100 Console
 Button 4-2
 Choice Field 4-1
 Correcting Text Entries 4-2
 Entry Field 4-1
 Keyboard Shortcuts 4-2
 List Boxes 4-2

W

Warnings in text 2

3Com Corporation LIMITED WARRANTY

For purposes of this warranty, the **SuperStack II Switch 2000 TR Token Ring-in-Fast Ethernet Module** is considered a(n) **Internetworking product**.

HARDWARE

3Com warrants its hardware products to be free from defects in workmanship and materials, under normal use and service, for the following lengths of time from the date of purchase from 3Com or its Authorized Reseller:

Internetworking products	One year
Network adapters	Lifetime
Ethernet stackable hubs and Unmanaged Ethernet fixed port repeaters	Lifetime* (One year if not registered)
*Power supply and fans in the stackable hubs and unmanaged repeaters	One year
Other hardware products	One year
Spare parts and spares kits	90 days

If a product does not operate as warranted above during the applicable warranty period, 3Com shall, at its option and expense, repair the defective product or part, deliver to Customer an equivalent product or part to replace the defective item, or refund to Customer the purchase price paid for the defective product. All products that are replaced will become the property of 3Com. Replacement products may be new or reconditioned. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer.

3Com shall not be responsible for any software, firmware, information, or memory data of Customer contained in, stored on, or integrated with any products returned to 3Com for repair, whether under warranty or not.

SOFTWARE

3Com warrants that the software programs licensed from it will perform in substantial conformance to the program specifications therefor for a period of ninety (90) days from the date of purchase from 3Com or its Authorized Reseller. 3Com warrants the media containing software against failure during the warranty period. No updates are provided. 3Com's sole obligation with respect to this express warranty shall be (at 3Com's discretion) to refund the purchase price paid by Customer for any defective software products, or to replace any defective media with software which substantially conforms to 3Com's applicable published specifications. Customer assumes responsibility for the selection of the appropriate applications program and associated reference materials. 3Com makes no warranty or representation that its software products will work in combination with any hardware or applications software products provided by third parties, that the operation of the software products will be uninterrupted or error free, or that all defects in the

software products will be corrected. For any third-party products listed in the 3Com software product documentation or specifications as being compatible, 3Com will make reasonable efforts to provide compatibility, except where the noncompatibility is caused by a "bug" or defect in the third party's product.

STANDARD WARRANTY SERVICE

Standard warranty service for *hardware* products may be obtained by delivering the defective product, accompanied by a copy of the dated proof of purchase, to 3Com's Corporate Service Center or to an Authorized 3Com Service Center during the applicable warranty period. Standard warranty service for *software* products may be obtained by telephoning 3Com's Corporate Service Center or an Authorized 3Com Service Center, within the warranty period. Products returned to 3Com's Corporate Service Center must be pre-authorized by 3Com with a Return Material Authorization (RMA) number marked on the outside of the package, and sent prepaid, insured, and packaged appropriately for safe shipment. The repaired or replaced item will be shipped to Customer, at 3Com's expense, not later than thirty (30) days after receipt of the defective product by 3Com.

WARRANTIES EXCLUSIVE

IF A 3COM PRODUCT DOES NOT OPERATE AS WARRANTED ABOVE, CUSTOMER'S SOLE REMEDY FOR BREACH OF THAT WARRANTY SHALL BE REPAIR, REPLACEMENT, OR REFUND OF THE PURCHASE PRICE PAID, AT 3COM'S OPTION. TO THE FULL EXTENT ALLOWED BY LAW, THE FOREGOING WARRANTIES AND REMEDIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER WARRANTIES, TERMS, OR CONDITIONS, EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES, TERMS, OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND SATISFACTORY QUALITY. 3COM NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE, INSTALLATION, MAINTENANCE, OR USE OF ITS PRODUCTS.

3COM SHALL NOT BE LIABLE UNDER THIS WARRANTY IF ITS TESTING AND EXAMINATION DISCLOSE THAT THE ALLEGED DEFECT IN THE PRODUCT DOES NOT EXIST OR WAS CAUSED BY CUSTOMER'S OR ANY THIRD PERSON'S MISUSE, NEGLIGENCE, IMPROPER INSTALLATION OR TESTING, UNAUTHORIZED ATTEMPTS TO REPAIR OR MODIFY, OR ANY OTHER CAUSE BEYOND THE RANGE OF THE INTENDED USE, OR BY ACCIDENT, FIRE, LIGHTNING, OR OTHER HAZARD.

LIMITATION OF LIABILITY

TO THE FULL EXTENT ALLOWED BY LAW, 3COM ALSO EXCLUDES FOR ITSELF AND ITS SUPPLIERS ANY LIABILITY, WHETHER BASED IN CONTRACT OR TORT (INCLUDING NEGLIGENCE), FOR INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY KIND, OR FOR LOSS OF REVENUE OR PROFITS, LOSS OF BUSINESS, LOSS OF INFORMATION OR DATA, OR OTHER FINANCIAL LOSS ARISING OUT OF OR IN CONNECTION WITH THE SALE, INSTALLATION, MAINTENANCE, USE, PERFORMANCE, FAILURE, OR INTERRUPTION OF ITS PRODUCTS, EVEN IF 3COM OR ITS AUTHORIZED RESELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND LIMITS ITS LIABILITY TO REPAIR, REPLACEMENT, OR REFUND OF THE

PURCHASE PRICE PAID, AT 3COM'S OPTION. THIS DISCLAIMER OF LIABILITY FOR DAMAGES WILL NOT BE AFFECTED IF ANY REMEDY PROVIDED HEREIN SHALL FAIL OF ITS ESSENTIAL PURPOSE.

Some countries, states, or provinces do not allow the exclusion or limitation of implied warranties or the limitation of incidental or consequential damages for certain products supplied to consumers, so the above limitations and exclusions may be limited in their application to you. This warranty gives you specific legal rights which may vary depending on local law.

GOVERNING LAW

This Limited Warranty shall be governed by the laws of the state of California.

3Com Corporation, 5400 Bayfront Plaza, Santa Clara, CA 95052-8145 (408)
764-5000

8/20/96