



FT-2000 OC-48 Lightwave System Releases 8.1 Through 9.1

User/Service Manual

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1. Testing indicates that the FT-2000 ADR is Year 2000 (Y2K) compliant with Software Releases 7.1 and later.
2. All software releases, including releases prior to R7.1, will continue to support transmission, at century rollover, with no problems being encountered. However, some of the security aspects will not function properly following century rollover in software releases prior to R7.1. Specifically, user passwords and visitor logins will not expire.
3. It is recommended that all customers upgrade to current software releases (R7.2.3 or later).

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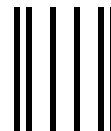
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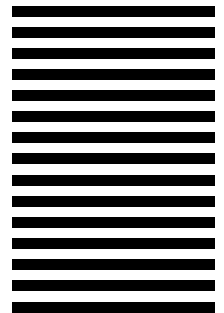
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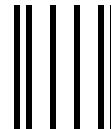
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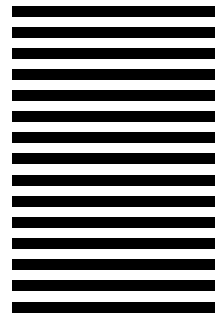
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About This Document

Purpose

This user/service manual provides the following information about the FT-2000 OC-48 Lightwave System Release 9.1:

- Detailed descriptive information to circuit pack level
- Craft interface terminal usage
- Operation and maintenance (O&M) task oriented practice (TOP) supporting acceptance, circuit order, operation, and trouble clearing tasks.

The FT-2000 OC-48 Lightwave System has a phased product release plan. Document 365-575-102, Issue 7.2, is the FT-2000 User/Service Manual for Releases 1 through 7.2. No additional issues of (365-575-102, Issue 7.2) are planned. However, Issue 7.2 will be updated with addendum(s) as appropriate. All future releases of the FT-2000 OC-48 Lightwave System will be included in this document (365-575-103) and will be based on Issue 8.1.

Intended Audiences

This user/service manual is primarily for end users responsible for operating and maintaining the FT-2000 OC-48 Lightwave System. It may be used by anyone desiring specific operation and maintenance information.

Reason for Reissue

This is Issue 3 of this document. It is based on information from the FT-2000 Lightwave System, Release 8.1 (365-575-103, Issue 8.1). Since some of the descriptive information relating to previous releases is not applicable to Release 9.1, it has been deleted so as to minimize confusion. Additional new information which is directly related to R9.1 is included.



NOTE:

This document contains change bars to identify where there has been new information added (beyond Release 9.0) and where obsolete information has been deleted.

Record of Changes for Release 9.1

Significant changes in this update issue are:

- Two new Circuit Order procedures (NTP-019 and NTP-020) and one Trouble Clearing procedure (TAP-177)
- The FT-2000 Add/Drop-Rings Terminal has been DAed as of December, 1999, along with the corresponding E-Bay documentation set (J68974E1).
- There are also 16 new OC-48 TRMTR (STS-1 OC-12c 1.5 STD) circuit packs (739H1-16) that are described in this manual but were not issued as part of Release 9.1. These circuit packs are for non-OLS compatible, passive DWDM systems. For more information on the 739H1-16 circuit packs, see Chapter 7, "Circuit Pack Descriptions, and Chapter 10, "Technical Specifications."
- Release 9.1 provides the following:
 - Operations Interworking Enhancement — Bidirectional Line Switched Ring Interworking with *WaveStar*^{*} Bandwidth Manager Release 2.0, *WaveStar* 2.5G Release 3.0, and *WaveStar* 10G Release 1.0
 - DRI Enhancement — DRI switching on LOP-P
 - Operations Interworking Enhancement — TL1-GNE for *WaveStar* 2.5G, 10G, and Tellabs *TITAN*
 - CIT Enhancement — Support of *Windows 98*[†]

* *WaveStar*[™] is a registered trademark of Lucent Technologies.

† *Windows NT*[®], *Windows 95*[®], and *Windows 98*[®] are registered trademarks of Microsoft Corporation.

Record of Changes for Release 9.0

Significant changes in this update issue are:

- Expanded and improved index.
- A new circuit order procedure, **NTP-018**, as well as significant changes to **DLP-536**, **TAP-113**, **TAP-119**, **TAP-136** and **TAP-176**.
- Software Release 9.0. Release 9.0 provides the following:
 - DRI Enhancement — STS Path Payload Defect Indicator (PDI-P)
 - Performance Monitoring Enhancement — Pointer Justification Counts (PJC)
 - *TIRKS*[®]* (Trunk Integrated Record Keeping System) Compatible STS-1 Numbering
 - Equipage Dependent Reports
- New OC-3 Low Speed Interface Circuit Pack (LAA10B)
 - STS-1 Granularity Enhancement — Full E/W directionality
 - Synchronization Messaging Enhancement — Synchronization Messaging on S1 Byte
- CIT Enhancement — Support of *Windows 95* and *Windows NT*.

Record of Changes for Releases 8.0 and 8.1

- CPro-2000 update modifications
- New technical support medium: Global Technical Support Information Platform (GTSIP) to replace COACH.
- DDM-2000 Ring to FT-2000 1+1 Linear Add/Drop applications
- Year 2000 Impact Statement
- Release 8.1 has replaced Release 8.0. Release 8.0 is discontinued availability (DA) as of April, 1998. Release 8.1 has also been rated discontinued availability as of June 30, 1999. Modifications included in 8.0/8.1 are:
 - Red Line Services
 - Enhancements to Dual Ring Interworking (DRI): DRI on Protection (DRI-P) and Switch on STS Path Unequipped (UNEQ-P)
 - Multi-Vendor Operations Interworking (OI):
 - Multi-Vendor Operations Interworking (OI) compatibility

* *TIRKS*[®] is a Bellcore operations system and registered trademark.

- FT-2000 is compatible with any other vendor NEs that support Target ID Address Resolution (TARP) protocol, OSI, and TL1/X.25 Bellcore GR-253.
- Compatible with Tellabs *TITAN* 5500/S Release 5.0 Digital Cross-Connect System, including TL1/X.25 OS access with *TITAN* 5500/s Digital Cross-Connect System serving as the TL1/X.25 GNE.
- Lucent 2000 Product Family OI compatibility
 - Compatible with DDM-2000 OC-3 R13.0, OC-12 R7.0, and FiberReach R3.0 (but not with earlier releases due to multi-vendor OI support).
 - FT-2000 TL1/X.25 GNE support up to 105 (up from 64 previously) TL1 logins to remote NEs.
 - DDM-2000 OC-3 R13.0 and OC-12 R7.0 can serve as the TL1/X.25 GNE for FT-2000 R8.0 remote NEs.
- Large subnetworks
 - Support large subnetworks of up to 50 NEs (Level 1 Area only).
 - Supports large subnetworks of up to 256 NEs by partitioning into multiple areas connected via Level 2 Intermediate Systems (IS).
 - ITM SNC supports enhanced database backup and restore of FT-2000
 - ITM SNC software download for upgrading to future releases of FT-2000.
 - ITM SNC as the TL1/X.25 GNE for FT-2000.

How to Use This Document

The sections in this document are marked with white tabs and provide the following information:

- "About This Document" describes the purpose, intended audience, and organization of this document. This section also presents safety information, references other related documentation, and provides product support information. It also explains how to order and make comments or recommendations for changes to this document.
- Section 1, "System Introduction," introduces the members of the Lucent Technologies 2000 Product Family and briefly describes the FT-2000 OC-48 Lightwave System.

- Section 2, "Applications," describes how the FT-2000 OC-48 Lightwave System meets point-to-point, hubbing, bidirectional line-switched rings, dual ring interworking, dual-wire center architecture, broadband service transport, FT-Lightwave Booster Amplifier (FT-LBA) for extended distances, loop feeder network applications, path-in-line architecture, wavelength division multiplexing, operations interworking, and gateway network element operation.
- Section 3, "Platform Descriptions," introduces the FT-2000 OC-48 Lightwave System platforms and provides a more detailed view of the FT-2000 OC-48 Lightwave System physical design.
- Section 4, "Power," describes the power distribution and dissipation of the FT-2000 OC-48 Lightwave System.
- Section 5, "Control, Transmission, and Synchronization Interfaces," describes the FT-2000 OC-48 Lightwave System interfaces and architecture. The system control, transmission, and synchronization interfaces and architecture are described down to the circuit pack level.
- Section 6, "Operations Interfaces," describes the interfaces that allow access to the FT-2000 OC-48 Lightwave System and provides alarm and status information.
- Section 7, "Circuit Pack Descriptions," provides a detailed circuit description of each FT-2000 OC-48 Lightwave System circuit pack.
- Section 8, "Administration and Provisioning," describes administration and provisioning of the FT-2000 OC-48 Lightwave System.
- Section 9, "Maintenance Description," defines the "maintenance philosophy" outlining the various features available to monitor and maintain the FT-2000 OC-48 Lightwave System.
- Section 10, "Technical Specifications," lists the technical specifications for the FT-2000 OC-48 Lightwave System.
- Section 11, "Craft Interface Terminal Usage," describes how the craft interface terminal is used and shows the FT-2000 OC-48 Lightwave System inputs (commands), output messages, and reports. It also includes a tutorial on the use of the craft interface terminal.
- The "Operation and Maintenance (TOP)" contains specific task-oriented procedures for the acceptance, circuit order, operation, and trouble clearing of the FT-2000 OC-48 Lightwave System.

Conventions Used

The **BOLD** font is used throughout this manual for emphasis. The descriptive sections in this manual use a **Courier Bold** font to identify menu input selections to the system. UPPERCASE letters identify letter designations on panels, shelves, and circuit packs.

The procedures in the "Operation and Maintenance (TOP)" section use a MONOSPACE font to identify text on a screen or a response displayed from the system. A **BOLD** font identifies letter designations on panels, shelves, and circuit packs.

Safety Instructions

Safety Labels

This manual may contain safety labels in the form of **DANGERS**, **WARNINGS**, and **CAUTIONS**. These safety labels have the following definitions:

- **DANGER** shows the presence of a hazard that *will* cause death or severe personal injury if the hazard is not avoided.
- **WARNING** shows the presence of a hazard that *can* cause death or severe personal injury if the hazard is not avoided.
- **CAUTION** shows the presence of a hazard that *will* or can cause minor personal injury or property damage if the hazard is not avoided. Caution is also used for property-damage-only accidents. This includes equipment damage, loss of software, or service interruption.

These admonishments are noted by the alert symbol •.

Lightwave Safety Guidelines

General Laser Information

The FT-2000 OC-48 Lightwave System and associated optical test sets use semiconductor laser transmitters that emit light at wavelengths between approximately 800 nanometers (nm) and 1600 nm. The emitted light is above the red end of the visible spectrum, which is normally not visible to the human eye. Although radiant energy at near-infrared wavelengths is officially designated invisible, some people can see the shorter wavelength energy even at power levels several orders of magnitude below any that have been shown to cause injury to the eye.

Conventional lasers can produce an intense beam of monochromatic light. Monochromatic light is a single wavelength output of pure color that may be visible or invisible to the eye. A conventional laser produces a small-size beam of light, and because the beam size is small the power density (also called irradiance) is very high. Consequently, lasers and laser products are subject to federal and applicable state regulations as well as international standards for their safe operation.

A conventional laser beam expands very little over distance or is said to be very well collimated. Thus, conventional laser irradiance remains relatively constant over distance. However, lasers used in lightwave systems have a large beam divergence, typically 10 to 20 degrees. Here, irradiance obeys the inverse square law (doubling the distance reduces the irradiance by a factor of 4) and rapidly decreases over distance.

Lasers and Eye Damage

Light energy emitted by laser and high-radiance light-emitting diodes (LEDs) in the 400- to 1400-nm range may cause eye damage if absorbed by the retina. When a beam of light enters the eye, the eye magnifies and focuses the energy, magnifying the irradiance. The irradiance of the energy that reaches the retina is approximately 10,000 or 100,000 times that at the cornea, and if sufficiently intense, may cause a retinal burn.

The damage mechanism at the wavelengths used in telecommunications is thermal in origin, for example, damage caused by heating. Therefore, a specific amount of energy is required for a definite time to heat an area of retinal tissue. Damage is not instantaneous. It occurs only when one looks at the light sufficiently long enough that the product of the retinal irradiance and the viewing time exceeds the damage threshold. Light energies above 1400 nm would cause surface and skin burns and do not affect the retina.

Classification of Lasers

Manufacturers of lasers and laser products in the United States are regulated by the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) under 21 CFR 1040. These regulations require manufacturers to certify each laser or laser product as belonging to one of the major Classes I, II, IIIa, IIIb, or IV. Lasers are classified according to the accessible emission limits and their potential for causing injury. Lightwave systems are generally classified as Class I, because, under normal operating conditions, all energized laser transmitting circuit packs are terminated on optical fibers which enclose the laser energy with the fiber sheath forming a protective housing. Also, covers are in place over the circuit pack shelves.

Lightwave Safety Precautions

Under normal operating conditions, the FT-2000 OC-48 Lightwave System is totally enclosed and presents no risk of eye injury. It is a Class I system under the FDA/CDRH scheme.

The lightguide cables that interconnect various components of a lightwave system can disconnect or break and may expose people to lightwave emission. Also, certain measures and maintenance procedures may expose the technician to emission from the semiconductor laser during installation and servicing. Unlike more familiar laser devices, such as solid-state and gas lasers, the emission

pattern of a semiconductor laser results in a highly divergent beam. In a divergent beam, the irradiance (power density) decreases rapidly with distance. The greater the distance, the less energy will enter the eye and the less potential risk for eye injury.

Inadvertently viewing an unterminated fiber or damaged fiber with the unaided eye at distances greater than 5 to 6 inches normally will not cause eye injury provided the power in the fiber is less than a few milliwatts at the shorter wavelengths and higher at the longer wavelengths. However, damage may occur if an optical instrument such as a microscope, magnifying glass, or eye loupe is used to stare at the energized fiber end.



WARNING:

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.

Safety Precautions for Enclosed Systems

Under normal operating conditions the FT-2000 OC-48 Lightwave System is completely enclosed; nonetheless, the following precautions should be observed:

- Because of the potential for eye damage, technicians should neither disconnect any lightwave cable nor splice and stare into the optical connectors terminating the cables.
- Under no circumstance should lightwave/lightguide operations be performed by a technician before satisfactorily completing an approved training course.
- Since viewing lightwave emission directly with an optical instrument, such as an eye loupe, greatly increases the risk of eye damage, an appropriate label must appear in plain view on the front of the main frame or lightguide termination/interconnection equipment. The label shall read as follows:

NOTICE: UNTERMINATED OPTICAL CONNECTORS MAY EMIT LASER RADIATION. AVOID DIRECT EXPOSURE TO THE BEAM. DO NOT VIEW THIS BEAM WITH OPTICAL INSTRUMENTS.

A warning label (Figure 1) is provided on the filter panel of the Enhanced High-Speed Shelf and on the right front of the High Speed Shelf and Repeater Shelf–System Controller. The word DANGER is in central office white lettering on a red background. The text of the warning label is in black lettering on a white background.

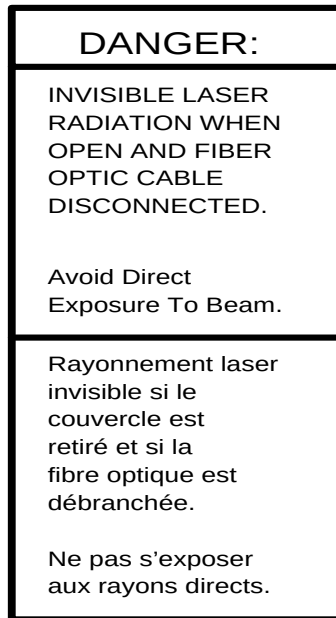


Figure 1. Warning Label

In addition, a compliance label stating that the system has been certified along with the manufacturer's name and place of manufacture is attached to each equipment bay. Figure 2 shows an example of a compliance label. The compliance label is located on the rear of the equipment bays (at eye level) and miscellaneous-mounted shelves.

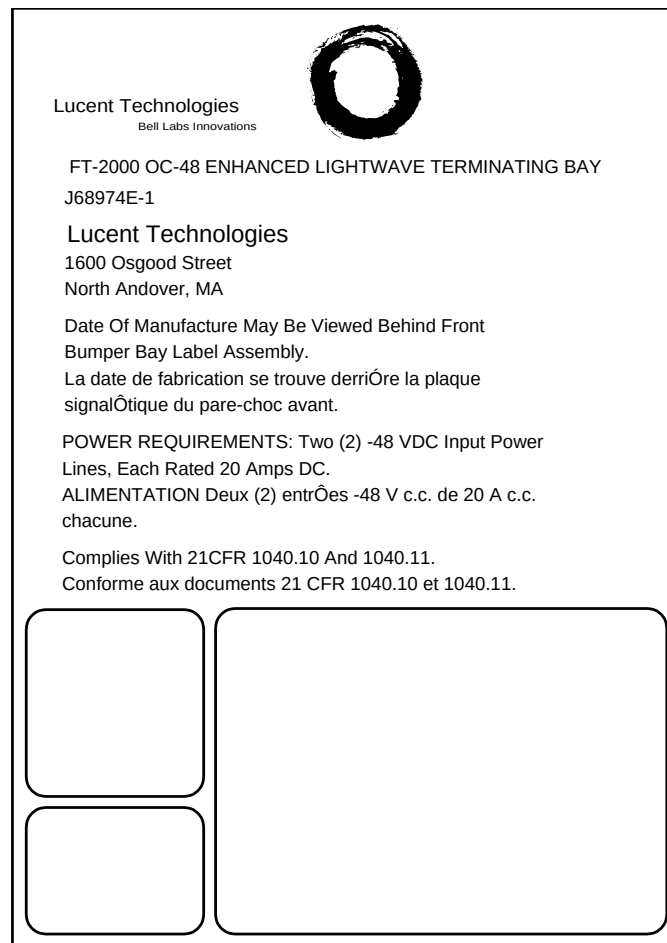


Figure 2. Compliance Label

Safety Precautions for Unenclosed Systems

During service, maintenance, or restoration, the FT-2000 OC-48 Lightwave System is considered unenclosed. During service, maintenance, or restoration, observe the following precautions:

- Only authorized, trained personnel should be permitted to do service, maintenance, and restoration. Avoid exposing the eye to emissions from unterminated, energized optical connectors at close distances. Connectors associated with lightwave regenerators are recessed, which limits the

exposure distance. However, technicians removing or replacing regenerators should not stare or look directly into the vacant regenerator slot with optical instruments or magnifying lenses. (Normal eyewear or indirect viewing instruments, such as Find-R-Scope are not considered magnifying lenses or optical instruments.)

- Only authorized, trained personnel should use the lightwave test equipment during installation or servicing, since this equipment contains semiconductor lasers. (Some examples of lightguide test equipment are optical time domain reflectometers (OTDRs), Hand-Held Loss Test Sets, and Feature Finders.)
- Under no circumstances should any personnel scan a fiber with an optical test set without verifying that all lightwave sources on the fiber are turned off.
- All unauthorized personnel should be excluded from the immediate area of lightwave transmission systems during installation and service.

Consult ANSI Z136.1, American National Standard for Safe Use of Lasers, for guidance on the safe use of lasers in the workplace.

Electrostatic Discharge (ESD) Considerations



CAUTION:

Industry experience has shown that all integrated circuit packs can be damaged by static electricity that builds up on work surfaces and personnel. The static charges are produced by various charging effects of movement and contact with other objects. Dry air allows greater static charges to accumulate. Higher potentials are measured in areas with low relative humidity, but potentials high enough to cause damage can occur anywhere.

Observe the following precautions when handling circuit packs to prevent damage by electrostatic discharge:

- Assume all circuit packs contain solid-state electronic components that can be damaged by ESD.
- When handling circuit packs (storing, installing, removing, etc.) or when working on the backplane, always wear a grounded wrist strap or wear a heel strap and stand on a grounded, static-dissipating floor mat.
- Handle all circuit packs by the faceplate or latch and by the top and bottom outermost edges. Never touch the components, conductors, or connector pins.
- Observe all warning labels on bags and cartons. Whenever possible, do not remove circuit packs from antistatic packaging until ready to insert them into slots.
- If possible, open all circuit packs at a static-safe work position, using properly grounded wrist straps and static-dissipating table mats.

- Always store and transport circuit packs in static-safe packaging. Shielding is not required unless specified.
- Keep all static-generating materials such as food wrappers, plastics, and *styrofoam** containers away from all circuit packs. When removing circuit packs from a bay, immediately place the circuit packs in static-safe packages.
- Whenever possible, maintain relative humidity above 20 percent.
- Always keep the electromagnetic interference (EMI)/ESD protective front covers on the shelves except during an upgrade or maintenance procedure. Once a circuit pack is replaced in the shelf, immediately close the front cover.

To reduce the possibility of ESD damage, shelves are equipped with grounding jacks to enable personnel to ground themselves using wrist straps (Figure 3), while handling circuit packs or working on a shelf. The jacks for connection of wrist straps are located at the lower right-hand corner of each user panel and filter panel and at the rear of the bay. These jacks are labeled. The wrist straps should be checked periodically with a wrist strap tester to ensure that they are working properly.

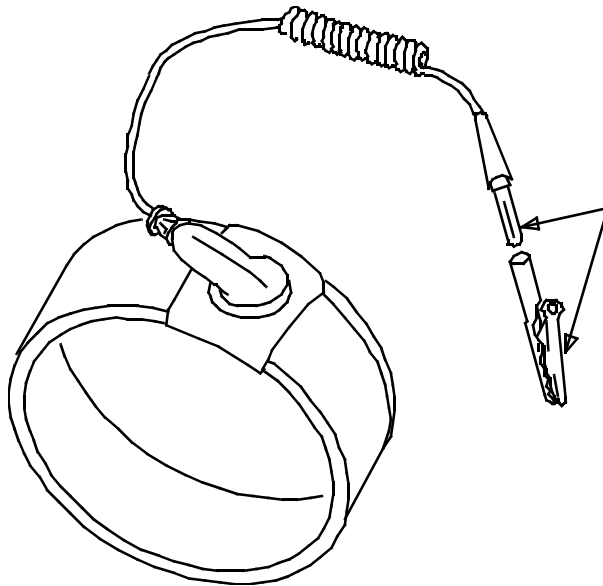


Figure 3. Static Control Wrist Strap

Security

Lucent Technologies has designed the craft interface terminal (CIT) so that, when properly administered, it will minimize the ability of unauthorized persons to gain access to the network. Each authorized user should be instructed about the proper use of the CIT.

IMPORTANT SAFETY INSTRUCTIONS

READ AND UNDERSTAND ALL INSTRUCTIONS.

When using this telecommunication equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:

1. Follow all warnings and instructions marked on the product.
2. Slots and openings in this product and the back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered.
3. Opening or removing rear covers or sheet-metal parts may present exposure to high current or electrical energy levels, or to other risks. Refer all servicing in those areas to qualified service personnel.
4. Never push objects of any kind into this product through slots, as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electrical shock. Never spill liquid of any kind on the product.
5. Refer servicing to qualified service personnel.

SAVE THESE INSTRUCTIONS.

IMPORTANT INSTALLATION SAFETY INSTRUCTIONS

READ AND UNDERSTAND ALL INSTRUCTIONS.

1. Use caution when installing and modifying telecommunications lines.
2. Never install telecommunication wiring during a lightning storm.
3. Never install telecommunication jacks in wet locations unless the jack is specifically designed for wet locations.
4. Never touch uninsulated telecommunication wires or terminals unless the telecommunication line has been disconnected at the network interface.

5. Installation must include an independent frame ground conductor to building ground. Grounding/bonding circuit continuity is vital for safe operation of this equipment. Never operate with grounding/bonding conductor disconnected.
6. This product has two –48 V DC input power feeders. Disconnecting one power feeder will not de-energize the product. To reduce the risk of injury, disconnect both power supply cables when removing power from the system.
7. Metallic telecommunication interfaces should not leave the building premises unless connected to telecommunication devices providing primary and secondary protection, as applicable.
8. For continued protection against risk of fire, replace only with same type and rating of fuse.
9. Use only Lucent Technologies manufactured, recognized circuit packs. Refer to 365-575-104, *FT-2000 OC-48 Lightwave System, Releases 1 and 2, Installation Manual*, and 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 4, 5, 6, and 7 Installation Manual*, for a list of recognized circuit packs.

SAVE THESE INSTRUCTIONS.

Related Documentation/Training

Lucent Technologies

The following Lucent Technologies practices provide information about the FT-2000 OC-48 Lightwave System:

- Number: 365-575-100
Title: *FT-2000 OC-48 Lightwave System, Applications, Planning, and Ordering Guide*
Audience: System planners and engineers
Content: Features, applications, general description, system planning/engineering, and ordering information
- Number: 365-575-102 (NON-TARP Releases)
Title: *FT-2000 OC-48 Lightwave System, User/Service Manual*
Audience: End user maintenance personnel
Content: Features, feature applications, configuration descriptions, equipment descriptions, administration and provisioning information, as well as operation and maintenance procedures.

- Number: 365-575-171
Title: *FT-2000 OC-48 Lightwave System, Quick Reference Guide*
Audience: End user maintenance personnel
Content: Abbreviated list of common report commands and a trouble clearing procedure that can be used to clear most trouble
- Number: 365-575-115
Title: *FT-2000 OC-48 Lightwave System, Releases 3 Through 8 Installation Manual*
Audience: Customers planning to install and turn up the equipment
Content: Customer installation instructions for the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay platforms
- Number: Comcode 108171539
Title: *FT-2000 OC-48 Lightwave System, Software Release Description, Release 9.1-ADR*
Audience: End user maintenance personnel
Content: Status of problems fixed and known problems for Release 9.1-ADR software
- Number: 365-575-121
Title: *FT-2000 OC-48 Repeater Bay/Shelf Provisioning Job Aid (Releases 2, 4, and 6)*
Audience: End user maintenance personnel
Content: List of provisionable parameters, original values, options, and the corresponding inputs for the FT-2000 OC-48 Repeater Bay/Shelf
- Number: 365-575-172
Title: *FT-2000 OC-48 Add/Drop-Rings Terminal Provisioning Job Aid (Release 8.1 and Later)*
Audience: End user maintenance personnel
Content: List of provisionable parameters, original values, options, and the corresponding inputs for the FT-2000 OC-48 Add/Drop-Rings Terminal
- Number: 365-575-123
Title: *FT-2000 Threshold Crossing Alert (TCA) Parameters Provisioning Job Aid (Releases 4, and Higher)*
Audience: End user maintenance personnel
Content: List of provisionable TCA parameters, original values, and the corresponding inputs for the FT-2000 OC-48 Add/Drop-Rings Terminal

- Number: 365-575-124
Title: *FT-2000 Cross-Connections Job Aid (Releases 8.1 and Later)*
Audience: End user maintenance personnel
Content: Considerations pertaining to Cross-Connect design and a blank "Work-Sheet for use when designing Cross-Connections"
- Number: 365-575-500
Title: *Digital Transmission System FT Lightwave Booster Amplifier Description Engineering and Maintenance Manual (Issue 2)*
Audience: Customers planning to install and turn up the equipment.
- Number: 824-102-144
Title: *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*
Audience: System planners and engineers
Content: Operations Interworking information for Lucent's 2000 Product Family systems, including DDM-2000 OC-3 R13.0, DDM-2000 OC-12 R7.0, FiberReach R3.0, and FT-2000 OC-48 R8.1 and later, as well as Lucent's 3000 Product Family systems, including *WaveStar* BandWidth Manager R2.0, *WaveStar* 2.5G R3.0, and *WaveStar* 10G R1.0 in Multi-Vendor subnetworks.
- Number: 824-102-147
Title: *Lucent Technologies 2000 Product Family Operations Interworking Guide*
Audience: Engineers responsible for system planning, using, or maintaining networks containing a mixture of 2000 Product Family products
Content: Information on using operations interworking capabilities in the 2000 Product Family
- Number: 824-102-151
Title: *DDM-2000 Multiplexers Operations Systems Engineering Guide*
Audience: Engineers
Content: Operations systems engineering information for the DDM-2000 Multiplexers
- Number: 824-102-148
Title: *FT-2000 OC-48 Lightwave System Operations Systems Engineering Guide*
Audience: Engineers
Content: Operations systems engineering information for the FT-2000 OC-48 Lightwave System

■ Number: MIP0030-MV

Title: *Modification Implementation Procedure 0030-MV, FT-2000 End Terminal to 2-Fiber Add/Drop-Rings Terminal Out-of-Service Upgrade*

Audience: RTAC, Installers, Engineers, Planners

Content: Procedures for upgrading out-of-service FT-2000 OC-48 1x1 End Terminals to FT-2000 OC-48 Add/Drop-Rings Terminals for 2-Fiber Rings

■ Number: MIP0036-MV

Title: *Modification Implementation Procedure 0036-MV, FT-2000 End Terminal to 2-Fiber Add/Drop-Rings Terminal In-Service Upgrade*

Audience: RTAC, Installers, Engineers, Planners

Content: Procedures for transferring service off an in-service FT-2000 OC-48 1x1 End Terminal in preparation for the MIP0030-MV out-of-service upgrade to be performed

■ Number: MIP0046-MV

Title: *Modification Implementation Procedure 0046-MV, FT-2000 Add/Drop Ring Terminal DCC Cable Upgrade.*

Audience: RTAC, Installers, Engineers, Planners

Content: Convert an in-service FT-2000 OC-48 ADR Terminal J68974, L3 or equivalent to an ADR Terminal with OC-3 Data Communications Channel (DCC) capability, J68974, L5 or equivalent

Lucent Technologies Drawings

The following Lucent Technologies drawings provide information about the FT-2000 OC-48 Lightwave System:

J68974AK-1	<i>FT-2000 OC-48 Lightwave Terminating Bay (Circuit Packs, Miscellaneous Hardware, and Spare Parts Shipped Separately from Equipment)</i>
J68974D-1	<i>FT-2000 OC-48 Dual Lightwave Terminating Bay(Equipment and Circuit Packs Ordered with Equipment)</i>
J68974E-1	<i>FT-2000 OC-48 Enhanced Lightwave Terminating Bay(Equipment and Circuit Packs Ordered with Equipment)</i>
J68974EK-1	<i>FT-2000 OC-48 Enhanced Lightwave Terminating Bay (Circuit Packs, Miscellaneous Hardware, and Spare Parts Shipped Separately from Equipment)</i>

J68974ES-1	<i>FT-2000 OC-48 Enhanced Lightwave Terminating Bay (Software and Documentation)</i>
J68974R-1	<i>FT-2000 OC-48 Lightwave Repeater Bay (Equipment and Circuit Packs Ordered with Equipment)</i>
J68974RK-1	<i>FT-2000 OC-48 Lightwave Repeater Bay (Circuit Packs, Miscellaneous Hardware, and Spare Parts Shipped Separately from Equipment)</i>
J68974RS-1	<i>FT-2000 OC-48 Lightwave Repeater Bay (Software and Documentation)</i>
SD-5G250-01	<i>FT-2000 OC-48 Lightwave Terminating Bay Application Schematic</i>
SD-5G250-02	<i>FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic</i>
SD-5G250-03	<i>FT-2000 OC-48 Dual Lightwave Terminating Bay Application Schematic</i>
SD-5G252-01	<i>FT-2000 OC-48 Lightwave Repeater Bay Application Schematic</i>
T-5G250-31	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Terminating Bay Interconnect Circuit</i>
T-5G250-33	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay Interconnect Circuit</i>
T-5G252-31	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Repeater Bay Interconnect Circuit</i>
ED-6G994-30	<i>User/Filter Panel</i>
ED-6G995-30	<i>High Speed Shelf Assembly</i>
ED-6G995-31	<i>Enhanced High Speed Shelf Assembly</i>
ED-6G999-30	<i>Low Speed Shelf Assembly</i>
ED-6G999-31	<i>Low Speed Shelf Assembly</i>
ED-7G000-30	<i>Repeater Shelf Assembly</i>
ED-7G001-10	<i>Method of Cabling for ED-7G001-30 OC-48 Lightwave Terminating Bay</i>
ED-7G001-11	<i>Method of Cabling for ED-7G001-31 OC-48 Enhanced Lightwave Terminating Bay</i>
ED-7G001-20	<i>Cable Assemblies for ED-7G001-30 OC-48 Lightwave Terminating Bay</i>

ED-7G001-24	<i>Cable Assemblies for ED-7G001-31 OC-48 Enhanced Lightwave Terminating Bay</i>
ED-7G001-21	<i>FT-2000 OC-48 Coaxial Cable Assemblies for All EC-1/DS3 Applications (Intraoffice Transmission Cables)</i>
ED-7G001-22	<i>FT-2000 OC-48 Interbay Cable Assemblies (Intraoffice Non-Transmission Cables)</i>
ED-7G001-30	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Terminating Bay Framework</i>
ED-7G001-31	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay Framework</i>
ED-7G002-10	<i>Method of Cabling for ED-7G002-30 OC-48 Lightwave Repeater Bay</i>
ED-7G002-30	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Repeater Bay Framework</i>
ED-8C500-50	<i>Network Bay Frame</i>
ED-8C800-50	<i>Seismic Network Bay Frame</i>
FPD 804-911-168-1	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Terminating Bay (with 2 Active Shelves)</i>
FPD 804-911-168-2	<i>FT-2000 Lightwave Transmission System OC-48 Lightwave Terminating Bay (with 3 Active Shelves)</i>
FPD 804-911-168-3	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay with 2 Active Shelves on Nonseismic Framework</i>
FPD 804-911-168-4	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay with 3 Active Shelves on Nonseismic Framework</i>
FPD 804-911-168-5	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay with 2 Active Shelves on Seismic Framework</i>
FPD 804-911-168-6	<i>FT-2000 Lightwave Transmission System OC-48 Enhanced Lightwave Terminating Bay with 3 Active Shelves on Seismic Framework</i>
FPD 804-911-168-10	<i>FT-2000 Lightwave Transmission System OC-48 Repeater Bay with 1 Active Shelf on Nonseismic Framework</i>
FPD 804-911-168-11	<i>FT-2000 Lightwave Transmission System OC-48 Repeater Bay with 2 Active Shelves on Nonseismic Framework</i>

- FPD 804-911-168-12 *FT-2000 Lightwave Transmission System OC-48 Repeater Bay OC-48 Repeater Bay with 3 Active Shelves on Nonseismic Framework*
- FPD 804-911-168-13 *FT-2000 Lightwave Transmission System OC-48 Repeater Shelf Miscellaneously Mounted*
- FPD 804-911-168-14 *FT-2000 Lightwave Transmission System OC-48 Repeater Bay with 1 Active Shelf on Seismic Framework*
- FPD 804-911-168-15 *FT-2000 Lightwave Transmission System OC-48 Repeater Bay with 2 Active Shelves on Seismic Framework*
- FPD 804-911-168-16 *FT-2000 Lightwave Transmission System OC-48 Repeater Bay with 3 Active Shelves on Seismic Framework.*

Lucent Technologies Practices for Related Equipment

The following Lucent Technologies practices provide information about related equipment:

065-215-200	<i>Seismic Network Bay Frame Application, Planning, and Ordering Guide</i>
065-215-250	<i>Seismic Network Bay Frame Installation Guide</i>
190-523-101	<i>Guide to Using CPro-2000</i>
365-331-000	<i>DACS III-2000 Release 2.0 Applications, Planning, and Ordering Guide</i>
365-340-004	<i>DACS IV-2000 Release 2.1 Reference Manual</i>
363-206-200	<i>DDM-2000 OC-3 and OC-12 Multiplexers, Applications, Planning, and Ordering Guide</i>
363-206-285	<i>DDM-2000 OC-3 Multiplexer, User/Service Manual, TARP Release 13.0 and later</i>
363-206-295	<i>DDM-2000 OC-12 Multiplexer, User/Service Manual, Release 7.0 TARP</i>
365-301-130	<i>System III DSX-3/4, Planning, Engineering, Installation, and Operation System Reference Guide</i>
365-303-102	<i>DSX-3 Cross-Connect Bay, Description, Operation, and Maintenance Manual</i>
636-299-120	LGX[®] <i>Distribution System, Planning, Engineering, Installation, and Operation System Reference Guide</i>

365-565-500	<i>Digital Transmission Systems, FT-Lightwave Booster Amplifier, Description, Engineering, Installation, and Maintenance Manual.</i>
365-370-100	<i>WaveStar BandWidth Manager Applications, Planning, and Ordering Guide, R2.0</i>
365-370-102	<i>WaveStar BandWidth Manager User/Service Manual, R2.0</i>
365-370-100	<i>WaveStar BandWidth Manager Installation Manual, R2.0</i>
365-371-100	<i>WaveStar TDM 2.5G Applications, Planning, and Ordering Guide, R3.0</i>
365-371-102	<i>WaveStar TDM 2.5G User/Service Manual, R3.0</i>
365-371-106	<i>WaveStar TDM 2.5G Installation Manual, R3.0</i>
365-371-301	<i>WaveStar TDM 10G Applications, Planning, and Ordering Guide, R1.0</i>
365-373-102	<i>WaveStar TDM 10G User/Service Manual, R1.0</i>
	<i>WaveStar TDM 10G Installation Manual, R1.0</i>

Training

No product offering is complete without a formal training package. The National Product Training Center at Dublin, Ohio, provides management courses for system planning, engineering, and ordering, as well as training telecommunications technicians in installation, operations, and maintenance. Suitcasing of these courses is also available. Contact the National Product Training Center on **1-800-TRA-INER (1-800-872-4637)** to enroll in training classes. To arrange suitcase sessions, call the Product Training Manager on **1-614-764-5542**.

The following courses are provided by the National Product Training Center:

- Number: LW2248

Title: *FT-2000 OC-48 Lightwave System Applications and Architecture*

Audience: Fundamental planners, account executives, and private telecommunications network technical consultants

Content: Basic synchronous optical network (SONET) terms, applications (for example, point-to-point, add/drop, rings), architecture (that is, bays, shelves, circuit packs), and operation, administration, maintenance, and provisioning (OAM&P) features

■ Number: LW2348

Title: *FT-2000 OC-48 Lightwave System Equipment Engineering and Planning*

Audience: Facility planners, outside plant engineers, central office equipment engineers, and private network design engineers

Content: Equipment and cabling specifications for engineering and ordering the FT-2000 OC-48 Lightwave System

■ Number: LW2616

Title: *FT-2000 OC-48 Add/Drop-Rings Terminal Operations and Maintenance*

Audience: Technicians, installers, maintenance engineers, technical support personnel, product evaluators, and anyone desiring operations and maintenance information for the FT-2000 OC-48 Add/Drop-Rings Terminal

Content: Description of initial turnup and day-to-day operations and maintenance tasks. Emphasis on developing:

- Skills using the installation manual and the user/service manual
- Competence performing turnup and day-to-day provisioning and maintenance tasks

Technical Support

The Regional Technical Assistance Center (RTAC) and the Customer Technical Support (CTS) organization provide help in maintaining installed systems. Figure 4 shows the single point of contact is the RTAC. RTAC personnel troubleshoot field problems 24 hours a day over the phone and, if necessary, on site. For technical help, notify your supervisor, your local technical support organization, or call **1-800-225-RTAC** in accordance with local procedures. The RTAC technical assistance telephone number is also available for customers to provide feedback and enhancement suggestions for improving the FT-2000 OC-48 Lightwave System. One call guarantees support.

RTAC organizations are supported by a centralized CTS organization for transmission products. The CTS organization maintains a close relationship with Bell Laboratories and other Lucent Technologies organizations to expedite resolutions and maintain contact with the development community. This association provides continuous accessibility to every phase of a product life cycle and assures a prompt resolution to all inquiries.

CTS has converted COACH to a new system — Global Technical Support Information Platform (GTSIP). This system is used to support all Lucent products worldwide. The customer interface is web based and requires a standard web browser such as *Netscape*™* or *Microsoft*®† Internet Explorer.

I

GTSIP is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. GTSIP tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. GTSIP tools reside on a dedicated time-share computer accessible over toll free lines and are available 24 hours a day, 7 days a week.

Many transmission products are currently supported by GTSIP, including the FT-2000 OC-48 Lightwave System.

Once connected to GTSIP, the user specifies which product to access and GTSIP grants the appropriate combination of tools and commands. The user reaches each one of these tools and commands through a centralized, menu-driven computer program. Every screen provides help in making appropriate menu selections. GTSIP users achieve proficiency quickly because of the consistency of menu selections among products.

* *Netscape* is a trademark of Netscape Communications Corporation

† *Microsoft* is a registered trademark of Microsoft Corporation

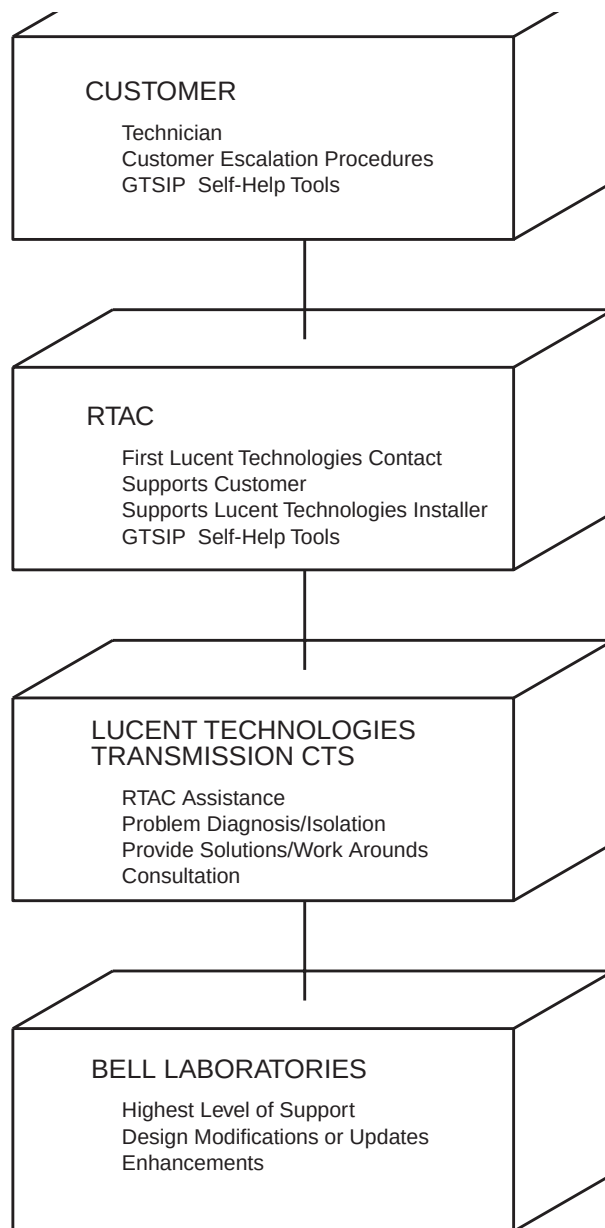


Figure 4. Product Support

These GTSIP tools are available to the user:

Diagnostic dictionary	The diagnostic dictionary contains histories of previously encountered problems and the descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem.
News and bulletins	Immediately after a user logs into the GTSIP tools, the news and bulletins tool displays bulletins containing urgent information relating to all the user's products. All users are automatically notified about urgent matters such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.
Compatibility data	Occasionally, hardware/software configuration problems arise when new software releases are issued. The compatibility data tools permit users to view the correct hardware configuration associated with a specific software release. The user simply enters the appropriate software release number and GTSIP responds with page-formatted lists of circuit packs compatible with the selected software release. This tool also contains the latest issue numbers of the customer documentation.
GTSIP user's guide	GTSIP supplies an on-line version of its user's guide. The GTSIP user's guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

For information about how to access GTSIP, visit the GTSIP website at <http://www.gtsip.com>, or contact your Product Administrator. The following is more contact information:

GTSIP Software Development
Department NB0031200
Lucent Technologies
1600 Osgood St.
North Andover, MA 01845
Telephone: **1-800-238-4021**
FAX: **1-978-960-1772**

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Contents

System Introduction

1

Overview

This section introduces the Lucent Technologies 2000 Product Family and briefly describes the FT-2000 OC-48 Lightwave System.

Introduction to the Lucent Technologies 2000 Product Family

Lucent Technologies offers the industry's widest range of high-quality transmission systems and related services designed to provide total network solutions. The Lucent Technologies 2000 Product Family is designed to help telecommunications service providers enter a new century of advanced services and revenue-generating capabilities. The 2000 Product Family complies with the synchronous optical network (SONET) Standard and builds on items that customers require to build an efficient and successful network. These items include bidirectional line-switched ring features and in-service upgrade capabilities. Bidirectional line-switched ring features almost instantaneously restore a network if a fiber cut occurs. In-service upgrade capabilities allow a graceful evolution from today's asynchronous networks to the world-class intelligent networks of the future. The 2000 Product Family provides broadband services, a high degree of reliability, and full compatibility with industry standards.

The FT-2000 OC-48 Lightwave System is the high capacity optical carrier level 48 (OC-48) lightwave system in the 2000 Product Family. The 2000 Product Family also includes the DDM-2000 Multiplexers, the DACS III-2000 Cross-Connect System, the DACS IV-2000 Cross-Connect System, ITM XM, CPro-2000, ITM SNC-2000, the SLC®-2000 Access System, and the BRT-2000 Access System.

The 2000 Product Family, along with the 5ESS®-2000 switch, provides the significant elements of the Lucent Technologies Service Net-2000 Architecture.

Service Net-2000 Architecture furnishes increased network capabilities with standard interfaces, increased bandwidth for end-customer services, faster provisioning, and more robust networks.

What Is the FT-2000 OC-48 Lightwave System?

The FT-2000 OC-48 Lightwave System is a flexible, high capacity lightwave system that transports digitally encoded information through single-mode optical fibers at the SONET OC-48 signal level of 2.5 Gb/s (up to 32,256 voice channels). The FT-2000 OC-48 Lightwave System consists of several platforms. A platform is a family of equipment and software configurations designed to support a particular set of applications. These platforms include the:

- FT-2000 OC-48 Dual Lightwave Terminating Bay
- FT-2000 OC-48 Add/Drop-Rings Terminal
- FT-2000 OC-48 Repeater Bay.



NOTE:

The FT-2000 Add/Drop-Rings Terminal has been rated discontinued availability (DA) as of December 31, 1999. Information regarding the ADR Terminal will remain in this user/service manual for those terminals still in use.

The different platforms enable the FT-2000 OC-48 Lightwave System to offer flexible features for different applications in high capacity loop, interoffice, outstate, and long-haul environments, and to provide different sets of features. The FT-2000 OC-48 Lightwave System software enables the platforms to be upgraded with new features when they become available. Figure 1-1 shows one equipment package of the FT-2000 OC-48 Add/Drop-Rings Terminal platform. For more information about the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay platforms, refer to Section 3, "Platform Descriptions."

The FT-2000 OC-48 Lightwave System transports up to 48 DS3 equivalent signals over the OC-48 line. It supports a mix of DS3, electrical carrier level 1 (EC-1), OC-3, IS-3, and OC-12 low-speed interfaces. The OC-3, IS-3, and OC-12 low-speed interfaces support optical extensions. The electrical DS3 and EC-1 low-speed interfaces are 1xM (M≤16) protected. The OC-3, IS-3, and OC-12 interfaces may be provisioned for either 0x1 protection or 1+1 protection.



NOTE:

The IS-3 interface is only used for intraoffice applications.

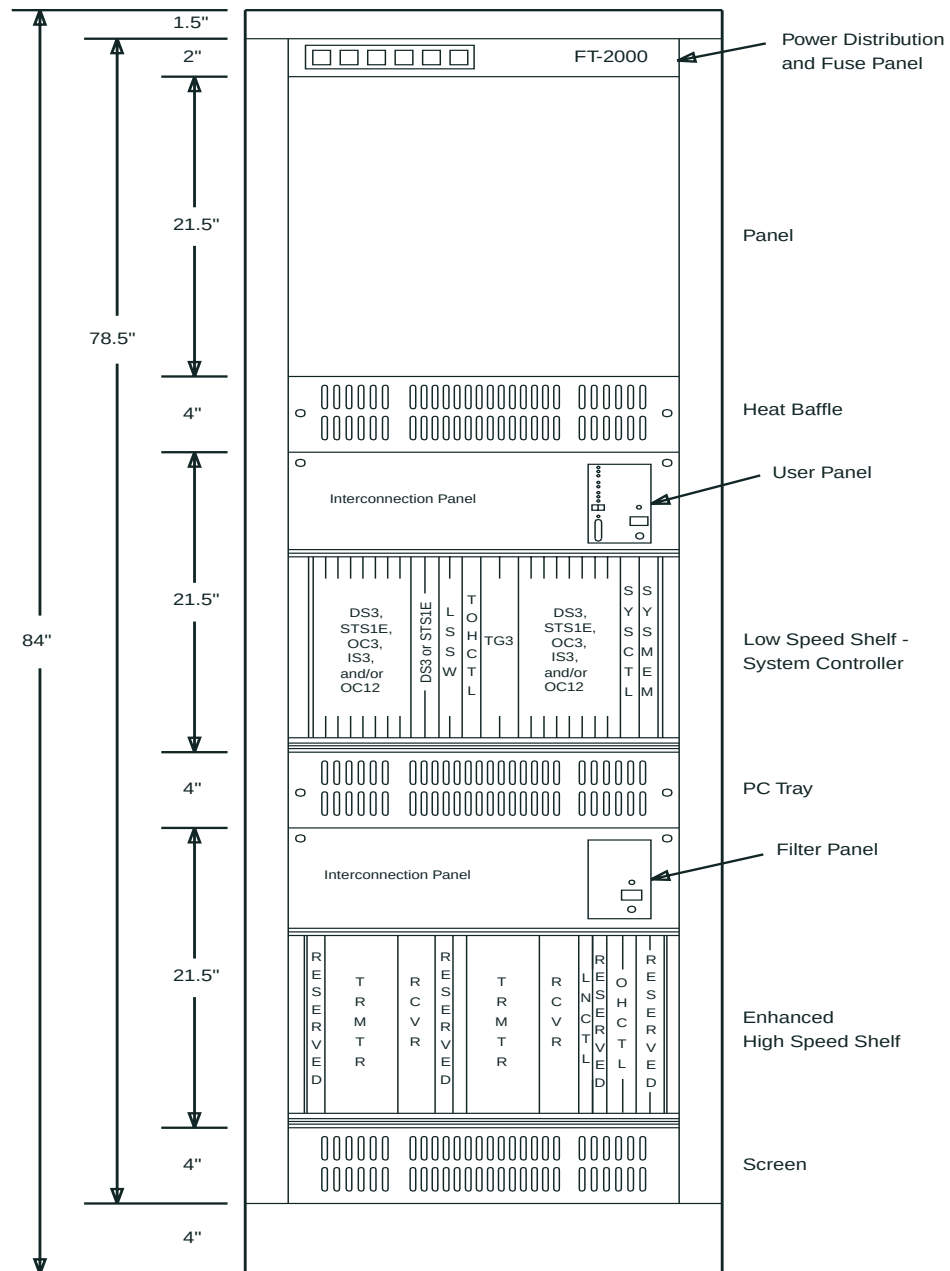


Figure 1-1. FT-2000 OC-48 Add/Drop-Rings Terminal for Two-Fiber Rings

The FT-2000 OC-48 Lightwave System also offers flexible OC-48 high-speed interfaces. Standard performance and high performance 1.3 μm OC-48 high-speed interfaces support spans of at least 53 and 60 kilometers, respectively. The 1.5 μm OC-48 high-speed interface* supports spans of at least 92 kilometers. The lightwave booster amplifier (LBA) standard performance 1.5 μm OC-48 high-speed interface* supports spans up to 140 km using standard fiber and spans up to 160 km using dispersion-shifted fiber. For information about OC-48 high-speed protection, refer to Section 9, "Maintenance Description." *

The FT-2000 OC-48 Lightwave System is designed for easy installation and operation. Centralized operation is supported by a full set of remote maintenance and control features. Automatic turnup tests and original value provisioning simplify installation and eliminate the need for external test equipment. Most tasks can be performed using the user panel and circuit pack faceplate light-emitting diodes (LEDs), displays, and controls. The personal computer-based craft interface terminal gives access to sophisticated maintenance and reporting features.

The FT-2000 OC-48 Lightwave System will be made available in a series of phased product releases. These phased product releases will provide new sets of features. This user/service manual covers Release 9.1 and will be updated to cover additional releases as they become available. As a review, Release 1 provides the FT-2000 OC-48 1x1 End Terminal platform and a basic OC-48 point-to-point system. Release 2 updates the FT-2000 OC-48 1x1 End Terminal platform and provides the FT-2000 OC-48 Repeater Bay platform. Release 3 provides the FT-2000 OC-48 Add/Drop-Rings Terminal platform and two-fiber bidirectional, line-switched rings. Release 4.0 updates the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay platforms. Release 4.1 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with enhanced TL1 commands/reports, password aging, and one-way cross-connections. It also provides dual-ring interworking and gateway network element operation. Release 5 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with OC-3 low-speed interfaces, F and M bit adjusted DS3 performance monitoring, more TL1 commands/reports, login aging, circuit provisioning audits, and multiple bridge cross-connections. Release 6 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with new operations interworking capabilities available through the OC-3 data communications channel (DCC).

* The standard performance 1.5 μm OC-48 high-speed interfaces are only available with the FT-2000 OC-48 Add/Drop-Rings Terminal.

Release 7.1.0 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with the following features:



NOTE:

Release 7.1.0 was discontinued availability (DA) in April, 1998.

- OC-12 optical low-speed interface
- IS-3 optical low-speed interface for use in intraoffice networks
- OC-3/OC-12 port states
- Synchronization messaging
- Enhanced TL1 commands for:
 - Remote provisioning
 - Remote backup and restore
- STS-3 Non-Preemptible Protection Access (NPPA) (B5 Optics Only)
- DRI Enhancements
 - Revertive DRI
 - Switching on AIS-P

I

Release 7.2.7 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with the following new features:

- New Low Speed Shelf/User Panel/Interconnection Panel
- Dense Wavelength Division Multiplexing (DWDM)—OLS-compatible transmitters (739E1-739E8) and (739G1-G8)
- STS-1 Non-Preemptible Protection Access (NPPA) with all optics
- STS-3 Non-Preemptible Protection Access (NPPA) with all optics
- Operations Interworking (OI) via the DCC channel for OC-12 1+1 protected links
- Synchronization messaging: line timing and auto reconfiguration
- Deny enhancements for Delete command
- Switch on Signal Degrade and Adaptive Alarming for DRI.

Release 8.1 provides the following major software enhancements (features):



NOTE:

Most of the features listed below were originally enhancements for Release 8.0. As of April, 1998, Release 8.0 has been discontinued availability (DA). Those enhancements made specifically for Release 8.0 are listed here under Release 8.1.



NOTE:

Release 8.1 has been rated discontinued availability (DA) as of June 30, 1999.

- Multi-Vendor Operations Interworking (OI)
 - FT-2000 is compatible with any other-vendor NE that supports Target ID Address Resolution (TARP) protocol, OSI on the DCC, and TL1/X.25 as specified in Bellcore GR-253. Compatible with Tellabs *TITAN*^{*} 5500/S Release 5.0 Digital Cross-Connect System, including TL1/X.25 OS access with *TITAN* 5500/S Digital Cross-Connect System serving as the TL1/X.25 GNE.
- Lucent 2000 Product Family OI compatibility
 - Compatible with DDM-2000 OC-3 R13.0, OC-12 R7.0, and FiberReach R3.0 (but not with earlier releases due to Multi-Vendor OI support).
 - FT-2000 TL1/X.25 GNE support of up to 105 (up from 64 previously) TL1 logins to remote NEs.
 - DDM-2000 OC-3 R13.0 and OC-12 R7.0 can serve as the TL1/X.25 GNE for FT-2000 R8.1 remote NEs.
- Large Subnetworks
 - Supports sizes of up to 256 NEs by partitioning into multiple areas connected via Level 2 Intermediate Systems (ISs).
- ITM SNC Release 5.0 enhancements
 - ITM SNC supports enhanced database backup and restore of FT-2000
 - ITM SNC software download to FT-2000 (this feature will be useful when upgrading “*FROM*” FT-2000 R9.0 “*TO*” later releases)
 - ITM SNC as the TL1-GNE for FT-2000
- DRI Feature enhancements
 - DRI Switch on Path Unequipped

* TITAN is a registered trademark of Tellabs, Inc.

- DRI on Protection

- Red Line Services

Release 9.0 updates the FT-2000 OC-48 Add/Drop-Rings Terminal platform with the following enhancements (features):

- Software Release 9.0

- DRI Enhancement — STS Path Payload Defect Indicator (PDI-P) on OC-3, OC-12 and EC-1 interfaces.
- Performance Monitoring Enhancement — Pointer Justification Counts (PJC) on OC-3, OC-12 and EC-1 interfaces.
- *TIRKS®* Compatible STS-1 Numbering
- Equipage Dependent Reports

- New LAA10B OC-3 Low-Speed Interface Circuit Pack (backward compatible with LAA10)

With Software Release 9.0 upgrade and LAA10B circuit pack installed, the following features are available:

- STS-1 Granularity Enhancement — Full E/W directionality on OC-3 interface
- Synchronization Messaging Enhancement — Synchronization messaging on S1 Byte on OC-3 interface.

- CIT Enhancement — Support of *Windows 95* and *Windows NT*



NOTE:

Release 9.0 is a TARP release and is operations interworking (OI) compatible with Release 8.1, but is not OI compatible with Releases 7.2 and earlier.

Table 1-1 also shows the major features of the FT-2000 OC-48 Lightwave System and the corresponding product releases.



NOTE:

In order to accurately convey the differences, Release 7.2, 8.1, and 9.0 are also included in Table 1-1.

Release 9.1 (Add/Drop-Rings platform) includes the following features:

- Operations Interworking Enhancement — Bidirectional Line Switched Ring Interworking with *Wavestar*™ Bandwidth Manager Release 2.0, WaveStar 2.5G Release 3.0, and WaveStar 10G Release 1.0.
- DRI Enhancement — DRI switching on LOP-P.
- Operations Interworking Enhancement — TL1-GNE for Wavestar 2.5G, 10G, and Tellabs *TITAN*
- CIT Enhancement — Support of *Windows* 98.

There are also 16 new OC-48 TRMTR (STS-1 OC-12c 1.5 STD) circuit packs (739H1-16) that are described in this manual but were not issued as part of Release 9.1. These circuit packs are for non-OLS compatible, passive DWDM systems. For more information on the 739H1-16 circuit packs, see Chapter 2 (“Features”), Chapter 3 (“Applications”), and Chapter 4 (“Product Description”).

Release 9.1 is a TARP release and is Operations Interworking (OI) compatible with Release 8.1 and Release 9.0, but is not OI compatible with Releases 7.2 and earlier.

Table 1-1. Major Features of Product Releases 7.2 Through 9.1

Major Features Applications	Available in Product Release:			
	7.2	8.1	9.0	9.1
- 2-Fiber Rings	X	X	X	X
- 2-Fiber Rings with Repeaters	X	X	X	X
- Dual Ring Interworking (DRI)	X	X	X	X
- TL1/X.25-GNE	X	X	X	X
- TID Address Resolution Protocol (TARP)		X	X	X
- Lucent Directory Services (LDS)	X			
- Operation with the FT-Lightwave Booster Amplifier	X	X	X	X
- Path-in-Line Architecture	X	X	X	X
- Lucent Operations Interworking	X			
- Multi-Vendor Operations Interworking		X	X	X
High-Speed Transmission Interfaces				
- 1.3 μ m Standard Performance	X	X	X	X
- 1.3 μ m High Performance	X	X	X	X
- 1.5 μ m Standard Performance	X	X	X	X
- Wavelength Division Multiplexing and Lightwave Booster Amplifier Compatible Transmitters/Regenerators	X	X	X	X
- Dense Wavelength Division Multiplexing (DWDM)—OLS-compatible (739E1-739E8)	X	X	X	X
- Dense Wavelength Division Multiplexing (DWDM)—OLS-compatible (739G1-739G8)	X	X	X	X

Table 1-1. Major Features of Product Releases 7.2 Through 9.1 (Contd)

Major Features Applications	Available in Product Release:			
	7.2	8.1	9.0	9.1
- Dense Wavelength Division Multiplexing (DWDM)—non-OLS-compatible (739H1-739H16)	X	X	X	X
- Universal Optical Connectors (ST [®] , FC/PC, and SC Connectors)	X	X	X	X
- Transmitters and Receivers Compatible with STS-1 Cross-Connections	X	X	X	X
Low-Speed Transmission Interfaces				
- DS3	X	X	X	X
- EC-1/STS-1E	X	X	X	X
- OC-3	X	X	X	X
- IS-3	X	X	X	X
- OC-12	X	X	X	X
Administration and Provisioning				
- One-Way STS-3 Cross-Connections	X	X	X	X
- Two-Way STS-3 Cross-Connections	X	X	X	X
- DRI on Protection		X	X	X
- STS Path Payload Defect Indicator			X	X
- Red Line Services		X	X	X
- Equipage Dependent Reports			X	X
- <i>TIRKS</i> Compatible STS-1Numbering			X	X
- Switch on Path Unequipped for DRI Services		X	X	X
- Revertive DRI Protection Switching on STS (low speed) Links	X	X	X	X
- STS-1 Cross-Connections Across an OC-48 Signal	X	X	X	X
- STS-3 Non-Preemptible Protection Access (NPPA)	X	X	X	X
- STS-1 Non-Preemptible Protection Access (NPPA)	X	X	X	X
- STS-1 Granularity Time Slot Assignment Across an OC-48 with Full East/West Directionality			X	X
- Security	X	X	X	X
- Remote Software Downloads	X	X	X	X
Subnetwork Size				
- 50 NEs (Single Level 1 area only)	X			
- 256 NEs (Multiple areas with Level 2 ISs)		X	X	X
Maintenance				
- Performance Monitoring for Incoming Low Speed Signals	X	X	X	X
- F and M Bit, Adjusted DS3 Performance Monitoring	X	X	X	X
- Threshold Crossing Alert Reporting	X	X	X	X
- TL1 Commands and Reports	X	X	X	X
- ASCII-Based Terminal Interface	X	X	X	X

Table 1-1. Major Features of Product Releases 7.2 Through 9.1 (Contd)

Major Features Applications	Available in Product Release:			
	7.2	8.1	9.0	9.1
- Circuit Provisioning Audits	X	X	X	X
- OI via the DCC for OC-3 0x1 and 1+1 links	X	X	X	X
- OI via the DCC for OC-12 0x1 and 1+1 links	X	X	X	X
- Orderwire at Repeaters	X	X	X	X
- Remote Alarms (NE-to-NE Status) reporting	X			
- Synchronization Messaging	X	X	X	X
- Line Timed Mode Synchronization With Auto Reconfiguration	X	X	X	X
- Switch on Line Signal Degrade for DRI	X	X	X	X
- BLSR Interworking with <i>WaveStar</i> BWM, 2.5G and 10G				X

For more information about the FT-2000 OC-48 Lightwave System releases and their availability, refer to 365-575-100, *FT-2000 OC-48 Lightwave System, Applications, Planning, and Ordering Guide*.

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Overview

The FT-2000 OC-48 Lightwave System (Release 9.1) satisfies a wide range of applications with maximum economy and efficiency. These applications include OC-48 point-to-point, two-fiber bidirectional line-switched rings, hubbing, DRI, dual-wire center architecture, broadband service transport, and loop feeder network applications. This section describes how the FT-2000 OC-48 Lightwave System meets these diverse needs with the following platforms:

- FT-2000 OC-48 Dual Lightwave Terminating Bay
- FT-2000 OC-48 Add/Drop-Rings Terminal
- FT-2000 OC-48 Repeater Bay.

**NOTE:**

The FT-2000 OC-48 Add/Drop-Rings Terminal has been rated discontinued availability as of December 31, 1999. Information regarding the ADR Terminal will remain in this user/service manual for those ADR Terminals still in use. The FT-2000 OC-48 Dual Lightwave Terminating Bay functions similarly to the ADR Terminal.

For more information about the FT-2000 OC-48 Lightwave System platforms, refer to Section 3, "Platform Descriptions."

The FT-2000 OC-48 Lightwave System provides cost-effective DS3 transport in interoffice suburban and outstate trunk routes. Up to 48 DS3 equivalent signals (32,256 voice channels) may be transported over an OC-48 line at 2.5 Gb/s.

To accommodate loop and interoffice routes, the standard performance and high performance 1.3 μ m OC-48 high-speed interfaces support spans of at least 53

and 60 kilometers, respectively. The standard performance 1.5 μm OC-48 high-speed interface supports spans of at least 92 kilometers. The lightwave booster amplifier (LBA) standard performance 1.5 μm OC-48 high-speed interface supports spans up to 140 kilometers (km) using standard fiber and spans up to 160 km using dispersion-shifted fiber. For more information about transmission distances, refer to Section 10, "Technical Specifications."

The FT-2000 OC-48 Add/Drop-Rings Terminal typically interfaces to digital multiplexers, such as the DDM-2000 Multiplexers, to digital access and cross-connect systems such as DACS III-2000, DACS IV-2000, or Tellabs *TITAN* 5500/S, a digital switch, or other facilities.

Network Configurations

This section describes many of the network configurations in which the FT-2000 OC-48 ADR Terminals can be used. In addition to the configurations specifically described, many other combinations of these network configurations can be used to meet specific application/customer needs.

OC-48 Point-to-Point

The FT-2000 OC-48 Lightwave System can be configured to provide an OC-48 point-to-point application. The OC-48 point-to-point application consists of two FT-2000 OC-48 Add/Drop-Rings Terminals (Figure 2-1). Both FT-2000 OC-48 Add/Drop-Rings Terminals must be equipped with the same software release. Figure 2-1 shows an OC-48 point-to-point application using two FT-2000 OC-48 Add/Drop-Rings Terminals with two diversely routed OC-48 high-speed lines.

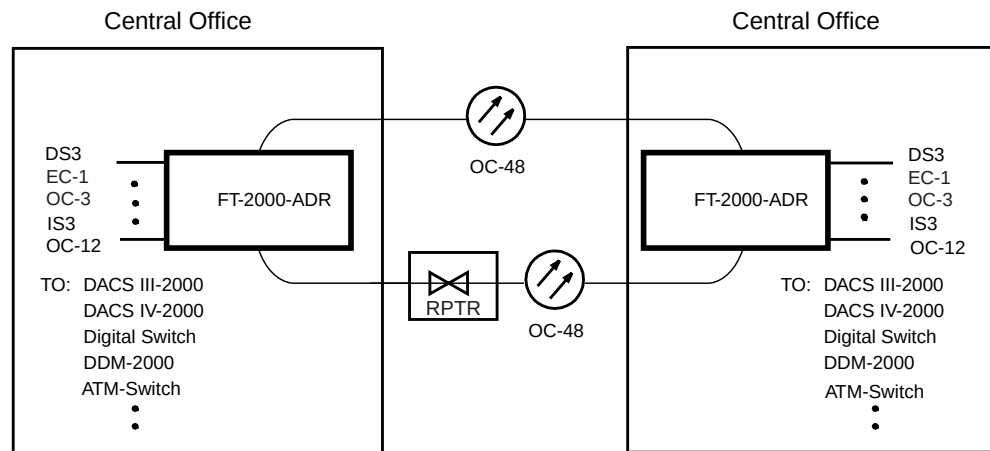


Figure 2-1. OC-48 Point-to-Point Application (with FT-2000 OC-48 Add/Drop-Rings Terminals)

The FT-2000 OC-48 Repeater Bay equipped with Release 4.1.0-RPTR or 6.0.0-RPTR software is available to increase the distance between two FT-2000 OC-48 Add/Drop-Rings Terminals. Up to 30 repeater sites may be used in a single span.

The FT-2000 OC-48 Add/Drop-Rings Terminal is equipped with two OC-48 high-speed lines (1E and 1W). Each OC-48 high-speed line consists of a pair of single-mode fibers (one transmit, one receive). The FT-2000 OC-48 Add/Drop-Rings Terminal uses two-fiber ring protection switching in OC-48 point-to-point applications.

In two-fiber ring protection switching, each OC-48 high-speed line consists of 8 service 155 Mb/s STS-3 (three STS-1) tributaries and 8 protection STS-3 (three STS-1) tributaries. When a fiber cut occurs on one OC-48 high-speed line, traffic is switched from the service tributaries to the protection tributaries of the other OC-48 high-speed line. When the fault clears, the traffic is automatically switched back (reverts) to the service tributaries. For more information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

When the protection tributaries are not carrying traffic, they can also be used for low-priority traffic or for restoration purposes. For more information, refer to the "Extra Traffic for Restoration and Revenue Generation" application in this section.

The FT-2000 OC-48 Add/Drop-Rings Terminal is a flexible product that can be used for ring and non-ring applications. For example, in a non-ring application

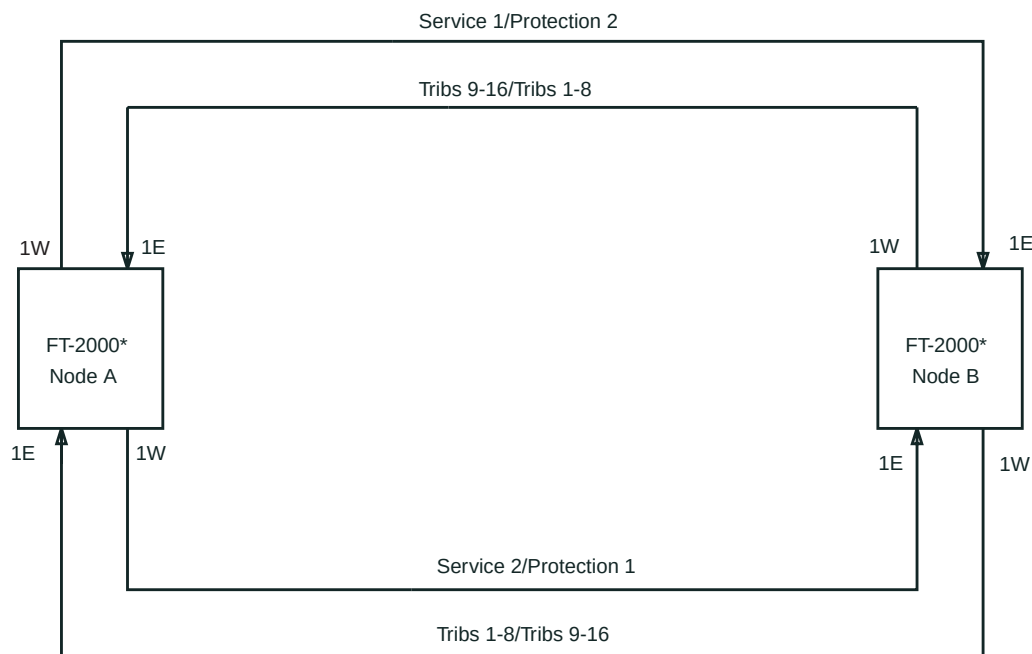
such as an OC-48 point-to-point application, the FT-2000 OC-48 Add/Drop-Rings Terminal provides the following advantages:

- One platform to install, operate, provision, maintain, and administer
- No upgrades to a ring at a later date.

Two-Fiber Bidirectional Line-Switched Rings

The FT-2000 OC-48 Add/Drop-Rings Terminal may be configured to support two-fiber bidirectional line-switched rings. Bidirectional line-switched rings provide redundant bandwidth and/or equipment to ensure system integrity in the event of any transmission or timing failure, including a fiber cut or node failure.

Figure 2-2 shows an example of a two-fiber bidirectional line-switched ring with two nodes. With Release 8.1 and later, up to 50 nodes can be supported in a Level 1 Area. This complies with T1X1 standards for bidirectional line-switched rings.



* FT-2000 OC-48 Add/Drop-Rings Terminal

Figure 2-2. Two-Fiber Bidirectional Ring Application

In a two-fiber bidirectional ring, *all* FT-2000 OC-48 Add/Drop-Rings Terminals must be equipped with the same release of software.

The FT-2000 OC-48 Repeater Bay equipped with Release 4.1.0-RPTR or 6.0.0-RPTR software is also available to increase the distance between two FT-2000 OC-48 Add/Drop-Rings Terminals.

Each node in a two-fiber bidirectional ring interfaces with two OC-48 high-speed lines (1W and 1E). Each OC-48 high-speed line consists of sixteen 155 Mb/s (STS-3) tributaries. The STS-3 tributaries 1 through 8 are service tributaries and STS-3 tributaries 9 through 16 are protection tributaries. In Figure 2-2, the Eastbound service STS-3 tributaries are identified as *Service 1*, and the Westbound service tributaries are identified as *Service 2*. The Eastbound protection STS-3 tributaries are identified as *Protection 2*, and the Westbound protection STS-3 tributaries are identified as *Protection 1*.

Under normal conditions, traffic travels over the service STS-3 tributaries of the OC-48 high-speed lines in a ring. When a fiber cut occurs, traffic is switched from the service STS-3 tributaries to the protection STS-3 tributaries using revertive line switches in ≤ 60 milliseconds. This includes detection and switching time. In Figure 2-2, the Eastbound service STS-3 tributaries (*Service 1*) are protected by the Westbound protection STS-3 tributaries (*Protection 1*). The Westbound service STS-3 tributaries (*Service 2*) are protected by the Eastbound protection STS-3 tributaries (*Protection 2*). For example, in Figure 2-2, traffic may enter Node A and be routed over the service STS-3 tributaries (*Service 1*) of OC-48 high-speed line 1E to Node B. If a fiber cut occurs, the traffic is switched to the protection STS-3 tributaries (*Protection 1*) of OC-48 high-speed line 1W to Node B. For more information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

The FT-2000 OC-48 Add/Drop-Rings Terminal offers a time slot assignment (TSA) capability that allows any service STS-3 tributary of OC-48 high-speed line 1E or 1W to be cross-connected to any service low-speed interface slot (add/drop cross-connection) or to the same-numbered service STS-3 tributary of the other OC-48 high-speed line (through cross-connection).

The FT-2000 OC-48 Add/Drop-Rings Terminal also offers a TSA capability that allows any service STS-1 tributary of OC-48 high-speed line 1E or 1W to be cross-connected to any service low-speed interface slot (add/drop cross-connection) or to the same-numbered service STS-1 tributary of the other OC-48 high-speed line (through cross-connection).

The FT-2000 OC-48 Add/Drop-Rings Terminal can also provide *extra traffic*. Extra traffic allows access to the protection STS-3 tributaries for low-priority traffic or for restoration purposes. In Release 7 and later releases, extra traffic also allows access to the protection STS-1 tributaries for low-priority traffic or for restoration purposes. Extra traffic is preempted if a two-fiber ring protection switch occurs.

Non-Preemptible Protection Access is a type of extra traffic. It increases a nodes "service traffic" capacity at the expense of reducing bandwidth on the protection fiber. It should be understood that this type of traffic is not impacted by a ring protection switch. Also, for each slot of STS-3 NPPA traffic (or STS-1 traffic) on the protection fiber there will also be a corresponding "non-protected" slot on the service fiber.



NOTE:

Cross-connections (to administer and provision extra traffic) can be made using the craft interface terminal (CIT) interface.

Cross-connections can also be made through the message-based operations system interface, using X.25 protocol and Transaction Language 1 (TL1) messages. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

BLSR Interworking with WaveStar BandWidth Manager, 2.5G, and 10G

The FT-2000 Add/Drop-Rings Terminal Release 9.1 now has the capability to interwork with WaveStar BandWidth Manager (BWM) Release 2.0, WaveStar 2.5G Release 3.0, and WaveStar 10G via the same OC-48 2-fiber bidirectional line-switched ring (BLSR). This capability provides the flexibility needed to expand existing FT-2000 rings by adding BWM, 2.5G, or 10G nodes to those rings. Transmission with all FT-2000 ADR transmitter (TRMTR) and receiver (RCVR) circuit packs is supported.

The two primary advantages of utilizing these mixed ring applications are:

- the replacement of multiple, collocated (one central office) FT-2000 ring nodes supporting many different 2-fiber bidirectional line-switched rings with a single BWM system
- additional low-speed interface access to OC-48 bandwidth. WaveStar systems support 100% add/drop capacity. FT-2000 systems support only 50% add/drop capacity.

FT-2000/WaveStar BandWidth Manager Interworking

FT-2000 ADR interworking with WaveStar BandWidth Manager Release 2.0 provides the opportunity to replace multiple FT-2000 2-fiber bidirectional line-switched ring nodes located in one central office (CO) with a single BandWidth Manager system. This capability is especially beneficial in COs where space limitation is an issue. Rather than acquiring more space in a building, replacing the

FT-2000 nodes with a single BWM provides additional access capacity at a lower cost per circuit. Also, once those FT-2000 nodes have been replaced, they can be redeployed in central offices where space is not a concern.

Currently, each FT-2000 ADR node located in a CO supports only one 2-fiber BLSR. The BWM has much greater capacity to support BLSRs. One BandWidth Manager can support as many as 192 2-fiber BLSRs, broken down as follows:

- 1 BWM shelf can support up to **4** 2-fiber BLSRs
- 1 BWM bay (2 shelves) can support up to **8** 2-fiber BLSRs
- 1 BWM (24 bays, 48 shelves) can support up to **192** 2-fiber BLSRs.

Figure 2-3 (A) shows a central office with multiple FT-2000 nodes supporting several different 2-fiber BLSRs.

Figure 2-3 (B) shows the multiple FT-2000 nodes in the central office being replaced by a single BandWidth Manager.

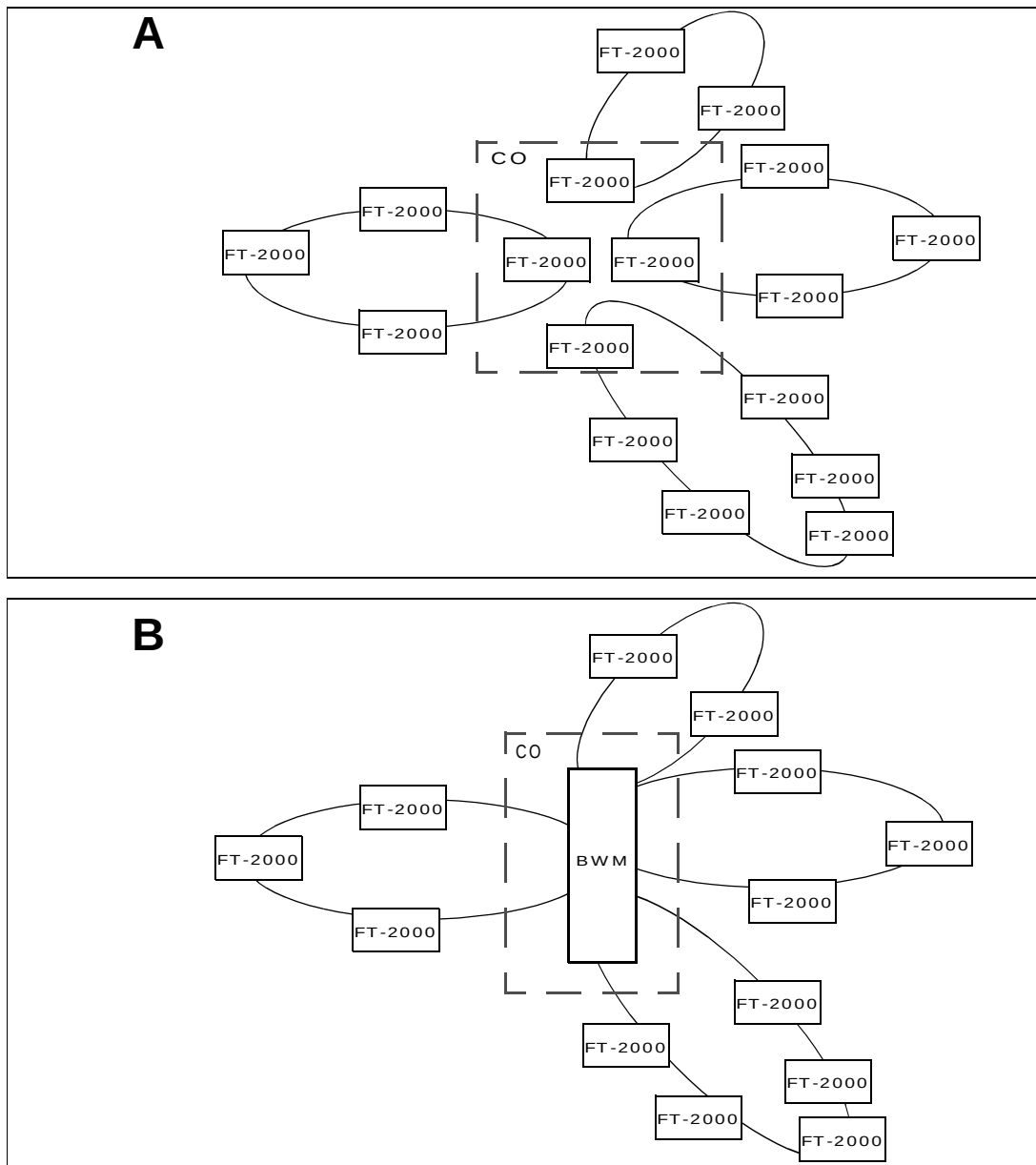


Figure 2-3. FT-2000/WaveStar BandWidth Manager BLSR Interworking

FT-2000/*WaveStar* 2.5G Interworking

FT-2000 ADR interworking with *WaveStar* 2.5G Release provides additional access to OC-48 bandwidth. When an existing FT-2000 ring node has exhausted its low-speed interface capacity, a 2.5G node can be added to the ring at the capacity exhaust location (FT-2000 node).

There are two possible 2-fiber BLSR configuration options when the FT-2000 ADR interworks with 2.5G. After adding the 2.5G node into the existing ring, the FT-2000 node can either:

- remain collocated with the 2.5G node, or
- be redeployed elsewhere in the network.

The traffic on the FT-2000 node can be moved onto the 2.5G node if redeployment of the FT-2000 node is desired. This configuration is advantageous because the 2-fiber BLSR 2.5G node can add/drop up to 96 STS-1 tributaries, while the FT-2000 node can add/drop only up to 48 STS-1 tributaries. The greater bandwidth capacity of the 2.5G node can preserve a ring node in situations where a ring is at or near the BLSR 16 node limit.

Figure 2-4 (A) shows a normal FT-2000 ring, but node C has exhausted its low-speed interface capacity. Figure 2-4 (B) shows a 2.5G node added at the capacity exhaust location (node C). In Figure 2-4 (C), the FT-2000 node is removed and all traffic is moved onto the 2.5G node.

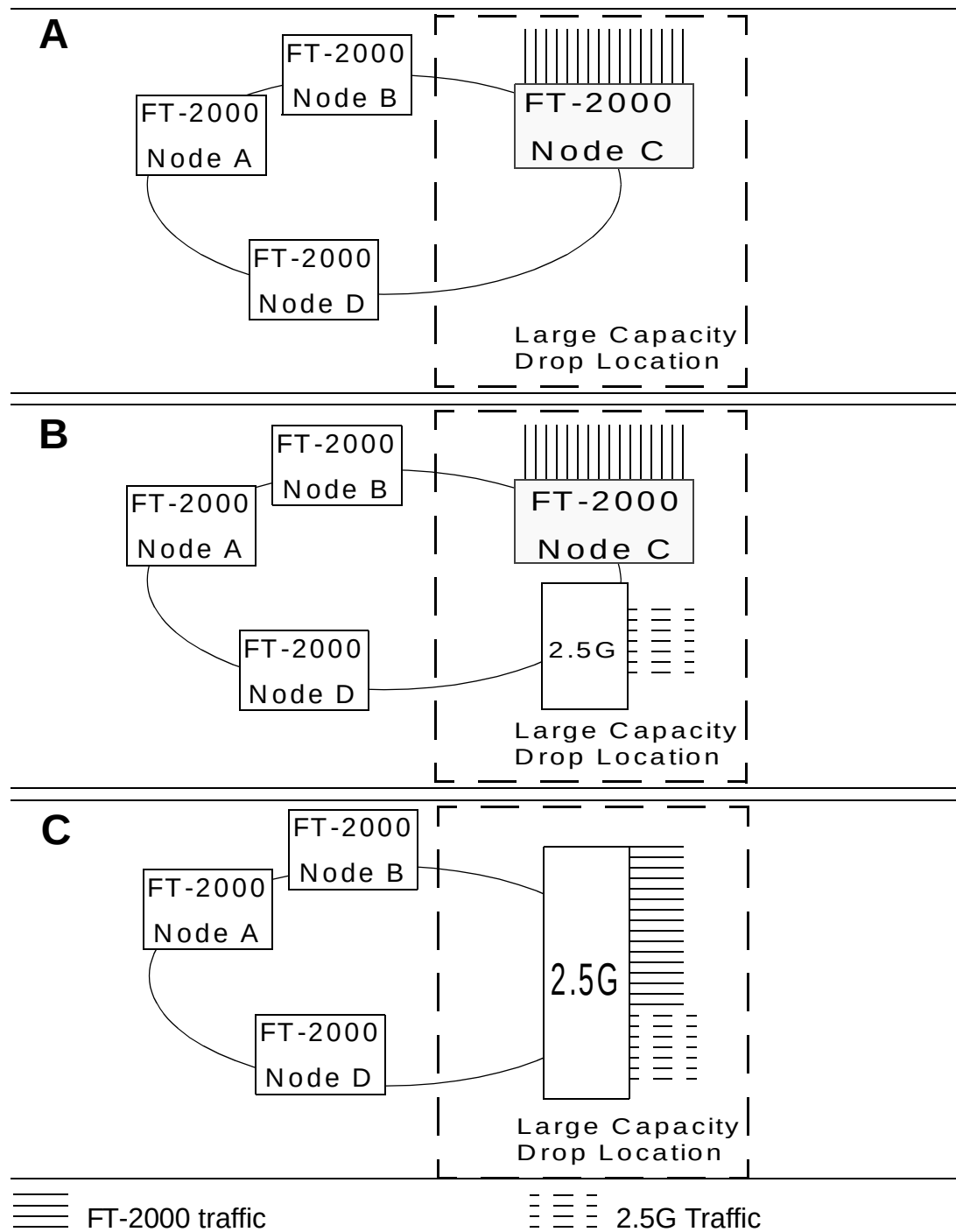


Figure 2-4. FT-2000/WaveStar 2.5G BLSR Interworking

Guidelines for Mixed FT-2000/*WaveStar* Networks

When interworking with *WaveStar* products, some equipment and features associated with the FT-2000 OC-48 Lightwave System are either not available or are effected in some manner, including provisioning, configuration, and performance monitoring. To avoid possible problems, it is suggested that you precondition all FT-2000/*WaveStar* networks based on the guidelines below. Some of the restrictions listed may be removed in later releases of *WaveStar* products.

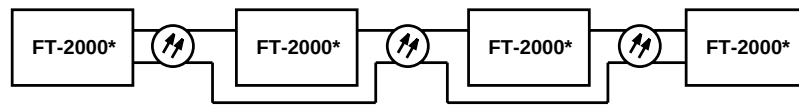
- **FT-2000 Repeater Bay** — Do not install FT-2000 Repeater Bays on lines between *WaveStar* and FT-2000 nodes, or on lines between *WaveStar* nodes. Do not install *WaveStar* nodes on lines adjacent to FT-2000 Repeater Bays. Transmission is supported with this configuration, but alarm management is not. Standing **incoming OC-48 invalid F byte** and **site provisioning conflict** alarms will exist at the Repeater Bay.
- **F-Byte Processing** — F-Byte processing is used by FT-2000 terminals to fault locate FT-2000 Repeaters. However, F-Byte processing is not supported by *WaveStar* products and must be disabled at all FT-2000 nodes with lines connecting to *WaveStar* nodes. If not disabled, the FT-2000 node will generate **incoming OC-48 invalid F byte** and **site provisioning conflict** alarms. To clear the alarms, disable F-Byte processing using the **CONFIGURATION-Set-OC48** command and reset the FT-2000 node.
- **OC-48 Line Cabling** — In mixed FT-2000/*WaveStar* rings, the East line must be cabled to the West line, and the West line must be cabled to the East line. If the OC-48 line is not connected E/W, an **inc. (from OC48) DCC failure** will alarm at the FT-2000 node and an **E/W Cable Error** will alarm at the *WaveStar* node.
- **OC-48 Section DCC Orientation** — In mixed FT-2000/*WaveStar* rings, the user/network side of the *WaveStar* node must be provisioned as “user” for the East line and “network” for the West line for the OC48 Section DCC. If incorrectly provisioned, an **inc. (from OC48) DCC failure** will alarm at the FT-2000 node and a **User-Network Side Sect Failure** will alarm at the *WaveStar* node.
- **Performance Monitoring (PM)** — Do not enable Far End Performance Monitoring on *WaveStar* nodes. REI-L indicators will not be accurate if Far End PM is “enabled”. Far End PM is “disabled” by default.
- **Non-Preemptible Protection Access (NPPA)** — Attempts to enable NPPA in a mixed FT-2000/*WaveStar* ring will be denied because *WaveStar* does not support NPPA. If NPPA is enabled prior to adding a *WaveStar* node to the ring, the FT-2000 node will be alarmed with **protn access prov but not est**. Clear the alarm by changing the protection access value to “preemptible”.

- **Synchronization** — In mixed FT-2000/*WaveStar* rings, all *WaveStar* nodes must be provisioned externally timed. Any FT-2000 nodes adjacent to *WaveStar* nodes must also be provisioned externally timed. Any FT-2000 nodes that are not adjacent to *WaveStar* nodes may be externally timed, line timed, or through timed.
- **Dual Ring Interworking** — DRI-P cross-connections can only be provisioned at FT-2000 nodes because *WaveStar* does not support DRI-P. BWM R2.0 does not support DRI-P cross-connections, but 2.5G R3.0 does support them.
- **Remote Login** — Remote login from a *WaveStar* CIT to an FT-2000 network element or from an FT-2000 CIT to a *WaveStar* network element is not possible in a mixed FT-2000/*WaveStar* ring. It is possible to use TL1 cut-through from the *WaveStar* CIT to login to the FT-2000 NE and enter TL1 commands.

For more information regarding the features described above, refer to the appropriate sections of this user/service manual. For more information regarding operations interworking in mixed FT-2000/*WaveStar* rings, refer to the *Lucent Technologies 2000 Product Family Multivendor Operations Interworking Guide*, 824-102-144. For more information on *WaveStar* products, refer to one of the following user/service manuals: 365-370-102 (BWM), 365-371-102 (2.5G), or 365-373-102 (10G).

Folded Rings (Point-to-point)

The FT-2000 OC-48 Add/Drop-Rings Terminal may be configured to support the folded rings architecture. Folded rings are rings without fiber diversity. This terminology is derived from the image of folding a ring into a linear segment. Figure 2-5 shows an example of a folded ring where adjacent ring nodes are connected and the end nodes are connected together across the whole network.



* FT-2000 OC-48 Add/Drop-Rings Terminal

Figure 2-5. Folded Ring Application

The FT-2000 OC-48 Add/Drop-Rings Terminal may be used in folded rings. In a folded ring application, *all* FT-2000 OC-48 Add/Drop-Rings Terminals must be equipped with the same release of software.

The FT-2000 OC-48 Repeater Bay equipped with Release 4.1.0-RPTR or 6.0.0-RPTR software is also available to increase the distance between two FT-2000 OC-48 Add/Drop-Rings Terminals.

The FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay allow folded ring applications to be used in place of non-ring applications, for example, linear add/drop.

Folded rings also provide flexibility and can help evolve networks into full ring applications. Figure 2-6 shows an example of a folded ring that evolves into a full ring application. In many cases, a network starts out as a folded ring because of short-term service needs between some of the nodes. Then the folded ring evolves into a full ring later when service and fiber facilities to other nodes in the network are needed. It is easier to evolve a folded ring into a full-ring application if a folded ring is used in the nodes that have this short-term service need. Folded rings have upgrade, operational, and self-healing advantages over other applications for this type of evolution.

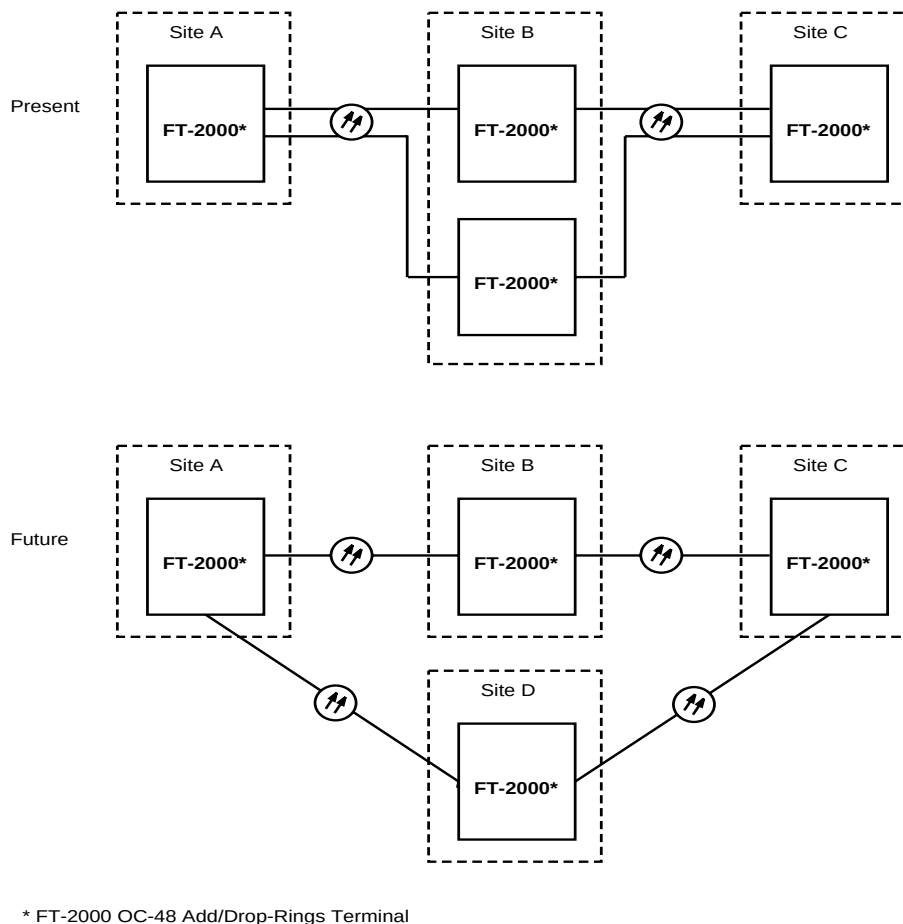


Figure 2-6. Folded Rings Evolving to Full Ring Networks

End-to-End Interface Mixing

The FT-2000 OC-48 Add/Drop-Rings Terminal supports a mix of low-speed interfaces. The mix may include any, or all, of the following:

- DS3
- EC-1
- OC-3
- IS-3

■ OC-12.

Mixing is supported within an FT-2000 OC-48 Add/Drop-Rings Terminal and between FT-2000 OC-48 Add/Drop-Rings Terminals. This capability offers more efficient network evolution and lets planners improve their equipment deployment based on the needs of the particular application. For example, the asynchronous (DS3) low-speed interfaces at one FT-2000 OC-48 Add/Drop-Rings Terminal in a network can be upgraded in service to synchronous (EC-1, IS-3, OC-3 or OC-12) low-speed interfaces without any changes at the other FT-2000 OC-48 Add/Drop-Rings Terminal terminating the circuit (Figure 2-7).

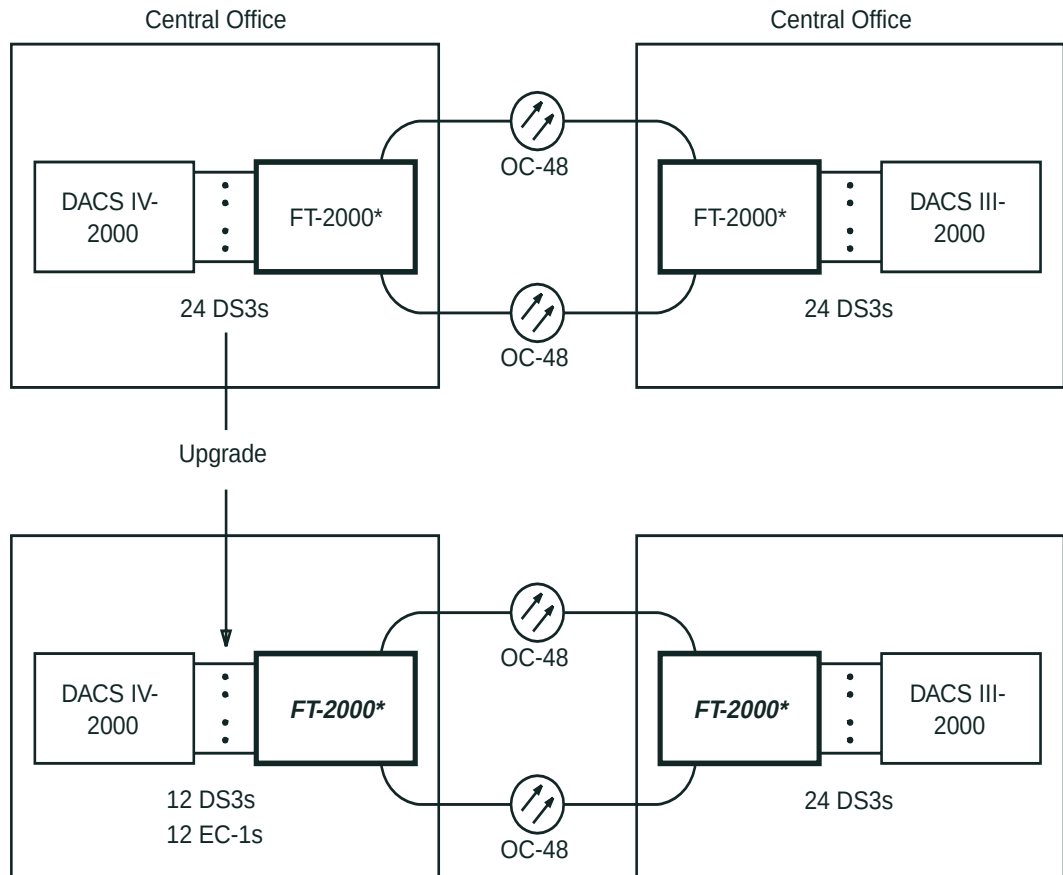


Figure 2-7. End-to-End Interface Mixing Application

The FT-2000 OC-48 Add/Drop-Rings Terminal supports the following combinations of low-speed interfaces concurrently between nodes in a network:

- Three DS3 or EC-1 signals at one end (or from various nodes) and one OC-3 signal at the other end
- Three DS3 signals at one end (or from various nodes) and three EC-1 signals at the other end (or at various nodes)
- Four OC-3s at one end and one OC-12 at the other end
- One OC-3 at one end and one IS-3 at the other end

Limited STS-1 cross-connections allow three DS3 or EC-1 circuits from various nodes in a network to be routed to a single destination and output as an OC-3 signal. The FT-2000 OC-48 Add/Drop-Rings Terminal also has an STS-1 TSA capability that allows STS-1 cross-connections. The STS-1 cross-connections allow individual DS3 or EC-1 circuits from various nodes in a network to be routed to a single destination node. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

OC-48 Hubbing

The FT-2000 OC-48 Add/Drop-Rings Terminal supports OC-48 hubbing. An FT-2000 OC-48 Add/Drop-Rings Terminal can serve a cluster of DDM-2000 OC-3 Multiplexers located at remote sites in the loop environment. Figure 2-8 shows an FT-2000 OC-48 Add/Drop-Rings Terminal serving as an OC-48 hub. The OC-48 hub supplies OC-3 optical extensions and local DS3 and/or EC-1 low-speed interfaces. All the traffic for the DDM-2000 OC-3 Multiplexers passes through the OC-48 hub using the OC-3 optical extensions.

The FT-2000 OC-48 Add/Drop-Rings Terminal provides single-ended operation capabilities through the OC-3 data communications channel (DCC). The OC-12 also provides this same DCC capability. For more information about the single-ended operation capabilities, refer to the "Operations Interworking" application in this section. For more information about operations interworking between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-147, *2000 Product Family Operations Interworking Guide*.

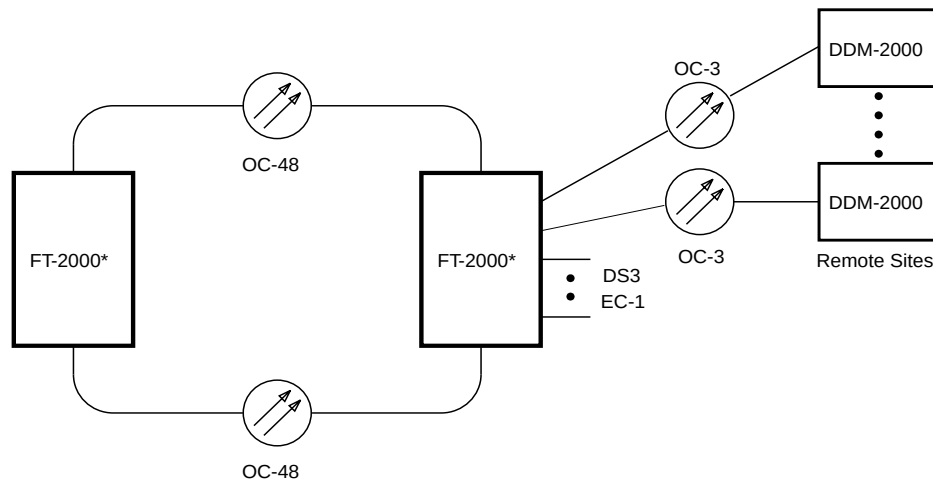


Figure 2-8. OC-48 Hubbing Application

Dual Ring Interworking (DRI)

The DRI application consists of two ring networks that are interconnected by two nodes in each ring. Figure 2-9 shows an example of the DRI application with Ring A and Ring B.

- Ring A is a line-switched ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals.
- Ring B may be any of the following:
 - Another line-switched ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals
 - A path-switched ring equipped with DDM-2000 OC-3 Multiplexers
 - A path-switched ring equipped with DDM-2000 OC-12 Multiplexers
 - A path-switched ring equipped with *SLC*[®]-2000 Access System OC-3 Multiplexers.

The two rings may be electrically connected (DS3 and/or EC-1) and/or optically connected using OC-3 or OC-12 interfaces.

The DRI application protects a circuit with one termination in one ring and the other termination in another ring if one of the interconnecting nodes fails or a connection between two interconnecting nodes fail. For each circuit with a

termination in both rings, one FT-2000 OC-48 Add/Drop-Rings Terminal is designated as the primary node and one FT-2000 OC-48 Add/Drop-Rings Terminal is designated as the secondary node.

The primary and secondary nodes may be designated on an STS-3 or STS-1 tributary basis. The primary node for one tributary may be the secondary node for another tributary. A DRI circuit must be established using STS-3 or STS-1 cross-connections so that traffic is routed from the source node in the ring to the primary node. From the primary node, the traffic is bridged to the secondary node. For example, in Figure 2-9, if traffic is routed from Node 0 in Ring A to Node 5 and bridged to Node 4, Node 5 is the primary node and Node 4 is the secondary node. Different types of cross-connections are required at the primary and secondary nodes. (The primary and secondary nodes are not required to be adjacent nodes.) For more information about the cross-connections required at the primary and secondary nodes for DRI protection switching, refer to Section 9, "Maintenance Description."

In a DRI application with two line-switched rings equipped with FT-2000 OC-48 Add/Drop-Rings Terminals, the primary node in one ring may be connected to the primary node in the other ring. For example, in Figure 2-9, Node 5 is the primary node in Ring A and Node 1 is the primary node in Ring B.



NOTE:

If the primary node in one ring is connected to the secondary node in the other ring, the DRI-provisioned circuit will be protected against a failure of the low-speed cross-connected circuit. However, the DRI-provisioned circuit may not be protected if one of the DRI-provisioned nodes becomes isolated from the ring (for example, node power failure or open fibers on both sides).

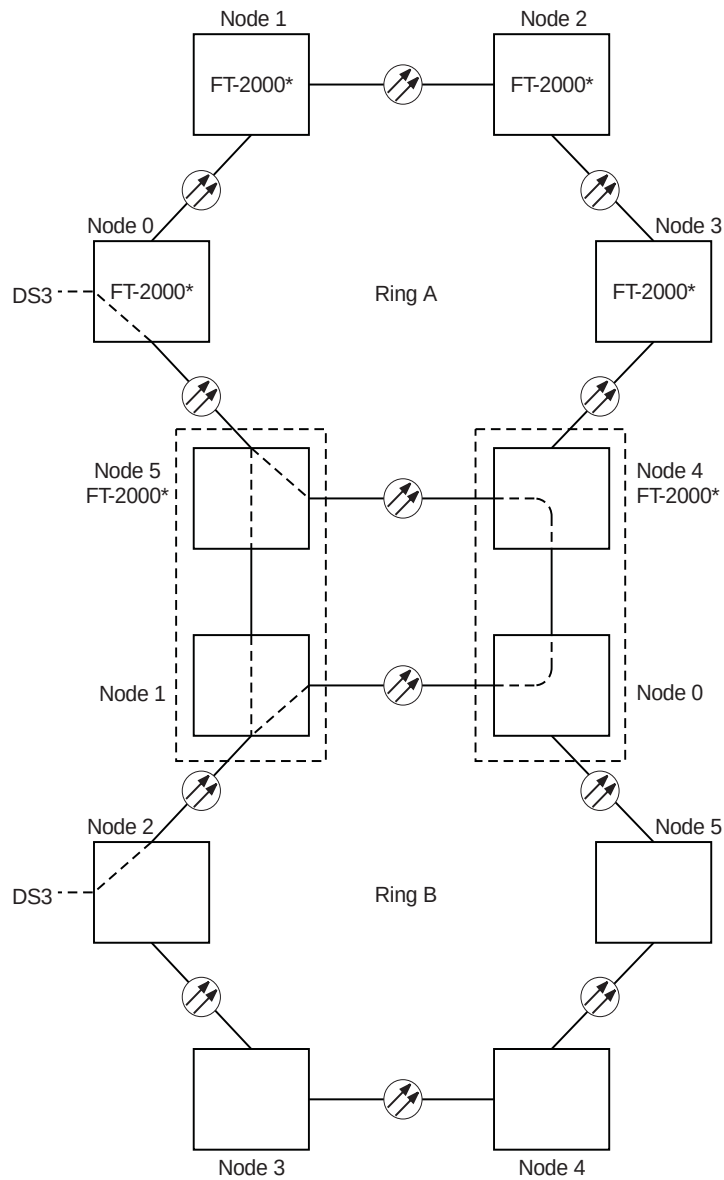


Figure 2-9. Dual Ring Interworking Application



CAUTION:

The primary node should be connected directly to a node in the other ring. No intervening transmission equipment (for example, DACS III-2000 Cross-

Connect System) should be present. If intervening transmission equipment is present and a loss-of-signal (LOS) condition occurs, the intervening equipment may transmit alarm indication signals (AIS) toward the primary node. The secondary node can be connected through intervening transmission equipment to a node in the other ring. If a DRI cross-connection is established, then an AIS or AIS-P will cause a DRI protection switch. Also, whenever a DRI cross-connection is established, a DRI switch will be active if a SONET EC-1, OC-3, or OC-12 signal is not provided to the input of the low-speed pack.

DRI Sub-Features/Enhancements by Release Number

Signal Type/Alarm Parameter	R-4.1	R-5	R-6	R-7	R-7.1	R-7.2	R8.1	R9.0	R9.1
Electrical Connection -DS3									
LOS	X	X	X	X	X	X	X	X	X
-EC-1/STS-1E									
LOS	X	X	X	X	X	X	X	X	X
AIS-P					X	X	X	X	X
LOF	X	X	X	X	X	X	X	X	X
SD						X	X	X	X
SF						X	X	X	X
UNEQ-P							X	X	X
PDI-P								X	X
LOP-P									X
Optical Connection -OC-3									
LOS		X	X	X	X	X	X	X	X
LOF		X	X	X	X	X	X	X	X
AIS-P					X	X	X	X	X
SD						X	X	X	X
SF						X	X	X	X
UNEQ-P							X	X	X
PDI-P								X	X
LOP-P									X
-OC-12									
LOS				X	X	X	X	X	X
LOF				X	X	X	X	X	X
AIS-P					X	X	X	X	X
SD						X	X	X	X
SF						X	X	X	X
UNEQ-P							X	X	X
PDI-P								X	X
LOP-P									X

Figure 2-10 shows a DRI application using OC-3 interfaces between a line-switched ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals and a path-switched ring equipped with DDM-2000 OC-3 Multiplexers. There is a direct intra-office connection between the primary node in the FT-2000 OC-48 two-fiber ring and Node 2 in the DDM-2000 ring. There is also a direct interoffice connection, using an OC-3 optical extension, between the secondary node in the FT-2000 OC-48 two-fiber ring and Node 4 in the DDM-2000 ring.

The DRI application supports synchronous optical network (SONET) path connectivity between rings with EC-1 and OC-3 interfaces. For example, a DS3 signal may enter a node in a ring, be transported from the primary node to the other ring as a DS3-based EC-1 signal, then emerge from a node in the other ring in the original DS3 format. A line-switched ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals may also accept VT1.5-based EC-1 signals from a path-switched ring equipped with DDM-2000 Multiplexers. This allows VT1.5 level cross-connections in the path-switched ring. The OC-3 interfaces may be used between rings to transport DS3-based and Virtual Terminal (VT)1.5-based EC-1 signals, or STS-3c signals in broadband service applications. DS3 interfaces may be used between rings; however, DS3 interfaces do not support SONET path connectivity between rings. DS3 interfaces terminate the SONET path.

A circuit with one termination in the line-switched ring and the other termination in the other ring (path-switched ring or another line-switched ring) is protected by two identical input low-speed signals and two identical output low-speed signals. In the line-switched ring, the primary node and secondary node accept an identical low-speed signal from the other ring. The primary node selects the low-speed signal from the other ring as the active low-speed signal and the low-speed signal from the secondary node as the standby low-speed signal.

The primary and secondary nodes of the line-switched ring also provide two identical output low-speed signals to the other ring. The primary node bridges the STS-3 or STS-1 tributary using its drop and continue capability to the secondary node.

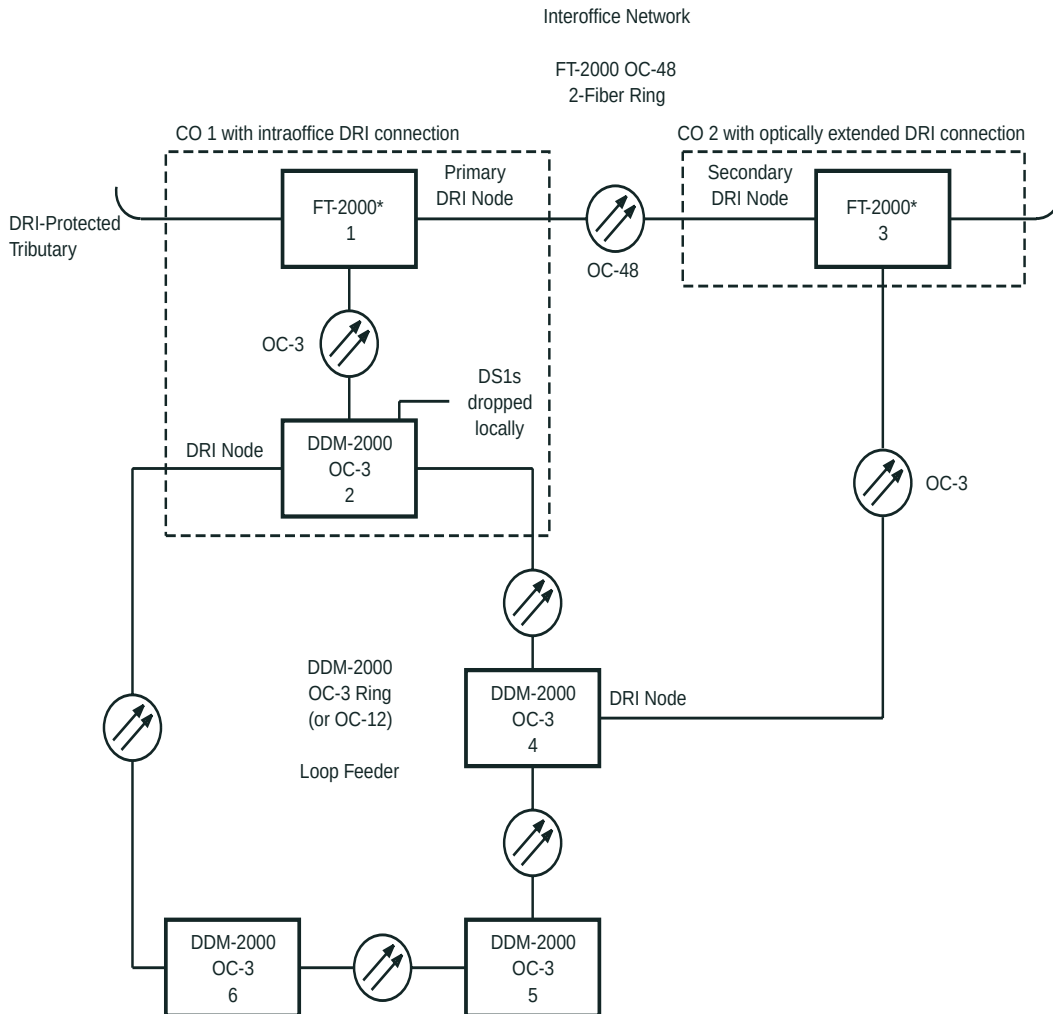


Figure 2-10. Dual Ring Interworking Application with the DDM-2000 OC-3 Multiplexer

If an incoming DS3 or EC-1 LOS is detected at the primary node as a result of an incoming signal failure or an interconnecting node failure in the other ring, the primary node performs an automatic DRI protection switch. The primary node selects the low-speed signal from the secondary node as the active low-speed signal, completing the circuit between the secondary node and the terminating node. An unprotected incoming OC-3/OC-12 LOS or loss of frame (LOF) also

triggers a DRI protection switch. An AIS-P failure can occur in any of the SONET low-speed interfaces (e.g., STS-1E, OC-3, IS-3 or OC-12). And, an AIS-P will result in a DRI protection switch. Similarly, a Signal Degrade (SD) condition can occur on any of the SONET low-speed interfaces. And, an SD will result in a DRI protection switch. Also, a path unequipped on any of the SONET low-speed interfaces will result in a DRI protection switch.

Depending on how the DRI cross-connection is established, the DRI protection switch may take place at either the STS-3 or STS-1 level. Therefore, if one of the three incoming DS3 or EC-1 low-speed signals fails in an STS-3 tributary, the DRI protection switch will only affect the failed STS-1 tributary.

The primary node does not monitor the condition of the incoming low-speed signal at the secondary node before performing a DRI protection switch. The DRI protection switch time is less than 100 milliseconds for unprotected (0x1) OC-3 interfaces and less than 200 milliseconds for unprotected failures in 1+1 protected OC-3 interfaces. For more information about DRI protection switching, refer to Section 9, "Maintenance Description."

If the primary node in the line-switched ring fails, the FT-2000 OC-48 Add/Drop-Rings Terminals adjacent to the primary node perform two-fiber ring protection switching. Traffic is rerouted to/from the termination node in the line-switched ring through the secondary node to the other ring.

If the secondary node in the line-switched ring fails, the FT-2000 OC-48 Add/Drop-Rings Terminals adjacent to the secondary node perform two-fiber ring protection switching. However, traffic continues to be routed to/from the termination node in the line-switched ring through the primary node to the other ring. For information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

Cross-connections can be made, using the CIT or message-based operations system interface. The message-based operations system interface uses X.25 protocol and TL1 messages. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

For Releases 8.1 and later, basic Dual Ring Interworking has been enhanced in two ways:

- by providing greater bandwidth-management flexibility by allowing the secondary source of a Dual Ring Interworking circuit to be provisioned on an OC-48 protection tributary. This is called Dual Ring Interworking on Protection. The two new cross-connection types provided for this feature are 2-Way-DRI-Pri and 2-Way-DRI-Sec.
- by providing a third new cross-connection type: 2-way-dri. This allows the use of a single command to fully provision a 2-way-dri circuit at the primary node. Previously, three commands were required to provision a 2-way-dri circuit: 1-way-dri, 1-way through and 1-way drop.

For Release 9.1 and later:

STS Path Loss of Pointer (LOP-P) — The STS path loss of pointer condition will trigger a DRI switch.

**NOTE:**

Detection of LOP-P requires a series 5 or later transmitter.

Figure 2-11 illustrates the DRI and DRI-P cross-connection types.

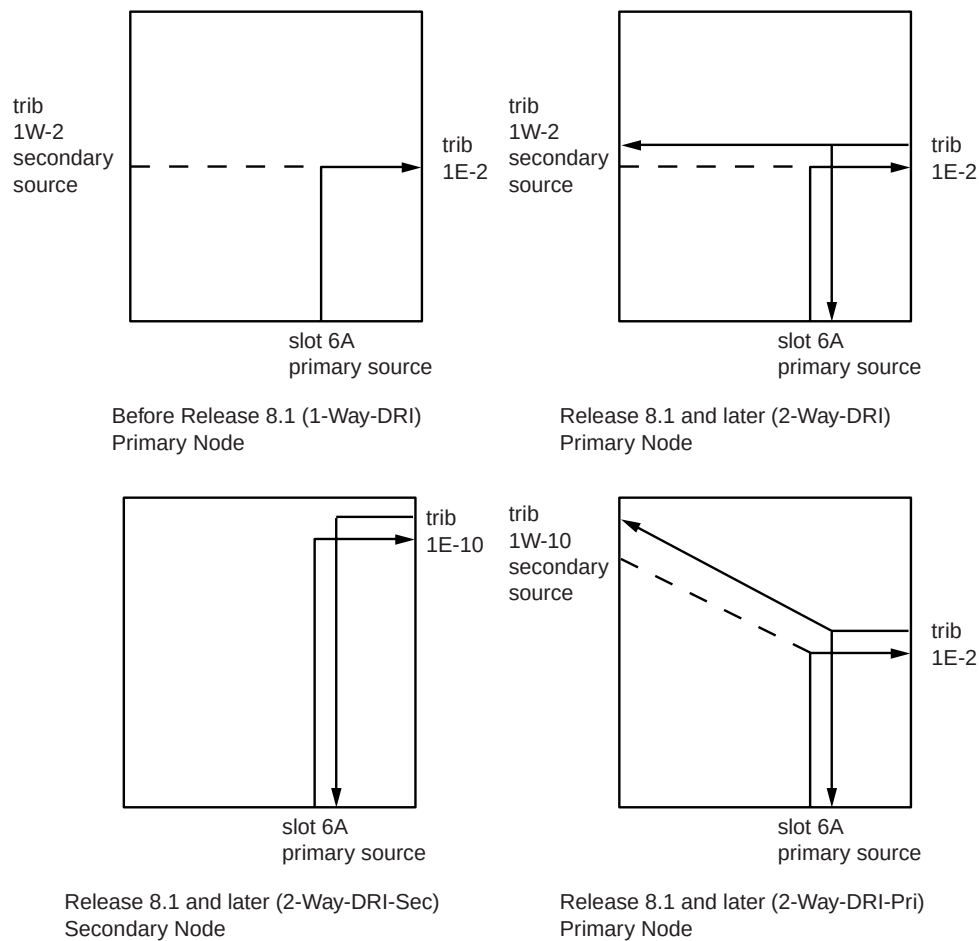


Figure 2-11. DRI and DRI-P Cross-Connection Types

DRI on Protection (DRI-P)

For Releases 8.1 and later:

Dual Ring Interworking on Protection (DRI-P) applications such as the one illustrated in Figure 2-12 are now possible. Provisioning both basic DRI and DRI-P cross-connects on the same service tributaries effectively doubles the bandwidth available for carrying DRI services. Prior to Release 8.1, basic Dual Ring Interworking restrictions would prevent full usage of available bandwidth.



NOTE:

In mixed FT-2000/*WaveStar* rings, DRI and DRI-P cross-connections can only be provisioned at the FT-2000 nodes in the ring. *WaveStar* BandWidth Manager Release 2.0 and *WaveStar* 2.5G Release 3.0 do not support DRI-P at this time. *WaveStar* 2.5G Release 3.0 supports only standard Dual Ring Interworking.



NOTE:

Only one transmission direction is shown for clarity.

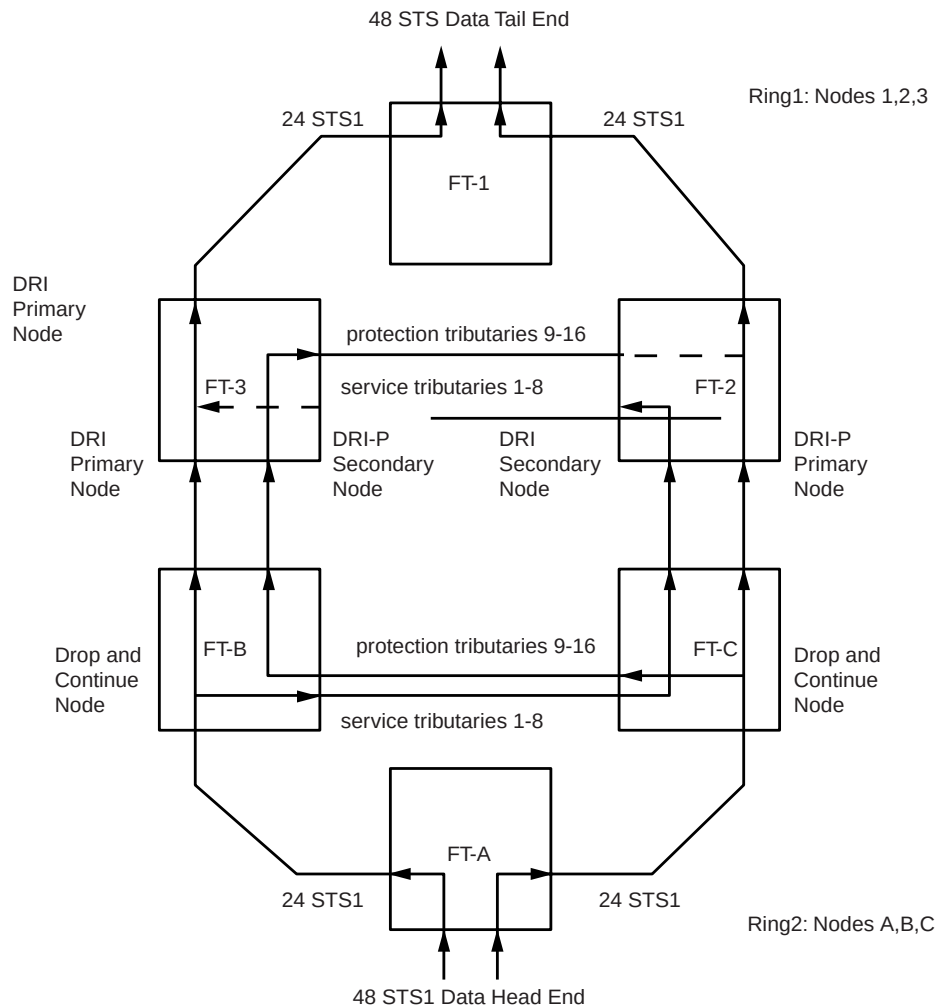
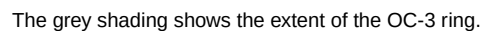


Figure 2-12. Dual Ring Interworking on Protection (DRI-P)

Figure 2-13 shows an OC-48 Ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals that are used to close (or complete) a DDM-2000 OC-3 Ring. The OC-48 Ring provides the needed bandwidth (three STS-1 tributaries) between CO 1 and CO 2. The DDM-2000 OC-3 Ring has four DDM-2000 OC-3 nodes and four OC-3 signals (OC3 1, OC3 2, OC3 3, OC3 4) connecting them. The OC-3 1 signal is transported between CO 1 and CO 2 by the FT-2000 OC-48 Add/Drop-Rings Terminals. One or more OC-48 Ring segments or rings may be used as segments of a DDM-2000 OC-3 Ring.



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The FT-2000 OC-48 Add/Drop-Rings Terminals at CO 1 and CO 2 are equipped with OC-3 low-speed interfaces. The OC-3 low-speed interfaces may be used as intra-office interfaces or interoffice optical extensions.

The FT-2000 OC-48 Add/Drop-Rings Terminal provides single-ended operation capabilities through the OC-3 DCC. For more information about the single-ended operation capabilities, refer to the "Operations Interworking" application in this section. For more information about operations interworking between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-144, *2000 Product Family Multi-Vendor Operations Interworking Guide*.

I

DDM-2000 OC-12 Ring Transport

The FT-2000 OC-48 Add/Drop-Rings Terminal can provide transport within a DDM-2000 OC-12 Ring. A DDM-2000 OC-12 Ring is an end-to-end self-healing network providing path-switched protection of OC-12 signals. Functionally, a DDM-2000 OC-12 Ring is identical to an OC-3 ring, except for 0x1 DCC support and capacity of the ring.

DDM-2000 Ring Interface With FT-2000 1+1 Low-Speed Interface

Figure 2-14 illustrates the DDM-2000 Ring configured with FT-2000 1+1 OC-3/OC-12 interface in a linear add/drop application. This figure is not intended to be a specific representation for all possible applications. Node 16 could be a node in one FT-ring while nodes 3 and 4 might be part of a different FT-ring. The DDM node could be:

- a. adding/dropping traffic from node 16 via side C



NOTE:

This traffic could subsequently be passed to the other FT-ring, or dropped via the DDM (side A or B).

- b. adding dropping traffic from node 3 via the Main.



NOTE:

This added/dropped traffic could be passed from one DDM node to another DDM node (via a linear path provided by the FT-ring), or it could be part of an actual DDM OC-3/OC-12 ring.

The cross-connections that must be established for Node 3 are detailed in “Circuit Order – NTP-018.”

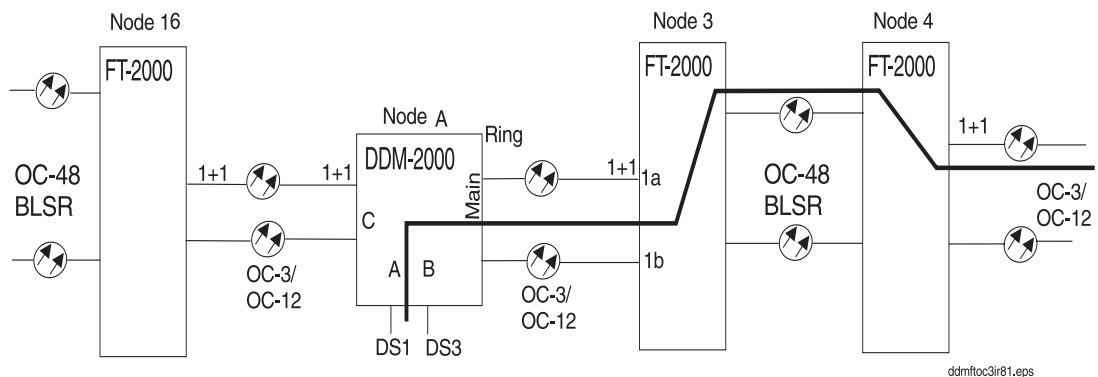


Figure 2-14. DDM-2000 OC-3/OC-12 Ring to FT-2000 1+1 OC-3/OC-12 Interface

Dual-Wire Center Architecture

The FT-2000 OC-48 Add/Drop-Rings Terminal supports the dual-wire center architecture with EC-1 and OC-3 interfaces (Figure 2-15).

A dual-wire center architecture is a self-healing network architecture that provides end-to-end survivable DS1 and DS3 business access services. Figure 2-15 shows two nodes in an OC-3 path-switched ring connected to two nodes in an OC-48 bidirectional line-switched ring with EC-1 interfaces and DACS IV-2000 Cross-Connect Systems. The EC-1 signals can contain a mixture of VT1.5 channels for all types of services. The capability to mix services, instead of having application-specific assignments for STS-1 tributaries, conserves the bandwidth of OC-3 access rings.

Traffic is routed from the terminating nodes in the DDM-2000 OC-3 path-switched ring to the interconnecting DDM-2000 OC-3 Multiplexers using two-way VT1.5 or STS-1 cross-connections. Drop and continue cross-connections are required at the interconnecting DDM-2000 OC-3 Multiplexers. Each interconnecting DDM-2000 OC-3 Multiplexer provides an EC-1 signal to a DACS IV-2000 Cross-Connect System.

Within the dual-wire center architecture, dual-wire center services and non-dual-wire center services can be mixed on an EC-1 signal from the DDM-2000 OC-3 Multiplexers (nodes 3 and 4) and sent to a DACS IV-2000 Cross-Connect System (nodes 6 and 7) to be VT-groomed (reassigned) for their destination. VT-grooming between rings by a DACS IV-2000 Cross-Connect System can optimize interoffice bandwidth usage. VT1.5 channels coming in to a DACS IV-2000 Cross-Connect System are groomed so that the outgoing facility has a uniform and efficient fill. The DACS IV-2000 Cross-Connect System may groom VT1.5 channels from multiple OC-3 access rings. The DACS IV-2000 Cross-Connect System can also provide outputs for local traffic.

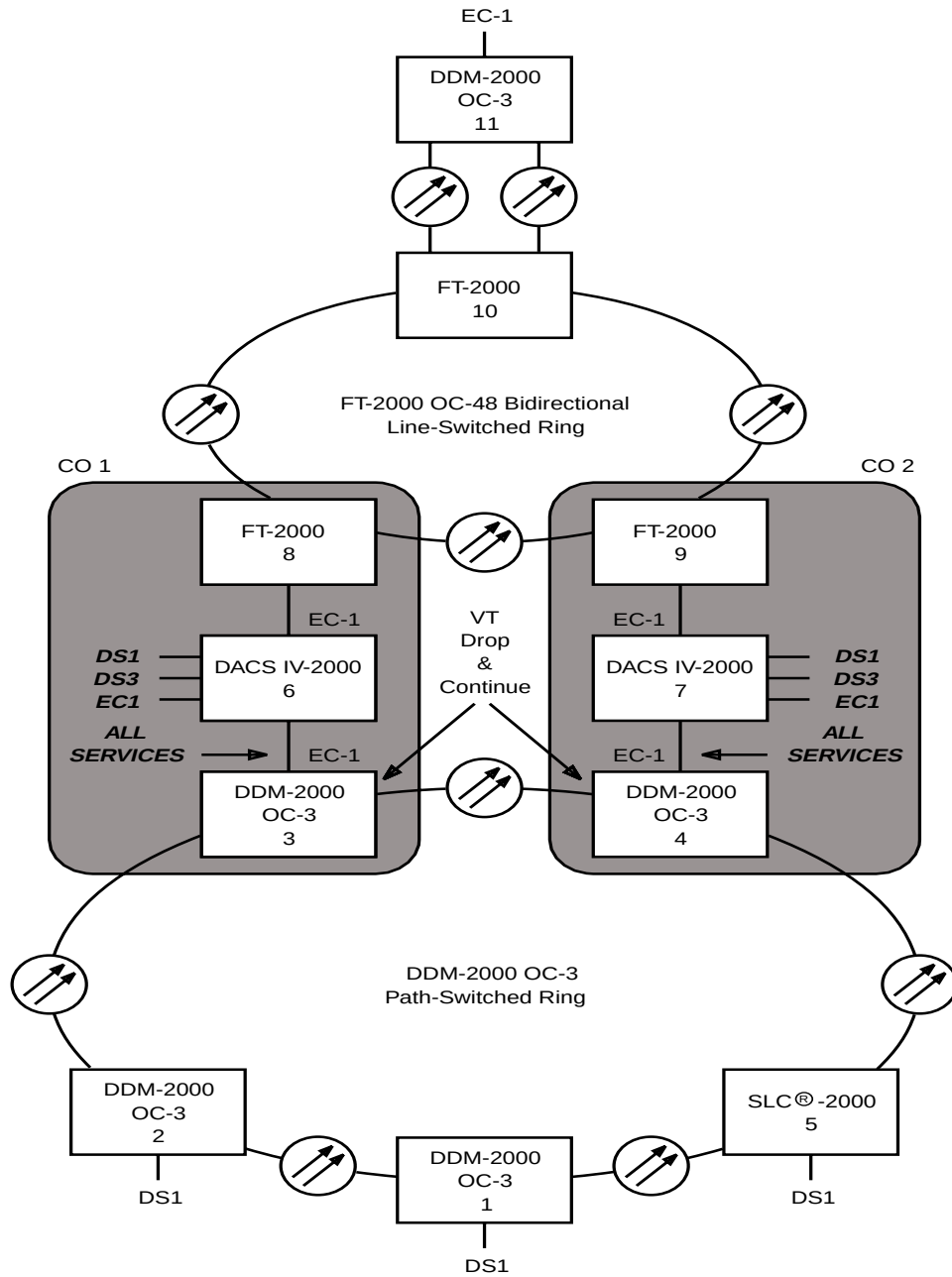


Figure 2-15. Dual-Wire Center Architecture Application

Each interconnecting FT-2000 OC-48 Add/Drop-Rings Terminal accepts an EC-1 signal from a DACS IV-2000 Cross-Connect System and routes the EC-1 signal to the terminating node. For example, in Figure 2-15, two separate STS-3 or STS-1 signals are routed from the interconnecting nodes (nodes 8 and 9) to the terminating node (node 10). Two separate STS-1 signals may be routed using two-way STS-1 cross-connections at the FT-2000 OC-48 Add/Drop-Rings Terminals. Cross-connections can be made, using the CIT or message-based operations system interface. The message-based operations system interface uses X.25 protocol and TL1 messages. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

The dual-wire center architecture protects against facility failures, node failures, and interconnection failures. A failure in one ring or a single simultaneous failure in each ring is automatically healed and service is reestablished in ≤ 60 milliseconds (includes detection and switching times). This results in a highly reliable network.

Any failures on the OC-48 bidirectional line-switched ring are protected by the FT-2000 OC-48 Add/Drop-Rings Terminal using two-fiber ring protection switching. For more information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

Any failures in the OC-3 path-switched rings or in the interconnections between the rings (for example, a DACS IV-2000 Cross-Connect System failure) are protected by the DDM-2000 Multiplexers using path-protection switching. For more information about the DDM-2000 Multiplexers, VT1.5 and STS-1 cross-connections, and path-protection switching, refer to 363-206-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*.

The FT-2000 OC-48 Add/Drop-Rings Terminal provides OI capabilities through the DCC. For more information about OI between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-144, *2000 Product Family Multi-Vendor Operations Interworking Guide*.

Multi-Vendor Applications

Figure 2-16 shows a Multi-Vendor application partnering Lucent's FT-2000 (Release 8.1 or later) and DDM-2000 OC-3 (Release 13.0 or later) with a Tellabs *TITAN* 5500 DCS. The DDM-2000 OC-3 and *TITAN* 5500 DCS are connected to the FT-2000 ring as a "dual-homed" OC-3 ring. Also, the FT-2000 ring supports a "single-homed" OC-12 ring consisting of Lucent's DDM-2000 OC-12 (Release 7.0 or later) multiplexers.

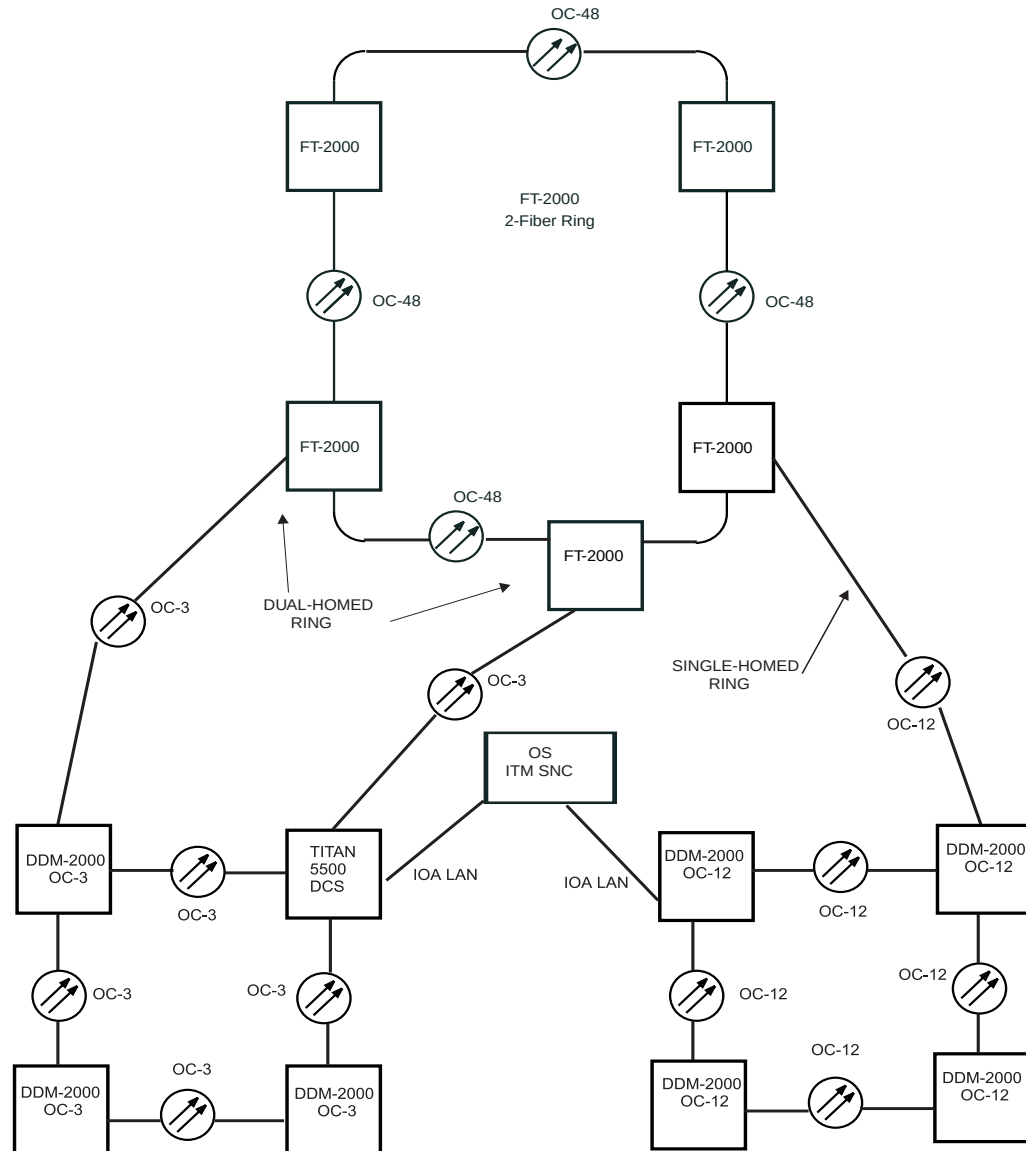


Figure 2-16. Lucent FT-2000 R8.1 in a Multi-Vendor Subnetwork

In releases prior to R9.1, the Tellabs *TITAN* may be the TL1/X.25 GNE for both the FT-2000 and DDM-2000. However, neither the FT-2000 or DDM-2000 can be the TL1/X.25 GNE to the *TITAN*.

FT-2000 OC-48 R9.1 enables the FT-2000 to serve as the TL1/X.25 GNE for Tellabs *TITAN*, as well as *WaveStar* 2.5G and 10G.

The Lucent 3000 Product Family (including *WaveStar* BandWidth Manager, 2.5G and 10G) also supports TARP, OSI, and TL1/X.25, enabling compatibility with the Lucent 2000 Product Family.

⇒ **NOTE:**
It is still important to realize that the CIT remote login capability (from FT-2000 to other FT-2000 NEs or DDM-2000 NEs in the same subnetwork) is still supported. Also, FT-2000 to FT-2000 software copies. Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

⇒ **NOTE:**
The new OC3 (1.3 STD) LAA10B circuit pack provides a “synchronization messaging on S1 byte” feature that enables you to provision for multivendor synchronization messaging for timing distribution. Sync messages provide better information about the sync distribution signals that service providers use. For more information on sync messaging, refer to Chapter 5, “Control, Transmission, and Synchronization Interfaces.”

Service Applications

Broadband Service Transport —STS-3c/STS-12c

The FT-2000 OC-48 Add/Drop-Rings Terminal equipped with OC-3 low-speed interfaces supports the broadband service transport application. This allows the FT-2000 OC-48 Add/Drop-Rings Terminal to transport STS-3c payloads generated by asynchronous transfer mode (ATM) products and nonswitched services such as medical imaging. When equipped with OC-12 low-speed interfaces, STS-12c payloads may be transported.

Figure 2-17 shows a two-fiber bidirectional ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals. The FT-2000 OC-48 Add/Drop-Rings Terminals are connected to ATM service multiplexers and switches with OC-3 low-speed interfaces. The FT-2000 OC-48 Add/Drop-Rings Terminals at CO 1 and CO 2 are optical hubs that provide OC-3/OC-12 optical extensions to ATM service multiplexers. The STS-3c payload may pass through other transmission equipment before reaching the FT-2000 OC-48 Add/Drop-Rings Terminal (for



CAUTION:

Exercise caution when using STS-1 cross-connections to provision STS-3c/STS-12c circuits. It is possible to provision circuits with STS-1 cross-connections that do not properly carry STS-3c/STS-12c signals and are not reported or alarmed. For example, if the second and third STS-1 signals in an STS-3c signal are transposed at an add cross-connection or at a drop cross-connection, the resulting STS-3c signal will be corrupted but no conditions are reported or alarmed.

For more information about the STS-3c/STS-12c concatenated signals, refer to the "Concatenated Mode" part of Appendix A, "A SONET Overview." For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

The FT-2000 OC-48 Add/Drop-Rings Terminal equipped with OC-3 low-speed interfaces can also be provisioned to transport SONET STS-3 and STS-3c payloads or synchronous digital hierarchy (SDH) STM-1 AU-4 mapped payloads. This allows a direct interface to SDH equipment over an STM-1 optical connection. The OC3 circuit pack can automatically support transport of STS-3, STS-3c, or STM-1 signals carrying AU-4 mapped signals. For more information about provisioning an OC-3 low-speed interface, refer to the information describing the **CONFIGURATION-Set -OC3** input in Section 8, "Administration and Provisioning."

Similarly, and in summary, the OC-12 low-speed interface can transport a single SONET STS-12c signal, a combination of STS-1 and STS-3c signals, or an SDH type STM-4 signal.

The FT-2000 OC-48 Add/Drop-Rings Terminal provides single-ended operation capabilities through the OC-3 DCC. For more information about the single-ended operation capabilities, refer to the "Operations Interworking" application in this section. For more information about operations interworking between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-147, *2000 Product Family Operations Interworking Guide*.

STS-1/STS-3 Non-Preemptible Protection Access

This feature is applicable for FT-2000 OC-48 ADR Terminal ring configurations that are equipped with STS-1 granularity hardware (for example, 739 transmitter and 839B5 receiver) at all ring nodes.



NOTE:

For rings that are not equipped to support STS-1 granularity—then non-preemptible protection access is supported at the STS-3 level. This means that three STS-1 tributaries must be selected at a time. On a comparative basis (STS-1 versus STS-3) it should be evident that the STS-1 level gives the ability to use the available bandwidth more efficiently. Bandwidth

efficiency is even more important when mixing signals from different services.

This feature permits the use of idle protection capacity to carry "extra traffic" on an unprotected/non-preemptible basis. The traffic carried by non-preemptible tributaries is not dropped (preempted) by any ring loopback protection switch. For a two-fiber ring it is important to realize that whenever a protection tributary is selected for non-preemptible protection access, the corresponding STS-3 tributary of service capacity on ALL spans of the ring becomes unprotected. This results in two unprotected/non-preemptible tributaries on all spans of the ring; both the service tributary (STS-3 #n) and the protection tributary (STS-3 #n+8).



NOTE:

The capability to select non-preemptible protection access on a per individual span basis is made very useful in four-fiber rings by their ability to provide per-span protection switching. Service on other spans can still be protected. This gives four-fiber rings an advantage over two-fiber rings in all applications where the need for non-preemptible capacity is to carry add/drop traffic on individual spans, part-of-the-way around the ring.

In terms of user administration, there are two "protection access states" associated with a tributary being used for Non-Preemptible Protection Access. These two "protection access states" are:

- Temporary, and
- Permanent.



NOTE:

With these two additions there are now a total of three protection access states (preemptible, temporary, and permanent).



NOTE:

NPPA should not be enabled at FT-2000 NEs in mixed FT-2000/*WaveStar* networks because *WaveStar* products do not support this feature. Attempts to enable NPPA in a mixed FT-2000/*WaveStar* ring will be denied. If NPPA is enabled prior to adding a *WaveStar* node to the ring, the FT-2000 node will be alarmed with **protn access prov but not est**. Clear the alarm by changing the protection access value to "preemptible".

It should be emphasized that the primary need for this feature is to increase the span capacity and thus increase bandwidth efficiency for "Path-in-Line" applications. As a review, a "Path-in-Line" application carries path-switched ring traffic within the FT-2000 line-switched ring. Tributaries of the FT-2000 ring provide transport between DDM-2000 OC-3 and/or SLC-2000 ring nodes. The path-switched ring protects traffic with dual-fed signals. The node that originates the traffic sends it in both directions (East and West) from the node where the traffic

enters the ring. The node where the traffic exits the ring selects one of the two received signals.

"Path-in-Line" applications are always administered as "Permanent". Other examples of these types of applications include:

- **Real-Time Networks**—that support time-sensitive control functions.
- **ATM and Bridge/Router Traffic**—for this application customers may already provide their own rerouting, in case of failure, and may not need FT-2000 protection switching.
- **Video Transport**—which sometimes require non-preemptible transport without protection.
- **Dual-Wire Center Architecture**—a self healing network that provides end-to-end survivable DS1 and DS3 business access services.

An application that uses the "Temporary" protection access state is in support of DACS-based network restoration. For this application the service traffic is temporarily made unprotected so that a restoration can use protection access that is non-preemptible.

One-Way Video Distribution

The FT-2000 OC-48 Add/Drop-Rings Terminal can be used in 1-way video distribution applications. The FT-2000 OC-48 Add/Drop-Rings Terminal is used to distribute video signals from one or more video servers to video serving areas (Figure 2-18).

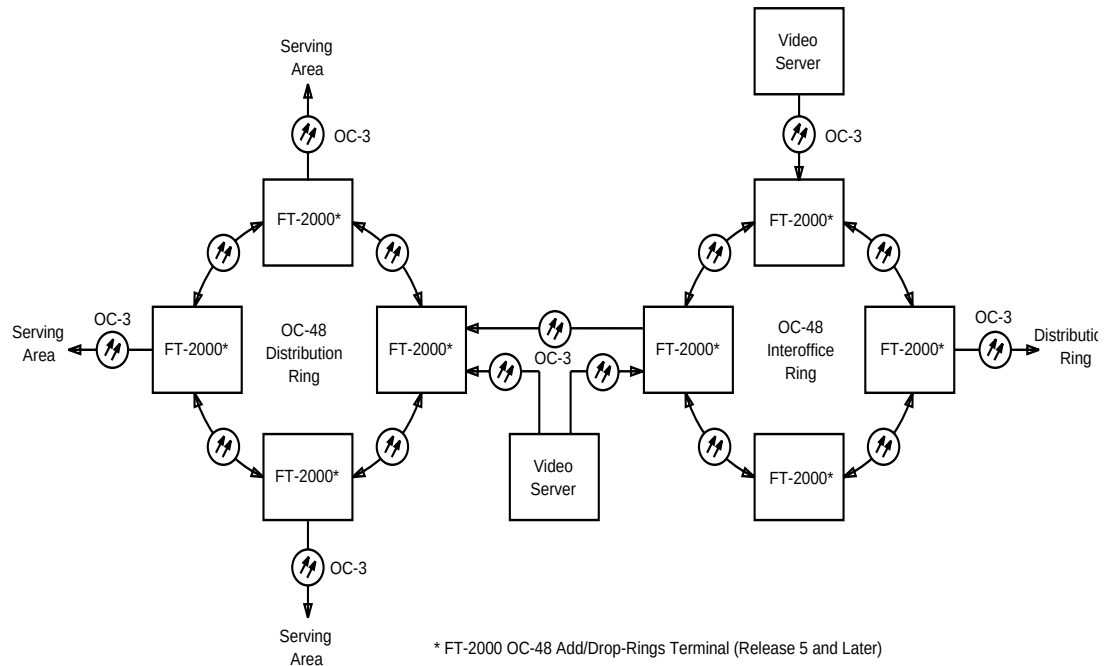


Figure 2-18. One-Way Video Distribution Application

The FT-2000 OC-48 Add/Drop-Rings Terminal accepts up to 16 unprotected (0x1) OC-3c signals carrying broadcast television and interactive multimedia television (IMTV) services for transport to the serving areas. The OC-3c signals are fully protected within the two-fiber bidirectional ring. Up to eight OC-3c signals may be cross-connected to OC-48 high-speed line 1E, and up to eight OC-3c signals may be cross-connected to OC-48 high-speed line 1W. For more information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

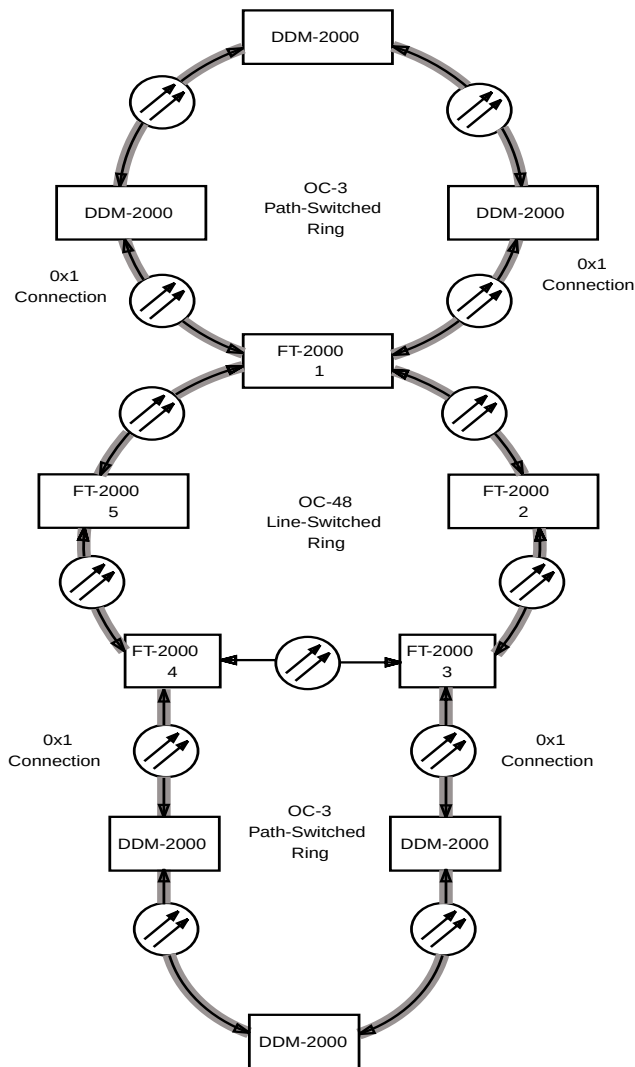
All cross-connections in this video application are 1-way STS-3 cross-connections from the video server to the customer. Because the corresponding return path has no input signal, the FT-2000 OC-48 Add/Drop-Rings Terminal reports a trouble condition. The FT-2000 OC-48 Add/Drop-Rings Terminal may be provisioned to disable reporting this trouble condition. For more information about provisioning, refer to Section 8, "Administration and Provisioning," and the "Operation and Maintenance (TOP)" section.

The FT-2000 OC-48 Add/Drop-Rings Terminal supports the OC-3/OC-12 section DCC and integrated single-ended operations with other FT-2000 OC-48 Add/Drop-Rings Terminals, via an OC-3/OC-12 line.

For more information about operations interworking between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

Path-In-Line Architecture

The FT-2000 OC-48 Add/Drop-Rings Terminal supports the path-in-line architecture (Figure 2-19). The path-in-line architecture allows part of the bandwidth of an OC-48 bidirectional line-switched ring to be part of an OC-3 path-switched ring. This architecture allows part of the bandwidth of an OC-48 bidirectional line-switched ring to be part of an OC-12 path-switched ring.



The grey shading indicates the extent of OC-3 ring.

Figure 2-19. Path-In-Line Architecture

The path-in-line architecture is a self-healing network architecture that provides end-to-end survivable DS1 and DS3 services. Figure 2-19 shows an OC-3 path-switched ring using part of the bandwidth of an OC-48 bidirectional line-switched ring. The OC-3 interfaces can contain a mixture of VT1.5 and STS-1 channels for all types of services. The capability to mix services, instead of having application-specific assignments for STS-1 tributaries, conserves the bandwidth of OC-3 access rings.

Traffic is routed from the terminating node in the DDM-2000 OC-3 path-switched ring to the interconnecting DDM-2000 OC-3 Multiplexers using two-way add/drop and pass-through cross-connections. Unprotected 0x1 connections are supported between the OC-3 path-switched rings and the OC-48 bidirectional line-switched ring.

Each interconnecting FT-2000 OC-48 Add/Drop-Rings Terminal accepts one OC-3 signal or two OC-3 signals. Traffic is routed through the OC-48 bidirectional line-switched ring using two-way STS-3 cross-connections at the FT-2000 OC-48 Add/Drop-Rings Terminals.

Cross-connections can be made using the CIT or message-based operations system interface. The message-based operations system interface uses X.25 protocol and TL1 messages. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

The path-in-line architecture protects against facility failures, node failures, and interconnection failures. A failure in one ring or a single simultaneous failure in each ring is automatically healed and service is reestablished in ≤ 60 milliseconds (includes detection and switching times). This results in a highly reliable network.

Any failures on the OC-48 bidirectional line-switched ring are protected by the FT-2000 OC-48 Add/Drop-Rings Terminal using two-fiber ring protection switching. For more information about two-fiber ring protection switching, refer to Section 9, "Maintenance Description."

Any failures in the OC-3 path-switched rings or in the interconnections between the rings are protected by the DDM-2000 Multiplexers using path-protection switching. For more information about the DDM-2000 Multiplexers, VT1.5 and STS-1 cross-connections, and path-protection switching, refer to 363-206-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*.

The FT-2000 OC-48 Add/Drop-Rings Terminal provides single-ended operation capabilities through the OC-3 DCC. For more information about operations interworking between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

Loop Feeder Network

The FT-2000 OC-48 Add/Drop-Rings Terminal can be used in a loop feeder network with OC-3/OC-12 low-speed interfaces. Figure 2-20 shows a two-fiber ring used to connect one or more central offices to one or more DDM-2000 Multiplexers at remote sites.

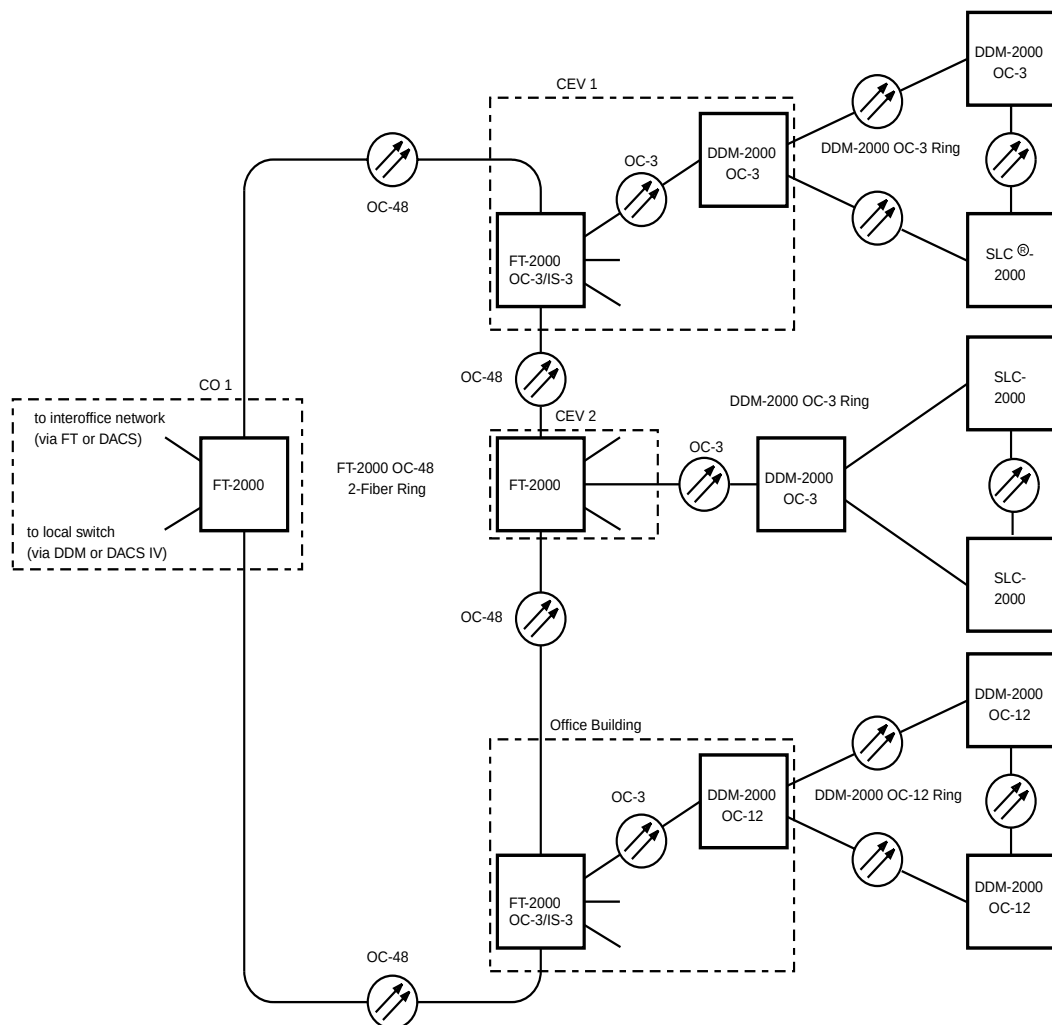


Figure 2-20. Loop Feeder Network Application

The FT-2000 OC-48 Add/Drop-Rings Terminal must be located in a controlled environment facility (for example, a controlled environment vault [CEV], temperature controlled hut, or central office).

Figure 2-20 shows the following OC-3 connections between the DDM-2000 Multiplexers and an FT-2000 OC-48 Add/Drop-Rings Terminal equipped with OC-3 low-speed interfaces:

- OC-3/IS-3 intra-office connection to a local DDM-2000 OC-3 Multiplexer (CEV 1)
- OC-3 interoffice connection to a remote DDM-2000 OC-3 Multiplexer (CEV 2)
- OC-3/IS-3 intra-office connection to a local DDM-2000 OC-12 Multiplexer (office building).

An STS-3 payload can enter the two-fiber ring via an OC-3 interface and exit the two-fiber ring via an OC-3 interface or a mix of DS3 and EC-1 interfaces at another node.

The OC-3 signal or the available DS1 timing outputs and inputs can be used to distribute network timing from the FT-2000 OC-48 Add/Drop-Rings Terminal to the DDM-2000 Multiplexers and *SLC*[®]-2000 access systems.

For more information about OI between the FT-2000 OC-48 Lightwave System and the DDM-2000 Multiplexers, refer to 824-102-144, *2000 Product Family Multi-Vendor Operations Interworking Guide*.

Extra Traffic for Restoration and Revenue Generation

The FT-2000 OC-48 Add/Drop-Rings Terminal allows access to the idle protection STS-3 tributaries for low priority traffic or for restoration purposes.

Figure 2-21 shows how the FT-2000 OC-48 Add/Drop-Rings Terminal can be used with a DACS III-2000 and/or DACS IV-2000 Cross-Connect System and the *ITM XM* controller for restoration purposes. If a failure occurs between central offices, the *ITM XM* controller receives alarms and sends cross-connect commands to the DACS III-2000 and/or DACS IV-2000 Cross-Connect Systems in the network to reroute traffic around the failure. At the FT-2000 OC-48 Add/Drop-Rings Terminals, the idle protection STS-3 tributaries carry rerouted traffic until the failure is fixed and the regular service route is restored.

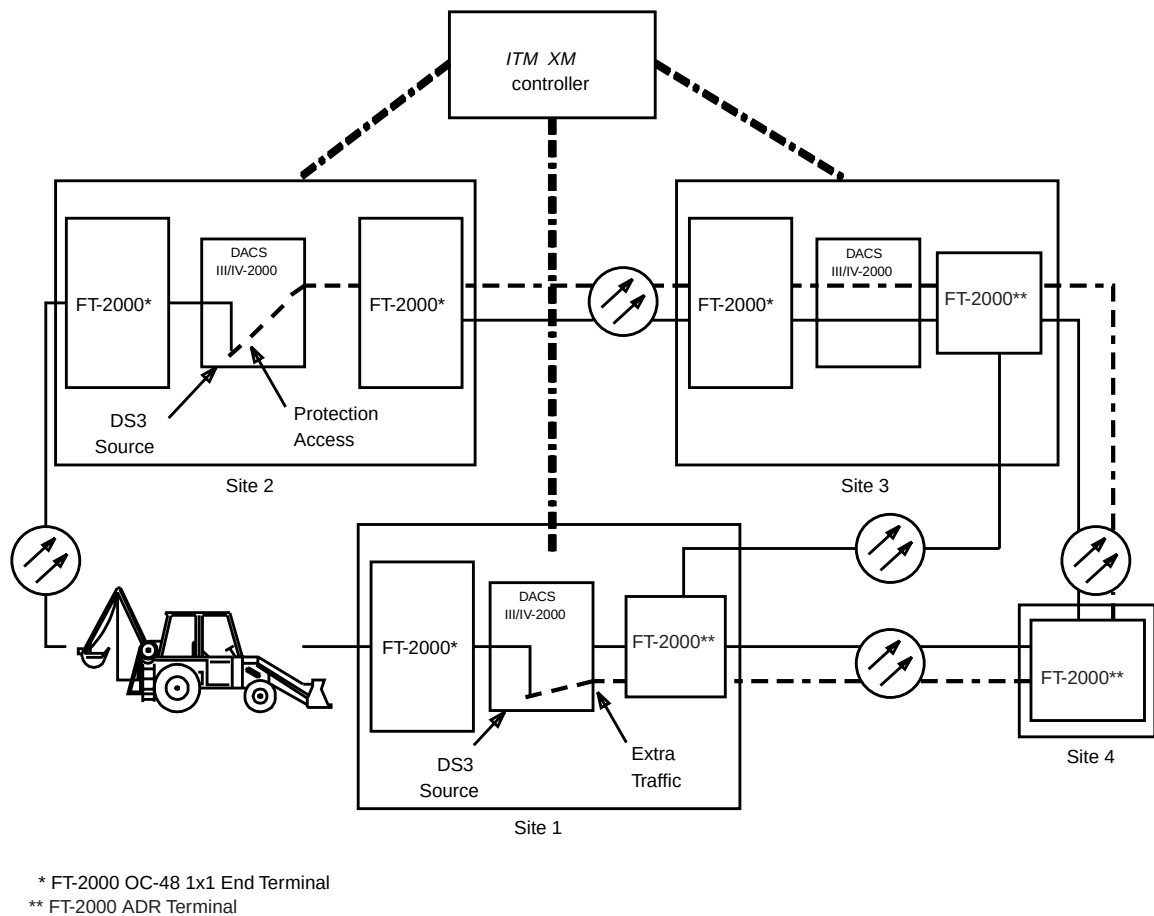


Figure 2-21. Extra Traffic (Protection Line Access) for Restoration and Revenue Generation Application

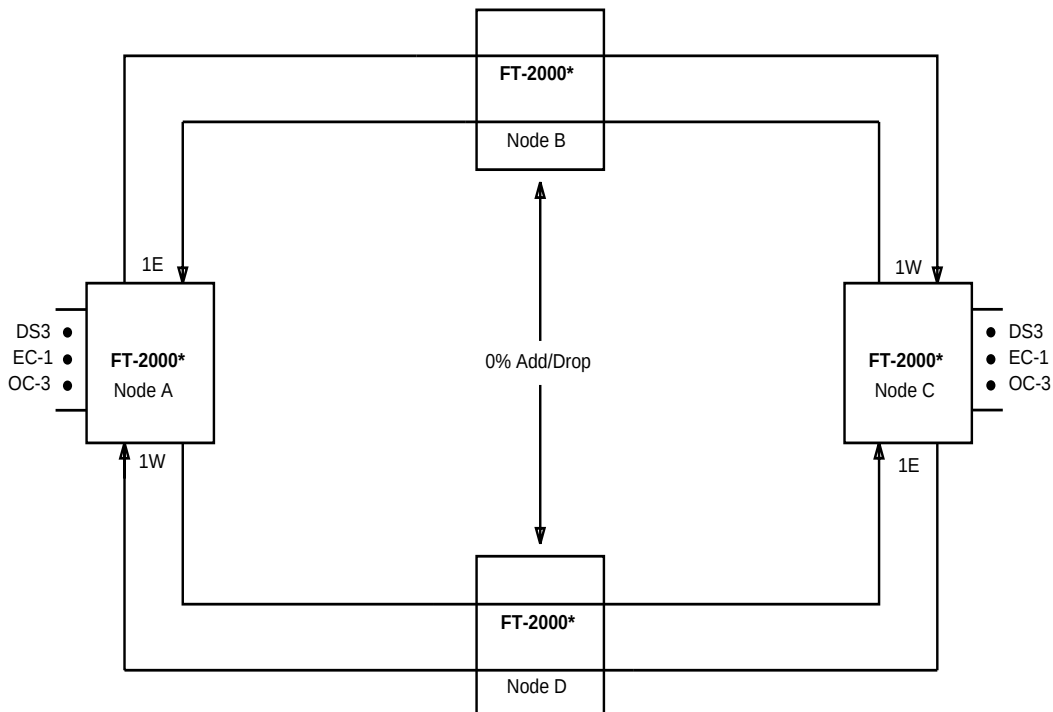
Extra traffic is established by cross-connecting low-speed service slots to protection STS-3 tributaries, using the CIT (locally or remotely).

"Extra traffic" can be administered as either preemptible or non-preemptible. Non-preemptible means the "Extra traffic" carried on a protection slot cannot be preempted/dropped by a failure of one of the service slots. For more information about cross-connections and extra traffic, refer to Section 8, "Administration and Provisioning."

0% Add/Drop

Figure 2-22 shows the FT-2000 OC-48 Add/Drop-Rings Terminal in a 0% add/drop application. In the 0% add/drop application, an FT-2000 OC-48 Add/Drop-Rings Terminal is not equipped with low speed interface circuit packs and acts as a repeater. Only 1-way and two-way through cross-connections are used at the 0% add/drop node.

Low-speed interface circuit packs may be added to the 0% add/drop node if add/drop traffic is required in the future. The FT-2000 OC-48 Add/Drop-Rings Terminal also allows access to the OC-48 DCC to perform operations, administration, maintenance, and provisioning at remote FT-2000 OC-48 Add/Drop-Rings Terminals in the ring. The FT-2000 OC-48 Repeater Bay does not allow access to the OC-48 DCC.



* FT-2000 OC-48 Add/Drop-Rings Terminal

Figure 2-22. 0% Add/Drop Application

FT-Lightwave Booster Amplifier (FT-LBA) for Extended Distances

The FT-LBA can be used with the FT-2000 OC-48 Add/Drop-Rings Terminal to extend the distance between sites (Figure 2-23). The FT-LBA is a miscellaneous-mounted shelf that provides optical amplifiers. The optical amplifiers supply 9, 12, or 16 dBm of optical output power.

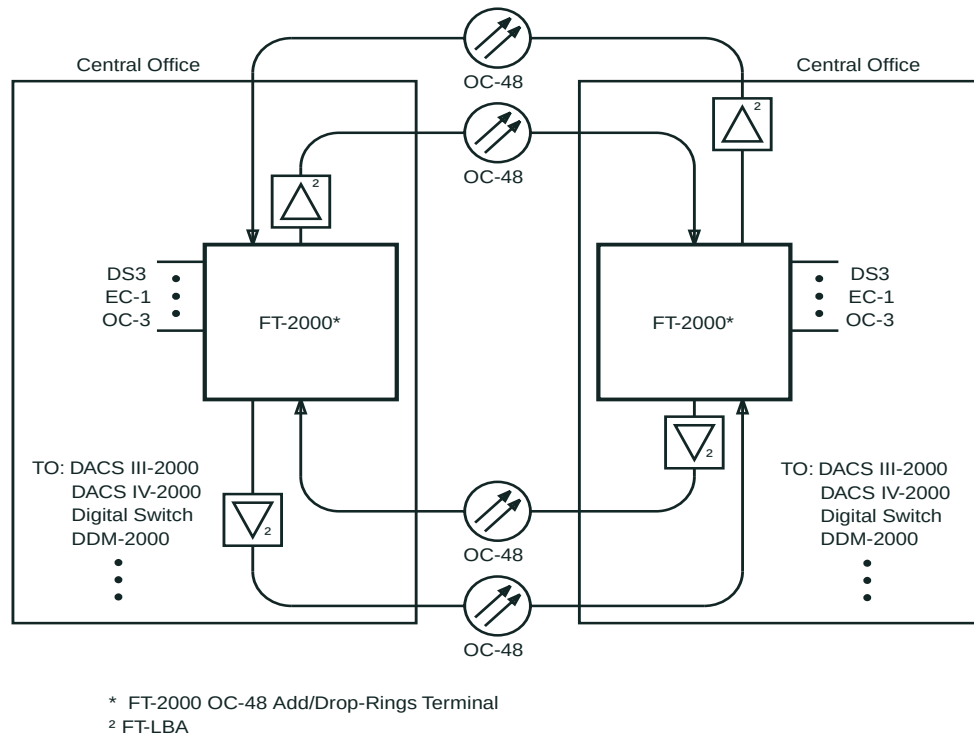


Figure 2-23. Operation with FT-Lightwave Booster Amplifier

The FT-2000 OC-48 Add/Drop-Rings Terminal and FT-LBA support span lengths up to 140 km using standard fiber or 160 km using dispersion-shifted fiber. This capability reduces the number of repeater sites on long routes. This capability also allows the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-LBA to be used with poor fiber or fiber that has frequent, high-loss splices (for example, in urban areas) or with dispersion-shifted fiber and terrestrial electronics (for example, underwater/sea applications).

The FT-2000 OC-48 Add/Drop-Rings Terminal may be equipped with the OC48 Transmitter, Add/Drop - 1.5 μ m LBA Wavelength 1 (OC48 TRMTR [A/D 1.5 LBA W1]) and the OC48 Transmitter, Add/Drop - 1.5 μ m LBA Wavelength 2 (OC48 TRMTR [A/D 1.5 LBA W2]) circuit packs when operating with the FT-LBA.

The FT-2000 OC-48 Add/Drop-Rings Terminal may be equipped with the OC48 TRMTR (A/D STS1 1.5 LBA), the OC48 TRMTR (A/D STS1 1.5 LBA, W1), and the OC48 TRMTR (A/D STS1 1.5 LBA, W2) circuit packs when operating with the FT-LBA.

The FT-Lightwave Booster Amplifier (FT-LBA) can also be used with the FT-2000 OC-48 Repeater Bay equipped with Release 6.0.0-RPTR software to extend the distance between sites. The FT-2000 OC-48 Repeater Bay must be equipped with the OC48 Regenerator - 1.5 μ m Standard Performance [OC48 REGENR (1.5 LBA)], OC48 Regenerator - 1.5 μ m Standard Performance (OC48 REGENR [1.5 LBA W1]), or the OC48 Regenerator - 1.5 μ m Standard Performance (OC48 REGENR [1.5 LBA W2]) circuit packs when operating with the FT-LBA.

The integrated operation of the FT-2000 OC-48 Add/Drop-Rings Terminal and the FT-LBA is further supported by additional cabling to transport conditions from the FT-LBA to the FT-2000 OC-48 Add/Drop-Rings Terminal using the miscellaneous discrete interface. For more information about the miscellaneous discrete interface, refer to Section 6, "Operations Interfaces."

For more information about loss budgets and transmission distances when operating with the FT-LBA, refer to Section 10, "Technical Specifications." For more information about the FT-LBA, refer to 365-565-500, *Digital Transmission Systems FT-Lightwave Booster Amplifier Description, Engineering, Installation, and Maintenance*.

Wavelength Division Multiplexing (WDM)

The circuit-carrying capacity of lightguide cable can be increased by transmitting two signals of different wavelengths simultaneously over a single fiber. WDM is the combination of two lightwave signals at different wavelengths.

The device used to implement WDM for the FT-2000 OC-48 Lightwave System is called a WDM filter. Figure 2-24 is a high level diagram depicting how the WDM filters multiplex and demultiplex a single-mode 1.3 μ m wavelength signal and a single-mode 1.5 μ m wavelength signal, enabling the two signals to operate on the same fiber pair. Thus, one FT-2000 OC-48 Lightwave System and one FT Series G 1.7 Gb/s system or two FT-2000 OC-48 Lightwave Systems at the same location, each equipped for lightwave transmission at different wavelengths, can share the same fiber pair.

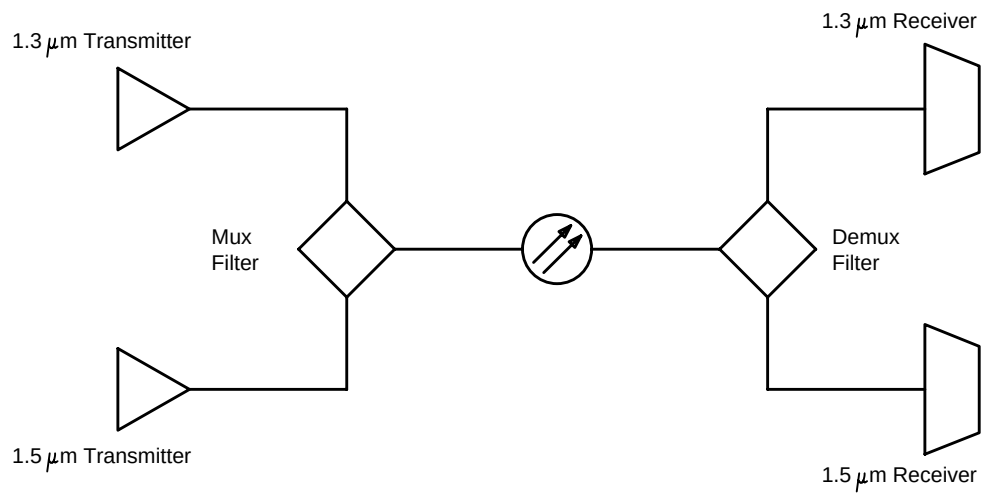


Figure 2-24. Wavelength Division Multiplexing Application (1.3 μ m/1.5 μ m)

Figure 2-25 shows WDM used in repeater sections.

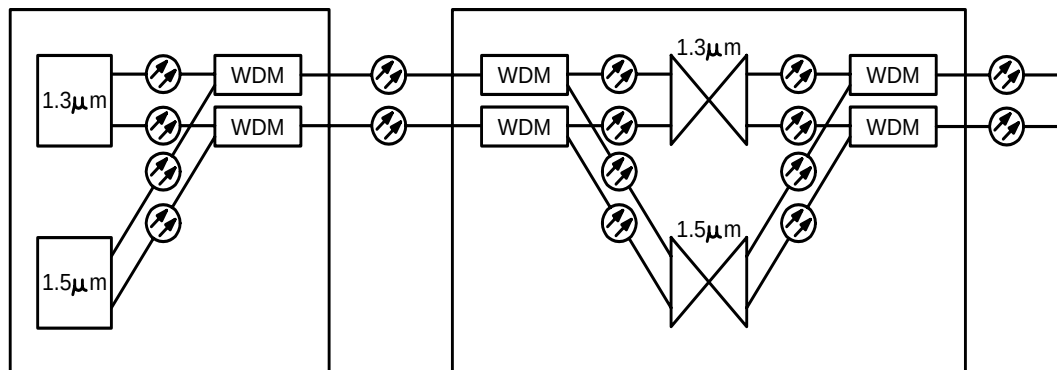


Figure 2-25. Section by Section Wavelength Division Multiplexing (1.3 μ m/1.5 μ m)

The FT-2000 OC-48 Add/Drop-Rings Terminal may be equipped with the OC48 TRMTR (A/D STS1 1.5 LBA, W1) and the OC48 TRMTR (A/D STS1 1.5 LBA, W2) circuit packs in WDM applications. The 7A WDM Filter Assembly is recommended for use with these OC48 TRMTR circuit packs.

Figure 2-26 is a detailed diagram that shows how the WDM filters multiplex and demultiplex two single-mode 1.5 μm wavelength signals with slightly different wavelengths. Thus, two FT-2000 OC-48 Lightwave Systems at the same location, each equipped for lightwave transmission at different wavelengths, can share the same fiber pair.

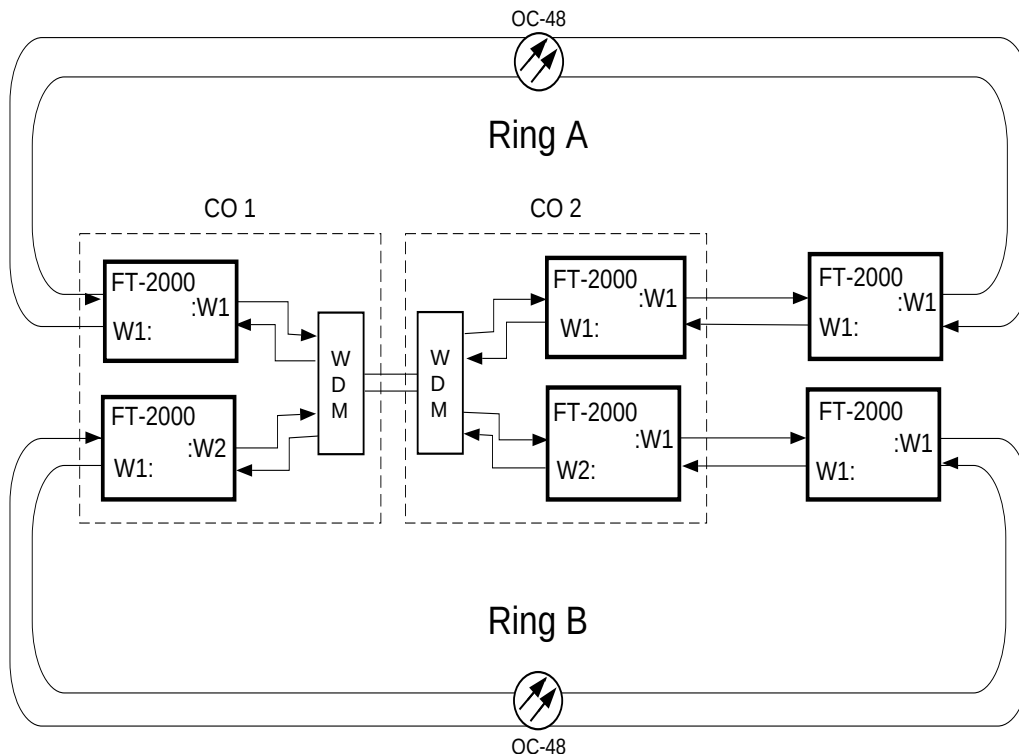


Figure 2-26. Wavelength Division Multiplexing Application (1.3 μm /1.5 μm)

The FT-2000 OC-48 Repeater Bay may be equipped with the OC48 REGENR — 1.5 μm Standard Performance (OC48 REGENR [1.5 LBA W1]) and the OC48 Regenerator - 1.5 μm Standard Performance (OC48 REGENR [1.5 LBA W2]) circuit packs when using wavelength division multiplexing. The OC48 REGENR (1.5 LBA W1) circuit pack operates at the same wavelengths as the OC48 TRMTR (A/D 1.5 LBA W1) and OC48 TRMTR (A/D STS1 1.5 LBA, W1) circuit packs. The OC48 REGENR (1.5 LBA W2) circuit pack operates at the same wavelengths as the OC48 TRMTR (A/D 1.5 LBA W2) and OC48 TRMTR (A/D STS1 1.5 LBA, W2) circuit packs.

Figure 2-27 shows WDM used in repeater sections with FT-LBA.

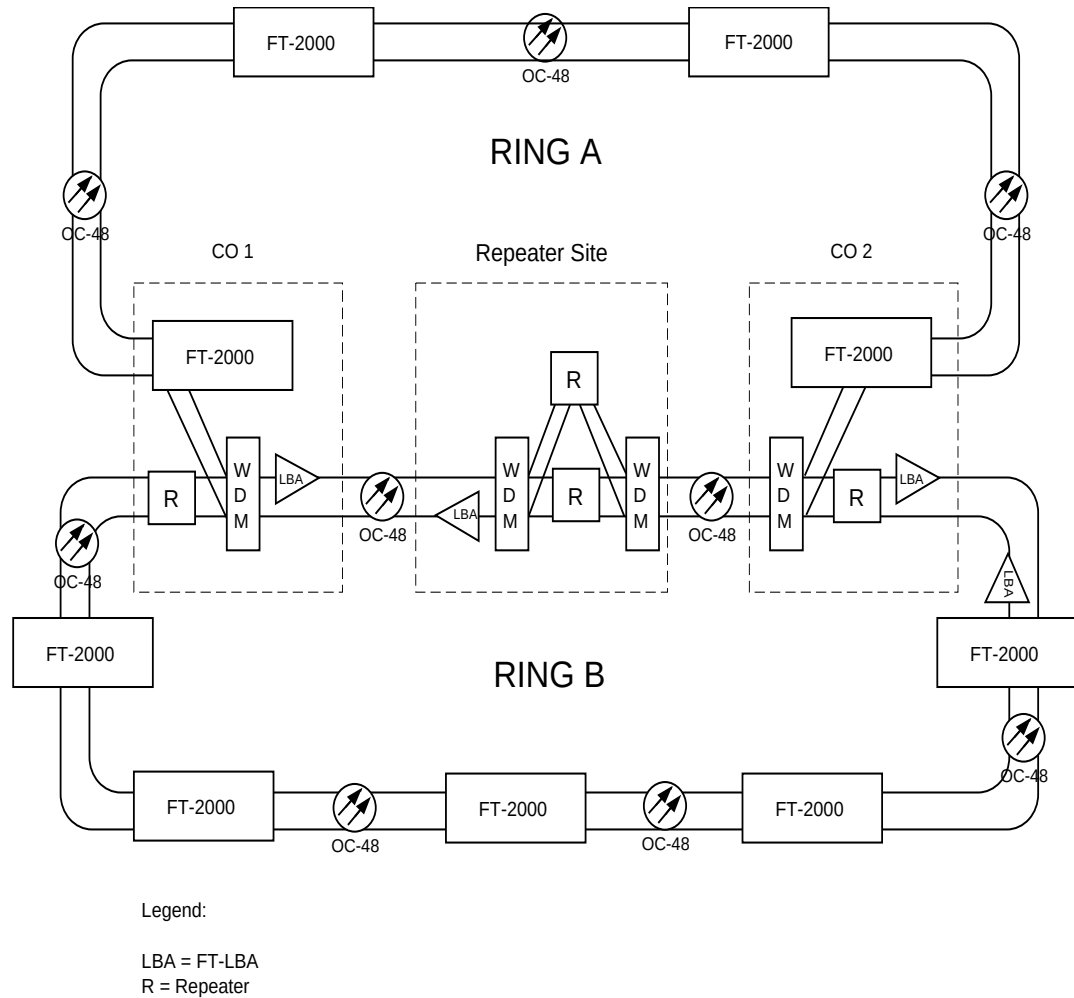


Figure 2-27. Section by Section WDM (1.5 μm/1.5 μm)



CAUTION:

In WDM applications with bidirectional OC-48 signal transmission over a single fiber, unprotected fiber or coupler failures are possible. If a fiber break or coupler failure occurs, sufficient light may be reflected from the

break to the local receiver and cause the local receiver to frame on the signal transmitted by the local transmitter (optical loopback). If an optical loopback occurs, the failure would not be detected or alarmed and not protected. The probability of this condition occurring depends on the type of fiber break and the distance between the break and receiver.

When WDM is planned for a future addition to a span, the insertion loss of the WDM devices must be properly allocated in each outside plant repeater section cable loss design. For more information about loss budgets and WDM specifications, refer to Section 10, "Technical Specifications."

For more information about operation with the FT-LBA, refer to the "FT-Lightwave Booster Amplifier (FT-LBA) for Extended Distances" application in this section.

Dense Wavelength Division Multiplexing (OLS Compatible)

DWDM is a technology that meets the customer's need for transporting more capacity per fiber. Specifically, this technology permits two or more OC-48 signals (each with a different wavelength) to be multiplexed together and simultaneously transmitted over a single fiber. The Optical Line System (OLS) is used to implement DWDM for FT-2000 OC-48 ADR. The OLS supports up to eight wavelengths in the 1.5 μm band. The channels (wavelengths) can be equipped in any order. The OLS is used to multiplex the transmission of multiple FT-2000 OC-48 ADR systems onto the same OLS lines (fiber pairs). Figure 2-28 shows how the OLS allows multiple FT-2000 OC-48 ADR systems to use the same fiber or span that have already reached fiber exhaust.

The actual multiplexing is accomplished within the Optical Line System (OLS). On the FT-2000 side, the 739E[1-8] and 739G[1-8] transmitter circuit packs provide a direct interface to the OLS product. For FT-2000 Release 7.2, these sixteen transmitters (739E1-E8 and 739G1-G8) are designed to transmit in the eight wavelengths required by OLS. These transmitters have their dispersion performance optimized for the long distances that OLS makes possible (up to 360 km with E type transmitters and 640 km with G type transmitters). The 839E5 receiver must be used at the other end of the span, consistent with OLS requirements.

When FT-2000 OC-48 ADR is used with OLS in routes for dispersion of up to 6800 ps/nm and distance up to 360 km, one of the E type (739E1-E8) transmitters must be used.

When FT-2000 OC-48 ADR is used with OLS in routes for dispersion from 6800 to 10,880 ps/nm, and up to 640 km, one of the G type (739G1-G8) transmitters must be used.

I

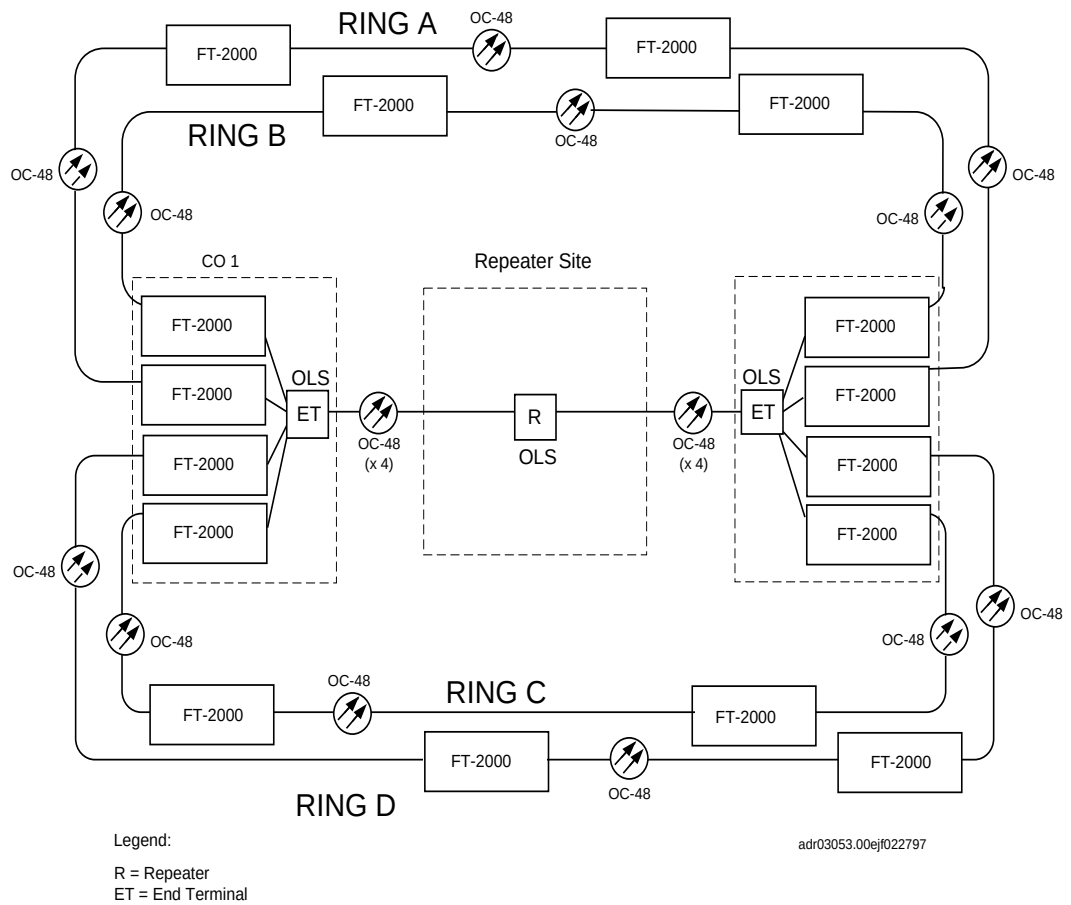


Figure 2-28. Integrated FT-2000 OC-48 ADR and DWDM/OLS System

Dense Wave Division Multiplexing (Non-OLS Compatible)

Passive DWDM systems are used in short span fiber exhaust applications. The 739H(1-16) TRMTR circuit packs are optimized for use with passive DWDM systems, and can be used with the FT-2000 Add/Drop-Rings Terminal. These 16 transmitters are designed to transmit in the 16 wavelengths required by passive 16-channel DWDM systems. The 839E5 receiver must be used at the other end of the span.

When the FT-2000 OC-48 Add/Drop-Rings Terminal is used with passive DWDM in routes for dispersion from 1525.80 to 1560.00 ps/nm, and up to 60 km, one of the 739H(1-16) transmitters must be used.

Lucent Operations Interworking

The software that resides with the subnetwork NEs must be functionally compatible with that residing on the FT-2000. And, since FT-2000 R8.1 and later supports TARP—the DDM-2000 subnetworks must also be configured with software that supports TARP. For both products, this means that OI is of the Multi-Vendor type. Therefore, Lucent Operations Interworking is generally not applicable for those rings configured with R8.1 and later software.

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Overview

This section introduces the FT-2000 OC-48 Lightwave System platforms and provides a more detailed view of the FT-2000 OC-48 Lightwave System physical design.

Introduction

The FT-2000 OC-48 Lightwave System is a flexible high-capacity lightwave system that transports digitally encoded information through single-mode optical fibers at the synchronous optical network (SONET) OC-48 signal level of 2.5 Gb/s (up to 32,256 voice channels). The FT-2000 OC-48 Lightwave System consists of several platforms. A platform is a family of equipment and software configurations designed to support a particular set of applications. These platforms include the:

- FT-2000 OC-48 Dual Lightwave Terminating Bay
- FT-2000 OC-48 Add/Drop-Rings Terminal
- FT-2000 OC-48 Repeater Bay.

These platforms enable the FT-2000 OC-48 Lightwave System to offer flexible and upgradable features for different applications in high-capacity loop, interoffice, outstate, and long-haul environments, and to provide different sets of features. The FT-2000 OC-48 Lightwave System software enables the different platforms to be upgraded with new features as they become available.

The FT-2000 Oc-48 Add/Drop-Rings Terminal has been rated DA (discontinued availability) as of December 31, 1999. Information pertaining to the ADR Terminal will remain in this User/Service Manual for those terminals still in use.

FT-2000 OC-48 Add/Drop-Rings Terminal



NOTE:

The FT-2000 OC-48 Add/Drop-Rings Terminal (E-Bay) has been rated discontinued availability (DA) as of December 31, 1999. Information concerning the ADR Terminal will remain in this user/service manual for those ADR Terminals still in use.

Equipment Packages

The FT-2000 OC-48 Add/Drop-Rings Terminal is available in the following equipment package:

- **FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings:** The FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings (Figure 3-1) consists of the FT-2000 OC-48 Enhanced Lightwave Terminating Bay (or the J68974A FT-2000 OC-48 Lightwave Terminating Bay) along with the software that was ordered.

In this equipment package, the J68974E FT-2000 OC-48 Enhanced Lightwave Terminating Bay consists of a power distribution and fuse panel, one Low-Speed Shelf — System Controller, a personal computer (PC) tray, and one Enhanced High-Speed Shelf mounted in a single seismic network bay framework.

This equipment package provides OC-48 high-speed lines 1W and 1E. The low-speed interface service capacity of an FT-2000 OC-48 Add/Drop-Rings Terminal is 48 DS3 and/or EC-1 signals, or eight 1+1 protected OC-3 signals (16 unprotected), or a mix of DS3, EC-1, OC-3, and OC-12 signals.

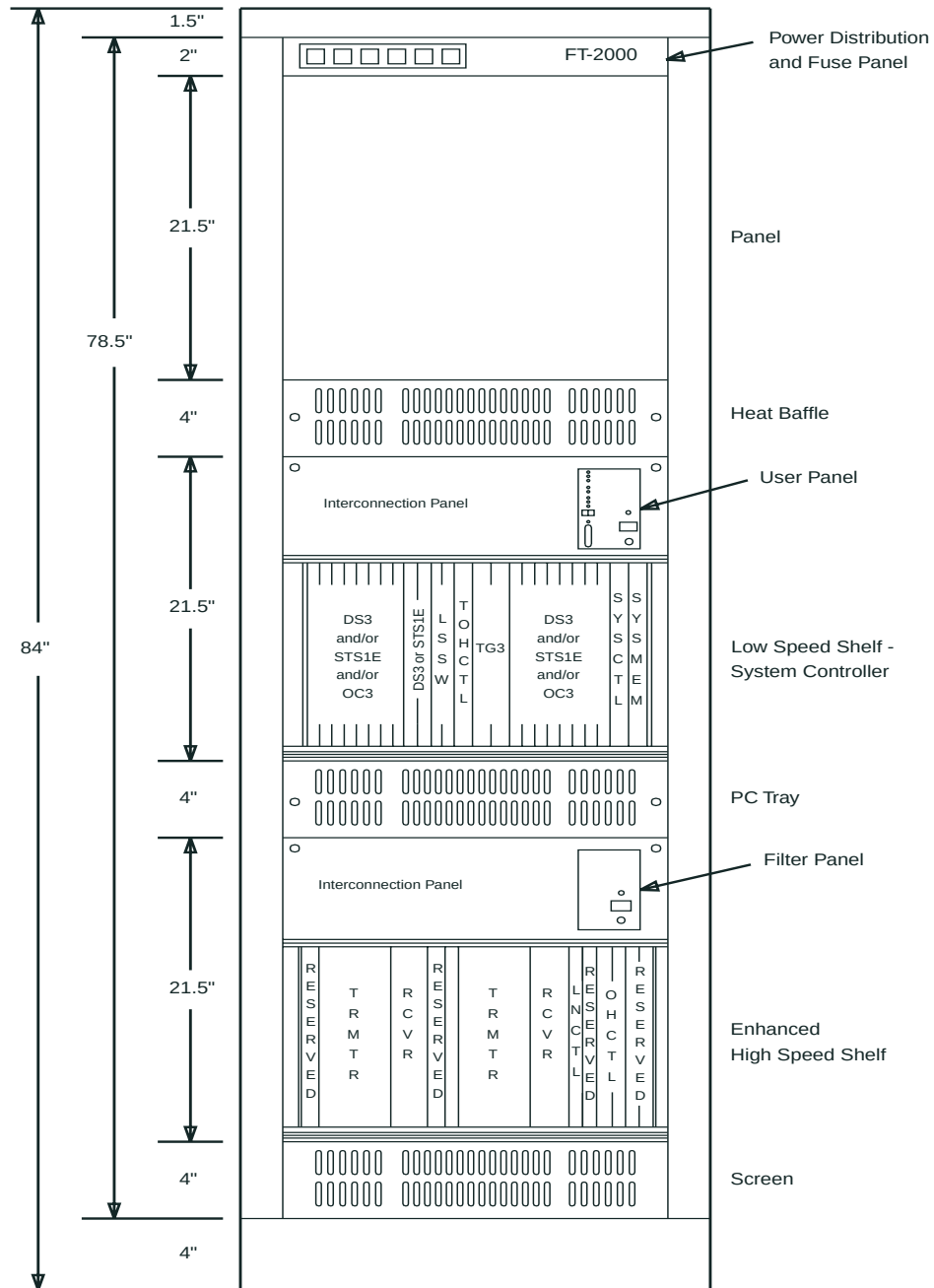


Figure 3-1. FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings (E-Bay)

Shelf Descriptions

Power Distribution and Fuse Panel

The power distribution and fuse panel (Figure 3-2) is located at the top of each FT-2000 OC-48 Lightwave System bay. It measures 2 inches high by 21.5 inches wide by 12 inches deep. The power distribution and fuse panel has a removable front cover that allows front access for shelf power connections. It accepts two 8-gauge power feeder stubs and distributes power to the shelves in the bay. The power distribution and fuse panel is also equipped with six 10-amp fuses (two for each shelf in the bay). Three fuses are for power feeder A and three fuses are for power feeder B. For more information about power distribution, refer to Section 4, "Power."

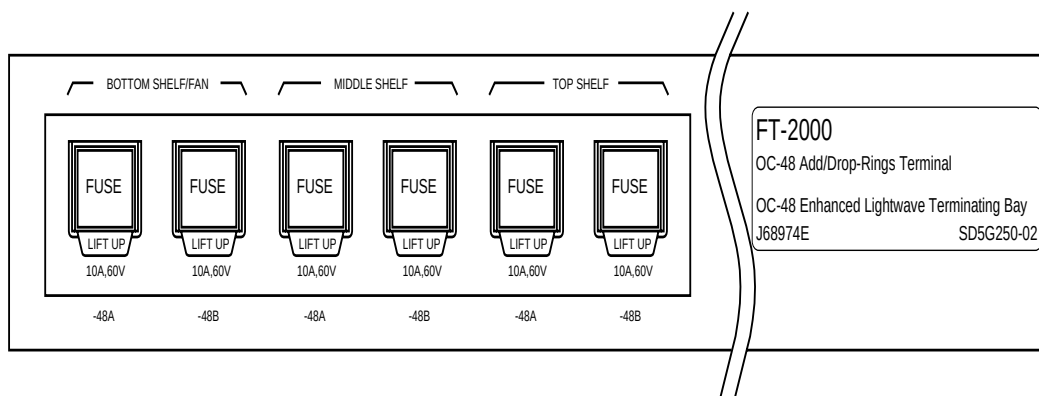


Figure 3-2. Power Distribution and Fuse Panel

Low-Speed Shelf — System Controller

Purpose of Low-Speed Shelf — System Controller

The Low-Speed Shelf — System Controller provides high-level system control functions and serves as an interface for up to 48 service DS3 and/or EC-1 signals, eight 1+1 protected OC-3 signals (16 unprotected), two 1+1 protected OC-12 signals, or a mix of DS3, EC-1, OC-3 and OC-12 signals. A single DS3 or EC-1 signal can also be cross-connected to OC-48 high-speed line 1W or 1E.

The Low-Speed Shelf — System Controller (Figure 3-3) consists of a fully connectorized interconnection panel, a USER PANEL, and 25 circuit pack slots. It measures 21.5 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide seismic network bay framework.

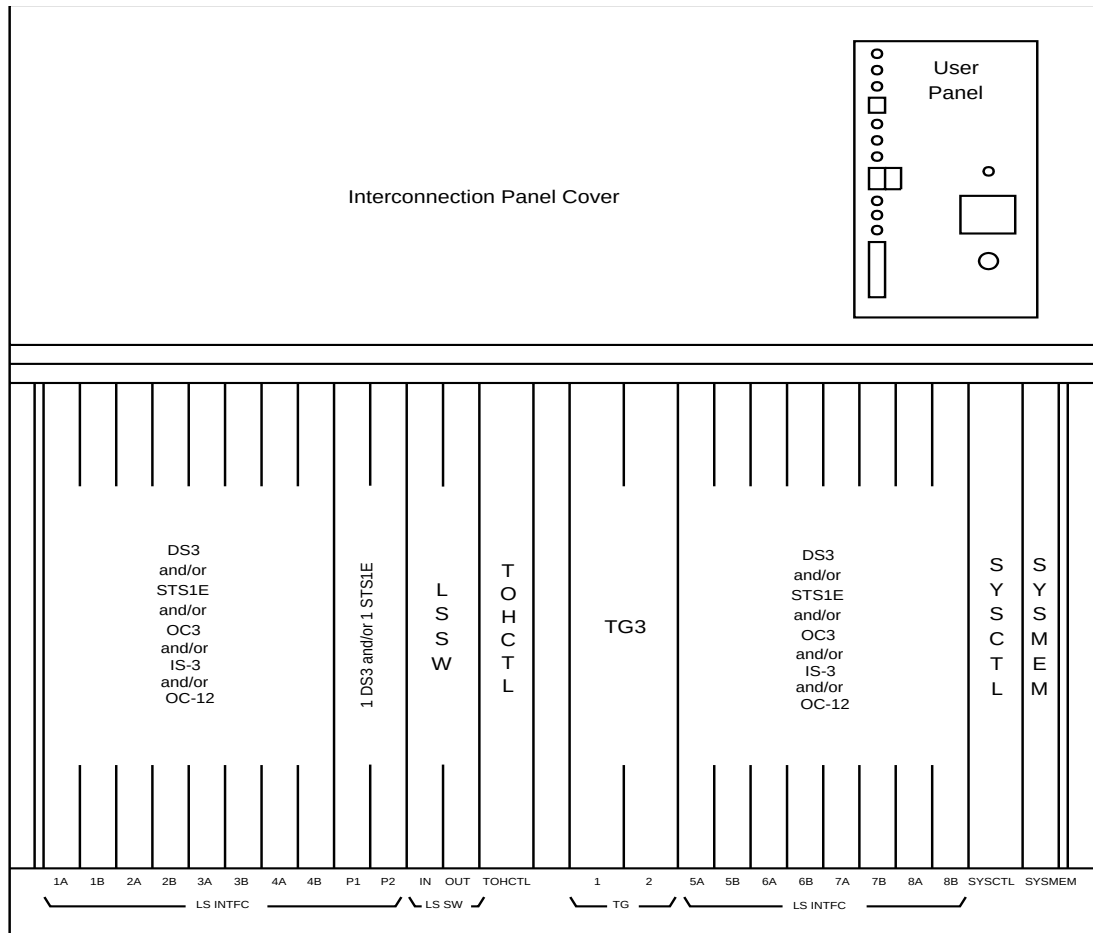
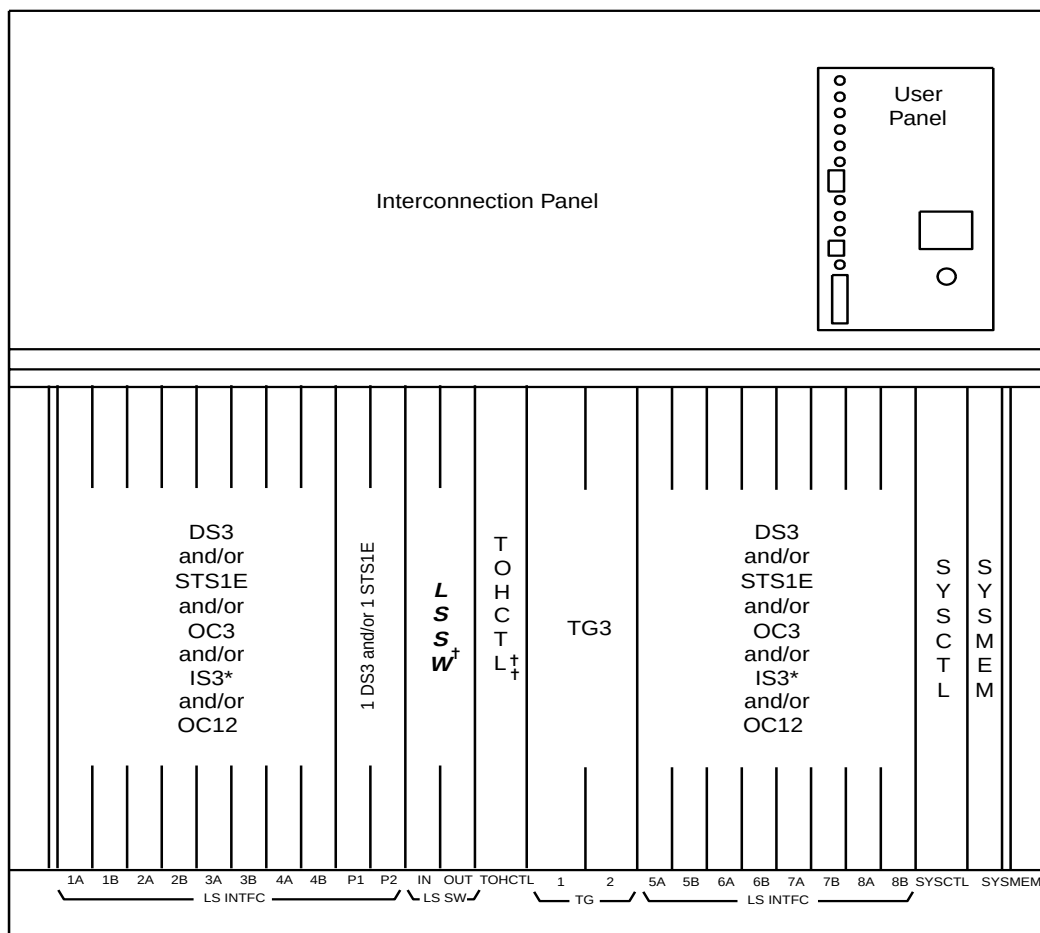


Figure 3-3. Low-Speed Shelf — System Controller (Without Circuit Pack Cover)— ED6G999-31, G5

The Low-Speed Shelf — System Controller (Figure 3-4) is functionally identical to Figure 3-3 and is its new replacement. The main distinguishing differences are: (1) a slightly modified User Panel, and (2) a fully integrated backplane that has eliminated all intra-shelf cabling.



* IS3 circuit pack is for intraoffice applications only.

† LSSW is required only if you use DS3 and/or STS1E circuit packs with low speed protection (low speed protection is strongly recommended).

‡ TOHCTL is required only if you use OC3 or OC12 circuit packs and want DCC capabilities.

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**Figure 3-4. Low-Speed Shelf — System Controller (Without Circuit Pack Cover)
— ED6G999-32, G3**

Low-Speed Shelf — System Controller Circuit Packs

The Low-Speed Shelf — System Controller (Figure 3-3) provides the following circuit pack slots:

■ **LS INTFC 1A - 8B:** Sixteen slots are provided for the following circuit packs.

- LAA2 DS3 Interface (DS3) (S1:1 or S4:4) circuit pack (service): The S1:1 DS3 circuit pack has been discontinued and replaced with the S4:4 DS3 circuit pack. The S1:1 DS3 circuit pack is NOT compatible with Release 8.1 and later software. The S4:4 DS3 circuit pack is compatible with Release 8.1 and later software.
- LAA4 STS1 Electrical Interface (STS1E) circuit pack (service):
- LAA10 OC3 Optical Interface — 1.3 μ m Standard Performance (OC3 [1.3 STD]) circuit pack (service and protection): For optional 1+1 nonrevertive protection, two OC3 (1.3 STD) circuit packs must be placed in adjacent "A" and "B" LS INTFC slots (for example, LS INTFC slots "2A" and "2B").
- LAA10B OC3 Optical Interface — 1.3 μ m Standard Performance (OC3 [1.3 STD]) circuit pack (service and protection): This circuit pack provides more effective STS-1 signal transport in loop feeder, intra-office, dual ring interworking, and OC-3 virtual ring applications by removing the restriction of dropping all STS-1 signals to the same OC3 circuit pack from the same OC-48 line. With Release 9.0.0-ADR and later software, the LAA10B (1.3 STD) circuit pack supports fully-flexible, unrestricted E/W STS-1 drops to an OC3 circuit pack as well as multi-vendor synchronization for timing distribution using the S1 byte.
- LAA5 IS-3 Optical Interface — For intra-office (within a building) applications, it is a cost effective alternative to the OC-3 Optical Interface. The IS-3 terminates one input signal, generates one output signal, and supports the transport of both STS-3 and STS-3c formats. It supports interconnection distances up to 2000-feet using multimode fiber.



NOTE:

For both 1+1 nonrevertive protection applications and transport of STS-3c, two IS-3 circuit packs must be placed in adjacent "A" and "B" LS INTFC slots (for example, LS INTFC slots "2A" and "2B").

- T939A OC-12 Optical Interface 1.3 μ m Standard Performance circuit pack (service and protection): It may be used for either intraoffice or interoffice applications. The OC-12 terminates one STS-12/STS-12c input signal and generates one STS-12/STS-12c output signal.

The OC-12 is a "quad-size" circuit pack and thus requires four adjacent low-speed slots as shown in Table 3-1.

Table 3-1. Permitted Slot Locations for the Quad Circuit Pack

OC-12 Quad	Slot Locations	Command Slot	Extension Slots	OC-12 Pack AID
1	1A-1B-2A-2B	1B	1A, 2A, 2B	ls-1b
2	3A-3B-4A-4B	3B	3A, 4A, 4B	ls-3b
3	5A-5B-6A-6B	5B	5A, 6A, 6B	ls-5b
4	7A-7B-8A-8B	7B	7A, 8A, 8B	ls-7b

**NOTE:**

Each quad location consists of one command slot and three extension slots. The command slot address is used in the OC-12 provisioning commands and for reporting any circuit pack and OC-12 signal-related alarm conditions. The extension slots are used to gain access to the STS-3 signals in conjunction with cross-connect commands. The extension slots are also used for reporting tributary related alarms.

Each low-speed shelf can support a maximum capacity of up to four OC-12 circuit packs. The four circuit packs may be configured to operate independently in an 0x1 unprotected mode or as pairs in a 1+1 protected mode. In a protected mode, the Service and Protection OC-12 packs must be inserted in quad pairs as follows:

- Quads 1 and 2, or
- Quads 3 and 4.

**NOTE:**

Quads 2 and 3 will not protect each other. Likewise, quads 1 and 4 will not protect each other.

In an all 0x1 configuration, the FT-2000 has the capacity to add/drop four OC-12 equivalents of traffic. In an all 1+1 protected configuration, the FT-2000 provides the capacity to add/drop two OC-12 equivalents of traffic. In a mixed 1+1/0x1 configuration, the capacity is three OC-12 equivalents of traffic.

- **LS INTFC P1 and P2:** Two slots are provided for one protection LAA2 DS3 circuit pack (S1:1 or S4:4) and/or one protection LAA4 STS1E circuit pack. Two DS3 or two STS1E circuit packs cannot be used. The protection DS3 and STS1E circuit packs can be placed in slot P1 or P2. The S1:1 DS3 circuit pack has been discontinued and replaced with the S4:4 DS3 circuit pack.
- **LSSW IN and OUT:** Two slots are provided for the LAA12B Low Speed Switch (LSSW) circuit packs. The LSSW circuit packs are required when DS3 and STS1E low-speed protection is desired. The LSSW circuit packs are not required if the LS INTFC slots are equipped with only OC-3/OC-12 (1.3 STD) circuit packs.

- **TOHCTL:** One slot is provided for the LAA26 Tributary - Overhead Controller (TOHCTL) circuit pack. The TOHCTL circuit pack is required when an LS INTFC slot is equipped with an OC-3/OC-12 circuit pack and single-ended operation is desired through the OC-3/OC-12 data communications channel (DCC).
- **TG 1 and 2:** Two slots are provided for the LAA17 or LAA18 Timing Generator, Stratum 3 — DS1 (TG3 [DS1]) circuit packs. The LAA17 TG3 (DS1) circuit pack has been discontinued and replaced with the LAA18 TG3 (DS1) circuit pack.
- **SYSCTL:** One slot is provided for the LAA23B System Controller (SYSCTL) circuit pack.
- **SYSMEM:** One slot is provided for the LAA25 System Memory (SYSMEM) circuit pack.

Table 3-2 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-2. Low-Speed Shelf — System Controller Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	Compatible Software			
		R7.2 of ADR	R8.1 of ADR	R9.0 of ADR	R9.1 of ADR
LS INTFC 1A-8B	LAA2 DS3, S1:1				
	LAA2 DS3, S4:4	X	X	X	X
	LAA4 STS1E	X	X	X	X
	LAA10 OC3 (1.3 STD)	X	X	X	X
	LAA10B OC3 (1.3 STD)	X	X	X	X
	LAA5 IS-3	X	X	X	X
	T939A OC-12	X	X	X	X
LS INTFC P1 and P2	LAA2 DS3, S1:1*	X	X	X	X
	LAA2 DS3, S4:4	X	X	X	X
	LAA4 STS1E	X	X	X	X
LSSW in and OUT	LAA12B LSSW††	X	X	X	X
TOHCTL	LAA26 TOHCTL	X	X	X	X
TG 1 and 2	LAA17 TG3 (DS1)†	X	X	X	X
	LAA18 TG3 (DS1)	X	X	X	X
SYSCTL	LAA23B SYSCTL	X	X	X	X
SYSMEM	LAA25 SYSMEM	X	X	X	X

* The S1:1 DS3 circuit pack has been discontinued and replaced with the S4:4 DS3 circuit pack.

† The LAA17 TG3 (DS1) circuit pack has been discontinued and replaced with the LAA18 TG3 (DS1) circuit pack.

†† The LAA12 circuit pack has been manufacture discontinued and replaced with the LAA12B circuit pack.

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

Low-Speed Shelf — System Controller Interfaces—ED6G999-31,G5

Front access cabling is provided through the interconnection panel (Figure 3-5). The interconnection panel provides the following interfaces:

- **LS INTFC 1A — 8B:** These connectors are cabled to the low-speed interface slots 1A through 8B. For example, the DS3 circuit pack in slot 1A receives three DS3 signals through the three IN connectors (1, 2, and 3) on the interconnection panel associated with slot 1A. The DS3 circuit pack in slot 1A also transmits three DS3 signals through the three OUT connectors (1, 2, and 3) associated with slot 1A. The 9A through 16B connector designations are not used on this shelf. Any LS INTFC 1A — 8B connector cabled to a slot equipped with an OC3/OC12 (1.3 STD) circuit pack is not used. For more information, refer to SD-5G250-02, *FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic* (or SD-5G250-01, *FT-2000 OC-48 Lightwave Terminating Bay Application Schematic*).
- **X.25:** This connector provides an interface to a message-based operations system that uses X.25 protocol and the TL1 message language. For more information about this message-based operations system interface, refer to Section 6, "Operations Interfaces."
- **OFFICE ALMS:** This connector provides an interface to the local office audible and visible alarms. For more information about this office alarm interface, refer to Section 6, "Operations Interfaces."
- **MISC DSCRT 1 and MISC DSCRT 2:** These connectors provide an interface to external equipment via a terminal strip. This allows an operations system to monitor and control equipment collocated with the FT-2000 OC-48 Lightwave System. For more information about this user-settable miscellaneous discrete interface, refer to Section 6, "Operations Interfaces." For detailed information about terminal strip wiring, refer to 365-575-115, *FT-2000 OC-48 Lightwave System* and SD-5G250-02, *FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic* (or SD-5G250-01, *FT-2000 OC-48 Lightwave Terminating Bay Application Schematic*).
- **CIT (DTE):** This connector provides an interface to a modem that allows dial-up access. For more information about the craft interface terminal (CIT) DTE interface, refer to Section 6, "Operations Interfaces."
- **TIMING IN PRI and TIMING IN SECY:** These connectors provide a primary (PRI) and secondary (SEC) interface to an external DS1 timing source that is required for synchronous operation. For more information about synchronization interfaces, refer to Section 5, "Control, Transmission, and Synchronization Interfaces."

- **TIMING OUT 1 and TIMING OUT 2:** These connectors provide an interface to other central office equipment that requires a DS1 timing reference signal. For more information about synchronization interfaces, refer to Section 5, "Control, Transmission, and Synchronization Interfaces."
- **CIT (DCE):** This connector provides an interface to the CIT (DCE) port on the user panel (USER PNL) that allows local access. For more information about the CIT (DCE) interface, refer to Section 6, "Operations Interfaces."
- **USER PNL DISPLAY:** This connector provides an interface to the alarm and status indicators, and also to the display on the user panel. For information about the user panel display and indicators, refer to Section 6, "Operations Interfaces."
- **PWR:** These connectors provide an interface to the –48 V power filters on the user panel. For more information about power, refer to Section 4, "Power."

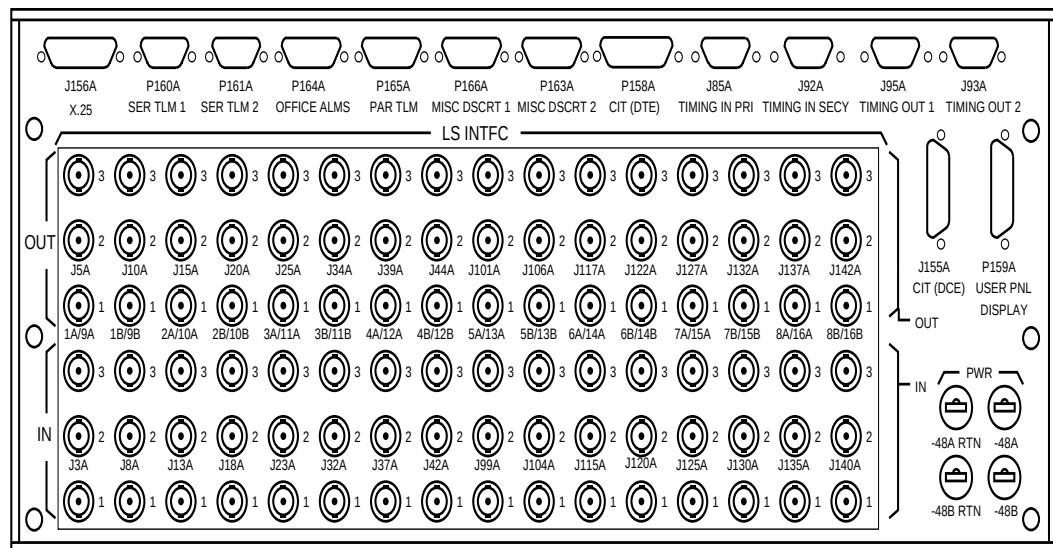


Figure 3-5. Interconnection Panel (Low-Speed Shelf — System Controller)

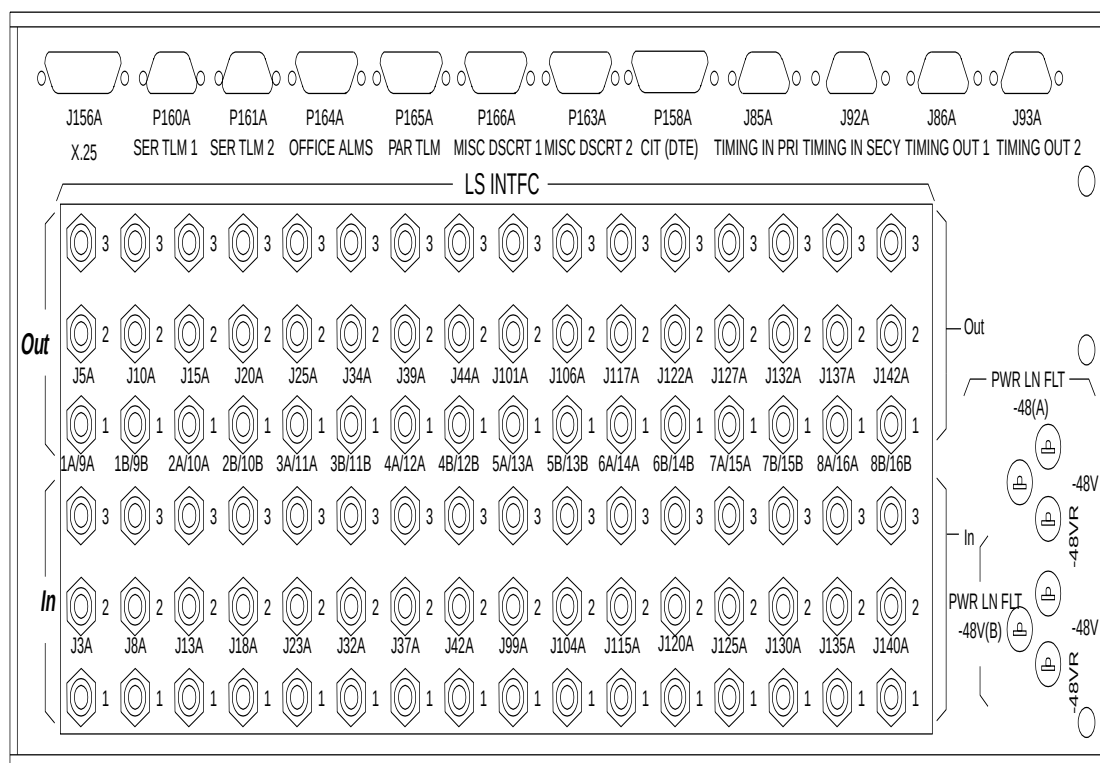
Except for power, all cabling entering the interconnection panel is connectorized with the following industry standard connectors:

- **BNC connectors:** The BNC connectors are used on all cables for electrical low-speed interfaces.
- **D-subminiature connectors:** The D-subminiature connectors are used on all cables for the operation system and central office interfaces.

The power cables are connected to radio frequency (RF) filters on the interconnection panel using push-on type connectors.

Low-Speed Shelf — System Controller Interconnect Panel—ED6G999-32,G3

The new (G3) panel provides the same basic functionality as the older (G5) panel. However, the placement of the power indicator LEDs has been rearranged. Also, the CIT and User Panel connectors have been eliminated. Figure 3-6 shows the G3 Interconnect Panel.



adr04009.01eJK040997

Figure 3-6. Interconnection Panel (Low-Speed Shelf — System Controller)—ED6G999-32,G3

The user panel (Figure 3-7) provides –48 V power filters, a power on (PWR ON) LED, an electrostatic discharge jack, and system level information. For more information about the user panel, refer to Section 6, "Operations Interfaces."

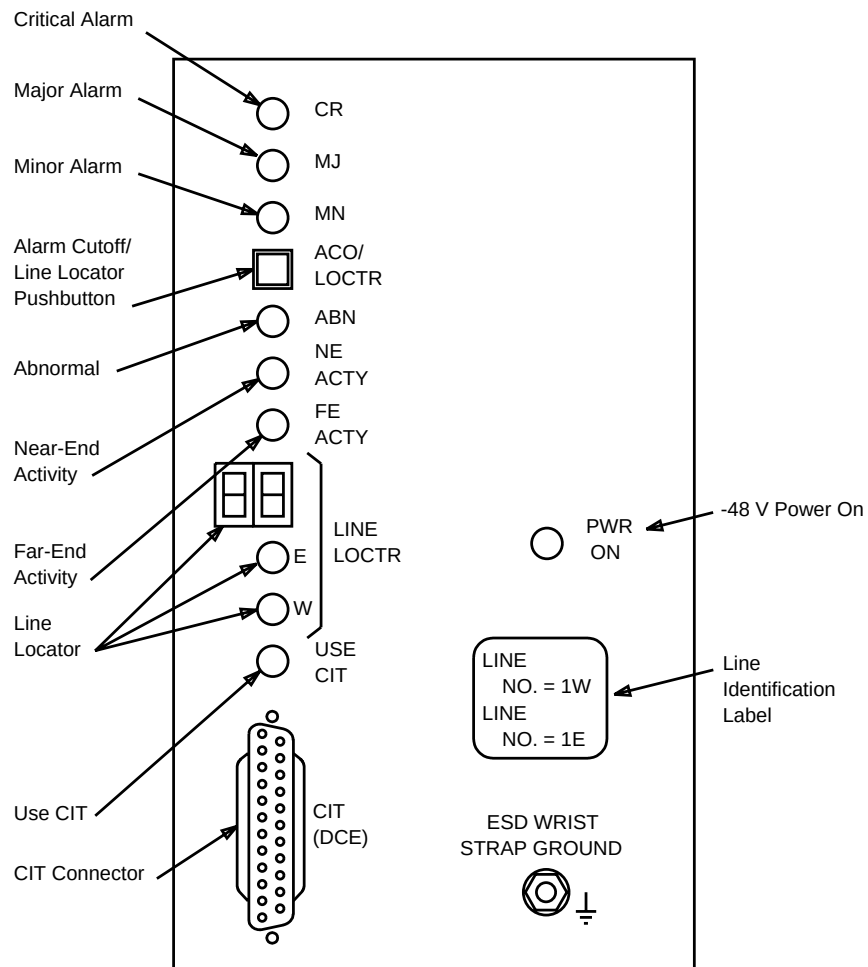


Figure 3-7. User Panel (Enhanced) ED6G999-31,G5

Functionally, the (newer) G3 User Panel is the same as the (older) G5 panel. However, there are minor physical differences. Figure 3-8 depicts the G3 user panel.

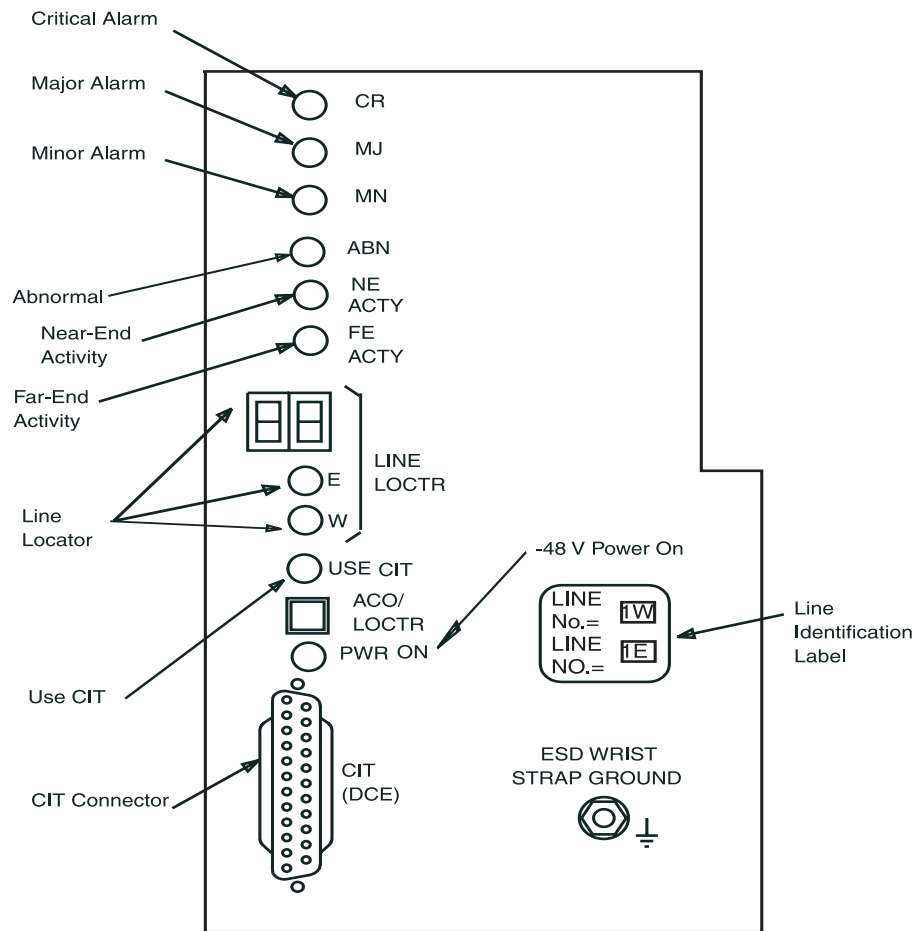


Figure 3-8. User Panel ED6G999-32,G3

The Low-Speed Shelf — System Controller has two front covers (Figure 3-9). One cover covers the interconnection panel and the other covers the circuit packs. Openings are provided in the top cover that allow the user panel to show through and provide access to the (CIT) port. The covers are hinged and can be easily removed for maintenance access.

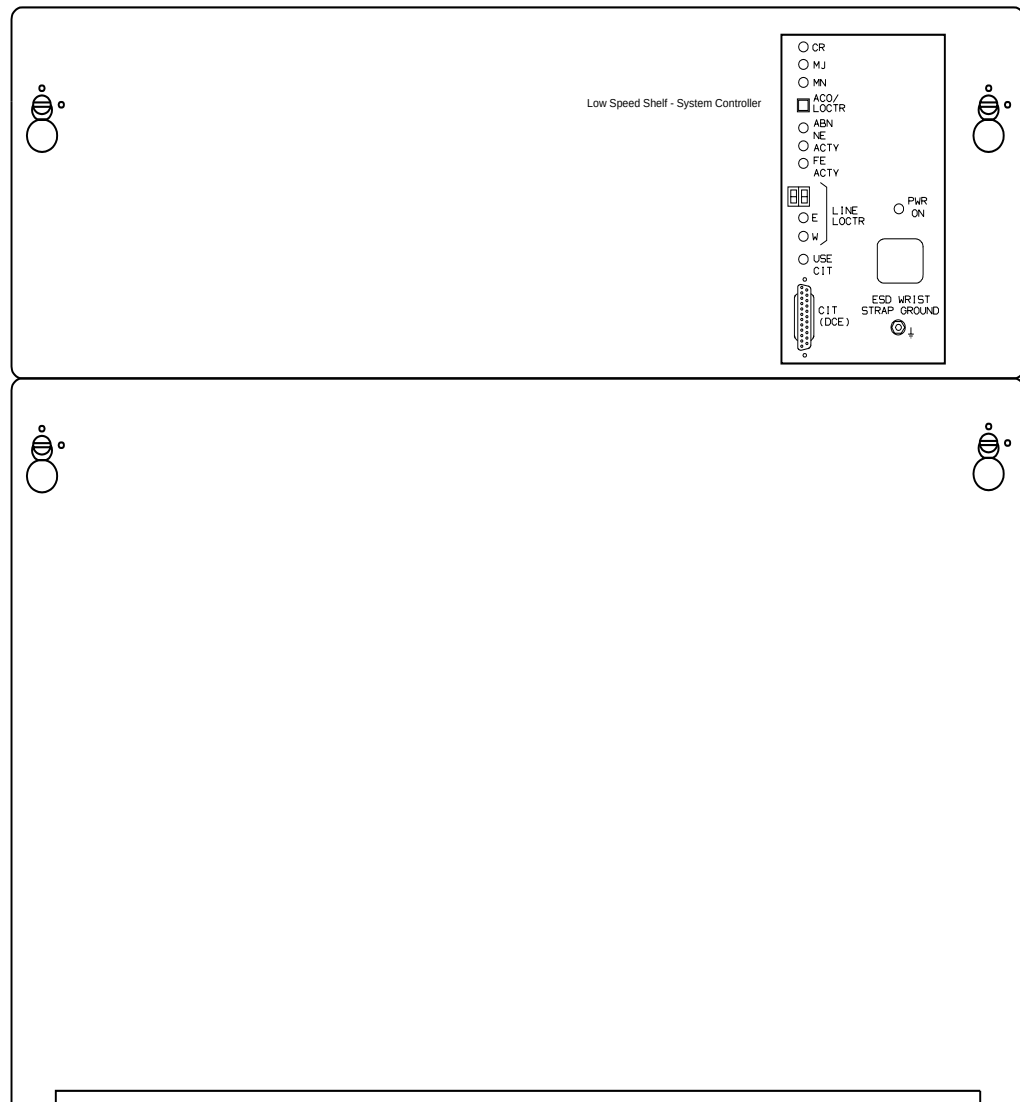


Figure 3-9. Low-Speed Shelf — System Controller (with Covers)

High-Speed Shelf

Purpose of High-Speed Shelf

The High-Speed Shelf serves as an interface for the OC-48 high-speed lines 1W and 1E. The High-Speed Shelf (Figure 3-10) consists of the fully connectorized interconnection panel, a filter panel, and eight circuit pack slots. It measures 21.5 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide network bay framework. ^{*†}

High-Speed Shelf Circuit Packs

The High-Speed Shelf (Figure 3-10) provides the following circuit pack slots:

- **TRMTR:** One slot is provided for the 739B2†, 739C2†, 739E[1-8], 739G[1-8], 739H[1-16], 739J2†, 739J3†, 739R2†, 739S2†, 739B4, 739J4, 739B5, 739C5, 739J5, 739P5, 739R5, or 739S5 OC48 Transmitter, Add/Drop [OC48 TRMTR (A/D)] circuit pack for OC-48 high-speed line.
- **RCVR:** One slot is provided for the 839B2†, 839B4B, 839B5, or 839E5 OC48 Receiver, Add/Drop (OC48 RCVR [A/D]) circuit pack for OC-48 high-speed line.

**NOTE:**

The 839E5 receiver is optimized for operation in the 1.5 μm in WDM applications with E(), G(), and H()-type transmitters. However, the 839E5 receiver will also work with all FT-2000 transmitter codes.

- **LNCTL:** One slot is provided for the LAA28 Line Controller — 4 Megabyte (LNCTL [4 MEG]) circuit pack.
- **OHCTL 1W:** One slot is provided for the LAA22 Overhead Controller — Terminal (OHCTL [TERM]) circuit pack.
- **OHCTL 1E:** One slot is provided for the LAA21 Overhead Controller — Terminal [OHCTL (TERM)] circuit pack.

* The High-Speed Shelf is used only on an FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings equipped with the J68974A FT-2000 OC-48 Lightwave Terminating Bay.

† These transmitters and receivers are DA effective 06/30/97.

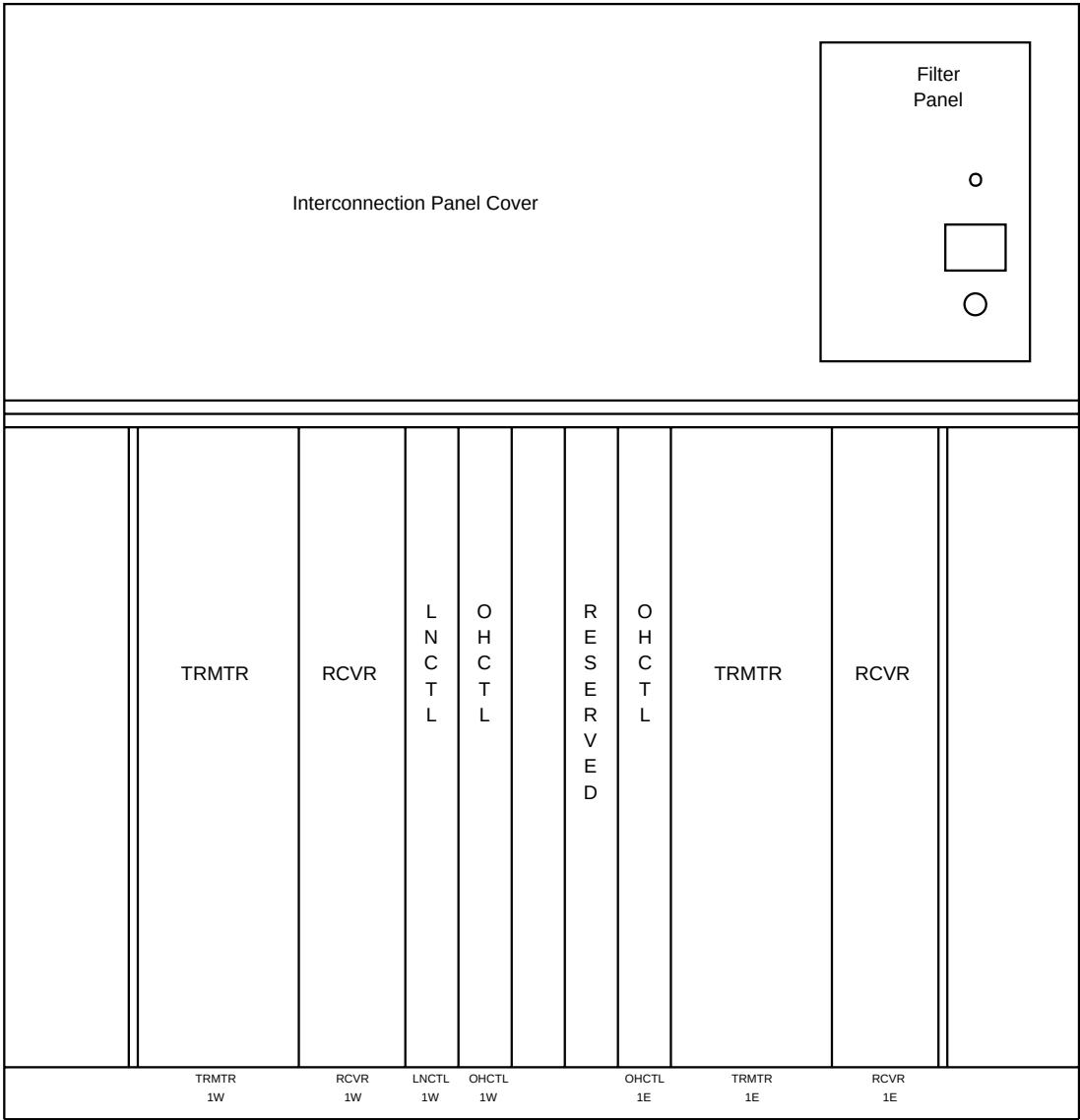


Figure 3-10. High-Speed Shelf (Without Circuit Pack Cover)

Table 3-3 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-3. High-Speed Shelf Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	ADR Compatible Software (Note)			
		R7.2	R8.1	R9.0	R9.1
TRMTR	739B2† OC48 TRMTR	DA	DA	DA	DA
	739C2† OC48 TRMTR	DA	DA	DA	DA
	739E[1-8] OC48 TRMTR	X	X	X	X
	739G[1-8] OC48 TRMTR	X	X	X	X
	739H[1-16] OC-48 TRMTR*	X	X	X	X
	739J2† OC48 TRMTR	DA	DA	DA	DA
	739J3† OC48 TRMTR	DA	DA	DA	DA
	739R2† OC48 TRMTR	DA	DA	DA	DA
	739S2† OC48 TRMTR	DA	DA	DA	DA
	739B4 OC48 TRMTR	X	X	X	X
	739J4 OC48 TRMTR	X	X	X	X
	739B5 OC48 TRMTR	X	X	X	X
	739C5 OC48 TRMTR	X	X	X	X
	739J5 OC48 TRMTR	X	X	X	X
	739P5 OC48 TRMTR	X	X	X	X
	739R5 OC48 TRMTR	X	X	X	X
	739S5 OC48 TRMTR	X	X	X	X
RCVR	839B2† OC48 RCVR	DA	DA	DA	DA
	839B4B OC48 RCVR	X	X	X	X
	839B5 OC48 RCVR	X	X	X	X
	839E5 OC48 RCVR	X	X	X	X
LNCTL	LAA28 LNCTL	X	X	X	X
OHCTL 1W	LAA22 OHCTL (TERM)	X	X	X	X
OHCTL 1E	LAA21 OHCTL (TERM)	X	X	X	X

* The 739H(1-16) OC48 TRMTR (STS-1 OC-12c 1.5 STD) were not released as part of the FT-2000 OC-48 Lightwave System Release 9.1. These circuit packs are for non-OLS compatible, passive DWDM systems.

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

High-Speed Shelf Interfaces

Front access cabling is provided through the interconnection panel (Figure 3-11).

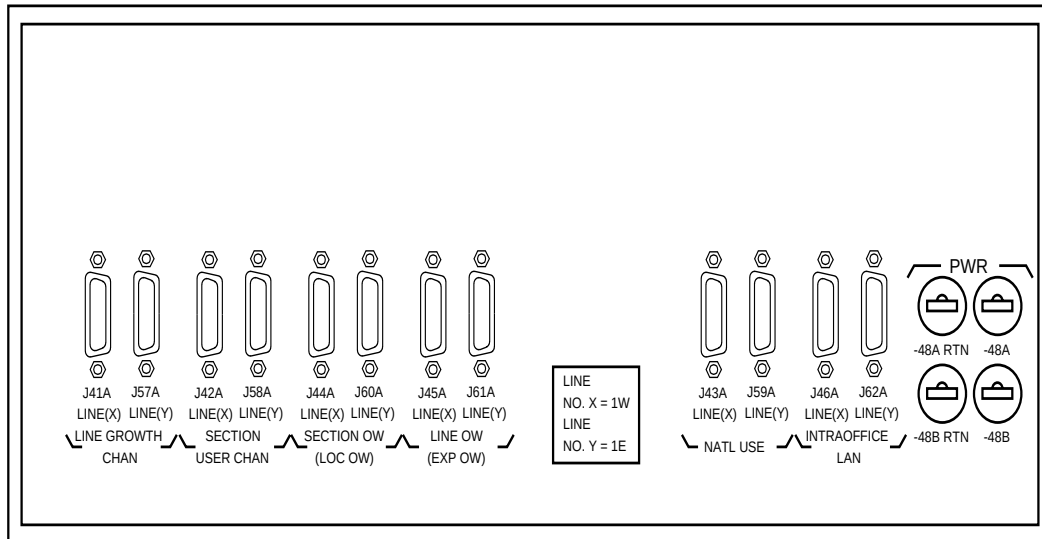


Figure 3-11. Interconnection Panel (High-Speed Shelf)

The interconnection panel provides the following interfaces:

- **LINE GROWTH CHAN LINE (X) and LINE (Y):** These connectors provide an interface that allows access to the line growth channel (Z1 and Z2 bytes) of the OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **SECTION USER CHAN LINE (X) and LINE (Y):** These connectors provide an interface that allows access to the section user channel (F1 byte) of the service and protection OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **SECTION OW (LOC OW) LINE (X) and LINE (Y):** These connectors provide an interface that allows an orderwire (OW) set access to the section orderwire (E1 byte) for voice communications. For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- **LINE OW (EXP OW) LINE (X) and LINE (Y):** These connectors provide an interface that allows an orderwire set access to the line orderwire (E2 byte) for voice communications. For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- **NATL USE LINE (X) and LINE (Y):** These connectors are not used on this shelf.
- **INTRAOFFICE LAN LINE (X) and LINE (Y):** These connectors are reserved for use in a future release.

- **PWR:** These connectors provide an interface to the –48 V power filters on the filter panel. For more information about power, refer to Section 4, "Power."

Except for power, all the cabling entering the interconnection panel is connectorized with D-subminiature connectors. The power cables are connected to RF filters on the interconnection panel using push-on type connectors.

The filter panel (Figure 3-12) provides –48 V power filters, a power on (PWR ON) LED, and an electrostatic discharge jack for the High-Speed Shelf. For more information about the filter panel, refer to Section 6, "Operations Interfaces."

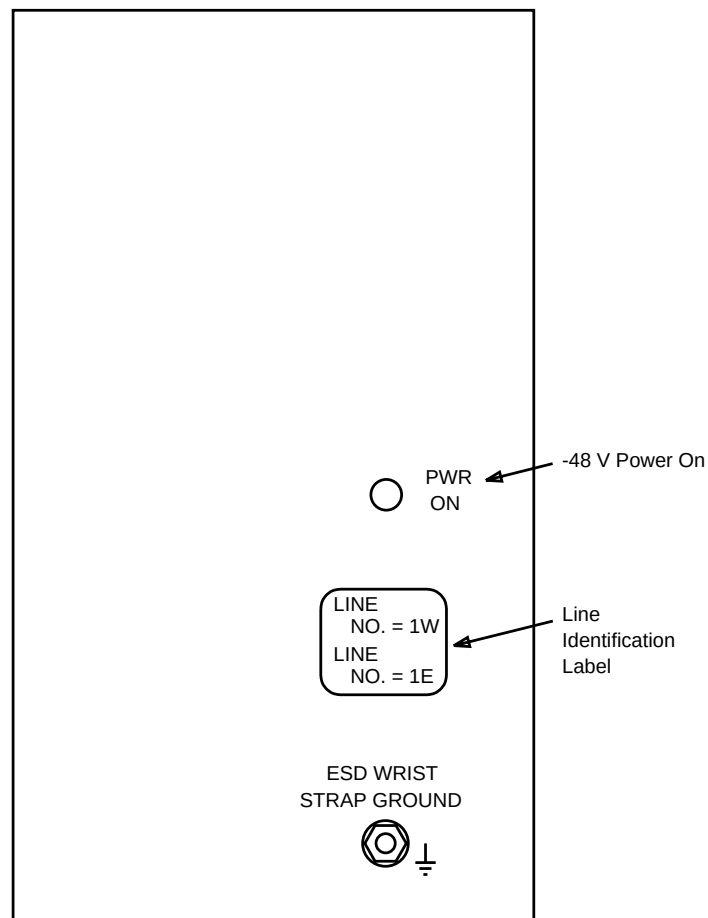


Figure 3-12. Filter Panel (High-Speed Shelf and Enhanced High-Speed Shelf)

The High-Speed Shelf has two front covers (Figure 3-13). One cover covers the interconnection panel and the other covers the circuit packs. Openings are provided in the top cover that allow the filter panel to show through. The covers are hinged and can be easily removed for maintenance access.

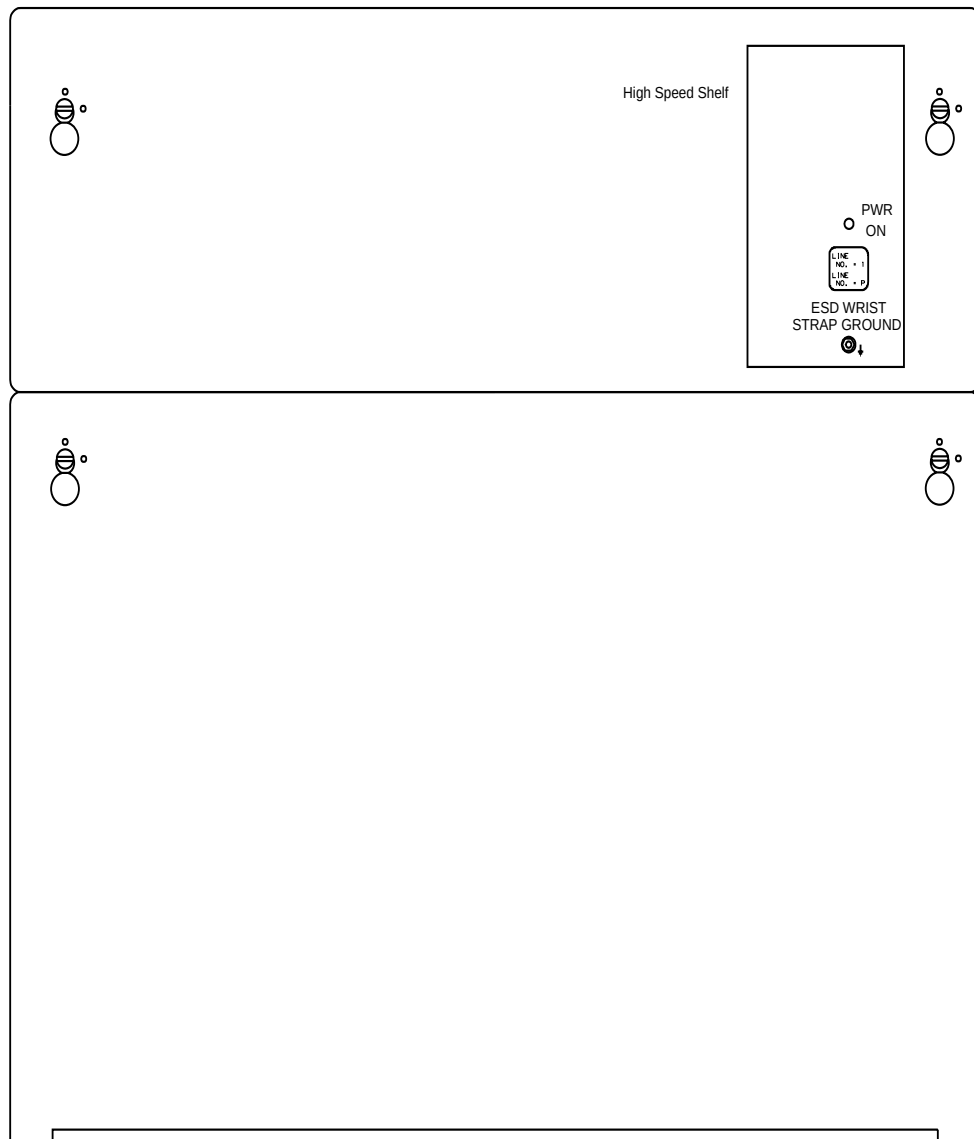


Figure 3-13. High-Speed Shelf (with Covers)

Enhanced High-Speed Shelf

Purpose of Enhanced High-Speed Shelf

The Enhanced High-Speed Shelf* serves as an interface for OC-48 high-speed lines 1W and 1E. *The Enhanced High-Speed Shelf (Figure 3-13) consists of the fully connectorized interconnection panel, a filter panel, and 12 circuit pack slots. It measures 21.5 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide network bay framework.

Enhanced High-Speed Shelf Circuit Packs

The Enhanced High-Speed Shelf (Figure 3-14) provides the following circuit pack slots:

- **TRMTR:** One slot is provided for the 739B2, 739C2, 739E[1-8], 739G[1-8], 739H[1-16], 739J2, 739J3, 739R2, 739S2 739B4, 739J4, 739B5, 739C5, 739J5, 739P5, 739R5, or 739S5 OC48 Transmitter, Add/Drop (OC48 TRMTR [A/D]) circuit pack for OC-48 high-speed line.
- **RCVR:** One slot is provided for the 839B2, 839B4B, 839B5, or 839E5 OC48 Receiver, Add/Drop (OC48 RCVR [A/D]) circuit packs for OC-48 high-speed line.

**NOTE:**

The 839E5 receiver is optimized for operation in the 1.5 μm in WDM applications with E(), G(), and H()-type transmitters. However, the 839E5 receiver will also work with all FT-2000 transmitter codes.

- **LNCTL:** One slot is provided for the LAA28 Line Controller — 4 Megabyte (LNCTL [4 MEG]) circuit pack.
- **OHCTL 1W:** One slot is provided for the LAA21 Overhead Controller — Terminal (OHCTL [TERM]) circuit pack for OC-48 high-speed line 1W.
- **OHCTL 1E:** One slot is provided for the LAA21 OHCTL (TERM) circuit pack for OC-48 high-speed line 1E.
- **LOHCTL 1W and 1E:** Two slots are reserved for the Overhead Controller - LAN (LOHCTL) circuit packs in a future release.

* The Enhanced High-Speed Shelf is used only on FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings equipped with the J68974E FT-2000 OC-48 Enhanced Lightwave Terminating Bay.

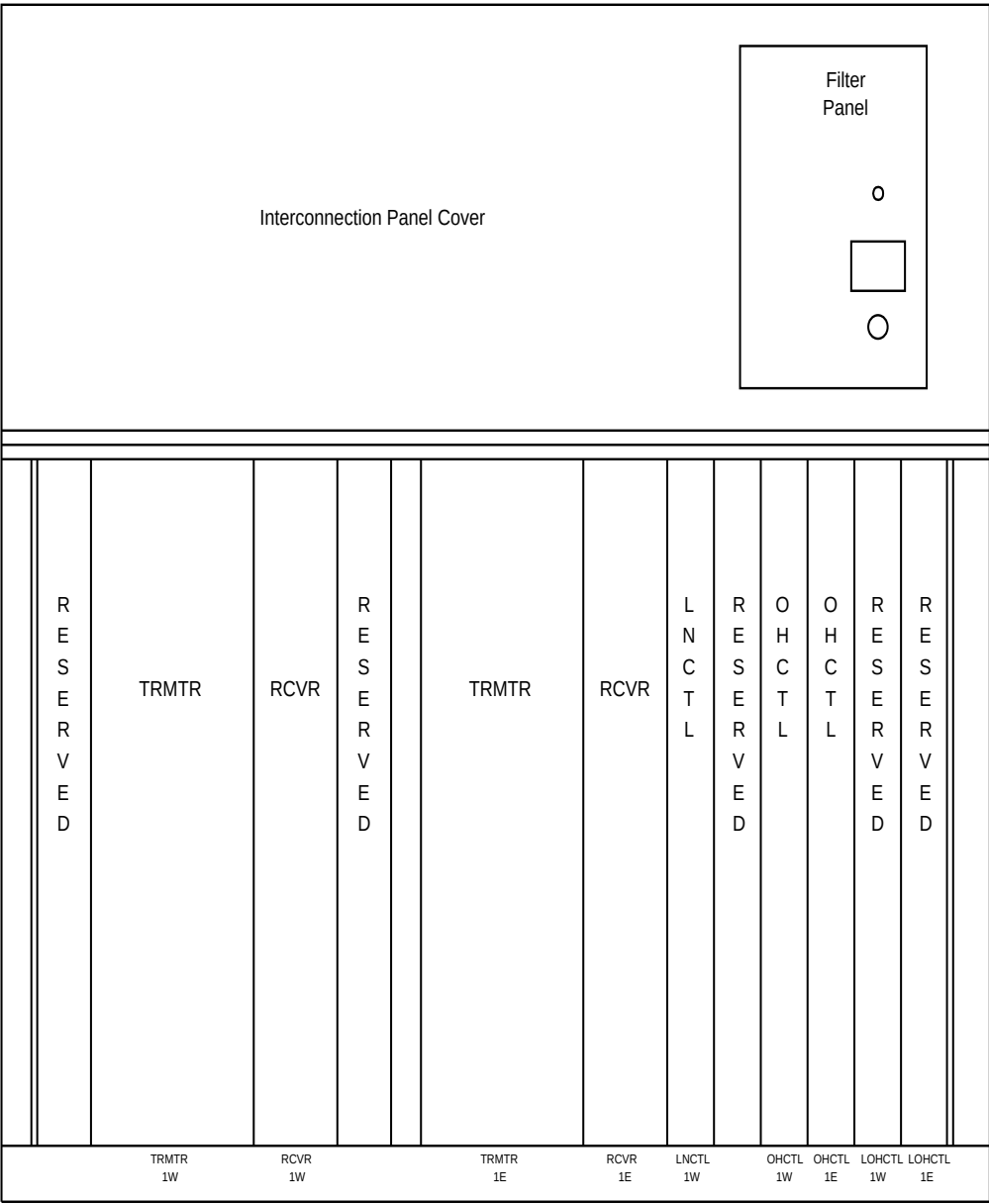


Figure 3-14. Enhanced High-Speed Shelf (Without Circuit Pack Cover)

Table 3-4 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-4. Enhanced High-Speed Shelf Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	ADR Compatible Software			
		R7.2	R8.1	R9.0	R9.1
TRMTR	739B2† OC48 TRMTR	DA	DA	DA	DA
	739C2† OC48 TRMTR	DA	DA	DA	DA
	739E[1-8] OC48 TRMTR	X	X	X	X
	739G[1-8] OC48 TRMTR	X	X	X	X
	739H[1-16] OC48 TRMTR*	X	X	X	X
	739J2† OC48 TRMTR	DA	DA	DA	DA
	739J3† OC48 TRMTR	DA	DA	DA	DA
	739R2† OC48 TRMTR	DA	DA	DA	DA
	739S2† OC48 TRMTR	DA	DA	DA	DA
	739B4 OC48 TRMTR	X	X	X	X
	739J4 OC48 TRMTR	X	X	X	X
	739B5 OC48 TRMTR	X	X	X	X
	739C5 OC48 TRMTR	X	X	X	X
	739J5 OC48 TRMTR	X	X	X	X
	739P5 OC48 TRMTR	X	X	X	X
	739R5 OC48 TRMTR	X	X	X	X
	739S5 OC48 TRMTR	X	X	X	X
RCVR	839B2† OC48 RCVR	DA	DA	DA	DA
	839B4B OC48 RCVR	X	X	X	X
	839B5 OC48 RCVR	X	X	X	X
	839E5 OC48 RCVR	X	X	X	X
LNCTL	LAA28 LNCTL	X	X	X	X
OHCTL 1W	LAA22 OHCTL (TERM)	X	X	X	X
OHCTL 1E	LAA21 OHCTL (TERM)	X	X	X	X



NOTE:

If you do not have OLS equipment in place yet and want to use the E5 receiver in the interim, the E5 receivers can be driven directly from standard FT-2000 optics (B2, B5, etc.).

* The 739H(1-16) OC48 TRMTR (STS-1 OC-12c 1.5 STD) were not released as part of the FT-2000 OC-48 Lightwave System Release 9.1. These circuit packs are for non-OLS compatible, passive DWDM systems.

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

Enhanced High-Speed Shelf Interfaces

Front access cabling is provided through the interconnection panel (Figure 3-15).

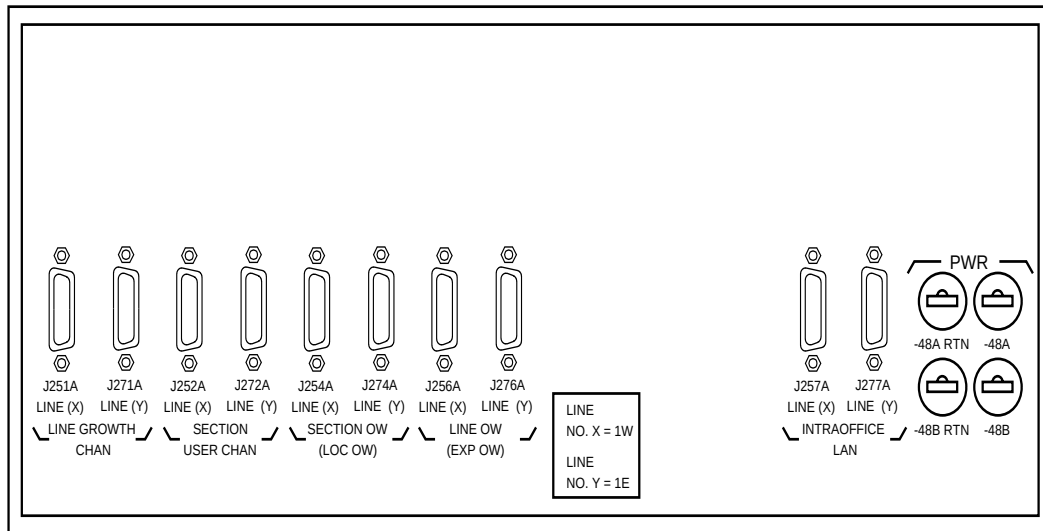


Figure 3-15. Interconnection Panel (Enhanced High-Speed Shelf)

The interconnection panel provides the following interfaces:

- **LINE GROWTH CHAN LINE (X) and LINE (Y):** These connectors provide an interface that allows access to the line growth channel (Z1 and Z2 bytes) of the OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **SECTION USER CHAN LINE (X) and LINE (Y):** These connectors provide an interface that allows access to the section user channel (F1 byte) of the service and protection OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **SECTION OW (LOC OW) LINE (X) and LINE (Y):** These connectors provide an interface that allows an orderwire set access to the section orderwire (E1 byte) for voice communications (local orderwire). For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- **LINE OW (EXP OW) LINE (X) and LINE (Y):** These connectors provide an interface that allows an orderwire set access to the line orderwire (E2 byte) for voice communications (express orderwire). For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."

- **INTRAOFFICE LAN LINE (X) and LINE (Y):** These connectors are reserved for use in a future release.
- **PWR:** These connectors provide an interface to the –48 V power filters on the filter panel. For more information about power, refer to Section 4, "Power."

Except for power, all the cabling entering the interconnection panel is connectorized with D-subminiature connectors. The power cables are connected to RF filters on the interconnection panel using push-on type connectors.

The filter panel (Figure 3-12) provides –48 V power filters, a PWR ON LED, and an electrostatic discharge jack for the Enhanced High-Speed Shelf. For more information about the filter panel, refer to Section 6, "Operations Interfaces."

The Enhanced High-Speed Shelf has two front covers (Figure 3-16). One cover covers the interconnection panel and the other covers the circuit packs. Openings are provided in the top cover that allow the filter panel to show through. The covers are hinged and can be easily removed for maintenance access.

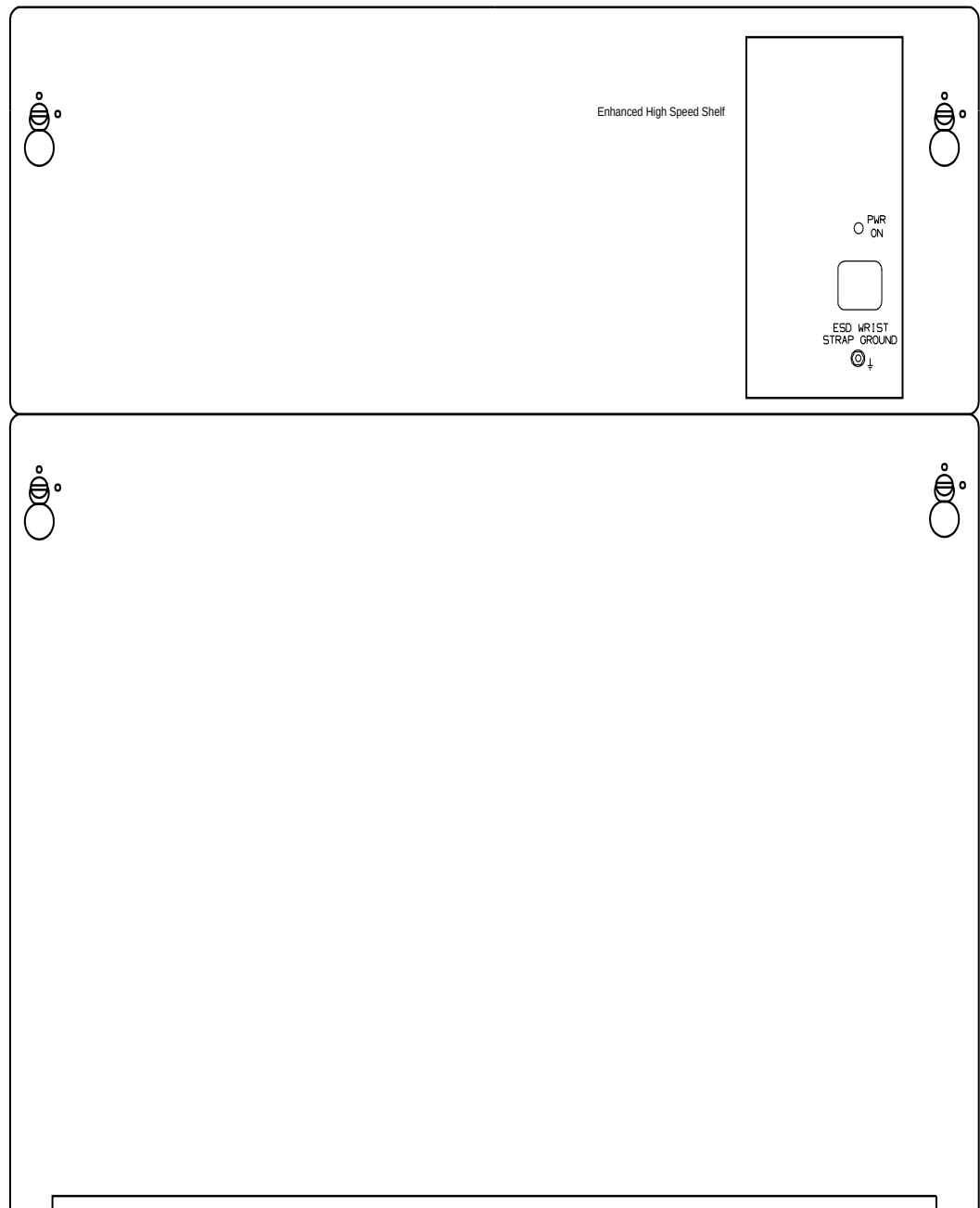


Figure 3-16. Enhanced High-Speed Shelf (with Covers)

Heat Baffle

The heat baffles prevent heat rising from the shelf below from entering the shelf above. A front cover is provided to maintain a flush appearance.

PC Tray

The PC tray is a combination PC tray and heat baffle. It provides a place to hold a portable PC (for example, the *NCR** 3170 computer) weighing up to 25 pounds and measuring up to 20 inches wide and 12 inches deep. It can also serve as a writing tray. This fixture folds into the heat baffle when not in use. A front cover is also provided to maintain a flush appearance. *

Screen

The screen provides a filter panel at the bottom of the bay and an air intake plenum for cooling purposes.

FT-2000 OC-48 Repeater (R-Bay)

Equipment Packages

The FT-2000 OC-48 Repeater Bay is available in the following equipment packages:

- **FT-2000 OC-48 Repeater Bay:** The FT-2000 OC-48 Repeater Bay (Figure 3-17) consists of the J68974R FT-2000 OC-48 Repeater Bay and the software that was ordered.

The J68974R FT-2000 OC-48 Repeater Bay consists of a power distribution and fuse panel, up to three Repeater Shelf — System Controllers, and a PC tray mounted in a single seismic network bay framework.

This equipment package supports up to six OC-48 high-speed lines.

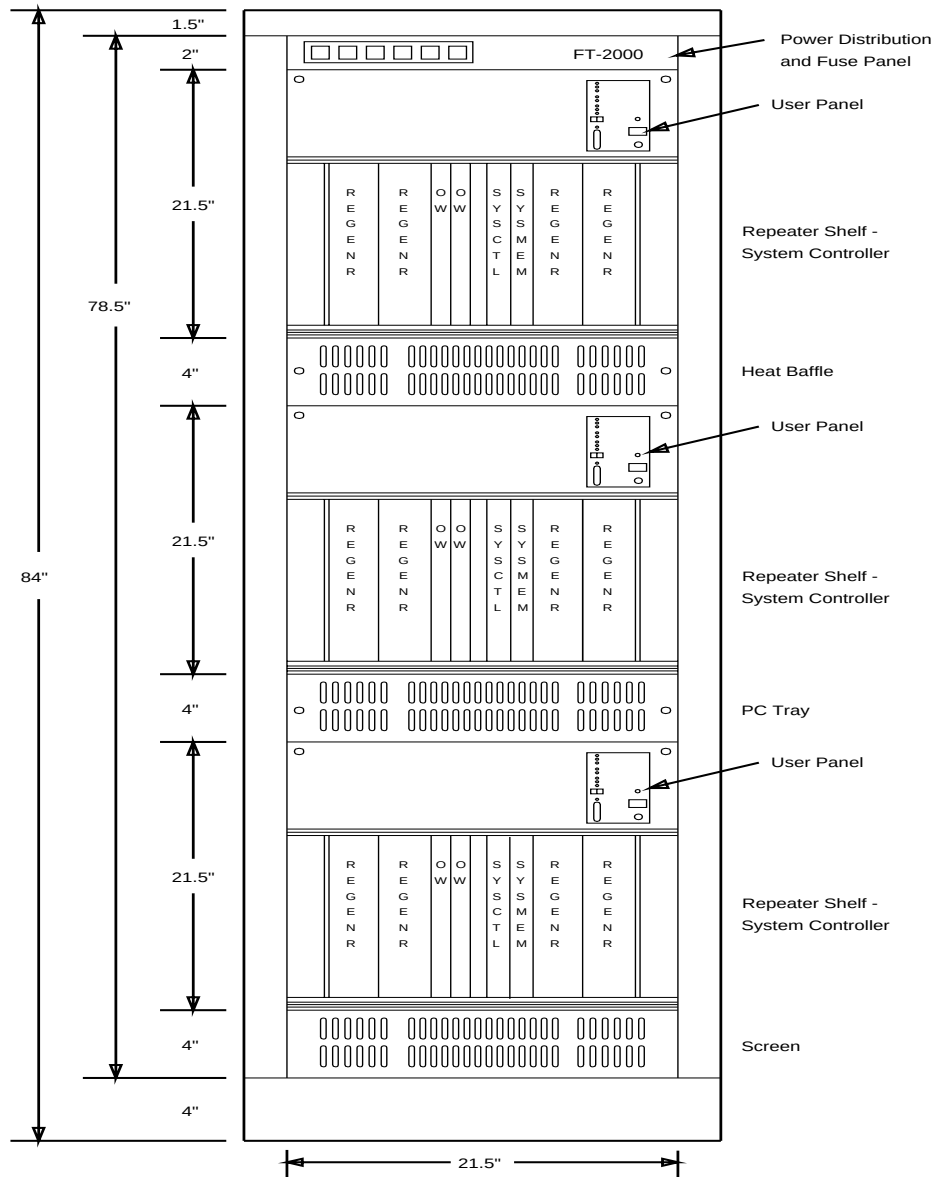
- **FT-2000 OC-48 Repeater Shelf:** The FT-2000 OC-48 Repeater Shelf (Figure 3-18) consists of a miscellaneous mounted shelf arrangement and the software that was ordered.

This shelf arrangement consists of one Repeater Shelf — System Controller, a PC tray, and a user panel equipped with two 10-amp fuses. (Power fusing is performed on the shelf level.) It is possible to mount the

* Trademark of NCR Corporation.

FT-2000 OC-48 Repeater Shelf in several types of network bay frameworks and certain *ESS*[™] switch frameworks. This shelf arrangement may be used in existing bays where space is limited or in cross route locations.

This equipment package supports two OC-48 high-speed lines.



tpa 814210/01

Figure 3-17. FT-2000 OC-48 Repeater Bay

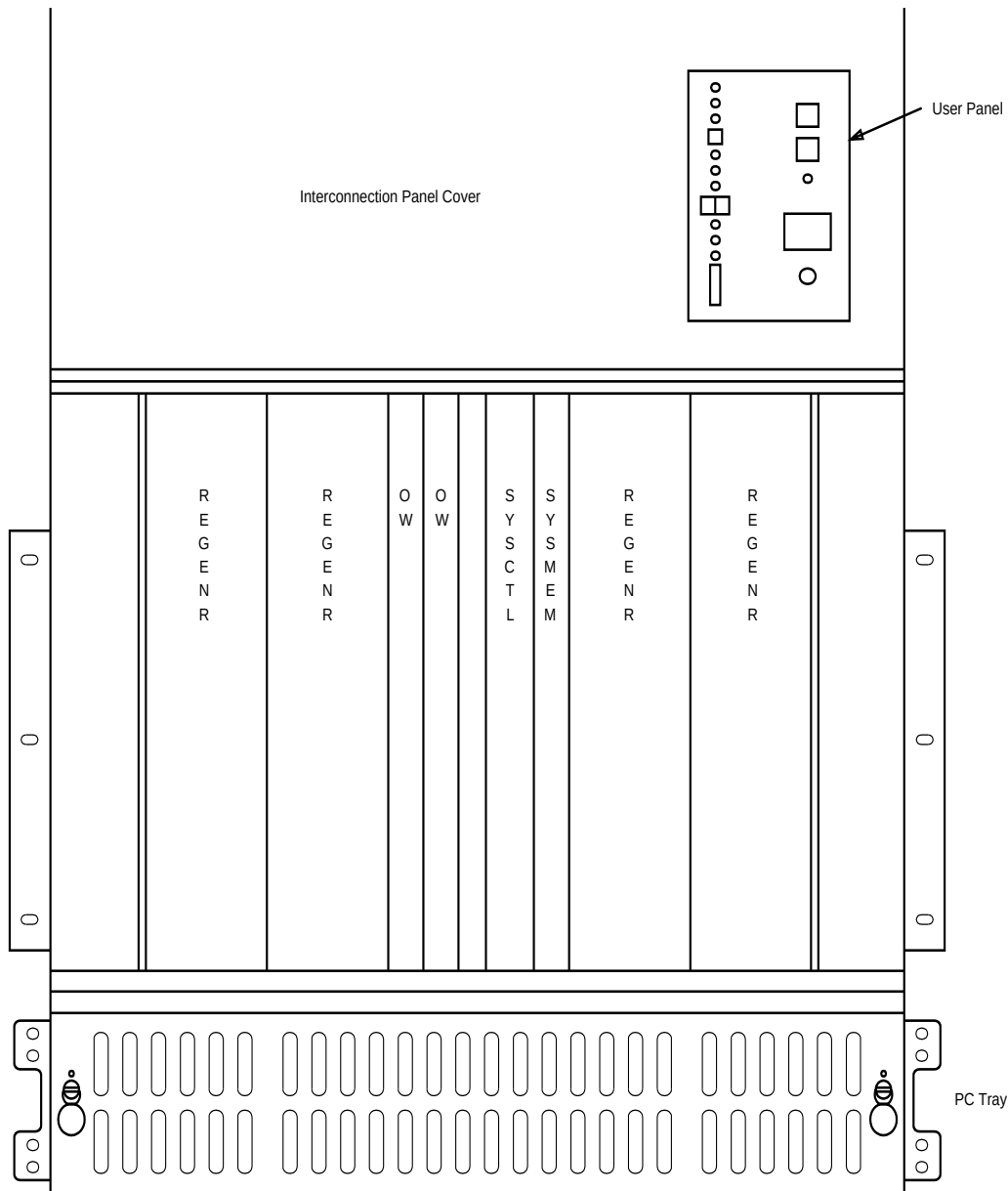


Figure 3-18. FT-2000 OC-48 Repeater Shelf (Miscellaneously Mounted)

Shelf Descriptions

Power Distribution and Fuse Panel

The power distribution and fuse panel (Figure 3-19) is located at the top of each FT-2000 OC-48 Lightwave System bay. It measures 2 inches high by 21.5 inches wide by 12 inches deep. The power distribution and fuse panel has a removable front cover that allows front access for shelf power connections. It accepts two 8-gauge power feeder stubs and distributes power to the shelves in the bay. The power distribution and fuse panel is also equipped with six 10-amp fuses (two for each shelf in the bay). Three fuses are for power feeder A and three fuses are for power feeder B. For more information about power distribution, refer to Section 4, "Power."

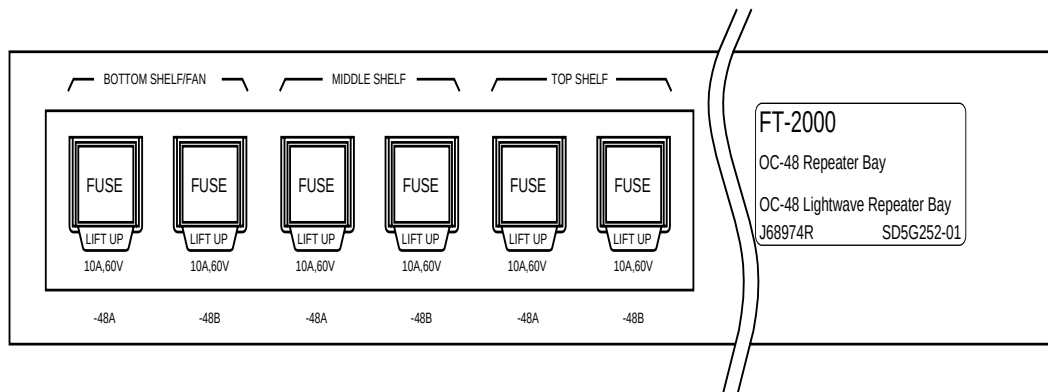
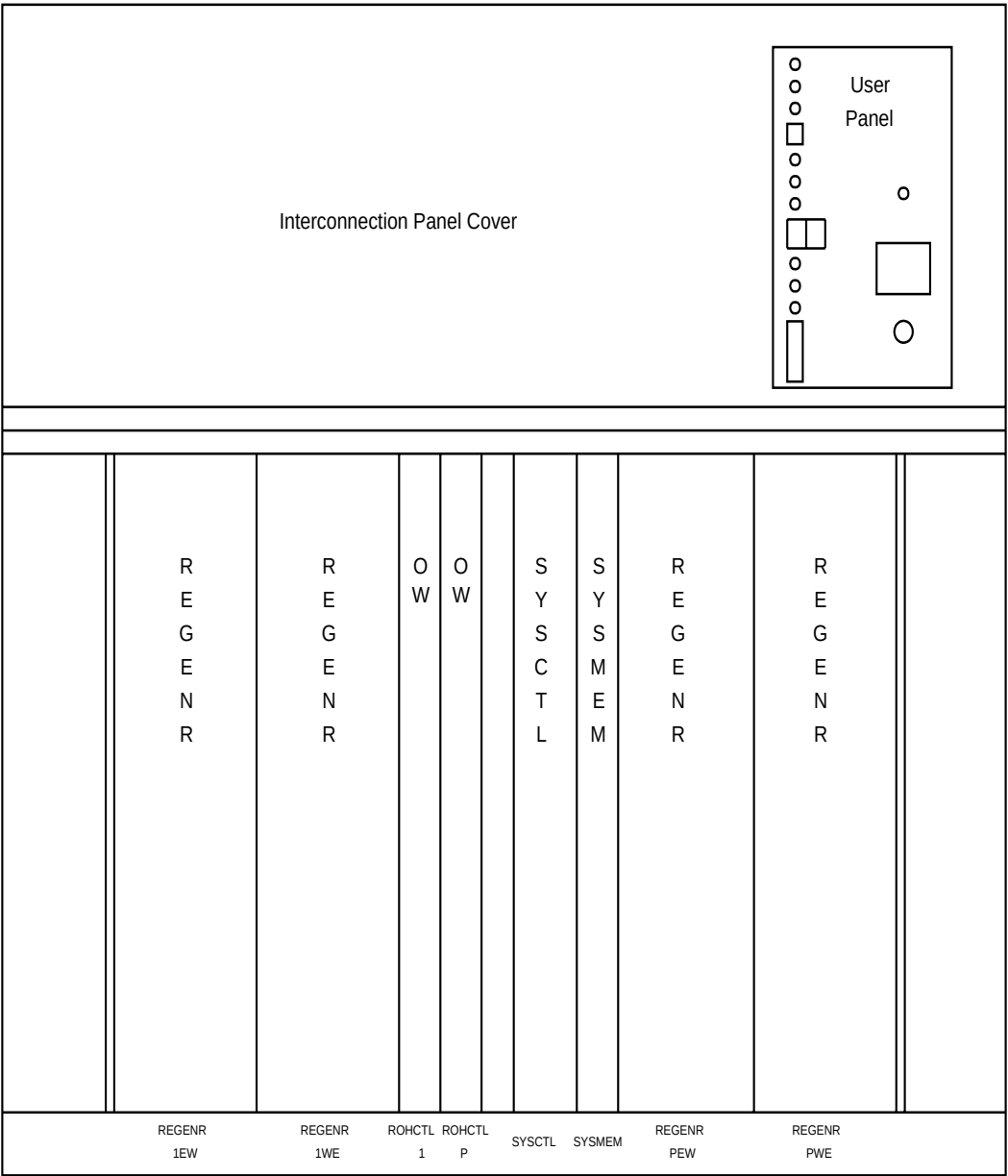


Figure 3-19. Power Distribution and Fuse Panel

Repeater Shelf — System Controller

Purpose of Repeater Shelf — System Controller

The Repeater Shelf — System Controller provides high-level system control functions and regenerates OC-48 signals for two OC-48 high-speed lines. The Repeater Shelf — SYSCTL (Figure 3-20) consists of the fully connectorized interconnection panel, a user panel, and eight circuit pack slots. It measures 21.5 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide seismic network bay framework. The miscellaneous mounted version can also be mounted in certain ESS switch frameworks.



tpa 814212/01

Figure 3-20. Repeater Shelf — System Controller (Without Circuit Pack Cover)

Repeater Shelf — System Controller Circuit Packs

The Repeater Shelf — System Controller (Figure 3-20) provides the following circuit pack slots:

- **REGENR 1EW and 1WE:** Two slots are provided for the 39B1, 39C1, 39B2, 39C2, 39J2, 39R2, or 39S2 OC48 Regenerator (OC48 REGENR) circuit packs for one OC-48 high-speed line. The 39B1 and 39C1 OC48 REGENR circuit packs were discontinued and replaced with the 39B2 and 39C2 OC48 REGENR circuit packs, respectively.
- **ROHCTL 1 and ROHCTL P:** Two slots are provided for the LAA14 Orderwire (OW) circuit pack. The LAA14 OW circuit pack is required to access the OC-48 section overhead bytes for orderwire.
- **SYSCTL:** One slot is provided for the LAA23 or LAA23B System Controller (SYSCTL) circuit pack. The LAA23 SYSCTL circuit pack has been discontinued and replaced with the LAA23B SYSCTL circuit pack.
- **SYSTEMEM:** One slot is provided for the LAA25 System Memory (SYSTEMEM) circuit pack.
- **REGENR PEW and PWE:** Two slots are provided for the 39B1, 39C1, 39B2, 39C2, 39J2, 39R2, or 39S2 OC48 Regenerator (OC48 REGENR) circuit packs for one OC-48 high-speed line. The 39B1 and 39C1 OC48 REGENR circuit packs were discontinued and replaced with the 39B2 and 39C2 OC48 REGENR circuit packs, respectively.

Table 3-5 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-5. Repeater Shelf — System Controller Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	Compatible Software (Note)		
		R2.1.0-RPTR	R4.0.0-RPTR	R6.0.0-RPTR
REGENR 1EW and 1WE	39B1 OC48 REGENR*	X	X	X
	39B2 OC48 REGENR	X	X	X
	39C1 OC48 REGENR*	X	X	X
	39C2 OC48 REGENR	X	X	X
	39J2 OC48 REGENR		X	X
	39R2 OC48 REGENR			X
	39S2 OC48 REGENR			X
ROHCTL 1 and P	LAA14 OW	X	X	X
SYSCTL	LAA23 SYSCTL†	X	X	X
	LAA23B SYSCTL	X	X	X
SYSTEMEM	LAA25 SYSTEMEM	X	X	X

 **NOTE:**
Release 2.0.1-RPTR has been discontinued.

 **NOTE:**
The ()B2 transmitters and receivers have been rated discontinued availability (DA). Replacement B2 optical packs may still be obtained through Lucent Technologies Special Customer Operations. Contact your Account Executive for more details.

* The 39B1 and 39C1 OC48 REGENR circuit packs were discontinued in December 1995.

† The LAA23 SYSCTL circuit pack has been discontinued and replaced with the LAA23B SYSCTL circuit pack.

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

Repeater Shelf — System Controller Interfaces

Front access cabling is provided through the interconnection panel (Figure 3-21).

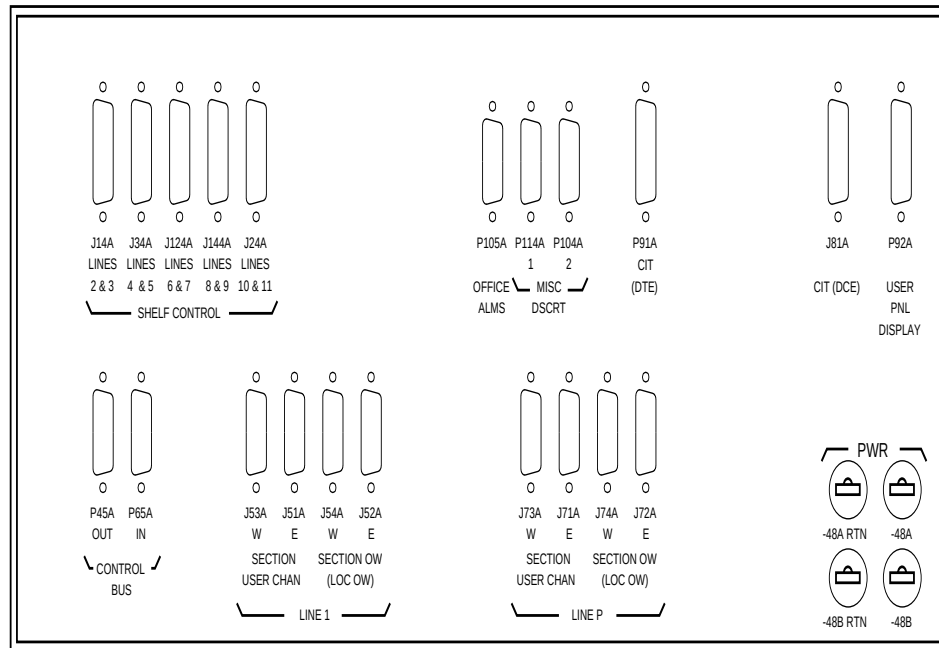


Figure 3-21. Interconnection Panel (Repeater Shelf — System Controller)

The interconnection panel provides the following interfaces:

- **SHELF CONTROL:** These connectors are reserved for use in a future release. (These connectors and the associated cabling are not provided on the miscellaneous mounted FT-2000 OC-48 Repeater Shelf.)
- **OFFICE ALMS:** This connector provides an interface to the local office audible and visible alarms. For more information about this office alarm interface, refer to Section 6, "Operations Interfaces."
- **MISC DSCRT 1 and 2:** These connectors provide an interface that allows an operations system to monitor equipment collocated with the FT-2000 OC-48 Repeater Bay. For more information about this user-settable miscellaneous discrete interface, refer to Section 6, "Operations Interfaces."

- **CIT (DTE):** This connector provides an interface to a modem that allows dial-up access. For more information about the CIT (DTE) interface, refer to Section 6, "Operations Interfaces."
 - **CIT (DCE):** This connector provides an interface to the CIT (DCE) port on the user panel that allows local access. For more information about the CIT (DCE) interface, refer to Section 6, "Operations Interfaces."
 - **USER PNL DISPLAY:** This connector provides an interface to the alarm and status indicators, and display on the user panel. For more information about the user panel display and indicators, refer to Section 6, "Operations Interfaces."
 - **CONTROL BUS OUT and IN:** These connectors are reserved for use in a future release. (These connectors and the associated cabling are not provided on the miscellaneously mounted FT-2000 OC-48 Repeater Shelf.)
 - **SECTION USER CHAN LINE 1 and LINE P:** These connectors are reserved for use in a future release.
 - **SECTION OW (LOC OW) LINE 1 and LINE P:** These connectors provide an interface that allows an orderwire set access to the section orderwire (E1 byte) for voice communications. For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- PWR:** These connectors provide an interface to the –48 V power filters on the user panel. For more information about power, refer to Section 4, "Power."

Except for power, all the cabling entering the interconnection panel is connectorized with D-subminiature connectors. The power cables are connected to RF filters on the interconnection panel using push-on type connectors.

The user panel provides –48 V power filters, a PWR ON LED, an electrostatic discharge jack, and system level information. Figure 3-22 shows the user panel for the miscellaneously mounted FT-2000 OC-48 Repeater Shelf. Figure 3-7 shows the user panel for the FT-2000 OC-48 Repeater Bay except the line identification label is the same as shown in Figure 3-22. For more information about the user panel, refer to Section 6, "Operations Interfaces."

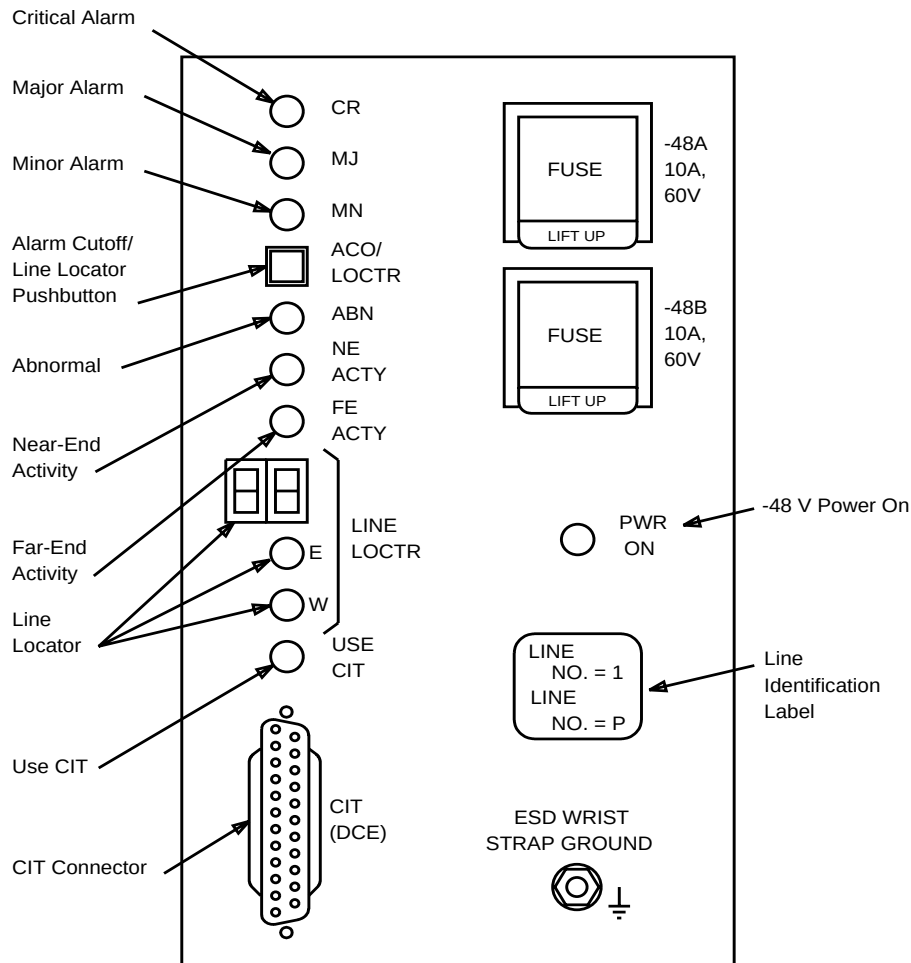


Figure 3-22. User Panel (FT-2000 OC-48 Repeater Shelf) for Miscellaneous Mounting Only

The Repeater Shelf — System Controller has two front covers. One covers the interconnection panel and the other covers the circuit packs. Openings are provided in the top cover that allow the user panel to show through and provide access to the CIT port. The covers are hinged and can be easily removed for maintenance access. Figure 3-23 shows the Repeater Shelf — System Controller with covers for the FT-2000 OC-48 Repeater Bay. Figure 3-24 shows the Repeater Shelf — System Controller with covers for the miscellaneously mounted FT-2000 OC-48 Repeater Shelf.

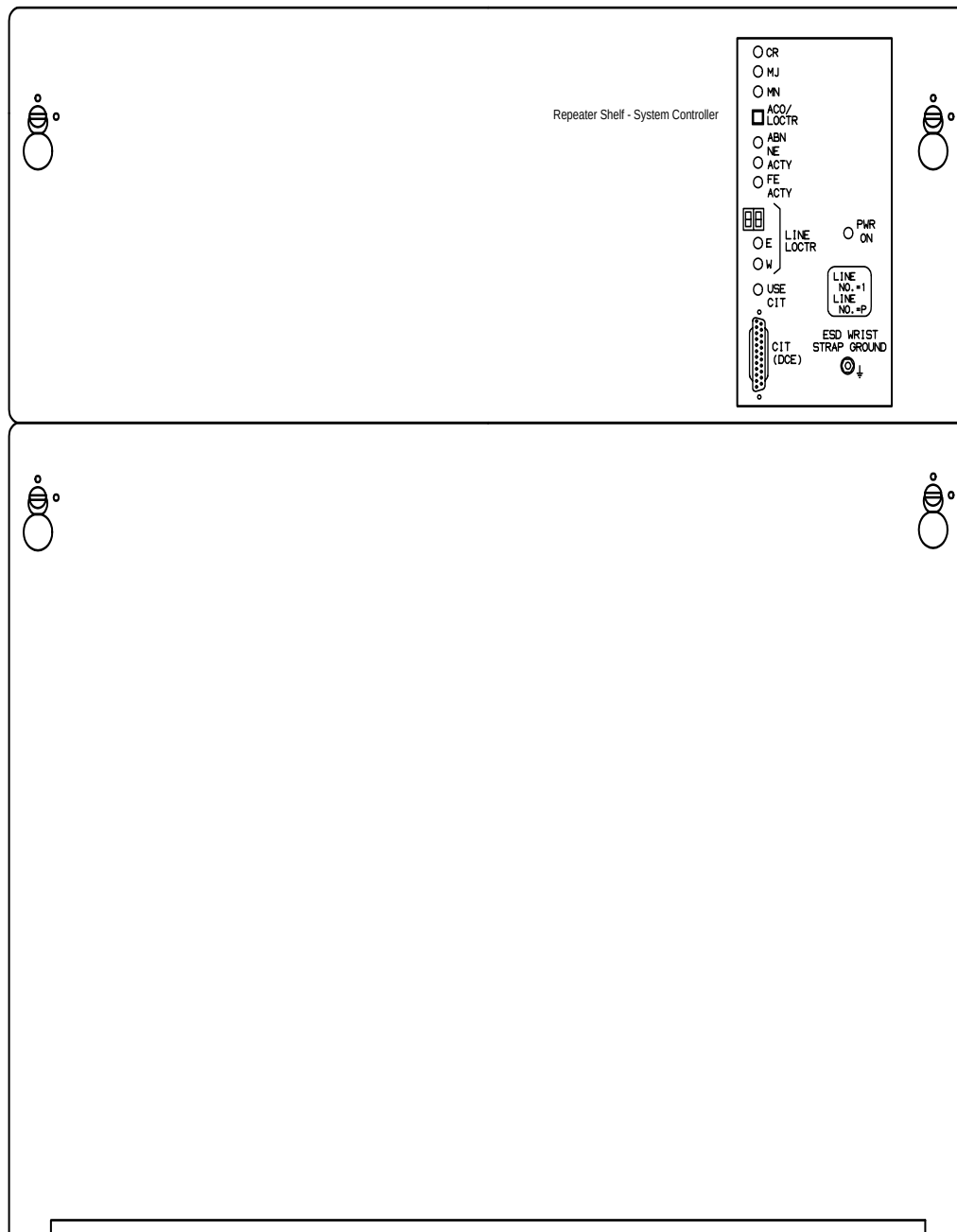


Figure 3-23. Repeater Shelf — System Controller with Covers (FT-2000 OC-48 Repeater Bay)

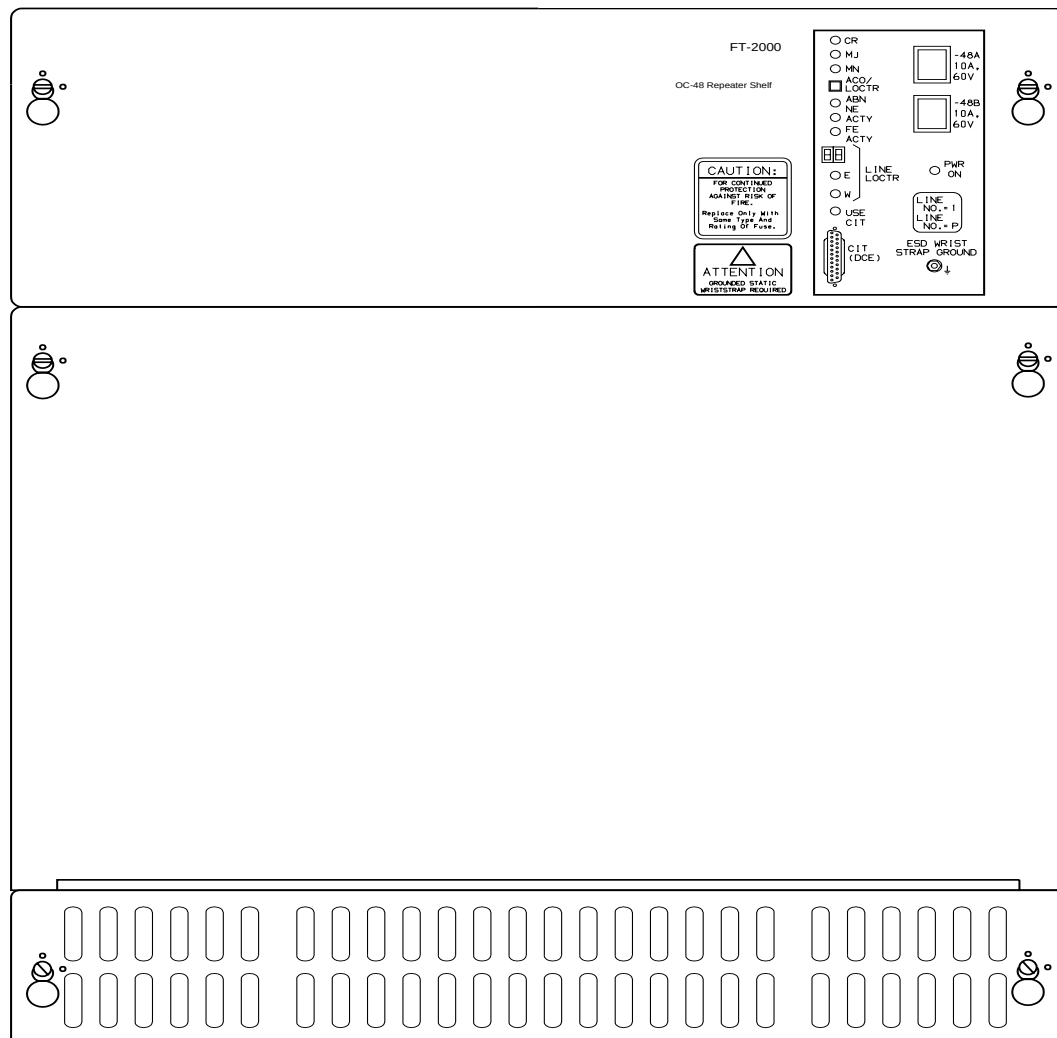


Figure 3-24. Repeater Shelf — System Controller with Covers (FT-2000 OC-48 Repeater Shelf)

Heat Baffle

The heat baffles prevent heat rising from the shelf below from entering the shelf above. A front cover is provided to maintain a flush appearance.

PC Tray

The PC tray is a combination PC tray and heat baffle. It provides a place to hold a portable PC (for example, the *NCR 3170* computer) weighing up to 25 pounds and measuring up to 20 inches wide and 12 inches deep. It can also serve as a writing tray. This fixture folds into the heat baffle when not in use. A front cover is also provided to maintain a flush appearance.

Screen

The screen provides a filter panel at the bottom of the bay and an air intake plenum for cooling purposes.

Upgrades

The FT-2000 OC-48 Repeater Bay equipped with one Repeater Shelf — System Controller can be upgraded in service with up to two additional Repeater Shelf — System Controllers.

For more information about possible upgrades, consult your local Account Executive.

For more information about the FT-2000 OC-48 Lightwave System features release plan and the availability of features, refer to 365-575-100, *FT-2000 OC-48 Lightwave System, Applications, Planning, and Ordering Guide*.

FT-2000 OC-48 Dual ADR Terminal

Equipment Packages

This equipment package is identified as J68974D. Conceptually, the Dual Bay is very similar to the Add/Drop-Rings Terminal. The main differences are:

- A modified power distribution and fuse panel
- A more compact arrangement of the circuit pack shelves
- A new high-speed shelf—which is identified as the "Condensed High-Speed Shelf"
- A new fan assembly—for forced air circulation.

This configuration includes two Low-Speed/High-Speed shelf pairs and supports two independent two-fiber ring systems. This means that the bay provides a total of 96 slots. Thus, whenever the Dual Bay is fully equipped, it is functionally equivalent to two single OC-48 Add/Drop-Rings Terminals. Figure 3-25 functionally depicts the Dual Bay.



NOTE:

In terms of operational features, there are no differences between the Add/Drop-Rings Terminal and the Dual Bay. They both require the same circuit packs and same generic software.

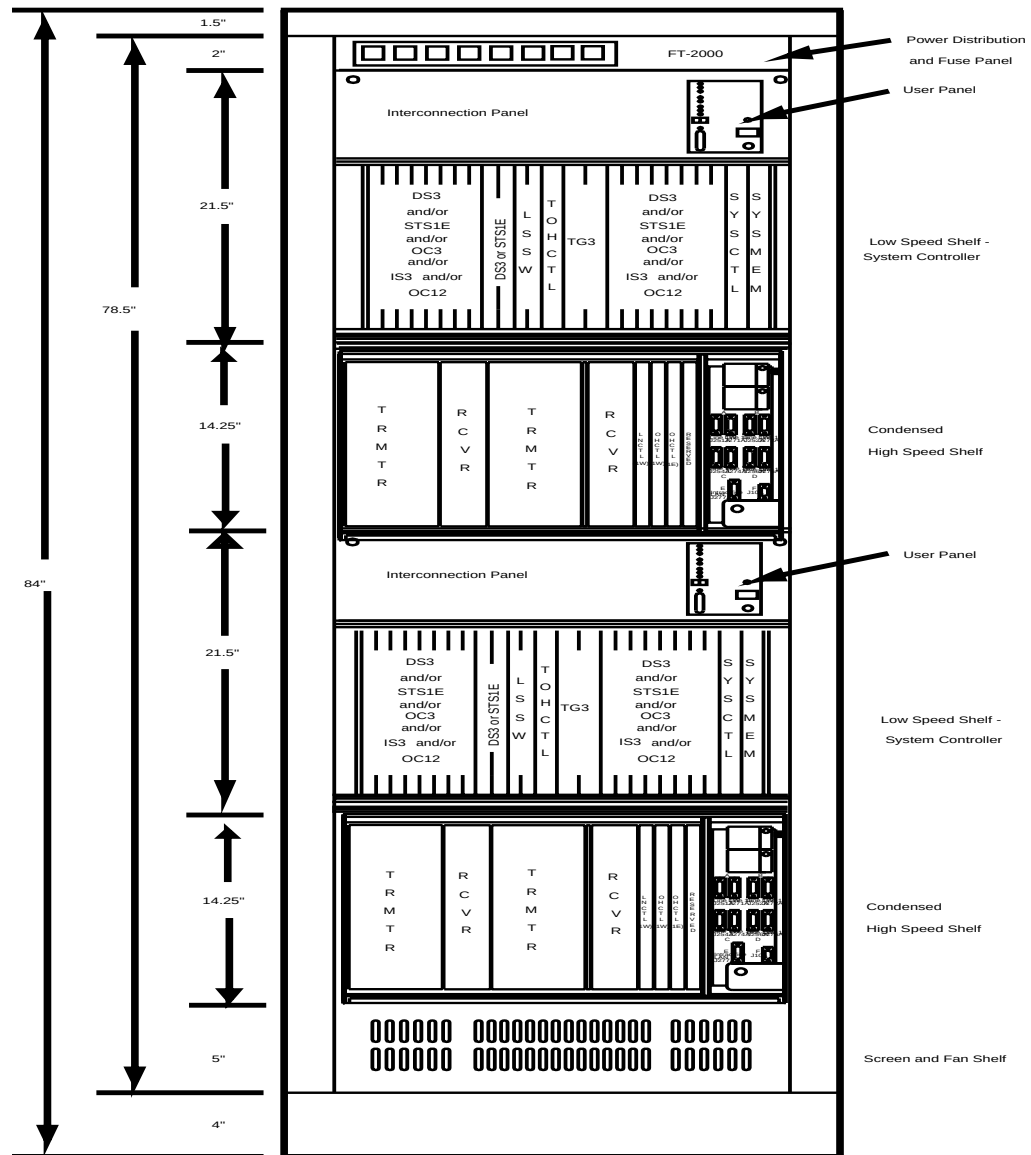


Figure 3-25. FT-2000 OC-48 Dual ADR Terminal for two-Fiber Rings

Shelf Descriptions

Power Distribution and Fuse Panel

The power distribution and fuse panel Figure 3-26 is located at the top of each FT-2000 OC-48 Dual Bay. It measures 2 inches high by 21.5 inches wide by 12 inches deep. The power distribution and fuse panel has a removable front cover that allows for shelf power connections. It accepts two 8-gauge power feeder stubs and distributes power to the shelves in the bay. The power distribution and fuse panel is also equipped with eight 10-amp fuses (two for each shelf in the bay). Four fuses are for power feeder A and four fuses are for power feeder B. For more information about power distribution refer to Section 4, "Power."

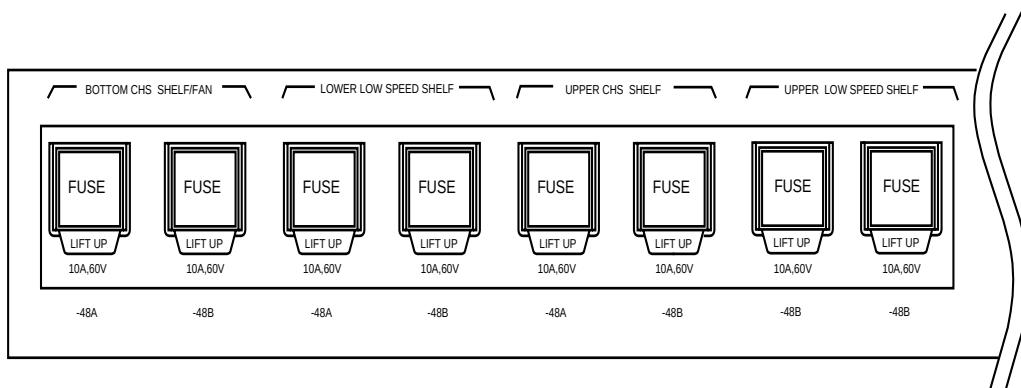


Figure 3-26. FT-2000 OC-48 D-Bay Power Distribution and Fuse Panel

Low-Speed Shelf — System Controller

Purpose of Low-Speed Shelf — System Controller

There are no differences between the Low-Speed Shelf(s) used in the Add/Drop-Rings Terminal and Dual Bay. Each low-speed shelf — System Controller provides high-level system control functions and serves as an interface for up to 48 service DS3 and or EC-1 signals, eight 1+1 protected OC-3 signals (16 unprotected), two 1+1 protected OC-12 signals, or a mix of DS3, EC-1, OC-3 and OC-12 signals. All of these Low-Speed signals can be cross-connected to either the 1W or 1E high-speed line.

The Low-Speed Shelf — System Controller (Figure 3-26) consists of a fully connectorized interconnection panel, a user panel, and 25 circuit pack slots. It

measures 21.5 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide seismic network bay framework.

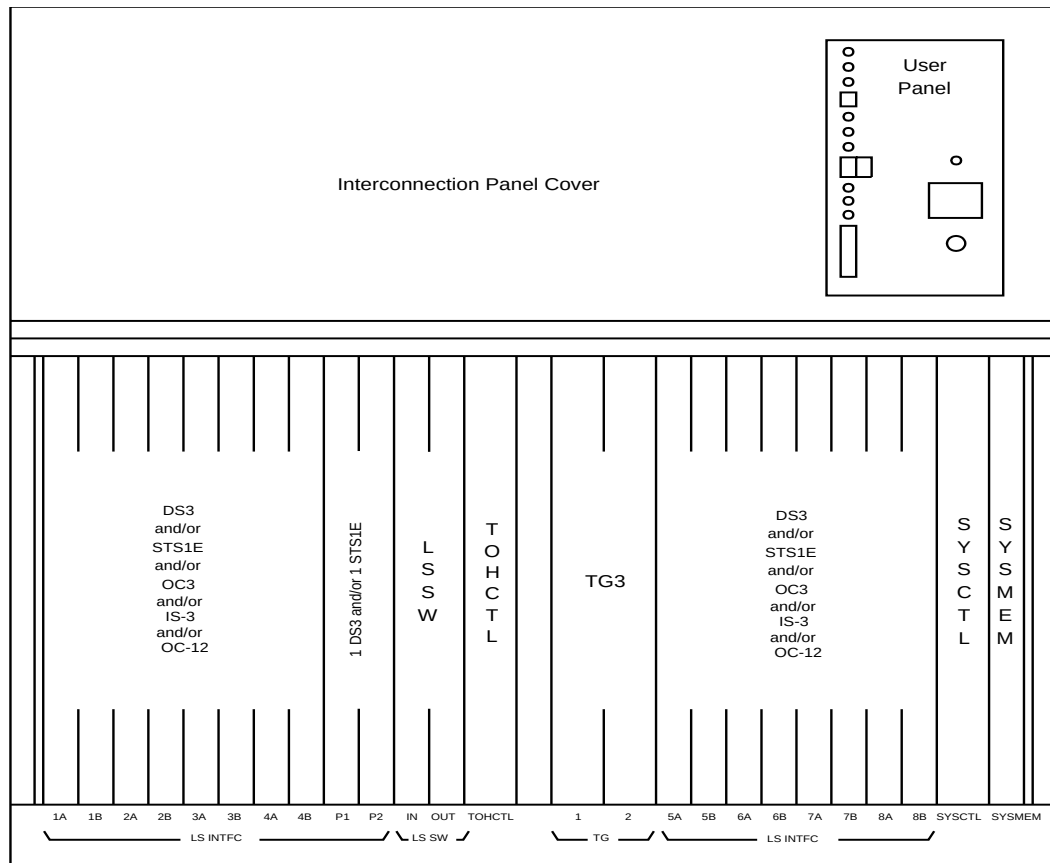
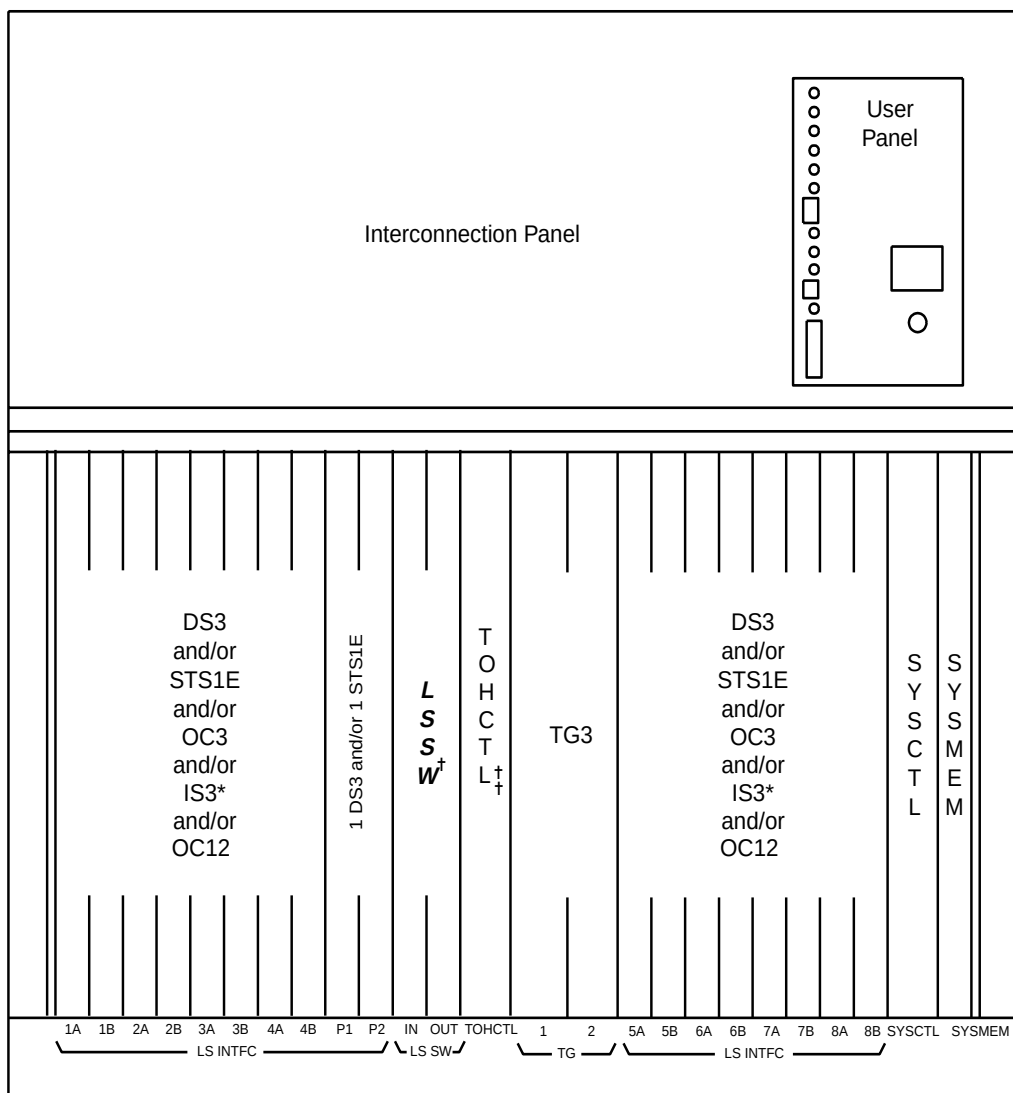


Figure 3-27. Low-Speed Shelf — System Controller (Without Circuit Pack Cover) — ED6G999-31, G5

The Low-Speed Shelf — System Controller (Figure 3-28) is functionally identical to Figure 3-3 and is its new replacement. The main distinguishing differences are: (1) a slightly modified User Panel, and (2) a fully integrated backplane that has eliminated all intra-shelf cabling.



* IS3 circuit pack is for intraoffice applications only.

† LSSW is required only if you use DS3 and/or STS1E circuit packs with low speed protection (low speed protection is strongly recommended).

† TOHCTL is required only if you use OC3 or OC12 circuit packs and want DCC capabilities.

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Figure 3-28. Low-Speed Shelf — System Controller (Without Circuit Pack Cover)
— ED6G999-32, G3

Low-Speed Shelf — System Controller Circuit Packs

The Low-Speed Shelf — System Controller (Figure 3-28) provides the following circuit pack slots:

- **LS INTFC 1A - 8B:** Sixteen slots are provided for the following circuit packs.
 - LAA2 DS3 Interface (DS3) (S4:4) circuit pack (service):
 - LAA4 STS1 Electrical Interface (STS1E) circuit pack (service):
 - LAA10 OC3 Optical Interface — 1.3 μ m Standard Performance (OC3 [1.3 STD]) circuit pack (service and protection): For optional 1+1 nonrevertive protection, two OC3 (1.3 STD) circuit packs must be placed in adjacent "A" and "B" LS INTFC slots (for example, LS INTFC slots "2A" and "2B").
 - LAA10B OC3 Optical Interface — 1.3 μ m Standard Performance (OC3 [1.3 STD]) circuit pack (service and protection): This circuit pack provides more effective STS-1 signal transport in loop feeder, intra-office, dual ring interworking, and OC-3 virtual ring applications by removing the restriction of dropping all STS-1 signals to the same OC3 circuit pack from the same OC-48 line. With Release 9.0.0-ADR and later software, the LAA10B (1.3 STD) circuit pack supports fully-flexible, unrestricted E/W STS-1 drops to an OC3 circuit pack as well as multi-vendor synchronization for timing distribution using the S1 byte.
 - LAA5 IS-3 Optical Interface — For intraoffice applications, it is a cost effective alternative to the OC-3 Optical Interface. The IS-3 terminates one input signal, generates one output signal, and supports the transport of both STS-3 and STS-3c formats. It supports interconnection distances up to 2000-feet using multimode fiber.



NOTE:

For both 1+1 nonrevertive protection applications and transport of STS-3c, two IS-3 circuit packs must be placed in adjacent "A" and "B" LS INTFC slots (for example, LS INTFC slots "2A" and "2B").

- T939A OC-12 Optical Interface 1.3 μ m Standard Performance circuit pack (service and protection). It may be used for either intraoffice or interoffice applications. The OC-12 terminates one STS-12/STS-12c input signal and generates one STS-12/STS-12c output signal.

The OC-12 is a "quad-size" circuit pack and thus requires four adjacent low-speed slots as shown in Table 3-6.

Table 3-6. Permitted Slot Locations for the Quad Circuit Pack

OC-12 Quad	Slot Locations	Command Slot	Extension Slots	OC-12 Pack AID
1	1A-1B-2A-2B	1B	1A, 2A, 2B	ls-1b
2	3A-3B-4A-4B	3B	3A, 4A, 4B	ls-3b
3	5A-5B-6A-6B	5B	5A, 6A, 6B	ls-5b
4	7A-7B-8A-8B	7B	7A, 8A, 8B	ls-7b



NOTE:

Each quad location consists of one command slot and three extension slots. The command slot address is used in the OC-12 provisioning commands and for reporting any circuit pack and OC-12 signal-related alarm conditions. The extension slots are used to gain access to the STS-3 signals, in conjunction with cross-connect commands, and for reporting tributary related alarms.

Each low-speed shelf can support a maximum capacity of up to four OC-12 circuit packs. The four circuit packs may be configured to operate independently in an 0x1 unprotected mode or as pairs in a 1+1 protected mode. In a protected mode, the Service and Protection OC-12 packs must be inserted in quad pairs as follows:

- Quads 1 and 2, or
- Quads 3 and 4.



NOTE:

Quads 2 and 3 will not protect each other. Likewise, quads 1 and 4 will not protect each other.

In an all 0x1 configuration, the FT-2000 has the capacity to add/drop four OC-12 equivalents of traffic. In an all 1+1 protected configuration, the FT-2000 provides the capacity to add/drop two OC-12 equivalents of traffic. In a mixed 1+1/0x1 configuration, the capacity is three OC-12 equivalents of traffic.

- **LS INTFC P1 and P2:** Two slots are provided for one protection LAA2 DS3 circuit pack (S4:4) and/or one protection LAA4 STS1E circuit pack. Two DS3 or two STS1E circuit packs cannot be used. The protection DS3 and STS1E circuit packs can be placed in slot P1 or P2.

- **LSSW IN and OUT:** Two slots are provided for the LAA12 LSSW circuit packs. The LSSW circuit packs are required when DS3 and STS1E low-speed protection is desired. The LSSW circuit packs are not required if the LS INTFC slots are equipped with only OC3 (1.3 STD) circuit packs.
- **TOHCTL:** One slot is provided for the LAA26 Tributary - Overhead Controller (TOHCTL) circuit pack. The TOHCTL circuit pack is required when an LS INTFC slot is equipped with an OC3 circuit pack and single-ended operation is desired through the OC-3 data communications channel (DCC).
- **TG 1 and 2:** Two slots are provided for the LAA17 or LAA18 Timing Generator, Stratum 3 - DS1 (TG3 [DS1]) circuit packs. The LAA17 TG3 (DS1) circuit pack has been discontinued and replaced with the LAA18 TG3 (DS1) circuit pack.
- **SYSCTL:** One slot is provided for the LAA23B System Controller (SYSCTL) circuit pack.
- **SYSMEM:** One slot is provided for the LAA25 System Memory (SYSMEM) circuit pack.

Table 3-7 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-7. Low-Speed Shelf — System Controller Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	Compatible Software			
		R 7.2	R8.1	R9.0	R9.1
LS INTFC 1A-8B	LAA2 DS3, S4:4	X	X	X	X
	LAA4 STS1E	X	X	X	X
	LAA10 OC3 (1.3 STD)	X	X	X	X
	LAA10B OC3 (1.3 STD)	X	X	X	X
	LAA5 IS-3	X	X	X	X
	T939A OC-12	X	X	X	X
LS INTFC P1 and P2	LAA2 DS3, S4:4	X	X	X	X
	LAA4 STS1E	X	X	X	X
LSSW in and OUT	LAA12B LSSW	X	X	X	X
TOHCTL	LAA26 TOHCTL	X	X	X	X
TG 1 and 2	LAA17 TG3 (DS1)	X	X	X	X
	LAA18 TG3 (DS1)	X	X	X	X
SYSCTL	LAA23B SYSCTL	X	X	X	X
SYSMEM	LAA25 SYSMEM	X	X	X	X

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

Low-Speed Shelf — System Controller Interfaces

Front access cabling is provided through the interconnection panel (Figure 3-29). The interconnection panel provides the following interfaces:

- **LS INTFC 1A - 8B:** These connectors are cabled to the low-speed interface slots 1A through 8B. For example, the DS3 circuit pack in slot 1A receives three DS3 signals through the three IN connectors (1, 2, and 3) on the interconnection panel associated with slot 1A. The DS3 circuit pack in slot 1A also transmits three DS3 signals through the three OUT connectors (1, 2, and 3) associated with slot 1A. The 9A through 16B connector designations are not used on this shelf. Any LS INTFC 1A - 8B connector cabled to a slot equipped with an OC3 (1.3 STD) circuit pack is not used. For more information, refer to SD-5G250-02, *FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic* (or SD-5G250-01, *FT-2000 OC-48 Lightwave Terminating Bay Application Schematic*).
- **X.25:** This connector provides an interface to a message-based operations system that uses X.25 protocol and the TL1 message language. For more information about this message-based operations system interface, refer to Section 6, "Operations Interfaces."
- **OFFICE ALMS:** This connector provides an interface to the local office audible and visible alarms. For more information about this office alarm interface, refer to Section 6, "Operations Interfaces."
- **PAR TLM:** This connector provides an interface to an operations center for alarm information. For more information about this parallel telemetry interface, refer to Section 6, "Operations Interfaces."
- **MISC DSCRT 1 and MISC DSCRT 2:** These connectors provide an interface to external equipment via a terminal strip. This allows an operations system to monitor and control equipment collocated with the FT-2000 OC-48 Lightwave System. For more information about this user-settable miscellaneous discrete interface, refer to Section 6, "Operations Interfaces." For detailed information about terminal strip wiring, refer to 365-575-115, *FT-2000 OC-48 Lightwave System, Installation Manual*, and SD-5G250-02, *FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic* (or SD-5G250-01, *FT-2000 OC-48 Lightwave Terminating Bay Application Schematic*).
- **CIT (DTE):** This connector provides an interface to a modem that allows dial-up access. For more information about the CIT (DTE) interface, refer to Section 6, "Operations Interfaces."

- **TIMING IN PRI and TIMING IN SECY:** These connectors provide a PRI and SEC interface to an external DS1 timing source that is required for synchronous operation. For more information about synchronization interfaces, refer to Section 5, "Control, Transmission, and Synchronization Interfaces."
- **TIMING OUT 1 and TIMING OUT 2:** These connectors provide an interface to other central office equipment that requires a DS1 timing reference signal. For more information about synchronization interfaces, refer to Section 5, "Control, Transmission, and Synchronization Interfaces."
- **CIT (DCE):** This connector provides an interface to the CIT (DCE) port on the user panel that allows local access. For more information about the CIT (DCE) interface, refer to Section 6, "Operations Interfaces."
- **USER PNL DISPLAY:** This connector provides an interface to the alarm and status indicators, and display on the user panel. For information about the user panel display and indicators, refer to Section 6, "Operations Interfaces."
- **PWR:** These connectors provide an interface to the –48 V power filters on the user panel. For more information about power, refer to Section 4, "Power."

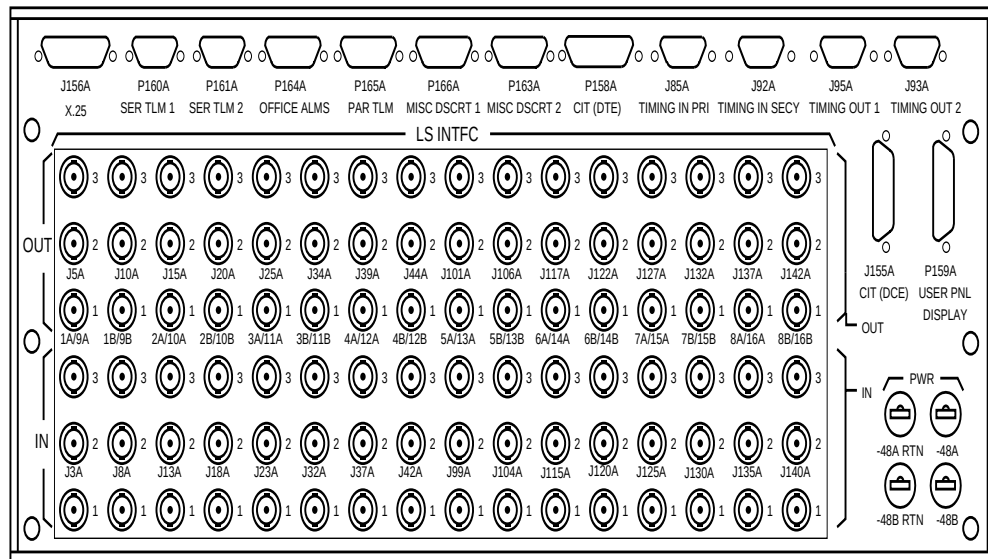


Figure 3-29. Interconnection Panel (Low-Speed Shelf - System Controller)—ED6G999-31,G5

Except for power, all cabling entering the interconnection panel is connectorized with the following industry standard connectors:

- **BNC connectors:** The BNC connectors are used on all cables for electrical low-speed interfaces.
- **D-subminiature connectors:** The D-subminiature connectors are used on all cables for the operation system and central office interfaces.

The power cables are connected to radio frequency (RF) filters on the interconnection panel using push-on type connectors.

The user panel (Figure 3-30) provides –48 V power filters, a power on (PWR ON) LED, an electrostatic discharge jack, and system level information. For more information about the user panel, refer to Section 6, "Operations Interfaces."

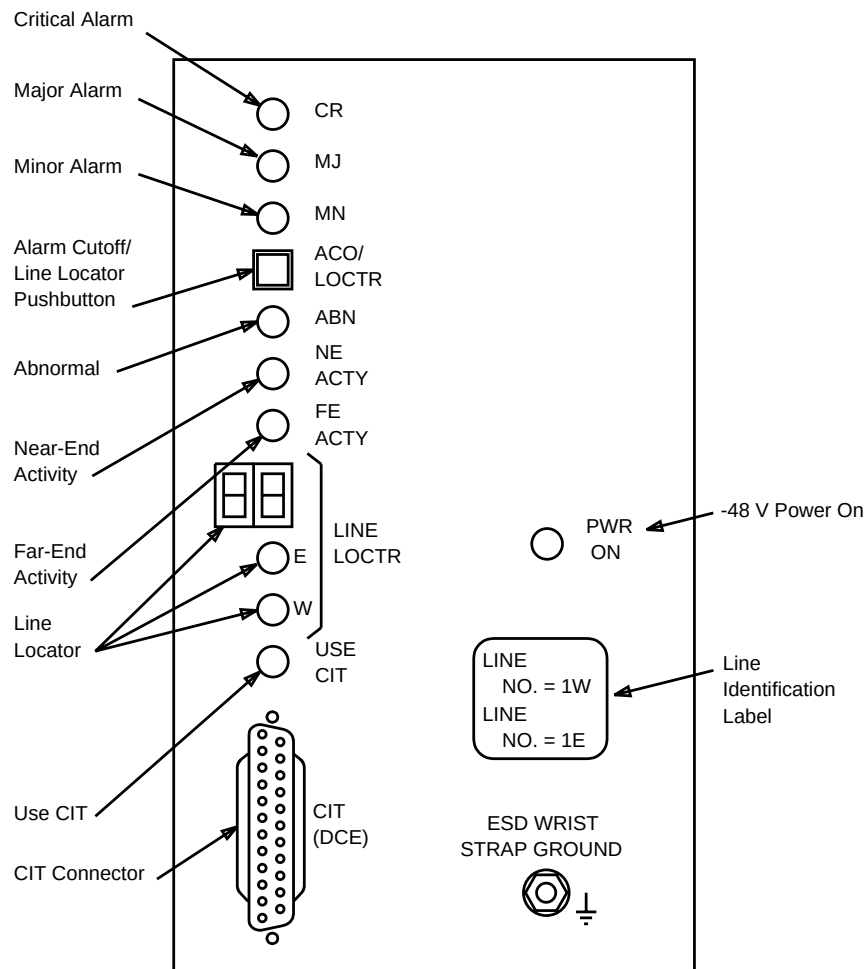


Figure 3-30. User Panel (Enhanced)

The Low-Speed Shelf - System Controller has two front covers (Figure 3-31). One covers the interconnection panel and the other covers the circuit packs. Openings are provided in the top cover that allow the user panel to show through and provide access to the CIT port. The covers are hinged and can be easily removed for maintenance access.

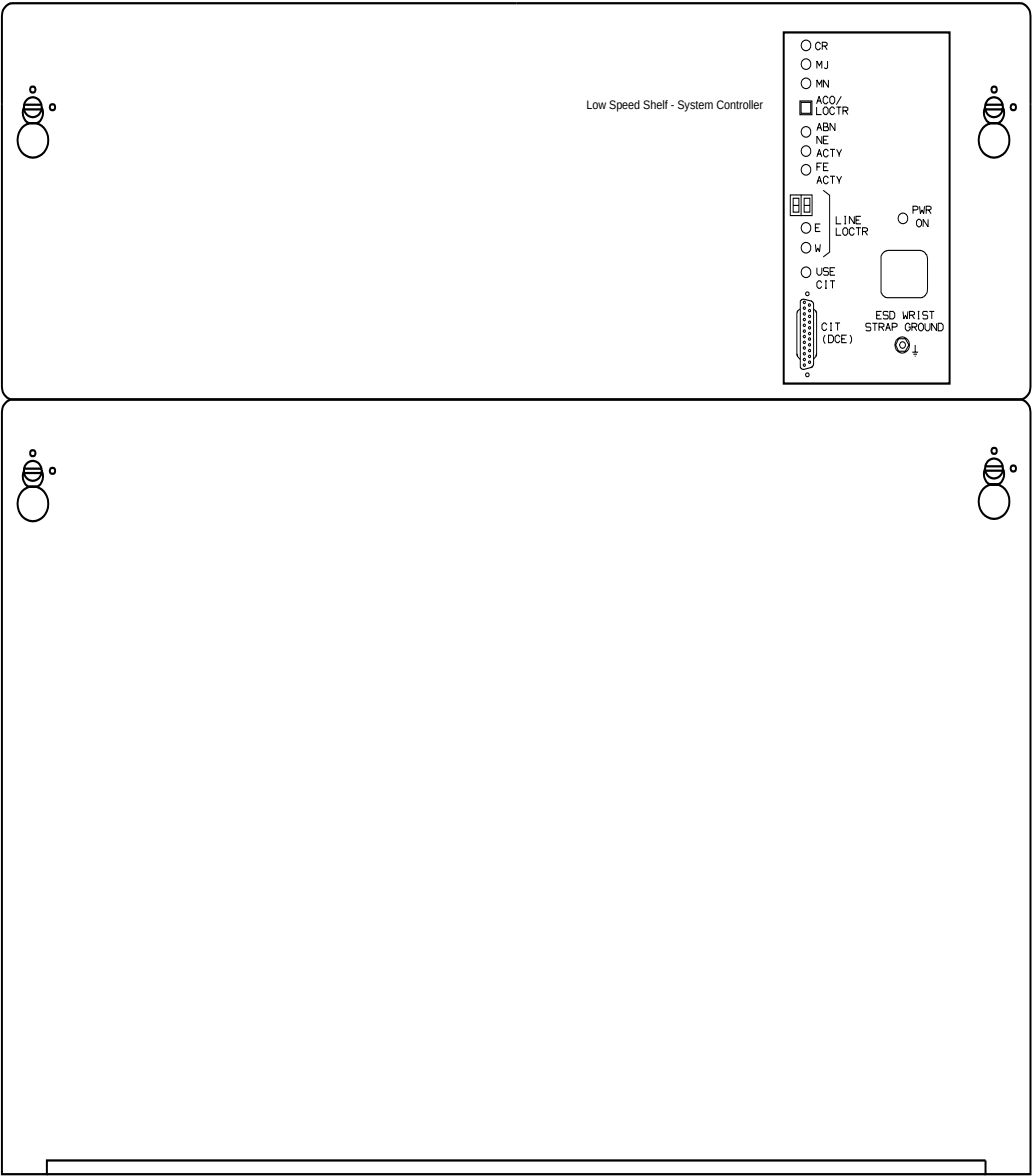


Figure 3-31. Low-Speed Shelf - System Controller (with Covers)

Condensed High-Speed Shelf

Purpose of Condensed High-Speed Shelf

Each Condensed High-Speed Shelf* serves as an interface for OC-48 high-speed lines 1W and 1E. The Condensed High-Speed Shelf* (Figure 3-32) consists of the fully connectorized interconnection panel, a filter panel, and 12 circuit pack slots. It measures 14.25 inches high by 21.5 inches wide by 12 inches deep and fits in a standard 23-inch wide network bay framework.

Condensed High-Speed Shelf Circuit Packs

The Condensed High-Speed Shelf (Figure 3-32) provides the following circuit pack slots:

- **TRMTR:** One slot is provided for the 739B2†, 739C2†, 739E[1-8]†, 739G[1-8], 739H[1-16], 739J2†, 739J3†, 739R2†, 739S2† 739B4, 739J4, 739B5, 739C5, 739J5, 739P5, 739R5, or 739S5 OC48 Transmitter, Add/Drop (OC48 TRMTR [A/D]) circuit pack for OC-48 high-speed line.
- **RCVR:** One slot is provided for the 839B2†, 839B4B, or 839B5 OC48 Receiver, Add/Drop (OC48 RCVR [A/D]) circuit packs for OC-48 high-speed line 1W. The 839B4B and 839B5 OC48 RCVR (A/D) circuit packs are compatible with Release 7.0.0-ADR or later software. The 839E5 circuit pack is compatible with Release 7.2.0 and later software.
- **LNCTL:** One slot is provided for the LAA28 Line Controller — 4 Megabyte [LNCTL (4 MEG)] circuit pack.
- **OHCTL 1W:** One slot is provided for the LAA21 Overhead Controller — Terminal (OHCTL [TERM]) circuit pack for OC-48 high-speed line 1W.
- **OHCTL 1E:** One slot is provided for the LAA21 OHCTL (TERM) circuit pack for OC-48 high-speed line 1E.
- **RESERVED:** One slot is reserved for the Overhead Controller — LAN (LOHCTL) circuit packs in a future release.

* The Condensed High-Speed Shelf is used only on FT-2000 OC-48 Add/Drop-Rings Terminal for two-Fiber Rings equipped with the J68974D FT-2000 OC-48 Enhanced Lightwave Terminating Bay.

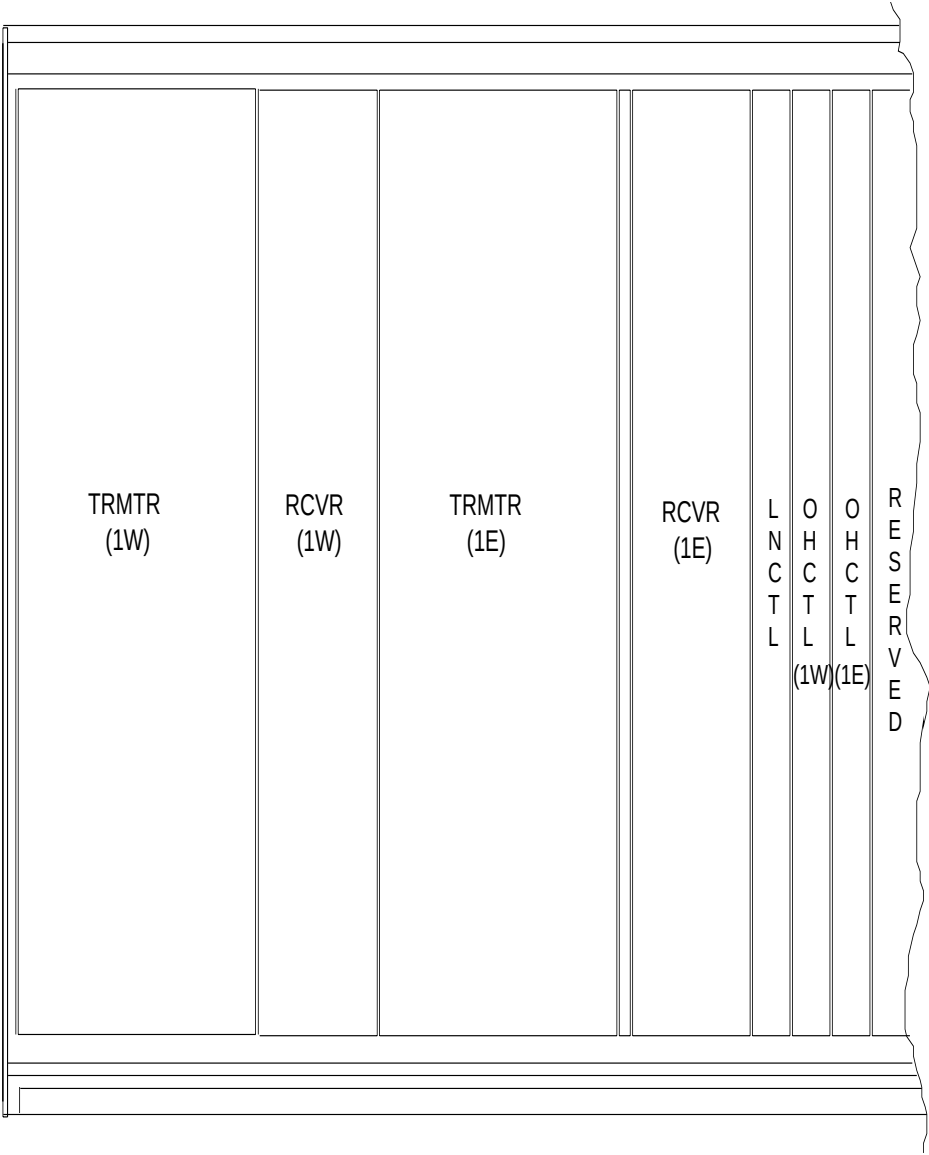


Figure 3-32. Condensed High-Speed Shelf (Without Circuit Pack Cover)

Table 3-8 also provides circuit pack slot/circuit pack code/software compatibility information.

Table 3-8. Condensed High-Speed Shelf Circuit Pack Slot/Circuit Pack Code/Software Compatibility

Circuit Pack Slot	Supported Circuit Pack Codes	ADR Compatible Software			
		R7.2	R8.1	R9.0	R9.1
TRMTR	739B2† OC48 TRMTR	DA	DA	DA	DA
	739C2† OC48 TRMTR	DA	DA	DA	DA
	739E[1-8] OC48 TRMTR	X	X	X	X
	739G[1-8] OC48 TRMTR	X	X	X	X
	739H(1-16) OC48 TRMTR *	X	X	X	X
	739J2† OC48 TRMTR	DA	DA	DA	DA
	739J3† OC48 TRMTR	DA	DA	DA	DA
	739R2† OC48 TRMTR	DA	DA	DA	DA
	739S2† OC48 TRMTR	DA	DA	DA	DA
	739B4 OC48 TRMTR	X	X	X	X
	739J4 OC48 TRMTR	X	X	X	X
	739B5 OC48 TRMTR	X	X	X	X
	739C5 OC48 TRMTR	X	X	X	X
	739J5 OC48 TRMTR	X	X	X	X
	739P5 OC48 TRMTR	X	X	X	X
	739R5 OC48 TRMTR	X	X	X	X
	739S5 OC48 TRMTR	X	X	X	X
RCVR	839B2† OC48 RCVR	DA	DA	DA	DA
	839B4B OC48 RCVR	X	X	X	X
	839B5 OC48 RCVR	X	X	X	X
	839E5 OC48 RCVR	X	X	X	X
LNCTL	LAA28 LNCTL	X	X	X	X
OHCTL 1W	LAA21 OHCTL (TERM)	X	X	X	X
OHCTL 1E	LAA21 OHCTL (TERM)	X	X	X	X

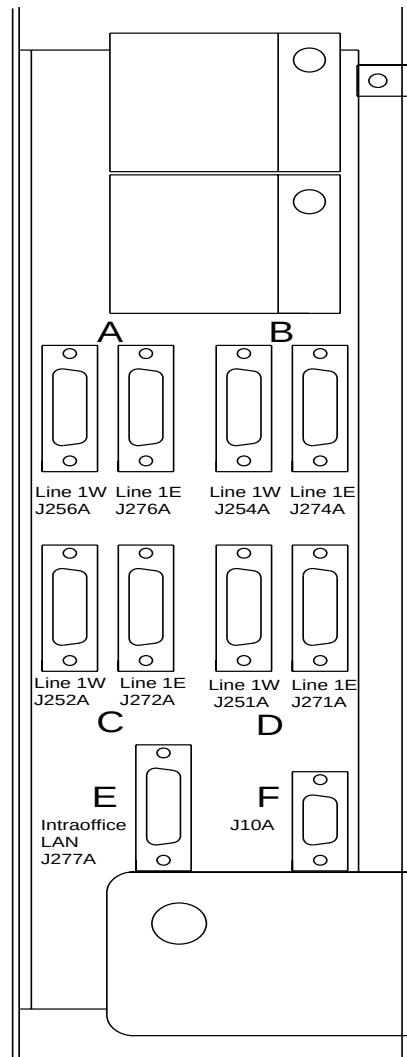
* The 739H(1-16) OC48 TRMTR (STS-1 OC-12c 1.5 STD) were not released as part of the FT-2000 OC-48 Lightwave System Release 9.1. These circuit packs are for non-OLS compatible, passive DWDM systems.

Circuit pack keying prevents circuit packs from being accidentally inserted in incorrect slots.

For detailed circuit pack descriptions and software compatibility information, refer to Section 7, "Circuit Pack Descriptions."

Condensed High-Speed Shelf Interfaces

Front access cabling (for ordering and power) is provided through the Interconnection and Filter Panel (Figure 3-33).



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Figure 3-33. Interconnection and Filter Panel (Condensed High-Speed Shelf)

The interconnection and filter panel is divided into six segments. They are labeled A-through-F and each interface is described as follows:

- **A SECTION OW (LOC OW) LINE (1W) and LINE (1E):** These connectors provide an interface that allows an orderwire set access to the section orderwire (E1 byte) for voice communications (local orderwire). For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- **B LINE OW (EXP OW) LINE (1W) and LINE (1E):** These connectors provide an interface that allows an orderwire set access to the line orderwire (E2 byte) for voice communications (express orderwire). For more information about the orderwire interface, refer to Section 6, "Operations Interfaces."
- **C LINE GROWTH CHAN LINE (1W) and LINE (1E):** These connectors provide an interface that allows access to the line growth channel (Z1 and Z2 bytes) of the OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **D SECTION USER CHAN LINE (1W) and LINE (1E):** These connectors provide an interface that allows access to the section user channel (F1 byte) of the service and protection OC-48 high-speed lines. These connectors are reserved for use in a future release.
- **E INTRAOFFICE LAN:** This connector is reserved for use in a future release.
- **F:** This connector provides an interface to the –48 V power filters on the filter panel. This is a factory-wired connection.

Except for power, all the cabling entering the interconnection panel is connectorized with D-subminiature connectors. The power cables are connected to RF filters on the interconnection panel using push-on type connectors.

Fan Assembly

I

The fan assembly is located in the bottom of the Dual Bay. It consists of three six-inch fans. The fan controller senses the incoming air temperature and provides a signal enabling the fans to operate at different speeds. Cooling air is taken in from the bottom front of the bay. It passes through a user-replaceable air filter and is forced up through all four shelves and exhausted through a top rear grill.



NOTE:

Normally, the fans will be operating at medium speed. However, with a higher ambient air temperature the fans will operate at high-speed. These modes of operation should result in increased fan life and reduced operating noise.

The fan assembly contains two status LEDs. These are:

- Power-On
- Alarm.

The alarm signal is brought from a connector located on the left side of the fan assembly and terminated on the "miscellaneous discrete alarm inputs connector" which is located on the lower low-speed shelf.

Contents

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Contents

Overview

This section describes the power distribution and dissipation of the FT-2000 OC-48 Lightwave System.

General

The FT-2000 OC-48 Lightwave System power distribution philosophy is based on individual rather than bulk power supplies. Each circuit pack contains DC-to-DC converters that change the office battery voltages to the voltages required. This leads to improved system reliability, since heat is dissipated uniformly across the system avoiding "hot spots."

The FT-2000 OC-48 Lightwave System is powered by –48 V DC. The voltage range for all the components is –42.75 to –60 V DC as measured at the power feeder inputs and returns at the bay.

Power Distribution

The FT-2000 OC-48 Lightwave System accepts two –48 V DC office power feeders for feeder redundancy from the battery distribution and fuse bay (BDFB) or equivalent. Figure 4-1 shows how power is distributed in an FT-2000 OC-48 Lightwave System bay. The power feeders are 4.5-foot, 8-gauge power feeder stubs gutter-tapped to the feeder cables going to the BDFB. There are also 8.5- and 15-foot, 8-gauge power feeders available for overhead high bay cable racking and raised-floor applications, respectively. Power feeders can also be ordered to length.

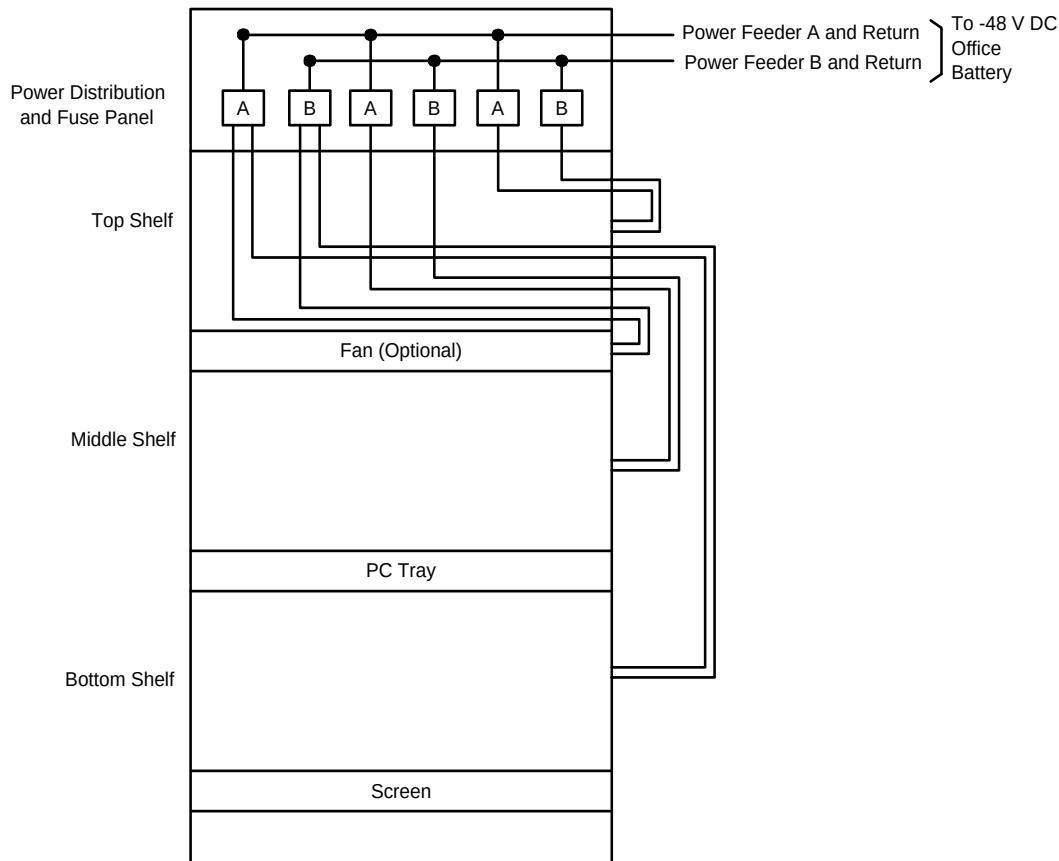


Figure 4-1. Bay Power Distribution

The 8-gauge power feeder stubs (power feeder A and power feeder B) are terminated at the bay power distribution and fuse panel. Within the power distribution and fuse panel, the power feeders are routed with 10-gauge wire to six 10-amp fuses (red lamp is lighted when blown). Three fuses are for power feeder A and three fuses are for power feeder B. The bottom shelf and the fan assembly (if equipped) share the first pair of fuses. The second pair of fuses is assigned to the middle shelf. The third pair of fuses is assigned to the top shelf.

The power feeders are cabled, using 14-gauge wire, from the fuses down the right side of the bay (when viewed from the front) to the shelves and the fan assembly (if equipped).

Figure 4-2 shows an example of how power is distributed to a miscellaneously mounted FT-2000 OC-48 Repeater Shelf. The 8-gauge power feeder stubs are

terminated at two 10-gauge power connectors that are connected to the user panel. The user panel is equipped with two 10-amp fuses: one fuse for power feeder A and one fuse for power feeder B (red lamp is lighted when blown).

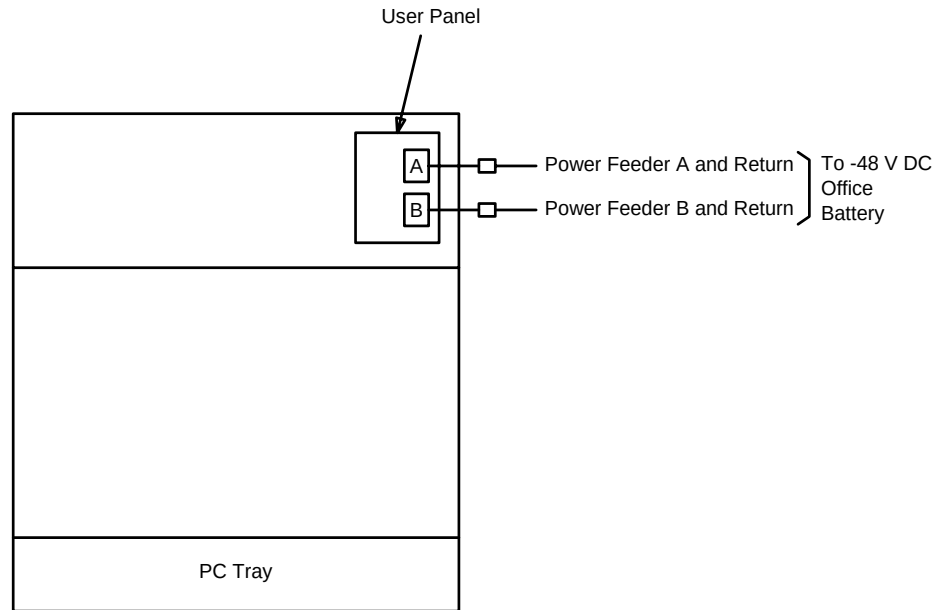


Figure 4-2. Miscellaneously-Mounted FT-2000 OC-48 Repeater Shelf Power Distribution

The two independent –48 volt office power feeders (A and B) enter each shelf via a power interface circuit and are distributed to the circuit packs (Figure 4-3) via the printed backplane. The power interface circuit consists of a green PWR ON LED, two power filter assemblies, and two radio-frequency (RF) filters.

The green PWR ON LED (located on the user panel and filter panel) shows that the shelf is receiving fused –48 volt power. The green PWR ON LED will remain lighted as long as either –48 volt power feeder is supplying power to the shelf.

Each power filter assembly smooths the input current and reduces the converter switching noise to the allowed limit. Each power feeder also passes through an RF filter at the interconnection panel to remove any RF energy before going to the backplane.

From the RF filters, the power feeders are connected to the backplane and distributed to the circuit packs on the shelf. Each backplane power feeder connects to the circuit pack via four backplane pins. One pin is longer than the other three power pins and connects to the circuit pack first. This long pin feeds a

surge resistor to limit in-rush currents and prevents voltage dropouts on the power feeders.

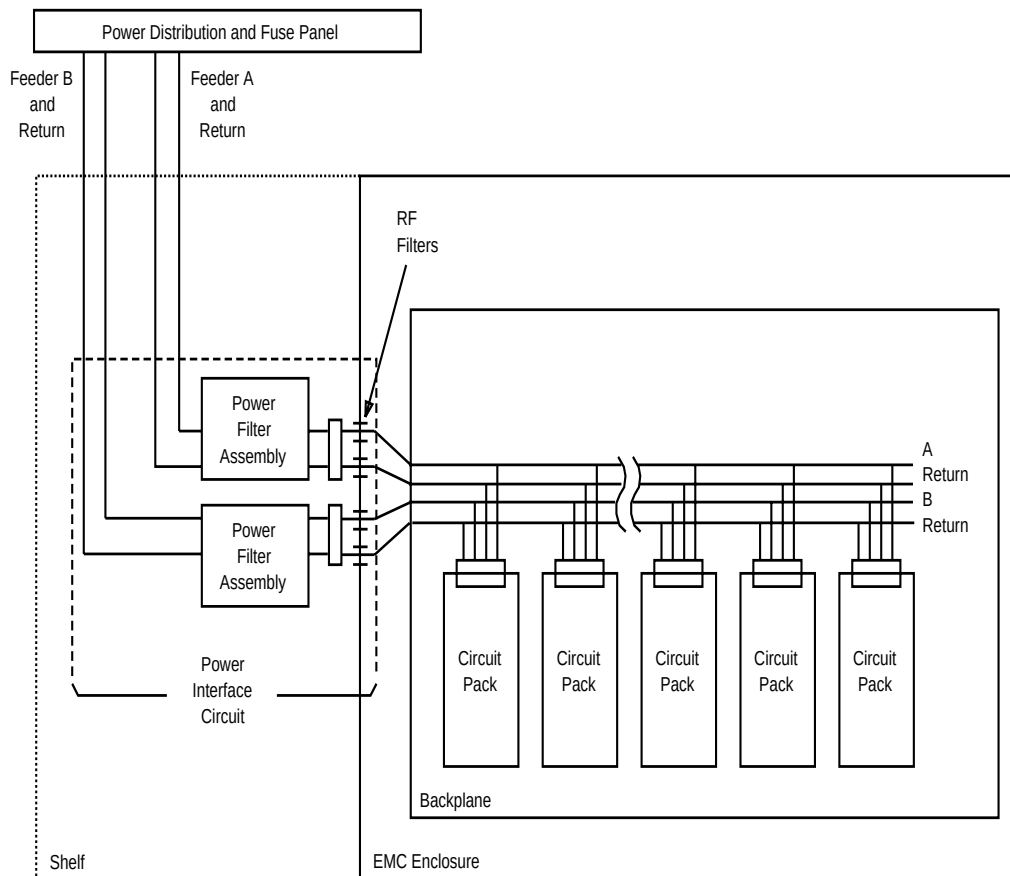


Figure 4-3. Shelf Power Distribution

Each circuit pack is equipped with diodes and fuses that protect the power feeders (Figure 4-4). A filtering section follows the fused input. Modular DC-to-DC power converters on each circuit pack convert the -48 V to the voltages required on the circuit pack.

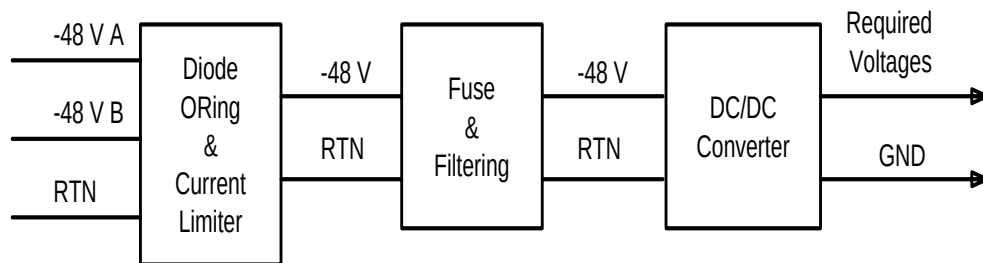


Figure 4-4. Circuit Pack Power Distribution

Power Dissipation

Table 4-1 shows the maximum power dissipation and current drains for the FT-2000 OC-48 Lightwave System.



NOTE:

Refer to the Floor Plan Data Sheet (FPD 804-911-168-[]) for complete information on power engineering for the FT-2000 OC-48 Lightwave System.

Table 4-1. Power Dissipation and Current Drains

Equipment Package	Maximum Power Dissipated		Current Drain (Amps) per Feeder (Two Feeders Required)	
	(Watts)	(Watts/ft ²)	Nominal (Note 1)	Maximum (Note 2)
FT-2000 OC-48 Add/Drop-Rings (E-Bay) Terminal for two-Fiber Rings	487	69	5.1	11.4
FT-2000 OC-48 Add/Drop-Rings (D-Bay) Terminal for Two 2-Fiber Rings	1142	162	11.0	26.7

⇒ **NOTE:**
Nominal (List 1) current drains are used to size batteries and rectifiers. To size batteries and rectifiers, use twice the nominal current drain per feeder. These current drains represent the average busy-hour current at normal operating voltages. Nominal current drains occur at –48 V.

⇒ **NOTE:**
Maximum (List 2) current drains are used to size each feeder cable and fuse. To size feeder cables and fuses, use the maximum current drain per feeder. These current drains represent the peak current under worst-case operating conditions. Normally, the current for the system is shared equally by both feeders. If one feeder fails, the other feeder carries the total load for both feeders (feeder A + feeder B current). Maximum current drains occur at –42.75 V.

LEDs

The green PWR ON LED (located on the user panel and filter panel) and the circuit pack red FAULT LED (located on the circuit pack faceplates) are associated with shelf and circuit pack power. The green PWR ON LED shows that the shelf is receiving fused –48 volt power. The green PWR ON LED will remain lighted as long as either –48 volt power feeder is supplying power to the shelf.

The red FAULT LED shows circuit pack failures. If the fuse or DC-to-DC converter fails on a transmission circuit pack at an FT-2000 OC-48 Repeater Bay, the red FAULT LED will be operated via a separate power path from the System Controller (SYSCTL) circuit pack.

If the fuse or DC-to-DC converter fails on a transmission or synchronization circuit pack at an FT-2000 OC-48 Add/Drop-Rings Terminal, the red FAULT LED will be operated via a separate power path from the Line Controller (LNCTL) circuit pack. If the fuse or DC-to-DC converter fails on the LNCTL, Overhead Controller — Terminal (OHCTL [TERM]), or System Memory (SYSMEM) circuit pack, the red FAULT LED will be operated via a separate power path from the SYSCTL circuit pack. If the fuse or DC-to-DC converter fails on the SYSCTL circuit pack, the red FAULT LED will be operated via a separate power path from the SYSMEM circuit pack.

Control, Transmission, and Synchronization Interfaces

5

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Overview

This section describes the FT-2000 OC-48 Lightwave System architecture. The system control, transmission, and synchronization architecture are described down to the circuit pack level.

Control

The FT-2000 OC-48 Lightwave System has a robust, flexible, three-level system control architecture that supports all platforms. Figure 5-1 shows the system control architecture for the FT-2000 OC-48 Add/Drop-Rings Terminal. Figure 5-2 shows the system control architecture for the FT-2000 OC-48 Repeater Bay. The system control architecture distributes the monitoring and control functions down to the lowest level where a particular function (for example, switching or timing) is performed.

At the lowest level of the control hierarchy is the board controller that is located on each transmission, synchronization, and protection circuit pack. The board controller consists of a microprocessor and its supporting circuitry. The board controller is responsible for the real-time intensive monitoring and control functions of the transmission, timing, and protection switch circuitry on a circuit pack. It also controls the circuit pack FAULT LED and performs self-maintenance functions (for example, audit checks and routine diagnostics).

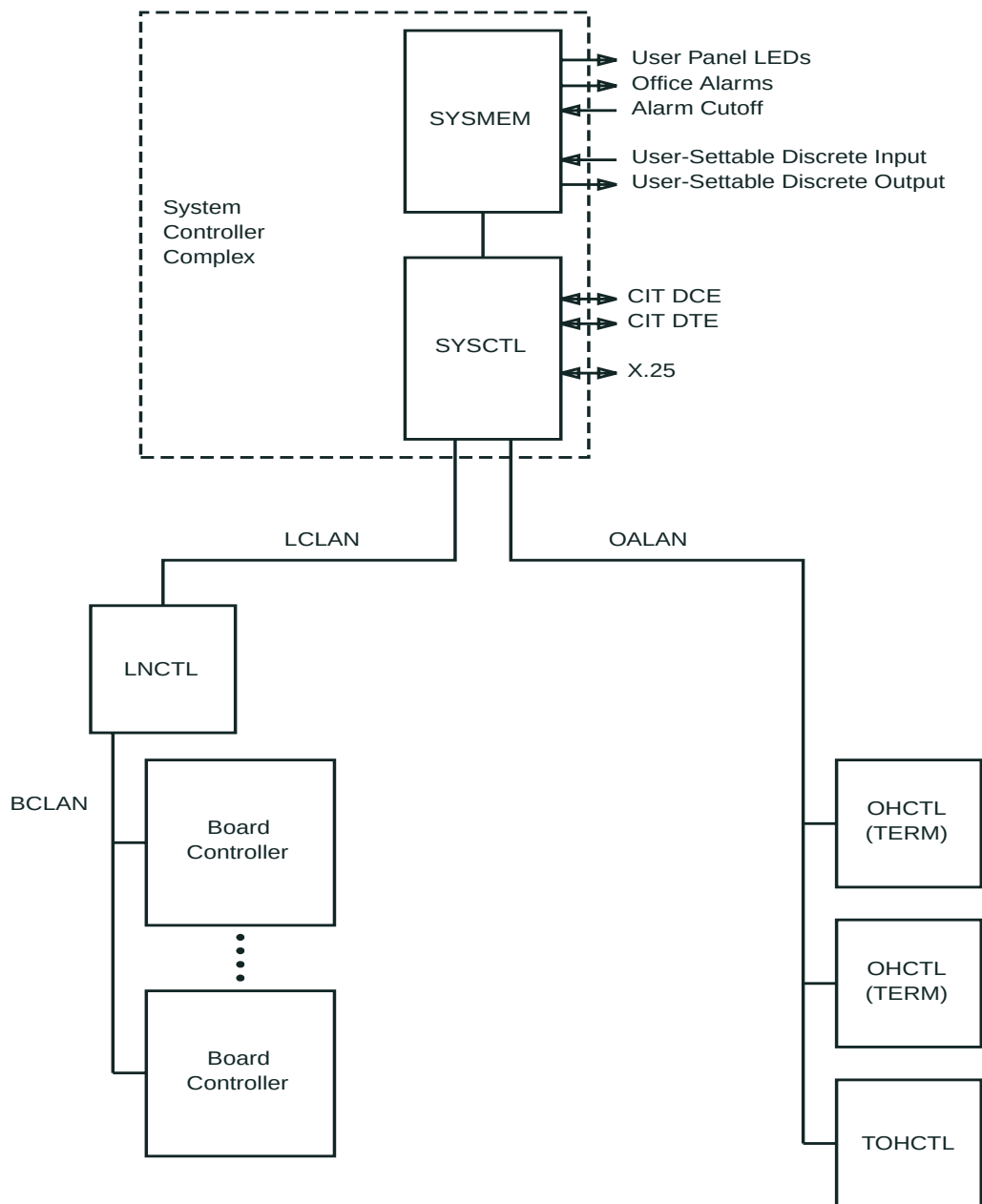
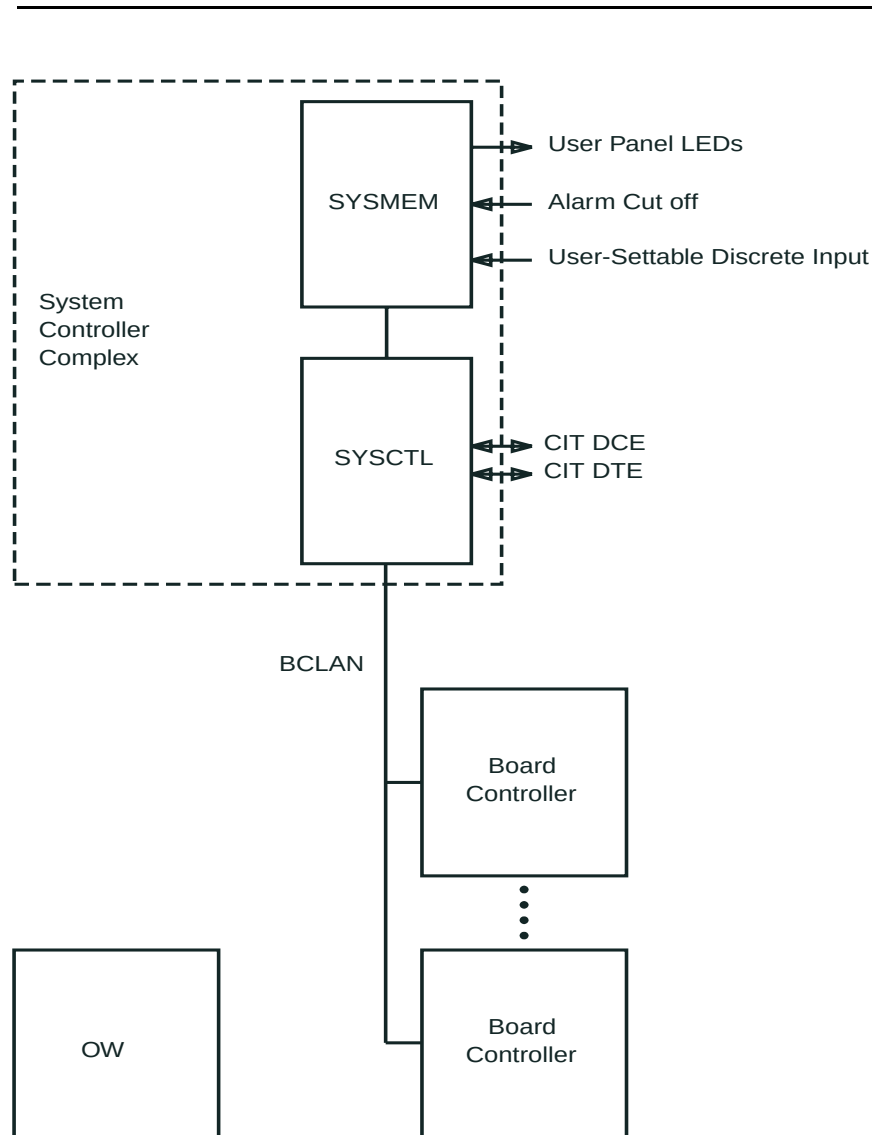


Figure 5-1. System Control Architecture for the FT-2000 OC-48 Add/Drop-Rings Terminal



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Figure 5-2. System Control Architecture for the FT-2000 OC-48 Repeater Bay

The middle level of the control hierarchy is the Line Controller (LNCTL) circuit pack. The LNCTL circuit pack is responsible for fault recovery. The LNCTL circuit pack communicates with the board controllers to activate protection switching. The middle level of the control hierarchy is not needed in the FT-2000 OC-48 Repeater Bay. Therefore, the FT-2000 OC-48 Repeater Bay does not require any LNCTL circuit packs.

The system controller complex is the highest level of the control hierarchy. The system controller complex consists of the System Controller (SYSCTL) circuit pack and the System Memory (SYSMEM) circuit pack. The system controller complex performs the non-real time intensive functions requiring overall system knowledge. The system controller complex also plays a major role in providing the extensive operations, administration, maintenance, and provisioning functions. For more information about the operations, administration, maintenance, and provisioning functions, refer to Section 6, "Operations Interfaces," Section 8, "Administration and Provisioning," and Section 9, "Maintenance Description."

The Overhead Controller - Terminal [OHCTL (TERM)] circuit pack performs synchronous optical network (SONET) overhead access and processing functions. The OHCTL (TERM) circuit pack processes OC-48 section and line data communications channel (DCC) information and supports line and section orderwire (local and express orderwire, bytes E1 and E2), the user channel (F1), and the growth bytes (Z1, Z2). For more information about the overhead bytes, refer to Appendix A, "A SONET Overview."

The Overhead Controller - Tributary (TOHCTL) circuit pack also performs SONET overhead access and processing functions at FT-2000 OC-48 Add/Drop-Rings Terminals. The TOHCTL circuit pack processes (OC-3/OC-12) section DCC information (bytes D1-D3).

The Orderwire (OW) circuit pack performs SONET section overhead access functions at FT-2000 OC-48 Repeater Bays. The OW circuit pack provides access to the OC-48 section orderwire (E1) and user channel (F1) bytes.

The controllers within the control architecture communicate among the different hierarchical levels using internal local area networks (LANs). The board controllers and the LNCTL circuit pack of the same line communicate using the board controller local area network (BCLAN). The LNCTL circuit packs and the system controller complex communicate using the line controller local area network (LCLAN). The OHCTL (TERM) circuit packs, TOHCTL circuit pack, and system controller complex communicate using the overhead access local area network (OALAN). The OW circuit pack does not communicate with other controllers in the control architecture.

The FT-2000 OC-48 Lightwave System's extensive control features are available through several craft and operations system (OS) interfaces. In addition to accessing the local terminal, the craft and OS interfaces can reach a remote terminal using the data communications channel in the OC-48 signal. Craft and OS interfaces can reach remote terminals and DDM-2000 Multiplexers using the OC-3 and OC-12 DCC. These functions are provided by the SYSCTL, SYSMEM, LNCTL, OHCTL, TOHCTL, and OW circuit packs. For more information about craft and operations system interfaces, refer to Section 6, "Operations Interfaces."

Transmission

FT-2000 OC-48 Add/Drop-Rings Terminal

The FT-2000 OC-48 ADR Terminal for 2-Fiber Rings allows groups of three DS3 signals, three EC-1 signals, one OC-3 and/or one OC-12 signal to be easily added/dropped while the through traffic is passed on without requiring low speed interface circuit packs. The FT-2000 OC-48 ADR Terminal for 2-Fiber Rings also allows single DS3 and/or EC-1 signals to be added/dropped while the through traffic is passed on without requiring low-speed interface circuit packs. A bidirectional ring capability allows the FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings to be used in 2-fiber bidirectional line-switched ring applications.

Figure 5-3 shows a transmission block diagram of the FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings.

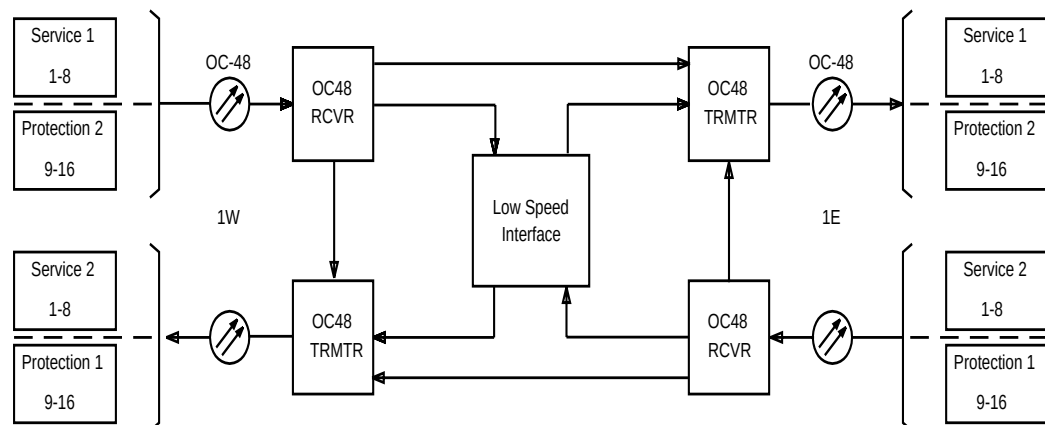


Figure 5-3. FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings Transmission Block Diagram

The FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings interfaces with up to 48 bidirectional DS3 equivalent signals (DS3, EC-1, OC-3, and/or OC-12) and 2 OC-48 high speed lines (1E and 1W). Each OC-48 high speed line consists of sixteen 155 Mb/s (STS-3) tributaries. The STS-3 tributaries 1 through 8 are the service tributaries, and STS-3 tributaries 9 through 16 are the protection tributaries. In Figure 5-3, the Eastbound service STS-3 tributaries are identified as *Service 1* and the Westbound service tributaries are identified as *Service 2*. The Eastbound protection STS-3 tributaries are identified as *Protection 2* and the Westbound protection STS-3 tributaries are identified as *Protection 1*.

If a failure occurs, the Eastbound service STS-3 tributaries (Service 1) are protected by the Westbound protection STS-3 tributaries (Protection 1). The Westbound service STS-3 tributaries (Service 2) are protected by the Eastbound protection STS-3 tributaries (Protection 2). For more information about 2-fiber ring protection switching, electrical low speed protection switching, and optical low speed protection switching, refer to Section 9, "Maintenance Description."

Internally, the FT-2000 OC-48 ADR Terminal for 2-Fiber Rings employs standard synchronous multiplexing for add/drop and through traffic. (Refer to Appendix A, "A SONET Overview.") To add DS3 or EC-1 electrical low speed signals, each electrical low speed interface circuit pack (DS3 or STS1E) accepts up to three low speed signals (DS3 or EC-1) and maps them into 155 Mb/s signals (STS-3 tributaries). To add OC-3 optical low speed signals, each OC3 (1.3 STD) circuit pack accepts one OC-3 low speed signal and maps it into an STS-3 tributary. To add OC-12 optical low speed signals, each OC12 (1.3 STD) circuit pack accepts one OC-12 low speed signal and maps it into four STS-3 tributaries. These add/drop STS-3 tributaries are combined with the through STS-3 tributaries, multiplexed to one STS-48 signal, and converted to an optical OC-48 signal for transmission over high speed line 1E or 1W.

To drop DS3, EC-1, OC-3, and/or OC-12 low speed signals, the incoming optical OC-48 signal is converted back to an electrical STS-48 signal and is demultiplexed to sixteen STS-3 tributaries. The STS-3 tributaries that are designated to be dropped are demultiplexed into DS3, EC-1, OC-3, and/or OC-12 low speed signals. The STS-3 tributaries not designated to be dropped are the through traffic. The through traffic is combined with the add traffic for transmission in the opposite direction.



CAUTION:

All DS3 and EC-1 signal outputs from the FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings must be properly terminated at all times. Therefore, these outputs must be connected to cross-connect panels that have internal 75-ohm terminations (for example, Lucent Technologies cross-connect panels meet this requirement) or other working transmission equipment (for example, DACS III-2000 Cross-Connect System or DDM-2000 Multiplexer) where the associated low speed interfaces are equipped. When operating the FT-2000 OC-48 ADR Terminal with cross-connect panels that do not automatically terminate the DS3 and EC-1 signal outputs, 75-ohm termination plugs must be placed at the cross-connect panel.

It is recommended that care be exercised during maintenance and that the DS3 and EC-1 signal outputs are terminated properly. However, if DS3 and EC-1 signal outputs are not terminated properly and the unterminated DS3 and EC-1 ports in the drop direction (from OC-48 line) are in the NMON state, false trouble conditions will not be reported by the FT-2000 OC-48 ADR Terminal.

The FT-2000 OC-48 ADR Terminal for 2-Fiber Rings has no fixed connection, or association, between the low speed interface circuit packs and the OC-48 high speed lines (add/drop traffic) or between high speed line 1E and 1W (through

traffic). User specified cross-connections allow any low speed interface slot to be cross-connected to any STS-3 tributary of OC-48 high speed line 1E or 1W. They also allow any incoming STS-3 tributary of OC-48 high speed line 1E or 1W to be cross-connected to the same-numbered outgoing STS-3 tributary of the other OC-48 high speed line. The FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings offers an STS-3 time slot assignment capability that allows the following cross-connections:

- 1-way cross-connections
- 1-way-DRI cross-connections
- 2-way cross-connections.

Switching and bridging circuitry within the OC48 TRMTR, OC48 RCVR, and low speed interface circuit packs allow cross-connections to be specified. In the transmit direction, a low speed interface circuit pack bridges a 155 Mb/s signal to both OC48 TRMTR circuit packs. The user-specified cross-connections determine which OC48 TRMTR circuit pack selects the 155 Mb/s signal for transmission. In the receive direction, a low speed interface circuit pack selects a 155 Mb/s signal from one OC48 RCVR circuit pack based on the user specified cross-connections. For more information about the OC48 TRMTR, OC48 RCVR, and low speed interface circuit packs, refer to Section 7, "Circuit Pack Descriptions."

The FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings also provides limited support for STS-1 cross-connections across an STS-3 tributary.

The FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings also provides support for STS-1 cross-connections across an OC-48 signal.

The FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings also has the capability to provide *extra traffic*. Extra traffic allows access to the protection STS-3 tributaries for low priority traffic or for restoration purposes.

Cross-connections can be made using the CIT interface. Cross-connections can also be made through the message-based operations system interface using X.25 protocol and Transaction Language 1 (TL1) messages. For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

FT-2000 OC-48 Repeater Bay

The FT-2000 OC-48 Repeater Bay regenerates optical OC-48 signals for up to six OC-48 high speed lines. Figure 5-4 shows a transmission block diagram of the FT-2000 OC-48 Repeater Bay for one 1x1 system.

Two OC48 Regenerator (OC48 REGENR) circuit packs make a repeater. One OC48 REGENR circuit pack receives an incoming OC-48 signal from high speed line 1W, for example, and transmits it toward high speed line 1E. The other OC48 REGENR circuit pack receives an incoming OC-48 signal from high speed line 1E and transmits it toward high speed line 1W.

Internally, the FT-2000 OC-48 Repeater Bay employs standard synchronous multiplexing. (Refer to Appendix A, "A SONET Overview.") For example, the incoming optical OC-48 signal from high speed line 1W is converted to an electrical STS-48 signal and demultiplexed to sixteen 155 Mb/s signals. This allows certain SONET section overhead bytes to be extracted, monitored, and controlled. The 155 Mb/s signals are then multiplexed to one STS-48 signal, and the SONET section overhead bytes are inserted. The STS-48 signal is then converted back to an optical OC-48 signal for transmission on high speed line 1E.

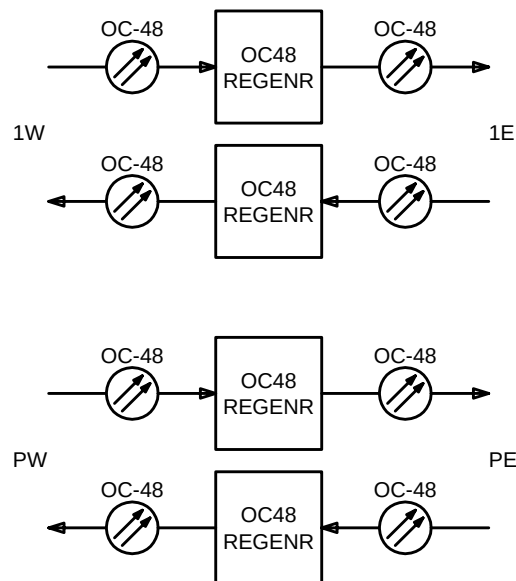


Figure 5-4. FT-2000 OC-48 Repeater Bay Transmission Block Diagram

Synchronization Modes

Platform Synchronization

General

The FT-2000 OC-48 Lightwave System platforms can be provisioned for the following synchronization modes:

- FT-2000 OC-48 Add/Drop-Rings Terminal
 - **Externally timed** to the digital synchronization network using DS1 synchronization references (external timing)

- **Free Running** from an internal oscillator
- **Through timed** from an incoming OC-48 signal
- **Line Timed** using sync-messages that are derived from the incoming OC-48 signal (Release 7.2.0 and later software)



NOTE:

The FT-2000 ADR Terminal also provides "Sync Messaging". For those OC-48 rings that connect to other rings (including a DDM-2000 ring) — this feature may be used to enhance network synchronization. More specifically, Sync Messaging includes the STU, ST3 and DUS messages on the OC-48 side. These messages are sent out on the OC-3 and OC-12 side via the K-bytes, which are provisionable. For FT-2000 Add/Drop-Rings Terminals equipped with Release 9.0.0-ADR or later software and the LAA10B OC3 (1.3 STD) circuit pack, synchronization messages can be sent out on the OC-3 side via the S1 byte, which is also provisionable.

- **FT-2000 OC-48 Repeater Bay**

- **Through timed** from an incoming OC-48 signal.

As network needs evolve, the FT-2000 OC-48 Lightwave System can be reprovisioned easily while in service to change synchronization modes as needed. If the synchronization mode is provisioned to the externally timed mode (the default setting), external DS1 synchronization references are required.

The FT-2000 OC-48 Lightwave System also provides DS1 synchronization output signals to the office building integrated timing supply (BITS) clock or other central office equipment.

Internal timing functions—reference interfaces, the on-board clock elements, and timing distribution—are located on the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs. The TG3 (DS1) circuit packs distribute clock signals derived from the selected reference source to the transmission circuit packs.

Two TG3 (DS1) circuit packs are located on each Low Speed Shelf and support the synchronization needs of the FT-2000 OC-48 rings. The FT-2000 OC-48 Repeater Bay does not require TG3 (DS1) circuit packs. The TG3 (DS1) circuit packs are 1x1 (revertive) protected, protecting against circuit pack failures. The DS1 synchronization references are revertively protected. For more information about synchronization protection, refer to Section 9, "Maintenance Description."

Externally Timed Mode

In the externally timed mode (phase locked mode in releases prior to Release 5) (Figure 5-5), each TG3 (DS1) circuit pack accepts a DS1 synchronization reference signal from an external stratum 3 or better clock. In bidirectional 2-fiber ring applications, the DS1 references synchronize the local FT-2000 OC-48 Add/Drop-Rings Terminal, and other FT-2000 OC-48 Add/Drop-Rings Terminals that are through timed, with other network equipment operating under the same primary clock source. Within the TG3 (DS1) circuit pack, a highly stable DPLL circuit removes any transient impairments on the DS1 reference for improved jitter performance.

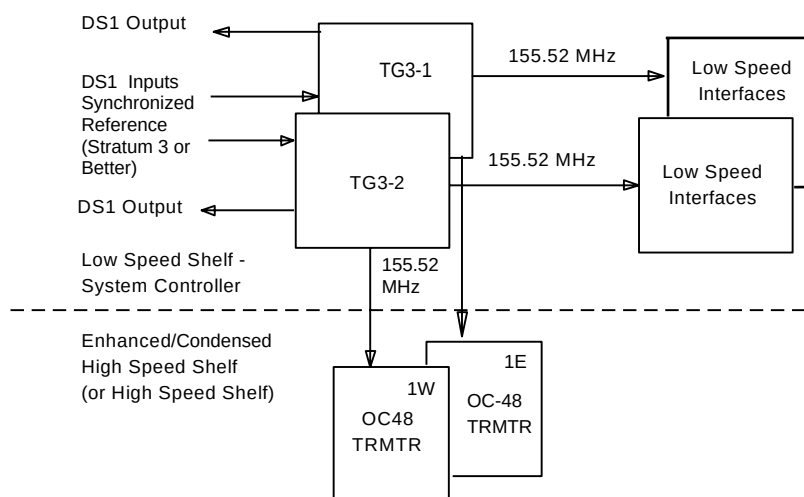


Figure 5-5. Externally Timed Synchronization

The DS1 references are continuously monitored. If the primary DS1 reference becomes corrupted, the TG3 (DS1) circuit pack will select the secondary DS1 reference without causing service degradations. If both DS1 references are corrupted, the DPLL circuit holds the on-board oscillator frequency at the last good reference sample while the DS1 references are repaired (holdover mode). In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

The TG3 (DS1) circuit packs distribute 155.52 MHz timing signals to the low speed interface circuit packs on the Low Speed Shelf - System Controller and the OC48 TRMTR circuit packs on the Enhanced High Speed Shelf (or High Speed Shelf).

In the externally timed mode, the LAA18 TG3 (DS1) circuit packs can also provide DS1 synchronization output signals to the office BITS clock or other central office equipment.

The DS1 reference input interface (TIMING IN PRI and TIMING IN SECY) and the DS1 reference output interface (TIMING OUT 1 and TIMING OUT 2) are located on the interconnection panel of the Low Speed Shelf - System Controller. Refer to Section 3, "Platform Descriptions," for more information about the physical location of the DS1 reference interfaces.

| Free Running Mode

In the free running mode (Figure 5-6), the TG3 (DS1) circuit packs on the Low Speed Shelf - System Controller derive timing from a highly stable crystal oscillator. This oscillator has a long-term accuracy better than ± 4.6 ppm. The TG3 (DS1) circuit packs distribute 155.52 MHz timing signals to the low speed interface circuit packs on the Low Speed Shelf - System Controller and the OC48 Transmitter (OC48 TRMTR) circuit packs on the Enhanced High Speed Shelf (or High Speed Shelf).

In the free running mode, the DS1 reference input interface (TIMING IN PRI and TIMING IN SECY) and DS1 reference output interface (TIMING OUT 1 and TIMING OUT 2) located on the interconnection panel of the Low Speed Shelf - System Controller are not used.

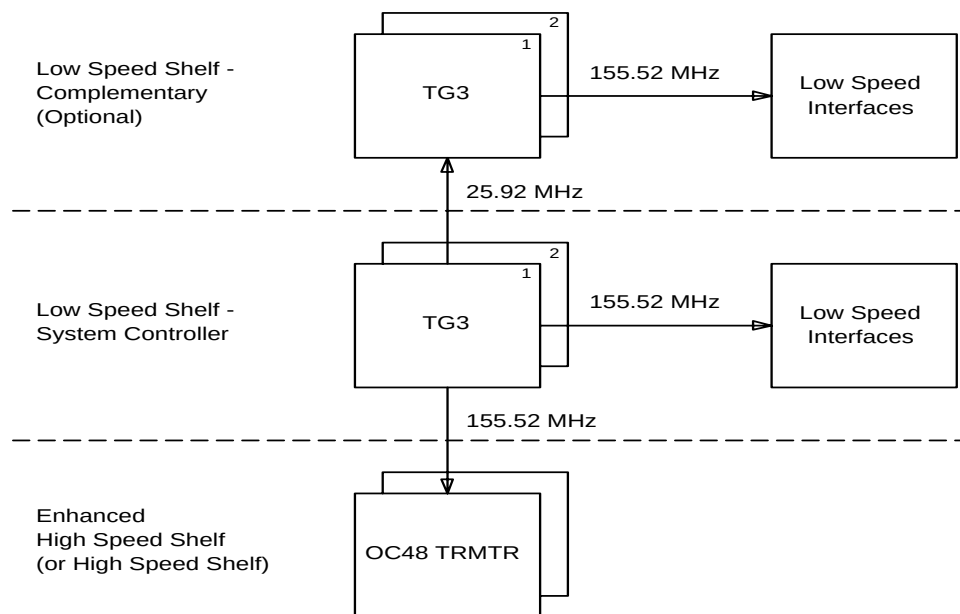


Figure 5-6. Free Running Synchronization

Line Timed Mode

The line timed mode of synchronization is available in FT-2000 OC-48 ADR Release 7.2 and later releases. It provides several benefits which make it superior to other modes—particularly with FT-2000 nodes that are located in sites without BITS clocks. More specifically, this mode uses status type messages that are referred to as "sync-messages." These "sync-messages" are a method by which nodes in an FT-2000 NE can communicate their synchronization status to other NEs in the ring. The main advantages provided by "sync-messages" are the following:

- The ability to automatically reconfigure how synchronization is obtained,
- Better reliability for timing distribution.

In terms of operation, the user may choose from which direction the timing is derived, East(E), or West(W), or Auto. West is the default option. When Auto is chosen, the particular received signal selected is determined by the sync-message algorithm. Simply put, the sync message algorithm allows each node to reconfigure its timing source to derive timing from the best available source. As a contrast to through timed, whenever line timed makes a switch/reconfiguration that event is "non-revertive."

**NOTE:**

The line timed-auto mode can reconfigure for: (a) two transmission line failures, (b) a node failure, and (c) failure of an external timing source. The sync messages, via optical low speed interfaces, supports interworking with DDM-2000 rings. However, it should not be assumed that the 7.2.0 version's (timing messages or DCC communication) will interwork with other vendors products.

Synchronization (Sync) Messaging

Synchronization messages are a method by which nodes within an FT-2000 ring can communicate their synchronization status with other nodes within the ring. This message set is transmitted in the S1 byte on an OC-N signal.

The messages in Table 5-1 indicate the stratum level to which the timing on an incoming OC-N line is traceable.

Table 5-1. Synchronization Status Messages

Description	Acronym	Quality Level	S1 bits 5678	K2 bits 123
PRS Traceable	PRS	1	0001	111
Synchronized - traceability unknown	STU	2	0000	110
Traceable Stratum 2 Holdover	ST2	3	0111	101

Table 5-1. Synchronization Status Messages

Description	Acronym	Quality Level	S1 bits 5678	K2 bits 123
Traceable Stratum 3 Holdover	ST3	4	1010	100
Traceable SONET clock self-timed	SIC	5	1100	N/A
DON'T USE for Sync	DUS	7	1111	000

The message DUS (Don't Use for Synchronization) is used to indicate

- A link on which timing has been looped back, in order to prevent timing loops.
- An invalid message.

Synchronization messages are exchanged

- Between FT-2000 nodes over OC-48 interfaces via bits 5, 6, 7, and 8 of the S1 byte.
- From FT-2000 nodes to DDM-2000 nodes over OC-3 and OC-12 interfaces via a proprietary message set on bits 1, 2, and 3 of the K2 byte.
- From FT-2000 nodes to DDM-2000 OC-3 or other vendor OC-3 equipment over LAA10B OC-3 interfaces via bits 5, 6, 7 and 8 of the S1 byte.

On the OC-48 interface, synchronization messages are both transmitted and processed. On the IS-3, OC-3, and OC-12 interfaces, synchronization messages are supported in the direction to distribute timing to DDM-2000. The table below shows two ring environments available:

- interoffice
- customer location.

Table 5-2 explains ring environments and the use of synchronization.

Table 5-2. FT-2000 Ring Environments

IF the ring environment is...	THEN the synchronization is located in	AND
interoffice	central offices with BITS clocks	synchronization messages are not needed.
loop (customer location)	customer sites without BITS clocks	DS1 output will be used to provide timing to the equipment in the customer location. Note: if the timing is not traceable to the timing network, insert DS1 AIS.

Through Timed Mode

In the through timed mode, an intermediate site (FT-2000 OC-48 Add/Drop-Rings Terminal or FT-2000 OC-48 Repeater Bay) derives timing from the incoming OC-48 signals.

In the FT-2000 OC-48 Add/Drop-Rings Terminal, the TG3 (DS1) circuit packs derive timing from the incoming OC-48 signals (Figure 5-7). The TG3 (DS1) circuit packs accept an OC-48 line reference signal (25.92 MHz) from the OC48 RCVR circuit packs and derive the internal synchronization used by the transmission circuit packs. For example, the TG3 (DS1) circuit pack that accepts the OC-48 line reference signal from high speed line 1E derives timing for the OC-48 signal transmitted on high speed line 1W. Also, the TG3 (DS1) circuit pack that accepts the OC-48 line reference signal from high speed line 1W derives timing for the OC-48 signal transmitted on high speed line 1E.

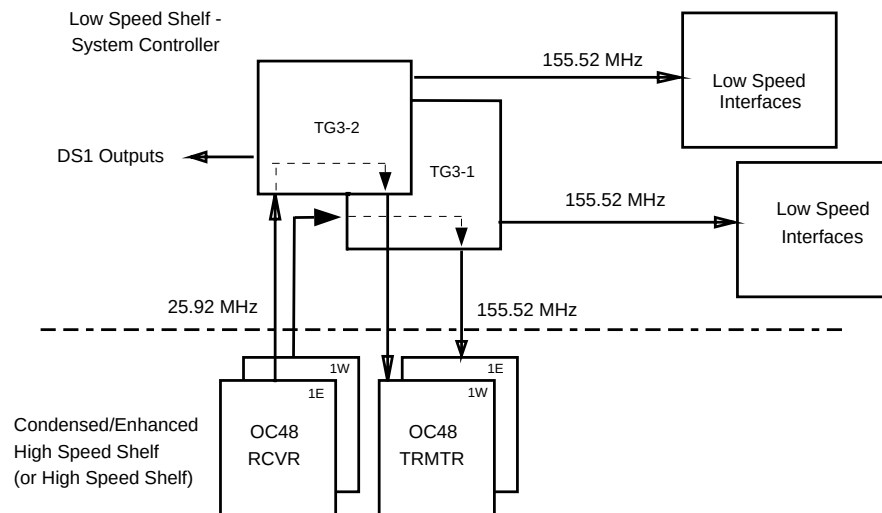


Figure 5-7. Through Timed Synchronization (FT-2000 OC-48 Add/Drop-Rings Terminal)

The OC-48 line reference signals are continuously monitored. If the primary OC-48 line reference signal becomes corrupted, the TG3 (DS1) circuit pack will select the secondary OC-48 line reference signal without causing service degradations. If the primary and secondary OC-48 line reference signals fail, the digital phase-locked loop (DPLL) circuit holds the on-board oscillator frequency at the last good reference sample while the references are repaired (holdover mode). This mechanism is provided so that operation with or without an external BITS clock can be easily accommodated. In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

In the through timed mode, the TG3 (DS1) circuit packs can also provide DS1 reference outputs to the office BITS clock or other central office equipment. The LAA17 TG3 (DS1) circuit pack derives the DS1 reference outputs from the internal oscillator. The LAA18 TG3 (DS1) circuit pack derives the DS1 reference outputs directly from the OC-48 line reference signals. The DS1 reference output interface (TIMING OUT 1 and TIMING OUT 2) is located on the interconnection panel of the Low Speed Shelf - System Controller. For more information about the physical location of the DS1 reference interfaces, refer to Section 3, "Platform Descriptions."



NOTE:

The OC-12 low speed interface(s) can be provisioned to drop traffic from both the West and East directions. Thus, the OC-12 is provisioned with multiple cross-connections. With regard to synchronization (through timed mode only), the direction from which the OC-12 circuit pack derives its timing is user-provisioned as 1W or 1E, corresponding to the two incoming OC48 lines. The default provision for the OC12 timing direction is (incoming OC48 line) 1W.

In the FT-2000 OC-48 Repeater Bay, the OC48 Regenerator (OC48 REGENR) circuit packs derive timing from the incoming OC-48 signals and use it to time their outgoing OC-48 signals. For example, the OC48 REGENR circuit pack that accepts the incoming OC-48 signal from high speed line 1E derives timing for the OC-48 signal transmitted on high speed line 1W (Figure 5-8). Also, the OC48 REGENR circuit pack that accepts the incoming OC-48 signal from high speed line 1W derives timing for the OC-48 signal transmitted on high speed line 1E. The FT-2000 OC-48 Repeater Bay does not require TG3 (DS1) circuit packs.

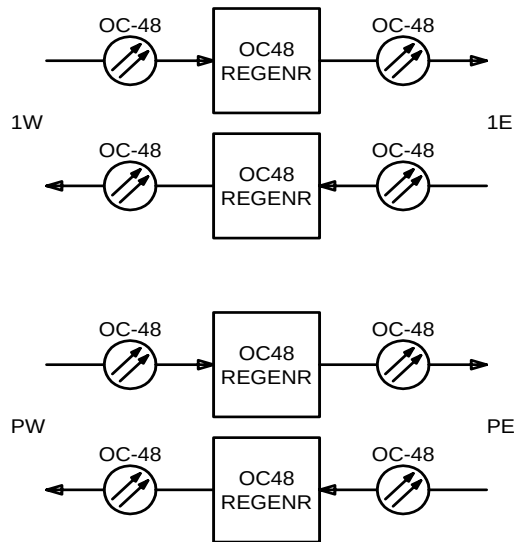


Figure 5-8. Through Timed Synchronization (FT-2000 OC-48 Repeater Bay)

Loop Timed Mode—only for Point-to-Point Releases of ADR

In the loop timed mode (Figure 5-9), the TG3 (DS1) circuit packs on the Low Speed Shelf - System Controller derive timing from the incoming OC-48 signals. The TG3 (DS1) circuit packs accept an OC-48 line reference signal (25.92 MHz) from the OC48 RCVR circuit packs and derive the internal synchronization used by the transmission packs.

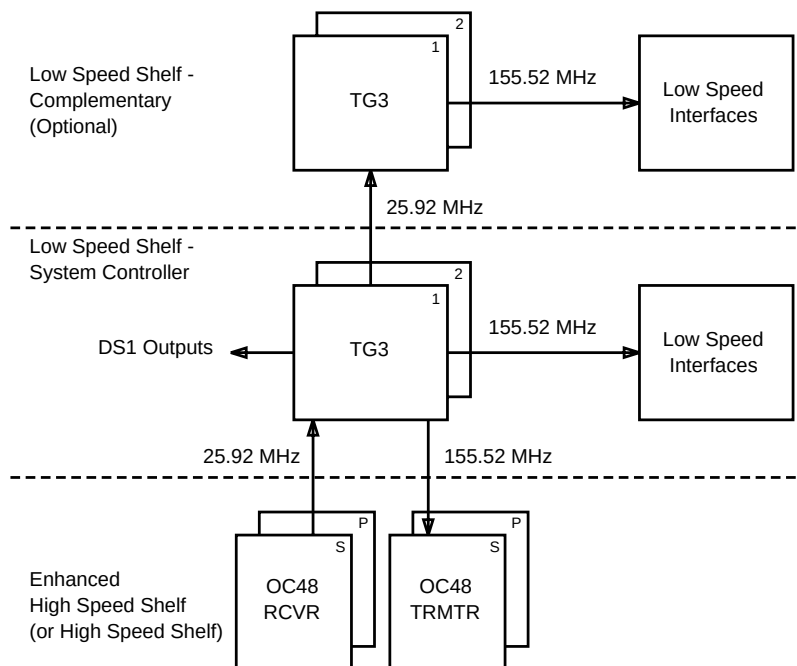


Figure 5-9. Loop Timed Synchronization

The OC-48 line reference signals are continuously monitored for error-free operation. If the primary OC-48 line reference signal becomes corrupted, the TG3 (DS1) circuit pack will select the secondary OC-48 line reference signal without causing service degradations. If both OC-48 line reference signals are corrupted, the digital phase-locked loop (DPLL) circuit will attempt to lock on to the primary DS1 synchronization input (if equipped). If the primary DS1 synchronization input is not equipped or fails, the DPLL circuit will attempt to lock on to the secondary DS1 synchronization input (if equipped). If all these references fail, the DPLL circuit holds the on-board oscillator frequency at the last good reference sample while the references are repaired (holdover mode). This mechanism is provided so that operation with or without an external BITS clock can be easily accommodated. In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

The TG3 (DS1) circuit packs distribute 155.52 MHz timing signals to the low speed interface circuit packs on the Low Speed Shelf - System Controller and the OC48 TRMTR circuit packs on the Enhanced High Speed Shelf (or High Speed Shelf).

In the loop timed mode, the TG3 (DS1) circuit packs can also provide DS1 synchronization outputs to the office BITS clock or other central office equipment.

The LAA17 TG3 (DS1) circuit pack derives the DS1 synchronization outputs from the internal oscillator. The LAA18 TG3 (DS1) circuit pack derives the DS1 synchronization outputs directly from the OC-48 line reference signal. If the OC-48 line reference signals fail, the TG3 (DS1) circuit pack transmits DS1 alarm indication signals (AIS) to the BITS clock to prevent any uncontrolled timing loops.

The DS1 reference input interface (TIMING IN PRI and TIMING IN SECY) and the DS1 reference output interface (TIMING OUT 1 and TIMING OUT 2) are located on the interconnection panel of the Low Speed Shelf - System Controller. For more information about the physical location of the DS1 reference interfaces, refer to Section 3, "Platform Descriptions."

Network Synchronization

General

Careful consideration should be given to proper design of the SONET network's synchronization. Proper synchronization engineering minimizes timing instabilities, maintains quality transmission network performance, and limits network degradation due to unwanted propagation of network synchronization faults. The synchronization features of the FT-2000 OC-48 Lightwave System are designed to complement existing and future network synchronization and, hence, allow it not only to make use of network synchronization but also to take an active role in facilitating network synchronization.

Several published sources give generic recommendations on setting up a synchronization network. The FT-2000 OC-48 Lightwave System is designed to operate in a network that complies with recommendations stated in GR-436-CORE, *Digital Synchronization Network Plan*, Issue 1, June 1994; GR-378-CORE, *Generic Requirements for Timing Signal Generators (TSG)*, Issue 1, June 1995; and ANSI* T1.101-1994, *American National Standard for Telecommunications - Synchronization Interface Standards*. The following are some key recommendations from these documents. For further detailed explanation, consult the sources directly. *

- A network element can only receive the synchronization reference signal from another network element that contains a clock of equivalent or superior quality (stratum level).
- The facilities with the greatest availability (absence of outages) should be selected for synchronization facilities.
- Where possible, all primary and secondary synchronization facilities should be diverse, and synchronization facilities within the same cable should be minimized.

* Registered trademark of American National Standards Institute, Inc.

- The total number of network elements in series from the stratum 1 source should be minimized. For example, the primary synchronization network would ideally look like a star configuration with the stratum 1 source at the center. The network elements connected to the star would branch out in decreasing stratum level from the center.
- No timing loops may be formed in any combination of primary and secondary facilities.

The FT-2000 OC-48 Lightwave System supports the following applications (with or without the FT-2000 OC-48 Repeater Bay) and network synchronization configurations:

- OC-48 point-to-point applications with asynchronous (DS3) and synchronous (EC-1, OC-3 and/or OC-12) low speed interfaces
 - Externally timed/externally timed configuration
 - Externally timed/through timed configuration
 - Free running/free running configuration
 - Free running/through timed configuration
 - Phase locked/phase locked configuration.
- Bidirectional ring applications with asynchronous (DS3) and synchronous (EC-1, OC-3 and/or OC-12) low speed interfaces
 - Ring applications not used to distribute timing to BITS clocks
 - Ring applications used to distribute timing to BITS clocks.

OC-48 Point-to-Point Applications

Free Running/Free Running Configuration

For initial SONET deployment with DS3 low speed interfaces, no external synchronization reference is needed; therefore, the expense of connecting to one is eliminated. The free running/free running configuration is ideal for linear networks with asynchronous interfaces. It allows the FT-2000 OC-48 Add/Drop-Rings Terminal to interface with the existing asynchronous equipment in a network and enables a smooth evolution to a synchronous network.

The free running/free running configuration applies to OC-48 point-to-point applications (with or without FT-2000 OC-48 Repeater Bays) with asynchronous (DS3) low speed interfaces only.

In the free running/free running configuration (Figure 5-10), both terminals are free running; that is, they require no external synchronization reference. The transmit and receive signals are asynchronous with respect to each other.

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

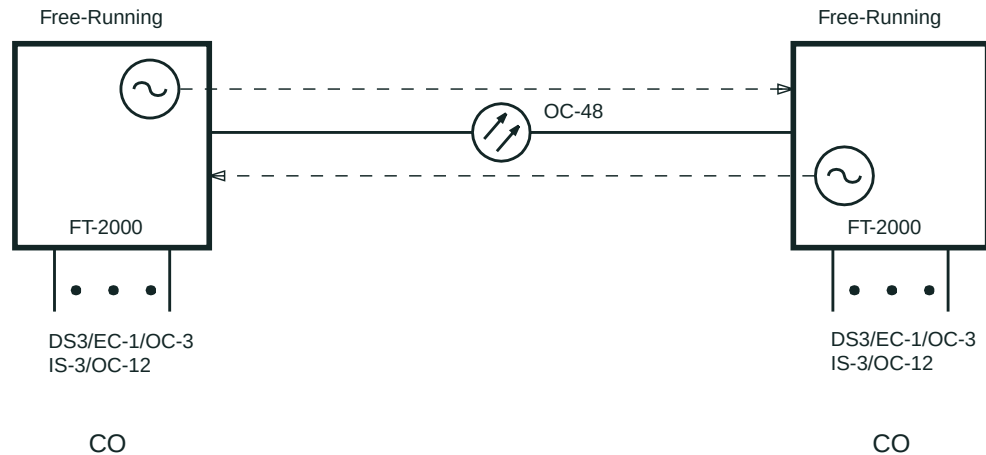


Figure 5-10. Free Running/Free Running Configuration

Free Running/Through Timed Configuration

The free running/through timed configuration may be used for initial asynchronous applications and reprovisioned later to the externally timed/through timed configuration by adding an external DS1 synchronization reference.

The free running/through timed configuration applies to OC-48 point-to-point applications (with or without FT-2000 OC-48 Repeater Bays) with asynchronous (DS3) low speed interfaces only.

In the free running/through timed configuration (Figure 5-11), one FT-2000 OC-48 Add/Drop-Rings Terminal times its transmitted signals from its free running internal oscillator. The internal oscillator at the other FT-2000 OC-48 Add/Drop-Rings Terminal uses the OC-48 line reference signal recovered from the incoming OC-48 signal to derive timing for its transmitted signals.

The FT-2000 OC-48 Add/Drop-Rings Terminal in the through timed mode also derives two DS1 synchronization outputs. The LAA18 TG3 (DS1) circuit pack derives the DS1 synchronization outputs directly from the timing signal recovered from the incoming OC-48 signal. The DS1 synchronization outputs are made available to the office BITS clock or other SONET network elements in the office.

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

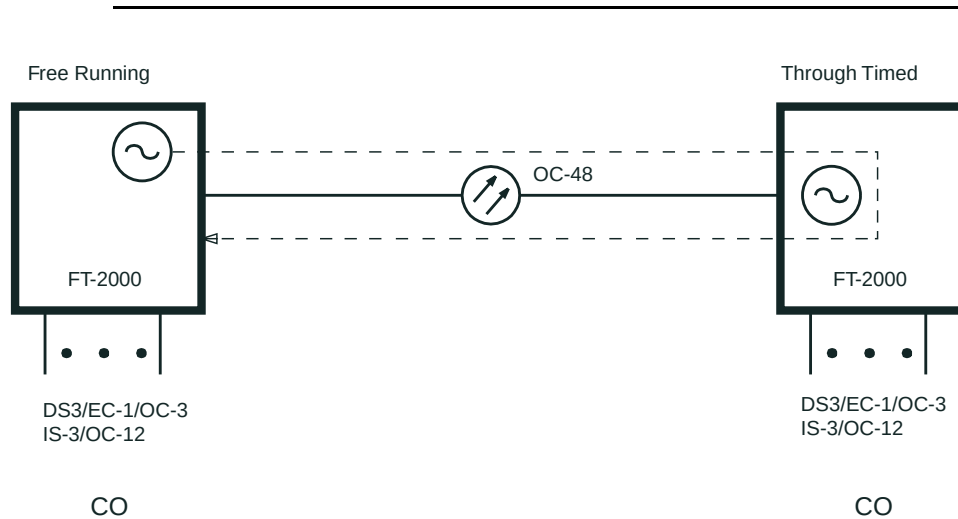


Figure 5-11. Free Running/Through Timed Configuration

Externally Timed/Through Timed Configuration

The externally timed/through timed configuration allows the FT-2000 OC-48 Add/Drop-Rings Terminal to synchronize to the digital synchronization network as required for synchronous operation by the SONET standard. The network is synchronized to a local central office clock via DS1 external synchronization references. The local office clock must be stratum 3 or better, with timing traceable to a primary reference source (stratum 1 clock). If synchronous (EC-1, OC-3, IS-3 and/or OC-12) low speed interfaces are present, external sources must be traceable to a stratum 1 clock.

The externally timed/through timed configuration applies to all OC-48 point-to-point applications (with or without the FT-2000 OC-48 Repeater Bay).

The FT-2000 OC-48 Add/Drop-Rings Terminal in the through timed mode may be equipped with two DS1 external synchronization references. If the OC-48 line reference signals fail, the TG3 (DS1) circuit pack holds the on-board oscillator frequency at the last good reference sample (holdover mode).

The FT-2000 OC-48 Add/Drop-Rings Terminal in the through timed mode can also provide two DS1 synchronization outputs to the office BITS clock or other SONET network elements. An FT-2000 OC-48 Add/Drop-Rings Terminal equipped with the LAA18 TG3 (DS1) circuit pack derives the DS1 synchronization outputs directly from the OC-48 line reference signals (Figure 5-12). For more information about platform timing modes, refer to "Platform Synchronization" in this section.

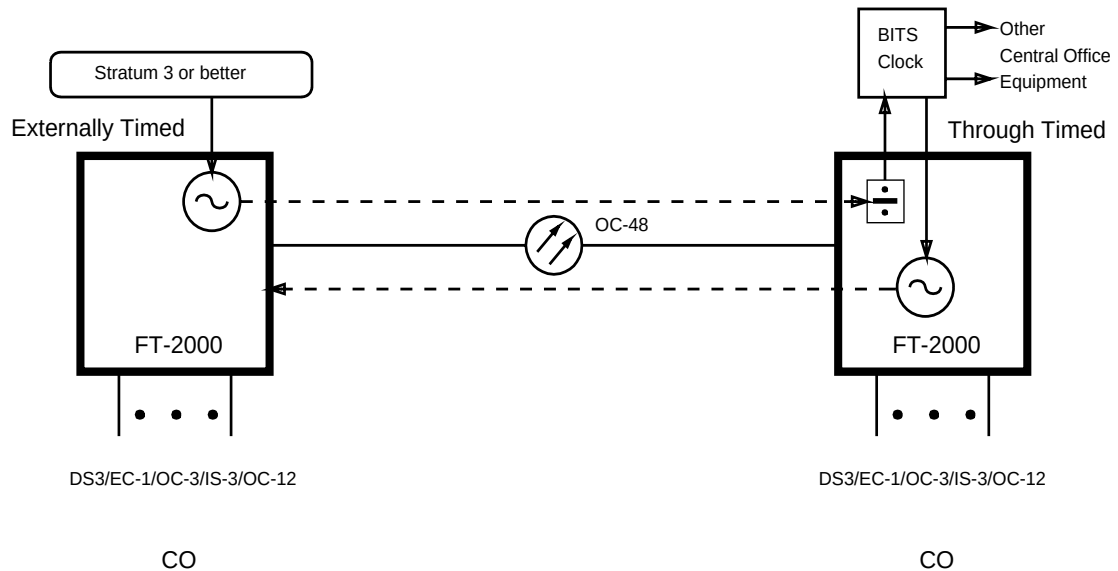


Figure 5-12. Externally Timed/Through Timed Configuration

Phase Locked/Phase Locked Configuration

In the phase locked/phase locked configuration, both FT-2000 OC-48 Add/Drop-Rings Terminals time their transmitted signals from internal oscillators that are locked to the DS1 external synchronization reference.

Since this configuration requires local office clocks at each end terminal, it is most suited to interoffice applications. The network may have all DS1 references traceable to a common primary reference source (for example, outstate trunking) or to multiple primary reference sources (for example, a carrier-to-carrier interface). The use of multiple primary reference sources is referred to as plesiochronous operation (Figure 5-13).

The phase locked/phase locked configuration applies to all OC-48 point-to-point applications (with or without the FT-2000 OC-48 Repeater Bay).

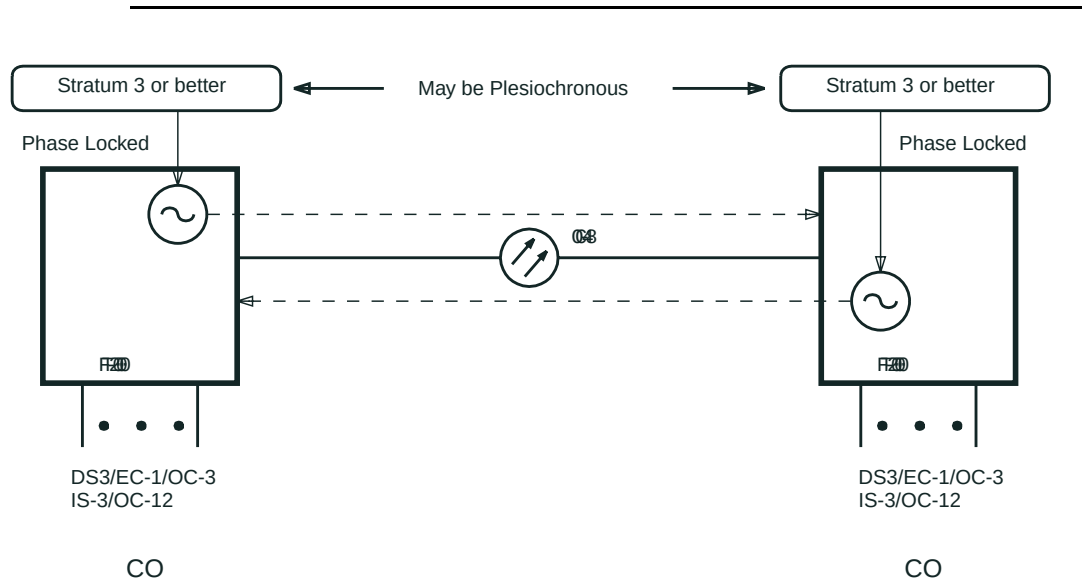


Figure 5-13. Phase Locked/Phase Locked Configuration

An FT-2000 OC-48 Add/Drop-Rings Terminal equipped with the LAA18 TG3 (DS1) circuit pack can also provide DS1 synchronization outputs to the office BITS clock or other central office equipment (Figure 5-14).

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

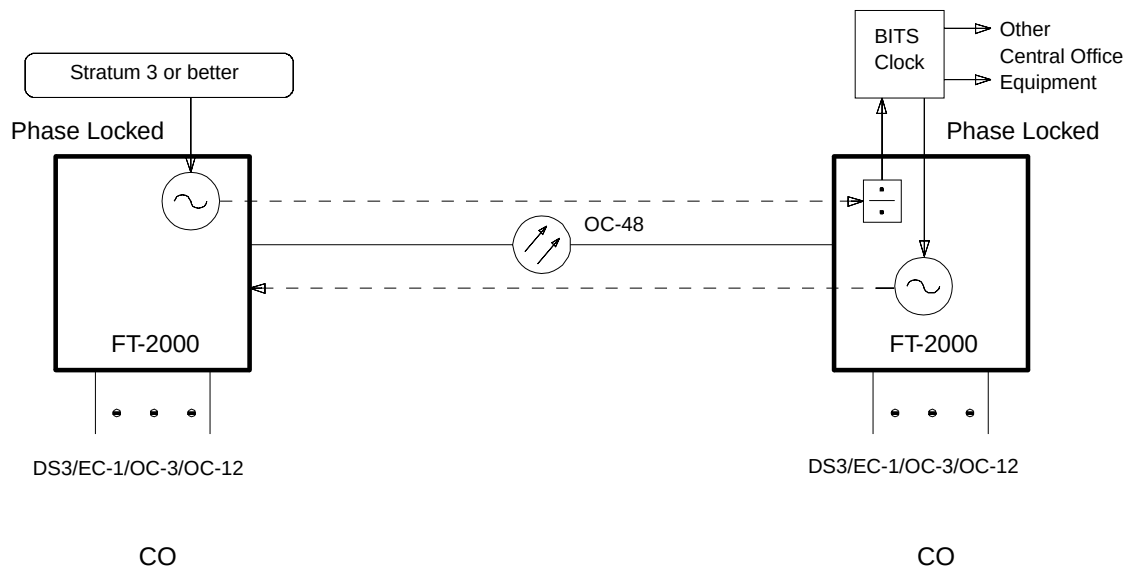


Figure 5-14. Phase Locked/Phase Locked Configuration [LAA18 TG3 (DS1) Circuit Pack]

Externally Timed/Externally Timed Configuration

In the externally timed/externally timed configuration (Figure 5-15), both FT-2000 OC-48 Add/Drop-Rings Terminals time their transmitted signals from internal oscillators that are locked to the DS1 external synchronization reference.

Since this configuration requires local office clocks at each terminal, it is most suited to interoffice applications. The network must have all DS1 references traceable to a common primary reference source (for example, outstate trunking) or to multiple primary reference sources (for example, a carrier-to-carrier interface). The use of multiple primary reference sources is referred to as plesiochronous operation. If synchronous (EC-1, OC-3, IS-3 or OC-12) low speed interfaces are present, external sources must be traceable to a stratum 1 clock.

The externally timed/externally timed configuration applies to all OC-48 point-to-point applications (with or without the FT-2000 OC-48 Repeater Bay).

The LAA18 TG3 (DS1) circuit pack can also provide DS1 synchronization outputs to the office BITS clock or other central office equipment. For more information about platform timing modes, refer to "Platform Synchronization" in this section.

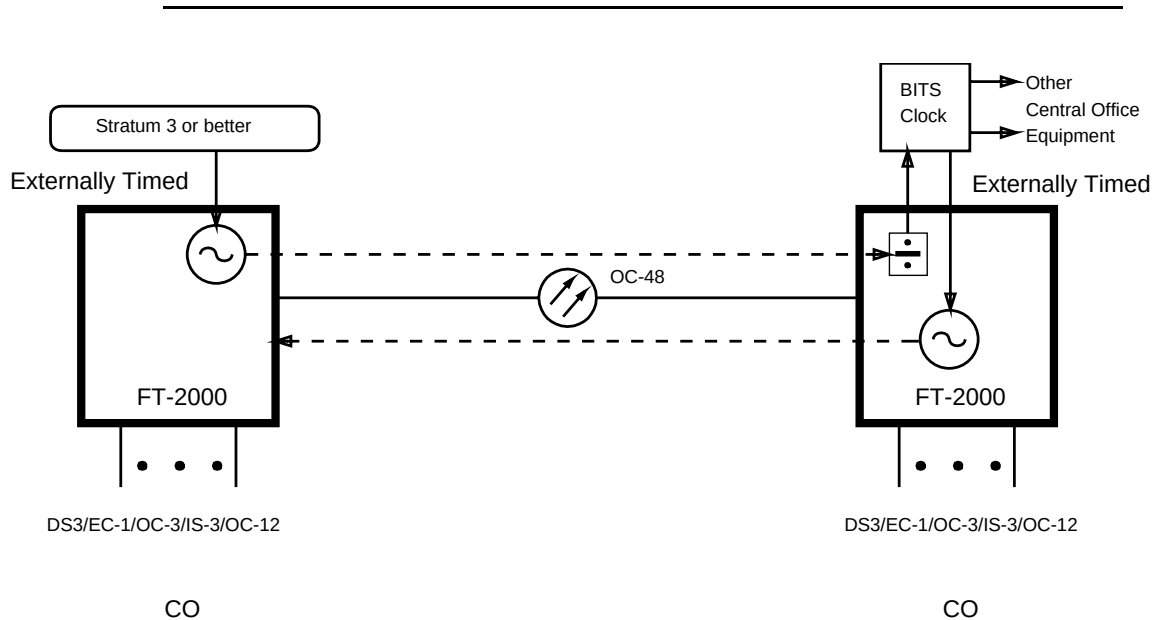


Figure 5-15. Externally Timed/Externally Timed Configuration

Bidirectional Ring Applications

General

A bidirectional ring consists of up to 16 nodes, and each node has several synchronization provisioning options possible. This section contains a complete set of rules for determining how the synchronization mode should be provisioned for each node.

In addition to providing high quality, protected transmission, an FT-2000 ring can also be used to distribute timing signals from BITS clocks to other BITS clocks using the OC-48 signal. Distributing timing signals to BITS clocks using the FT-2000 OC-48 Lightwave System is becoming an increasingly important additional application to the transmission function. This is because the OC-48 line is a higher quality medium than direct T1 lines currently used to distribute timing signals or T1 facilities carried in the payload of SONET systems. (SONET payloads carrying T1 facilities cannot be used to distribute timing in rings.) However, there are many good quality synchronization distribution networks in place using T1 facilities that users may not wish to convert. Therefore, the FT-2000 OC-48 Lightwave System may or may not be used for distributing timing signals. The user must decide if the FT-2000 ring will be used to distribute timing signals to BITS clocks. This distinction is necessary to ensure that the nodes in the ring are provisioned properly to prevent closed timing loops during protection switching operations.

Prior to FT-2000 OC-48 ADR Release 7.2, network configurations could only use: (a) free running, (b) external timed, or (c) through timed synchronization modes. With Release 7.2 line timed synchronization mode is available. Reconfiguring a customer's network to support this mode is optional, but it is recommended. A combination of through timed and line timed in the same ring should only be used temporarily during the upgrade/reconfiguration process. During normal operations the ring should be configured for either all through timed or line timed with 2 nodes externally timed.



NOTE:

Bidirectional line switched rings, as an option, may or may not be used to distribute timing.



NOTE:

In mixed FT-2000/*WaveStar* rings, all *WaveStar* nodes must be provisioned externally timed. Any FT-2000 nodes adjacent to *WaveStar* nodes should be provisioned externally timed as well. Any FT-2000 nodes that are **not** adjacent to *WaveStar* nodes may be externally timed, line timed or through timed.

Ring Applications Not Used to Distribute Timing

Asynchronous Applications (DS-3 Low Speed Interfaces Only) . In ring applications not used to distribute timing signals to BITS clocks, there are six possible synchronization configurations. The two asynchronous configurations are as follows:

- **One node provisioned free running; all other nodes provisioned through timed:** This configuration (Figure 5-16) is used when there are only asynchronous (DS3) low speed interfaces on every node in the ring. Only one node in the ring should be provisioned free running. This prevents cumulative pointer processing on transmission signals passing through a node.

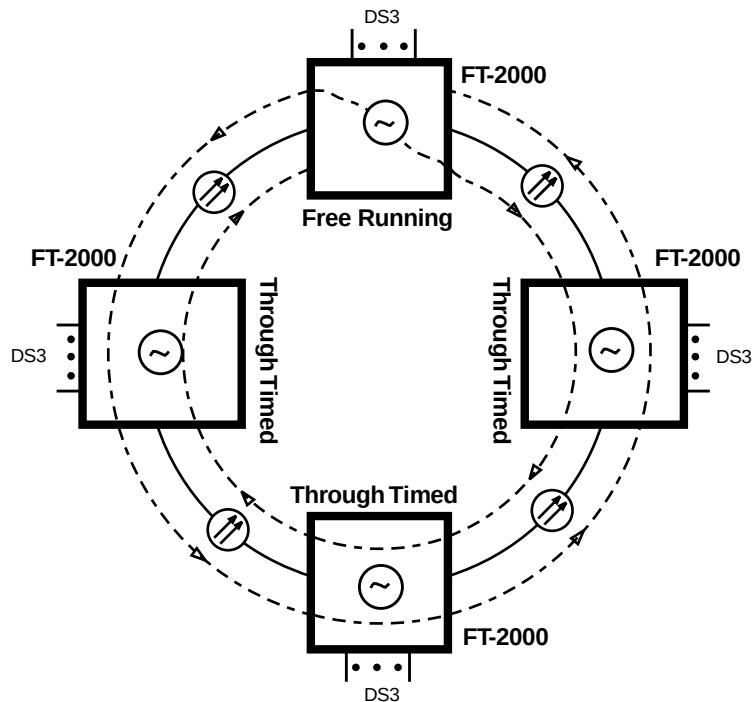


Figure 5-16. Example of a Ring Application with One Node Provisioned Free Running and All Other Nodes Provisioned Through Timed (Without Timing Drops)

- One node provisioned free running; all other nodes provisioned Line Timed:** Refer to (Figure 5-17). This configuration is used when there are asynchronous (DS3) interfaces at every node in the ring. Only one node in the ring should be provisioned free running. This prevents cumulative pointer processing on transmission signals passing through a node. In Figure 5-17, synchronization messages (DUS and ST3) are shown as they are transmitted on the OC-48 line.

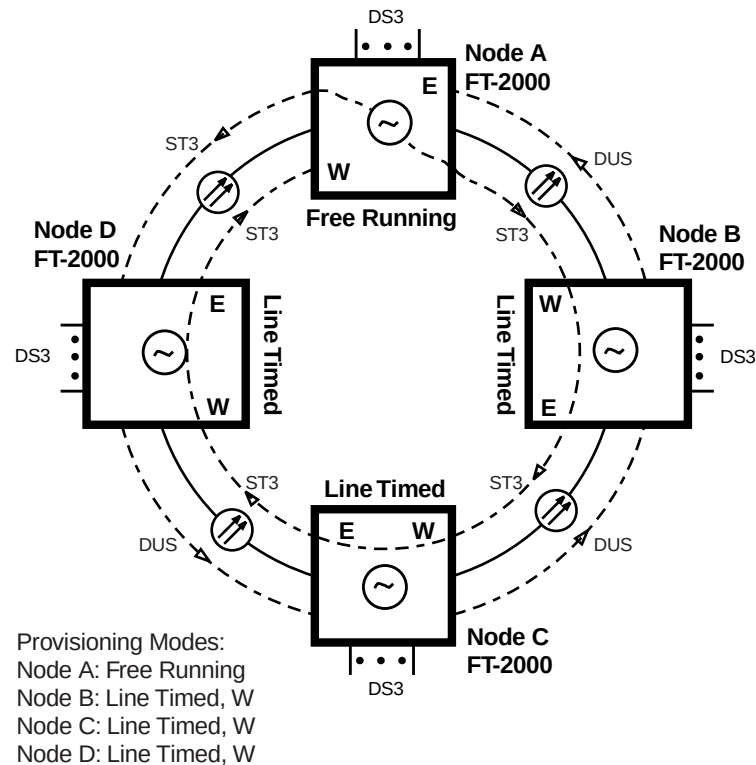


Figure 5-17. Example of a Ring Application with One Node Provisioned Free Running and All Other Nodes Provisioned Line Timed (Without Timing Drops)



NOTE:

If synchronous (EC-1, OC-3, IS-3 and/or OC-12) low speed interfaces are to be added to nodes of an asynchronous application, one node should be provisioned externally timed, and all other nodes should be provisioned "through timed," "line timed," or "externally timed."

Synchronous Applications (With a Mixture of Asynchronous and Synchronous Low Speed Interfaces.

- **One node provisioned externally timed; all other nodes provisioned through timed, line timed, or externally timed:** This configuration (Figure 5-18, Figure 5-19, and Figure 5-20) is used with asynchronous (DS3) or synchronous (EC-1, OC-3 and/or OC-12) low speed interfaces, or a mix of synchronous and asynchronous low speed interfaces. These configurations also prevent the need of having to reprovision a node when synchronous low speed interfaces are added. The timing signals used to synchronize the externally timed nodes should be traceable to a high quality source(s). If synchronous low speed interfaces are present, the timing signals must be traceable to a stratum 1 source. If only

asynchronous low speed interfaces are present, the timing signals must be traceable to a stratum 3 or better source. The quality and source of the timing signals must be engineered appropriately. The guidelines for choosing the timing source(s) and the BITS clock configurations are beyond the scope of this document.

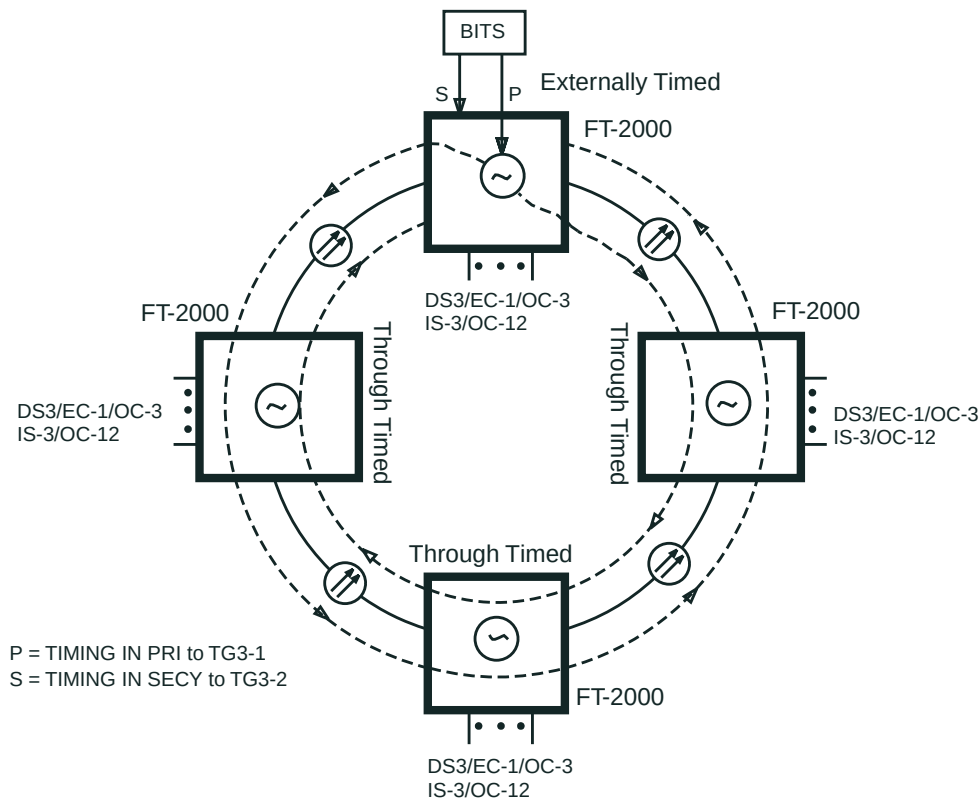


Figure 5-18. Example of a Ring Application with One Node Provisioned Externally Timed and All Other Nodes Provisioned Through Timed (Without Timing Drops)

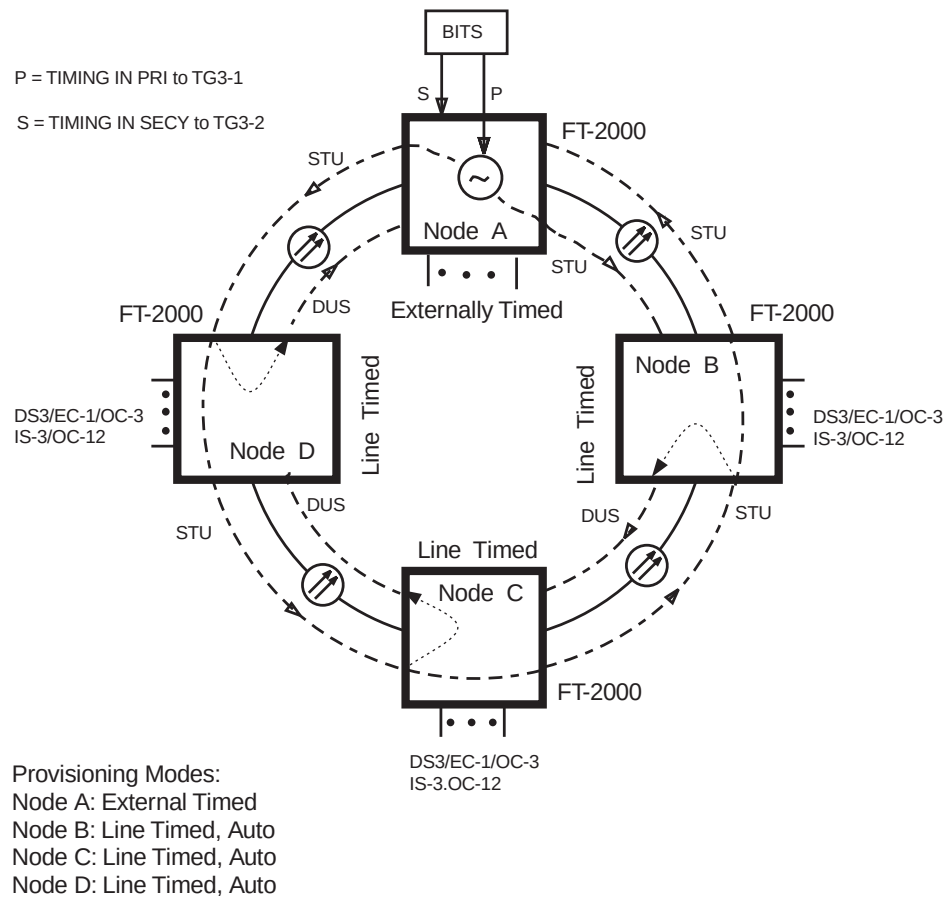


Figure 5-19. Example of a Ring Application with One Node Provisioned Externally Timed and All Other Nodes Provisioned Line Timed (Without Timing Drops)

NOTE:
In (Figure 5-19) synchronization messages (DUS and STU) are shown as they are transmitted on the OC-48 line.

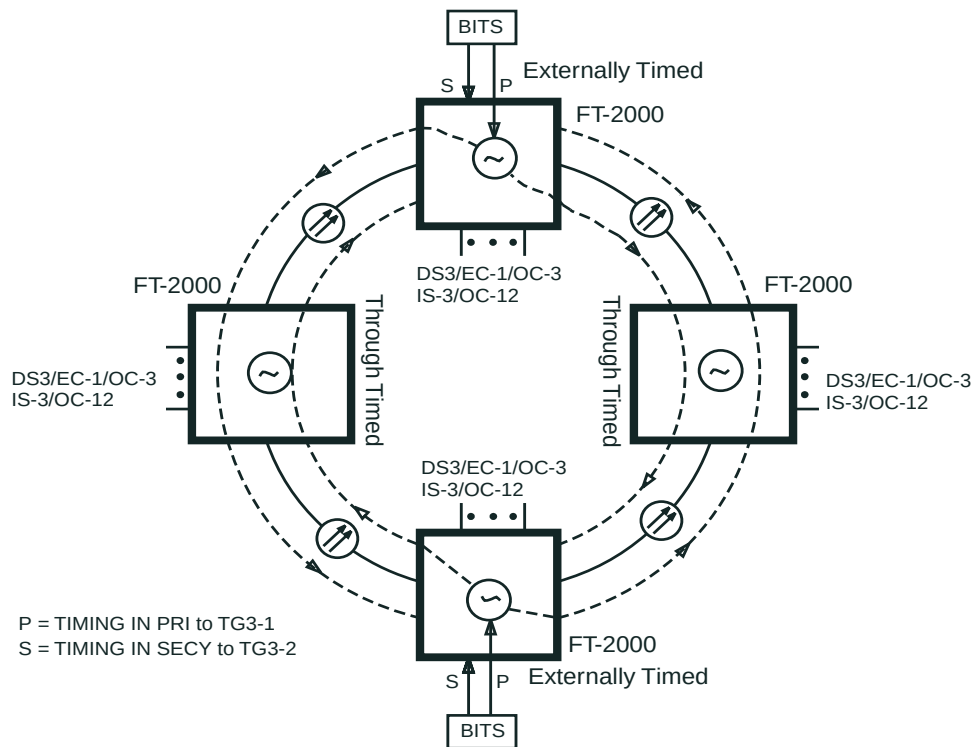


Figure 5-20. Example of a Ring Application with Two Nodes Provisioned Externally Timed and All Other Nodes Provisioned Through Timed or Externally Timed (Without Timing Drops)

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

Ring Applications Used to Distribute Timing

For ring applications that are used to distribute timing, it is recommended that "Line Timed" mode of synchronization be used. Through timing is also (still) acceptable. In ring applications used to distribute timing signals to BITS clocks, there are two possible configurations. Considering all available releases of FT-2000, then there are three fundamentally different configurations. They are as follows:

- **One node provisioned externally timed; all other nodes provisioned line timed.** In this configuration (Figure 5-21), any one or all nodes that are provisioned line timed can derive and distribute timing.

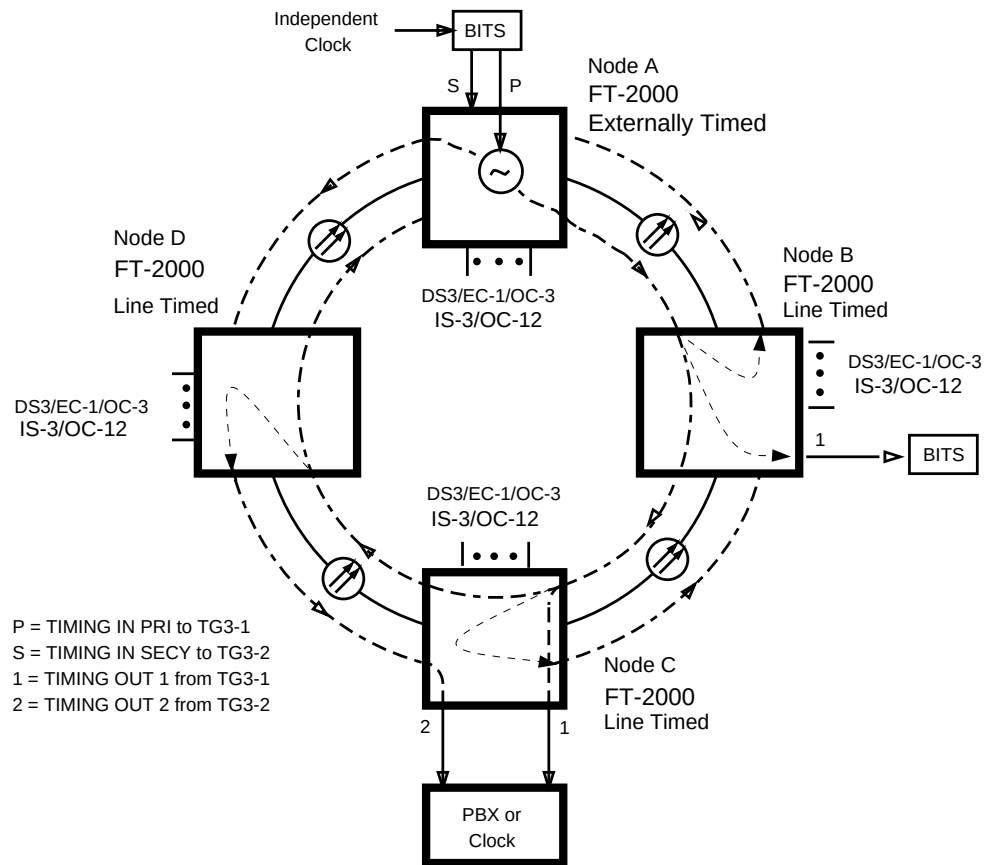


Figure 5-21. Example of a Ring Application with One Node Provisioned Externally Timed and All Other Nodes Provisioned Line Timed (With Two Timing Drops)

- **One node provisioned externally timed; all other nodes provisioned through timed or externally timed:** In this configuration (Figure 5-22 and Figure 5-23), at least one node should be provisioned externally timed, and any nodes that drop timing signals should be provisioned through timed. All other nodes should be provisioned externally timed or through timed.

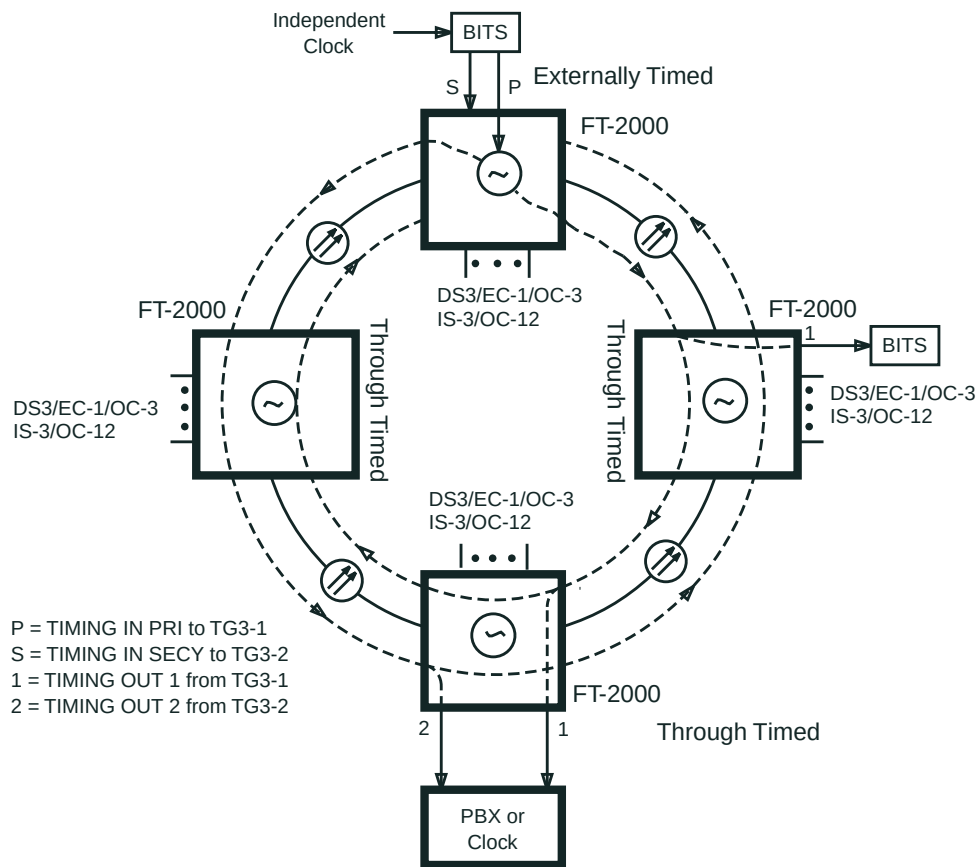


Figure 5-22. Example of a Ring Application with One Node Provisioned Externally Timed and All Other Nodes Provisioned Through Timed (with Timing Drops)

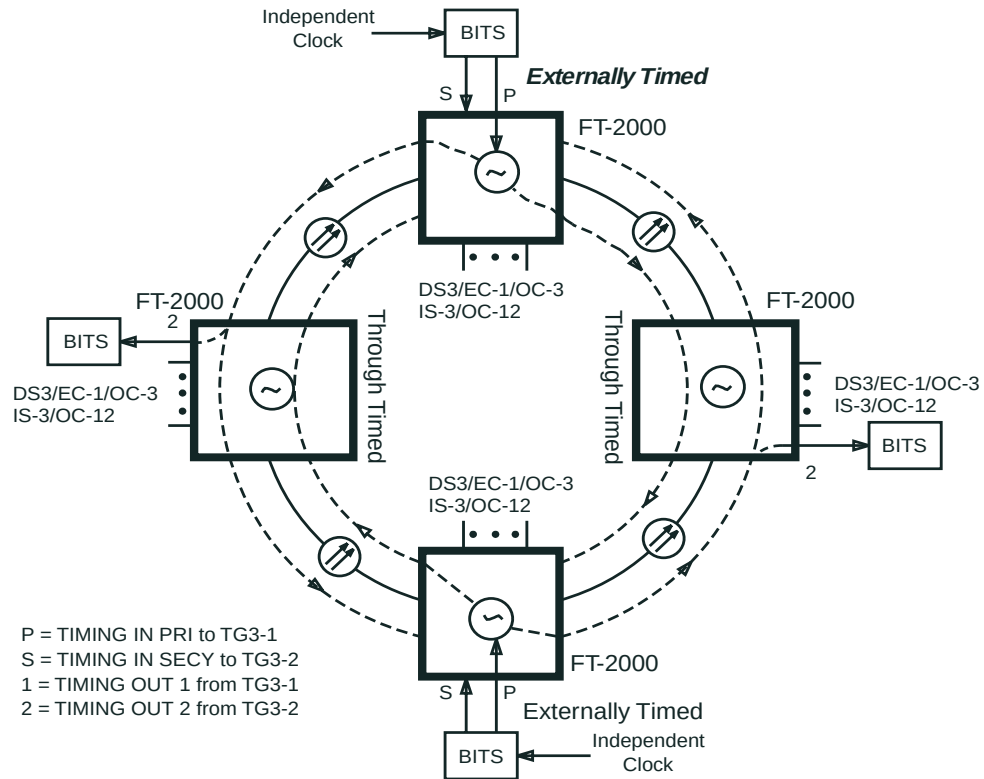


Figure 5-23. Example of a Ring Application with One Node Provisioned Externally Timed and All Other Nodes Provisioned Through Timed or Externally Timed (with Timing Drops)

At least one node should be provisioned externally timed to provide the timing signal that is distributed to some or all the remaining nodes. The timing signals used to synchronize the externally timed nodes should be traceable to a high quality timing source(s). If synchronous low speed interfaces are present, the timing signals must be traceable to a stratum 1 source. If only asynchronous low speed interfaces are present, the timing signals must be traceable to a stratum 3 or better source.

For the nodes that distribute the timing signal, the LAA18 TG3 (DS1) circuit pack should be used. The LAA18 TG3 (DS1) circuit pack provides a timing signal (DS1 synchronization output) derived directly from the OC-48 high speed line. This configuration supports either asynchronous or synchronous low speed interfaces or any combination. The quality and source of the timing signals must be engineered appropriately. The guidelines for choosing the timing source(s) and the BITS clock configurations are beyond the scope of this document.

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

- **All nodes provisioned externally timed:** This configuration (Figure 5-24) is for users with BITS or stratum 1 traceable clocks at all nodes in the ring. At least one node must be externally timed with a stratum 1 traceable source that is not derived from the ring. This node provides the timing signal that is distributed to some or all of the remaining nodes. At the remaining nodes, timing signals are provided to and received from a BITS clock. All nodes must be provisioned externally timed in this configuration or timing loops will occur. Figure 5-25 shows a ring application in this configuration with one node provisioned through timed and the resulting timing loop.

Timing signal input/output interfaces must be consistent. All nodes with BITS clocks must use the primary timing interface (TIMING IN PRI and TIMING OUT 1), *or* all nodes with BITS clock must use the secondary timing interface (TIMING IN SECY and TIMING OUT 2). Figure 5-26 shows a ring application in this configuration with inconsistent timing interfaces and the resulting timing loop.

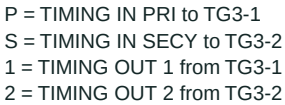


Figure 5-24. Example of a Ring Application with All Nodes Provisioned Externally Timed (with Timing Drops)

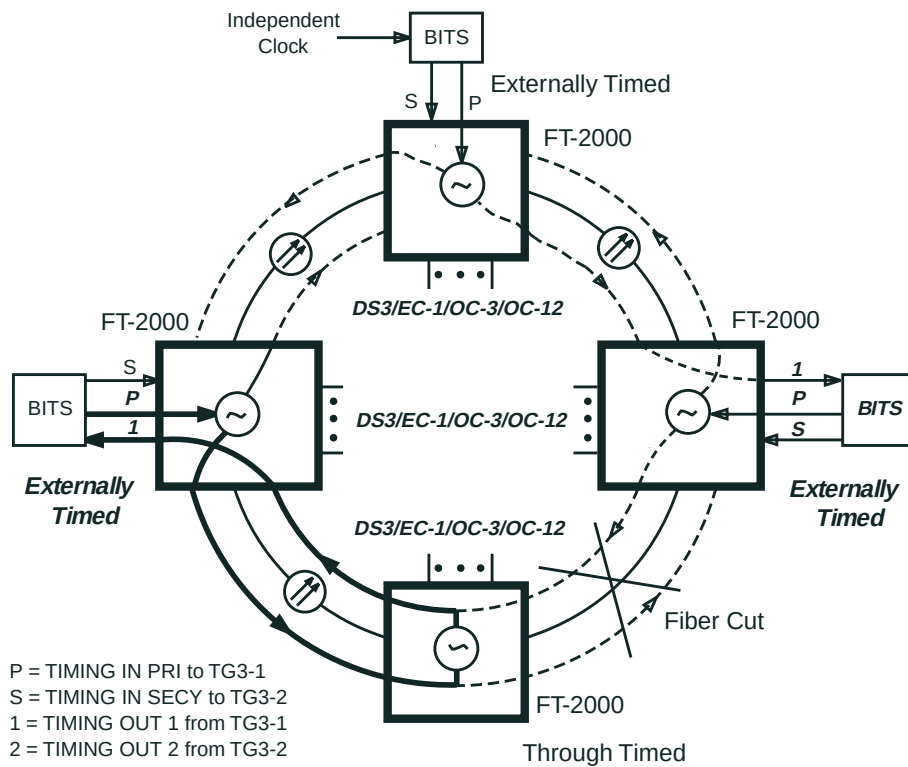


Figure 5-25. Example of a Timing Loop Resulting from Incorrect Provisioning

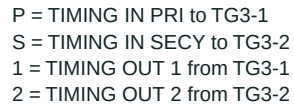


Figure 5-26. Example of a Timing Loop Resulting from Inconsistent DS1 Timing Interfaces

If a BITS or stratum 1 traceable clock is not available at a node and externally timed provisioning is desired, an external timing emulation (null BITS) cable may be used to emulate BITS operation (Figure 5-27). The external timing emulation cable connects TIMING OUT 1 to TIMING IN PRI, or TIMING OUT 2 to TIMING IN SECY at the node.

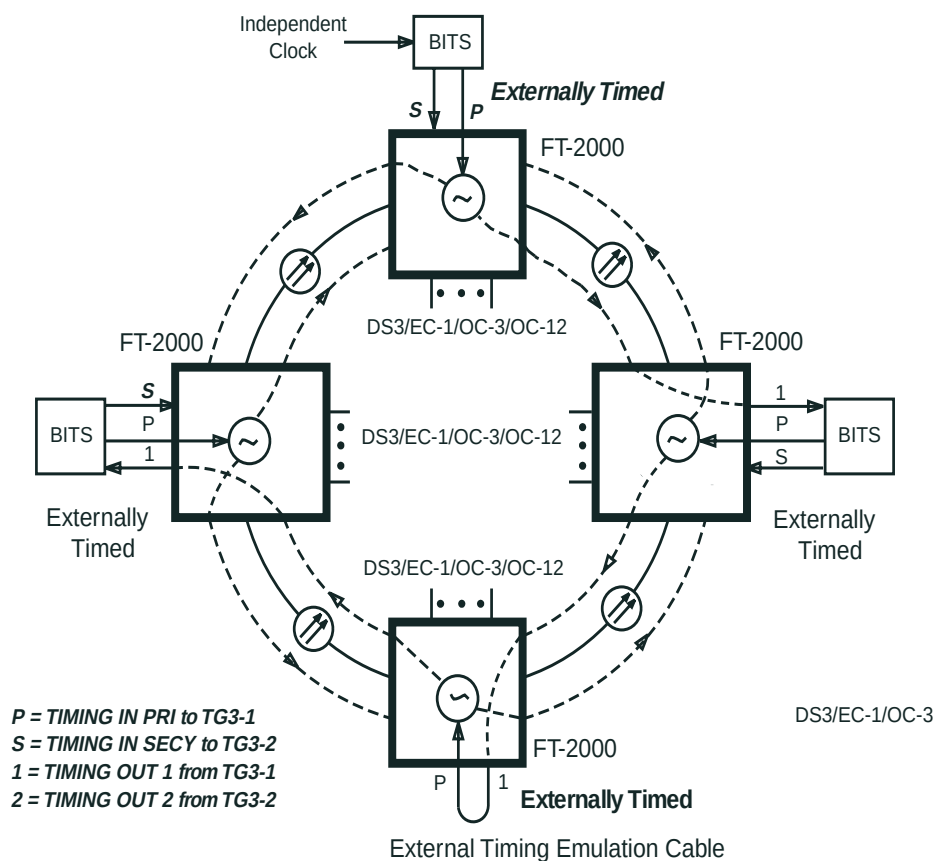


Figure 5-27. Example of a Ring Application with All Nodes Provisioned Externally Timed (with External Timing Emulation Cable)

For the nodes that distribute timing signals, the LAA18 TG3 (DS1) circuit pack should be used. The LAA18 TG3 (DS1) circuit pack provides a timing signal (DS1 synchronization output) derived directly from the OC-48 high speed line. This configuration supports either asynchronous or synchronous low speed interfaces or any combination. The quality and source of the timing signals must be engineered appropriately. The guidelines for choosing the timing source(s) and the BITS clock configurations are beyond the scope of this document.

For more information about platform timing modes, refer to "Platform Synchronization" in this section.

Summary of Timing Rules for Bidirectional Line-Switched Rings

Strategy 1.

Strategy 1 is applicable for all ring topologies.

- At least one node must be externally timed from a stratum 1 traceable timing source that is not distributed by this ring.
- Nodes used as a timing drop must be through timed or line-timed.
- Other nodes may be externally timed or through timed.



NOTE:

In mixed FT-2000/*WaveStar* rings, the following timing rules for bidirectional line-switched rings must be followed:

- All *WaveStar* nodes must be provisioned externally timed.
- Any FT-2000 nodes adjacent to *WaveStar* nodes must be provisioned externally timed.
- Any FT-2000 nodes that are **not** adjacent to *WaveStar* nodes may be externally time, line timed, or through timed.

Strategy 2.

Strategy 2 is applicable for rings that are used to distribute timing and where there is a BITS clock at every node. These are typically rings that connect central offices.

Externally timed nodes that are used to derive timing must obey the following rules to guarantee no timing loops:

- All nodes must be provisioned externally timed.
- At least one node must be timed from a stratum 1 traceable timing source that is not derived from this ring.
- Use only the Timing Out 1 signal. Alternately, it is possible to use only the Timing Out 2 signal—conditional that Timing Out 1 is not used.

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Contents

Overview

This section presents the operations interfaces that allow access to the FT-2000 OC-48 Lightwave System and provide alarm and status information. Local operations interfaces include the craft interface terminal, user panel LEDs and controls, and the circuit pack faceplate LEDs. Other operations interfaces include office alarms, a user-settable miscellaneous discrete interface, a message-based operations system interface, and orderwire.

Craft Interface Terminal

General

The craft interface terminal (CIT) provides full access to the administrative, maintenance, and provisioning capabilities of the FT-2000 OC-48 Lightwave System. The FT-2000 OC-48 Lightwave System supports CIT local access through the CIT (DCE) port, dial-up access using a modem through the CIT (DTE) port, and remote access using the OC-48 data communications channel (DCC). The FT-2000 OC-48 Add/Drop-Rings Terminal also supports remote access using the OC-3 and/or OC-12 DCC.

The following functions are provided using the CIT:

- Reports
- Loopbacks and testing
- Protection switching

- Initializing performance-monitoring storage registers
- Cross-connections
- Provisioning.

The FT-2000 OC-48 Lightwave System also provides a security function to protect against unauthorized access to the CIT system functions (for example, provisioning). Logins, passwords, functional capabilities, authorization levels, and access to the system capabilities are provided. For more information about security, refer to Section 8, "Administration and Provisioning."

The CIT may be one of the following:

- A personal computer (PC) loaded with the FT-2000 CIT-PC software
- A PC loaded with the Lucent's CPro-2000 Graphical User Interface (GUI) and Provisioning Tool
- An American Standard Code for Information Interchange (ASCII) based (dumb) terminal

The FT-2000 OC-48 Add/Drop-Rings Terminal may be provisioned to accept a PC loaded with the CPro-2000 software or an ASCII-based (dumb) terminal as the CIT using the **SECURITY-Set-Security-Port** input or **ENT-CID-SECU** TL1 command. For more information about provisioning and the **SECURITY-Set-Security-Port** input, refer to Section 8, "Administration and Provisioning."

PC with FT-2000 CIT-PC Software

A PC loaded with FT-2000 CIT-PC software communicates with the FT-2000 OC-48 Lightwave System using the F-interface protocol. A PC loaded with FT-2000 CIT-PC software has a graphical user interface that uses pull-down menus. Extensive on-line help is also provided. A PC loaded with FT-2000 CIT-PC software must be used to install software in an FT-2000 OC-48 Add/Drop-Rings Terminal.



NOTE:

Prior to Release 9.0, you must use the CIT-PC if you are installing or accepting a system. Software can be installed via the ITM-SNC with FT-2000 R9.0 or later software and an ITM-SNC R5 or later.

A PC must meet the following minimum requirements to be loaded with FT-2000 CIT-PC software and used as a CIT:

- 386SX *IBM*^{*} compatible computer (desktop or lap top) (25 MHz or greater clock)

*

Registered trademark of International Business Machines Corporation.

- Disk drive — one 1.44 megabytes (3.5 inches)
- Hard disk with approximately 5 megabytes of free space
- 4 megabytes RAM*
- *MS-DOS* computer program, Version 5.0 or later
- Serial port (EIA-232-D) — configured as COM1, COM2, COM3, or COM4
- Parallel port — configured as LPT1
- VGA color monitor.

When the PC is loaded with terminal emulation software (for example, *ProComm Plus*[†] software), it can also be used to access a local DDM-2000 Multiplexer. With this arrangement, the PC does not require terminal emulation software to access a DDM-2000 Multiplexer. The CIT can access a remote DDM-2000 Multiplexer using the OC-3/OC-12 DCC.

The CIT-PC software will run in a *Windows*[‡] program environment. Users can create multiple windows running the CIT-PC software to control the same FT-2000 OC-48 Add/Drop-Rings Terminal. The most recent user to log in supersedes all previous users. When this user logs out, all sessions are deleted.

With FT-2000 R9.0 or later software, the accompanying CIT-PC software will also run as an application under *Windows 95* or *Windows NT*. With FT-2000 R9.1 or later software, the CIT-PC software will run as an application under *Windows 98*. Additionally, it fully supports the use of serial ports COM3 and COM4.

When running the CIT-PC software in a *Windows* program environment, a program information file (PIF) must be created for the CIT. The PIF file should specify that the task be "exclusive" for 386 enhanced mode. If running in standard mode, users should select "directly modifies" for the COM port they will be using. In addition, users should select some of the other options (like no screen saver, no task switching, etc.) to reduce the amount of memory required. A CIT icon must also be defined and linked to the PIF file.

* No memory resident programs running in the background. 565 kilobytes of free conventional memory are required. Two megabytes of extended memory is also required. If less than 565 kilobytes of free conventional memory are available, a memory manager (for example, HIMEM.SYS with *MS-DOS* 5.0 and later) is required to increase the free conventional memory.

† Registered trademark of Datastorm Technologies, Inc.

‡ Trademark of Microsoft Corporation.

The following is an example of a CIT.PIF for the 386 enhanced mode:

PIF Editor	
Program Filename:	CIT.EXE
Window Title:	FT-2000 CIT Interface
Optional Parameters:	
Start-Up Directory:	Use your directory name!
Video Memory:	Text
Memory Requirements:	KB Required 540 KB Desired 640
EMS Memory:	MB Required 2 MB Desired 4
XMS Memory:	KB Required 0 KB Desired 1024
Display Usage:	Full Screen
Execution:	Exclusive
Close Window on Exit:	Yes

Advanced Options	
Multitasking Options:	
Background Priority:	50
Foreground Priority:	100
Detect Idle Time:	Yes
Memory Options:	
Lock Application Memory:	Yes
Display Options:	
Monitor Ports:	Emulate Text Mode
Other Options:	
Allow Fast Paste:	Yes

The following is an example of a CIT.PIF for the standard mode:

Program Filename:	CIT.EXE
Window Title:	FT-2000 CIT Interface
Optional Parameters:	
Start-Up Directory:	Use your directory name!
Video Memory:	Text
Memory Requirements:	KB Required 540
XMS Memory:	KB Required 0 KB Desired 0
Directly Modifies:	COM1
Close Window on Exit:	Yes
No Screen Exchange:	Yes
Prevent Program Switch:	Yes
No Screen Save:	Yes

PC with CPro-2000 Software

A PC loaded with Release 7.0, or later, of Lucent's CPro-2000 GUI and Provisioning Tool is compatible with the FT-2000 OC-48 Add/Drop-Rings Terminal. The GUI and Provisioning Tool is a *Windows* program-based alternative to entering TL1 commands manually.

A PC equipped with CPro-2000 GUI and Provisioning Tool communicates with FT-2000 OC-48 Lightwave System using the same TL1 message set as the TL1/X.25 OS interface. The TL1 message set consists of maintenance and provisioning commands (excluding autonomous messages) and cannot be used to install software in an FT-2000 OC-48 Add/Drop-Rings Terminal. On-line help messages are not supported. For detailed information about TL1 messages, refer to 824-102-151, *FT-2000 OC-48 Lightwave System Operations Systems Engineering Guide*.

The CPro-2000 GUI and Provisioning Tool simplifies and mechanizes operations of transmission NEs. It provides a common look and feel across the SONET subsystem of FT-2000, DDM-2000 Multiplexers and the *SLC®-2000* Access System.

A PC must meet the following minimum requirements to be loaded with the CPro-2000 software and used as a CIT:

386SX *IBM* compatible computer (desktop or lap top) (25 MHz or greater clock)

- Disk drive — one 1.44 megabytes (3.5 inches)

- Hard disk with approximately 5 megabytes of free space
- 8 megabyte RAM*
- *MS-DOS* computer program, Version 5.0 or later
- *Windows* computer program, Version 3.1
- Serial port (EIA-232-D) — configured as COM1 or COM2
- Mouse
- VGA color monitor.

The CPro-2000 GUI and Provisioning Tool has been tested with *NCR*^{*}, *NEC*[†], and *Gateway-2000*[‡] personal computers. The CPro-2000 GUI and Provisioning Tool has also been tested with a *SUN*[§] *SPARC*[¶] station 10 workstation that has a SUNPC3.1 software environment set up on a PC emulator hardware and running windows in the enhanced mode. For more information about the CPro-2000 GUI and Provisioning Tool, refer to 190-523-101, *Guide to Using CPro-2000*.

ASCII-Based Terminal

An ASCII-based terminal may be used to interface with the FT-2000 OC-48 Add/Drop-Rings Terminal. Users communicate with the FT-2000 OC-48 Add/Drop-Rings Terminal using an ASCII-based terminal and TL1 messages. The same TL1 message set is used by the TL1/X.25 OS interface. The TL1 messages must be entered manually by an experienced user.

The TL1 message set consists of provisioning and maintenance commands (excluding autonomous messages) and can not be used to install software in an FT-2000 OC-48 Add/Drop-Rings Terminal. On-line help messages and menus are not supported. For detailed information about TL1 messages, refer to 824-102-151, *FT-2000 OC-48 Lightwave System Operations Systems Engineering Guide*.

An ASCII-based terminal must meet the following minimum requirements to be used as a CIT:

ASCII-based data communications terminal with an 80-column display

- Scroll capability
- Local echo
- Serial port (EIA-232-D)

* Trademark of NCR Corporation
† Registered trademark of Nippon Denki Kabushiki Kaisha
‡ Registered trademark of Gateway 2000, Inc.
§ Registered trademark of SUN Microsystems Inc.
¶ Registered trademark of SPARC International, Inc., licensed exclusively to SUN Microsystems Inc.

- Data transmission speed should be from 1200 to 9600 baud
- XON/XOFF flow control capability.

The ASCII-based terminal should be configured for byte serial data transmission of 8-bit bytes with one start bit and one stop bit. Parity should be "none" and the flow control should be "DC1/DC3." With flow control, entering **<Ct l-S>** stops the output (X/off state), and **<Ct l-Q><CR>**, **<Ct l-Q><Ct l-J>**, or **<Ct l-Q><Ct l-M>** resumes the output (X/on state).

Local Access Through the CIT (DCE) Port

The FT-2000 OC-48 Lightwave System supports CIT local access through the CIT (DCE) port on the user panel of the Low Speed Shelf - System Controller and the Repeater Shelf - System Controller. The CIT (DCE) port is configured as data circuit equipment (DCE) for direct CIT access. This port is also compatible with the ASCII EIA-232-D standard.

The CIT (DCE) port allows a PC running FT-2000 CIT-PC software to communicate with the FT-2000 OC-48 Lightwave System using the F-interface protocol. A PC running FT-2000 CIT-PC software automatically selects the highest usable baud rate (up to 9600 baud).

The CIT (DCE) port can also be provisioned using the **SECURITY-Set - Security-Port** input or **ENT-CID-SECU** TL1 command to allow a PC running CPro-2000 software or an ASCII-based terminal to access the FT-2000 OC-48 Lightwave System. A PC running CPro-2000 software or an ASCII-based terminal communicates with the FT-2000 OC-48 Lightwave System using the same TL1 message set (excluding autonomous messages) as the TL1/X.25 OS interface. For more information about provisioning and the **SECURITY-Set - Security-Port** input, refer to Section 8, "Administration and Provisioning."

For more information about local access using the CIT (DCE), refer to the "Operation and Maintenance (TOP)" Section.

Dial-Up Access Using a Modem Through the CIT (DTE) Port

The FT-2000 OC-48 Lightwave System supports CIT dial-up access using a modem through the CIT (DTE) port on the interconnection panel of the Low Speed Shelf - System Controller and the Repeater Shelf - System Controller. The CIT (DTE) port is configured as data terminating equipment (DTE) to allow a permanent connection to a modem. The CIT (DTE) port also allows local access using a null modem adapter. This port is also compatible with the ASCII EIA-232-D standard.

The CIT (DTE) port allows a PC running FT-2000 CIT-PC software to communicate with the FT-2000 OC-48 Lightwave System using the F-interface

protocol. A PC running FT-2000 CIT-PC software automatically selects the highest usable baud rate (up to 9600 baud).

The CIT (DTE) port can also be provisioned using the **SECURITY-Set - Security-Port** input or **ENT-CID-SECU** TL1 command to allow a PC running CPro-2000 software or an ASCII-based terminal to access the FT-2000 OC-48 Lightwave System. A PC running CPro-2000 software or an ASCII-based terminal communicates with the FT-2000 OC-48 Lightwave System using the same TL1 message set (excluding autonomous messages) as the TL1/X.25 OS interface. For more information about provisioning and the **SECURITY-Set - Security-Port** input, refer to Section 8, "Administration and Provisioning."

A pair of compatible modems allows remote dial-up access to the FT-2000 OC-48 Lightwave System from a CIT over the public switched telephone network. One modem is connected to the CIT (DTE) port at the FT-2000 OC-48 Lightwave System, and the other modem is connected to the serial port of the CIT. An internal modem in the CIT may be used instead of a stand-alone modem.

A digital data network may be used in place of the modem pair to provide remote dial-up access to the FT-2000 OC-48 Lightwave System from the CIT.

A compatible modem or digital data network must meet the following minimum requirements:

- Full duplex
- Asynchronous
- Byte serial data transmission of eight bit bytes
- One start bit
- One stop bit
- Data transmission speed should be from 1200 to 9600 baud.

The modem must comply with one of the following transmission standards depending on the desired baud rate. These standards apply to signaling used between modems.

Standard	Baud Rate(s)
Bell 212A	1200
V.22	1200
V.22 bis	2400
V.32	4800, 9600
V.32 bis	9600 (fax), 14400 (data)

For more information about establishing dial-up access using a modem and local access using a null modem adapter, refer to the "Operation and Maintenance (TOP)" Section.

CIT Remote Access Using the OC-48 DCC

The FT-2000 OC-48 Lightwave System supports CIT remote access from the local terminal to a remote terminal using the OC-48 data communications channel (DCC). The FT-2000 OC-48 Lightwave System supports one incoming remote login session and one outgoing login session at a time. For example, a local user can gain remote access to a remote terminal at the same time as a remote user can gain remote access to the local terminal.



NOTE:

Remote login and remote software copy are not possible from an FT-2000 CIT to a *WaveStar* NE. However, remote login and remote software copy will pass through *WaveStar* NEs in mixed FT-2000/*WaveStar* rings.

For more information about establishing remote access, refer to the "Operation and Maintenance (TOP)" Section.

CIT Remote Access Using the OC-3/OC-12 DCC

The FT-2000 OC-48 Add/Drop-Rings Terminal supports CIT remote access using the OC-3 or OC-12 DCC. This allows the local FT-2000 OC-48 Add/Drop-Rings Terminal to access a remote FT-2000 OC-48 Add/Drop-Rings Terminal or a remote DDM-2000 Multiplexer. The FT-2000 OC-48 Add/Drop-Rings Terminal supports one incoming remote login session (from another FT-2000 OC-48 Add/Drop-Rings Terminal) and one outgoing login session (to a DDM-2000 Multiplexer or another FT-2000 OC-48 Add/Drop-Rings Terminal) at a time. For example, a local user can gain remote access to a remote FT-2000 OC-48 Add/Drop-Rings Terminal or DDM-2000 Multiplexer at the same time as a remote user can gain remote access to the local terminal.

The CIT must be a PC equipped with FT-2000 CIT-PC software to establish a CIT remote login to a DDM-2000 Multiplexer. For more information about establishing remote access, refer to the "Operation and Maintenance (TOP)" Section.

The FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with the OC3/OC-12 Optical Interface - 1.3 μ m Standard Performance [OC3/OC-12 (1.3 STD)] circuit pack and the Overhead Controller - Tributary (TOHCTL) circuit pack to access the OC-3/OC-12 DCC. A single TOHCTL circuit pack can access up to eight OC-3 DCCs or four OC-12 DCCs. Low speed interface slots must be assigned to an OC-3/OC-12 DCC channel. For more information about entering OC-3/OC-12 DCC channel assignments, refer to Section 8, "Administration and Provisioning."

CIT Remote Access Using the OC-48 Section Orderwire

The FT-2000 OC-48 Add/Drop-Rings Terminal supports CIT remote access using the OC-48 section orderwire. This allows the following:

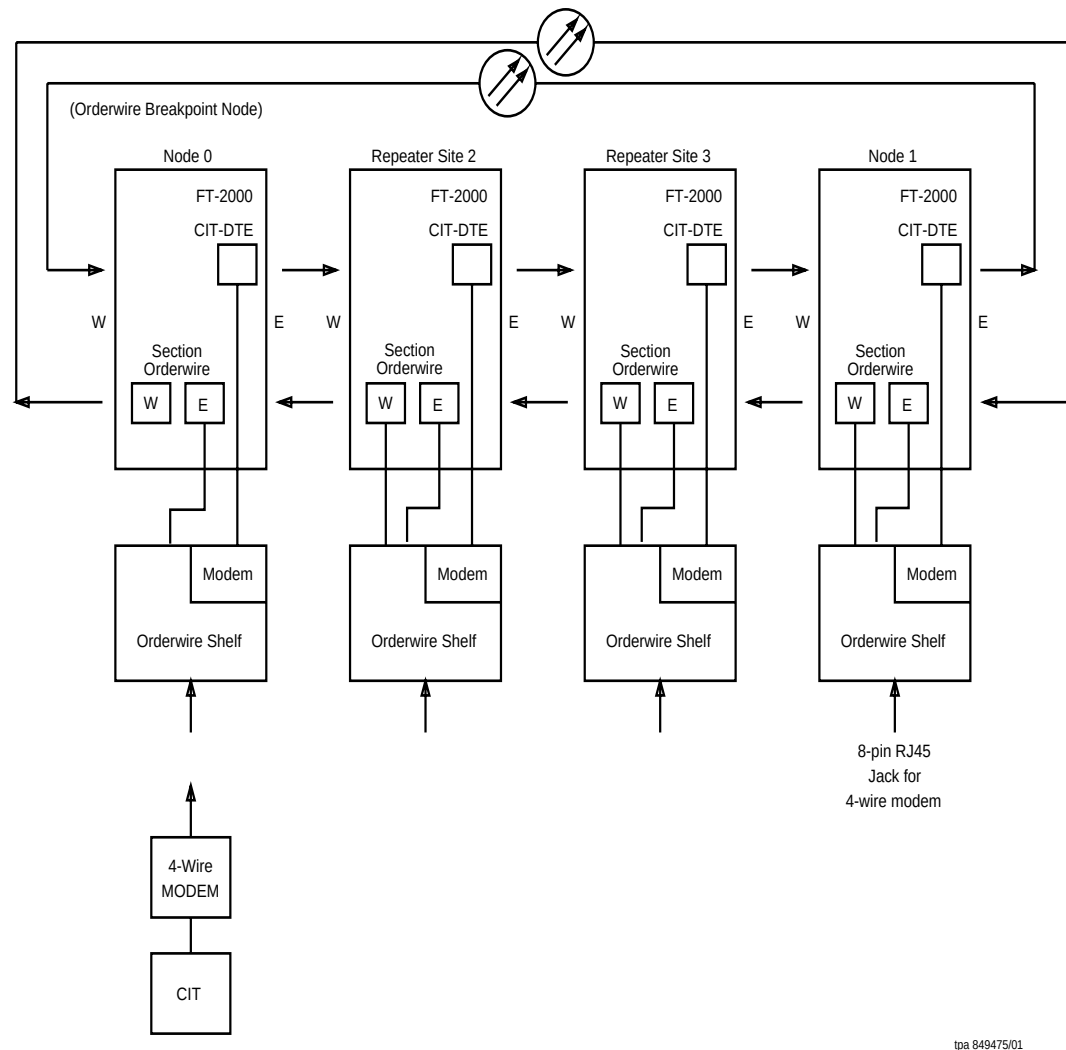
- Remote access from a terminal to a repeater site
- Remote access from a repeater site to a terminal
- Remote access from a repeater site to another repeater site.

Figure 6-1 shows a 2-fiber OC-48 bidirectional, line-switched ring with two FT-2000 OC-48 Add/Drop-Rings Terminals and two FT-2000 OC-48 Repeater Bays. The FT-2000 OC-48 Add/Drop-Rings Terminals and FT-2000 OC-48 Repeater Bays must be equipped with the new *Dante/* orderwire assembly (A18-05547-01). At each node, the orderwire assembly has connections to the section orderwire [SECTION OW (LOC OW)] and the CIT (DTE) interfaces. The orderwire assembly cannot be used for voice communications and CIT remote access simultaneously.

The FT-2000 OC-48 Repeater Bays in the ring must be equipped with the Orderwire (OW) circuit pack to access the OC-48 section orderwire.

One node in the ring must be designated as the break point node (Node 0 in Figure 6-6) to avoid oscillating audio in the system. At the break point node, the orderwire assembly should only be connected to one section orderwire interface (east or west). The break point node should be in the central office where maintenance activity is most likely to be initiated.

A CIT and modem are required to establish a remote login. The CIT must be a PC equipped with FT-2000 CIT-PC software. For more information about establishing remote access, refer to the "Operation and Maintenance (TOP)" Section.



tpa 849475/01

Figure 6-1. CIT Remote Access Using the OC-48 Section Orderwire

User Panel

The user panel is a factory-installed unit mounted next to the right-hand flange on the Low Speed Shelf - System Controller, the Repeater Shelf - System Controller, and the FT-2000 OC-48 Repeater Shelf. Figure 6-2 and Figure 6-3 shows the user panel on the Low Speed Shelf - System Controller and the Repeater Shelf -

System Controller. Figure 6-4 shows the user panel on the FT-2000 OC-48 Repeater Shelf. The user panel provides -48 V power filters, an electrostatic discharge jack, and local system-level information.

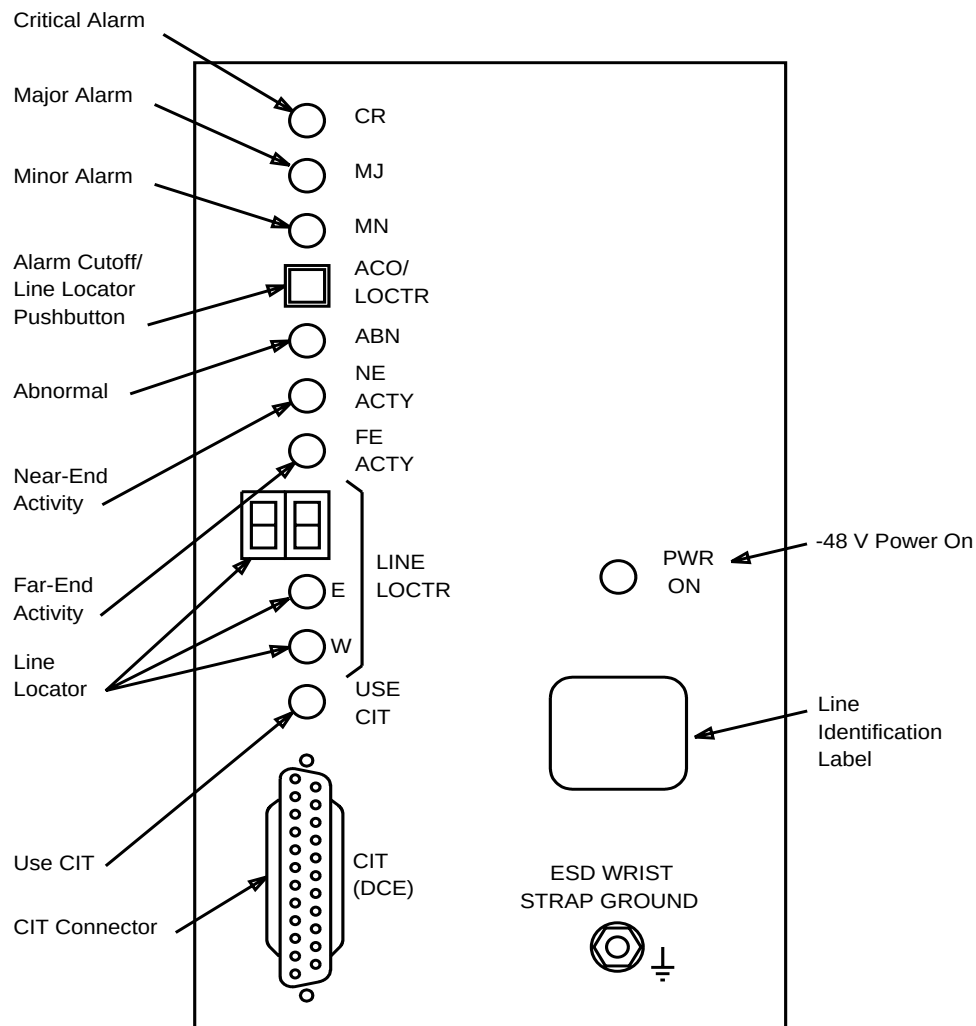


Figure 6-2. User Panel (Low Speed Shelf - System Controller and Repeater Shelf - System Controller) — Cabled Version (Before 06/97)

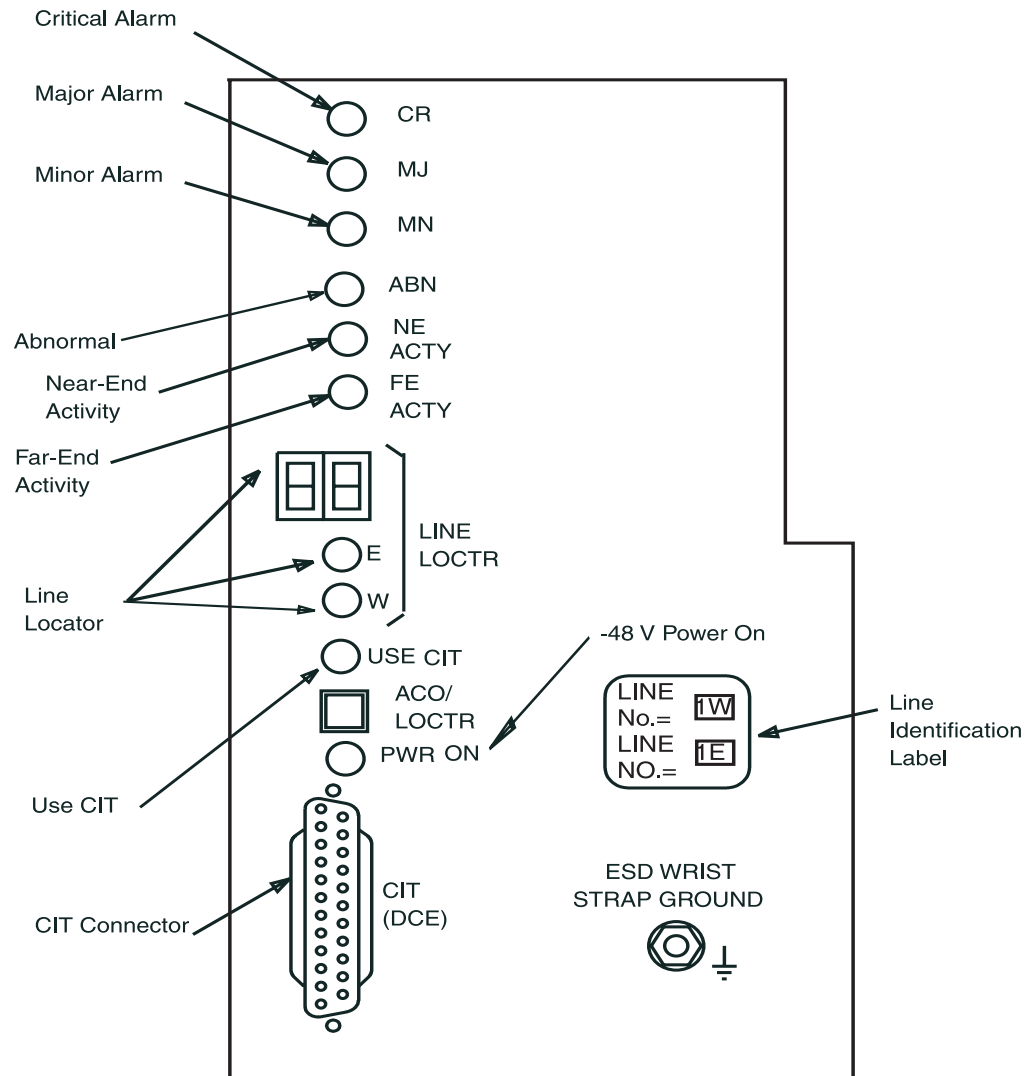


Figure 6-3. User Panel (Low Speed Shelf - System Controller and Repeater Shelf - System Controller) — Plug-In-Type (After 06/97)

The user panel LEDs show the following local system information:

- The active alarm level is shown by red LEDs for critical (CR) and major (MJ) alarms and by a yellow LED for minor (MN) alarms.
- A green alarm cutoff/locator (ACO/LOCTR) push-button with a built-in LED activates the alarm cutoff function and lights the LED. The ACO/LOCTR push-button also controls the line locator (LINE LOCTR) displays and LEDs, showing the shelf where a fault has occurred.

- The yellow abnormal (ABN) LED is lighted when a temporary condition potentially affecting transmission exists; for example, a CIT-initiated protection switch or lockout, or loopback.
- The yellow near-end activity (NE ACTY) LED is lighted when any alarm or status condition exists at the local terminal or local repeater site.
- The yellow far-end activity (FE ACTY) LED is lighted when an OC-48 line protection switch is active at any remote ring terminal in the same OC-48 ring.
- The LINE LOCTR consists of two 7-segment displays and two individual LEDs. The two 7-segment displays normally show the line number when a circuit pack fails. When the ACO/LOCTR push-button is pressed in and held, the shelf associated with the line containing the failed circuit pack is displayed.

The yellow east (E) and west (W) LEDs complete the number of the line containing the failed circuit pack. For example, if the failed circuit pack is associated with high speed line 1E, the right-hand 7-segment display will show the number "1" and the E LED will be lighted.

- The yellow USE CIT LED is lighted when the CIT must be used to obtain more detailed information about system status. The USE CIT LED and the LINE LOCTR display are never lighted at the same time (except during an LED test).
- The green power on (PWR ON) LED is lighted when the shelf is receiving – 48 V power.

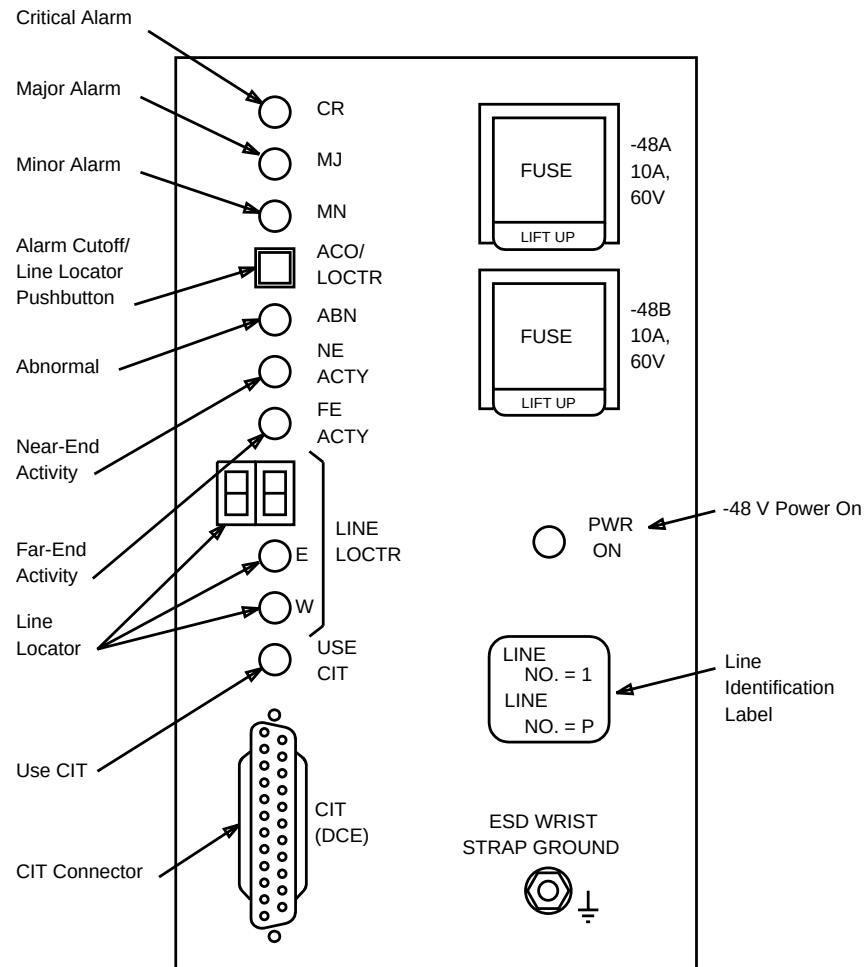


Figure 6-4. User Panel (FT-2000 OC-48 Repeater Shelf)

Filter Panel

The filter panel (Figure 6-5 and Figure 6-6) is a factory-installed unit mounted next to the right-hand flange on the Low Speed Shelf - Complementary, High Speed Shelf, Enhanced High Speed Shelf, and the Condensed High Speed Shelf. The filter panel has -48 V power filters, an electrostatic discharge jack, and a green PWR ON LED. The PWR ON LED shows that the shelf is receiving -48 V power.

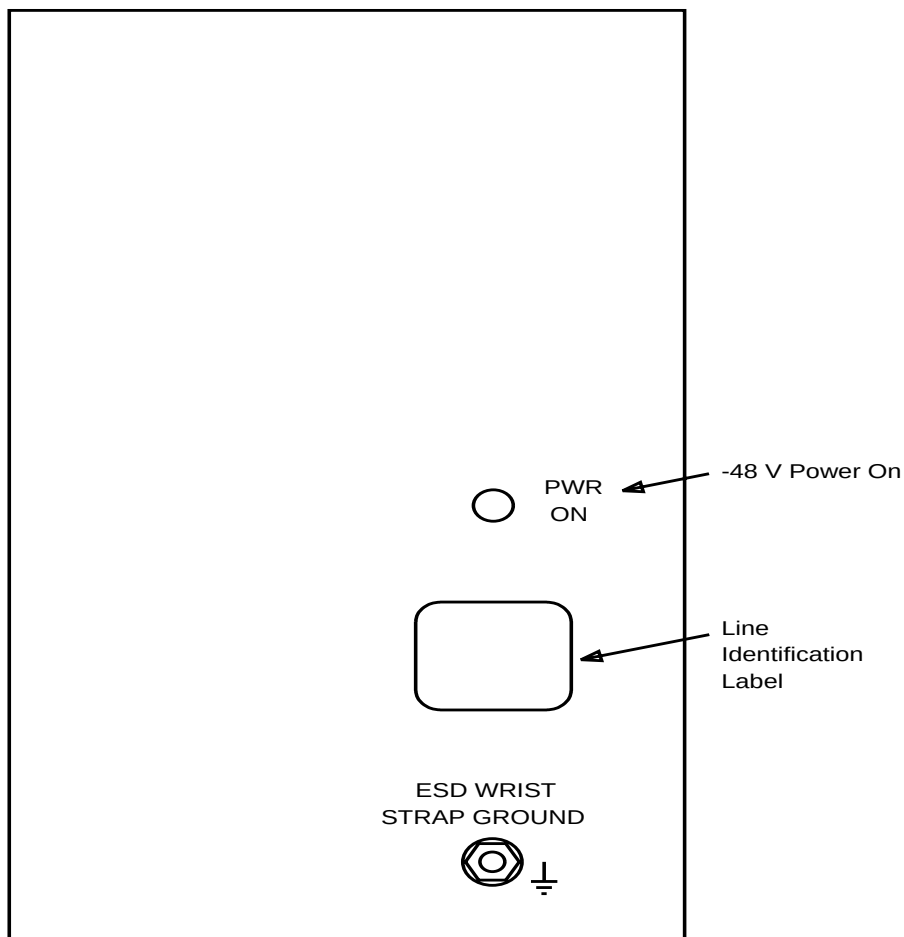


Figure 6-5. Filter Panel for the Enhanced High Speed Shelf

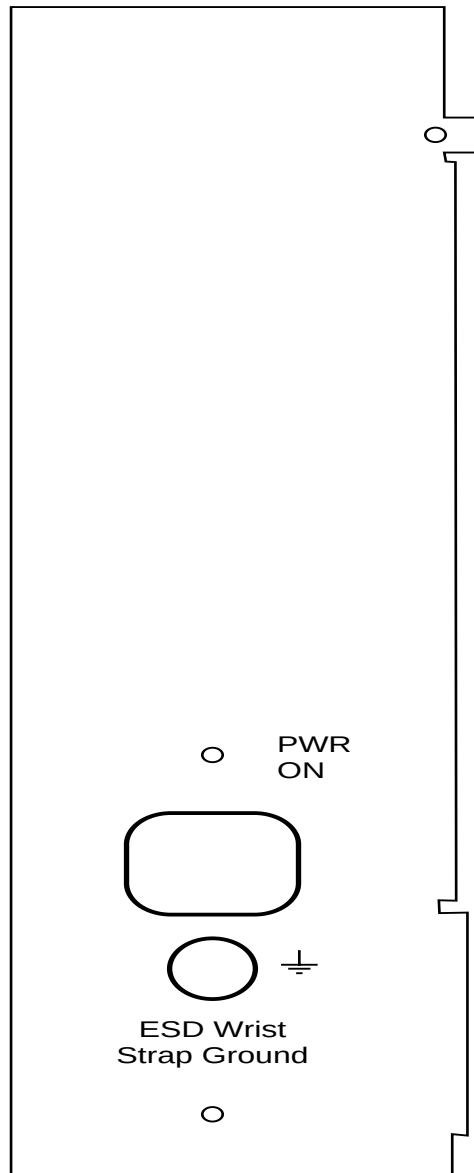


Figure 6-6. Power Indicating Panel for the Condensed High Speed Shelf

To supplement the user panel's system-level view, each circuit pack has a red FAULT LED on its faceplate. A continuously lighted FAULT LED means that the FT-2000 OC-48 Lightwave System has isolated a failure to this circuit pack. A flashing FAULT LED shows the following:

- A flashing FAULT LED on a transmission circuit pack shows that an incoming signal to that circuit pack has failed.
- A flashing FAULT LED on a synchronization circuit pack shows that an external timing reference input signal has failed.
- A flashing FAULT LED on the System Memory circuit pack shows that the contents of the nonvolatile memory differ from the duplicate copy in the System Controller circuit pack. It can also indicate corrupted data in the nonvolatile memory of the System Memory circuit pack.

Office Alarms Interface

The FT-2000 OC-48 Lightwave System provides relays for connection to the local office audible and visible alarms. Relays are provided for each alarm condition: CR (critical), MJ (major), and MN (minor). The steady state current for office alarm connections must not exceed 0.9 A at 60 V or 1.8 A at 30 V. The maximum transient currents (20 msec duration) during initial contact closure must not exceed 9 A at 60 V or 18 A at 30 V.



CAUTION:

The office alarms interface of the FT-2000 OC-48 Repeater Bay is optional. If the office alarms interface of the FT-2000 OC-48 Repeater Bay is used, there is a certain class of single failures that causes the office alarms interface to be activated in TWO offices. If this occurs and technicians at each office react to the alarms, service could be dropped.

The audible office alarms are silenced through activation of the alarm cutoff (ACO) function. Visible alarms are not extinguished by the ACO function.

To prevent intermittent failures from causing unnecessary maintenance activity, a provisionable incoming signal alarm delay is provided. The office alarms will not be activated unless an incoming signal condition of greater duration than the alarm delay occurs. When a failure clears, an alarm clear delay prevents premature clearing of the alarm.

To accommodate Bell Operating Company (BOC) practices, the MJ and CR relay closures are designed to allow these office alarms to be OR'ed together and reported as an office MJ alarm.

As with the user panel LEDs, when multiple alarm conditions occur, the highest level office alarm (audible and visible) is activated. When the highest level alarm condition clears, the office alarm "bumps down" to the next highest level alarm condition.

If the ACO function has been activated to silence the active audible alarm and a "bump down" occurs, the audible alarm remains silent (that is, the lower level visible alarm is activated, but the corresponding audible alarm is not reactivated).

If another alarmable condition occurs while the ACO is active, the highest level audible alarm is activated even if the new condition is a lower level. (For example, if an MJ alarm was active and silenced using the ACO function and an MN alarmable condition occurs, the MJ audible alarm will sound.)

The office alarms (OFFICE ALMS) interface is located on the interconnection panel of the Low Speed Shelf - System Controller. Refer to Section 3, "Platform Descriptions," for more information about the physical location of the office alarm interface.

User-Settable Miscellaneous Discrete Interface

The user-settable miscellaneous discrete interface allows an OS to monitor and control equipment collocated with the FT-2000 OC-48 Lightwave System through a set of input and output contact closures. Sixteen environmental inputs are provided to monitor environmental conditions (for example, open door, high temperature, etc.). The FT-2000 OC-48 Add/Drop-Rings Terminal also provides four control outputs to control external equipment (for example, pumps, generators, etc.).

Any external customer equipment to be monitored by the FT-2000 OC-48 Lightwave System must provide the electrical equivalent of a contact closure across the corresponding environmental input wiring pairs. The contact closure must be capable of passing at least 10 mA of drive current.

The power source to enable the FT-2000 OC-48 Lightwave System to control external customer equipment may be from a minimum of 3 V to a maximum of 72 V. The FT-2000 OC-48 Lightwave System provides a unidirectional opto-isolator connection across each corresponding control output wiring pair. The load current across each control output wiring pair must be limited by the external customer equipment and must not exceed 35 mA. For detailed wiring information, refer to 365-575-104, *FT-2000 OC-48 Lightwave System, Releases 1 and 2, Installation Manual*; 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 3, 4, 5, 6, and 7 Installation Manual*; and SD-5G250-02, *FT-2000 OC-48 Enhanced Lightwave Terminating Bay Application Schematic* (or SD-5G250-01, *FT-2000 OC-48 Lightwave Terminating Bay Application Schematic*).

The environmental inputs are addressed by the numbers 1 through 16, and the control outputs are addressed by the numbers 1 through 4. The environmental inputs can be assigned in any order; however, if the bay is equipped with a fan assembly, the number 16 input is reserved for the fan alarm.

The number 1, 2, 3, and 4 inputs are reserved for alarms from an FT-Lightwave Booster Amplifier. Table 6-1 shows the guidelines for mapping the miscellaneous discrete points from the FT-LBA to environmental inputs of the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 6-1. FT-LBA Miscellaneous Discrete Mapping

FT-LBA Miscellaneous Discrete	FT-2000 Environmental Input	Suggested Text
Fuse/Power Alarm	1	FT-LBA fuse/ power failure
Fan Alarm	2	FT-LBA fan failure
1EW (Service) Failure	3	FT-LBA 1EW failure
1WE (Service) Failure	4	FT-LBA 1WE failure

Refer to Section 8, "Administration and Provisioning," for information about provisioning a string of characters associated with an environmental input or control output.

OS access to individual environmental inputs and control outputs at an FT-2000 OC-48 ADR Terminal is provided through the TL1/X.25 interface.

OS access to the environmental inputs at an FT-2000 OC-48 Repeater Bay is provided through the TL1/X.25 interface of an FT-2000 OC-48 AD Terminal.

Local access to the environmental inputs is provided through the CIT interface using the **FAULT-Retrieve-Alarm (and Status)** input. For more information, refer to the **FAULT-Retrieve-Alarm (and Status)** input in Section 11, "Craft Interface Terminal Usage." Local access to the control outputs is not provided.

The miscellaneous discrete (MISC DSCRT 1 and MISC DSCRT 2) interfaces are located on the interconnection panel of the Low Speed Shelf - System Controller and the Repeater Shelf - System Controller. The MISC DSCRT 1 and MISC DSCRT 2 interfaces each provide eight environmental inputs and two control outputs. Refer to Section 3, "Platform Descriptions," for more information about the physical location of the miscellaneous discrete interface.

Message-Based OS Interface

The FT-2000 OC-48 ADR Terminal provides a message-based interface to OSs such as Bellcore's Network Monitoring and Analysis (*NMA*^{*}) and Lucent's ITM SNC. Included within the message-based interface are alarm surveillance, performance monitoring, and provisioning with memory administration. This interface uses an X.25 protocol and the transaction language 1 (TL1) message language. Different virtual circuits (VCs) on the TL1/X.25 interface may be used to interface to different OSs.

The FT-2000 OC-48 ADR supports two permanent virtual circuits (PVCs) and up to six switched virtual circuits (SVCs). The OS type and the associated TL1 autonomous messages are provisionable on a virtual circuit basis using the **SECURITY-Set-Security-Port** CIT-PC command or the **ENT-CID-SECU** TL1 command. The OS type is a filter that determines the types of TL1 autonomous messages that are transmitted on a VC to the OS. The calling address is also provisionable for each SVC using the **SECURITY-Set-Security-Port** CIT-PC command or the **ENT-CID-SECU** TL1 command. The calling address is used to determine the X.25 logical channel number for SVCs. There is a fixed association between PVCs and X.25 logical channel numbers. The interface operates over a synchronous line at data rates ranging from 1200 to 19,200 bps.

The FT-2000 OC-48 ADR provides a security function for the TL1/X.25 interface to protect against unauthorized access to the system functions (for example, provisioning). Logins, passwords, functional capabilities, authorization levels, and access to the system capabilities are provided. For more information about security, refer to Section 8, "Administration and Provisioning."

Gateway Network Element (GNE)

The FT-2000 OC-48 ADR Terminal may operate as a TL1 gateway network element (TL1-GNE) that serves as a single interface to the TL1/X.25 OS for all the FT-2000 OC-48 ADR Terminals or DDM-2000 Multiplexers in a subnetwork. Any FT-2000 OC-48 ADR Terminal in a subnetwork will automatically operate as a TL1-GNE if it receives TL1 messages through the local X.25 interface that are for another FT-2000 or DDM-2000 in the subnetwork.

The GNE receives operations information from all the FT-2000 OC-48 ADR Terminals or DDM-2000 Multiplexers in the subnetwork through the DCC and TL1/X.25 (Figure 6-7). The operations information is in the form of TL1 messages. The OS can also send TL1 commands through the GNE to any FT-2000 OC-48 ADR Terminal or DDM-2000 Multiplexer in the subnetwork.

* NMA is a trademark of Bellcore, Inc.

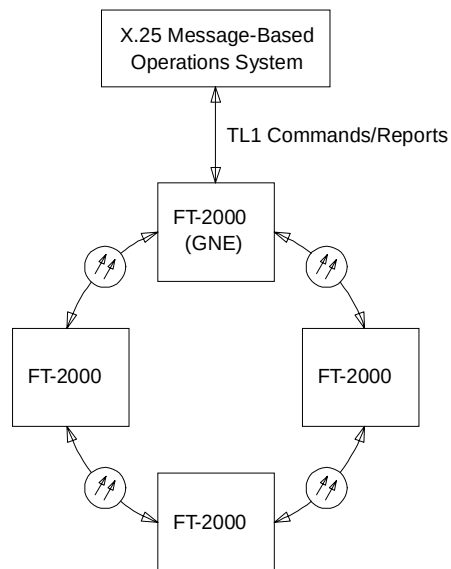


Figure 6-7. Gateway Network Element Application – Simple Ring

One or more FT-2000 OC-48 ADR Terminals can serve as a single interface to the local X.25 message-based operations system for the DDM-2000 Multiplexers through the OC-3/OC-12 DCC (Figure 6-8). The GNE also serves as a single interface for all FT-2000 OC-48 Add/Drop-Rings Terminals in the same ring network and in the same subnetwork.

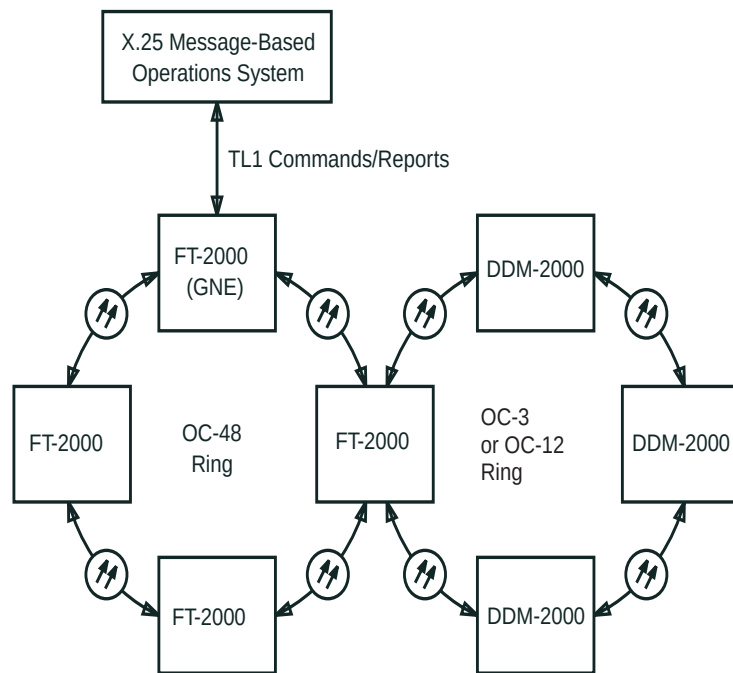


Figure 6-8. Gateway Network Element Application – With Subnetwork

The FT-2000 OC-48 ADR Terminal must be equipped with the OC3 or OC-12 circuit pack(s) and the Overhead Controller - Tributary (TOHCTL) circuit pack to access the low-speed OC-3 or OC-12 DCC. A single TOHCTL circuit pack can access up to eight low-speed DCC channels. Low-speed interface slots must be assigned to a DCC channel.

For more information about entering OC-3 or OC-12 DCC channel assignments, refer to Section 8, "Administration and Provisioning."

The number of GNEs in a subnetwork is based on operational needs. For example, to reduce the number of X.25 links between the ring network and the OS, one FT-2000 OC-48 ADR Terminal may operate as the GNE. If redundancy is desired, two or more FT-2000 OC-48 ADR Terminals may operate as GNEs.



NOTE:

FT-2000 OC-48 ADR R8.1 and later, DDM-2000 OC-3 R13.0 and later, DDM-2000 OC-12 R7.0 and later, can serve as the TL1/X.25 GNE for FT-2000 remote NEs. Also, Tellabs *TITAN* R5.0 or ITM SNC R5.0 can serve as the GNE for FT-2000 R8.1 remote NEs (but not vice versa). FT-2000 OC-48 ADR R9.1 and later enables the FT-2000 to serve as the TL1/X.25 GNE for Tellabs *TITAN*, as well as *WaveStar 2.5G and 10G*. Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*."

The following TL1 autonomous messages are supported:

REPORT ALARM (REPT ALM) —

autonomous reports of alarm condition

REPORT ALARM ENVIRONMENT (REPT ALM ENV) —

autonomous reports of environmental alarm conditions

REPORT CONDITIONS (REPT COND) —

autonomous reports of activity status (nonalarmed) conditions

REPORT DATABASE CHANGES (REPT DBCHG) —

autonomous reports of internal cross-connection changes,

ENT-ULSDCC-L3/L4 changes, **DEL-ULSDCC-L3/L4** changes,

changes resulting from use of the **SET-ATTR-*** command, and line

(OC-48, OC-12, OC-3, EC-1, and DS3) termination parameters

REPORT EVENT (REPT EVT) —

autonomous reports of status conditions, including performance-monitoring threshold-crossing alerts (TCAs)

REPORT SWITCH (REPT SW) —

autonomous reports of electrical low speed interface circuit pack (DS3 and STS1E), or TG3 (DS1) circuit pack protection switches.

The following TL1 command/response messages are supported:

ACTIVATE-USER (ACT-USER) —

activates a TL1 access login session

ALLOW-MESSAGE (ALW-MSG) —

allows transmission of autonomous messages

CANCEL-USER (CANC-USER) —

terminates a TL1 login session

COPY-PROGRAM (CPY-PRGM) —

copies software from a network element to another network element

DELETE-ASSIGNMENT-DCC (DLT-ASGNMT-DCC) —

deletes an OC-3 or OC-12 DCC assignment

DELETE-CROSS-CONNECTION (DLT-CRS-rr) —

deletes an STS-3 or STS-1 cross-connection

DELETE-USER-SECURITY (DLT-USER-SECU) —

deletes the security parameters associated with a user

DELETE-UPPER-LAYER-STACK-DCC (DEL-ULSDCC-L4) —
deletes data which affects Layer 4 of the OSI protocol stack on the DCC

EDIT-CROSS-CONNECTION (ED-CRS-rr)
edits a cross-connection's designation as a Red Line Service

EDIT-DATE (ED-DAT) —
changes the system date and time

EDIT-PASSWORD ID (ED-PID) —
changes the user password

EDIT-USER-SECURITY (ED-USER-SECU) —
changes the login ID, password, and/or user privileges of any non-privileged user

ENTER-ASSIGNMENT-DCC (ENT-ASGNMT-DCC) —
enters an OC-3 or OC-12 DCC assignment

ENTER-CHANNEL IDENTIFIER-SECURITY (ENT-CID-SECU) —
Sets system security for the CIT-PC, DCC and X.25 ports

ENTER-CROSS-CONNECTION (ENT-CRS-rr) —
establishes an STS-3 or STS-1 cross-connection

ENTER-NETWORK-ELEMENT-SECURITY (ENT-NE-SECU) —
establishes the global security parameters of the system (e.g., password aging, login aging, etc).

ENTER-PROTECTION-LINE (ENT-PRONT-LINE) —
sets the "wait-to-restore" line protection switching characteristic for the system.

ENTER-PROTECTION-LOW-SPEED (ENT-PROTN-LS) —
sets the "wait-to-restore" low speed protection switching characteristics for the system.

ENTER-PROTECTION-STS3 (ENT-PROT-rr) —
enters protection for an STS-3 (NPPA).

ENTER-ROLL (ENT-ROLL-rr) —
performs a 1-way roll of an STS-3 or STS-1 cross-connection;
converts between 2-way-dri and 2-way-dri-pri cross-connections

ENTER-SYNCHRONIZATION (ENT-SYCN) —
provisions the synchronization mode.

ENTER-SYSTEM (ENT-SYS) —
sets network element name and other system level parameters

ENTER-STS1 (ENT-STS1) —
sets user-settable strings to the transmit and receive path trace fields; enables/disables DRI switching on PDI-P

ENTER-USER-SECURITY (ENT-USER-SECU) —
enters the security parameters associated with a user

ENTER-rr (ENT-rr) —
provisions various parameters of low speed ports and slots

ENTER-ULSDCC-L3 —
provisions the user-settable parameters for the NE to be an IS-IS level 2 router

ENTER-ULSDCC-L4 —
provisions (enables/disables) the TARP data cache feature

INHIBIT-MESSAGE (INH-MSG) —

Inhibits transmission of all autonomous TL1 messages, office alarms, and/or parallel telemetry from a network element

INITIALIZE-REGISTER (INIT-REG) —

Initializes all current day and/or current 15-minute performance-monitoring storage registers

INITIALIZE-SYSTEM (INIT-SYS) —

Initializes (resets) provisionable parameters to their original value and restarts the network element software

OPERATE-ALARM CUTOFF (OPR-AC0) —

operates alarm cutoff to silence the audible office alarms

OPERATE-EXTERNAL CONTROL (OPR-EXT-CONT) —

operates an external miscellaneous discrete control output

OPERATE-LOOPBACK (OPR-LPBK-rr) —

operates low speed (DS3, EC-1, OC-3, and OC-12) or high speed (OC-48) loopback

OPERATE-PROTECTION SWITCH-OC3 (OPR-PROTNSW-OC3) —

operates OC-3 line protection switching

OPERATE-PROTECTION SWITCH-OC12 (OPR-PROTNSW-OC12) —

—operates OC-12 line protection switching

OPERATE-PROTECTION SWITCH-OC48 (OPR-PROTNSW-OC48) —

—operates OC-48 line protection switching

OPERATE-PROTECTION SWITCH (OPR-PROTNSW-rr) —

operates STS-3 tributary protection switching

OPERATE-SYNCHRONIZATION SWITCH (OPR-SYNCNSW) —

operates synchronization reference protection switching

RELEASE-EXTERNAL CONTROL (RLS-EXT-CONT) —

releases an external miscellaneous discrete control output

RELEASE-LOOPBACK (RLS-LPBK-rr) —

releases low speed (DS3, EC-1, OC-3 and OC-12) or high speed (OC-48)

RELEASE-PROTECTION SWITCH-OC3 (RLS-PROTNSW-OC3) —

releases OC-3 line protection switching

RELEASE-PROTECTION SWITCH-OC12 (RLS-PROTNSW-OC12) —

releases OC-12 line protection switching.

RELEASE-PROTECTION SWITCH-OC48 (RLS-PROTNSW-OC48) —

releases OC-48 line protection switching

RELEASE-PROTECTION SWITCH (RLS-PROTNSW-rr) —

releases STS-3 tributary protection switching

RELEASE-SYNCHRONIZATION SWITCH (RLS-SYNCNSW) —

releases synchronization reference protection switching

RETRIEVE-AUTONOMOUS OUTPUT (RTRV-A0) —

retrieves copies of autonomous TL1 messages

RETRIEVE-ALARM (RTRV-ALM) —

retrieves active alarm conditions

RETRIEVE-ALARM-ENVIRONMENT (RTRV-ALM-ENV) —

retrieves active environmental alarm conditions

RETRIEVE-rr (RTRV-rr) —

retrieves current provisioned state of low speed ports and slots

RETRIEVE-ASSIGNMENT-DCC (RTRV-ASGNMT-DCC) —

retrieves information on the assignment of DCC Channels to low speed slots or slot pairs.

RETRIEVE-ATTRIBUTE ALARM (RTRV-ATTR-ALM) —

retrieves the current values of the incoming signal alarm delay, alarm clear delay interval, and power minor alarm parameters

RETRIEVE-ATTRIBUTE CONTROL (RTRV-ATTR-CONT) —

retrieves provisioned description(s) of the external control outputs

RETRIEVE-ATTRIBUTE ENVIRONMENT (RTRV-ATTR-ENV) —

retrieves provisioned description(s) of the environmental inputs

RETRIEVE-ATTRIBUTE (RTRV-ATTR-rr) —

retrieves the notification code associated with incoming signal failure events

RETRIEVE-CHANNEL IDENTIFIER-SECURITY (RTRV-CID-SECU)

retrieves system security for the CIT-PC, DCC, and X.25 ports

RETRIEVE-CIRCUIT-PATH (RTRV-CKT-rr)§§ —

retrieves a circuit path report showing all of the cross-connections that make up the circuit.

RETRIEVE-CONDITION (RTRV-COND) —

retrieves all active alarm and status conditions

RETRIEVE-CROSS-CONNECTION (RTRV-CRS-rr) —

retrieves current cross-connections

RETRIEVE-CROSSCONNECTION-TIRKS (RTRV-CRS-TIRKS) —

retrieves current cross-connections for TIRKS-compatible STS-1 AIDs.

RETRIEVE-DATE-AND-TIME (RTRV-DAT) —

retrieves the network element's time zone and day light savings time information

RETRIEVE-EQUIPMENT (RTRV-EQPT) —

retrieves circuit pack and version information for one or more slots

RETRIEVE-HEADER (RTRV-HDR) —

retrieves system ID, time, and date

RETRIEVE-LOG (RTRV-LOG) —

retrieves a history log, of events, for the Network Elements

RETRIEVE-MAP-NEIGHBOR (RTRV-MAP-NEIGHBOR) —

retrieves a list of all Network Elements with direct optical connections carrying active DCC channels to that NE

RETRIEVE-MAP-NETWORK (RTRV-MAP-NETWORK) —

retrieves a list of all network elements in the local SONET subnetwork

RETRIEVE-MAP-RING (RTRV-MAP-RING) —

retrieves a list of all network elements in the local area or all Level 2 ISs in the subnetwork

RETRIEVE-NETWORK-SECURITY (RTRV-NE-SECU) —

retrieves network element global security information

RETRIEVE-PATH TRACE (RTRV-PTHTRC) —

retrieves the provisioned transmit and receive path traces, path trace status, actual receive path trace, and path signal label (including payload defects); retrieves enabled/disabled status of DRI switching on PDI-P

RETRIEVE-PERFORMANCE MONITORING (RTRV-PM) —

retrieves performance-monitoring (PM) data, including historical PM data

RETRIEVE-PERFORMANCE-MONITORING-START-TIME (RTRV-PM-STIME)§ —

retrieves the start time for measuring when the day begins

RETRIEVE-PROTECTION-LINE (RTRV-PROTN-LINE) —

retrieves the “wait-to-restore” line protection switching characteristics

RETRIEVE-PROTECTION-LOW-SPEED (RTRV-PROTN-LS) —

retrieves the “wait-to-restore” low speed protection switching characteristics

RETRIEVE-PROTECTION-STS1 (RTRV-PROT-rr) —

retrieves protection state for an STS-1 (NPPA)

RETRIEVE-rr (RTRV-rr)

retrieves various parameters of low-speed ports and slots

RETRIEVE-STATE (RTRV-STATE) —

retrieves the slot, port, tributary, and line protection switching state for the Network Element

RETRIEVE-SYNCHRONIZATION (RTRV-SYCN) —

retrieves the provisioning and operational information on the synchronization attributes

RETRIEVE-SYSTEM (RTRV-SYS) —

retrieves network element name and other system level parameters

RETRIEVE-THRESHOLD (RTRV-TH) —

retrieves the current threshold level of one or more monitored parameters

RETRIEVE-TIME-SLOT (RTRV-TMSLT) —

retrieves the Tributary Map report

RETRIEVE-TRANSLATE-OC12 (RTRV-TRNSLT-OC12) —

retrieves the FT-2000 OC-12 quad, slot and port to translated TIRKS OC-12 ports.

RETRIEVE-TRANSLATE-TRIB (RTRV-TRNSLT-TRIB) —

retrieves a list of FT-2000 STS-1 and STS-3 tributary AIDs to translated TIRKS STS-1 tributary AIDs.

RETRIEVE-ULSDCC-L3 (RTRV-ULSDCC-L3) —

retrieves the provisioning information on the upper layers DCC and NSAP attribute

RETRIEVE-ULSDCC-L4 (RTRV-ULSDCC-L4) —

retrieves the provisioning information on the TARP data cache parameter

RETRIEVE-USER-SECURITY (RTRV-USER-SEC) —

retrieves security parameters associated with a login

SET-ATTRIBUTE ALARM (SET-ATTR-ALM)—

sets the current values of the incoming signal alarm delay, alarm clear delay interval, and power minor alarm parameters

SET-ATTRIBUTE CONTROL (SET-ATTR-CONT) —

provisions the description(s) of the external control outputs

SET-ATTRIBUTE ENVIRONMENT (SET-ATTR-ENV) —

provisions the description(s) of the environmental inputs

SET-ATTRIBUTE (SET-ATTR-rr)* —

sets notification code associated with incoming signal failure events

SET-PERFORMANCE-MONITORING-START-TIME (SET-PM-STIME) —

sets the start time for the measurement of all 24 hour performance monitoring parameters

SET-SITE ID (SET-SID) —

sets the target identifier (TID) of the network element

SET-THRESHOLD (SET-TH) —

sets the threshold level for monitored parameters

SWITCH-TO PROTECTION (SW-TOPROTN) —

performs an equipment (circuit pack) protection switch on DS3 and/or STS1E, or TG3 (DS1) circuit packs

SWITCH-TO WORKING (SW-TOWKG) —

resets an equipment (circuit pack) protection switch on DS3 and/or STS1E, or TG3 (DS1) circuit packs

TEST-AUTO-TURNUP (TEST-AUTO) —

tests the system and cabling

TEST-EQUIPMENT (TEST-EQPT) —

tests the audible and visual office alarms and the system LEDs

UPDATE-SYSTEM (UPD-SYS) —

updates the state of all the automatically provisioned parameters



NOTE:

Ensure that there are no active local or remote TL1 login sessions before removing the X.25 cable from the X.25 connector at the local FT-2000 OC-48 Add/Drop-Rings Terminal. If the X.25 cable is removed from the X.25 connector, any active local or remote TL1 login sessions are not dropped. Using the CIT at the local and remote network elements, the Active User Report shows these TL1 login sessions are still active.

The TL1/X.25 interface (X.25) is located on the interconnection panel of the Low Speed Shelf - System Controller. Refer to Section 3, "Platform Descriptions," for more information about the physical location of the TL1/X.25 interface.

Refer to 824-102-148, *FT-2000 OC-48 Lightwave System Operations Systems Engineering Guide*, for detailed information about the TL1/X.25 interface and TL1 message/command descriptions.

Orderwire Interface

The orderwire interface provides a facility for voice communications between terminals for maintenance personnel to perform facility maintenance. The orderwire interface provides a facility for voice communications and remote access between terminals and repeaters, and between repeaters. The FT-2000 OC-48 Repeater Bay must be equipped with the Orderwire (OW) circuit pack to access the section orderwire byte. The FT-2000 OC-48 Add/Drop-Rings Terminal provides four 64-kb/s orderwire interfaces for section and line orderwire. The FT-2000 OC-48 Repeater Bay provides four 64-kb/s orderwire interfaces for section orderwire. The line (express) and section (local) orderwire interfaces are V.11/EIA-422. The section orderwire interface will not provide voice communications between FT-2000 OC-48 Add/Drop-Rings Terminals when there is an FT-2000 OC-48 Repeater Bay in the intervening OC-48 high speed line that is not equipped with the Orderwire (OW) circuit pack.

The line (express) and section (local) orderwire interfaces [LINE OW (EXP OW) and SECTION OW (LOC OW)] are located on the interconnection panel of the Enhanced High Speed Shelf (or High Speed Shelf). The section (local) orderwire interfaces [SECTION OW (LOC OW)] are located on the interconnection panel of the Repeater Shelf - System Controller. Refer to Section 3, "Platform Descriptions," for more information about the physical location of the line and section orderwire interfaces.

To use the orderwire interface, the FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with two OHCTL (TERM) circuit packs. The FT-2000 OC-48 Repeater Bay must be equipped with an Orderwire (OW) circuit pack. The OHCTL (TERM) and OW circuit packs insert/extract the orderwire bytes to/from the synchronous optical network (SONET) overhead channel.

Standard equipment can be connected to the orderwire interface. For example, a DANTEL* orderwire shelf may be used with the FT-2000 OC-48 Lightwave System.*

Subnetwork Size

FT-2000 R8.1 and later releases support subnetwork sizes of up to 256 NEs by partitioning into multiple areas connected via Level 2 Intermediate Systems (ISs). Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*, for additional details.

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Contents

Overview

This section provides a detailed functional description of the FT-2000 OC-48 Lightwave System circuit packs.

General

The FT-2000 OC-48 Lightwave System circuit packs are divided into three main categories:

- Control circuit packs
 - System Controller (SYSCTL) LAA23B
 - System Memory - 4 Megabyte (SYSMEM) LAA25
 - Line Controller - 4 Megabyte [LNCTL (4 MEG)] LAA28
 - Overhead Controller - Terminal [OHCTL (TERM)] LAA21
 - Overhead Controller - Terminal [OHCTL (TERM)] LAA22
 - Overhead Controller - Tributary (TOHCTL) LAA26
 - Orderwire (OW) LAA14
- Transmission circuit packs
 - DS3 Interface (DS3) LAA2
 - STS-1 Electrical Interface (STS1E) LAA4
 - IS3 Optical Interface -
Contains LED optics (for intraoffice applications only) LAA5

- OC3 Optical Interface - 1.3 μm Standard Performance [OC3 (1.3 STD)] LAA10
- OC3 Optical Interface - 1.3 μm Standard Performance [OC3 (1.3 STD)] LAA10B
- OC12 Optical Interface - 1.3 μm Standard Performance [OC12 (1.3 STD)] T939A
- Low Speed Switch (LSSW) LAA12B
- OC48 Receiver, Add/Drop [OC48 RCVR (A/D)] 839B2
- OC48 Receiver, Add/Drop [OC48 RCVR (A/D)] 839B4B
- OC48 Receiver, Add/Drop [OC48 RCVR (A/D)] 839B5
- OC48 Receiver, Add/Drop [OC48 RCVR (A/D)] 839E5
- OC48 Transmitter, Add/Drop - 1.3 μm Standard Performance [OC48 TRMTR (A/D 1.3 STD)] 739B2
- OC48 Transmitter, Add/Drop - 1.3 μm Standard Performance [OC48 TRMTR (A/D 1.3 STD)] 739B4
- OC48 Transmitter, Add/Drop - 1.3 μm Standard Performance [OC48 TRMTR (A/D STS1 1.3 STD)] 739B5
- OC48 Transmitter, Add/Drop - 1.3 μm High Performance [OC48 TRMTR (A/D 1.3 HI PERF)] 739C2
- OC48 Transmitter, Add/Drop - 1.3 μm High Performance [OC48 TRMTR (A/D STS1 1.3 HI PERF)] 739C5
- OC48 Transmitter, Add/Drop - 1.5 μm Wavelength n , 360km Dispersion Limit [OC48 TRMTR (A/D 1.5 Wn) 360km DISP] ($n=1-8$) 739E[1-8]
- OC48 Transmitter, Add/Drop - 1.5 μm Wavelength n , 640km Dispersion Limit [OC48 TRMTR (A/D 1.5 Wn) 640km DISP] ($n=1-8$) 739G[1-8]
- OC48 Transmitter, Add/Drop - 1.5 μm Wavelength n , 60km Dispersion Limit [OC48 TRMTR (A/D 1.5 Wn) 60km DISP] ($n=1-16$) 739H[1-16]
- OC48 Transmitter, Add/Drop - 1.5 μm Standard Performance [OC48 TRMTR (A/D 1.5 STD)] 739J2
- OC48 Transmitter, Add/Drop - 1.5 μm LBA Standard Performance [OC48 TRMTR (A/D 1.5 LBA)] 739J3
- OC48 Transmitter, Add/Drop - 1.5 μm LBA Standard Performance [OC48 TRMTR (A/D 1.5 LBA)] 739J4
- OC48 Transmitter, Add/Drop - 1.5 μm Standard Performance [OC48 TRMTR (A/D STS1 1.5 STD)] 739J5
- OC48 Transmitter, Add/Drop - 1.5 μm LBA Standard Performance [OC48 TRMTR (A/D STS1 1.5 LBA)] 739P5

- OC48 Transmitter, Add/Drop - 1.5 μ m LBA Wavelength 1
[OC48 TRMTR (A/D 1.5 LBA W1)] 739R2
- OC48 Transmitter, Add/Drop - 1.5 μ m LBA Standard Performance
[OC48 TRMTR (A/D STS1 1.5 LBA, W1)] 739R5
- OC48 Transmitter, Add/Drop - 1.5 μ m LBA Wavelength 2
[OC48 TRMTR (A/D 1.5 LBA W2)] 739S2
- OC48 Transmitter, Add/Drop - 1.5 μ m LBA Standard Performance
[OC48 TRMTR (A/D STS1 1.5 LBA, W2)] 739S5
- Synchronization circuit pack
 - Timing Generator, Stratum 3 - DS1
[TG3 (DS1)] LAA18.

Circuit Pack and Software Compatibility

Refer to Table 7-1 for information about circuit packs and compatible software.

Table 7-1. Circuit Packs and Compatible Software

Circuit Pack		Compatible Software			
Code	Name	R7.2 -ADR	R8.1-ADR	R9.0-ADR	R9.1-ADR
LAA2,S4:4	DS3	X	X	X	X
LAA4	STS1E	X	X	X	X
LAA5	IS3	X	X	X	X
LAA10	OC3 (1.3 STD)	X	X	X	X
LAA10B	OC3 (1.3 STD)	X	X	X	X
T939A	OC12	X	X	X	X
LAA12B	LSSW	X	X	X	X
LAA14	OW	X	X	X	X
LAA18	TG3 (DS1)	X	X	X	X
LAA21	OHCTL	X	X	X	X
LAA22†	OHCTL	X	X	X	X
LAA23B	SYSCTL	X	X	X	X
LAA25	SYSMEM	X	X	X	X
LAA26	TOHCTL	X	X	X	X
LAA28	LNCTL (4 MEG)	X	X	X	X
739B2	OC48 TRMTR (A/D 1.3 STD)	X	X	X	X
739B4	OC48 TRMTR (A/D 1.3 STD)	X	X	X	X
739B5	OC48 TRMTR	X	X	X	X
739C2	OC48 TRMTR (A/D 1.3 HI PERF)	X	X	X	X
739C5	OC48 TRMTR (A/D STS1 1.3 HI PERF)	X	X	X	X
739E1-E8	OC48 TRMTR (A/D STS1 1.5 360km DISP)	X	X	X	X
739G1-G8	OC48 TRMTR (A/D STS1 1.5 640km DISP)	X	X	X	X
739H1-H16	OC48 TRMTR (A/D STS1 1.5 60km DISP)	X	X	X	X
739J2	OC48 TRMTR (A/D 1.5 STD)	X	X	X	X
739J3	OC48 TRMTR (A/D 1.5 LBA)	X	X	X	X
739J4	OC48 TRMTR (A/D 1.5 LBA)	X	X	X	X
739J5	OC48 TRMTR (A/D STS1 1.5 STD)	X	X	X	X
739P5	OC48 TRMTR (A/D STS1 1.5 LBA)	X	X	X	X
739R2	OC48 TRMTR (A/D 1.5 LBA W1)	X	X	X	X
739R5	OC48 TRMTR (A/D STS1 1.5 LBA, W1)	X	X	X	X
739S2	OC48 TRMTR (A/D 1.5 LBA W2)	X	X	X	X

Table 7-1. Circuit Packs and Compatible Software—Contd

Circuit Pack		Compatible Software			
Code	Name	R7.2 -ADR	R8.1-ADR	R9.0-ADR	R9.1-ADR
739S5	OC48 TRMTR (A/D STS1 1.3 LBA, W2)	X	X	X	X
839B2	OC48 RCVR (A/D)	X	X	X	X
839B4B	OC48 RCVR (A/D)	X	X	X	X
839B5	OC48 RCVR (A/D STS1)	X	X	X	X
839E5	OC48 RCVR (A/D STS1)	X	X	X	X

† The LAA22 OHCTL circuit pack is only used in slot OHCTL 1W of the High Speed Shelf of the FT-2000 OC-48 Add/Drop-Rings Terminal.

Control

SYSCTL (LAA23 and LAA23B) Circuit Pack Description

Purpose of Circuit

The System Controller (SYSCTL) circuit pack is the main controller in the system. It has control over all FT-2000 OC-48 Lightwave System functions, and together with the System Memory (SYSMEM) circuit pack, provides all user interfaces to the system.

The LAA23B SYSCTL circuit pack is used in OC-48 point-to-point and bidirectional ring applications.

Faceplate LED

The SYSCTL circuit pack has a red FAULT LED on its faceplate (Figure 7-1). The red FAULT LED is lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the SYSMEM circuit pack to light the FAULT LED on the SYSCTL circuit pack.

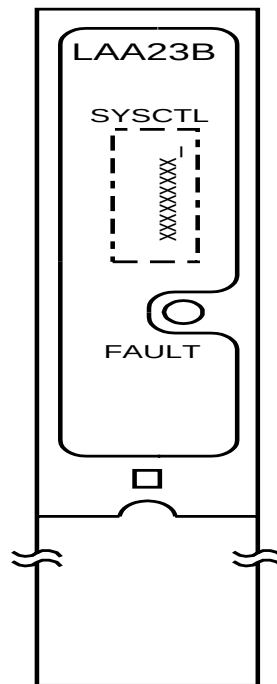


Figure 7-1. SYSCTL (LAA23B) Circuit Pack

The sanity check circuitry detects hardware and software faults. When a fault occurs, the microprocessor is reset and the FAULT LED on the circuit pack faceplate is lighted.

General Description of Operation

The SYSCTL circuit pack provides overall administrative control of the FT-2000 OC-48 Lightwave System. It performs system-wide computations and performance monitoring. It also provides the serial user interfaces.

The SYSCTL circuit pack also interfaces with the System Memory (SYSMEM), Line Controller (LNCTL), Overhead Controller - Terminal [OHCTL (TERM)], and Overhead Controller - Tributary (TOHCTL) circuit packs.

Detailed Description of Operation

Control Circuitry

Microprocessor . Figure 7-2 provides an overall block diagram of the SYSCTL circuit pack. The SYSCTL circuit pack is the highest level processor in the three-level control hierarchy of the FT-2000 OC-48 Lightwave System.

Memory

Start-Up Memory . The start-up memory consists of 64 kilobytes of read-only memory. The start-up memory contains the program that allows the microprocessor to copy the executable code and data for the system from the nonvolatile memory of the SYSMEM circuit pack into the operating memory of the SYSCTL circuit pack. This allows the microprocessor to start up operation during a power-up or a reset condition or when initializing new software. The LAA23B SYSCTL circuit pack also has a unique network services access point (NSAP) code in the read-only memory. This is required for bidirectional ring applications.

Operating Memory . The main operating memory consists of 4 megabytes of dynamic random access memory (DRAM). Direct memory access (DMA) allows the SYSCTL circuit pack to copy the executable code and data for the system from the nonvolatile memory of the SYSMEM circuit pack into the operating memory during a power-up or reset condition, or when initializing new software.

Nonvolatile Memory . The nonvolatile memory consists of 128 bytes of electrically-erasable programmable read-only memory (EEPROM). The nonvolatile memory is used to store information about the history of the SYSCTL circuit pack such as the *Common Language** CLEI code and type/version information.

For more information about memory administration, refer to Section 8, "Administration and Provisioning."*

* Common Language is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research Inc.

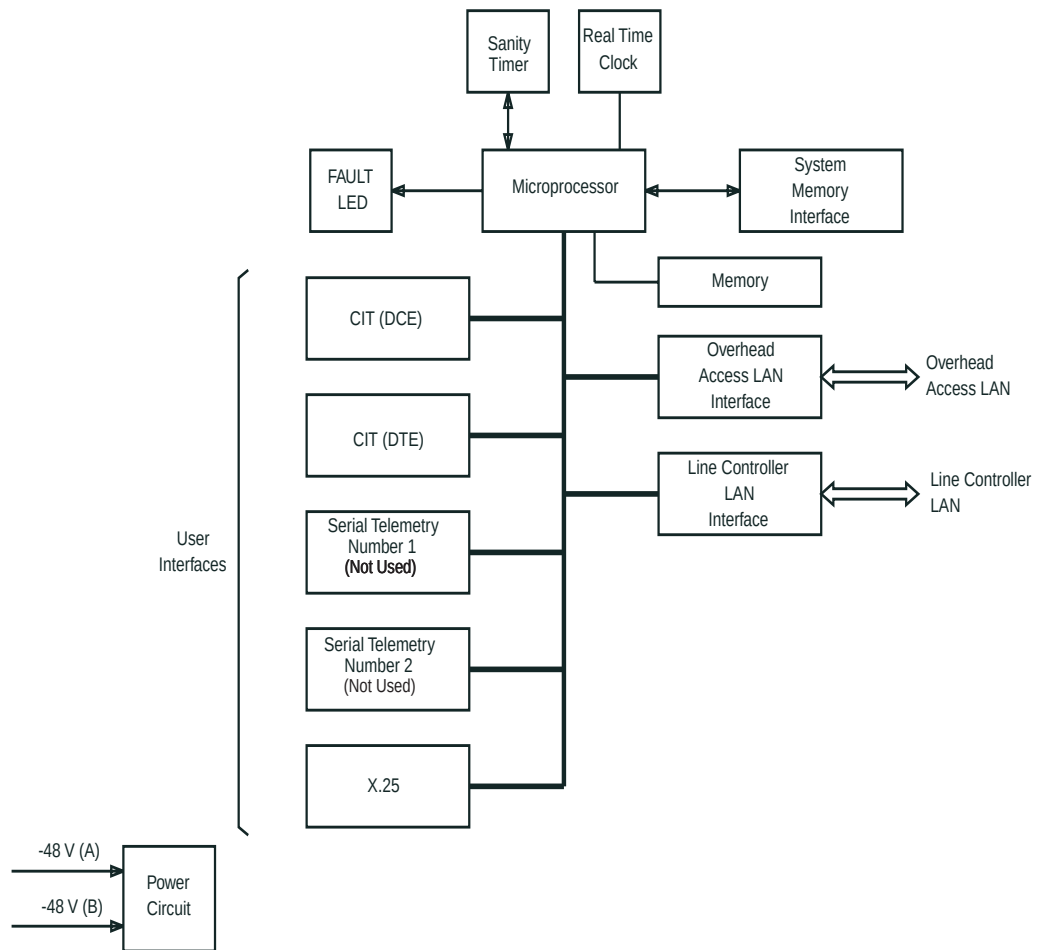


Figure 7-2. SYSTL Circuit Pack Block Diagram

Interface Circuitry

Line Controller Local Area Network Interface. The line controller local area network (LCLAN) interface allows the SYSTL circuit pack to communicate with the Line Controller (LNCTL) circuit packs. In the FT-2000 OC-48 Repeater Bay, the SYSTL circuit pack communicates directly with the board controllers on the individual circuit packs. The LNCTL circuit pack is not required for the FT-2000 OC-48 Repeater Bay.

Overhead Access Local Area Network Interface. The overhead access local area network (OALAN) interface allows the SYSTL circuit pack to communicate with the Overhead Controller - Terminal [OHCTL (TERM)] and Overhead Controller - Tributary (TOHCTL) circuit pack.

Serial User Interfaces. The SYSCTL circuit pack provides the following serial user interfaces:

- CIT (DCE) interface:** The CIT (DCE) interface is configured as data circuit equipment (DCE) for direct craft interface terminal (CIT) access. The CIT (DCE) interface may also be provisioned to allow direct access to a PC running the CPro-2000 software or an ASCII-based terminal. The CIT (DCE) interface supports data rates up to 9600 baud.
- **CIT (DTE) interface:** The CIT (DTE) interface is configured as data terminating equipment (DTE) to allow a permanent connection to a modem. The CIT (DTE) interface may also be provisioned to allow direct access to a PC running the CPro-2000 software or an ASCII-based terminal. The CIT (DTE) interface supports data rates up to 9600 baud.
- **X.25 interface:** The X.25 interface supports X.25 protocol and the transaction language 1 (TL1) message language. The physical connection is an EIA RS-232D port which may operate at data rates from 1200 to 19,200 bps (FT-2000 OC-48 ADR Terminals only).

*For more information about these interfaces, refer to Section 6, "Operations Interfaces."

Power Circuitry

The SYSCTL circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts and –5 volts used on the circuit pack. The power converter also provides a +5 volt source for the FAULT LED on any circuit pack that has a power failure.

The SYSCTL circuit pack monitors the two –48 volt sources to the circuit pack. If the SYSCTL circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the SYSMEM circuit pack provides +5 volts to light the FAULT LED on the SYSCTL circuit pack.

Quick Reference Summary

Control Functions

The SYSCTL circuit pack performs the following control and maintenance functions:

- a. Stores the operating copy of the system executable code and data
- b. Performs system-wide maintenance computations and performance monitoring
- c. Automatically resets the system during power up

* NMA is a trademark of Bellcore, Inc.

- d. Isolates faults for the LCLAN and OALAN
- e. Maintains the real-time clock
- f. Performs self audits
- g. Controls the circuit pack faceplate FAULT LED on the SYSCTL and the SYSMEM circuit packs.

Interface Functions

The SYSCTL circuit pack provides the following interface functions:

- a. Communications between the SYSCTL and SYSMEM circuit packs using the SYSCTL/SYSMEM interface
- b. Communications between the SYSCTL and the LNCTL circuit packs using the line controller local area network (LCLAN) (FT-2000 OC-48 Add/Drop-Rings Terminals only)
- c. Communications between the SYSCTL circuit pack and the OHCTL (TERM) circuit pack(s) using the overhead access local area network (OALAN)
- d. Communications between the SYSCTL circuit pack and the TOHCTL circuit pack using the overhead access local area network (OALAN)
- e. CIT (DCE) interface for direct local access to the system operating at 1200, 2400, 4800, or 9600 baud
- f. CIT (DTE) interface for remote dial-up access to the system operating at 1200, 2400, 4800, or 9600 baud
- g. X.25 interface for advanced provisioning, performance monitoring, administration, and maintenance activities operating at 1200 to 19,200 bps (FT-2000 OC-48 ADR Terminals only).

SYSMEM (LAA25) Circuit Pack Description

Purpose of Circuit

The System Memory (SYSMEM) circuit pack provides the nonvolatile memory necessary for storing the executable code and data for the system. The SYSMEM circuit pack also contains the office alarm circuitry and the processor parallel input/output (I/O) circuitry.

Faceplate LED

The SYSMEM circuit pack has a red FAULT LED on its faceplate (Figure 7-3). The red FAULT LED is lighted during a reset condition, when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a

separate path is provided for power from the System Controller (SYSCTL) circuit pack to light the FAULT LED on the SYSMEM circuit pack.

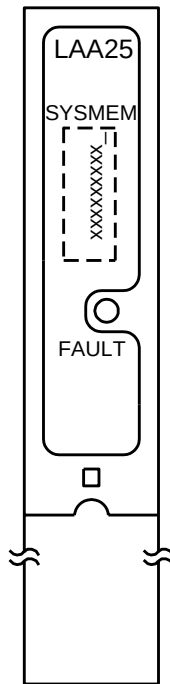


Figure 7-3. SYSMEM (LAA25) Circuit Pack

General Description of Operation

The SYSMEM circuit pack provides the following:

- Nonvolatile program (executable code) and configuration (data) memory
- Office alarms interface
- User panel LEDs and controls
- User-settable miscellaneous discrete interface.

Detailed Description of Operation

Memory

Nonvolatile Program (Executable Code) Storage. Figure 7-4 shows a functional block diagram of the SYSMEM circuit pack. The nonvolatile program storage is provided by 4 megabytes of flash erasable programmable read-only memory

(flash-EPROM). This contains the main system software for all the controllers in the system (for example, System Controller, Line Controllers, and board controllers). Flash-EPROM combines the nonvolatility of EPROM with the in-circuit reprogramming ability of electrically erasable programmable read-only memory (EEPROM). Flash-EPROM allows in-service software upgrades to be performed locally or remotely (via modem connections).

Nonvolatile Configuration (Data) Storage. The nonvolatile configuration storage is provided by 128 kilobytes of EEPROM. This contains all system state and user-provisioned data. This includes all system parameters with their original and current values. EEPROM is byte erasable and writable. This allows configuration information to be easily changed during system operation.

Nonvolatile Memory. The nonvolatile memory consists of 128 bytes of EEPROM. The nonvolatile memory is used to store information about the history of the SYSMEM circuit pack such as the *CLEI* code and type/version information.

For more information about memory administration, refer to Section 8, "Administration and Provisioning."

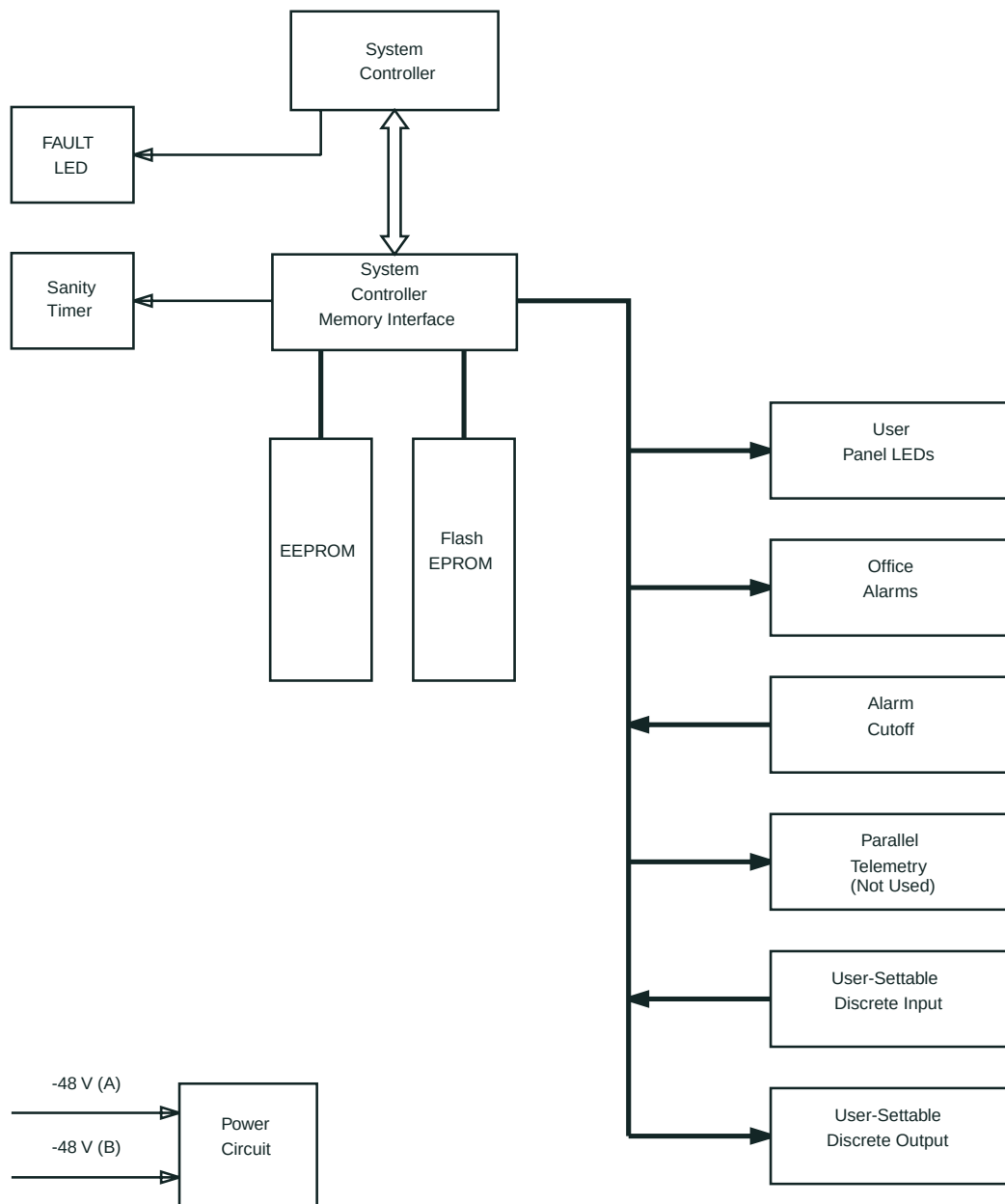


Figure 7-4. SYSMEM Circuit Pack Block Diagram

Office Alarms Interface

The SYSMEM circuit pack provides relays for the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay to interface with a central office alarm grid. The relays are controlled by the microprocessor on the SYSCCTL circuit pack. Relays are provided for audible and visible alarms for:

- Critical
- Major
- Minor.

The normally closed contacts for the critical and major relays provide the alarm closure if power fails. For more information about the office alarms interface, refer to Section 6, "Operations Interfaces."

User Panel LEDs and Controls

The SYSMEM circuit pack provides the outputs to light the following LEDs on the user panel:

- Critical (CR) alarm
- Major (MJ) alarm
- Minor (MN) alarm
- Abnormal (ABN) status
- Near-end activity (NE ACTY)
- Far-end activity (FE ACTY)
- Line locator (LINE LOCTR) display
- Use CIT (USE CIT).

The SYSMEM circuit pack also accepts the alarm cutoff (ACO) input from the user panel. For more information about the user panel, refer to Section 6, "Operations Interfaces."

User-Settable Miscellaneous Discrete Interface

The SYSMEM circuit pack accepts 16 user-settable environmental inputs and provides 4 user-settable control outputs at the FT-2000 OC-48 Add/Drop-Rings Terminal. At the FT-2000 OC-48 Repeater Bay, the SYSMEM circuit pack accepts 16 environmental inputs only. For more information about the miscellaneous discrete interface, refer to Section 6, "Operations Interfaces."

Power Circuitry

The SYSMEM circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. Two modular DC-to-DC power converters produce +5 volts and +12 volts used on the circuit pack. The +5 volt power converter provides a +5 volt

source for the FAULT LED on the System Controller (SYSCTL) circuit pack if a power failure occurs on the SYSCTL circuit pack. The +12 volt power converter is used to program the flash memory.

The SYSMEM circuit pack monitors the two –48 volt sources to the circuit pack. If the SYSMEM circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or +5 volt power converter fails, the SYSCTL circuit pack provides +5 volts to light the FAULT LED on the SYSMEM circuit pack.

Quick Reference Summary

Control Functions

The SYSMEM circuit pack performs the following control functions:

- a. Provides program (executable code) memory storage
- b. Provides configuration (data) memory storage.

Interface Functions

The SYSMEM circuit pack provides the following interface functions:

- a. Office alarms
- b. User panel LEDs and controls
- c. User-settable miscellaneous discrete interface that provides environmental inputs (FT-2000 OC-48 Add/Drop-Rings Terminals and FT-2000 OC-48 Repeater Bays) and control outputs (FT-2000 OC-48 Add/Drop-Rings Terminals only).

LNCTL (LAA28) Circuit Pack Description

Purpose of Circuit

The Line Controller (LNCTL) circuit pack is the middle level of the three-level control hierarchy for the FT-2000 OC-48 Lightwave System. It performs real-time intensive line functions, primarily protection switching, and line specific computations. The LNCTL circuit pack is not required for the FT-2000 OC-48 Repeater Bay.

The LAA28 LNCTL (4 MEG) circuit pack is required for bidirectional ring applications.

Faceplate LED

The LNCTL circuit pack has a red FAULT LED on its faceplate (Figure 7-5). The red FAULT LED is lighted during a reset condition, when a circuit pack failure is detected, or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the System Controller (SYSCTL) circuit pack to light the FAULT LED on the LNCTL circuit pack.

The sanity check circuitry detects hardware and software faults. When a fault occurs, the microprocessor is reset and the FAULT LED on the circuit pack faceplate is lighted.

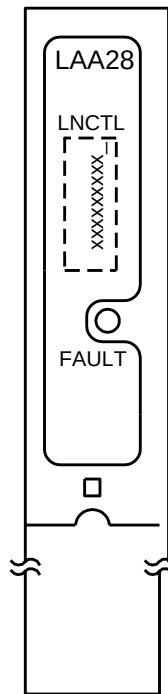


Figure 7-5. LNCTL (LAA28) Circuit Pack

General Description of Operation

The LAA28 LNCTL (4 MEG) circuit pack provides overall administrative control of up to two OC-48 high speed lines for the FT-2000 OC-48 Add/Drop-Rings Terminal. The LNCTL circuit pack provides low and high speed protection switching computations and other line specific computations. It interfaces with the board controllers on each circuit pack associated with an OC-48 high speed line and the System Controller (SYSCTL) circuit pack.

Detailed Description of Operation

Control Circuitry

Processor. Figure 7-6 provides an overall block diagram of the LNCTL circuit pack. The LNCTL circuit pack is the middle level processor in the three-level control hierarchy of the FT-2000 OC-48 Lightwave System.

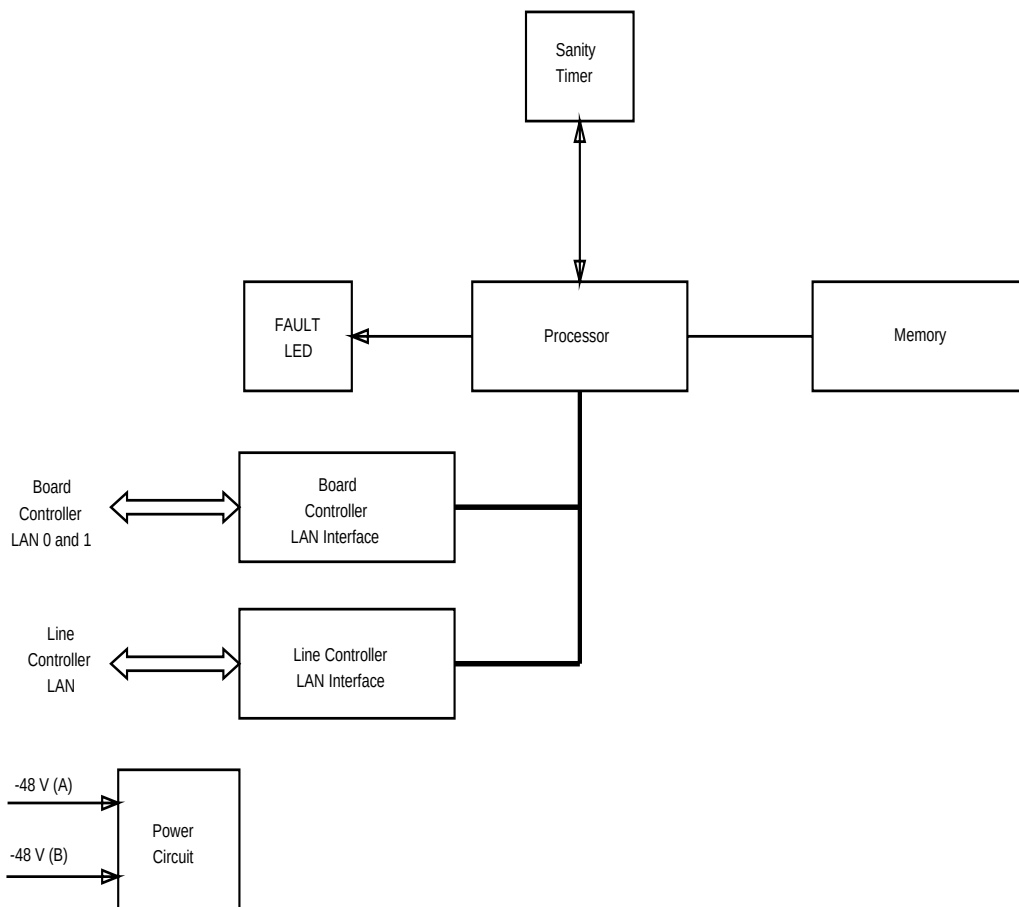


Figure 7-6. LNCTL Circuit Pack Block Diagram

Memory

Start-Up Memory. The start-up memory consists of 64 kilobytes of read-only memory. The start-up memory contains the program that allows the processor to load the executable code and data from the SYSCTL circuit pack into the

operating memory. This allows the processor to start up operation during a power-up or a reset condition, or when initializing new software.

Operating Memory. The main operating memory of the LAA28 LNCTL (4 MEG) circuit pack consists of 4 megabytes of DRAM. Direct memory access (DMA) allows the board controller to load the executable code and data received from the SYSCTL circuit pack (via the line controller local area network) into the operating memory during a power-up or reset condition, or when initializing new software.

Nonvolatile Memory. The nonvolatile memory consists of 128 bytes of electrically-erasable programmable read-only memory (EEPROM). The nonvolatile memory is used to store information about the history of the LNCTL circuit pack such as the *CLEI* code and type/version information.

For more information about memory administration, refer to Section 8, "Administration and Provisioning."

Interface Circuitry

Line Controller Local Area Network Interface. The line controller local area network (LCLAN) interface allows the LNCTL circuit pack to communicate with the SYSCTL circuit pack.

Board Controller Local Area Network Interface. The board controller local area network (BCLAN) interface allow the LNCTL circuit pack to communicate with the board controllers on each circuit pack associated with a particular OC-48 high speed line.

Power Circuitry

The LNCTL circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack. The power converter also provides two +5 volt sources for the FAULT LEDs on the other circuit packs (associated with the same OC-48 high speed line) if a power failure occurs.

The LNCTL circuit pack monitors the two –48 volt sources to the circuit pack. If the LNCTL circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the SYSCTL circuit pack provides +5 volts to light the FAULT LED on the LNCTL circuit pack.

Quick Reference Summary

Control Functions

The LNCTL circuit pack performs the following control and maintenance functions:

- a. Performs low and high speed protection switching computations
- b. Performs line specific computations

- c. Controls the circuit pack faceplate FAULT LED
- d. Isolates faults for the BCLANs.

Interface Functions

The LNCTL circuit pack provides the following interface functions:

- a. Communications between the LNCTL and SYSCTL circuit packs using the LCLAN interface
- b. Communications between the LNCTL and the board controller on the circuit packs associated with a particular OC-48 high speed line using the BCLANs.

OHCTL (TERM) (LAA21 and LAA22) Circuit Pack Description

Purpose of Circuit

The Overhead Controller - Terminal [OHCTL (TERM)] circuit pack provides access to the OC-48 SONET overhead channel. The overhead channel contains SONET line and section overhead bytes. The LAA21 OHCTL (TERM) circuit pack is required for orderwire access and single-ended operations (for example, CIT remote login). Two LAA21 OHCTL (TERM) circuit packs are required for the FT-2000 OC-48 Add/Drop-Rings Terminals (equipped with the Enhanced High Speed Shelf).

One LAA21 (East) OHCTL (TERM) and one LAA22 (West) OHCTL (TERM) circuit pack are required for the FT-2000 OC-48 Add/Drop-Rings Terminal (equipped with the High Speed Shelf).

Faceplate LED

The OHCTL (TERM) circuit pack has a red FAULT LED on its faceplate (Figure 7-7). The red FAULT LED is lighted during a reset condition, when a circuit pack failure is detected, or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the System Controller (SYSCTL) circuit pack to light the FAULT LED on the OHCTL (TERM) circuit pack.

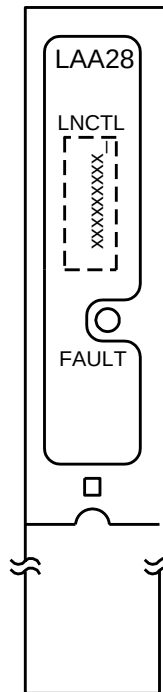


Figure 7-7. OHCTL (TERM) (LAA21 and LAA22) Circuit Pack

The sanity check circuitry detects hardware and software faults. When a fault occurs, the microprocessor is reset and the FAULT LED on the circuit pack faceplate is lighted.

General Description of Operation

The OHCTL (TERM) circuit pack assembles and disassembles the embedded information for the section and line overhead bytes. These overhead bytes include section and line data communications bytes, section and line orderwire bytes, growth bytes, and user bytes. Refer to Appendix A, "A SONET Overview," for definitions of SONET sections, lines, and paths. The OHCTL (TERM) circuit pack also interfaces with the SYSCTL circuit pack.

Detailed Description of Operation

Control Circuitry

Processor. Figure 7-8 provides an overall block diagram of the OHCTL (TERM) circuit pack. The OHCTL (TERM) circuit pack provides protocol processing for the

data communications channels and manages the overhead access local area network (OALAN) communications with the SYSCTL circuit pack.

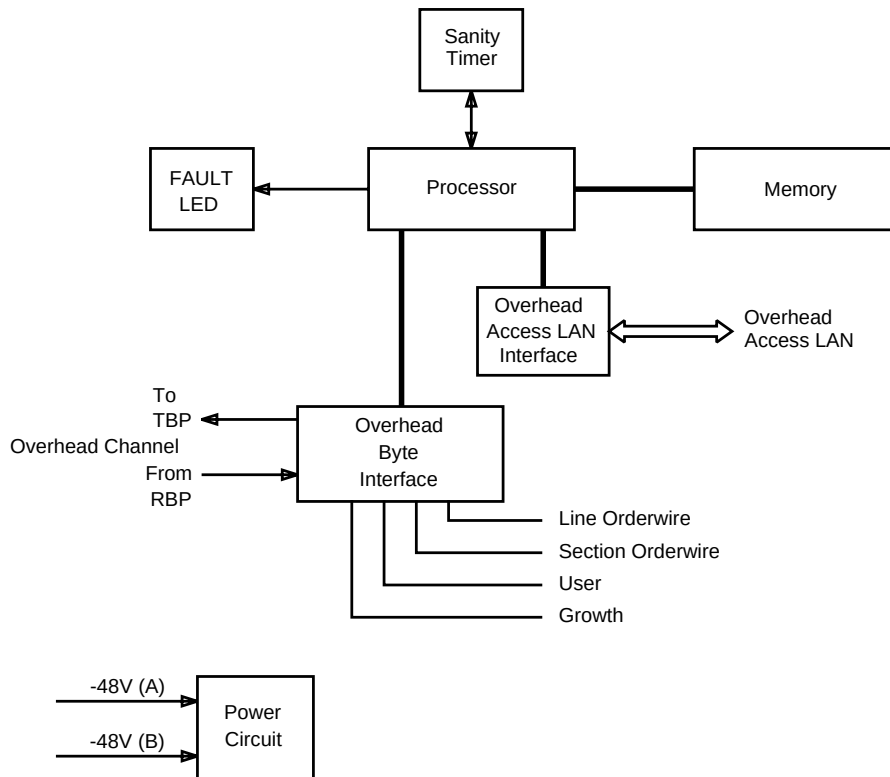


Figure 7-8. OHCTL (TERM) Circuit Pack Block Diagram

Memory

Start-Up Memory. The start-up memory consists of 64 kilobytes of read-only memory. The start-up memory contains the program that allows the processor to load the executable code and data from the SYSCTL circuit pack into the operating memory. This allows the processor to start up operation during a power-up or a reset condition, or when initializing new software.

Operating Memory. The main operating memory consists of 4 megabytes of DRAM. Direct memory access (DMA) allows the board controller to load the executable code and data received from the SYSCTL circuit pack (via the overhead access local area network) into the operating memory during a power-up or reset condition, or when initializing new software.

Nonvolatile Memory. The nonvolatile memory consists of 128 bytes of electrically-erasable programmable read-only memory (EEPROM). The nonvolatile memory is used to store information about the history of the OHCTL (TERM) circuit pack such as the *CLEI* code and type/version information.

Interface Circuitry

Overhead Access Local Area Network Interface. The overhead access local area network (OALAN) interface allows the OHCTL (TERM) circuit pack to communicate with the SYSCTL circuit pack. The OALAN allows the OHCTL (TERM) circuit pack to communicate with the Overhead Controller - Tributary (TOHCTL) circuit pack.

Overhead Byte Interface. The overhead byte interface interacts with the overhead channel. The overhead byte interface accepts the data communications channel (DCC) bytes from the System Controller circuit pack (via the OALAN) and the following overhead bytes from the interconnection panel of the Enhanced High Speed Shelf (or High Speed Shelf):

- Line orderwire
- Section orderwire
- User
- Growth.

The overhead byte interface multiplexes this information and sends it via the overhead channel to the transmit byte processor (TBP) on the OC48 Transmitter (OC48 TRMTR) circuit pack for transmission over the OC-48 high speed line. This information provides end-to-end communications and maintenance. In the LAA22 OHCTL (TERM) circuit pack, the protection overhead channel from the overhead byte interface to the TBP on the OC48 TRMTR circuit pack is not used and cannot be switched into service. One LAA22 and one LAA21 OHCTL (TERM) circuit pack are required for FT-2000 OC-48 Add/Drop-Rings Terminals equipped with the High Speed Shelf.

In the receive direction, the receive byte processor (RBP) on the OC48 Receiver (OC48 RCVR) circuit pack transmits the overhead bytes via the overhead channel to the overhead byte interface. The overhead byte interface then demultiplexes the DCC and overhead bytes and makes them available for use.

Table 7-2 shows the DCC and overhead bytes that are provided by the OHCTL (TERM) circuit pack.

Table 7-2. Overhead Bytes

Name	Overhead Byte	Data Rate	Access
Orderwire*	E1	64 kb/s	Interconnection Panel
Orderwire	E2	64 kb/s	Interconnection Panel
Growth†	Z1-Z2	1.536 Mb/s	Interconnection Panel
User†	F1	64 kb/s	Interconnection Panel
DCC	D1-D3	192 kb/s	System Controller
DCC	D4-D12	576 kb/s	System Controller

* Not available at FT-2000 OC-48 Add/Drop-Rings Terminal when there is an FT-2000 OC-48 Repeater Bay in the high speed line.

† Reserved for use in a future release.

Power Circuitry

The OHCTL (TERM) circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

The OHCTL (TERM) circuit pack monitors the two –48 volt sources to the circuit pack. If the OHCTL (TERM) circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the SYSCTL circuit pack provides +5 volts to light the FAULT LED on the OHCTL (TERM) circuit pack.

Quick Reference Summary

The OHCTL (TERM) circuit pack performs the following control and interface functions:

- Provides communications between the OHCTL (TERM) and SYSCTL circuit packs using the OALAN interface
- Provides communications between the TOHCTL and SYSCTL circuit packs using the OALAN interface
- Provides communications between the transmit byte processor on the OC48 TRMTR circuit pack and the receive byte processor on the OC48 RCVR circuit pack via the overhead channel
- Combines the section and line data communications channel, section and line orderwire, user bytes, and growth bytes to form the transmit overhead channel

- e. Splits the received overhead channel into the section and line data communications channel, section and line orderwire, user bytes, and growth bytes
- f. Sends/receives the data communications channel information to/from the SYSCTL circuit pack
- g. Sends/receives the section and line orderwire, user bytes, and growth bytes to/from the interconnection panel
- h. Controls the circuit pack faceplate FAULT LED.

TOHCTL (LAA26) Circuit Pack Description

Purpose of Circuit

The Overhead Controller - Tributary (TOHCTL) circuit pack provides access to the OC-3/OC-12 SONET overhead channel. The OC-3/OC-12 overhead channel contains SONET section data communications channel (DCC) bytes (bytes D1-D3).

One LAA26 TOHCTL circuit pack is optional for the FT-2000 OC-48 Add/Drop-Rings Terminal. The LAA26 TOHCTL circuit pack is required for single-ended operations using the OC-3/OC-12 DCC (for example, CIT remote login to a DDM-2000 Multiplexer).

Faceplate LED

The TOHCTL circuit pack has a red FAULT LED on its faceplate (Figure 7-9). The red FAULT LED is lighted during a reset condition, when a circuit pack failure is detected, or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the System Controller (SYSCTL) circuit pack to light the FAULT LED on the TOHCTL circuit pack.

The sanity check circuitry detects hardware and software faults. When a fault occurs, the microprocessor is reset and the FAULT LED on the circuit pack faceplate is lighted.

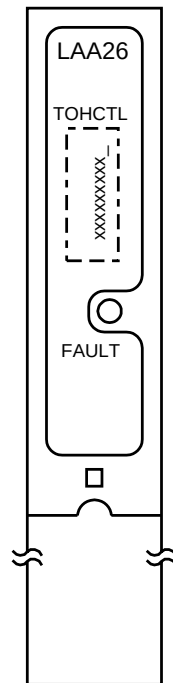


Figure 7-9. TOHCTL (LAA26) Circuit Pack

General Description of Operation

The TOHCTL circuit pack terminates (a) up to eight OC-3, (b) or two OC-12 1+1 (each with an active and standby DCC), (c) or four OC-12 0x1 section overhead channels. The OC-3/OC-12 overhead channel includes section data communications channel bytes D1-D3. Refer to Appendix A, "A SONET Overview," for definitions of SONET sections, lines, and paths. The TOHCTL circuit pack also interfaces with the OHCTL (TERM) and SYSCTL circuit packs.

Detailed Description of Operation

Control Circuitry

Processor. Figure 7-10 provides an overall block diagram of the TOHCTL circuit pack. The processor performs protocol processing for layer 3 (network) of the Open Systems Interconnection (OSI) 7-layer stack for the OC-3/OC-12 section DCC. The processor also manages the overhead access local area network (OALAN) communications with the OHCTL (TERM) and SYSCTL circuit packs.

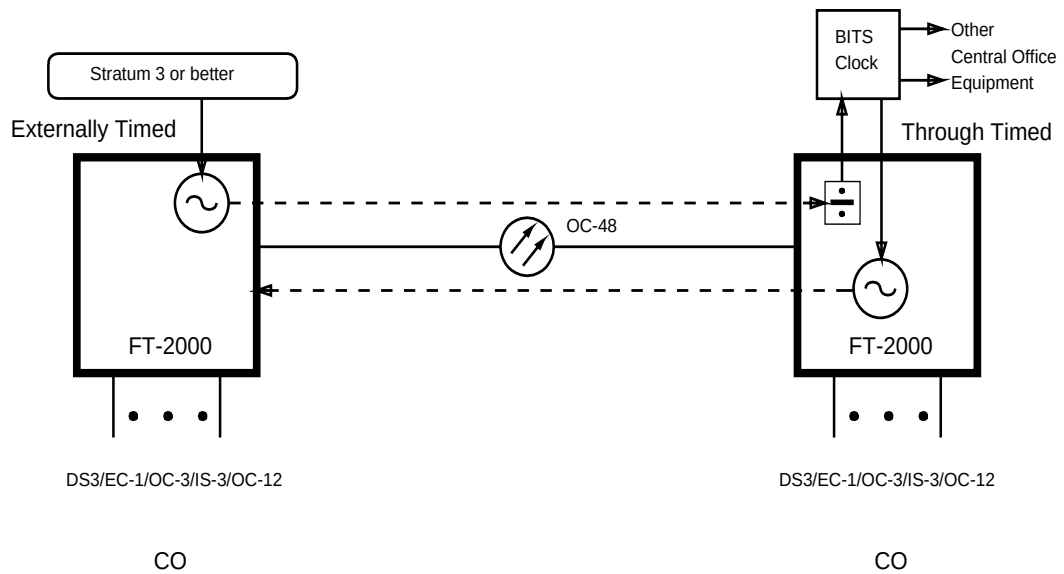


Figure 7-10. TOHCTL Circuit Pack Block Diagram

Memory

Start-Up Memory. The start-up memory consists of 64 kilobytes of read-only memory. The start-up memory contains the program that allows the processor to load the executable code and data from the SYSCTL circuit pack into the operating memory. This allows the processor to start up operation during a power-up or a reset condition, or when initializing new software.

Operating Memory. The main operating memory consists of 4 megabytes of DRAM. Direct memory access (DMA) allows the processor to load the executable code and data received from the SYSCTL circuit pack (via the overhead access local area network) into the operating memory during a power-up or reset condition, or when initializing new software.

Nonvolatile Memory. The nonvolatile memory consists of 128 bytes of electrically-erasable programmable read-only memory (EEPROM). The nonvolatile memory is used to store information about the history of the TOHCTL circuit pack such as the *CLEI* code and type/version information.

Interface Circuitry

DCC Interface. The DCC interface interacts with the OC-3/OC-12 (1.3 STD) circuit packs on the Low Speed Shelf - System Controller. Up to eight LS INTFC slots (1A through 8B) equipped with OC3/OC-12 (1.3 STD) circuit packs may be assigned to the DCC interface. The DCC interface performs protocol processing for layer 1 (physical) and layer 2 (data link) of the OSI 7-layer stack for the OC-3/

OC-12 section DCC. Refer to Section 8, "Administration and Provisioning," for more information about OC-3/OC-12 DCC channel assignments.

In the receive direction (from the OC-3/OC-12 line), the assigned OC3/OC-12 (1.3 STD) circuit pack transmits the overhead bytes via the overhead channel to the DCC interface. The DCC interface transmits the information to the processor for layer 3 (network) protocol processing.

In the transmit direction (toward the OC-3/OC-12 line), the DCC interface accepts the OC-3/OC-12 section DCC bytes from the processor and transmits the information via the overhead channel to the assigned OC3/OC-12 (1.3 STD) circuit pack. This information provides end-to-end communications and maintenance.

In addition to support for OC-3 and OC-12 links configured as 0x1 unprotected—the DCC interface also supports 1+1 protection switching for OC-3 links.

Table 7-3 shows the OC-3/OC-12 section DCC bytes that are provided by the TOHCTL circuit pack.

Table 7-3. Overhead Bytes

Name	Overhead Byte	Data Rate	Access
DCC	D1-D3	192 kb/s	System Controller

Overhead Access Local Area Network Interface. The overhead access local area network (OALAN) interface allows the TOHCTL circuit pack to communicate with the OHCTL (TERM) and SYSCTL circuit packs. The OHCTL (TERM) circuit pack performs protocol processing for layers 1 through 3 of the OSI 7-layer stack for the OC-48 section DCC. The SYSCTL circuit pack allows users to access the OC-3/OC-12 section DCC using the CIT, serial telemetry, and message-based operations system (X.25) interfaces for single-ended operations.

Power Circuitry

The TOHCTL circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

The TOHCTL circuit pack monitors the two –48 volt sources to the circuit pack. If the TOHCTL circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the SYSCTL circuit pack provides +5 volts to light the FAULT LED on the TOHCTL circuit pack.

Quick Reference Summary

The TOHCTL circuit pack performs the following control and interface functions:

- a. Terminates up to eight OC-3/two OC-12 section overhead channels.
- b. Provides communications with the OC3/OC-12 (1.3 STD) circuit packs via the overhead channel and DCC interface
- c. Performs low-level (layers 1 through 3 of the OSI 7-layer stack) protocol processing for the OC-3/OC-12 section DCC
- d. Provides communications with the OHCTL (TERM) and SYSCTL circuit packs using the OALAN interface
- e. Controls the circuit pack faceplate FAULT LED.

OW (LAA14) Circuit Pack Description

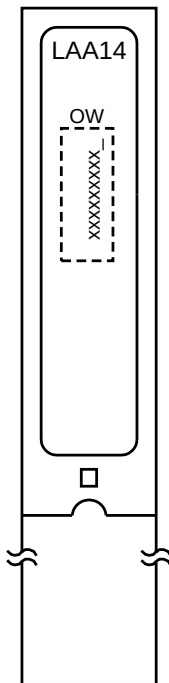
Purpose of Circuit

The Orderwire (OW) circuit pack provides access to the OC-48 SONET section overhead channel. The overhead channel contains the SONET section overhead bytes.

One LAA14 OW circuit pack is optional for the FT-2000 OC-48 Repeater Bay. However, the LAA14 OW circuit pack is required for orderwire access at repeater sites. The LAA14 OW circuit pack is compatible with Release 2.1.0-RPTR and later software.

Faceplate

Figure 7-11 shows the OW circuit pack faceplate. The faceplate of the OW circuit pack does not have a red FAULT LED.



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Figure 7-11. OW (LAA14) Circuit Pack

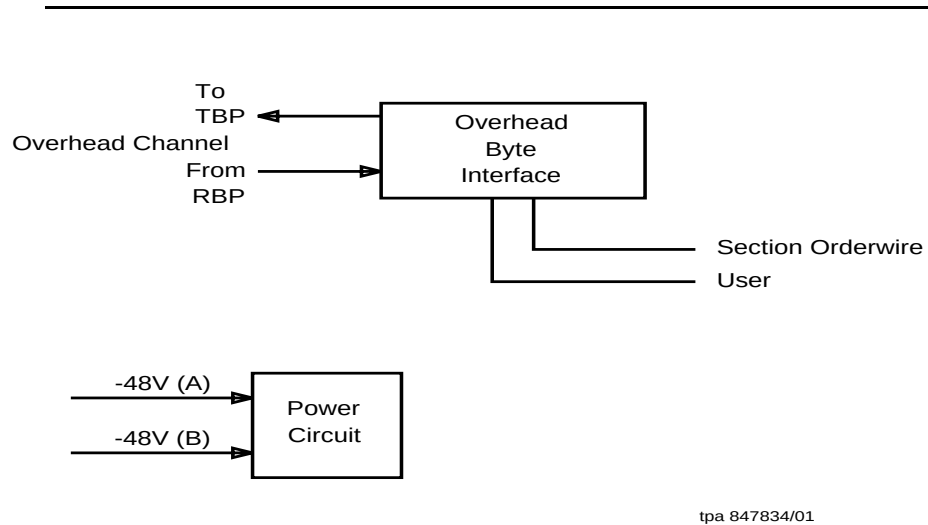
General Description of Operation

The OW circuit pack assembles and disassembles the embedded information for the SONET section overhead bytes. These overhead bytes include section orderwire bytes and user bytes. Refer to Appendix A, "A SONET Overview," for definitions of SONET sections, lines, and paths.

Detailed Description of Operation

Overhead Byte Interface

Figure 7-12 provides an overall block diagram of the OW circuit pack.



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Figure 7-12. OW Circuit Pack Block Diagram

The overhead byte interface interacts with the SONET section overhead channel. The overhead byte interface accepts the following overhead bytes from the interconnection panel of the Repeater Shelf - System Controller:

- Section orderwire
- User.

The overhead byte interface multiplexes this information and sends it via the overhead channel to the transmit byte processor (TBP) on the OC48 Regenerator (OC48 REGENR) circuit pack for transmission over the OC-48 high speed line. This information provides end-to-end communications and maintenance.

In the receive direction, the receive byte processor (RBP) on the OC48 Regenerator (OC48 REGENR) circuit pack transmits the overhead bytes via the overhead channel to the overhead byte interface. The overhead byte interface then demultiplexes the overhead bytes and makes them available for use.

Table 7-4 shows the overhead bytes that are provided by the OW circuit pack.

Table 7-4. Section Overhead Bytes

Name	Section Overhead Byte	Data Rate	Access
Orderwire	E1	64 kb/s	Interconnection Panel
User	F1	64 kb/s	Interconnection Panel

Power Circuitry

The OW circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

Quick Reference Summary

The OW circuit pack performs the following control and interface functions:

- a. Provides communications between the transmit byte processor on the OC48 REGENR circuit pack and the receive byte processor on the OC48 REGENR circuit pack via the overhead channel
- b. Combines the section orderwire and user bytes to form the transmit overhead channel
- c. Splits the received overhead channel into the section orderwire and user bytes
- d. Sends/receives the section orderwire and user bytes to/from the interconnection panel.

Transmission

DS3 (LAA2) Circuit Pack Description

Purpose of Circuit

The DS3 Interface (DS3) circuit pack provides a low speed interface between three asynchronous DS3 signals and an internal synchronous 155.52 Mb/s signal. The LAA2 DS3 (S4:4) circuit pack is compatible with Release 3.0.1-ADR or later software.

Faceplate LED

The DS3 circuit pack has a red FAULT LED on its faceplate (Figure 7-13). The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the DS3 circuit pack.

The board controller on the DS3 circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is continuously lighted. If an incoming DS3 signal from the DSX-3 panel (or equivalent) fails, the FAULT LED will flash on and off.

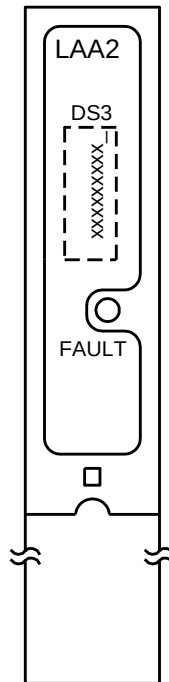


Figure 7-13. DS3 (LAA2) Circuit Pack

General Description of Operation

The DS3 circuit pack terminates three bidirectional DS3 lines complying with standard DSX-3 signal specifications. The three DS3 signals are multiplexed to one 155.52 Mb/s signal and sent to the OC48 Transmitter (OC48 TRMTR) circuit pack. In the receive direction, the DS3 circuit pack accepts one 155.52 Mb/s signal from an OC48 Receiver (OC48 RCVR) circuit pack and demultiplexes it to three DS3 signals. The DS3 circuit pack also interfaces with the Line Controller (LNCTL) circuit pack for that particular OC-48 high speed line.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-14 provides an overall block diagram of the DS3 circuit pack.

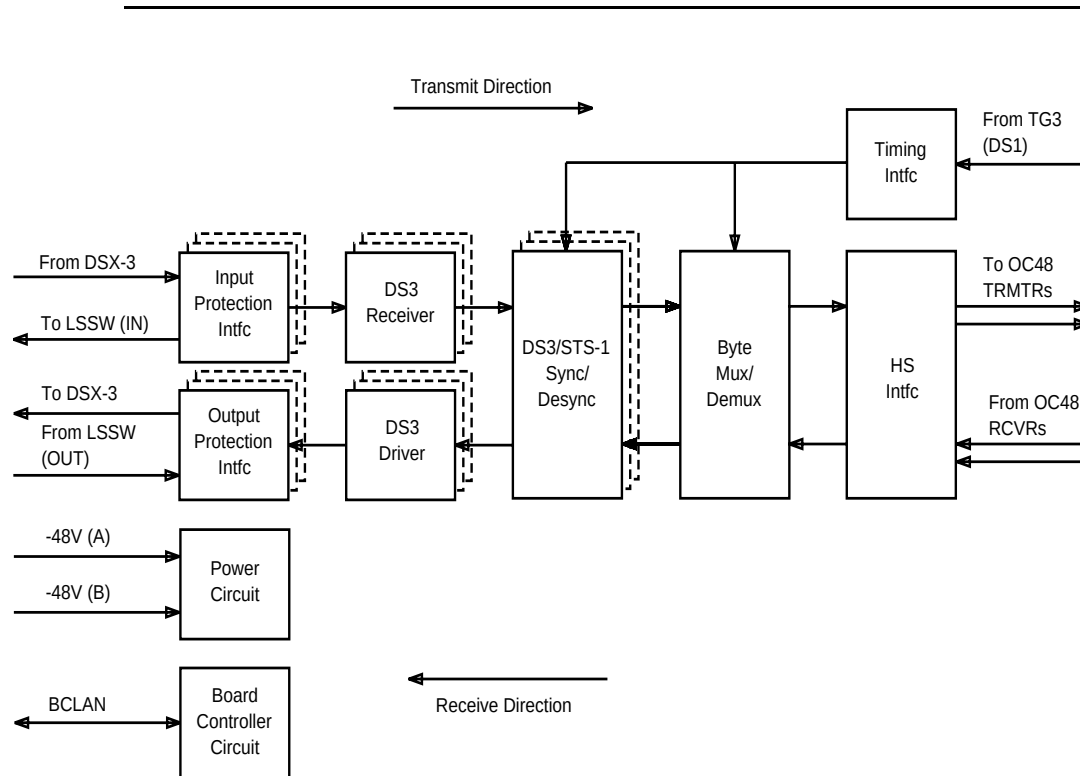


Figure 7-14. DS3 Circuit Pack Block Diagram

In the transmit direction, the incoming DS3 signals can be either formatted or unformatted (clear channel). The DS3 circuit pack accepts up to three 44.736 Mb/s bipolar 3-zero substitution (B3ZS) coded DS3 signals. These DS3 signals are split by the input protection interface. The outputs of the input protection interface are connected to the DS3 receiver and the Low Speed Switch (LSSW IN) circuit pack (for protection). The DS3 receiver recovers timing from the B3ZS-coded DS3 signals and sends the received data and recovered clock to the DS3/STS-1 synchronizer/desynchronizer. The DS3/STS-1 synchronizer/desynchronizer converts each DS3 to an STS-1 format (51.84 Mb/s). The STS-1 path overhead and pointer bytes are also added to the STS-1 signal. The byte multiplexer/demultiplexer then scrambles and multiplexes the three STS-1 signals into one 155.52 Mb/s signal. The high speed interface sends the 155.52 Mb/s signal to the OC48 TRMTR circuit packs.

Receive Direction. In the receive direction, the high speed interface accepts the 155.52 Mb/s signal from the OC48 Receiver (OC48 RCVR) circuit pack and sends it to the byte multiplexer/demultiplexer. The byte multiplexer/demultiplexer recovers timing, descrambles, and demultiplexes the 155.52 Mb/s signal into three STS-1 signals. The three STS-1 signals are then sent to the DS3/STS-1 synchronizer/desynchronizer. Each STS-1 signal goes through STS-1 pointer processing, and

the STS-1 path overhead is removed and processed. After each DS3 signal is recovered from the STS-1 payload envelope, the DS3 P-bits may be monitored and corrected through a provisionable violation, monitor, and removal function with optional alarm indication signals (AIS). The DS3/STS-1 synchronizer/desynchronizer sends three B3ZS-coded DS3 signals and a 44.736 MHz clock to the DS3 driver. The DS3 driver provides three standard B3ZS-coded DS3 signals to the output protection interface. The output protection interface selects the signals from the DS3 driver or the Low Speed Switch (LSSW OUT) circuit pack (for protection) and outputs then to the DSX-3 panel (or equivalent).

The four provisionable modes are:

- Violation monitoring and removal (VMR): In this mode, DS3 P-bit (parity) violation monitoring and removal are performed on the outgoing (toward the cross-connect panel) DS3 signals.
- Violation monitoring (VM) without removal: In this mode, DS3 P-bit (parity) violation monitoring is performed on the outgoing DS3 signals, but no corrections are made.
- Clear channel (CC) with AIS insertion: In this mode, outgoing DS3 signals are passed through without any violation monitoring. If an incoming loss of signal is detected, a DS3 AIS signal is inserted.
- CC without AIS insertion: In this mode, outgoing DS3 signals are passed through without any violation monitoring. If an incoming loss of signal is detected, no DS3 AIS signal is inserted.

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN). The DS3 circuit pack reports the status of the circuit pack and the incoming DS3 and 155.52 Mb/s signals, as well as the circuit pack inventory information (CLEI code, serial number, etc.). The LNCTL circuit pack uses the status information for fault detection and isolation. The DS3 circuit pack also responds to control signals from the LNCTL circuit pack.

Timing Circuitry

The DS3 circuit pack accepts two 155.52 MHz clock signals from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs (primary and secondary). During normal operation, the board controller selects the clock signal that is used. The selected clock signal (155.52 MHz) is connected to the byte multiplexer/demultiplexer that provides a divide-by-3 circuit. The divide-by-3 circuit generates a 51.84 MHz signal and sends it to an 8 KHz synchronization generator that is part of the high speed interface. The 8 KHz synchronization signal and 51.84 MHz clock signals are connected to each DS3/STS-1 synchronizer/desynchronizer.

Protection Circuitry

Low Speed Interface Protection. Optional 1xM ($M \leq 16$) revertive DS3 circuit pack protection is provided. A DS3 protection bus is implemented with on-board relays on the DSX-3 side and with selectors at the 155.52 Mb/s level on the service and protection OC48 Transmitter and OC48 Receiver circuit packs. The Low Speed Switch (LSSW) circuit pack provides power to these relays and controls their operation. If the +5 volt power on the DS3 circuit pack fails, the relays are still operational and controlled by the LSSW and LNCTL circuit packs. If the LNCTL circuit pack is removed, the relays will remain in their current state. Shorting contacts are provided in the DS3 circuit pack backplane connector so that when the circuit pack is removed, the DSX-3 cables short through to the LSSW circuit packs for routing to the protection DS3 circuit pack. When the DS3 circuit pack is reinserted, the relays are in the protection state until the LNCTL circuit pack determines that the circuit pack is good.

High Speed Protection. If an OC-48 signal fails or is degraded, the LNCTL circuit pack broadcasts a switch request to the board controllers on the DS3 circuit packs via the BCLAN. In the transmit direction, the DS3 circuit packs perform head-end bridges. In the FT-2000 OC-48 Add/Drop-Rings Terminal, the 155.52 Mb/s signals are provided to the OC48 TRMTR A/D circuit packs for lines 1E and 1W at all times. In the receive direction, the DS3 circuit packs perform tail-end switches. In the FT-2000 OC-48 Add/Drop-Rings Terminal, selector circuitry on the DS3 circuit packs accepts the 155.52 Mb/s signals from the OC48 RCVR A/D circuit pack opposite of the configured direction.

Dual Ring Interworking Protection. The DS3 circuit pack at the primary node of a dual ring interworking application monitors the DS3 signal(s) coming from the other ring. If an incoming DS3 loss-of-signal condition is detected, the DS3 circuit pack notifies the LNCTL circuit pack. The LNCTL circuit pack broadcasts an automatic switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the add (toward to OC-48 line) direction only, the OC48 TRMTR circuit pack switches to (selects) the standby 155.52 Mb/s signal (STS-3 tributary) from the secondary node. The OC48 TRMTR circuit pack may switch to (select) the standby 51.84 Mb/s signal (STS-1 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring.

Synchronization Reference Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The DS3 circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The DS3 circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous. If an error occurs, the board controller reports the error to the LNCTL circuit pack using the board controller

local area network (BCLAN). An out-of-service test is performed whenever the DS3 circuit pack is inserted in a slot or reset.

Loopbacks. The DS3 circuit pack provides one DS3 loopback for each DS3 signal. The loopback is implemented inside the DS3/STS-1 synchronizer/desynchronizer device. It bridges the desynchronizer output signal (transmitted towards the DSX-3 panel) back into the DS3 synchronizer input. The loopback is implemented in response to CIT commands (via the SYSCCTL and LNCTL circuit packs) and controlled by board controller.

Performance Monitoring. The DS3 circuit pack provides performance-monitoring circuitry for the following performance-monitoring parameters:

- DS3 line errored seconds
- DS3 path coding violations
- DS3 path errored seconds
- DS3 path severely errored seconds
- DS3 path severely errored frame/AIS seconds
- DS3 path unavailable seconds
- STS-1 path coding violations
- STS-1 path errored seconds
- STS-1 path severely errored seconds
- STS-1 path unavailable seconds
- Far-end STS-1 path coding violations
- Far-end STS-1 path errored seconds
- Far-end STS-1 path severely errored seconds
- Far-end STS-1 path unavailable seconds.

The DS3 line errored seconds parameter is measured on DS3 signals from the DSX-3 cross-connect panel, and all other performance-monitoring parameters are measured on the 155.52 Mb/s signals from the OC48 RCVR circuit pack.

The DS3 line errored seconds count is based only on B3ZS coding violations and bipolar violations.

The DS3 path coding violations, errored seconds, severely errored seconds, severely errored frame/AIS seconds, and unavailable seconds counts are based on P-bit errors. The FT-2000 OC-48 Add/Drop-Rings Terminal may be provisioned to accumulate DS3 path performance-monitoring data based on P-bit errors or F and M framing bit errors. The raw F and M framing bit error counts are adjusted to approximate the actual error count in the DS3 path payload.

When an incoming line AIS, high speed defect, or internal fault is detected, the DS3 circuit pack inserts a remote defect indicator-path (RDI-P) signal in the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack.

The DS3 circuit pack also inserts and detects STS-1 path trace and path signal label signals.

Power Circuitry

The DS3 circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack. The LSSW circuit packs supply power to the input and output protection relays on the DS3 circuit packs.

If the DS3 circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the DS3 circuit pack.

Quick Reference Summary

Transmit Functions

The DS3 circuit pack performs the following transmit functions:

- a. Receives three B3ZS-coded DS3 signals (44.736 Mb/s) from a DSX-3 panel (or equivalent)
- b. Recovers DS3 clock from each DS3 signal
- c. Synchronizes and maps each DS3 signal to an STS-1 (51.84 Mb/s) synchronous payload envelope (SPE)
- d. Inserts STS-1 path overhead and pointer bytes
- e. Multiplexes three STS-1 signals to a 155.52 Mb/s signal
- f. Provides the 155.52 Mb/s signal to an OC48 TRMTR circuit pack.

Receive Functions

The DS3 circuit pack performs the following receive functions:

- a. Receives a 155.52 Mb/s signal from an OC48 RCVR circuit pack
- b. Demultiplexes the 155.52 Mb/s into three STS-1 signals
- c. Extracts the path overhead and the embedded DS3 signal from each STS-1 signal
- d. Desynchronizes the DS3 signals
- e. Encodes each DS3 signal into a B3ZS format
- f. Provides three DS3 signals to a DSX-3 panel (or equivalent).

Timing and Control Functions

The DS3 circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz timing signal from the TG3 (DS1) circuit packs
- b. Provides relays for low speed protection switching
- c. Provides selector circuitry for high speed protection switching
- d. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- e. Provides one loopback for each DS3 signal
- f. Stores inventory information (CLEI code, serial number, etc.)
- g. Controls the circuit pack faceplate FAULT LED.

Maintenance Signal Functions

The DS3 circuit pack performs the following maintenance signal functions:

- a. Provides a provisionable violation, monitor, and removal function with optional DS3 AIS insertion toward the DSX-3 panel (or equivalent)
- b. Detects embedded DS3 AIS in the 155.52 Mb/s signal from the OC48 RCVR circuit pack
- c. Detects STS-1 path AIS in the 155.52 Mb/s signal from the OC48 RCVR circuit pack
- d. Detects RDI-P signals in the 155.52 Mb/s signal from the OC48 RCVR circuit pack
- e. Inserts an RDI-P signal in the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack
- f. Inserts an STS-1 path trace and path signal label signals in the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack
- g. Detects an STS-1 path trace and path signal label signals in the 155.52 Mb/s signal from the OC48 RCVR circuit pack.

STS1E (LAA4) Circuit Pack Description

Purpose of Circuit

The STS-1 Electrical Interface (STS1E) circuit pack provides a low speed interface between three synchronous EC-1 signals and an internal synchronous 155.52 Mb/s signal.

Faceplate LED

The STS1E circuit pack has a red FAULT LED on its faceplate (Figure 7-15). The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the STS1E circuit pack.

The board controller on the STS1E circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is continuously lighted. If an incoming EC-1 signal from the STSX-1 panel (or equivalent) fails, the FAULT LED will flash on and off.

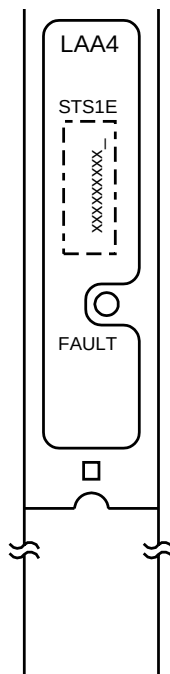


Figure 7-15. STS1E (LAA4) Circuit Pack

General Description of Operation

The STS1E circuit pack terminates three bidirectional EC-1 lines complying with standard STSX-1 signal specifications. The three 51.84 Mb/s EC-1 signals are multiplexed to one 155.52 Mb/s signal and sent to the OC48 Transmitter (OC48 TRMTR) circuit pack. In the receive direction, the STS1E circuit pack accepts one 155.52 Mb/s signal from an OC48 Receiver (OC48 RCVR) circuit pack and demultiplexes it to three 51.84 Mb/s EC-1 signals. The STS1E circuit pack also

interfaces with the Line Controller (LNCTL) circuit pack for that particular OC-48 high speed line.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction . Figure 7-16 provides an overall block diagram of the STS1E circuit pack.

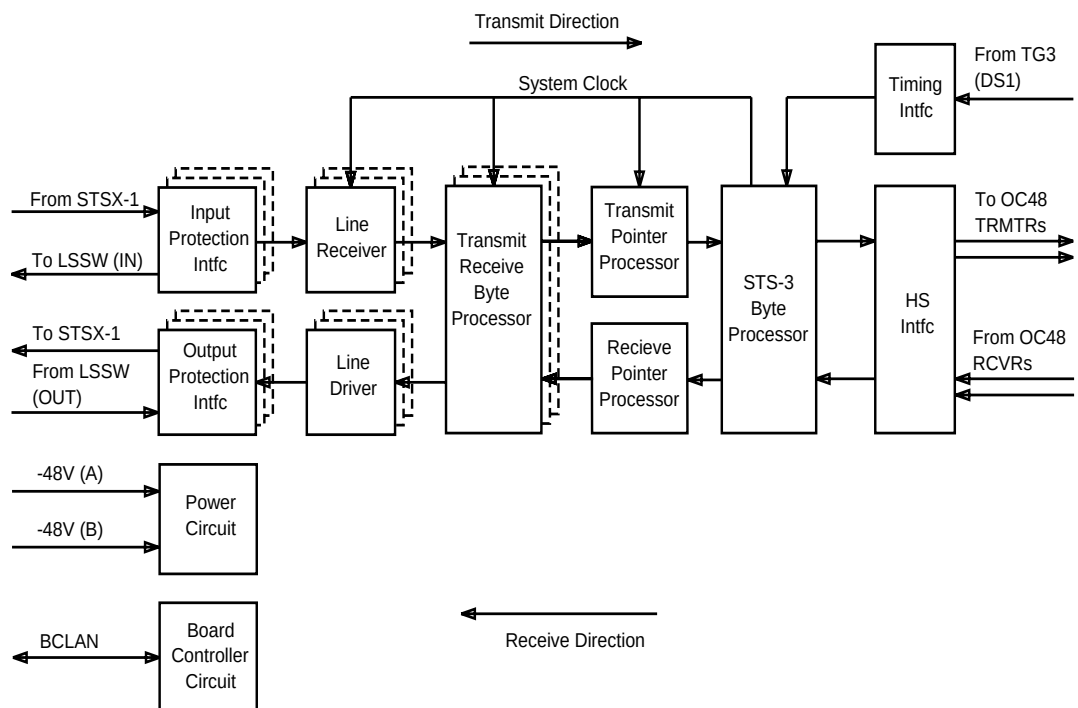


Figure 7-16. STS1E Circuit Pack Block Diagram

In the transmit direction, the STS1E circuit pack accepts up to three 51.84 Mb/s bipolar 3-zero substitution (B3ZS) coded EC-1 signals. These EC-1 signals are split by the input protection interface. The outputs of the input protection interface are connected to the line receiver and the Low Speed Switch (LSSW IN) circuit pack (for protection). The line receiver recovers timing from the B3ZS-coded EC-1 signals and sends the EC-1 signals (as STS-1 signals) with the recovered clock to the transmit/receive byte processor. The transmit/receive byte processor performs B3ZS decoding, framing, descrambling, and overhead byte processing on the received STS-1 signals. The transmit/receive byte processor then sends the clock and STS-1 signals to the transmit pointer processor. The transmit pointer

processor performs frequency adjustment and frame alignment on the clock and STS-1 signals using the 51.84 MHz system clock. The system clock is obtained by locally dividing the 155.52 MHz clock signal from the TG3 (DS1) circuit pack by three. The pointer processor sends the clock and STS-1 signals to the byte processor. The byte processor scrambles and multiplexes the three STS-1 signals into one 155 Mb/s signal. The high speed interface sends the 155.52 Mb/s signal to the OC48 TRMTR circuit packs.

Receive Direction. In the receive direction, the high speed interface accepts the 155.52 Mb/s signal from the OC48 Receiver (OC48 RCVR) circuit pack. The high speed interface recovers the 155.52 MHz clock signal, retimes the 155.52 Mb/s signal, and sends it to the byte processor. The byte processor descrambles and demultiplexes the 155.52 Mb/s signal into three 51.84 Mb/s STS-1 signals. The three STS-1 signals are then sent to the receive pointer processor. The receive pointer processor performs pointer processing on the three STS-1 signals and sends a clock and three STS-1 signals that are synchronized to the system clock to the transmit/receive byte processor. The transmit/receive byte processor performs scrambling, B3ZS encoding, and overhead byte processing. The transmit/receive byte processor then sends the clock and STS-1 signals to the line driver. The line driver converts the STS-1 signals to three standard bipolar EC-1 output signals. The line driver sends the three standard B3ZS-coded EC-1 signals to the output protection interface. The output protection interface selects the signals from the line driver or the Low Speed Switch (LSSW OUT) circuit pack (for protection) and outputs them to the STSX-1 panel (or equivalent).

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN). The STS1E circuit pack reports the status of the circuit pack and the incoming EC-1 and 155.52 Mb/s signals, as well as the circuit pack inventory information (CLEI code, serial number, etc.). The LNCTL circuit pack uses the status information for fault detection and isolation. The STS1E circuit pack also responds to control signals from the LNCTL circuit pack.

Timing Circuitry

The STS1E circuit pack accepts two 155.52 MHz clock signals from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs (primary and secondary). During normal operation, the board controller selects the clock signal that is used. The selected clock signal (155.52 MHz) is connected to the byte processor that provides a divide-by-3 circuit. The divide-by-3 circuit generates a 51.84 MHz signal and sends it to the transmit and receive pointer processors, transmit/receive byte processor, and the line driver circuits.

Protection Circuitry

Low Speed Interface Protection. Optional 1xM ($M \leq 16$) revertive STS1E circuit pack protection is provided. An STS-1 protection bus is implemented with on-board relays on the STSX-1 side and with selectors at the 155.52 Mb/s level on the

service and protection OC48 Transmitter and OC48 Receiver circuit packs. The Low Speed Switch (LSSW) circuit pack provides power to these relays and controls their operation. If the +5 volt power on the STS1E circuit pack fails, the relays are still operational and controlled by the LSSW and LNCTL circuit packs. If the LNCTL circuit pack is removed, the relays will remain in their current state. Shorting contacts are provided in the STS1E circuit pack backplane connector so that when the circuit pack is removed, the STSX-1 cables short through to the LSSW circuit packs for routing to the protection STS1E circuit pack. When the STS1E circuit pack is reinserted, the relays are in the protection state until the LNCTL circuit pack determines that the circuit pack is good.

High Speed Protection. If an OC-48 signal fails or is degraded, the LNCTL circuit pack broadcasts a switch request to the board controllers on the STS1E circuit packs via the BCLAN. In the transmit direction, the STS1E circuit packs perform head-end bridges. In the FT-2000 OC-48 Add/Drop-Rings Terminal, the 155.52 Mb/s signals are provided to the OC48 TRMTR A/D circuit packs for lines 1E and 1W. In the receive direction, the STS1E circuit packs perform tail-end switches. In the FT-2000 OC-48 Add/Drop-Rings Terminal, selector circuitry on the STS1E circuit packs accepts the 155.52 Mb/s signals from the OC48 RCVR A/D circuit pack opposite of the configured direction.

Dual Ring Interworking Protection. The STS1E circuit pack at the primary node of a dual ring interworking application monitors the EC-1 signal(s) coming from the other ring. If an incoming EC-1 loss-of-signal condition is detected, the STS1E circuit pack notifies the LNCTL circuit pack. The LNCTL circuit pack broadcasts an automatic switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the add (toward to OC-48 line) direction only, the OC48 TRMTR circuit pack switches to (selects) the standby 155.52 Mb/s signal (STS-3 tributary) from the secondary node. The OC48 TRMTR circuit pack may switch to (select) the standby 51.84 Mb/s signal (STS-1 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring.

Synchronization Reference Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The STS1E circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The STS1E circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous. If an error occurs, the board controller reports the error to the LNCTL circuit pack using the board controller local area network (BCLAN). An out-of-service test is performed whenever the STS1E circuit pack is inserted in a slot or when a reset is performed.

Loopbacks. The STS1E circuit pack provides one EC-1 loopback for each EC-1 signal. The loopback is implemented inside the transmit/receive byte processor device. It bridges the output signal (transmitted towards the STSX-1 panel) back

into the transmit/receive byte processor input. The loopback is implemented in response to CIT commands (via the SYSCTL and LNCTL circuit packs) and controlled by board controller.

Performance Monitoring. The STS1E circuit pack provides performance-monitoring circuitry for the following performance-monitoring parameters:

- EC-1 section severely errored frame seconds
- EC-1 line coding violations
- EC-1 line errored seconds
- EC-1 line severely errored seconds
- EC-1 line unavailable seconds
- EC-1 line pointer justification counts.

When an incoming EC-1 signal defect from the STSX-1 cross-connect panel is detected, the STS1E circuit pack inserts STS-1 path AIS in each STS-1 tributary of the 155.52 Mb/s signal transmitted toward the OC-48 TRMTR circuit pack.

When an incoming OC-48 signal defect is detected by the OC48 RCVR circuit pack or an STS-1 loss of pointer is detected by the STS1E circuit pack in the 155.52 Mb/s signal received from the OC48 RCVR circuit pack, the STS1E circuit pack inserts STS-1 path AIS in the EC-1 signal transmitted toward the STSX-1 cross-connect panel.

When an internal fault is detected, the STS1E circuit pack inserts STS-1 path AIS in each STS-1 tributary of the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack and in the EC-1 signals transmitted toward the STSX-1 cross-connect panel.

Power Circuitry

The STS1E circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack. The LSSW circuit packs supply power to the input and output protection relays on the STS1E circuit packs.

If the STS1E circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the STS1E circuit pack.

Quick Reference Summary

Transmit Functions

The STS1E circuit pack performs the following transmit functions:

- a. Receives three B3ZS-coded EC-1 signals (51.84 Mb/s) from an STSX-1 panel (or equivalent)

- b. Recovers an EC-1 clock from each EC-1 signal
- c. Converts each EC-1 signal to an internal STS-1 signal
- d. Inserts pointer bytes
- e. Multiplexes three STS-1 signals to a 155.52 Mb/s signal
- f. Provides the 155.52 Mb/s signal to an OC48 TRMTR circuit pack.

Receive Functions

The STS1E circuit pack performs the following receive functions:

- a. Receives a 155.52 Mb/s signal from an OC48 RCVR circuit pack
- b. Demultiplexes the 155.52 Mb/s into three STS-1 signals
- c. Extracts the pointer bytes
- d. Converts each internal STS-1 signal to an EC-1 signal
- e. Provides three standard B3ZS-encoded EC-1 signals to an STSX-1 panel (or equivalent).

Timing and Control Functions

The STS1E circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz timing signal from the TG3 (DS1) circuit packs
- b. Provides relays for low speed protection switching
- c. Provides selector circuitry for high speed protection switching
- d. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- e. Provides one loopback for each EC-1 signal
- f. Stores inventory information (CLEI code, serial number, etc.)
- g. Controls the circuit pack faceplate FAULT LED.

Maintenance Signal Functions

The STS1E circuit pack performs the following maintenance signal functions:

- a. Detects incoming (from the cross-connect panel) EC-1 loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), signal degrade (SD) based on the B2 error rate, and EC-1 line AIS
- b. Inserts STS-1 path AIS in each STS-1 tributary of the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack when incoming (from the cross-connect panel) EC-1 LOS, LOF, LOP, or EC-1 line AIS is detected

- c. Detects loss of pointer (LOP) in the 155.52 Mb/s signal from the OC48 RCVR circuit pack and inserts STS-1 path AIS in the EC-1 signals transmitted toward the cross-connect panel
- d. Inserts STS-1 path AIS in each STS-1 tributary of the 155.52 Mb/s signal transmitted toward the OC48 TRMTR circuit pack and in the EC-1 signals transmitted toward the cross-connect panel when an internal fault is detected.

OC3 (LAA10, LAA10B) Circuit Pack Description

Purpose of Circuit

The OC3 Optical Interface - 1.3 μ m Standard Performance [OC3 (1.3 STD)] circuit pack provides a bidirectional low speed interface between one synchronous OC-3 optical signal (155.52 Mb/s) and an internal synchronous STS-3/3c signal (155.52 Mb/s).



NOTE:

The OC3 (1.3 STD) LAA10B circuit pack is backward compatible with the current OC3 (1.3 STD) LAA10 circuit pack. The OC3 LAA10B circuit pack provides all the maintenance, provisioning, and performance monitoring features of the OC3 LAA10 circuit pack. In addition, the OC3 LAA10B circuit pack provides the following features when used with Release 9.0.0-ADR or later software:

- Unrestricted east/west drops to an OC3 circuit pack
- S1 Byte synchronization messaging on OC-3.

The LAA10B “unrestricted east/west drops” feature removes the OC3 LAA10 circuit pack restriction of having to drop all three STS-1s from the same OC-48 high speed line (1E or 1W). This feature allows you to provision the LAA10B OC-3 Optical Interface to accept bidirectional drops of STS-1 signals from either high speed line direction as determined by software provisioning. It requires Release 9 or later software and STS-1 capable high-speed optics. Refer to Chapter 8, “Administration and Provisioning,” for more information on provisioning the OC-3 Optical Interface.

The LAA10B “S1 byte synchronization messaging on OC-3” feature allows Synchronization Messaging via the S1 Byte to any vendor’s equipment that adheres to the Synchronization Messaging standards in GR-253-CORE. Software provisioning determines whether the sync messaging parameter is K2 Byte, S1 Byte, enabled, or disabled. Refer to Chapter 5, “Control, Transmission, and Synchronization Interfaces” for more information on S1 byte synchronization messaging on OC-3.

The “unrestricted east/west drops to an OC3 circuit pack” and “S1 byte synchronization messaging on OC-3” features require Release 9 or later software and the OC3 LAA10B circuit pack. Refer to Chapter 3, “Platform Descriptions,” for more information about OC3 LAA10B software compatibility.



NOTE:

The FT-2000 ADR Terminal does not support mixed LAA10/LAA10B operation in a 1+1 protected configuration. In a 1+1 configuration, all adjacent LS INTFC slots (for example, slots 2A and 2B) **MUST** be equipped with either LAA10 circuit packs or LAA10B circuit packs (but not a mix of the two) in both slots **IF** that slot pair is configured for 1+1 protection.

Faceplate LED

The OC3 (1.3 STD) circuit pack has a red FAULT LED on its faceplate (Figure 7-17). The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the OC3 (1.3 STD) circuit pack.

The board controller on the OC3 (1.3 STD) circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is continuously lighted. If an incoming OC-3 signal from the lightguide cross-connect panel (or equivalent) fails, the FAULT LED will flash on and off.

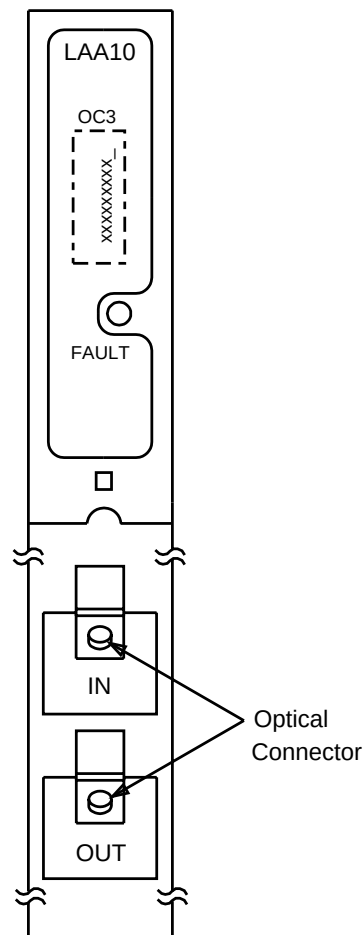


Figure 7-17. OC3 (1.3 STD) (LAA10) Circuit Pack

General Description of Operation

The OC3 (1.3 STD) circuit pack terminates one bidirectional OC-3 line. In the transmit direction (toward the OC-48 line), the OC3 (1.3 STD) circuit pack converts the incoming OC-3 optical signal to an electrical STS-3/3c signal (155.52 Mb/s). The STS-3/3c signal is demultiplexed into three STS-1 signals (51.84 Mb/s) and synchronized to the system clock. The three STS-1 signals are then multiplexed back to one STS-3/3c signal and sent to an OC48 Transmitter (OC48 TRMTR) circuit pack. In the receive direction (toward the OC-3 line), the OC3 (1.3 STD) circuit pack accepts one STS-3/3c signal from an OC48 Receiver (OC48 RCVR) circuit pack and demultiplexes it to three STS-1 signals. The three STS-1 signals are synchronized to the system clock, multiplexed back to one STS-3/3c signal, and converted to an optical OC-3 signal for transmission. The OC3 (1.3

STD) circuit pack also interfaces with the Line Controller (LNCTL) circuit pack for that particular OC-48 high speed line.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-18 provides an overall block diagram of the OC3 (1.3 STD) LAA10 circuit pack. Figure 7-19 shows an overall block diagram of the OC3 (1.3 STD) LAA10B circuit pack.

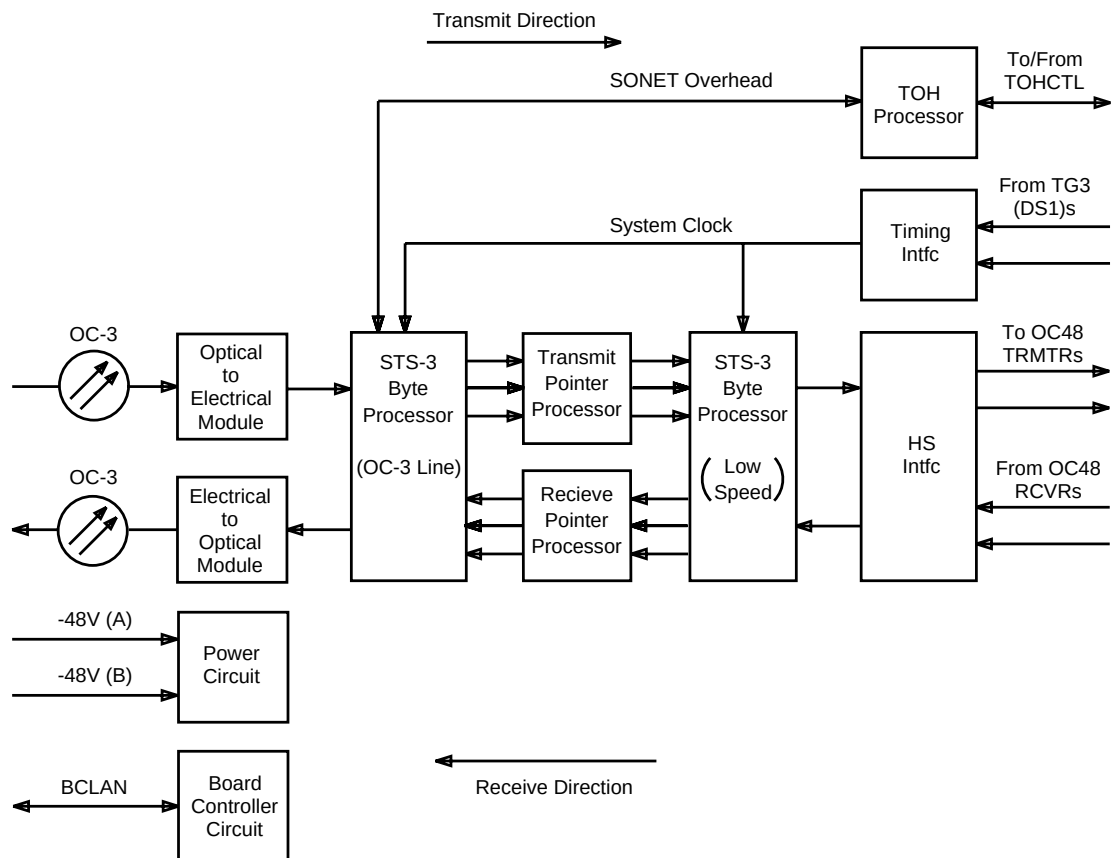


Figure 7-18. OC3 (1.3 STD) LAA10 Circuit Pack Block Diagram

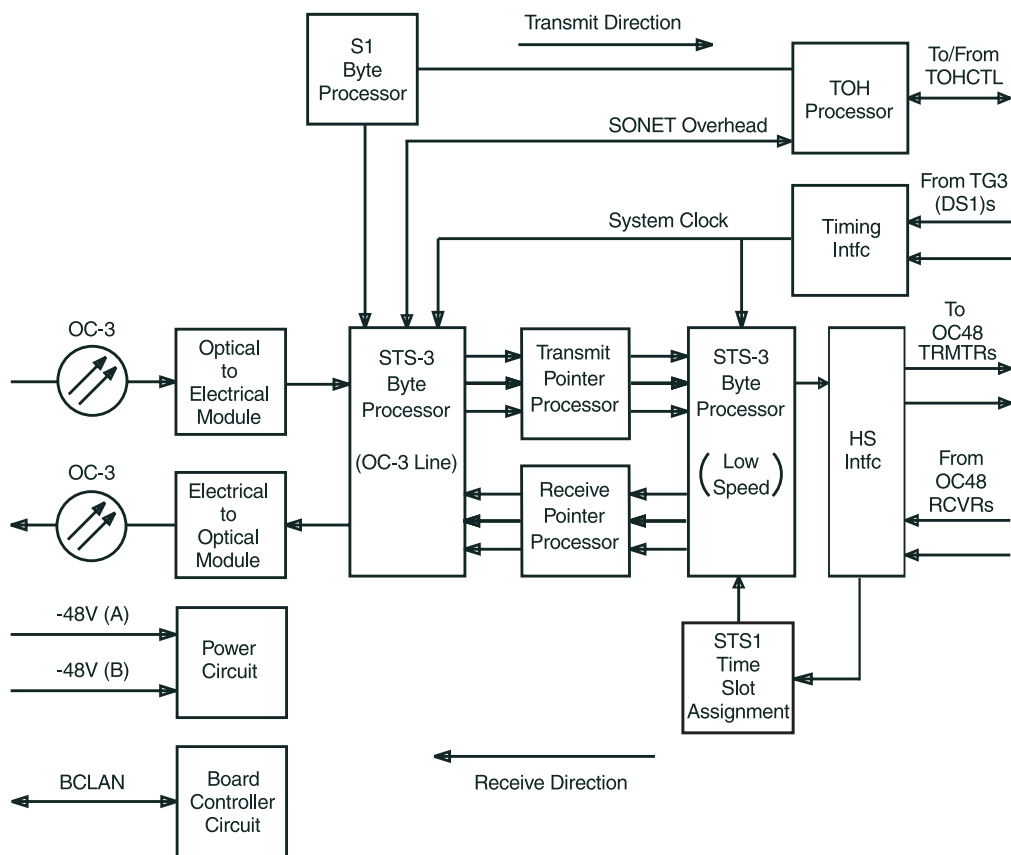


Figure 7-19. OC3 (1.3 STD) LAA10B Circuit Pack Block Diagram

In the transmit direction (toward the OC-48 line), the OC3 (1.3 STD) circuit pack accepts one OC-3 (155.52 Mb/s) non-return-to-zero (NRZ) synchronous optical network (SONET) compatible optical signal. Fiber access to the OC3 (1.3 STD) circuit pack is via a fixed *S7*[®]-type buildout block and a removable *S7*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled IN). Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All factory-equipped OC3 (1.3 STD) circuit packs come with a removable *S7*-type 0-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

The optical-to-electrical module receives the OC-3 signal, converts it to an electrical STS-3/3c signal (155.52 Mb/s), and sends it to a timing recovery circuit. The timing recovery circuit recovers a 155.52 MHz clock signal from the STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock signal. The STS-3/3c and clock signals are then sent to the OC-3 line STS-3 byte processor. The OC-3 line STS-3 byte processor descrambles and demultiplexes the STS-3/3c

signal into three STS-1 signals (51.84 Mb/s) and outputs the three STS-1 signals and a common clock signal to the transmit pointer processor.

The transmit pointer processor performs frequency adjustment and pointer processing on the three received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs by three. The divide-by-three circuit is part of the low speed STS-3 byte processor. The three STS-1 signals are then sent to the low speed STS-3 byte processor.

The low speed STS-3 byte processor scrambles and multiplexes the three STS-1 signals back to one STS-3/3c signal (155.52 Mb/s). The high speed interface distributes the STS-3/3c signal to the OC48 TRMTR circuit packs.

Receive Direction. In the receive direction (toward the OC-3 line), the high speed interface of a LAA10 OC-3 circuit pack accepts an STS-3/3c signal (155.52 Mb/s) from one of the OC48 RCVR circuit packs and sends it to a timing recovery circuit. The timing recovery circuit recovers a 155.52 MHz clock signal from the STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock signal.

In the receive direction (toward the OC-3 line), the high-speed interface of a LAA10B OC-3 circuit pack accepts two STS-3/3c signals (155.52 Mb/s) from both of the OC48 RCVR circuit packs and sends them to two timing recovery circuits. The timing recovery circuits recover a 155.52 MHz clock signal from each STS-3/3c signal and retime the STS-3/3c signals with the recovered clock signals. The two retimed STS-3/3c signals are then demultiplexed into six STS-1 signals. Three of these STS-1 signals are chosen depending on system provisioning and multiplexed into a STS-3/3c signal.

The STS-3/3c signal and clock signals are then sent to the low-speed STS-3 byte processor. The low-speed STS-3 byte processor descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s) and outputs the three STS-1 signals and a common clock signal to the receive pointer processor.

The receive pointer processor performs frequency adjustment and pointer processing on the three received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the TG3 (DS1) circuit pack by three. The divide-by-three circuit for the receive side is part of the OC-3 line STS-3 byte processor. The three STS-1 signals are then sent to the OC-3 line STS-3 byte processor.

The OC-3 line STS-3 byte processor scrambles and multiplexes the three STS-1 signals back to one STS-3/3c signal (155.52 Mb/s). The electrical-to-optical module receives the STS-3/3c signal and converts it to an OC-3 optical signal (155.52 Mb/s) for transmission. Fiber access to the OC3 (1.3 STD) circuit pack is via a fixed *S7*-type buildout block and a removable *S7*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled OUT). Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All

factory-equipped OC3 (1.3 STD) circuit packs come with a removable *ST*-type 7.1-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN). The OC3 (1.3 STD) circuit pack reports the status of the circuit pack and the incoming OC-3 and STS-3/3c signals, as well as the circuit pack inventory information (CLEI code, serial number, etc.). The LNCTL circuit pack uses the status information for fault detection and isolation. The OC3 (1.3 STD) circuit pack also responds to control signals from the LNCTL circuit pack.

Overhead Controller Circuitry

The transport overhead hyperchannel (TOH) circuitry provides access to the data communications channel (DCC) of the OC-3 line. Access is only provided to the D1-D3 overhead bytes of the DCC. In the LAA10B OC-3 circuit pack, the transport overhead hyperchannel circuitry also inserts the S1 Byte for synchronization messaging in the receive direction (toward the OC-3 line).

Timing Circuitry

The OC3 (1.3 STD) circuit pack accepts one 155.52 MHz clock signal from each of the two Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs (primary and secondary). During normal operation, the timing interface circuitry selects the clock signal that is used and automatically switches to the other clock signal if it detects a loss of signal. The board controller can also override the automatic clock selection mode and force either clock signal to be selected.

The selected clock signal (155.52 MHz) is connected to the OC-3 line STS-3 byte processor and the low speed STS-3 byte processor. The STS-3 byte processors provide divide-by-3 circuits that generate a 51.84 MHz signal. The 51.84 MHz signal from the divide-by-three circuit on the OC-3 line STS-3 byte processor is distributed to the receive circuitry of the OC-3 line STS-3 byte processor and the receive pointer processor. The 51.84 MHz signal from the divide-by-three circuit on the low speed STS-3 byte processor is distributed to the transmit circuitry of the low speed STS-3 byte processor and the transmit pointer processor.

Protection Circuitry

Low Speed Interface Protection . Optional 1+1 nonrevertive OC3 (1.3 STD) circuit pack protection in the transmit (toward the OC-48 line) and/or receive (toward the OC-3 line) direction is provided. For 1+1 nonrevertive protection, two OC3 (1.3 STD) circuit packs must be placed in adjacent "A" and "B" low speed interface slots of the Low Speed Shelf - System Controller (for example, LS INTFC slots 2A and 2B). Both OC3 (1.3 STD) circuit packs transmit the same OC-3 signal toward

the lightguide cross-connect panel (or equivalent). Both OC3 (1.3 STD) circuit packs receive the same OC-3 signal from the lightguide cross-connect panel (or equivalent) and transmit STS-3/3c signals to the OC48 TRMTR circuit pack. The OC3 circuit packs continuously monitor the incoming active and standby OC-3 signals. If the active OC-3 signal fails, the LNCTL circuit pack broadcasts a switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the transmit (toward the OC-48 line) direction only, the OC48 TRMTR circuit pack selects the standby STS-3/3c signal from the standby OC3 (1.3 STD) circuit pack. The OC3 (1.3 STD) circuit pack also supports 1+1 nonrevertive protection of the OC-3 data communications channels.

High Speed Protection. If an OC-48 signal fails or is degraded, the LNCTL circuit pack broadcasts a switch request to the board controllers on the OC3 (1.3 STD) circuit packs via the BCLAN. In the transmit direction, the OC3 (1.3 STD) circuit packs perform head-end bridges. In the FT-2000 OC-48 Add/Drop-Rings Terminal, the STS-3/3c signals (155.52 Mb/s) are provided to the OC48 TRMTR A/D circuit packs for lines 1E and 1W. In the receive direction, the OC3 (1.3 STD) circuit packs perform tail-end switches. In the FT-2000 OC-48 Add/Drop-Rings Terminal, selector circuitry on the OC3 (1.3 STD) circuit packs accepts the STS-3/3c signals from the OC48 RCVR A/D circuit pack opposite of the configured direction.

Dual Ring Interworking Protection. The OC3 (1.3 STD) circuit pack at the primary node of a dual ring interworking application monitors the OC-3 signal coming from the other ring. If an unprotected incoming OC-3 loss-of-signal or loss-of-frame condition is detected, the OC3 (1.3 STD) circuit pack notifies the LNCTL circuit pack. The LNCTL circuit pack broadcasts an automatic switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the add (toward to OC-48 line) direction only, the OC48 TRMTR circuit pack switches to (selects) the standby 155.52 Mb/s signal (STS-3 tributary) from the secondary node. The OC48 TRMTR circuit pack may switch to (select) the standby 51.84 Mb/s signal (STS-1 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring.

Synchronization Reference Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The timing interface circuitry of the OC3 (1.3 STD) circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The OC3 (1.3 STD) circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous. If an error occurs, the board controller reports the error to the LNCTL circuit pack using the board controller local area network (BCLAN). An out-of-service test is performed whenever the OC3 (1.3 STD) circuit pack is inserted in a slot or when a reset is performed.

Loopbacks . The OC3 (1.3 STD) circuit pack provides OC-3 and STS-3/3c loopbacks for fault isolation and remote testing. The OC-3 loopback loops the input from the OC-3 line back to the output of the OC-3 line via a loop connection in the low speed STS-3 byte processor. This loopback does not loop the OC-3 DCC overhead channel. The STS-3/3c loopback loops the STS-3/3c signal from the OC-48 line back to the STS-3/3c signal transmitted toward the OC-48 line via a loop connection in the OC-3 line STS-3 byte processor. The OC-3 and STS-3/3c loopback paths include the transmit and receive pointer processors.

These loopbacks are implemented in response to craft interface terminal (CIT) commands (via the SYSCTL and LNCTL circuit packs) and controlled by the board controller.

Performance Monitoring . The OC3 (1.3 STD) circuit pack monitors the following performance-monitoring parameters:

- Laser bias current
- Optical transmit power
- Received optical power
- Loss of signal
- Loss of frame
- Bit error rate thresholds
- Pointer justification counts (PJC).

When an incoming OC-3 signal defect from the lightguide cross-connect panel is detected, the OC3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal (155.52 Mb/s) transmitted toward the OC-48 TRMTR circuit pack.

When an incoming OC-48 signal defect is detected by the OC48 RCVR circuit pack or an STS-1 loss of pointer is detected by the OC3 (1.3 STD) circuit pack in the 155.52 Mb/s signal received from the OC48 RCVR circuit pack, the OC3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the OC-3 signal transmitted toward the lightguide cross-connect panel.

When an internal fault is detected, the OC3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal transmitted toward the OC48 TRMTR circuit pack and in the OC-3 signal transmitted toward the lightguide cross-connect panel.

Power Circuitry

The OC3 (1.3 STD) circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

If the OC3 (1.3 STD) circuit pack detects the failure of the onboard fuse or power converter the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the OC3 (1.3 STD) circuit pack.

Quick Reference Summary

Transmit Functions

The OC3 (1.3 STD) circuit pack performs the following transmit functions:

- a. Receives one OC-3 (155.52 Mb/s) non-return-to-zero (NRZ) SONET compatible optical signal from a lightguide cross-connect panel (or equivalent)
- b. Converts the optical OC-3 signal to an electrical STS-3/3c signal
- c. Recovers a 155.52 MHz clock signal from STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock
- d. Descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s)
- e. Performs frequency adjustments and pointer processing on the three STS-1 signals
- f. Scrambles and multiplexes the three STS-1 signals to an STS-3/3c signal (155.52 Mb/s)
- g. Provides the STS-3/3c signal to an OC48 TRMTR circuit pack
- h. Accepts the OC-3 SONET section DCC bytes from the TOHCTL circuit pack.

Receive Functions

The OC3 (1.3 STD) circuit pack performs the following receive functions:

- a. Receives an STS-3/3c signal (155.52 Mb/s) from an OC48 RCVR circuit pack
- b. Recovers a 155.52 MHz clock signal from STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock
- c. Descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s)
- d. Performs frequency adjustments and pointer processing on the three STS-1 signals
- e. Scrambles and multiplexes the three STS-1 signals to an STS-3/3c signal (155.52 Mb/s)
- f. Converts the electrical STS-3/3c signal to an optical OC-3 signal

- g. Provides the OC-3 optical signal to a lightguide cross-connect panel (or equivalent).
- h. Provides the OC-3 SONET section DCC bytes to the TOHCTL circuit pack (Release 6 and later).

Timing and Control Functions

The OC3 (1.3 STD) circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz timing signal from the TG3 (DS1) circuit packs
- b. Provides selector circuitry for high speed protection switching
- c. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- d. Provides OC-3 and STS-3/3c loopbacks
- e. Stores inventory information (CLEI code, serial number, etc.)
- f. Controls the circuit pack faceplate FAULT LED.

Maintenance Signal Functions

The OC3 (1.3 STD) circuit pack performs the following maintenance signal functions:

- a. Detects incoming (from the lightguide cross-connect panel) OC-3 loss of signal (LOS), loss of frame (LOF), and signal degrade (SD) based on the B2 error rate
- b. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal (155.52 Mb/s) transmitted toward the OC48 TRMTR circuit pack when incoming (from the lightguide cross-connect panel) OC-3 LOS or LOF is detected
- c. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal transmitted toward the OC48 TRMTR circuit pack and in the OC-3 signal transmitted toward the lightguide cross-connect panel when an internal fault is detected.

IS3 (LAA5) Circuit Pack Description

Purpose of Circuit

The IS3 Optical Interface - 1.3 μ m Standard Performance [IS3 (1.3 STD)] circuit pack provides a bidirectional low speed interface between one synchronous IS-3 optical signal (155.52 Mb/s) and an internal synchronous STS-3/3c signal (155.52 Mb/s).

Faceplate LED

The IS3 (1.3 STD) circuit pack has a red FAULT LED on its faceplate (Figure 7-20). The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the IS3 (1.3 STD) circuit pack.

The board controller on the IS3 (1.3 STD) circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is continuously lighted. If an incoming IS-3 signal from the lightguide cross-connect panel (or equivalent) fails, the FAULT LED will flash on and off.

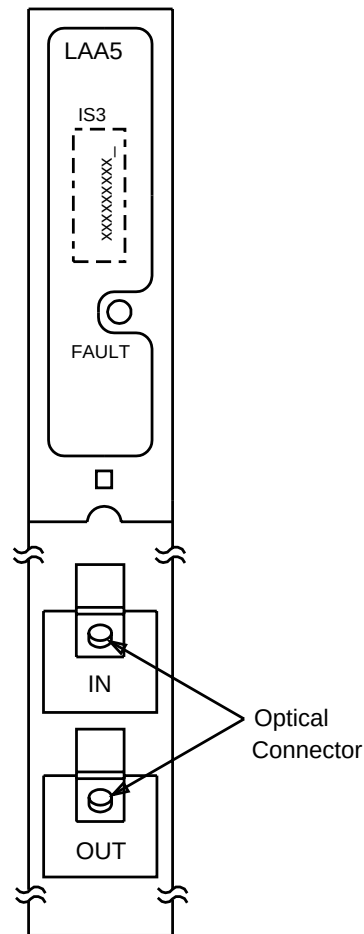


Figure 7-20. IS3 (1.3 STD) (LAA5) Circuit Pack

General Description of Operation

The IS3 (1.3 STD) circuit pack terminates one bidirectional IS-3 line. In the transmit direction (toward the OC-48 line), the IS3 (1.3 STD) circuit pack converts the incoming IS-3 optical signal to an electrical STS-3/3c signal (155.52 Mb/s). The STS-3/3c signal is demultiplexed into three STS-1 signals (51.84 Mb/s) and synchronized to the system clock. The three STS-1 signals are then multiplexed back to one STS-3/3c signal and sent to an OC48 Transmitter (OC48 TRMTR) circuit pack. In the receive direction (toward the IS-3 line), the IS3 (1.3 STD) circuit pack accepts one STS-3/3c signal from an OC48 Receiver (OC48 RCVR) circuit pack and demultiplexes it to three STS-1 signals. The three STS-1 signals are synchronized to the system clock, multiplexed back to one STS-3/3c signal, and converted to an optical IS-3 signal for transmission. The IS3 (1.3 STD) circuit pack also interfaces with the Line Controller (LNCTL) circuit pack for that particular OC-48 high speed line.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-21 provides an overall block diagram of the IS3 (1.3 STD) circuit pack.

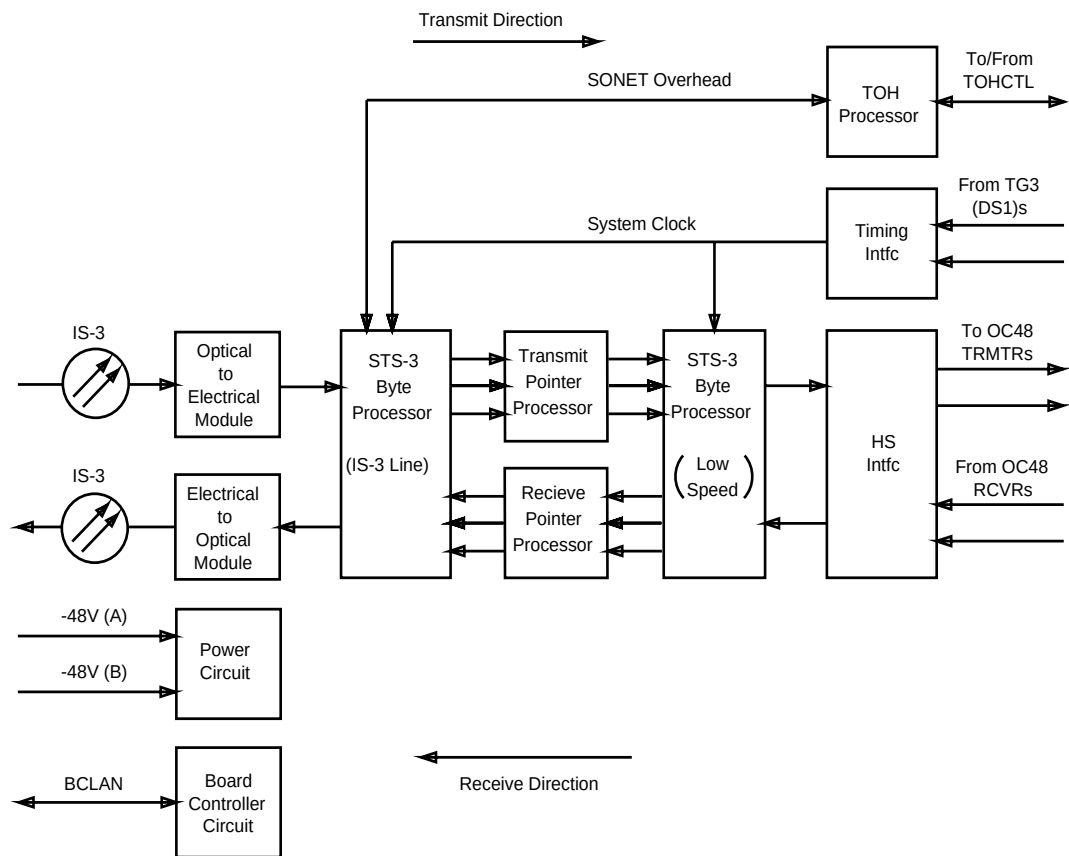


Figure 7-21. IS3 (1.3 STD) Circuit Pack Block Diagram

In the transmit direction (toward the OC-48 line), the IS3 (1.3 STD) circuit pack accepts one IS-3 (155.52 Mb/s) non-return-to-zero (NRZ) synchronous optical network (SONET) compatible optical signal. Fiber access to the IS3 (1.3 STD) circuit pack is via a fixed *S7*[®]-type buildout block and a removable *S7*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled IN). Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All factory-equipped IS3 (1.3 STD) circuit packs come with a removable *S7*-type 0-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

The optical-to-electrical module receives the IS-3 signal, converts it to an electrical STS-3/3c signal (155.52 Mb/s), and sends it to a timing recovery circuit. The timing recovery circuit recovers a 155.52 MHz clock signal from the STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock signal. The STS-

3/3c and clock signals are then sent to the IS-3 line STS-3 byte processor. The IS-3 line STS-3 byte processor descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s) and outputs the three STS-1 signals and a common clock signal to the transmit pointer processor.

The transmit pointer processor performs frequency adjustment and pointer processing on the three received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs by three. The divide-by-three circuit is part of the low speed STS-3 byte processor. The three STS-1 signals are then sent to the low speed STS-3 byte processor.

The low speed STS-3 byte processor scrambles and multiplexes the three STS-1 signals back to one STS-3/3c signal (155.52 Mb/s). The high speed interface distributes the STS-3/3c signal to the OC48 TRMTR circuit packs.

Receive Direction . In the receive direction (toward the IS-3 line), the high speed interface accepts the STS-3/3c signal (155.52 Mb/s) from an OC48 RCVR circuit pack and sends it to a timing recovery circuit. The timing recovery circuit recovers a 155.52 MHz clock signal from the STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock signal. The STS-3/3c and clock signals are then sent to the low speed STS-3 byte processor. The low speed STS-3 byte processor descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s) and outputs the three STS-1 signals and a common clock signal to the receive pointer processor.

The receive pointer processor performs frequency adjustment and pointer processing on the three received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the TG3 (DS1) circuit pack by three. The divide-by-three circuit for the receive side is part of the IS-3 line STS-3 byte processor. The three STS-1 signals are then sent to the IS-3 line STS-3 byte processor.

The IS-3 line STS-3 byte processor scrambles and multiplexes the three STS-1 signals back to one STS-3/3c signal (155.52 Mb/s). The electrical-to-optical module receives the STS-3/3c signal and converts it to an IS3 optical signal (155.52 Mb/s) for transmission. Fiber access to the IS3 (1.3 STD) circuit pack is via a fixed *ST*-type buildout block and a removable *ST*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled OUT). Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All factory-equipped IS3 (1.3 STD) circuit packs come with a removable *ST*-type 7.1-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN). The IS3 (1.3 STD) circuit pack reports the status of the circuit pack and the incoming IS-3 and STS-3/3c signals, as well as the circuit pack inventory information (CLEI code, serial number, etc.). The LNCTL circuit pack uses the status information for fault detection and isolation. The IS3 (1.3 STD) circuit pack also responds to control signals from the LNCTL circuit pack.

Overhead Controller Circuitry

The transport overhead hyperchannel (TOH) circuitry provides access to the data communications channel (DCC) of the IS-3 line. Access is only provided to the D1-D3 overhead bytes of the DCC.

Timing Circuitry

The IS3 (1.3 STD) circuit pack accepts one 155.52 MHz clock signal from each of the two Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs (primary and secondary). During normal operation, the timing interface circuitry selects the clock signal that is used and automatically switches to the other clock signal if it detects a loss of signal. The board controller can also override the automatic clock selection mode and force either clock signal to be selected.

The selected clock signal (155.52 MHz) is connected to the IS-3 line STS-3 byte processor and the low speed STS-3 byte processor. The STS-3 byte processors provide divide-by-3 circuits that generate a 51.84 MHz signal. The 51.84 MHz signal from the divide-by-three circuit on the IS-3 line STS-3 byte processor is distributed to the receive circuitry of the IS-3 line STS-3 byte processor and the receive pointer processor. The 51.84 MHz signal from the divide-by-three circuit on the low speed STS-3 byte processor is distributed to the transmit circuitry of the low speed STS-3 byte processor and the transmit pointer processor.

Protection Circuitry

Low Speed Interface Protection. Optional 1+1 nonrevertive IS3 (1.3 STD) circuit pack protection in the transmit (toward the OC-48 line) and/or receive (toward the IS-3 line) direction is provided. For 1+1 nonrevertive protection, two IS3 (1.3 STD) circuit packs must be placed in adjacent "A" and "B" low speed interface slots of the Low Speed Shelf - System Controller (for example, LS INTFC slots 2A and 2B). Both IS3 (1.3 STD) circuit packs transmit the same IS-3 signal toward the lightguide cross-connect panel (or equivalent). Both IS3 (1.3 STD) circuit packs receive the same IS-3 signal from the lightguide cross-connect panel (or equivalent) and transmit STS-3/3c signals to the OC48 TRMTR circuit pack. The IS3 circuit packs continuously monitor the incoming active and standby IS-3 signals. If the active IS-3 signal fails, the LNCTL circuit pack broadcasts a switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the transmit (toward the OC-48 line) direction only, the OC48 TRMTR circuit pack selects the standby STS-3/3c signal from the standby IS3 (1.3 STD) circuit

pack. The IS-3 (1.3 STD) circuit pack also supports 1+1 nonrevertive protection of the IS-3 data communications channels.

High Speed Protection . If an OC-48 signal fails or is degraded, the LNCTL circuit pack broadcasts a switch request to the board controllers on the IS3 (1.3 STD) circuit packs via the BCLAN. In the transmit direction, the IS3 (1.3 STD) circuit packs perform head-end bridges. In the FT-2000 OC-48 Add/Drop-Rings Terminal, the STS-3/3c signals (155.52 Mb/s) are provided to the OC48 TRMTR A/D circuit packs for lines 1E and 1W. In the receive direction, the IS3 (1.3 STD) circuit packs perform tail-end switches. In the FT-2000 OC-48 Add/Drop-Rings Terminal, selector circuitry on the IS3 (1.3 STD) circuit packs accepts the STS-3/3c signals from the OC48 RCVR A/D circuit pack opposite of the configured direction.

Synchronization Reference Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The timing interface circuitry of the IS3 (1.3 STD) circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The IS3 (1.3 STD) circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous. If an error occurs, the board controller reports the error to the LNCTL circuit pack using the board controller local area network (BCLAN). An out-of-service test is performed whenever the IS3 (1.3 STD) circuit pack is inserted in a slot or when a reset is performed.

Loopbacks. The IS3 (1.3 STD) circuit pack provides IS-3 and STS-3/3c loopbacks for fault isolation and remote testing. The IS-3 loopback loops the input from the IS-3 line back to the output of the IS-3 line via a loop connection in the low speed STS-3 byte processor. This loopback does not loop the IS-3 DCC overhead channel. The STS-3/3c loopback loops the STS-3/3c signal from the OC-48 line back to the STS-3/3c signal transmitted toward the OC-48 line via a loop connection in the IS-3 line STS-3 byte processor. The IS-3 and STS-3/3c loopback paths include the transmit and receive pointer processors.

These loopbacks are implemented in response to craft interface terminal (CIT) commands (via the SYSCTL and LNCTL circuit packs) and controlled by the board controller.

Performance Monitoring. The IS3 (1.3 STD) circuit pack monitors the following performance-monitoring parameters:

- Optical transmit power
- Loss of signal
- Loss of frame
- Bit error rate thresholds

- Pointer justification counts (PJC).

When an incoming IS-3 signal defect from the lightguide cross-connect panel is detected, the O3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal (155.52 Mb/s) transmitted toward the OC-48 TRMTR circuit pack.

When an incoming OC-48 signal defect is detected by the OC48 RCVR circuit pack or an STS-1 loss of pointer is detected by the IS3 (1.3 STD) circuit pack in the 155.52 Mb/s signal received from the OC48 RCVR circuit pack, the IS3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the IS-3 signal transmitted toward the lightguide cross-connect panel.

When an internal fault is detected, the IS3 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal transmitted toward the OC48 TRMTR circuit pack and in the IS-3 signal transmitted toward the lightguide cross-connect panel.

Power Circuitry

The IS3 (1.3 STD) circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

If the IS3 (1.3 STD) circuit pack detects the failure of the onboard fuse or power converter the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the IS3 (1.3 STD) circuit pack.

Quick Reference Summary

Transmit Functions

The IS3 (1.3 STD) circuit pack performs the following transmit functions:

- Receives one IS-3 (155.52 Mb/s) non-return-to-zero (NRZ) SONET compatible optical signal from a lightguide cross-connect panel (or equivalent)
- Converts the optical IS-3 signal to an electrical STS-3/3c signal
- Recovers a 155.52 MHz clock signal from STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock
- Descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s)
- Performs frequency adjustments and pointer processing on the three STS-1 signals
- Scrambles and multiplexes the three STS-1 signals to an STS-3/3c signal (155.52 Mb/s)

- g. Provides the STS-3/3c signal to an OC48 TRMTR circuit pack
- h. Accepts the IS-3 SONET section DCC bytes from the TOHCTL circuit pack.

Receive Functions

The IS3 (1.3 STD) circuit pack performs the following receive functions:

- a. Receives an STS-3/3c signal (155.52 Mb/s) from an OC48 RCVR circuit pack
- b. Recovers a 155.52 MHz clock signal from STS-3/3c signal and retimes the STS-3/3c signal with the recovered clock
- c. Descrambles and demultiplexes the STS-3/3c signal into three STS-1 signals (51.84 Mb/s)
- d. Performs frequency adjustments and pointer processing on the three STS-1 signals
- e. Scrambles and multiplexes the three STS-1 signals to an STS-3/3c signal (155.52 Mb/s)
- f. Converts the electrical STS-3/3c signal to an optical IS-3 signal
- g. Provides the IS-3 optical signal to a lightguide cross-connect panel (or equivalent).
- h. Provides the IS-3 SONET section DCC bytes to the TOHCTL circuit pack.

Timing and Control Functions

The IS3 (1.3 STD) circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz timing signal from the TG3 (DS1) circuit packs
- b. Provides selector circuitry for high speed protection switching
- c. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- d. Provides IS-3 and STS-3/3c loopbacks
- e. Stores inventory information (CLEI code, serial number, etc.)
- f. Controls the circuit pack faceplate FAULT LED.

Maintenance Signal Functions

The IS3 (1.3 STD) circuit pack performs the following maintenance signal functions:

- a. Detects incoming (from the lightguide cross-connect panel) IS-3 loss of signal (LOS), loss of frame (LOF), and signal degrade (SD) based on the B2 error rate

- b. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal (155.52 Mb/s) transmitted toward the OC48 TRMTR circuit pack when incoming (from the lightguide cross-connect panel) IS-3 LOS or LOF is detected
- c. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signal transmitted toward the OC48 TRMTR circuit pack and in the IS-3 signal transmitted toward the lightguide cross-connect panel when an internal fault is detected.

OC-12 (T939A) Circuit Pack Description

Purpose of Circuit

The OC-12 Optical Interface - 1.3 μ m Standard Performance [OC-12 (1.3 STD)] circuit pack provides a bi-directional low speed interface between one synchronous OC-12 optical signal (622.08 Mb/s) and four STS-3/3c signals (each at 155.52 M/bs).

Faceplate LED

The OC12 (1.3 STD) circuit pack has a red FAULT LED on its faceplate (Figure 7-22). The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the OC12 (1.3 STD) circuit pack.

The board controller on the OC12 (1.3 STD) circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is continuously lighted. If an incoming OC-12 signal from the lightguide cross-connect panel (or equivalent) fails, the FAULT LED will flash on and off.

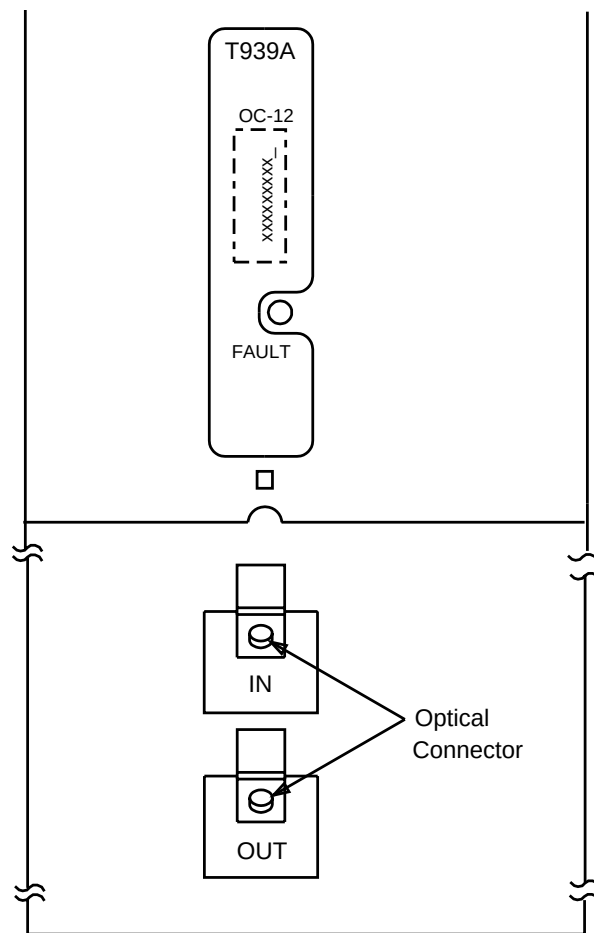


Figure 7-22. OC12 (1.3 STD) (T939A) Circuit Pack

General Description of Operation

The OC12 (1.3 STD) circuit pack terminates one bi-directional OC-12 line. In the transmit direction (toward the OC-48 line), the OC12 (1.3 STD) circuit pack converts the incoming OC-12 optical signal to an electrical STS-12/12c signal (622.08 Mb/s). The STS-12/12c signal is demultiplexed into twelve STS-1 signals (51.84 Mb/s) and synchronized to the system clock. The twelve STS-1 signals are then multiplexed back to four STS-3/3c signals and sent back to the OC48 transmitter (OC48 TRMTR) circuit pack(s). In the receive direction (toward the OC-12 line), the OC12 (1.3 STD) circuit pack accepts four STS-3/3c signals from the OC48 Receiver (OC48 RCVR) circuit pack(s) and demultiplexes it to twelve STS-1 signals. The twelve STS-1 signals are synchronized to the system clock, multiplexed back to one STS-12/12c signal, and converted to an optical OC-12

signal for transmission. The OC12 (1.3 STD) circuit pack also interfaces with the Line Controller (LNCTL) circuit pack for that particular OC-48 high speed line.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction . Figure 7-23 provides an overall block diagram of the OC12 (1.3 STD) circuit pack.

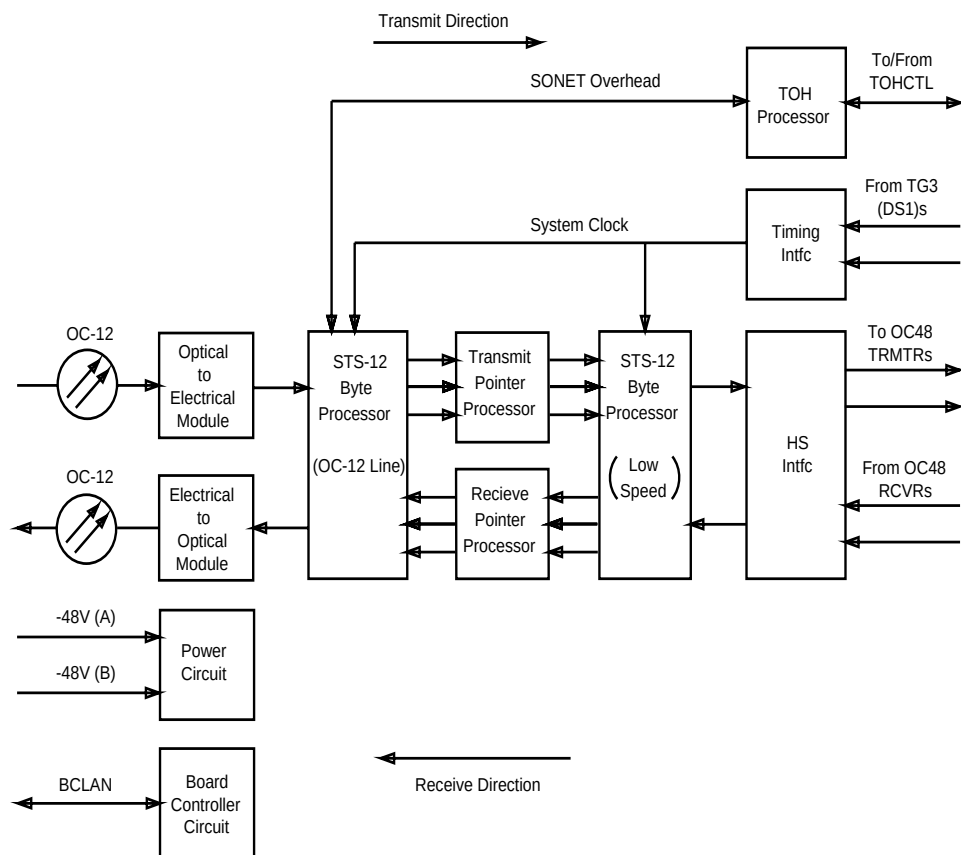


Figure 7-23. OC12 (1.3 STD) Circuit Pack Block Diagram

In the transmit direction (toward the OC-48 line), the OC12 (1.3 STD) circuit pack accepts one OC-12 (622.08 Mb/s) non-return-to-zero (NRZ) synchronous optical network (SONET) compatible optical signal. Fiber access to the OC12 (1.3 STD) circuit pack is via a fixed *ST*[®]-type buildout block and a removable *ST*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled IN).

Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All factory-equipped OC12 (1.3 STD) circuit packs come with a removable *ST*-type 0-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

The optical-to-electrical module receives the OC-12 signal, converts it to an electrical STS-12/12c signal (actually, four STS-3 rate signals yielding a composite 622.08 Mb/s signal), and sends it to a timing recovery circuit. The timing recovery circuit recovers a 622.08 MHz clock signal from the STS-12/12c signal and retimes the STS-12/12c signal with the recovered clock signal. The STS-12/12c and clock signals are then sent to the OC-12 line STS-12 byte processor. The OC-12 line STS-12 byte processor descrambles and demultiplexes the STS-12/12c signal into twelve STS-1 signals (51.84 Mb/s) and outputs the twelve STS-1 signals and a common clock signal to the transmit pointer processor.

The transmit pointer processor performs frequency adjustment and pointer processing on the twelve received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs by three. The divide-by-three circuit is part of the low-speed STS-1 byte processor. The twelve STS-1 signals are then sent to four low-speed STS-3 byte processors.

The low speed STS-3 byte processor scrambles and multiplexes the twelve STS-1 signals back to four STS-3/3c signals (each at 155.52 Mb/s signals). The high-speed interface distributes the STS-3/3c signals to the OC48 TRMTR circuit(s).

Receive Direction. In the receive direction (toward the OC-12 line), the high-speed interface accepts four STS-3/3c signals from the OC48 RCVR circuit pack(s) and sends it to a timing recovery circuit. The timing recovery circuit recovers a 155.52 MHz clock signal from the STS-3/3c signal and re-times the STS-3/3c signal with the recovered clock signal. The STS-3/3c and clock signals are then sent to the low-speed STS-3 byte processors. The low-speed STS-3 byte processors descrambles and demultiplexes the four STS-3/3c signals into twelve STS-1 signals (each at 51.84 Mb/s) and output the twelve STS-1 signals and a common clock signal to the receive pointer processor.

The receive pointer processor performs frequency adjustment and pointer processing on the twelve received STS-1 signals. This synchronizes the STS-1 signals to the 51.84 MHz system clock. The 51.84 MHz clock signal is obtained by dividing the 155.52 MHz from the TG3 (DS1) circuit pack by three. The divide-by-twelve circuit for the receive side is part of the OC-12 line STS-12 byte processor. The twelve STS-1 signals are then sent to the OC-12 line STS-12 byte processor.

The OC-12 line STS-12 byte processor scrambles and multiplexes the twelve STS-1 signals back to one STS-12/12c signal (622.08 Mb/s). The electrical-to-optical module receives the STS-12/12c signal and converts it to an OC-12 optical

signal (622.08 Mb/s) for transmission. Fiber access to the OC12 (1.3 STD) circuit pack is via a fixed *ST*-type buildout block and a removable *ST*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate (labeled OUT). Lightguide buildouts are chosen based on the attenuation desired, the type of connector interface, and the type of lightguide jumpers (single-mode or multimode). All factory-equipped OC12 (1.3 STD) circuit packs come with a removable *ST*-type 7.1-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN). The OC12 (1.3 STD) circuit pack reports the status of the circuit pack and the incoming OC-12 and STS-3/3c signals, as well as the circuit pack inventory information (CLEI code, serial number, etc.). The LNCTL circuit pack uses the status information for fault detection and isolation. The OC12 (1.3 STD) circuit pack also responds to control signals from the LNCTL circuit pack.

Overhead Controller Circuitry

The transport overhead hyperchannel (TOH) circuitry provides access to the data communications channel (DCC) of the OC-12 line. Access is only provided to the D1-D3 overhead bytes of the DCC.

Timing Circuitry

The OC12 (1.3 STD) circuit pack accepts one 155.52 MHz clock signal from each of the two Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs (primary and secondary). During normal operation, the timing interface circuitry selects the clock signal that is used and automatically switches to the other clock signal if it detects a loss of signal. The board controller can also override the automatic clock selection mode and force either clock signal to be selected.

The selected clock signal (155.52 MHz) is connected to the OC-12 line STS-12 byte processor and the low-speed STS-12 byte processor. The STS-12 byte processors provide divide-by-3 circuits that generate a 51.84 MHz signal. The 51.84 MHz signal from the divide-by-3 circuit on the OC-12 line STS-12 byte processor is distributed to the receive circuitry of the OC-12 line STS-12 byte processor and the receive pointer processor. The 51.84 MHz signal from the divide-by-3 circuit on the low-speed STS-12 byte processor is distributed to the transmit circuitry of the low-speed STS-12 byte processor and the transmit pointer processor.

When the network element is in the through-timed mode, the OC-12 Timing Direction parameter determines the high-speed line (1W or 1E) from which the OC-12 derives its timing. The OC-12 Timing Direction parameter is user-provisionable via the CIT, and its default value is 1W. This parameter may be

needed when the OC-12 is used to distribute timing to far-end equipment. When the network element is not through-timed, the OC-12 derives its timing from that element system clock.

Protection Circuitry

Low-Speed Interface Protection. Optional 1+1 non-revertive OC12 (1.3 STD) circuit pack protection in the transmit (toward the OC-48 line) and/or receive (toward the OC-12 line) direction is provided. For 1+1 non-revertive protection, two OC12 (1.3 STD) circuit packs must be placed in adjacent low-speed interface slots of the Low Speed Shelf - System Controller (for example, LS INTFC slots 1A-2B and 3A-4B or 5A-6A and 7A-8B). Both OC12 (1.3 STD) circuit packs transmit the same OC-12 signal toward the lightguide cross-connect panel (or equivalent). Both OC12 (1.3 STD) circuit packs receive the same OC-12 signal from the lightguide cross-connect panel (or equivalent) and transmit STS-3/3c signals to the OC48 TRMTR circuit pack(s). The OC12 circuit packs continuously monitor the incoming active and standby OC-12 signals. If the active OC-12 signal fails, the LNCTL circuit pack broadcasts a switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the transmit (toward the OC-48 line) direction only, the OC48 TRMTR circuit pack selects the standby STS-3/3c signal(s) from the standby OC12 (1.3 STD) circuit pack.

High-Speed Protection. If an OC-48 signal fails or is degraded, the LNCTL circuit pack broadcasts a switch request to the board controllers on the OC12 (1.3 STD) circuit packs via the BCLAN. In the transmit direction, the OC12 (1.3 STD) circuit packs perform head-end bridges. In the FT-2000 OC-48 Add/Drop-Rings Terminal, four STS-3/3c signals (each at 155.52 Mb/s) are provided to the OC48 TRMTR A/D circuit packs for lines 1E and 1W. In the receive direction, the OC12 (1.3 STD) circuit packs perform tail-end switches. In the FT-2000 OC-48 Add/Drop-Rings Terminal, selector circuitry on the OC12 (1.3 STD) circuit packs accept the STS-3/3c signals from the OC48 RCVR A/D circuit pack opposite of the configured direction.

Dual Ring Interworking Protection. The OC12 (1.3 STD) circuit pack at the primary node of a dual ring interworking application monitors the OC-12 signal coming from the other ring. If an unprotected incoming OC-12 loss-of-signal or loss-of-frame condition is detected, the OC12 (1.3 STD) circuit pack notifies the LNCTL circuit pack. The LNCTL circuit pack broadcasts an automatic switch request to the board controller on the OC48 TRMTR circuit pack via the BCLAN. In the add (toward to OC-48 line) direction only, the OC48 TRMTR circuit pack switches to (selects) the standby 155.52 Mb/s signals (STS-3 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring.

Synchronization Reference Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The timing interface circuitry of the OC12 (1.3 STD) circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

When the network element is in the through-timed mode, the OC-12 Timing Direction parameter determines the high-speed line (1W or 1E) from which the OC-12 derives its timing. The OC-12 Timing Direction parameter is user-provisionable via the CIT, and its default value is 1W. This parameter may be needed when the OC-12 is used to distribute timing to far-end equipment. When the network element is not through-timed, the OC-12 derives its timing from that element's system clock.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The OC12 (1.3 STD) circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous. If an error occurs, the board controller reports the error to the LNCTL circuit pack using the board controller local area network (BCLAN). An out-of-service test is performed whenever the OC12 (1.3 STD) circuit pack is inserted in a slot or when a reset is performed.

Loopbacks. The OC12 (1.3 STD) circuit pack provides an OC-12 loopback for fault isolation testing. The OC-12 loopback loops the input from the OC-12 line back to the output of the OC-12 line via a loop connection in the low speed STS-12 byte processor. This loopback does not loop the OC-12 DCC overhead channel. The OC-12 loopback path includes the transmit and receive pointer processors.

These loopbacks are implemented in response to craft interface terminal (CIT) commands (via the SYSCTL and LNCTL circuit packs) and controlled by the board controller.

Performance Monitoring. The OC12 (1.3 STD) circuit pack monitors the following performance-monitoring parameters:

- Laser bias current
- Optical transmit power
- Received optical power
- Loss of signal
- Loss of frame
- Bit error rate thresholds
- Pointer justification counts (PJC).

When an incoming OC-12 signal defect from the lightguide cross-connect panel is detected, the OC12 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the four STS-3/3c signals (155.52 Mb/s) transmitted toward the OC-48 TRMTR circuit pack.

When an incoming OC-48 signal defect is detected by the OC48 RCVR circuit pack or an STS-1 loss of pointer is detected by the OC12 (1.3 STD) circuit pack in any of the 155.52 Mb/s signal received from the OC48 RCVR circuit pack, the OC12 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the OC-12 signal transmitted toward the lightguide cross-connect panel.

When an internal fault is detected, the OC12 (1.3 STD) circuit pack inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signals transmitted toward the OC48 TRMTR circuit pack and in the OC-12 signal transmitted toward the lightguide cross-connect panel.

Power Circuitry

The OC12 (1.3 STD) circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

If the OC12 (1.3 STD) circuit pack detects the failure of the onboard fuse or power converter the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the OC12 (1.3 STD) circuit pack.

Quick Reference Summary

Transmit Functions

The OC12 (1.3 STD) circuit pack performs the following transmit functions:

- a. Receives one OC-12 (622.08 Mb/s) non-return-to-zero (NRZ) SONET compatible optical signal from a lightguide cross-connect panel (or equivalent)
- b. Converts the optical OC-12 signal to an electrical STS-12/12c signal
- c. Recovers a 622.08 MHz clock signal from STS-12/12c signal and retimes the STS-12/12c signal with the recovered clock
- d. Descrambles and demultiplexes the STS-12/12c signal into twelve STS-1 signals (51.84 Mb/s)
- e. Performs frequency adjustments and pointer processing on the twelve STS-1 signals
- f. Scrambles and multiplexes the twelve STS-1 signals into four STS-3/3c signals (each at 155.52 Mb/s)
- g. Provides four STS-3/3c signals to an OC48 TRMTR circuit pack (s)
- h. Accepts the OC-12 SONET section DCC bytes from the TOHCTL circuit pack.

Receive Functions

The OC12 (1.3 STD) circuit pack performs the following receive functions:

- a. Receives four STS-3/3c signals (each at 155.52 Mb/s) from an OC48 RCVR circuit pack(s)
- b. Recovers a 155.52 MHz clock signal from one of the STS-3/3c signals and retimes the STS-3/3c signal with the recovered clock
- c. Descrambles and demultiplexes the four STS-3/3c signals (each at 155.52 Mb/s) into twelve STS-1 signals (51.84 Mb/s)
- d. Performs frequency adjustments and pointer processing on the twelve STS-1 signals
- e. Scrambles and multiplexes the twelve STS-1 signals to an STS-12/12c signal (622.08 Mb/s)
- f. Converts the electrical STS-12/12c signal to an optical OC-12 signal
- g. Provides the OC-12 optical signal to a lightguide cross-connect panel (or equivalent).
- h. Provides the OC-12 SONET section DCC bytes to the TOHCTL circuit pack.

Timing and Control Functions

The OC12 (1.3 STD) circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz timing signal from the TG3 (DS1) circuit packs
- b. Provides selector circuitry for high speed protection switching
- c. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- d. Provides OC-12 and STS-12/12c loopbacks
- e. Stores inventory information (CLEI code, serial number, etc.)
- f. Controls the circuit pack faceplate FAULT LED.

Maintenance Signal Functions

The OC12 (1.3 STD) circuit pack performs the following maintenance signal functions:

- a. Detects incoming (from the lightguide cross-connect panel) OC-12 loss of signal (LOS), loss of frame (LOF), and signal degrade (SD) based on the B2 error rate

- b. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signals (each at 155.52 Mb/s) transmitted toward the OC48 TRMTR circuit pack(s) when incoming (from the lightguide cross-connect panel) OC-12 LOS or LOF is detected
- c. Inserts STS-1 path AIS in each STS-1 tributary of the STS-3/3c signals (each at 155.52 Mb/s) transmitted toward the OC48 TRMTR circuit pack(s) and in the OC-12 signal transmitted toward the lightguide cross-connect panel when an internal fault is detected.

LSSW (LAA12B) Circuit Pack Description



NOTE:

The LAA12 circuit pack was rated MD as of January 1997. It was replaced with the LAA12B circuit pack.

Purpose of Circuit

The Low Speed Switch (LSSW) circuit pack is a relay switch circuit pack used to build a low speed protection bus in the transmit and receive directions for the DS3 Interface (DS3) and STS-1 Electrical Interface (STS1E) circuit packs.

Faceplate LED

The LSSW circuit pack has a red FAULT LED on its faceplate (Figure 7-24). The red FAULT LED is lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the LSSW circuit pack.

The board controller on the LSSW circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the FAULT LED on the circuit pack is lighted.

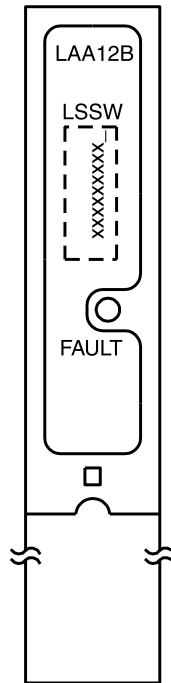


Figure 7-24. LSSW (LAA12B) Circuit Pack

General Description of Operation

The signal flow through the LSSW circuit pack may be in either direction, depending on the slot location. When the LSSW circuit pack is placed in the IN slot on the Low Speed Shelf - System Controller or Low Speed Shelf - Complementary, it provides a low speed protection bus in the transmit direction. When the LSSW circuit pack is placed in the OUT slot on the Low Speed Shelf - System Controller or Low Speed Shelf - Complementary, it provides a low speed protection bus in the receive direction.

Each LSSW circuit pack interfaces with up to 16 service DS3 and STS1E circuit packs, one protection DS3 circuit pack, and one protection STS1E circuit pack.

If a service DS3 or STS1E circuit pack fails, the input protection switching relays on the failed circuit pack route the three low speed signals (DS3 or EC-1) to the LSSW circuit pack in the IN slot. The LSSW circuit pack in the IN slot switches the three low speed signals (DS3 or EC-1) to the protection DS3 or STS1E circuit pack. In the receive direction, the LSSW circuit pack in the OUT slot accepts the three low speed signals (DS3 or EC-1) from the protection circuit pack (DS3 or

STS1E) and routes them to the output protection switching relays on the failed circuit pack and on to the DSX-3 or STSX-1 panel (or equivalent).

Shorting contacts are provided in the DS3 or STS1E circuit pack backplane connector so that when the circuit pack is removed, the DSX-3 or STSX-1 cables short through to the LSSW circuit packs for routing to the protection DS3 or STS1E circuit pack.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-25 provides an overall block diagram of the LSSW circuit pack.

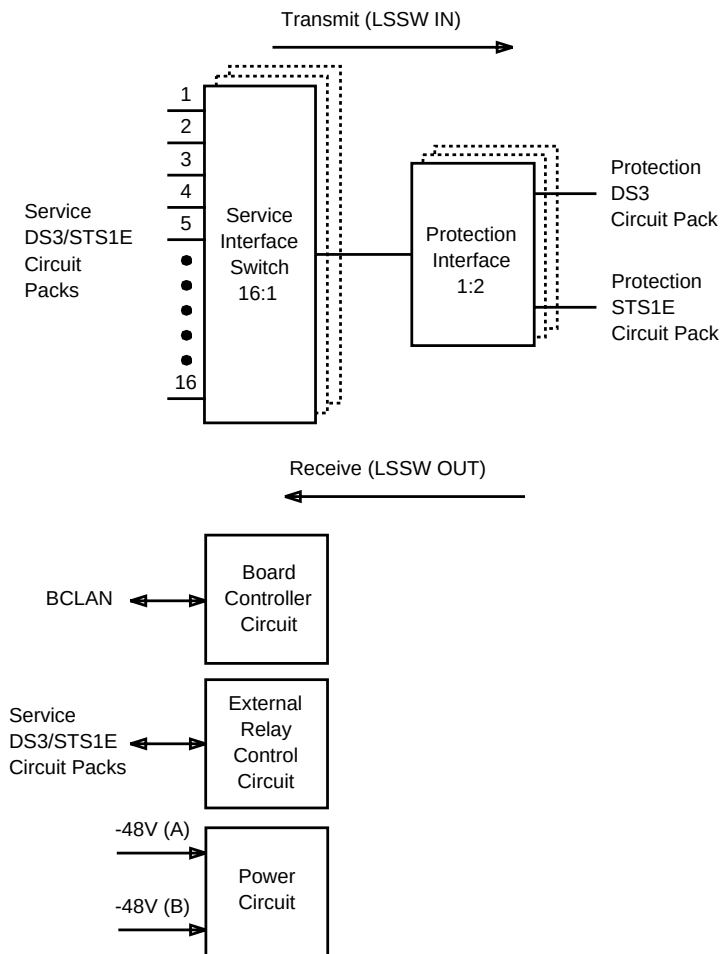


Figure 7-25. LSSW Circuit Pack Block Diagram

In the transmit direction, the LSSW circuit pack in the IN slot interfaces with up to 16 service DS3 and STS1E circuit packs, 1 protection DS3 circuit pack, and 1 protection STS1E circuit pack. If a service DS3 or STS1E circuit pack fails, the input protection switching relays on the failed circuit pack feed each of the three low speed signals (DS3 or EC-1) to the LSSW (IN) circuit pack. Shorting contacts are also provided in the DS3 and STS1E circuit pack backplane connectors so that when the circuit pack is removed, the DSX-3 or STSX-1 cables short through to the LSSW circuit packs for routing to the protection DS3 or STS1E circuit pack. The three low speed signals (DS3 or EC-1) are routed into a service interface switch on the LSSW (IN) circuit pack. Each service interface switch performs a 16:1 selection of the signal needing protection and terminates the other signals.

The three low speed signals are routed through the protection interface switches to the protection DS3 or STS1E circuit pack.

Receive Direction. In the receive direction, the LSSW circuit pack in the OUT slot accepts three DS3 or EC-1 signals from the protection DS3 or STS1E circuit pack. Each low speed signal (DS3 or EC-1) is routed through the protection interface switches and fed into a service interface switch. Each service interface switch performs a 1:16 selection to output the low speed signals to the output protection switching relays on the failed DS3 or STS1E circuit pack and on to the DSX-3 or STSX-1 panel (or equivalent).

When a service DS3 or STS1E circuit pack is reinserted in a slot, the protection switching relays remain in the protection state until the LNCTL circuit pack determines that the circuit pack is good.

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the Line Controller (LNCTL) circuit pack using the internal board controller local area network (BCLAN). The LSSW circuit pack reports the status of the circuit pack as well as the circuit pack inventory information (CLEI code, serial number, etc.). The status information is used by the LNCTL circuit pack for low speed protection switching. The LSSW circuit packs also respond to control signals from the LNCTL circuit pack; for example, low speed protection switching control.

The LSSW circuit packs also control the protection switching relays on the service DS3 and STS1E circuit packs. The LSSW circuit pack in the IN slot controls the protection switching relays on the DS3 and STS1E circuit packs in slots 1A through 4B. The LSSW circuit pack in the OUT slot controls the protection switching relays on the DS3 and STS1E circuit packs in slots 5A through 8B.

Power Circuitry

The LSSW circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces +5 volts used on the circuit pack.

The LSSW circuit packs also provide power to the protection switching relays on the service DS3 and STS1E circuit packs. The LSSW circuit pack in the IN slot powers the protection switching relays on the DS3 and STS1E circuit packs in slots 1A through 4B. The LSSW circuit pack in the OUT slot powers the protection switching relays on the DS3 and STS1E circuit packs in slots 5A through 8B.

The LSSW circuit pack monitors the two –48 volt sources to the circuit pack and any failures are reported to the board controller. If the LSSW circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the LSSW circuit pack.

Quick Reference Summary

Transmit Functions

The LSSW circuit pack performs the following transmit functions:

- a. Receives three DS3 or EC-1 signals from a failed DS3 or STS1E circuit pack
- b. Switches the three DS3 or EC-1 signals to the protection DS3 or STS1E circuit pack.

Receive Functions

The LSSW circuit pack performs the following receive functions:

- a. Receives three DS3 or EC-1 signals from the protection DS3 or STS1E circuit pack
- b. Switches the three DS3 or EC-1 signals to the correct service DS3 or STS1E circuit pack and to the DSX-3 or STSX-1 panel (or equivalent).

Control Functions

The LSSW circuit pack performs the following control functions:

- a. Controls and powers the protection switching relays on the DS3 and STS1E circuit packs
- b. Stores inventory information (CLEI code, serial number, etc.).
- c. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- d. Controls the circuit pack faceplate FAULT LED.

OC48 RCVR A/D (839B2, 839B4B, 839B5, and 839E5) Circuit Pack Description

Purpose of Circuit

The OC48 Receiver (OC48 RCVR A/D) circuit pack provides a high speed interface between an incoming OC-48 optical signal (2.5 Gb/s) and sixteen 155.52 Mb/s electrical signals. The 839B2 OC48 RCVR A/D circuit pack is used in bidirectional ring applications and is compatible with Release 3.0.1-ADR and later software. The 839B4B OC48 RCVR A/D circuit pack is a cost-reduced version of the 839B2 OC48 RCVR A/D circuit pack and is compatible with Release 7.0.0-ADR and later software.

The 839B5 OC48 RCVR A/D circuit pack is an enhanced version of the 839B4B OC48 RCVR A/D circuit pack with an STS-1 time slot assignment capability that allows STS-1 cross-connections.

The 839E5 OC48 RCVR A/D circuit pack provides an STS-1 time slot assignment capability that allows STS-1 cross-connections. This circuit pack is tuned "optimized" for the 1550 nm band and is required to support the DWDM feature (739E[1-8] circuit packs).

Faceplate LED

The OC48 RCVR A/D circuit pack has a red FAULT LED on its faceplate (Figure 7-26).

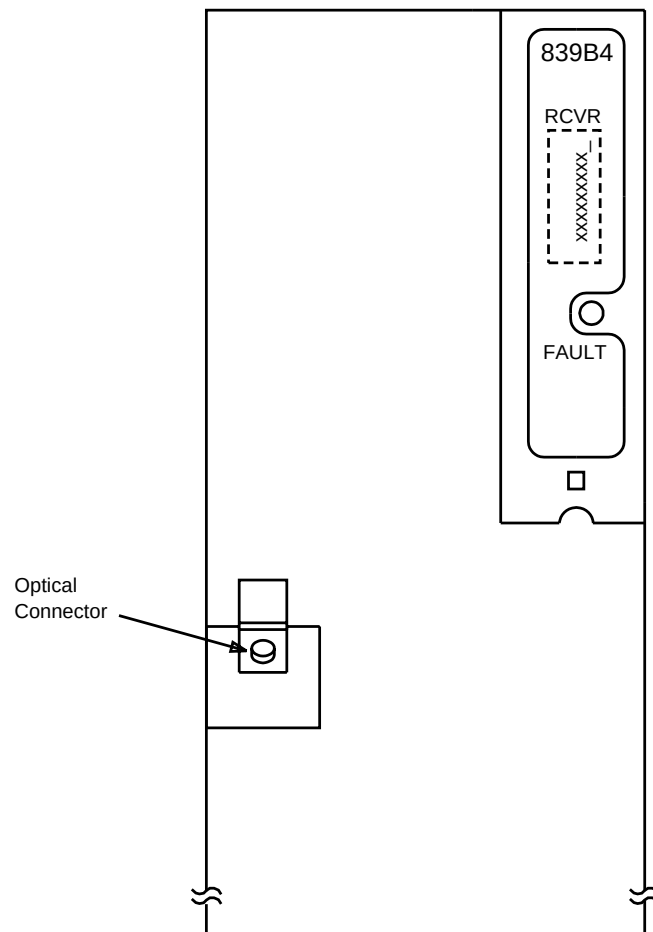


Figure 7-26. OC48 RCVR A/D (839B2, 839B4B, 839B5, and 839E5) Circuit Pack

The red FAULT LED is continuously lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the OC48 RCVR A/D circuit pack.

The board controller on the OC48 RCVR A/D circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the board controller is reset and the FAULT LED on the circuit pack is continuously lighted. If an incoming OC-48 signal fails, the FAULT LED will flash on and off.

General Description of Operation

The OC48 RCVR A/D circuit pack accepts the incoming OC-48 signal (2.5 Gb/s) and converts it to an electrical STS-48 signal. The STS-48 signal is descrambled and demultiplexed into sixteen 155.52 Mb/s signals. The SONET transport overhead bytes are also extracted and sent to the Overhead Controller - Terminal [OHCTL (TERM)] circuit pack. The 839B2 and 839B4B OC48 RCVR A/D circuit pack then passes the sixteen 155.52 Mb/s signals to the low speed interface circuit packs or the OC48 TRMTR A/D circuit pack in the opposite direction (bidirectional ring applications).

The 839B5 OC48 RCVR A/D circuit pack demultiplexes the STS-48 electrical signal into sixteen 155.52 Mb/s signals, which are fanned out to 54 STS-3 output ports through two parallel STS-1 time slot assignment (TSA) crosspoint switch devices. The sixteen 155.52 Mb/s signals are then passed to the low speed interface circuit packs or the OC48 TRMTR A/D circuit pack in the opposite direction (bidirectional ring applications).

Detailed Description of Operation

Transmission Circuitry

Figure 7-27 shows an overall block diagram of 839B2 and 839B4B OC48 RCVR A/D circuit packs, and Figure 7-28 shows an overall block diagram of the 839B5 and 839E5 OC48 RCVR A/D circuit pack. The OC48 RCVR A/D circuit pack accepts one 2.5 Gb/s non-return-to-zero (NRZ) SONET compatible optical signal. Fiber access to the OC48 RCVR A/D circuit pack is via a fixed *S*-type buildout block and a removable *S*-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate. Lightguide buildouts are chosen based on the attenuation desired, and the type of connector interface the single-mode lightguide jumper is equipped with. There are three types of lightguide buildouts available for the OC48 RCVR A/D circuit pack: *S*-type, FC/PC-type, and SC-type. All factory-equipped OC48 RCVR A/D circuit packs come with a removable *S*-type 0-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

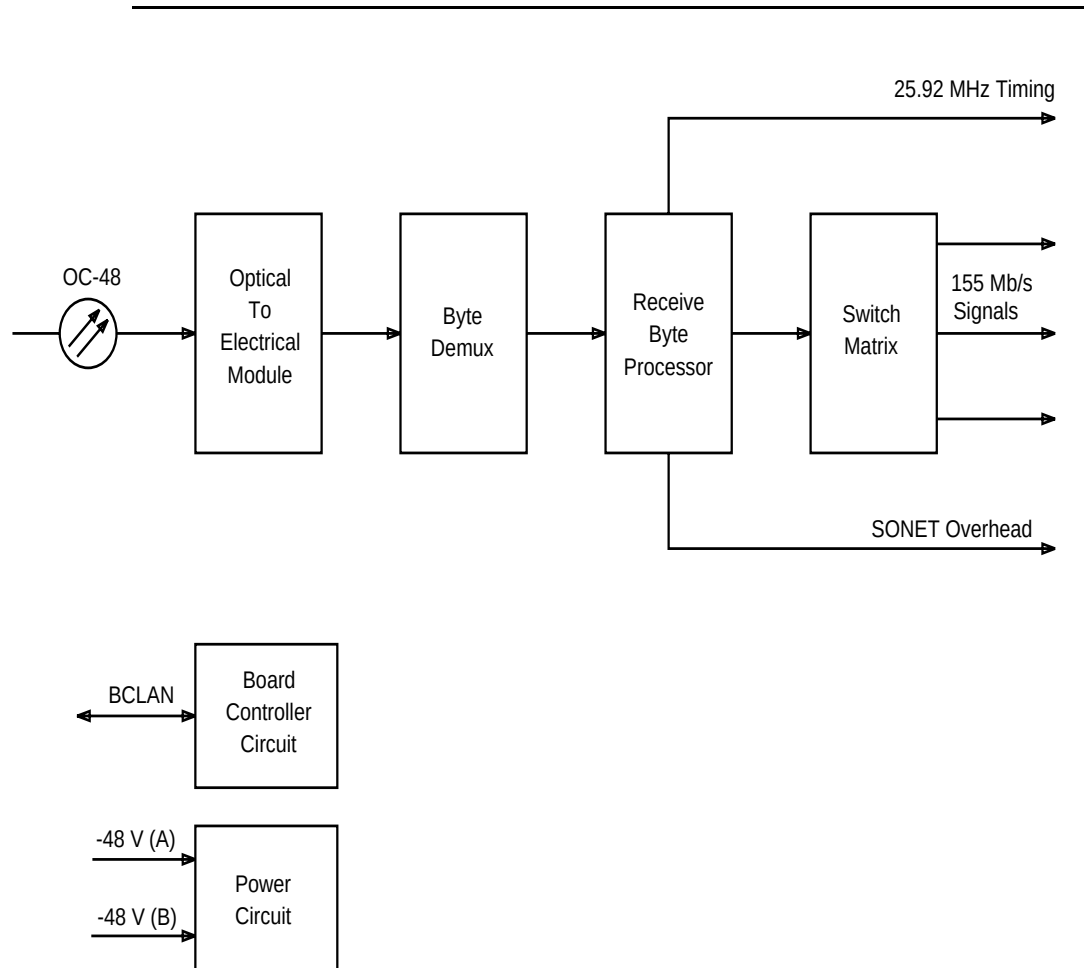


Figure 7-27. OC48 RCVR A/D (839B2 and 839B4B) Circuit Pack Block Diagram

The optical-to-electrical converter receives the OC-48 signal and converts it to an electrical STS-48 signal. The optical-to-electrical converter also detects OC-48 loss of signal (LOS). Timing is also extracted and the data is regenerated. The STS-48 data signal and 2.5 GHz clock signal are then passed to the byte demultiplexer.

The byte demultiplexer receives the STS-48 data signal from the optical-to-electrical converter and demultiplexes the STS-48 data signal into sixteen 155.52 Mb/s data signals. The sixteen 155.52 Mb/s data signals and a 155.52 MHz clock signal are sent to the receive byte processor.

The receive byte processor then frames on the incoming signals. The signals are descrambled and tested for section (B1) and line (B2) parity errors. The error rates are compared to user-settable thresholds. The SONET transport overhead bytes

are also extracted and sent to the optional OHCTL (TERM) circuit pack. The receive byte processor also tests overhead parity and inserts overhead alarm indication signals (AIS). The status of the K1 and K2 bytes (used for protection switching) is also monitored. A timing signal (25.92 MHz) is derived from the 2.5 GHz clock signal and sent to the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs.

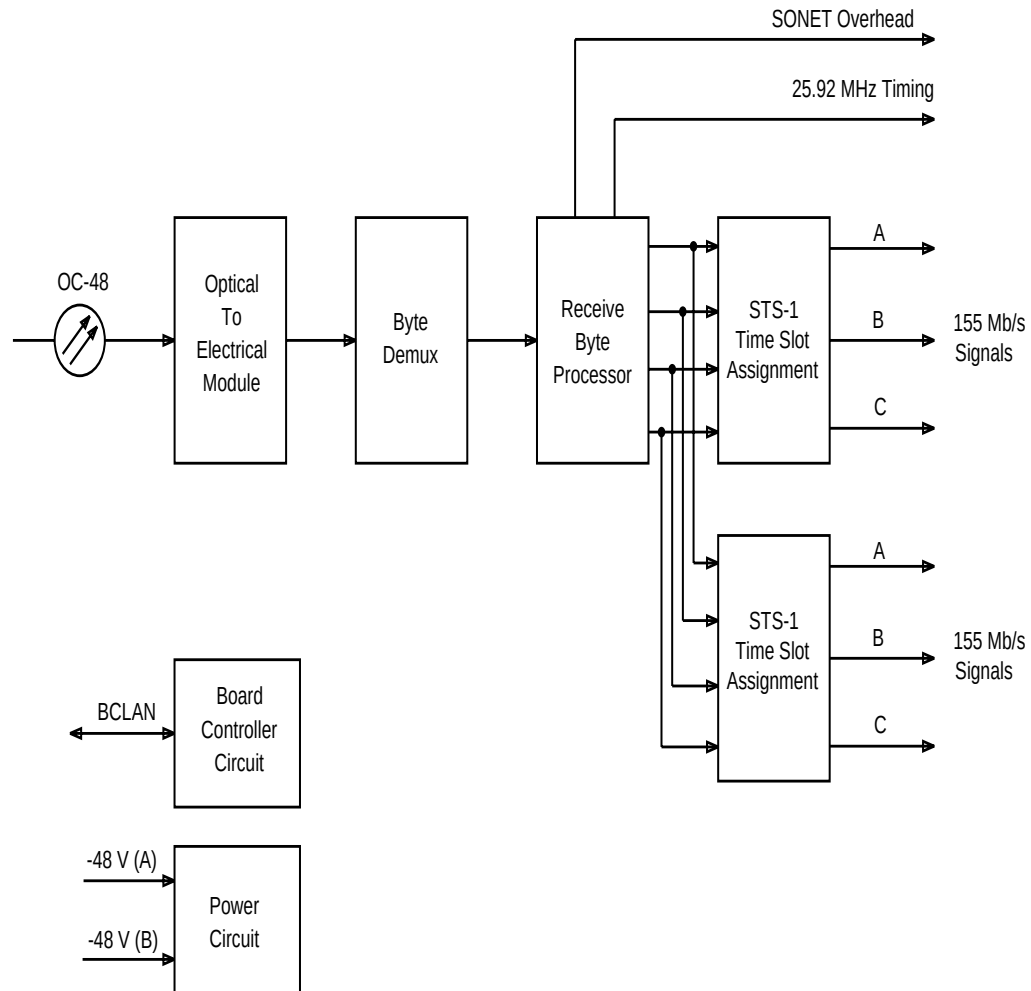


Figure 7-28. OC48 RCVR A/D (839B5 and 839E5) Circuit Pack Block Diagram

The 839B2, 839B4B, and 839E5 OC48 RCVR A/D circuit packs scramble the 155.52 Mb/s signals and pass them through a switching matrix to the low speed interface circuit packs. The switch matrix is used for implementing protection access, high speed protection, and low speed protection.

The receive byte processor (RBP) of the 839B5 OC48 RCVR A/D circuit pack transmits the sixteen 155.52 Mb/s signals to two STS-1 time slot assignment (TSA) devices that together form an equivalent 48x162 STS-1 crosspoint switch. Each STS-1 TSA device has 32 STS-3 inputs and 32 STS-3 outputs. The 16 155.52 Mb/s signal (STS-3) outputs from the receive byte processor are connected to the input of both STS-1 TSA devices (the other 16 inputs per device are unused). Fifty-four of the 64 total STS-3 output channels from the two devices are connected to the backplane.

Within the STS-1 TSA devices, the 16 STS-3 input channels are demultiplexed into 48 STS-1 tributaries. Each of these 48 inputs can be assigned to any of the 162 STS-1 time slots available in the 54 STS-3 output signals from the two devices. The STS-1 inputs can be broadcast to several or all outputs but do not have to be connected to any output. The 162 STS-1 signals are multiplexed back into 54 STS-3 signals after time slot assignment.

The connection matrix of the STS-1 TSA devices is programmed by the Board Controller. The switch fabric provisioning is fully data hitless and 100 percent non-blocking.

The STS-3 inputs to the STS-1 TSA devices are arranged in groups of four, or “quads.”

The outgoing STS-3 tributaries are arranged in three groups (A, B, and C), each containing sixteen service STS-3 tributaries and two protection STS-3 tributaries. A low speed protection switch can be performed by switching input signals to output protection tributaries.

The OC48 RCVR A/D circuit pack interfaces with up to three different buses (add/drop, high speed protection, and through) that carry up to eighteen 155.52 Mb/s signals each (sixteen service and two protection). The add/drop bus provides access to the low speed interface circuit packs. The high speed protection bus provides access to the OC48 TRMTR A/D circuit pack in the same direction for high speed line protection switching. The through bus provides access to the OC48 TRMTR A/D circuit pack for the 155.52 Mb/s signals that are passed through in bidirectional ring applications.

Control Circuitry

The board controller circuit controls most circuit pack activities. The board controller circuit interfaces with the Line Controller (LNCTL) circuit pack via the board controller local area network (BCLAN).

The OC48 RCVR A/D circuit pack reports the status of the circuit pack and the incoming OC-48 signal, as well as inventory information (CLEI code, serial number, etc.). The status information is used by the LNCTL circuit pack for fault detection and isolation. Conversely, the OC48 RCVR A/D circuit pack responds to control signals from the LNCTL circuit pack.

The OC48 RCVR A/D circuit pack also accesses the SONET transport overhead bytes and routes them via the transport overhead channel interface to the optional OHCTL (TERM) circuit pack.

Timing Circuitry

The receive byte processor of the OC48 RCVR A/D circuit pack generates a 25.92 MHz reference signal from the 2.5 GHz clock signal and sends it to the TG3 (DS1) circuit packs.

Protection Circuitry

High Speed Protection. In bidirectional ring applications, the FT-2000 OC-48 Add/Drop-Rings Terminal performs revertive bidirectional 2-fiber ring protection switching. The OC48 RCVR A/D circuit pack is protection switched by the LNCTL circuit pack in response to an external command, incoming signal failure, or internal equipment fault.

The switch matrix on the protection OC48 RCVR A/D circuit pack also allows access to the protection OC-48 high speed line (OC-48 point-to-point applications) or the protection 155.52 Mb/s signals (STS-3 tributaries in bidirectional 2-fiber ring applications) for low priority traffic or for restoration purposes.

Low Speed Protection. Low speed protection switching in the receive direction is done by routing the 155.52 Mb/s signal for the failed service electrical low speed interface circuit pack (DS3 or STS1E) to the protection DS3 or STS1E circuit pack. The OC48 RCVR A/D circuit pack also bridges the same 155.52 Mb/s signal (STS-3/3c) to the active and standby OC3 (1.3 STD) circuit packs. Low speed protection switching is performed in response to commands from the LNCTL circuit pack via the BCLAN.

Dual Ring Interworking Protection. The OC48 RCVR A/D circuit pack at the primary node of a dual ring interworking application bridges the 155.52 Mb/s signal (STS-3 tributary) in the drop direction to provide two identical signals to the other ring. One 155.52 Mb/s signal is sent to the local low speed interface circuit pack and the other 155.52 Mb/s signal is sent to the OC48 TRMTR circuit pack in the opposite direction for transmission to the secondary node. In Release 7 and later releases, the OC48 TRMTR circuit pack may switch to (select) the standby 51.84 Mb/s signal (STS-1 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The OC48 RCVR A/D circuit pack has an in-service and out-of-service built-in test capability. An out-of-service test is performed whenever the OC48 RCVR A/D circuit pack resets or is commanded to reset by the LNCTL circuit pack through the board controller local area network (BCLAN). When the OC48 RCVR A/D is inserted in a slot, an out-of-service test is also performed. In-

service testing is continuous. The board controller circuit reports errors when they occur to the LNCTL circuit pack via the BCLAN.

Performance Monitoring. The OC48 RCVR A/D circuit pack provides performance-monitoring circuitry for the following performance-monitoring parameters:

- Received optical power
- Loss of signal
- Loss of frame
- Bit error rate thresholds.

When an incoming line AIS, high speed defect, or internal fault is detected, the OC48 RCVR A/D circuit pack performs the following:

- Generates an STS-1 path AIS (if possible, since clock may not be available) toward the low speed interface circuit pack
- Signals the OC48 TRMTR circuit pack to insert a remote defect indicator-line (RDI-L) signal.

The OC48 RCVR A/D circuit pack passes through any remote defect indicator-path (RDI-P) signals and embedded DS3 AIS to the DS3 circuit packs. The OC48 RCVR A/D circuit pack also passes through any embedded STS-1 path AIS to the low speed interface circuit packs. The OC48 RCVR A/D also detects any incoming RDI-L signals.

Power Circuitry

The OC48 RCVR A/D circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. Modular DC-to-DC power converters produce +5 and –5.2 volts used on the circuit pack.

The OC48 RCVR A/D circuit pack monitors the two –48 volt sources to the circuit pack and any failures are reported to the board controller. If the OC48 RCVR A/D circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or +5 volt power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the OC48 RCVR A/D circuit pack.

Quick Reference Summary

Transmission Functions

The OC48 RCVR A/D circuit pack performs the following receive functions:

- a. Receives a SONET standard OC-48 optical signal
- b. Converts the OC-48 signal to an electrical STS-48 signal
- c. Extracts the 2.5 GHz clock signal and regenerates the STS-48 data signal

- d. Demultiplexes the STS-48 signal into sixteen 155.52 Mb/s signals
- e. Extracts the SONET transport overhead bytes and sends them to the OHCTL (TERM) circuit pack
- f. Routes the sixteen 155.52 Mb/s signals to two STS-1 time slot assignment (TSA) devices (839B5 or 839E5 OC48 RCVR A/D circuit packs only)
- g. Routes sixteen 155.52 Mb/s signals to the service DS3, STS1E, and/or OC3 (1.3 STD) circuit packs and one 155.52 Mb/s signal to the protection DS3 or STS1E circuit pack
- h. Passes through up to sixteen 155.52 Mb/s signals to the OC48 TRMTR A/D circuit pack in the opposite direction in bidirectional ring applications.

Timing and Control Functions

The OC48 RCVR A/D circuit pack performs the following timing and control functions:

- a. Extracts a 2.5 GHz clock signal from the incoming OC-48 signal
- b. Generates a 25.92 MHz timing reference signal and provides it to the TG3 (DS1) circuit packs
- c. Tests the incoming 155.52 Mb/s signals for section (B1) and line (B2) parity errors and compares the error rates to preset thresholds
- d. Monitors the K1 and K2 bytes
- e. Routes the 155.52 Mb/s signal for the failed service DS3 or STS1E circuit pack to the protection DS3 or STS1E circuit pack during low speed protection switching
- f. Routes the same 155.52 Mb/s signal to the active and standby OC3 (1.3 STD) circuit packs.
- g. Line switches up to eight 155.52 Mb/s signals to the OC48 TRMTR A/D circuit pack in the same direction in 2-fiber bidirectional ring applications.
- h. Allows access to the protection OC-48 high speed line (OC-48 point-to-point applications) or protection 155.52 Mb/s signals (STS-3 tributaries in 2-fiber bidirectional ring applications) for low priority traffic and for restoration access
- i. Bridges 155.52 Mb/s signals (STS-3 tributaries) at the primary node to provide two identical signals to the other ring in dual ring interworking applications
- j. Performs internal fault detection and interfaces with the LNCTL circuit pack using the board controller local area network (BCLAN)
- k. Controls the circuit pack faceplate FAULT LED
- l. Stores inventory information (CLEI code, serial number, etc.).

Maintenance Signal Functions

The OC48 RCVR A/D circuit pack performs the following maintenance signal functions:

- a. Detects incoming OC-48 loss of signal (LOS) and loss of frame (LOF)
- b. Detects line AIS from the incoming OC-48 signal
- c. Detects RDI-L signals from the incoming OC-48 signal
- d. Inserts an STS-1 path AIS in each STS-1 tributary of the 155.52 Mb/s signal transmitted to the low speed interface circuit pack.
- e. Signals the OC48 TRMTR circuit pack to insert an RDI-L signal in the OC-48 signal
- f. Passes RDI-P signals from the incoming OC-48 signal to the low speed interface circuit packs.
- g. Passes embedded DS3 AIS from the incoming OC-48 signal to the DS3 circuit pack.
- h. Passes embedded STS-1 path AIS from the incoming OC-48 signal to the low-speed interface circuit packs.

OC48 TRMTR A/D (739B_,739C_,739E_, 739G_,739H_, 739J_,739P5, 739R_,739S_) Circuit Pack Description

Purpose of Circuit

The OC48 Transmitter (OC48 TRMTR A/D) circuit pack provides a high speed interface between sixteen 155.52 Mb/s electrical signals and the outgoing OC-48 optical signal (2.5 Gb/s).

The 739B2, 739C2, and 739J2 OC48 TRMTR A/D circuit packs are used in bidirectional ring applications and are compatible with Release 3.0.1-ADR and later software. The 739J3 OC48 TRMTR (A/D 1.5 LBA) circuit pack is used in bidirectional ring applications and is compatible with Release 5.0.1-ADR and later software. The 739R2 OC48 TRMTR (A/D 1.5 LBA W1) and 739S2 OC48 TRMTR (A/D 1.5 LBA W2) circuit packs are used in bidirectional ring applications and are compatible with Release 6.0.0-ADR and later software. The 739E_, 739G_, and 739H_ circuit packs are used in DWDM applications and are compatible with Release 7.2 and later software.

The 739B4 OC48 TRMTR (A/D 1.3 STD) circuit pack is a cost-reduced version of the 739B2 OC48 TRMTR (A/D 1.3 STD) circuit pack. The following OC48 TRMTR circuit packs have an STS-1 time slot assignment capability that allows STS-1 cross-connections.

- 739B5 OC48 TRMTR (A/D STS1 1.3 STD)
- 739C5 OC48 TRMTR (A/D STS1 1.3 HI PERF)
- 739J5 OC48 TRMTR (A/D STS1 1.5 STD)
- 739P5 OC48 TRMTR (A/D STS1 1.5 LBA)
- 739R5 OC48 TRMTR (A/D STS1 1.5 LBA, W1)
- 739S5 OC48 TRMTR (A/D STS1 1.5 LBA, W2).
- 739E_ OC48 TRMTR (A/D STS1 1.5 360 km DISP)
- 739G_ OC48 TRMTR (A/D STS1 1.5 640 km DISP)
- 739H_ OC48 TRMTR (A/D STS1 1.5 60 km DISP)

Faceplate LED

The OC48 TRMTR A/D circuit pack has a red FAULT LED on its faceplate (Figure 7-29).

The red FAULT LED is lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the OC48 TRMTR A/D circuit pack.

The board controller on the OC48 TRMTR A/D circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the board controller is reset and the FAULT LED on the circuit pack is continuously lighted.

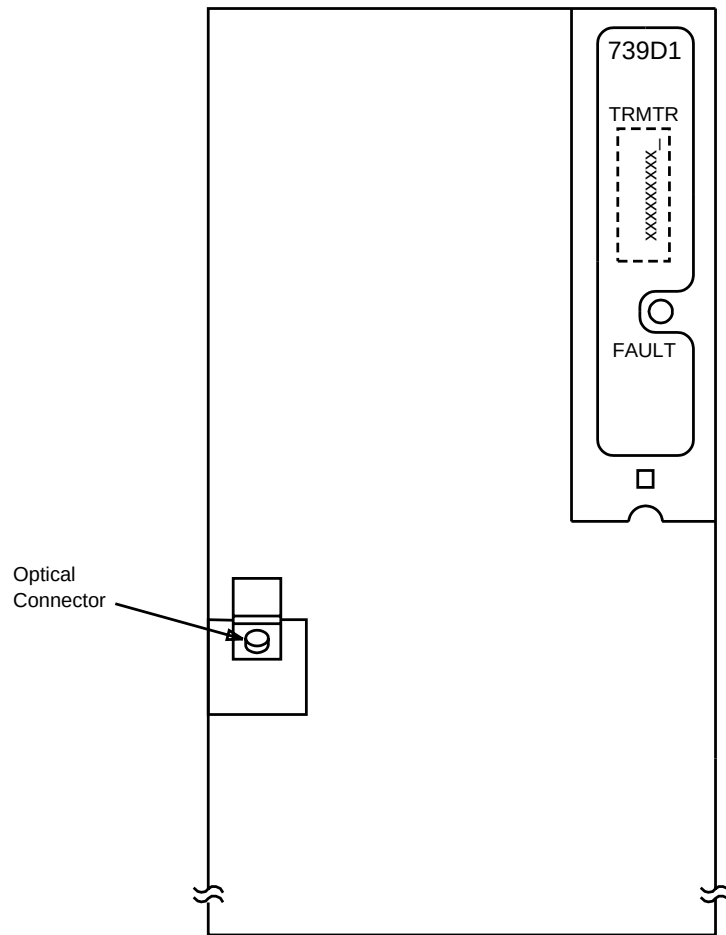


Figure 7-29. OC48 TRMTR A/D (739B2, 739B4, 739B5, 739C2, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J2, 739J3, 739J4, 739J5, 739P5, 739R2, 739R5, 739S2, and 739S5) Circuit Pack

General Description of Operation

The OC48 TRMTR A/D circuit pack interfaces with the outgoing high speed optical line. The OC48 TRMTR A/D circuit pack selects up to sixteen 155.52 Mb/s signals from sixteen DS3, STS1E, and/or OC3 (1.3 STD) circuit packs, one protection DS3 circuit pack, one protection STS1E circuit pack, or the OC48 RCVR A/D circuit pack in the opposite direction (bidirectional ring applications).

The 739B5, 739C5, 739E_, 739G_, 739H_, 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs demultiplex the 155.52 Mbs signals to STS-1 signals and select 48 STS-1 signals (out of 96 STS-1 signals) for STS-1 time slot

I assignment. The 739B5, 739C5, 739E_, 739H_, 739G_, 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs then multiplex the 48 STS-1 signals into sixteen 155.52 Mb/s signals.

The sixteen 155.52 Mb/s signals are frame-synchronized and multiplexed into an STS-48 signal (2.488 Gb/s). SONET line and section overhead bytes are also inserted into the STS-48 signal. The electrical STS-48 signal is then converted to an optical OC-48 signal for transmission over a single-mode fiber.

The OC48 TRMTR A/D circuit pack is available in the standard 1.3 μm , high performance 1.3 μm , and standard 1.5 μm options. For more information about loss budgets and transmission distances when operating with or without the FT-Lightwave Booster Amplifier (FT-LBA), refer to Section 10, "Technical Specifications."

Detailed Description of Operation

Transmission Circuitry

I Figure 7-30 shows an overall block diagram of the 739B2, 739B4, 739C2, 739J2, 739J4, 739R2, and 739S2 OC48 TRMTR A/D circuit packs. Figure 7-31 shows an overall block diagram of the 739B5, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs. The OC48 TRMTR A/D circuit packs interface with up to three different buses (add/drop, high speed protection, and through) that carry up to eighteen 155.52 Mb/s signals each (sixteen service and two protection). The add/drop bus provides access to the 155.52 Mb/s signals from the low speed interface circuit packs. The high speed protection bus provides access to the 155.52 Mb/s signals from the OC48 RCVR A/D circuit pack in the same direction for high speed line protection switching. The through bus provides access to the 155.52 Mb/s signals from the OC48 RCVR A/D circuit pack that are passed through in bidirectional ring applications.

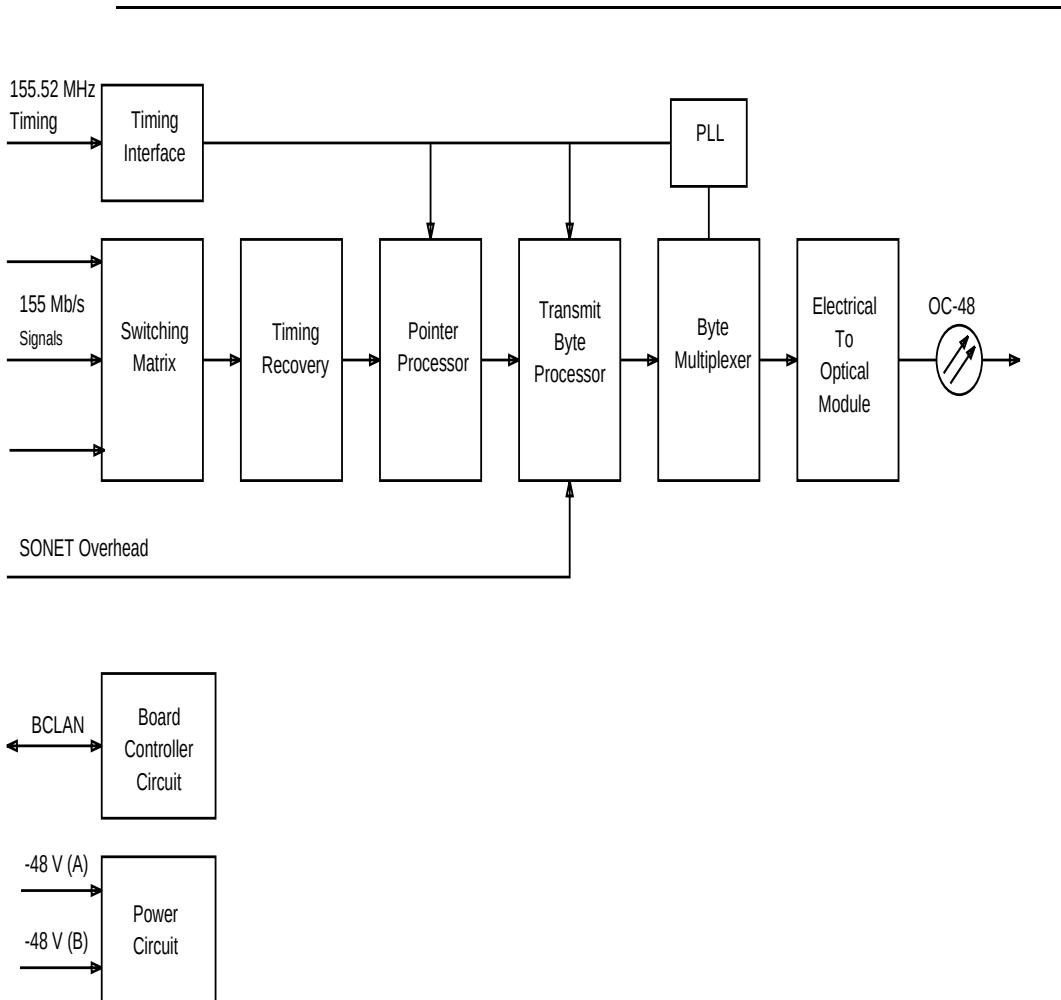


Figure 7-30. 739B2, 739B4, 739C2, 739J2, 739J3, 739J4, 739R2, and 739S2 OC48 TRMTR A/D Circuit Pack Block Diagram

A switching matrix interfaces with up to three 155.52 Mb/s buses (add/drop, high speed protection, and through) that carry up to eighteen 155.52 Mb/s signals each (sixteen service and two protection). The add/drop bus allows access to the low speed interface circuit packs for local traffic to be added. The high speed protection bus allows the through traffic from the OC48 RCVR (A/D) circuit pack to be looped back to the OC48 TRMTR (A/D) circuit pack. The through bus allows through traffic to be routed from OC-48 high speed line 1E to 1W or from OC-48 high speed line 1W to 1E. The switching matrix routes sixteen 155.52 Mb/s signals to the timing recovery circuit. The timing recovery circuit extracts a 155.52 MHz timing signal from the data stream, retimes the data with respect to the output clock, and passes it to the pointer processor.

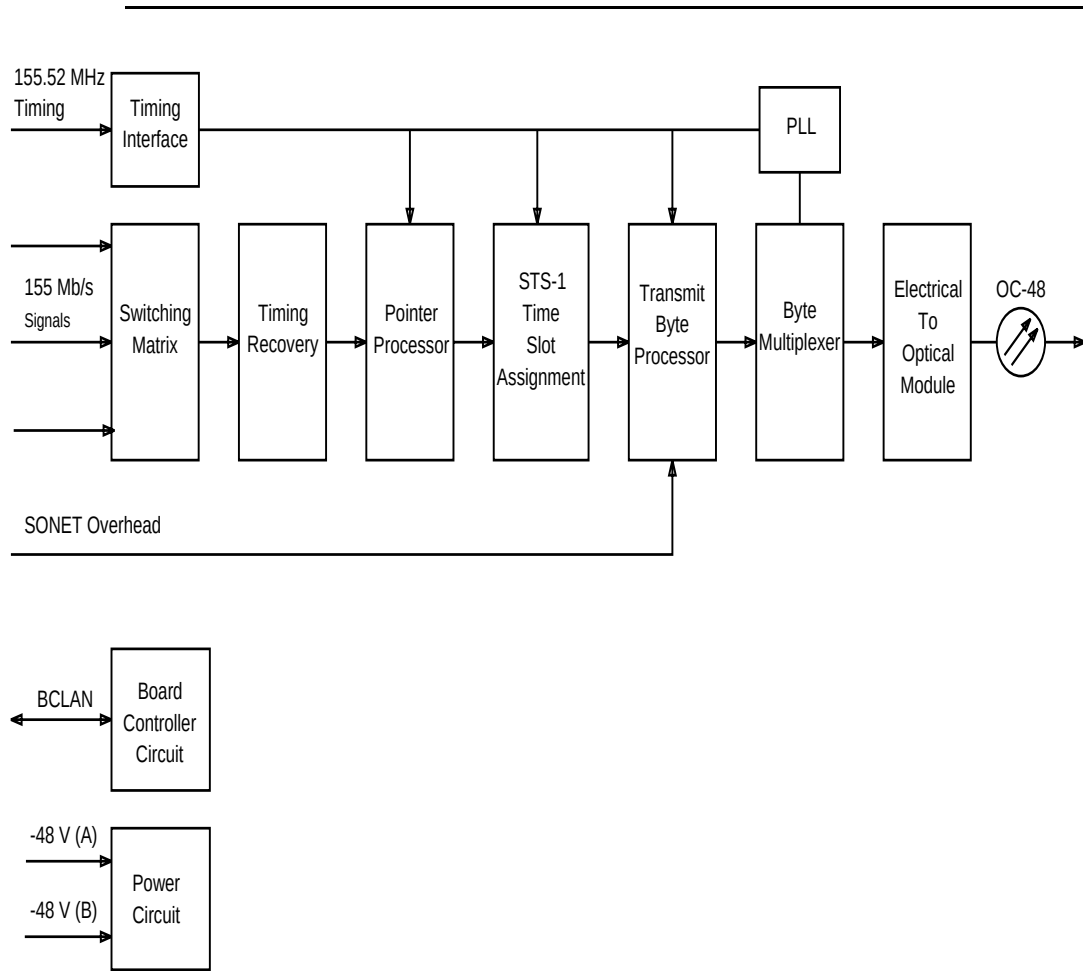


Figure 7-31. 739B5, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D Circuit Pack Block Diagram

The pointer processor performs phase, frequency, and frame realignment. The input data is descrambled and fed into an elastic store that accommodates input signal phase and wander. Frequency alignment is accomplished by using pointer adjustments (byte stuffs). New overhead frames are generated with respect to the local frame synchronization, and new pointer values are inserted into the outgoing overhead. After pointer processing, the 155.52 Mb/s signals are frame-synchronized and phase-aligned to the local system clock. The 739B2, 739B4, 739C2, 739J2, 739J3, 739J4, 739R2, and 739S2 OC48 TRMTR A/D circuit packs then pass the 155.52 Mb/s signals to the transmit byte processor. The 739B5, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs pass the 155.52 Mb/s signals to the STS-1 time slot assignment (TSA) device.

I The STS-1 TSA device in the 739B5, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs demultiplexes the 155.52 Mb/s (STS-3) signals to 96 STS-1 signals. Forty-eight STS-1 signals can be cross-connected to output time slots in the OC-48 signals. The STS-1 cross-connections are based on the connection matrix loaded into the STS-1 TSA device by the board controller. The STS-1 switch fabric provisioning is fully data hitless and 100 percent non-blocking. This allows any input STS-1 signal to be placed in any position in the byte interleaved OC-48 line signal. The STS-1 TSA device multiplexes the 48 STS-1 signals to sixteen STS-3 (155.52 Mb/s) signals and sends them to the transmit byte processor.

The transmit byte processor combines the pointer and payload information from the 155.52 Mb/s signals with internally and externally generated SONET transport overhead to form a parallel scrambled format. The optional Overhead Controller - Terminal [OHCTL (TERM)] circuit pack provides the externally generated SONET transport overhead bytes. The 155.52 Mb/s signals are then passed to the multiplexer circuit.

The multiplexer circuit byte interleaves the 155.52 Mb/s signals into a single 2.488 Gb/s STS-48 serial data stream and passes it to the electrical-to-optical module.

The electrical-to-optical module converts the STS-48 signal to an optical OC-48 signal. A single line distributed feedback laser with driver and control circuits converts the electrical signal to optical pulses for transmission.

Fiber access to the OC48 TRMTR A/D circuit pack is via a fixed *S*7-type buildout block and a removable *S*7-type, FC/PC-type, or SC-type lightguide buildout on the circuit pack faceplate. Lightguide buildouts are chosen based on the type of connector interface the single-mode lightguide jumper is equipped with. There are three types of lightguide buildouts available for OC48 TRMTR A/D circuit packs: *S*7-type, FC/PC-type, and SC-type. All factory-equipped OC48 TRMTR A/D circuit packs come with a removable *S*7-type 0-dB lightguide buildout. When installing or removing lightguide buildouts, do not pull the beam (front tab) outward. Pulling the beam (front tab) outward could result in breaking the beam (front tab).

Control Circuitry

The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the Line Controller (LNCTL) circuit pack via the board controller local area network (BCLAN).

The OC48 TRMTR A/D circuit pack reports the status of the circuit pack and the outgoing OC-48 signal, as well as inventory information (CLEI code, serial number, etc.). The status information is used by the LNCTL circuit pack for fault detection and isolation. Conversely, the OC48 TRMTR A/D circuit pack responds to control signals from the LNCTL circuit pack.

The OC48 TRMTR A/D circuit pack also accepts the SONET transport overhead bytes from the OHCTL (TERM) circuit pack via the transport overhead channel interface.

Timing Circuitry

The OC48 TRMTR A/D circuit pack accepts two 155.52 MHz timing references from the Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs. A switch device on the OC48 TRMTR A/D circuit pack selects one timing reference. A primary and secondary timing signal is provided for redundancy.

Protection Circuitry

High Speed Protection. In bidirectional ring applications, the FT-2000 OC-48 Add/Drop-Rings Terminal performs revertive bidirectional line protection switching. The OC48 TRMTR A/D circuit pack is protection switched by the LNCTL circuit pack in response to an external command, incoming signal failure, or internal equipment fault.

The switch matrix on the protection OC48 TRMTR A/D circuit pack allows access to the protection OC-48 high speed line (OC-48 point-to-point applications) or the protection 155.52 Mb/s signals (STS-3 tributaries in bidirectional 2-fiber ring applications) for low priority traffic or for restoration purposes.

Low Speed Protection. Low speed protection switching in the transmit direction is done by selecting a 155.52 Mb/s signal from the protection DS3 or STS1E circuit pack to substitute for a 155.52 Mb/s signal from a failed service DS3 or STS1E circuit pack. The OC48 TRMTR A/D circuit pack also accepts the same 155.52 Mb/s signal from a pair of 1+1 protected OC (1.3 STD) circuit packs. The OC48 TRMTR A/D circuit pack selects one 155.52 Mb/s signal as the active line and the other 155.52 Mb/s signal as the standby line. Low speed protection switching is performed in response to commands from the LNCTL circuit pack via the BCLAN.

Dual Ring Interworking Protection. The OC48 TRMTR A/D circuit pack at the primary node of a dual ring interworking application accepts an active 155.52 Mb/s signal (STS-3 tributary) from the local low speed interface circuit pack or an identical standby 155.52 Mb/s signal (STS-3 tributary) from the secondary node. If an incoming DS3 or EC-1 loss-of-signal condition is detected at the primary node, the LNCTL circuit pack broadcasts an automatic switch request to the board controller on the OC48 TRMTR A/D circuit pack via the BCLAN. In the add (toward to OC-48 line) direction only, the OC48 TRMTR A/D circuit pack switches to (selects) the standby 155.52 Mb/s signal (STS-3 tributary) from the secondary node. This completes the circuit from the secondary node to the termination node in the ring. Dual ring interworking protection switching also takes place in response to an unprotected incoming OC-3 loss-of-signal or loss-of-frame condition.

Synchronization Protection. Synchronization reference switching is done by selecting the primary or secondary synchronization reference signal from the TG3 (DS1) circuit packs. The OC48 TRMTR A/D circuit pack monitors these synchronization reference signals and can autonomously select the primary or secondary. The LNCTL circuit pack can inhibit this autonomous selection and make its own selection.

Fault Detection Circuitry

Monitoring and Testing. The board controller circuit monitors all the activities on the circuit pack. The OC48 TRMTR A/D circuit pack has an in-service and out-of-service built-in test capability. An out-of-service test is performed whenever the OC48 TRMTR A/D circuit pack resets or is commanded to reset by the LNCTL circuit pack through the board controller local area network (BCLAN). In-service testing is continuous. The board controller circuit reports errors when they occur to the LNCTL circuit pack via BCLAN. An out-of-service test is also performed whenever the OC48 TRMTR A/D circuit pack is inserted in a slot.

Performance Monitoring. The OC48 TRMTR A/D circuit pack performs the following performance-monitoring functions:

- Laser bias current
- Optical transmit power.

When an incoming high speed defect or line AIS is detected by the OC48 RCVR circuit pack, the OC48 TRMTR A/D circuit pack inserts an RDI signal in the outgoing OC-48 high speed signal.

When an incoming low speed defect is detected from the low speed interface circuit packs, the OC48 TRMTR A/D circuit pack inserts an STS-1 path AIS in each STS-1 tributary of the outgoing OC-48 high speed signal.

When an internal fault is detected in the OC48 TRMTR A/D circuit pack, a line AIS is inserted in the outgoing OC-48 high speed signal.

The OC48 TRMTR A/D circuit pack also passes through any remote defect indicator-path (RDI-P) signals, DS3 AIS, or STS-1 path AIS to the outgoing OC-48 high speed signal.

Power Circuitry

The OC48 TRMTR A/D circuit pack receives two sources of –48 volts that are diode OR'd, fused, and filtered. Modular DC-to-DC power converters produce +5, –5.2, +15 and –2 volts used on the circuit pack.

The OC48 TRMTR A/D circuit pack monitors the two –48 volt sources to the circuit pack and any failures are reported to the board controller. If the OC48 TRMTR A/D circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or +5 volt power converter fails, the LNCTL circuit pack provides +5 volts to light the FAULT LED on the OC48 TRMTR A/D circuit pack.

Quick Reference Summary

Transmit Functions

The OC48 TRMTR A/D circuit pack performs the following transmit functions:

- a. Accepts sixteen 155.52 Mb/s signals from the service DS3 and STS1E circuit packs, one 155.52 Mb/s signal from the protection DS3 circuit pack, and one 155.52 Mb/s signal from the protection STS1E circuit pack
- b. Demultiplexes the sixteen 155.52 Mb/s signals to 48 STS-1 signals, cross-connects the STS-1 signals to time slots in the OC-48 signal, and remultiplexes the 48 STS-1 signals to sixteen 155.52 Mb/s signals (739B5, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J5, 739P5, 739R5, and 739S5 OC48 TRMTR A/D circuit packs only)
- c. Inserts the SONET transport overhead bytes
- d. Bit-interleaves sixteen 155.52 Mb/s signals to produce a SONET standard STS-48 signal
- e. Modulates a laser transmitter to produce a SONET standard OC-48 optical signal.

Timing and Control Functions

The OC48 TRMTR A/D circuit pack performs the following timing and control functions:

- a. Selects the primary or secondary 155.52 MHz synchronization signal from the TG3 (DS1) circuit packs
- b. Provides selector circuitry for low speed protection switching
- c. Provides selector circuitry at the primary node for dual ring interworking protection switching
- d. Accepts up to eight 155.52 Mb/s signals from the OC48 RCVR A/D circuit pack in the opposite direction during line switches in bidirectional ring applications
- e. Allows access to the protection OC-48 high speed line (OC-48 point-to-point applications) or protection 155.52 Mb/s signals (STS-3 tributaries in 2-fiber bidirectional ring applications) for low priority traffic or for restoration purposes
- f. Performs internal fault detection and interfaces with the LNCTL circuit pack using the BCLAN
- g. Controls the circuit pack faceplate FAULT LED
- h. Stores inventory information (CLEI code, serial number, etc.).

Maintenance Signal Functions

The OC48 TRMTR A/D circuit pack performs the following maintenance signal functions:

- a. Inserts an RDI-L signal in the outgoing OC-48 high speed signal
- b. Inserts an STS-1 path AIS in each STS-1 tributary of the outgoing OC-48 high speed signal
- c. Inserts a line AIS in the outgoing OC-48 high speed signal
- d. Passes through any RDI-P signals from the low speed interface circuit packs to the outgoing OC-48 high speed signal
- e. Passes through any embedded DS3 AIS from the DS3 circuit packs to the outgoing OC-48 high speed signal.
- f. Passes through any embedded STS-1 path AIS from the low-speed interface circuit packs to the outgoing OC-48 high-speed signal.

TG3 (DS1) (LAA18) Circuit Pack Description

Purpose of Circuit

The Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit pack provides the OC48 Transmitter (OC48 TRMTR), DS3 Interface (DS3), and STS1 Electrical Interface (STS1E) circuit packs with their required timing signals.

Faceplate LED

The TG3 (DS1) circuit pack has a red FAULT LED on its faceplate (Figure 7-32). The red FAULT LED is lighted when a circuit pack failure is detected or when the circuit pack loses power. If the circuit pack loses power, a separate path is provided for power from the Line Controller (LNCTL) circuit pack to light the FAULT LED on the TG3 (DS1) circuit pack.

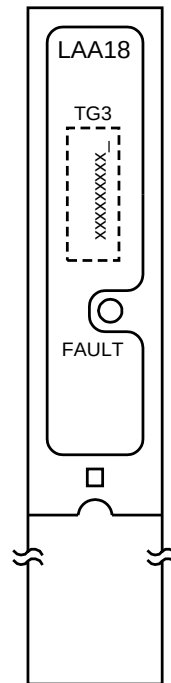


Figure 7-32. TG3 (DS1) (LAA18) Circuit Pack

The board controller on the TG3 (DS1) circuit pack detects hardware and software faults on the circuit pack. When a fault occurs, the board controller is reset and the FAULT LED on the circuit pack is continuously lighted. If an incoming DS1 reference signal fails, the FAULT LED will flash on and off.

General Description of Operation

The TG3 (DS1) circuit pack supports the synchronization features of the FT-2000 OC-48 Lightwave System in the following modes:

- **Externally timed mode:** In the externally timed mode each TG3 (DS1) circuit pack accepts a DS1 reference from an external stratum 3 or better clock. These references synchronize the local terminal, and any others that may loop time to it, with other network equipment operating under the same primary clock source. Within the TG3 (DS1) circuit pack, a highly stable digital phase-locked loop (DPLL) circuit removes any transient impairments on the DS1 reference for improved jitter performance.

The DS1 references are continuously monitored for error-free operation. If the selected reference becomes corrupted, the TG3 (DS1) circuit pack will select the protection reference without causing service degradations. If

both DS1 inputs are corrupted, the DPLL circuit holds the on-board oscillator frequency at the last good reference sample while the references are repaired (holdover mode).

The LAA18 TG3 (DS1) circuit pack will also provide an external DS1 synchronization output signal to the office building integrated timing supply (BITS) clock or other SONET network elements in an office. This DS1 output signal is derived directly from the 25.92 MHz line reference signal.

- **Through timed mode:** In the through timed mode (FT-2000 OC-48 Add/Drop-Rings Terminal only), the TG3 (DS1) circuit pack derives timing from the incoming OC-48 high speed signals. The number 1 TG3 (DS1) circuit pack accepts a 25.92 MHz line reference signal from the west OC48 RCVR circuit pack and derives the internal synchronization clock used by the east OC48 TRMTR (for through traffic), DS3 circuit packs terminating add/drop traffic from line 1E, and STS1E or OC3 (1.3 STD) circuit packs terminating add/drop traffic from line 1W. The number 2 TG3 (DS1) circuit pack accepts a 25.92 MHz line reference signal from the east OC48 RCVR circuit pack and derives the internal synchronization clock used by the west OC48 TRMTR (for through traffic), DS3 circuit packs terminating add/drop traffic from line 1W, and STS1E or OC3 (1.3 STD) circuit packs terminating add/drop traffic from line 1E. If the reference signals are corrupted or lost (for example, because of a cable cut), the DPLL circuit holds the on-board oscillator frequency at the last good reference sample (holdover mode).

The TG3 (DS1) circuit pack also provides an external DS1 synchronization output signal to the office BITS clock or other SONET network elements in an office. The LAA17 TG3 (DS1) circuit pack derives the DS1 output signal from the DPLL circuit. The LAA18 TG3 (DS1) circuit pack derives the DS1 output signal directly from the 25.92 MHz line reference signal.

- **Free running mode:** In the free running mode, the TG3 (DS1) circuit pack derives timing from a highly stable crystal oscillator. This oscillator has a long-term accuracy better than ± 4.6 ppm.

Line Timed: In line timed mode the TG3 (DS1) circuit pack derives timing from the incoming OC-48 high-speed signal. The number 1 TG3 (DS1) circuit pack accepts a 25.92 MHz line reference signal from the west OC48 RCVR circuit pack and derives the internal synchronization clock used by the east OC48 TRMTR. The number 2 TG3 (DS1) circuit pack accepts a 25.92 MHz line reference signal from the east OC48 RCVR circuit pack and derives the internal synchronization clock used by the west OC48 TRMTR. As a provisioning option, the user may choose which OC-48 line to derive timing from (e.g., E, W, or Auto). The type switching is always revertive.

Detailed Description of Operation

Control Circuitry

Figure 7-33 shows an overall block diagram of the LAA18 TG3 (DS1) circuit pack. The board controller circuit controls all the circuit pack activities. The board controller circuit interfaces with the LNCTL circuit pack via the BCLAN.

The TG3 (DS1) circuit pack reports the status of the circuit pack and the timing references, as well as inventory information (CLEI code, serial number, etc.). The status information is used by the LNCTL circuit pack for fault detection and isolation. Conversely, the TG3 (DS1) circuit pack responds to control signals from the LNCTL circuit pack.

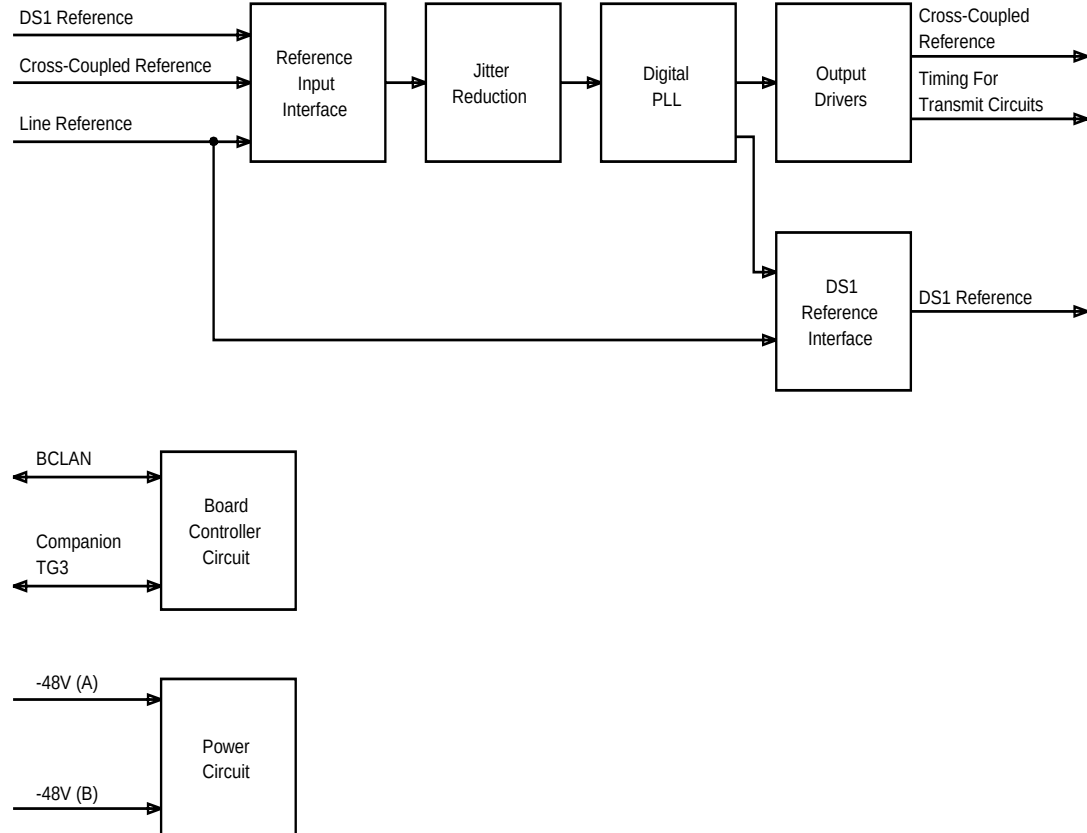


Figure 7-33. TG3 (DS1) (LAA18) Circuit Pack Block Diagram

Timing Circuitry

Reference Input Interface Circuit. The reference input interface circuit provides the required interface to all the reference inputs and selects one of the inputs as the timing reference. The reference input interface circuit interfaces with the following references:

- One external DS1 reference signal (1.544 MHz) from a stratum 3 or better source
- One line reference signal (25.92 MHz) from the OC48 Receiver circuit pack (up to four line reference signals in a future release)
- One cross-coupled reference signal (25.92 MHz) from the companion TG3 (DS1) circuit pack.

Jitter Reduction Circuit. The jitter reduction circuit reduces the jitter on the selected reference input before it enters the digital phase-locked loop circuit.

Digital Phase-Locked Loop Circuit. The digital phase-locked loop (DPLL) circuit consists of a digital counter, a microcontroller, a digital-to-analog converter, and a 51.84 MHz ovenized, voltage-controlled crystal oscillator. The microcontroller and software determine the loop parameters and loop performance, as well as reference monitoring and switching functions. The microcontroller periodically reads phase information contained in the digital counter. This information is used by the software to determine phase error and control the frequency output of the oscillator. The phase-locked loop incorporates a microprocessor as the loop filter. Software in this processor determines the loop bandwidth and performance, as well as monitoring and switching functions.

Output Driver Circuits. The output driver circuits generate and distribute the following types of timing signals:

- A 155.52 MHz signal is distributed to the OC48 Transmitter (OC48 TRMTR) and low speed interface circuit packs.
- A 25.92 MHz cross-coupled reference signal is distributed to the companion TG3 (DS1) circuit pack.

DS1 Reference Interface Circuit. The DS1 reference interface circuit generates and distributes a 1.544 MHz (DS1) synchronization output signal to the office BITS clock or other SONET network elements in an office. In the LAA18 TG3 (DS1) circuit pack (Figure 7-33), the DS1 reference interface circuit derives the DS1 output signal directly from the 25.92 MHz line reference. The DS1 reference interface circuit of the LAA18 TG3 (DS1) circuit pack also accepts a 51.84 MHz signal from the digital phase-locked loop circuit to generate DS1 alarm indication signals (AIS) whenever the line reference is not acceptable.

Protection Circuitry

The TG3 (DS1) circuit packs are 1x1 (revertive) protected. When the active TG3 (DS1) circuit pack board controller determines that its clock output is out of tolerance, it suppresses its timing outputs and signals the LNCTL circuit pack. The

LNCTL circuit pack signals the companion TG3 (DS1) circuit pack of the failed condition. The suppressed timing outputs cause the transmission circuit packs to perform a hardware switch to the standby TG3 (DS1) circuit pack.

Timing reference switching is done by selecting the primary or secondary reference signal (phase locked mode or loop timed mode). In the phase locked mode, if the primary DS1 reference signal fails, the secondary DS1 reference signal will be selected. If both DS1 reference signals fail, the TG3 (DS1) circuit pack holds the on-board oscillator frequency at the last good reference sample (holdover mode) while the DS1 reference signals are repaired.

In the loop timed mode, if the primary line reference fails, the secondary line reference is selected. If both line references fail, the TG3 (DS1) circuit pack will attempt to select the primary DS1 reference (if equipped). If the primary DS1 reference is not equipped or fails, the TG3 (DS1) circuit pack will attempt to select the secondary DS1 reference (if equipped). If all four of these references fail, the TG3 (DS1) circuit pack will enter the holdover mode.

In the through timed mode, if both line references fail, the TG3 (DS1) circuit pack will enter the holdover mode.

Fault Detection Circuitry

The TG3 (DS1) circuit pack has an in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the LNCTL circuit pack via the BCLAN. An out-of-service test is performed whenever the TG3 (DS1) circuit pack is inserted in a slot or reset.

The TG3 (DS1) circuit pack also monitors the incoming DS1 timing reference signals for the following:

- Loss of signal (175 ± 75 consecutive zeros)
- DS1 alarm indication signal (AIS) for at least 125 μ sec
- Bit error rate (BER) greater than 2×10^{-4} for a period ≥ 3 seconds
- Loss of frame for a period ≥ 3 seconds
- Excessive out-of-frame count
- Clock frequency out of specifications.

If one TG3 (DS1) circuit pack detects an incoming DS1 reference failure, it will signal the LNCTL circuit pack. The LNCTL circuit pack signals the companion TG3 (DS1) circuit pack to accept the secondary DS1 reference signal.

Power Circuitry

The TG3 (DS1) circuit pack receives two sources of -48 volts that are diode OR'd, fused, and filtered. A modular DC-to-DC power converter produces $+5$, -15 , and $+15$ volts used on the circuit pack.

The TG3 (DS1) circuit pack monitors the two –48 volt sources to the circuit pack and any failures are reported to the board controller. If the TG3 (DS1) circuit pack detects a failure of the onboard fuse or power converter, the red FAULT LED will light. If the fuse or +5 volt power converter fails, the LNCTL circuit provides +5 volts to light the FAULT LED on the TG3 (DS1) circuit pack.

Quick Reference Summary

Provisioned Modes

The TG3 (DS1) circuit pack can be provisioned using the craft interface terminal (CIT) for one of the following modes:

a. **Externally timed mode**

In the externally timed mode the TG3 (DS1) circuit pack phase locks to an external stratum 3 (± 4.6 ppm) or better external DS1 reference signal (1.544 MHz). The TG3 (DS1) circuit pack may be provisioned to accept a DS1 reference signal in the superframe or extended superframe format. It can also be provisioned with bipolar 8-zero substitution (B8ZS) or alternate mark inversion (AMI) line coding.

b. **Through timed mode**

In the through timed mode, the TG3 (DS1) circuit pack phase locks to an OC-48 line reference signal (25.92 MHz) provided by the OC48 Receiver (OC48 RCVR) circuit pack (FT-2000 OC-48 Add/Drop-Rings Terminal only).

c. **Free running mode**

In the free running mode, the TG3 (DS1) circuit pack generates timing from an on-board high stability fixed oscillator. The oscillator has a long-term accuracy of ± 4.6 ppm.

d. **Line Timed**

In the line timed mode, the TG3 (DS1) circuit pack phase locks to an OC-48 line reference signal (25.92 MHz) provided by the OC48 Receiver circuit pack (FT-2000 OC-48 ADR Terminal only). The direction selected (E, W, or Auto) is determined via provisioning. Also, the method for obtaining backup, or no backup, is determined at provisioning.

The equalization level of the DS1 reference output signals may also be provisioned. For detailed information about provisioning, refer to Section 8, "Administration and Provisioning."

Holdover Mode

The holdover mode can only be entered from the externally timed mode, loop timed mode, or through timed mode. In the holdover mode, the DPLL circuit uses storage techniques to maintain the last known good frequency of the external DS1 reference signal or line reference signal. The holdover mode is entered when the

integrity of the external DS1 reference signal or line reference signal is considered unacceptable. In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

Reference Input Functions

The incoming DS1 timing references are monitored for:

- a. Loss of signal (175 ± 75 consecutive zeros)
- b. DS1 alarm indication signal (AIS) for at least 125 μ sec
- c. Bit error rate (BER) greater than 2×10^{-4} for a period ≥ 3 seconds
- d. Loss of frame for a period ≥ 3 seconds
- e. Excessive out-of-frame count
- f. Clock frequency out of specifications.

If the microprocessor on one TG3 (DS1) circuit pack detects an incoming DS1 reference failure, it will signal the LNCTL circuit pack. The LNCTL circuit pack will signal the microprocessor on the companion TG3 (DS1) circuit pack to accept the secondary DS1 reference signal.

Clock Output Functions

The TG3 (DS1) circuit pack provides the following output signals:

- a. A 155.52 MHz signal is distributed to the OC48 Transmitter (OC48 TRMTR) and low speed interface circuit packs.
- b. A 25.92 MHz cross-coupled reference signal is distributed to the companion TG3 (DS1) circuit pack.
- c. A 1.544 MHz (DS1) signal is made available as a synchronization reference for the office BITS clock or other central office equipment.

Control Functions

The TG3 (DS1) circuit pack provides the following control functions:

- a. Selects the primary or secondary timing reference signal in the loop timed and phase locked modes
- b. Performs internal fault detection and interfaces with the LNCTL circuit pack using the BCLAN
- c. Controls the circuit pack faceplate FAULT LED
- d. Stores inventory information (CLEI code, serial number, etc.).

Maintenance Functions

The TG3 (DS1) circuit pack provides the following maintenance functions:

- a. Monitors the DS1 timing references

- b. Monitors the internal clock hardware
- c. Detects and inserts DS1 alarm indication signals (AIS).

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Overview

This section describes the administration and provisioning features of the FT-2000 OC-48 Lightwave System. It also presents a list of provisionable parameters with their ranges and original values.

Administration

Memory Administration

The FT-2000 OC-48 Lightwave System memory consists of the following:

- Executable code: This is the collection of "programs" that controls the operation of the system.
- Data: This is a collection of system parameters and their associated values. A parameter is a characteristic of the system that affects its operation. A value is a number, text string, or other menu selection associated with a parameter.

There are two complete copies of executable code in the system under normal conditions. One complete copy of executable code is located in the nonvolatile memory of the System Memory (SYSMEM) circuit pack. The other copy is distributed in the volatile memory of the System Controller (SYSCTL), the Line Controller (LNCTL) circuit packs, the Overhead Controller - Terminal [OHCTL (TERM)] circuit pack, and the individual board controllers on the other circuit packs. The system executes the copy in the board controllers and the SYSCTL, LNCTL, and OHCTL (TERM) circuit packs.

There are three sets of data in the system under normal conditions:

- Two sets of data are located in the nonvolatile memory of the SYSMEM circuit pack.
 - One set contains the system parameters and their original values (value assigned to a parameter at the factory).
 - The second set contains the system parameters and their current values (values currently being used by the system).
- The third set of data is located in the volatile memory of the SYSCTL, LNCTL, and OHCTL (TERM) circuit packs, plus the board controller of the other circuit packs. This set contains the system parameters and their current values.

If the system loses power and then regains power, the executable code and the data (with current values) are copied from the nonvolatile memory in the SYSMEM circuit pack to the volatile memory in the SYSCTL circuit pack. The system then starts running the executable code.

If the SYSCTL circuit pack is replaced, the executable code and data (with current values) are copied from the nonvolatile memory in the SYSMEM circuit pack to the volatile memory in the SYSCTL circuit pack. The system then starts running the executable code.

If the SYSMEM circuit pack is replaced and the executable code in the new SYSMEM circuit pack is different from what is running in the SYSCTL circuit pack, one of the following functions can be performed:

- Load another copy of the currently running version of the executable code from the craft interface terminal (CIT) to the SYSMEM circuit pack.
- Restart the system with the version of executable code in the new SYSMEM circuit pack.

The LNTCL and OHCTL circuit pack functions are not stopped when a SYSMEM unrecognizable code or SYSMEM/SYSCTL code mismatch condition is active after replacing a SYSMEM circuit pack.

The FT-2000 OC-48 Lightwave System supports the following CIT memory administration functions:

- **Install-Software:** This copies the executable code and original values from floppy disks in the CIT to the SYSMEM circuit pack. Refer to the Install-Software function in the "Operation" Tab of this manual.
- **Initialize-System:** The **CONFIGURATION-Initialize-System** input replaces most current values in the SYSMEM circuit pack with the original values in the SYSMEM circuit pack and initiates the reset function (see Reset). All cross-connections, loopbacks, and switch states are retained. However, 1+1 protection switch states are not retained. Automatically

provisioned parameters are unaffected by this command. The current values that are not replaced with their original values are those set with the following inputs:

- **CONFIGURATION-Set-Date**
 - **SECURITY-Set-Password**
 - **SECURITY-Set-Login**
 - **SECURITY-Set-Security**
 - **SECURITY-Set-Network Element**
- **Reset:** The **FAULT-Reset** input copies the current values from the SYSCTL circuit pack to the SYSMEM circuit pack and the executable code from the SYSMEM circuit pack to the SYSCTL circuit pack. The executable code in the SYSCTL circuit pack is then restarted and the current values in the SYSMEM circuit pack are reformatted to work with the new executable code.
 - **Update:** The **CONFIGURATION-Update** input updates the state of all the automatically provisioned parameters based on what circuit packs are present and the condition of the incoming signals. Refer to "Provisionable Parameters and Original Values" in this section for more information about automatically provisioned parameters.

Version Recognition

The FT-2000 OC-48 Lightwave System provides automatic version recognition of all the hardware and software installed. The FT-2000 OC-48 Lightwave System is able to report the type and version of the circuit pack that is installed in each slot. Each circuit pack's *Common Language** **CLEI*** code and serial number are stored on the circuit pack and are accessible by the System Controller circuit pack. The equipment catalog item (ECI) version identification and apparatus code for each circuit pack is also provided. Refer to the **CONFIGURATION-Retrieve-Equipment** input in Section 11, "Craft Interface Terminal Usage."

Security

General

The FT-2000 OC-48 Lightwave System provides a security function to protect against unauthorized access to the CIT functions (for example, provisioning). The security function limits access to the FT-2000 OC-48 Lightwave System to

* Common Language is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

legitimate users only. Security is provided using a four tier approach that provides maximum flexibility and control. The four tiers are:

- Port security
- User login security
- Network element login security
- Password aging.

Port Security

Port security provides the capability to control user access to the FT-2000 OC-48 Lightwave System on a per port basis. Port security includes the following:

- **Provisionable port status:** Dial-up access using the CIT (DTE) port and remote access using the DCC may be enabled to allow users to log in to that port or disabled to deny any attempt to log in to that port. Local access to the CIT (DCE) port may never be disabled. However, legitimate logins to the CIT (DCE) port are required.
- **Inactivity timers:** A provisionable inactivity timer (0-999 minutes) is provided for the local CIT (DCE), CIT (DTE) and CIT (DCC) ports, which can also be provisioned through TL1. If the user does not interact with the FT-2000 OC-48 Lightwave System within the provisioned time, the user will automatically be disconnected. The inactivity timer is reset by any data received at the port from a user, regardless of whether the data is addressed to a local or remote login session. The inactivity timer is also reset by any output addressed to the local port, regardless of origin (local or remote login session).

The **SECURITY-Set-Security-Port** input is used to enable/disable port security. For more information about provisioning port security, refer to the **SECURITY-Set-Security-Port** input in the "Local Provisioning" part of this section.

The **SECURITY-Retrieve-Security-Port** input is used to report port status. For information about the access port security configuration report, refer to the **SECURITY-Retrieve-Security-Port** input in Section 11, "Craft Interface Terminal Usage."

User Login Security

User login security provides the capability to control access to the FT-2000 OC-48 Lightwave System on an individual user basis. User login security includes the following:

- **Login ID and password:** All users must properly identify themselves by providing a valid login ID and password before gaining access to the FT-2000 OC-48 Lightwave System.

- **Four levels of access privileges:** Each user login ID is assigned one of the following access levels to control which system functions may be performed.
 - **Privileged/Expert:** A privileged login gains access to the "expert" input set by invoking the CIT-PC program in the expert mode. A privileged login in the expert mode has access to all the system functional capabilities. A privileged login in the expert mode is also allowed to execute the auto turnup tests and specify certain inputs that affect all low-speed ports in the system (for example, inputs that have the potential for massive service interruption).
 - **General:** The general logins have access to all the system functional capabilities except the security, access, system initialization, and software installation functions. General logins do not have access to the **Set - Date** input.
 - **Reports Only:** The reports only logins have access to the **Retrieve, Set - Password, Test - LED, and Operate - Alarm Cutoff** inputs. The reports only logins are not allowed to change any of the system provisioning values; however, reports only logins may change their password.

For information about the security level associated with each CIT-PC input, refer to the appropriate Inputs (Commands) Menu table in Section 11, "Craft Interface Terminal Usage."

- **Visitor Logins:** Visitor logins may be provisioned with expiration dates. Visitor logins are automatically deleted on the provisioned expiration date regardless of their use. Visitor logins are general or reports only logins.

A privileged user can create up to 98 nonprivileged logins per system. Login IDs and passwords are administered with the **SECURITY-Set - Login - Enter**, **SECURITY-Set - Login - Change**, and **SECURITY-Set - Login - Delete**, inputs. For more information about provisioning user login security, refer to the **SECURITY-Set - Login - Enter**, **SECURITY-Set - Login - Change**, and **SECURITY-Set - Login - Delete**, inputs in the "Local Provisioning" part of this section.

The **SECURITY-Retrieve - Login** input is used to report login status. For information about the login report, refer to the **SECURITY-Retrieve - Login** input in Section 11, "Craft Interface Terminal Usage."

Network Element Login Security

Network element login security provides the capability to control access to the FT-2000 OC-48 Lightwave System on a network element basis. Network element login security is provided by controlling whether or not nonprivileged (general or reports only) users are allowed to access the network element. When logins are allowed, nonprivileged users may log in and access the network element. When logins are not allowed, login attempts are denied. Privileged users are not affected by this security measure and are always allowed to log in.

Network element security is intended to disable nonprivileged logins quickly on a temporary basis. This capability might be used during routine maintenance or upgrade activities. Permanent security should be provided using port security or user login security.

Login aging prevents inactive, nonprivileged users from accessing the FT-2000 OC-48 Add/Drop-Rings Terminal. If the difference between the last login date and the current date* of a nonprivileged login *exceeds the provisioned login lifetime parameter, the login is automatically deleted. An audit runs each day at 11:59 p.m. to check for and delete expired logins. The same audit automatically deletes visitor logins at 11:59 p.m. on the provisioned expiration date. Login aging applies only to nonprivileged logins. A privileged login is never deleted.

The **SECURITY-Set-Security-Network Element** input is used to enable/disable nonprivileged user logins. For more information about provisioning network element security, refer to the **SECURITY-Set-Security-Network Element** input in the "Local Provisioning" part of this section.

The **SECURITY-Retrieve-Security-Network Element** input is used to report whether logins are allowed or not. For information about the global security report, refer to the **SECURITY-Retrieve-Security-Network Element** input in Section 11, "Craft Interface Terminal Usage."

Password Aging

Password aging provides the capability to force users to periodically change their password. If the users do not change their password within the provisioned period of time, their password will expire. The next time the users attempt to login, they will not be allowed to execute any commands until they change their password.

To enable password aging, the password aging interval must be provisioned in the range of 7 to 999 days. To disable password aging, the password aging interval must be provisioned to 0 days.

If password aging is enabled, a user may not change a password unless at least 7 days have passed since the last password change for that login. Any attempt to change a password when less than 7 days have passed shall be denied.

The **SECURITY-Set-Security-Network Element** input is used to enable/disable password aging and provision the password aging interval. For more information about provisioning password aging, refer to the **SECURITY-Set-Security-Network Element** input in the "Local Provisioning" part of this section.

* A privileged user may change the current date using the Set-Date input so that the login lifetime is exceeded even though the number of calendar days since the last login attempt is less.

The **SECURITY-Retrieve-Security-Network Element** input is used to report the password aging interval in days. For information about the global security report, refer to the **SECURITY-Retrieve-Security-Network Element** input in Section 11, "Craft Interface Terminal Usage."

Software Upgrades

The FT-2000 OC-48 Lightwave System provides an in-service software upgrade capability using a CIT locally or remotely (with a modem or digital data network). The CIT (PC running FT-2000 CIT-PC software) must be used locally to install the initial software into a system. Remote software upgrades over the OC-48 data communications channel (DCC) are possible. The **CONFIGURATION-Copy-Program** input copies the software contained in the SYSMEM circuit pack of one FT-2000 OC-48 Add/Drop-Rings Terminal (source) to the SYSMEM circuit pack of another FT-2000 OC-48 Add/Drop-Rings Terminal (destination).



NOTE:

Software can be installed via the ITM-SNC with an FT-2000 OC-48 Add/Drop-Rings Terminal Release 9.0 or later and an ITM-SNC Release 5.0 or later.

The FT-2000 OC-48 Add/Drop-Rings Terminal can copy software to another FT-2000 OC-48 Add/Drop-Rings Terminal in the same ring and through DDM-2000 NEs to a remote FT-2000 OC-48 Add/Drop-Rings Terminal in the same subnetwork via the OC-3/OC-12 DCC. The FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with the OC3 (or OC-12) Optical Interface circuit pack and the Overhead Controller - Tributary (TOHCTL) circuit pack to access the DCC. A single TOHCTL circuit pack can access up to eight DCCs. low-speed interface slots must be assigned to an OC-3/OC-12 DCC. For more information about entering DCC assignments, refer to "OC-3 (or OC-12) Data Communications Channel Assignments" in this section.

The FT-2000 OC-48 Lightwave system is **fully** operational during the software download. For example, the FT-2000 OC-48 Lightwave System maintains all transmission, protection switching, performance monitoring, and system reporting functions. For detailed information about installing a particular software release, refer to the applicable software release description:

The software release descriptions are shipped with the software and are not orderable from the Lucent Technologies Customer Information Center.

Release 9.0.0-ADR	Comcode 108361437 (3½" floppy); Comcode 108399973 (DAT tape*), <i>FT-2000 OC-48 Lightwave System</i> , Software Release Description, Release 9.0.0-ADR
Release 9.1.0	Comcode 108614363 (3½" floppy); Comcode 108686692 (DAT tape*), <i>FT-2000 OC-48 Lightwave System</i> , Software Release Description, Release 9.1.0

* DAT tape is required to download and distribute software via the ITM-SNC.

Cross-Connections

Cross-Connect Rules

DS-3/EC-1

- Three DS-3 signals are addressed using port AIDs.
- All STS-1 drop signals (DS-3) must come from the same side.
- The STS-1 add cross-connections can go to just one side or to both sides.

OC-3 Rules

- Three STS-1 signals contained within the OC-3 signal are addressed using port AIDs (i.e., 1s-1a-1, 1s-1a-2, 1s-1a-3).
- All STS-1 drop cross-connections must come from the same side (line). For example:

1e-1-1 -> 1a-1
1e-3-3 -> 1a-2
1e-8-2 -> 1a-3



NOTE:

With FT-2000 ADR Release 9.0 or later software and the OC3 (1.3 STD) LAA10B circuit pack, this STS-1 drop cross-connection restriction is removed. STS-1 drop cross-connections can come from either side (line).

- Uni-directional STS-1 add cross-connections can go to either side (line). For example,
1a-1 -> 1e-1-1
1a-2 -> 1w-3-3
1a-3 -> 1e-8-2
- The three consecutive STS-1 tributaries of an OC-3c signal must be cross-connected in parallel. For example,

1a-1 -> 1w-3-1
1a-2 -> 1w-3-2
1a-3 -> 1w-3-3

- An OC-3c signal must be aligned on an STS-3 boundary within the OC-48 signal. For example:

Correct	Incorrect
1a-1 -> 1w-3-1	1a-1 -> 1w-3-2
1a-2 -> 1w-3-2	1a-2 -> 1w-3-3
1a-3 -> 1w-3-3	1a-3 -> 1w-4-1

- An OC-3c cross-connect can be provisioned using either single **CONFIGURATION-Enter-Crossconnection-STS-3** command or three **CONFIGURATION-Enter-Crossconnection-STS-1** commands.

**NOTE:**

The FT-2000 OC-48 ADR Terminal does support the pre-provisioning of cross-connections. However, in order to prevent the generation of LOP alarms, the OC-3c signal should not be applied until: (a) the circuit pack has been installed; (b) ALL cross-connections for that circuit pack have been provisioned; and (c) all cross-connections in each NE of the signal's path have been provisioned. Then, and only then, should the signal be applied. Before deleting any of the cross-connections in an OC-3c signal's path, the signal must be removed.

OC-12/OC-12c Rules

- The STS-1 signals within an OC-12 signal are addressed using port AIDs (i.e., Quad 1 = 1a-1, 1a-2, 1a-3, 1b-1, 1b-2,.....2b-3).
- The OC-3 rules apply to the OC-12 on a per-slot basis. For example, all STS-1 drop cross-connections must come from the same side per slot but can come from different sides across the four slots. The following is permissible (1e-1-1 -> 1a-1, 1w-3-3 -> 1b-1).
- An OC-3c signal can ride within an OC-12 signal as long as it is aligned on an STS-3 boundary. The following example should clarify this rule.

Correct	Incorrect
1b-1 -> 1w-3-1	1a-2 -> 1w-3-1
1b-2 -> 1w-3-2	1a-3 -> 1w-3-2
1b-3 -> 1w-3-3	1b-1 -> 1w-3-3

- An OC-12c signal must be aligned on an STS-12 boundary within the OC-48 signal. For example, STS-3 tributaries 1-4, 5-8, 9-12, 13-16 each form STS-12 boundaries. An OC12 low-speed quad group (ie. slots 1A-2B) can be cross-connected within any STS-12 boundary.
- The twelve constituent STS-1 tributaries of an OC-12c signal must be cross-connected in parallel. An example for the STS-3 tributaries is as follows:

1a-1 -> 1w-5-1	2a-1 -> 1w-7-1
1a-2 -> 1w-5-2	2a-2 -> 1w-7-2
1a-3 -> 1w-5-3	2a-3 -> 1w-7-3
1b-1 -> 1w-6-1	2b-1 -> 1w-8-1
1b-2 -> 1w-6-2	2b-2 -> 1w-8-2
1b-3 -> 1w-6-3	2b-3 -> 1w-8-3

- An OC-12c signal can be provisioned using twelve (12) **CONFIGURATION-Enter-Crossconnect-STS-1** commands or four (4) **CONFIGURATION-Enter-Crossconnect-STS-3** commands. There are no STS-12 rate cross-connect commands.

**NOTE:**

The FT-2000 OC-48 ADR Terminal does support the pre-provisioning of cross-connections. However, in order to prevent the generation of LOP alarms—the OC-12c signal should not be applied until: (a) the circuit pack has been installed; (b) ALL cross-connections for that circuit pack have been provisioned; and (c) all cross-connections in each NE of the signal's path have been provisioned. Then, and only then, should the signal be applied. Before deleting any of the cross-connections in an OC-12c signal's path, the signal must be removed.

- An OC-12c signal cannot be "rolled" without a service hit due to the lack of a **CONFIGURATION-Enter-Roll-STS12** command.

STS-3 Cross-Connections

General

The FT-2000 OC-48 Add/Drop-Rings Terminal has no fixed connection, or association, between low-speed interface slots and the 155 Mb/s (STS-3) tributaries of OC-48 high-speed lines 1E and 1W. There is also no fixed connection between the STS-3 tributaries of OC-48 high-speed lines 1E and 1W. (In 2-fiber bidirectional rings, STS-3 tributaries 1 through 8 are service tributaries and STS-3 tributaries 9 through 16 are protection tributaries.) The FT-2000 OC-48 Add/Drop-Rings Terminal has an STS-3 time slot assignment (TSA) capability that supports the following cross-connections:

- 1-way cross-connections
- 2-way cross-connections (Default)
- 1-way-DRI cross-connections
- 2-way-DRI cross-connections
- 2-way-DRI-PRI cross-connections
- 2-way-DRI-SEC cross-connections.

When entering cross-connections, the source node is the node in the ring where the low-speed signals on that STS-3 tributary originate. The destination node is the last node in the same ring where the low-speed signals on that STS-3 tributary terminate.

**NOTE:**

Concatenated signals, such as an OC-3c, must be cross-connected within a single STS-3 tributary and cannot be broken up as STS-1 signals distributed across 3 different STS-3 tributaries. An OC-12c concatenated signal must be cross-connected to four contiguous STS-3 tributaries. Non-concatenated OC-3 and OC-12 signals can be freely cross-connected.

1-Way Cross-Connections

The 1-way cross-connections are the basic building block for all cross-connections. The FT-2000 OC-48 Add/Drop-Rings Terminal supports the following 1-way cross-connections:

- **Add cross-connections:** Add cross-connections are made from any service low-speed interface slot to any outgoing 155 Mb/s (STS-3) tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-1 shows service low-speed interface slot 2B cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W.

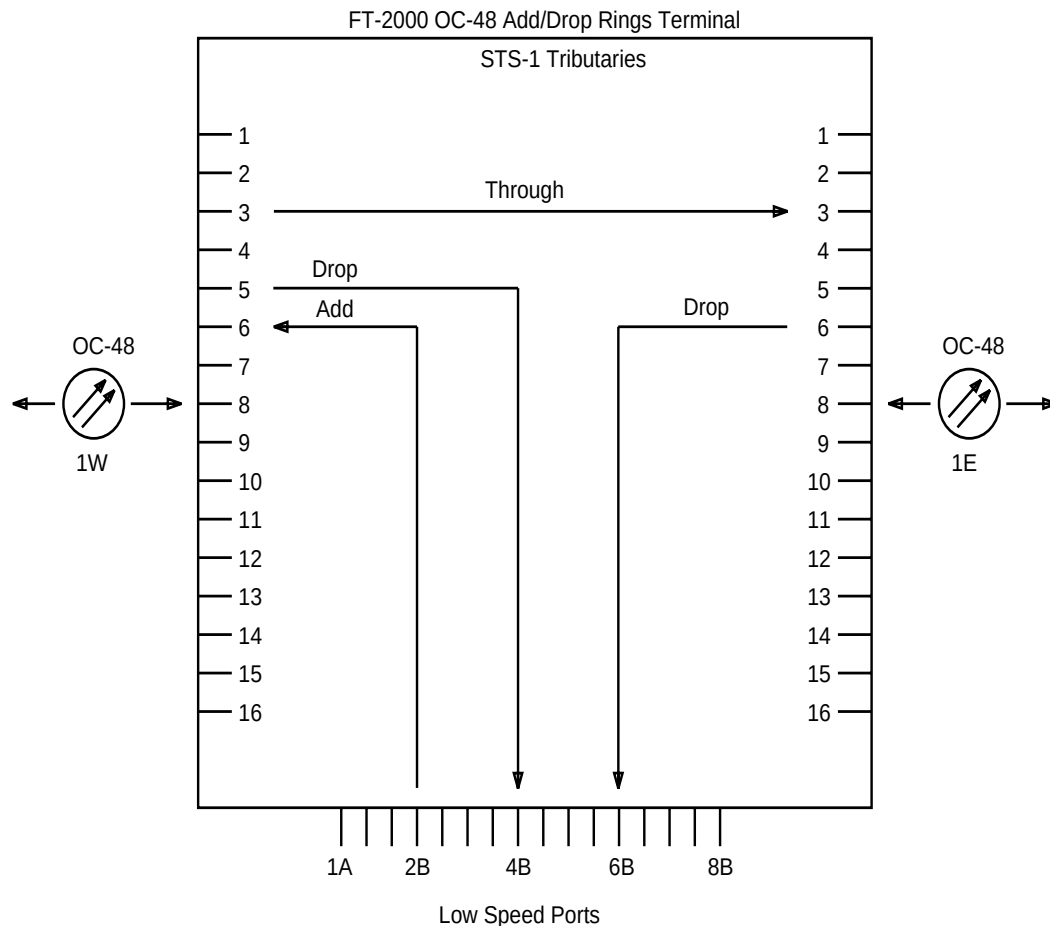


Figure 8-1. STS-3 1-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

Add cross-connections are made from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. A single input enters an active add cross-connection from the "A" slot to an outgoing STS-3 tributary of OC-48 high-speed line 1E or 1W and a standby cross-connection from the "B" slot to the same outgoing STS-3 tributary. For example, Figure 8-2 shows service low-speed interface slots 2A and 2B cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W. The add cross-connection from slot 2A to outgoing service STS-3 tributary 6 is active, and the add cross-connection from slot 2B to the same STS-3 tributary is standby.

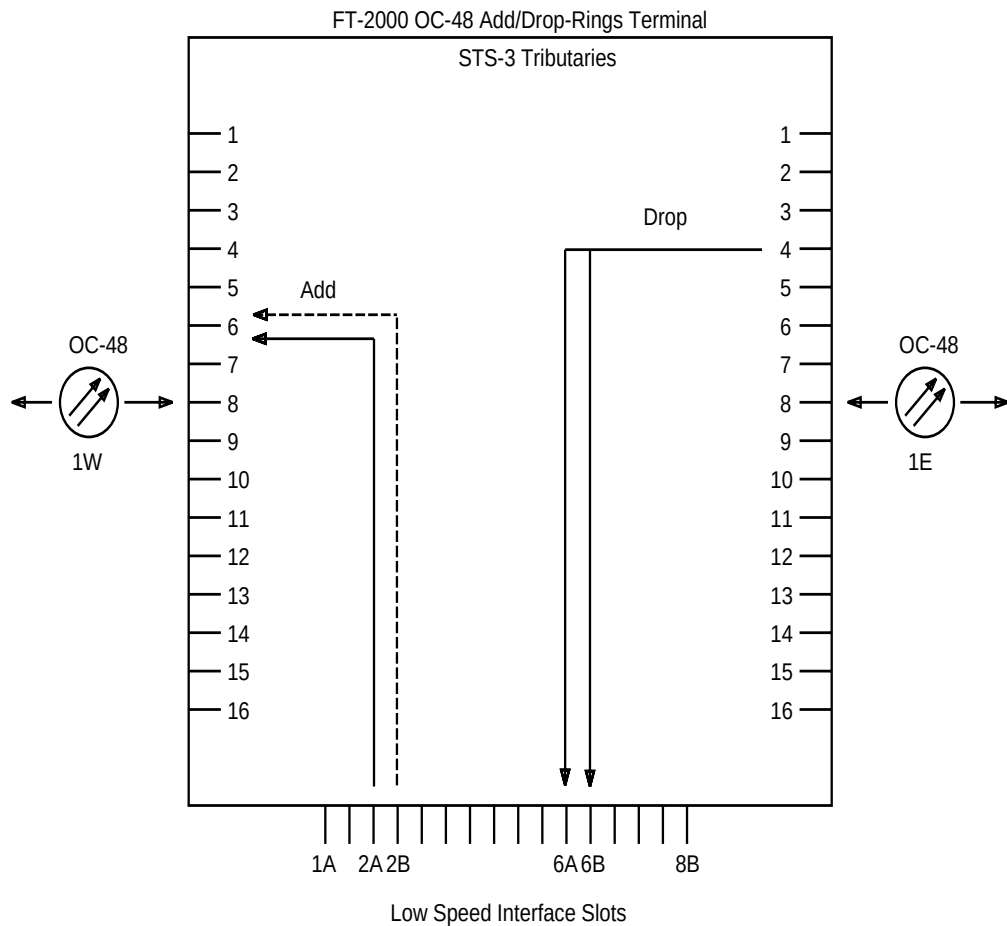


Figure 8-2. STS-3 1-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal (1+1 Protected Slots)

- Drop cross-connections:** Drop cross-connections are made from any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W to any service low-speed interface slot. For example, Figure 8-1 shows incoming service STS-3 tributary 5 of OC-48 high-speed line 1W cross-connected to service low-speed interface slot 4B.

Drop cross-connections are made to any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. A single input enters an active drop cross-connection from any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W to the "A" slot and another active drop cross-connection from the same incoming STS-3 tributary to the "B" slot.

For example, Figure 8-2 shows incoming service STS-3 tributary 4 of OC-48 high-speed line 1E cross-connected to service low-speed interface slots 6A and 6B.

- **Through cross-connections:** Through cross-connections are made from any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W to the same-numbered outgoing STS-3 tributary of the other OC-48 high-speed line. For example, Figure 8-1 shows incoming service STS-3 tributary 3 of OC-48 high-speed line 1W cross-connected to outgoing service STS-3 tributary 3 of OC-48 high-speed line 1E.

When an STS-3 tributary of OC-48 high-speed line 1E or 1W is cross-connected to a service low-speed interface slot, another service low-speed interface slot may be cross-connected to the same-numbered STS-3 tributary of the other OC-48 high-speed line. For example, Figure 8-1 shows service low-speed interface slot 2B cross-connected to service STS-3 tributary 6 of OC-48 high-speed line 1W, and service STS-3 tributary 6 of OC-48 high-speed line 1E cross-connected to service low-speed interface slot 6B. This is consistent with the 2-fiber bidirectional, line-switched ring standard.



NOTE:

In terms of functionality, a 1-way add plus a 1-way drop (to the same points) perform all of the same functions as a single 2-way.

The 1-way add, drop, and through cross-connections may be used to provide the following:

- **Bridge cross-connections:** A bridge cross-connection is limited to a drop cross-connection and a superimposed through cross-connection sharing the same source (drop and continue). The drop cross-connection and through cross-connection share the same incoming STS-3 tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-3 shows incoming service STS-3 tributary 3 of OC-48 high-speed line 1W cross-connected to outgoing service STS-3 tributary 3 of OC-48 high-speed line 1E. Incoming service STS-3 tributary 3 of OC-48 high-speed line 1W is also cross-connected to service low-speed interface slot 1A.

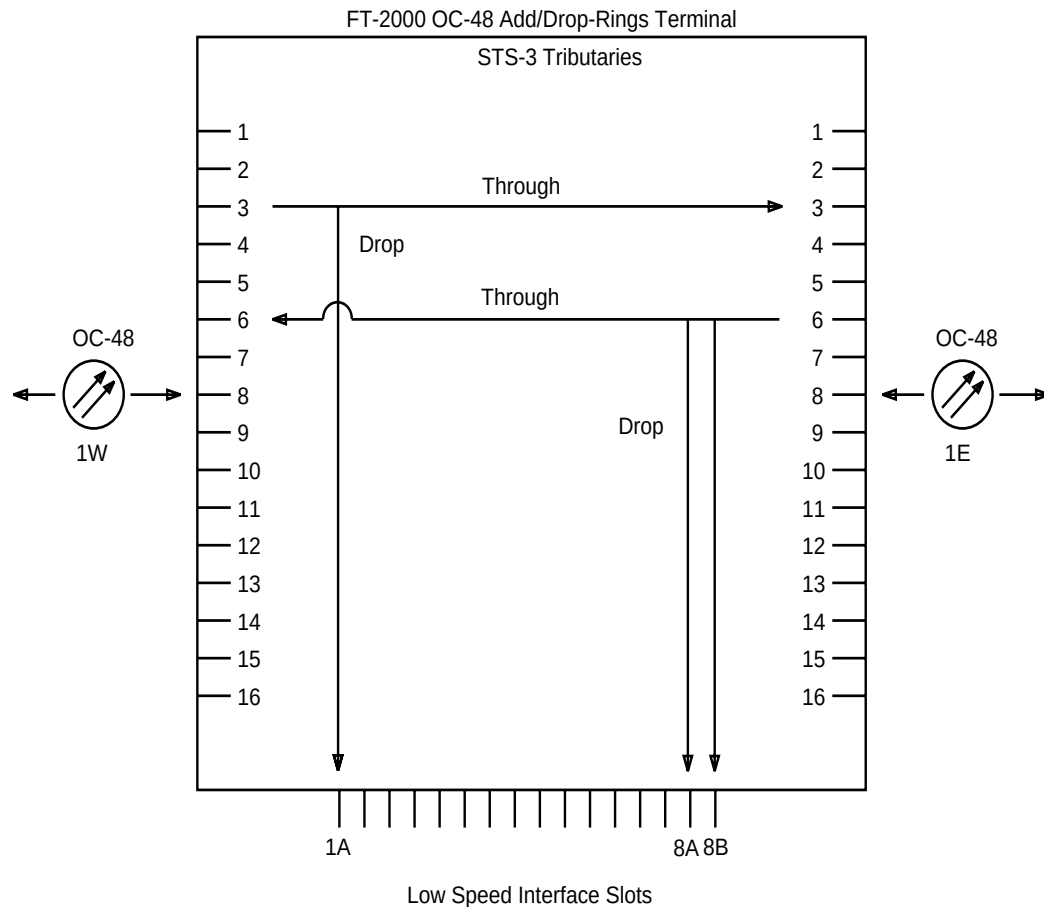


Figure 8-3. STS-3 Bridge Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

A bridge cross-connection is any two superimposed cross-connections sharing the same source. The source can be any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W, or any service low-speed interface slot.

Cross-connections can be made to/from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. For example, Figure 8-3 shows incoming service STS-3 tributary 6 of OC-48 high-speed line 1E cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W. Incoming service STS-3 tributary 6 of OC-48 high-speed line 1W is also cross-connected to service low-speed interface slots 8A and 8B.

- **Multiple bridge cross-connections:** The FT-2000 OC-48 Add/Drop-Rings Terminal supports multiple bridge cross-connections. A multiple bridge cross-connection is three or more superimposed cross-connections sharing the same source. The source can be any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W, or any service low-speed interface slot. For example, Figure 8-4 shows incoming service STS-3 tributary 7 of OC-48 high-speed line 1E cross-connected to service low-speed interface slots 6A, 6B, 7B, and 8A. Figure 8-4 also shows service low-speed interface slot 3A cross-connected to service STS-3 tributaries 1 and 2 of OC-48 high-speed line 1W, and service STS-3 tributary 3 of OC-48 high-speed line 1E.

Multiple bridge cross-connections can also be made to/from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. For example, Figure 8-4 shows service low-speed interface slots 1A and 1B cross-connected to service STS-3 tributaries 6, 7, and 8 of OC-48 high-speed line 1W.

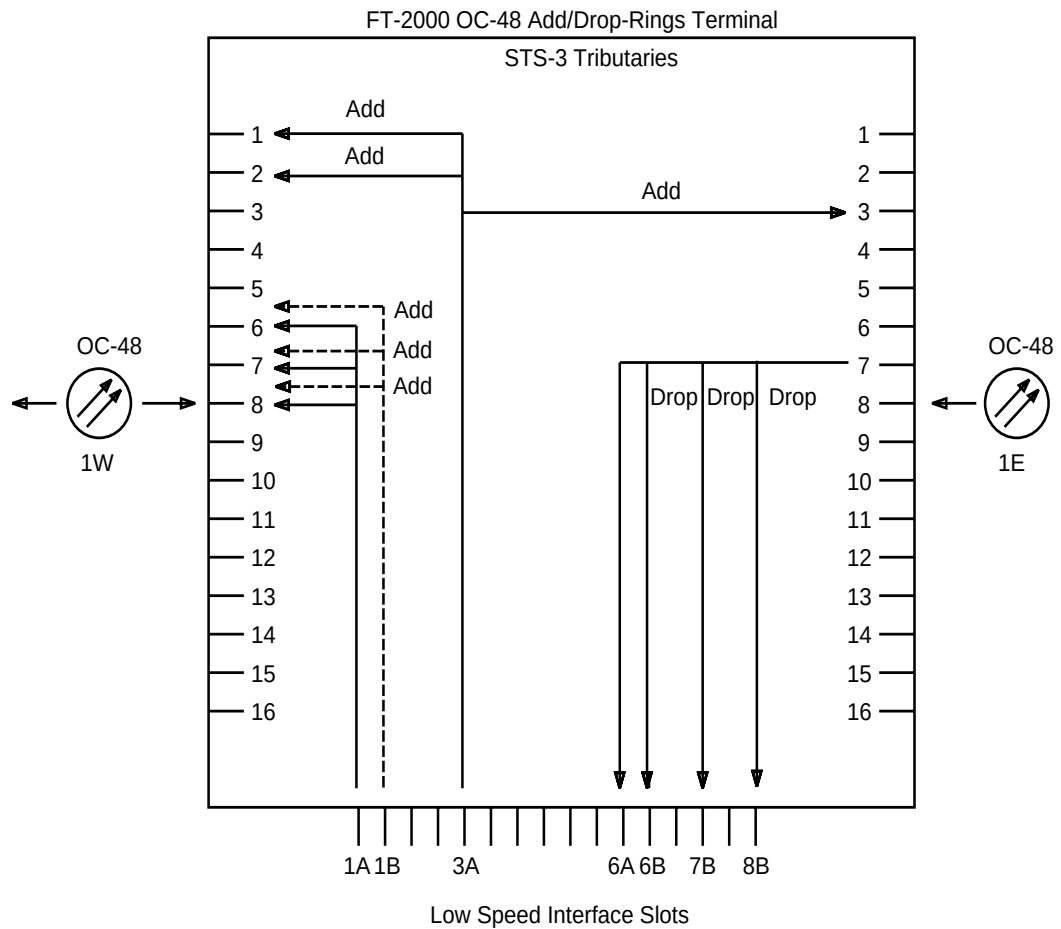


Figure 8-4. Multiple STS-3 Bridge Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

1-Way-DRI Cross-Connections

A 1-way-DRI cross-connection is a 1-way add cross-connection and a superimposed 1-way through cross-connection sharing the same destination. The add cross-connection and through cross-connection share the same outgoing service 155 Mb/s (STS-3) tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-5 shows incoming service STS-3 tributary 3 of OC-48 high-speed line 1W cross-connected to outgoing service STS-3 tributary 3 of OC-48 high-speed line 1E. Service low-speed interface slot 6B is also cross-connected to outgoing service STS-3 tributary 3 of OC-48 high-speed line 1E.

A single input enters an active add cross-connection and a standby through cross-connection.

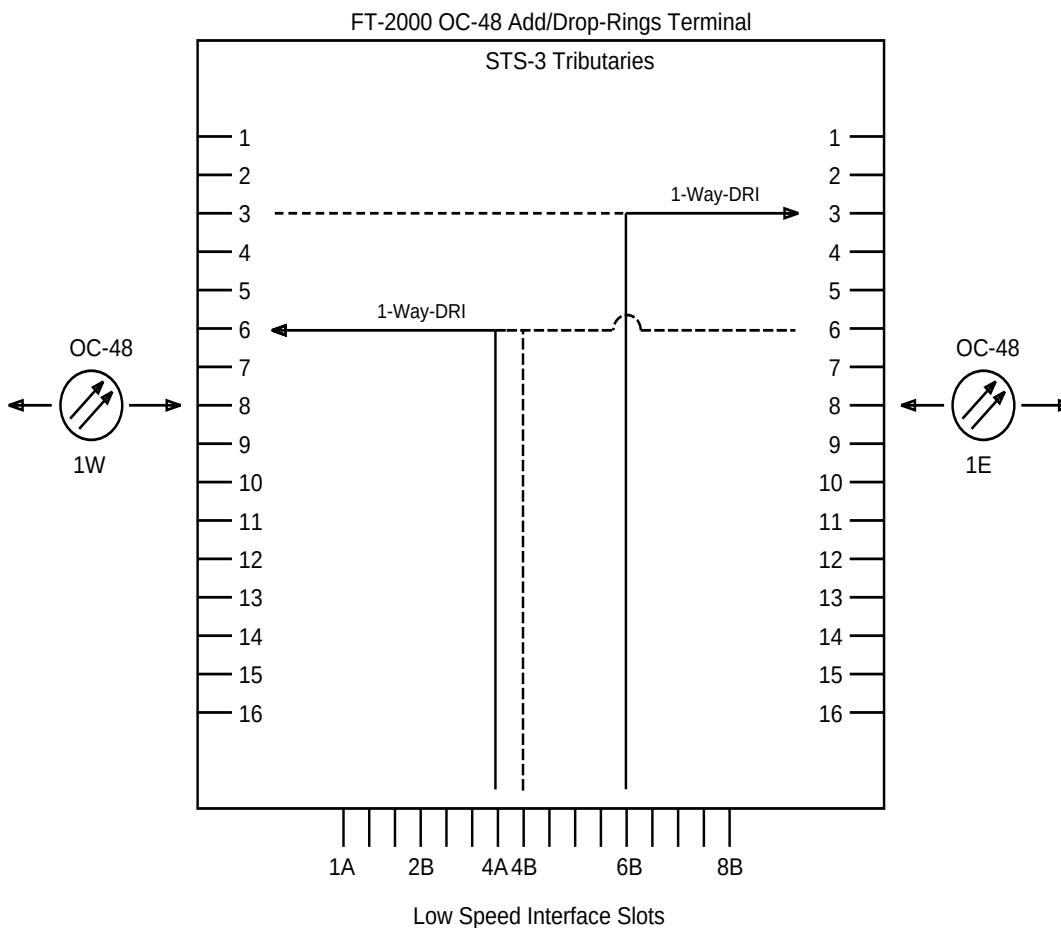


Figure 8-5. STS-3 1-Way-DRI Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

1-way-DRI cross-connections are made from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. For example, Figure 8-5 shows incoming service STS-3 tributary 6 of OC-48 high-speed line 1E cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W. Service low-speed interface slot pair 4A and 4B is also cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W.

A single input enters an active and standby add cross-connection from the service low-speed interface slot pair to a service STS-3 tributary and a standby through cross-connection for the same STS-3 tributary.

The active add cross-connection carries traffic during normal conditions. If an incoming DS3 or EC-1 loss-of-signal condition is detected by the low-speed interface circuit pack, the through cross-connection becomes active and the add cross-connection becomes standby. An unprotected incoming OC-3 loss-of-signal or loss-of-frame condition also causes the through cross-connection to become active and the add cross-connection to become standby.

Because the DRI feature is "revertive"—when the LOS, LOP, LOF or Line AIS condition clears, traffic DOES automatically switch (revert) to the add cross-connection. It is NOT necessary to manually switch the traffic back to the add cross-connection.

For more information about the dual ring interworking (DRI) application, refer to Section 2, "Applications." For more information about DRI protection switching, refer to Section 9, "Maintenance Description."

2-Way Cross-Connections

The FT-2000 OC-48 Add/Drop-Rings Terminal provides a time slot assignment (TSA) capability that supports the following 2-way cross-connections:

- **Add/drop cross-connections:** Add/drop cross-connections are made between any service low-speed interface slot and any 155 Mb/s (STS-3) tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-6 shows service low-speed interface slot 2B cross-connected to service STS-3 tributary 6 of OC-48 high-speed line 1W. (In 2-fiber bidirectional rings, STS-3 tributaries 1 through 8 are service tributaries and STS-3 tributaries 9 through 16 are protection tributaries.)

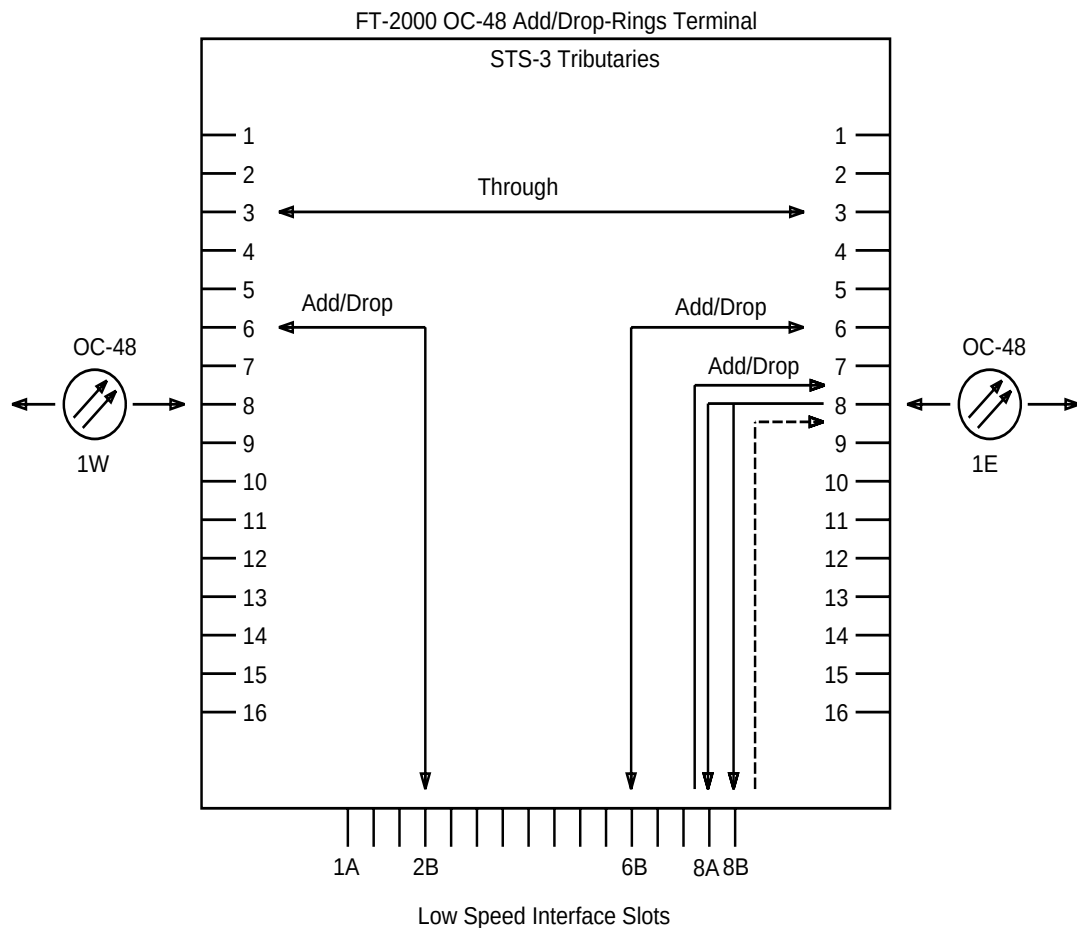


Figure 8-6. STS-3 2-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

Add/drop cross-connections are made between any service low-speed interface slot and the companion low-speed interface slot (for example, slot 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode and any service STS-3 tributary. A single input enters an active and a standby add cross-connection and two active drop cross-connections. For example, Figure 8-6 shows service low-speed interface slot pair 8A and 8B cross-connected to service STS-3 tributary 8 of OC-48 high-speed line 1E.

- **Through cross-connections:** Through cross-connections are made between any STS-3 tributary on OC-48 high-speed line 1E or 1W and the same-numbered STS-3 tributary of the other OC-48 high-speed line. For example, Figure 8-6 shows service STS-3 tributary 3 of OC-48 high-speed line 1W cross-connected to service STS-3 tributary 3 of OC-48 high-speed line 1E.

When an STS-3 tributary of OC-48 high-speed line 1E or 1W is cross-connected to a service low-speed interface slot, another service low-speed interface slot may be cross-connected to the same-numbered STS-3 tributary of the other OC-48 high-speed line. For example, Figure 8-6 shows service low-speed interface slot 2B cross-connected to service STS-3 tributary 6 of OC-48 high-speed line 1W, and service low-speed interface slot 6B cross-connected to service STS-3 tributary 6 of OC-48 high-speed line 1E. This is consistent with the 2-fiber bidirectional, line-switched ring standard.



NOTE:

In terms of functionality, a 1-way add plus a 1-way drop (to the same points) perform all of the same functions as a single 2-way.

2-Way-DRI Cross-Connection

A 2-way-DRI cross-connection is a combination of:

- A 1-way-DRI cross-connection, plus
- A drop and continue cross-connection (which is a type of a Bridge cross-connection).

The 2-way-DRI cross-connections are made between any (a) service low-speed slot, and any, (b) STS-3 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-7 shows:

- Service low-speed slot 6B cross-connected to outgoing service STS-3 tributary 3 on OC-48 high-speed line 1E.
- Incoming service STS-3 tributary 3 of high-speed line 1W is also cross-connected to the same destination (3 on OC-48 high-speed line 1E). This is the dashed line.
- Incoming service STS-3 tributary 3 on OC-48 high-speed line 1E is cross-connected to outgoing service STS-3 tributary 3 on OC-48 high-speed line 1W.
- Incoming service STS-3 tributary 3 on OC-48 high-speed line 1E is also cross-connected to service low-speed slot 6B.

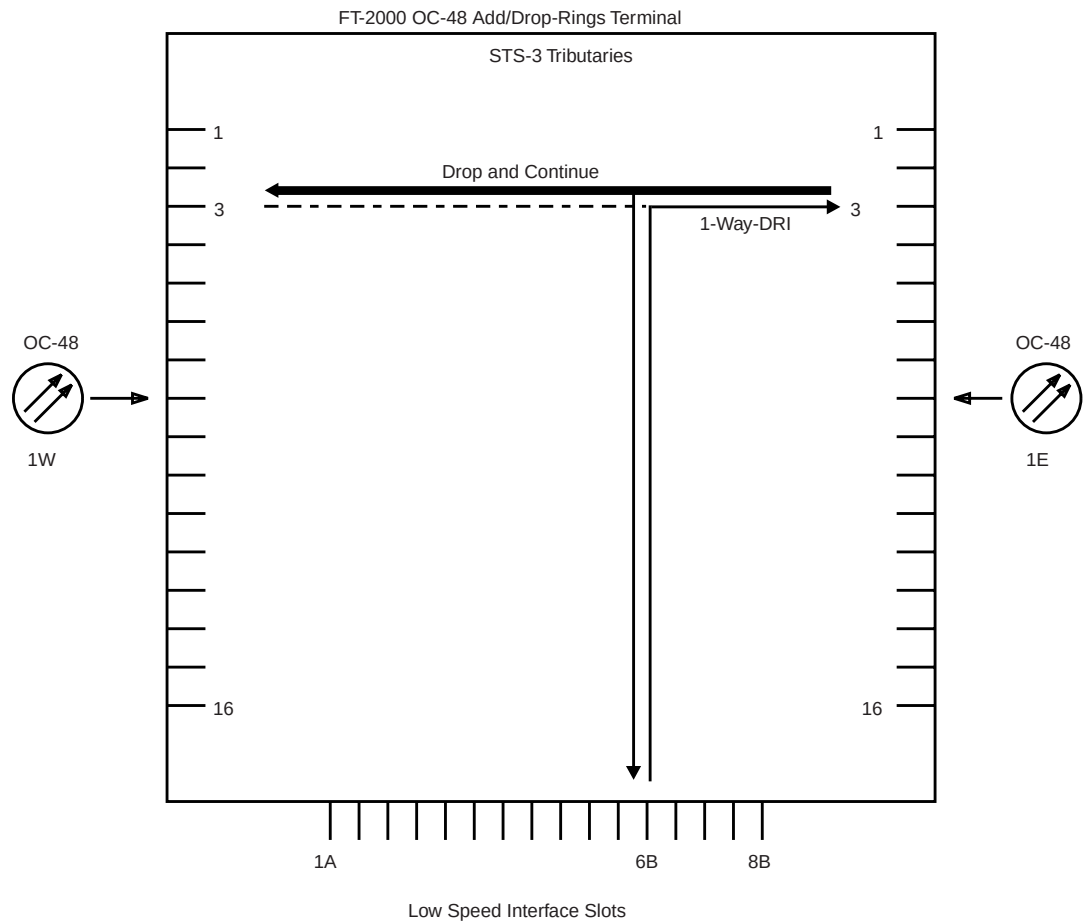


Figure 8-7. 2-way-DRI Cross-Connection

2-Way-DRI-Pri Cross-Connection

The 2-Way-DRI-Pri is part of the DRI on Protection (DRI-P) circuit which is an alternative to the 1-Way-DRI Cross-Connection. DRI-P takes advantage of the protection bandwidth for the secondary circuit between the primary and secondary interworking nodes. The secondary circuit is the combination of the continue segment of the drop and continue (from the primary node to the secondary node), along with the duplicate feed segment from the other ring (from the secondary node to the primary node).

A 2-way-DRI-Pri cross-connection is a combination of:

- A 1-way-DRI cross-connection with a time slot interchange (TSI) from the service to the protection tributary, plus
- A drop and TSI-continue cross-connection (which is a type of Bridge cross-connection).

The 2-way-DRI-Pri cross-connections are made between any (a) service low-speed slot, and any, (b) service STS-3 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-8 shows:

- Service low-speed slot 6B cross-connected to outgoing service STS-3 tributary on OC-48 high-speed line 1E.
- Incoming protection STS-3 tributary 11 of high-speed line 1W also cross-connected to the same destination (3 on OC-48 high-speed line 1E). This is the dashed line.
- Incoming service STS-3 tributary 3 on OC-48 high-speed line 1E is cross-connected to outgoing protection STS-3 tributary 11 on OC-48 high-speed line 1W.
- Incoming service STS-3 tributary 3 on OC-48 high-speed line 1E is also cross-connected to service low-speed slot 6B.

I

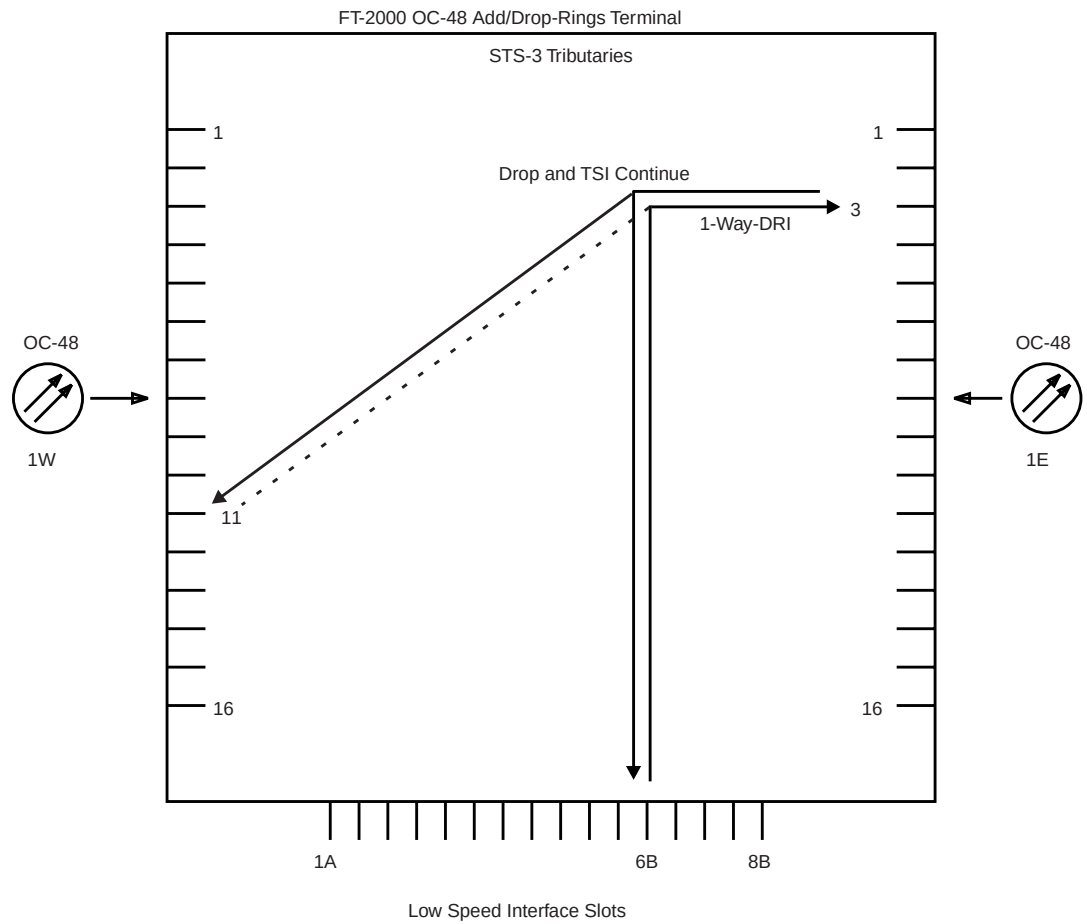


Figure 8-8. 2-way-DRI-Pri Cross-Connection on Protection Bandwidth

2-Way-DRI-Sec Cross-Connection

The 2-way-DRI-Sec cross-connections are made between any (a) service low-speed slot, and any, (b) protection STS-3 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-9 shows:

- Service low-speed slot 6B cross-connected to protection STS-3 tributary 11 on OC-48 high-speed line 1E.

**NOTE:**

The 2-Way-DRI-Sec is similar to the 2-Way Add/Drop cross-connection.

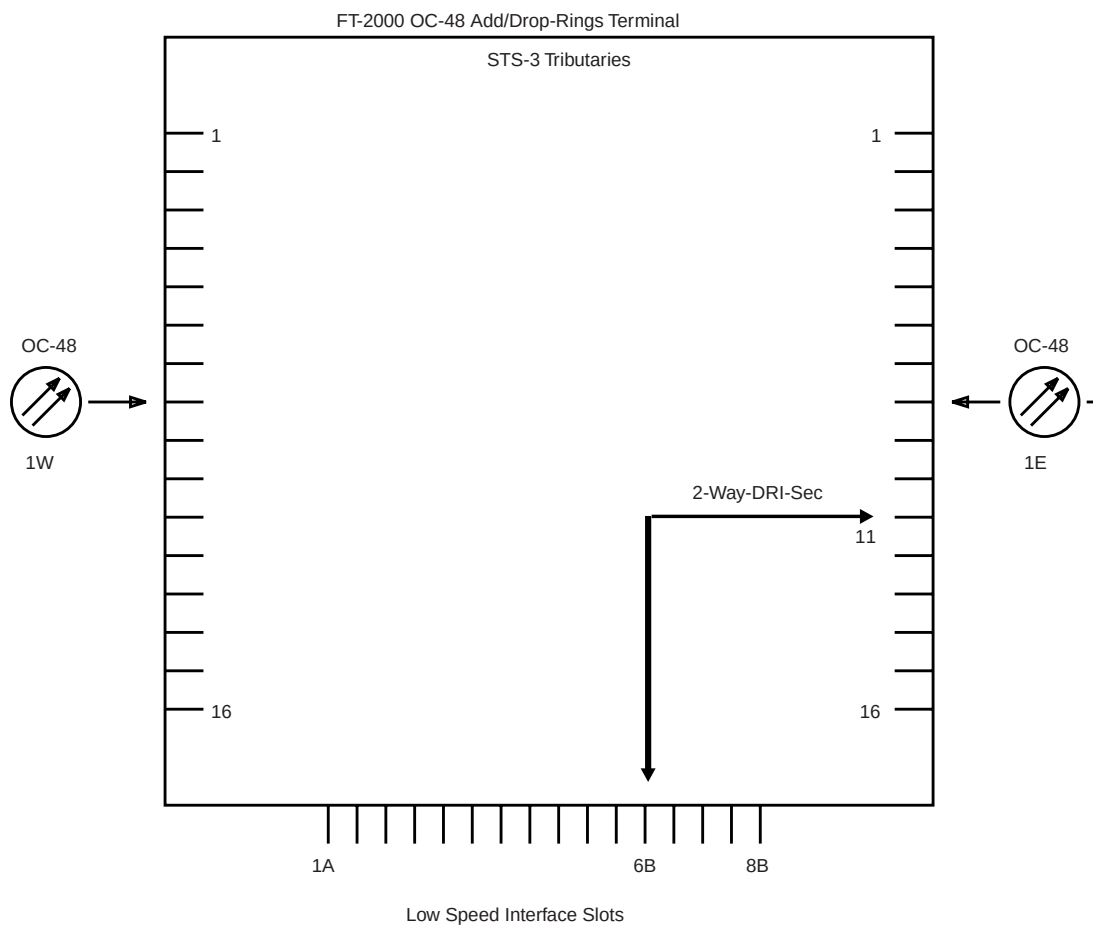


Figure 8-9. 2-way-DRI-Sec Cross-Connection on Protection Bandwidth

STS-3 Cross-Connection Restrictions

STS-3 cross-connections cannot be made from one low-speed interface slot to another low-speed interface slot or between two differently numbered STS-3 tributaries.

STS-1 Cross-Connections

General

The FT-2000 OC-48 Add/Drop-Rings Terminal has no fixed connection, or association, between low-speed ports and the STS-1 tributaries of OC-48 high-speed lines 1E and 1W. There is also no fixed connection between the STS-1 tributaries of OC-48 high-speed lines 1E and 1W. The FT-2000 OC-48 Add/Drop-Rings Terminal has an STS-1 time slot assignment (TSA) capability that supports the following STS-1 cross-connections across an OC-48 signal:

- 1-way cross-connections
- 2-way cross-connections (Default)
- 1-way-DRI cross-connections
- 2-way-DRI cross-connections
- 2-way-DRI-PRI cross-connections
- 2-way-DRI-SEC cross-connections
- Limited STS-1 cross-connections.

When entering cross-connections, the source node is the node in the ring where the low-speed signals on that STS-1 tributary originate. The destination node is the last node in the same ring where the low-speed signals on that STS-1 tributary terminate.



NOTE:

Concatenated signals, such as an OC-3c, must be cross-connected within a single STS-3 tributary and cannot be broken up as STS-1 signals distributed across 3 different STS-3 tributaries. An OC-12c concatenated signal must be cross-connected to four contiguous STS-3 tributaries. Non-concatenated OC-3 and OC-12 signals can be freely cross-connected.

1-Way Cross-Connections

1-way cross-connections are the basic building block for all STS-1 cross-connections. The FT-2000 OC-48 Add/Drop-Rings Terminal supports the following STS-1 1-way cross-connections:

- **Add cross-connections:** Add cross-connections are made from any service low-speed port to any outgoing STS-1 tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-10 shows service low-speed port 1 of slot 2B (2B-1) cross-connected to outgoing service STS-1 tributary 1 of STS-3 tributary 6 (6-1) on OC-48 high-speed line 1W.

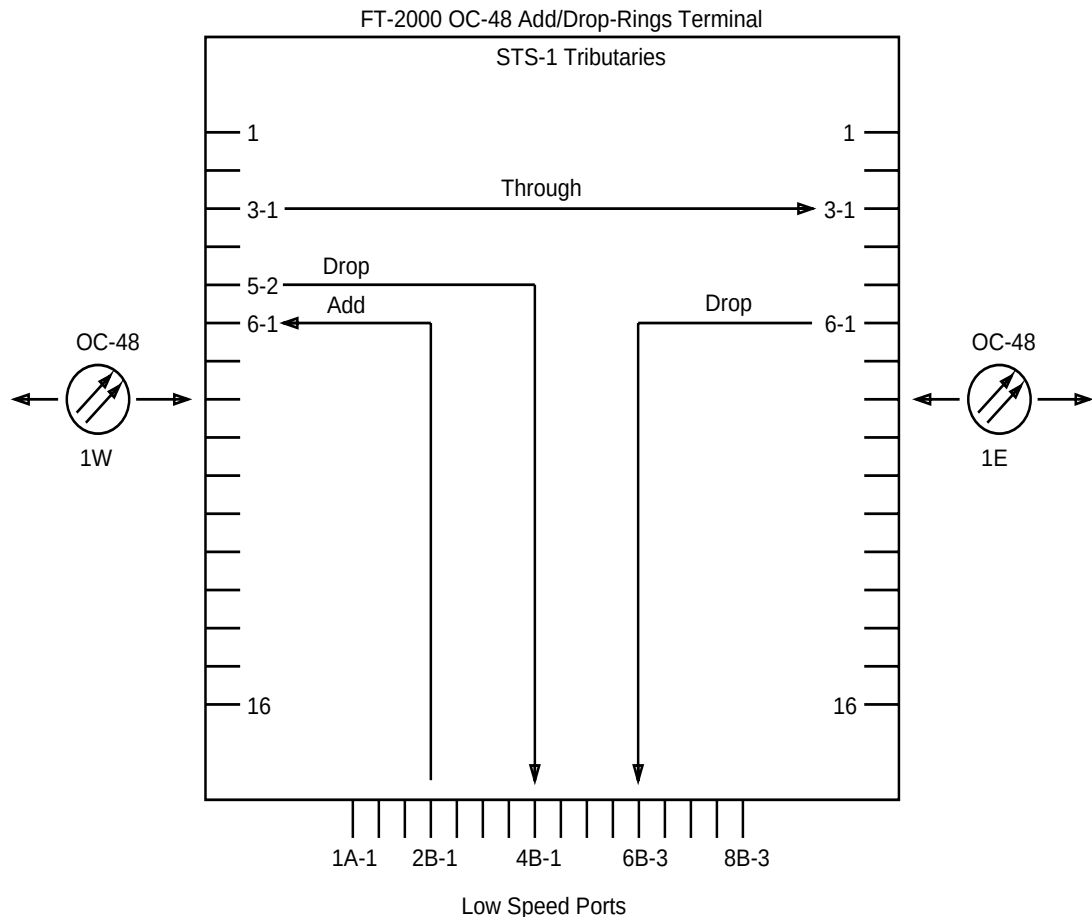


Figure 8-10. STS-1 1-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

Add cross-connections are also made from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. (Any low-speed port associated with the slot pair may be specified when entering the cross-connection.) A single input enters an active add cross-connection from the "A" slot to the outgoing STS-3 tributary of OC-48 high-speed line 1E or 1W and a standby cross-connection from the "B" slot to the same outgoing STS-3 tributary. For example, Figure 8-11 shows

service low-speed interface slots 2A and 2B cross-connected to outgoing service STS-3 tributary 6 of OC-48 high-speed line 1W. The add cross-connection from slot 2A to outgoing service STS-3 tributary 6 is active, and the add cross-connection from slot 2B to the same STS-3 tributary is standby.

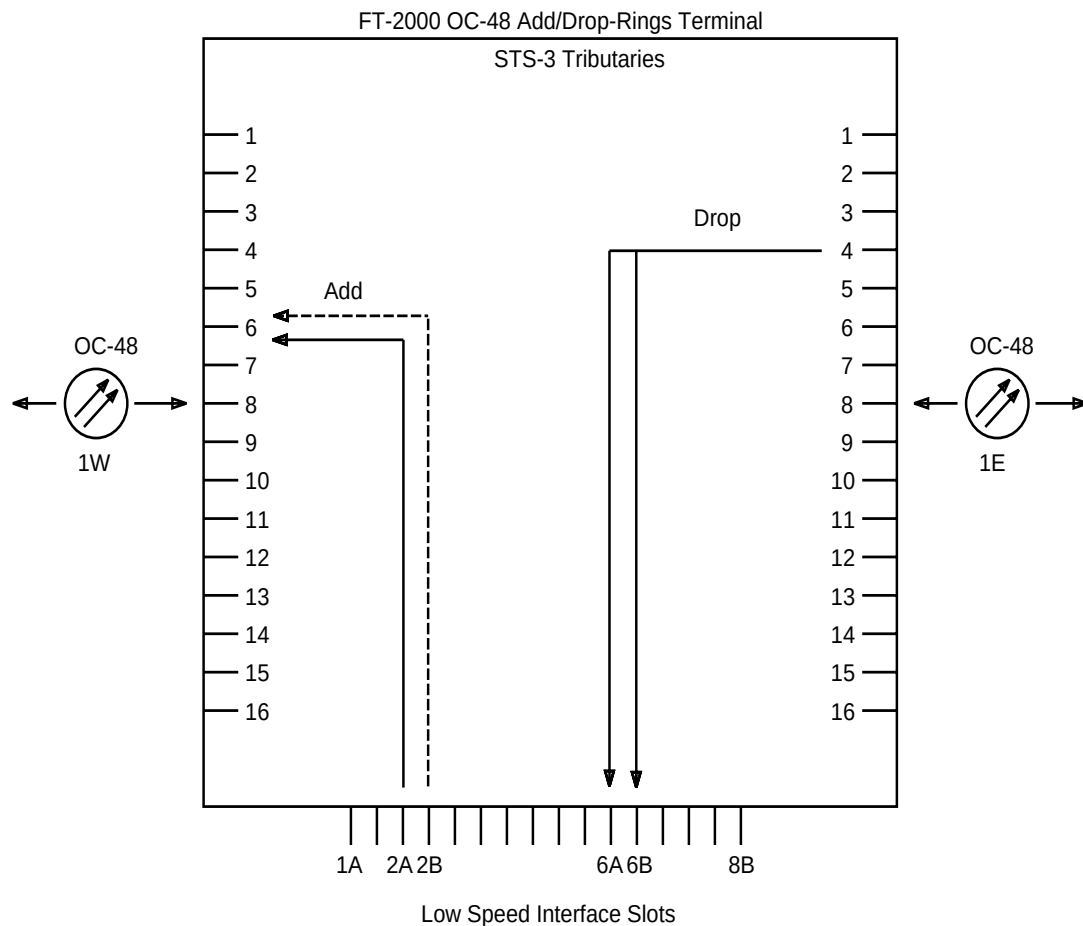


Figure 8-11. 1-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal (1+1 Protected Slots)

- **Drop cross-connections:** Drop cross-connections are made from any incoming STS-1 tributary of OC-48 high-speed line 1E or 1W to any service low-speed port. For example, Figure 8-10 shows incoming service STS-1 tributary 2 of STS-3 tributary 5 (5-2) on OC-48 high-speed line 1W cross-connected to service low-speed port 1 of slot 4B (4B-1).

Drop cross-connections are also made to any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. (Any low-speed port associated with the slot pair may be specified when entering the cross-connection.) A single input enters an active drop cross-connection from any incoming STS-3 tributary of OC-48 high-speed line 1E or 1W to the "A" slot and another active drop cross-connection from the same incoming STS-3 tributary to the "B" slot. For example, Figure 8-11 shows incoming service STS-3 tributary 4 of OC-48 high-speed line 1E cross-connected to service low-speed interface slots 6A and 6B.

- **Through cross-connections:** Through cross-connections are made from any incoming STS-1 tributary of OC-48 high-speed line 1E or 1W to the same-numbered outgoing STS-1 tributary of the other OC-48 high-speed line. For example, Figure 8-10 shows incoming service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1W cross-connected to outgoing service STS-1 tributary 1 of STS-3 tributary (3-1) on OC-48 high-speed line 1E.

When an STS-1 tributary of OC-48 high-speed line 1E or 1W is cross-connected to a service low-speed port, another service low-speed port may be cross-connected to the same-numbered STS-1 tributary of the other OC-48 high-speed line. For example, Figure 8-10 shows service low-speed port 1 of slot 2B cross-connected to service STS-1 tributary 1 of STS-3 tributary 6 (6-1) on OC-48 high-speed line 1W, and service STS-1 tributary 1 of STS-3 tributary 6 (6-1) on OC-48 high-speed line 1E cross-connected to service low-speed port 3 of slot 6B. This is consistent with the 2-fiber bidirectional, line-switched ring standard.

The 1-way add, drop, and through cross-connections may be used to provide the following:

- **Bridge cross-connections:** A bridge cross-connection is two cross-connections sharing the same source. The source can be any incoming STS-1 tributary of OC-48 high-speed line 1E or 1W, or any service low-speed port. For example, Figure 8-12 shows incoming service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1W cross-connected to outgoing service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1E. Incoming service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1W is also cross-connected to service low-speed port 2 of slot 1A (1A-2).



- **Multiple bridge cross-connections:** A multiple bridge cross-connection is three or more superimposed cross-connections sharing the same source. The source can be any incoming STS-1 tributary of OC-48 high-speed line 1E or 1W, or any service low-speed port. For example, Figure 8-13 shows incoming service STS-1 tributary 1 of STS-3 tributary 7 (7-1) on OC-48 high-speed line 1E cross-connected to service low-speed port 1 of slot 6A (6A-1), port 1 of slot 7B (7B-1), and port 2 of slot 8B (8B-2). Figure 8-13 also shows service low-speed port 1 of slot 3A (3A-1) cross-connected to

service STS-1 tributary 3 of STS-3 tributary 1 (1-3) and STS-1 tributary 1 of STS-3 tributary 2 (2-1) on OC-48 high-speed line 1W, and service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1E.

Multiple bridge cross-connections can also be made to/from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. (Any low-speed port associated with the slot pair may be specified when entering the cross-connection.)

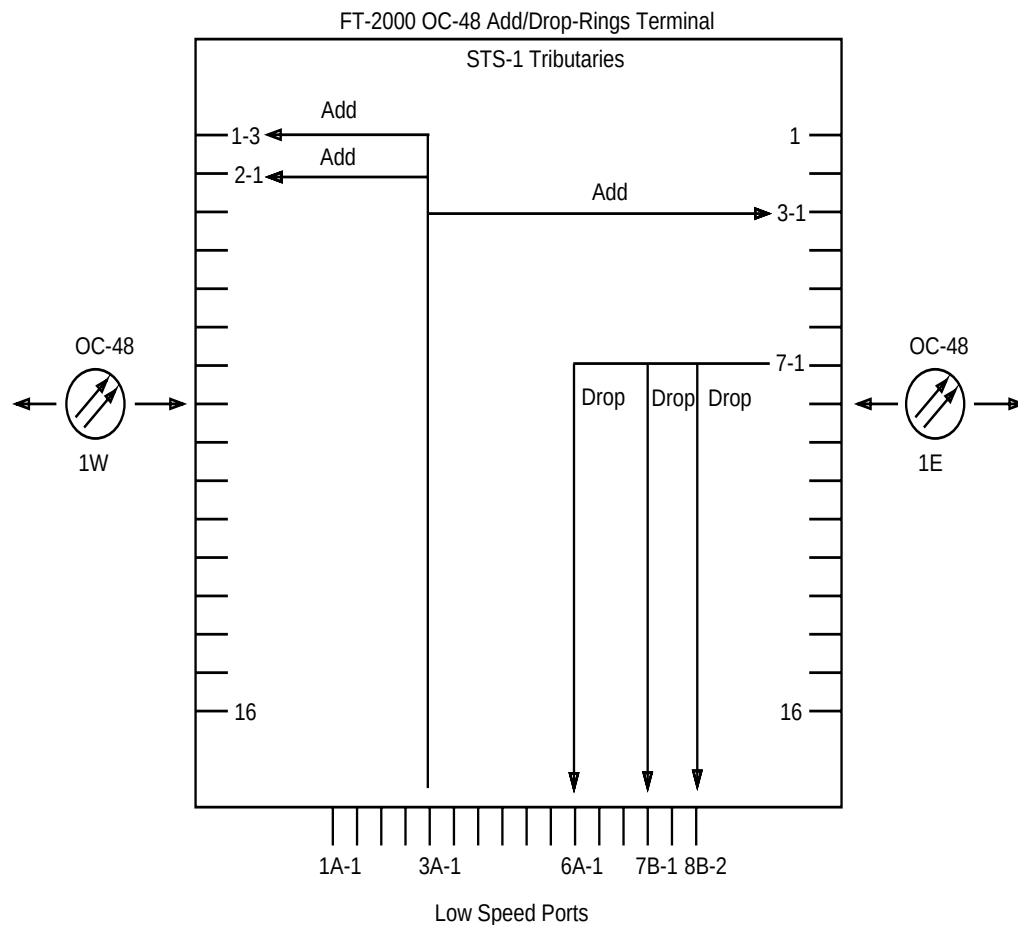


Figure 8-13. Multiple STS-1 Bridge Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

1-Way-DRI Cross-Connections

A 1-way-DRI cross-connection is a 1-way add cross-connection and a superimposed 1-way through cross-connection sharing the same destination. The add cross-connection and through cross-connection share the same outgoing service STS-1 tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-14 shows incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1W cross-connected to outgoing service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E. Service low-speed port 2 of slot 6B (6B-2) is also cross-connected to outgoing service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E.

A single input enters an active add cross-connection and a standby through cross-connection.

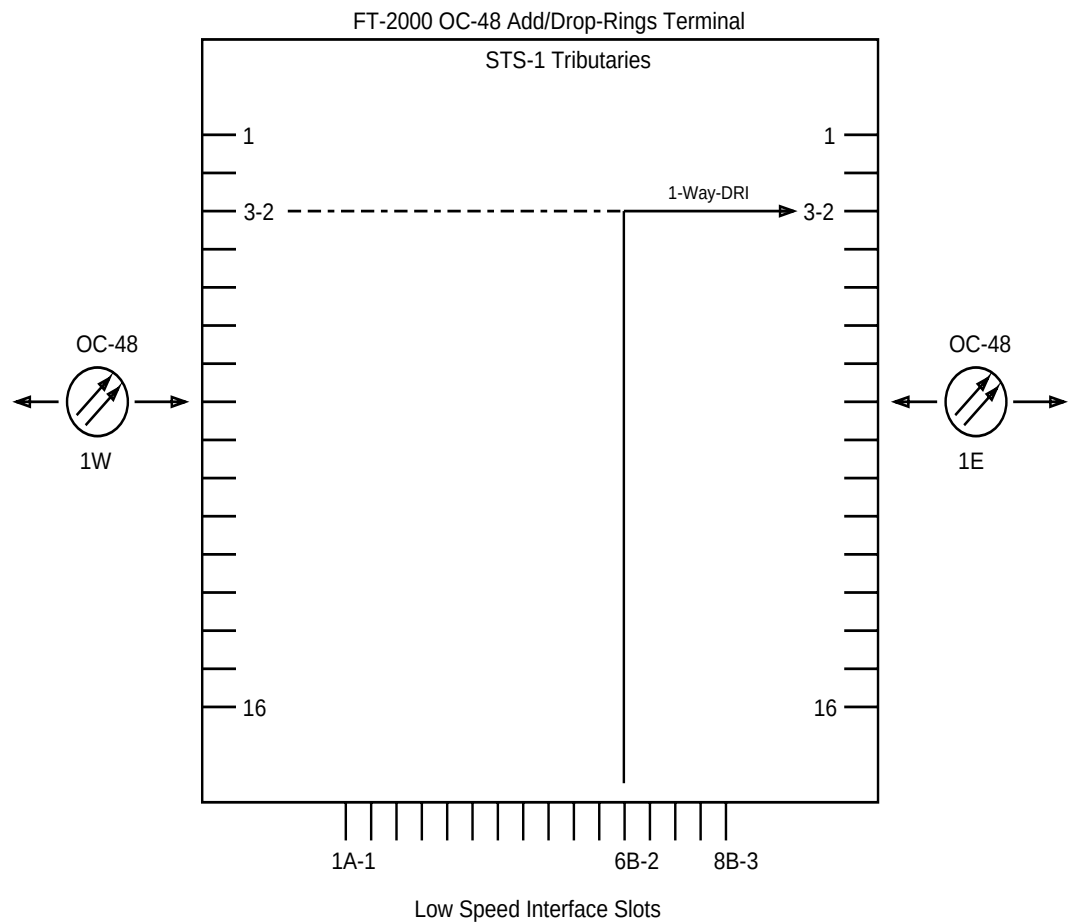


Figure 8-14. STS-1 1-Way-DRI Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

The 1-way-DRI cross-connections are also made from any service low-speed interface slot and the companion low-speed interface slot (for example, 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode. (Any low-speed port associated with the slot pair may be specified when entering the cross-connection.)

A single input enters an active and standby add cross-connection from the service low-speed interface slot pair to a service STS-3 tributary and a standby through cross-connection for the same STS-3 tributary.

The active add cross-connection carries traffic during normal conditions. If an incoming DS3 or EC-1 loss-of-signal condition is detected by the low-speed interface circuit pack, the through cross-connection becomes active and the add

cross-connection becomes standby. An unprotected incoming OC-3 loss-of-signal or loss-of-frame condition also causes the through cross-connection to become active and the add cross-connection to become standby.

Because the DRI feature is “revertive”—when the LOS, LOP, LOF or Line AIS condition clears, traffic DOES automatically switch (revert) to the add cross-connection. It is NOT necessary to manually switch the traffic back to the add cross-connection.

For more information about the dual ring interworking (DRI) application, refer to Section 2, “Applications.” For more information about DRI protection switching, refer to Section 9, “Maintenance Description.”

Example of a DRI Application Depicting Both Primary and Secondary Node Cross-Connections

Figure 8-15 is included to further depict a typical DRI network arrangement.

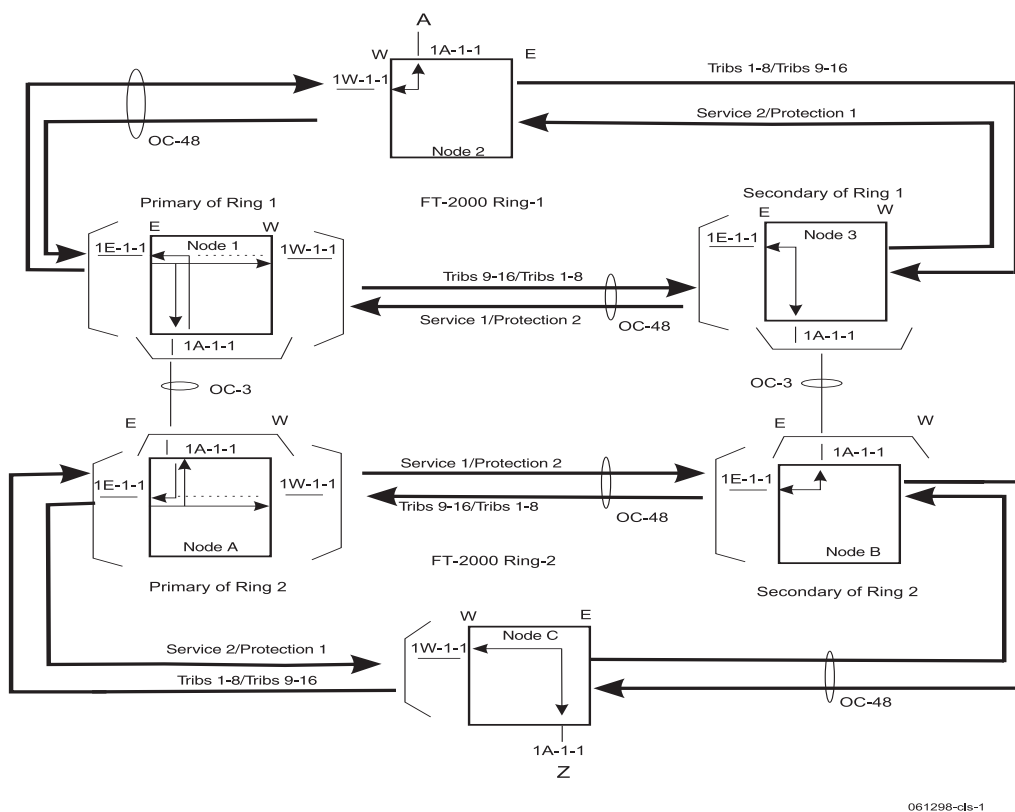


Figure 8-15. Example Application Depicting Primary and Secondary Nodes and Their Cross-Connections

For clarification, the dotted-line is the switched path. While this figure shows an FT-ring to FT-ring interconnection it should be understood that other ring types are also possible, FT-ring to DDM-ring, etc. Also, the interconnection facility may be DS-3, STS1E, OC-12, in addition to OC-3. The interconnection facility may be provisioned as 0x1, 1+1, or and as appropriate, 0xN. It is not necessary that the two rings be connected primary node to primary node. Primary node to secondary node interconnections will work. Additionally, there are no restrictions that would limit DRI connections to just two rings. For example, three or more rings may be connected.

2-Way-DRI Cross-Connection

A 2-way-DRI cross-connection is a combination of:

- A 1-way-DRI cross-connection, plus
- A drop and continue cross-connection (which is a type of a Bridge cross-connection).

The 2-way-DRI cross-connections are made between any (a) service low-speed port, and any, (b) STS-1 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-16 shows:

- Service low-speed port 2 of slot 6B (6B-2) cross-connected to outgoing service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E.
- Incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) of high-speed line 1W is also cross-connected to the same destination (3-2 on OC-48 high-speed line 1E). This is the dashed line.
- Incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E is cross-connected to outgoing service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1W.
- Incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E is also cross-connected to service low-speed port 2 of slot 6B (6B-2).

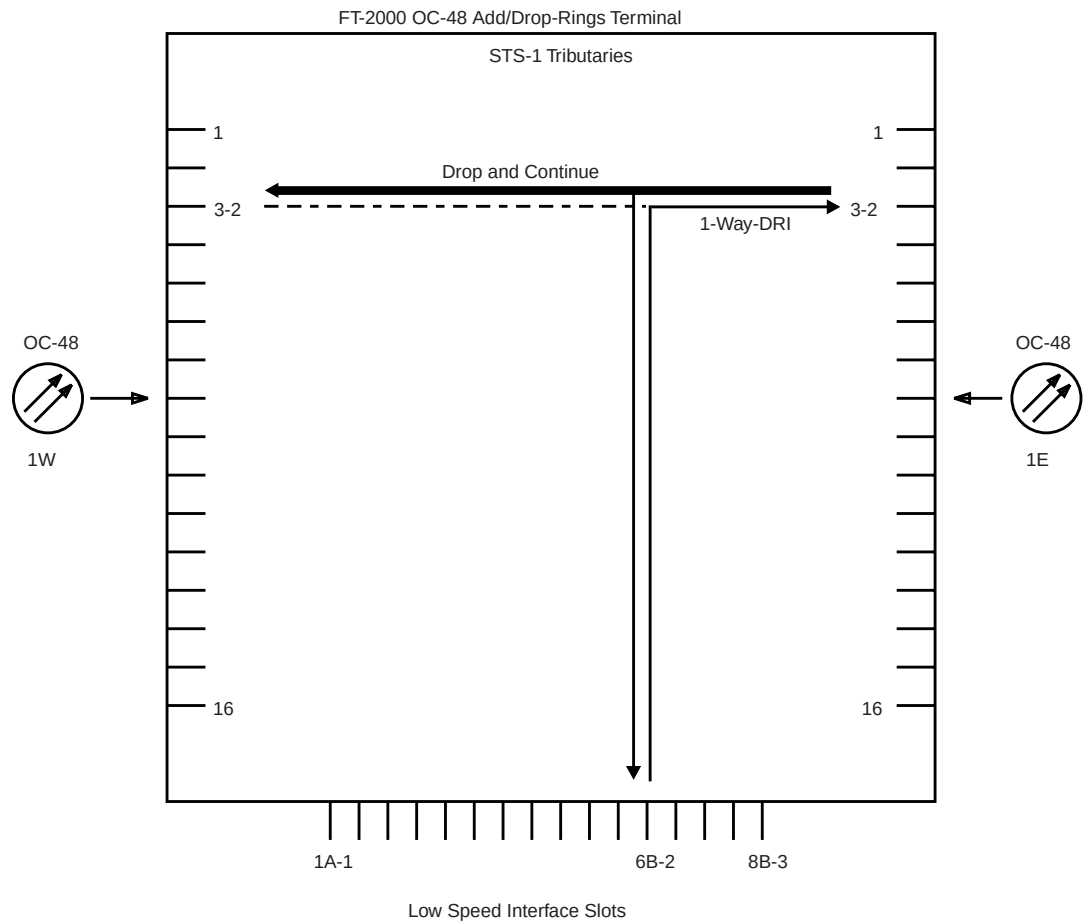


Figure 8-16. 2-Way-DRI Cross-Connection

2-Way-DRI-Pri Cross-Connection

The 2-Way-DRI-Pri is part of the DRI on Protection (DRIP) circuit which is an alternative to the 1-Way-DRI Cross-Connection. DRIP takes advantage of the protection bandwidth for the secondary circuit between the primary and secondary interworking nodes. The secondary circuit is the combination of the continue segment of the drop and continue (from the primary node to the secondary node), along with the duplicate feed segment from the other ring (from the secondary node to the primary node).

A 2-way-DRI-Pri cross-connection is a combination of:

- A 1-way-DRI cross-connection with a time slot interchange (TSI) from the service to the protection tributary, plus
- A drop and TSI-continue cross-connection (which is a type of Bridge cross-connection).

The 2-way-DRI-Pri cross-connections are made between any (a) service low-speed port, and any, (b) service STS-1 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-17 shows:

- Service low-speed port 2 of slot 6B (6B-2) cross-connected to outgoing service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E.
- Incoming protection STS-1 tributary 2 of STS-3 tributary 11 (11-2) of high-speed line 1W also cross-connected to the same destination (3-2 on OC-48 high-speed line 1E). This is the dashed line.
- Incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E is cross-connected to outgoing protection STS-1 tributary 2 of STS-3 tributary 11 (11-2) on OC-48 high-speed line 1W.
- Incoming service STS-1 tributary 2 of STS-3 tributary 3 (3-2) on OC-48 high-speed line 1E is also cross-connected to service low-speed port 2 of slot 6B (6B-2).

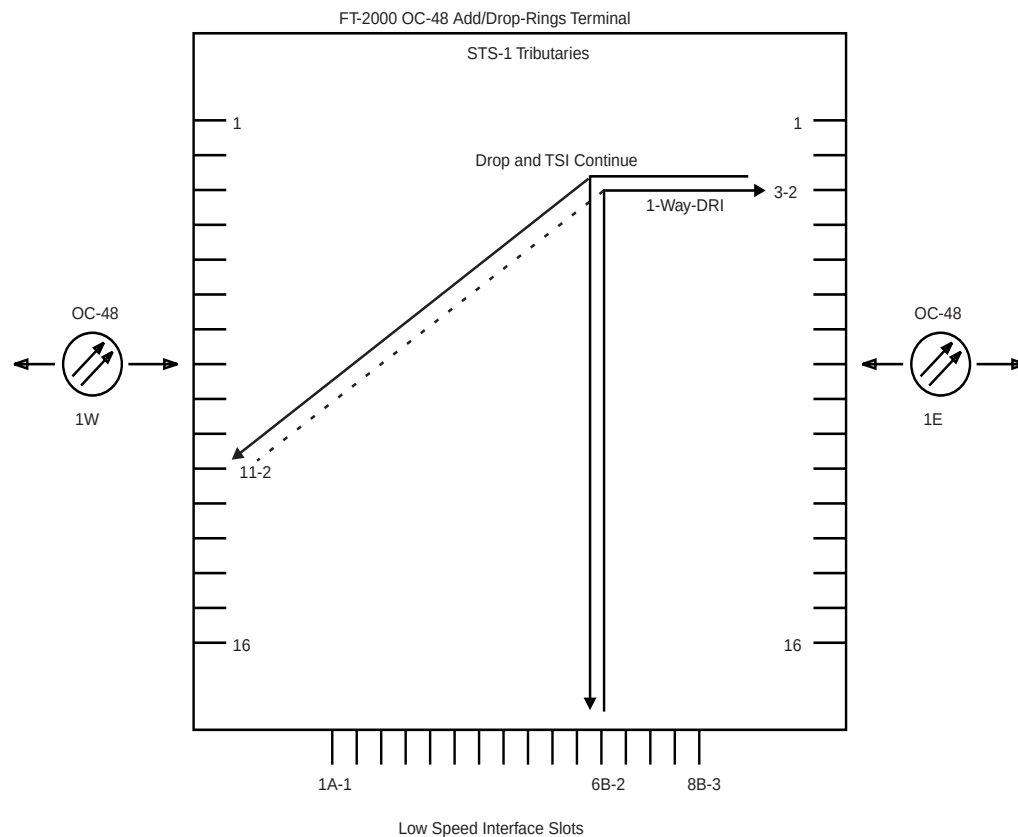


Figure 8-17. 2-Way-DRI-Pri Cross-Connection on Protection Bandwidth

2-Way-DRI-Sec Cross-Connection

The 2-way-DRI-Sec cross-connections are made between any (a) service low-speed port, and any, (b) protection STS-1 tributary on OC-48 high-speed line 1E or 1W. For example, Figure 8-18 shows:

- Service low-speed port 2 of slot 6B (6B-2) cross-connected to protection STS-1 tributary 2 of STS-3 tributary 11 (11-2) on OC-48 high-speed line 1E.

**NOTE:**

The 2-Way-DRI-Sec is similar to the 2-Way Add/Drop cross-connection.

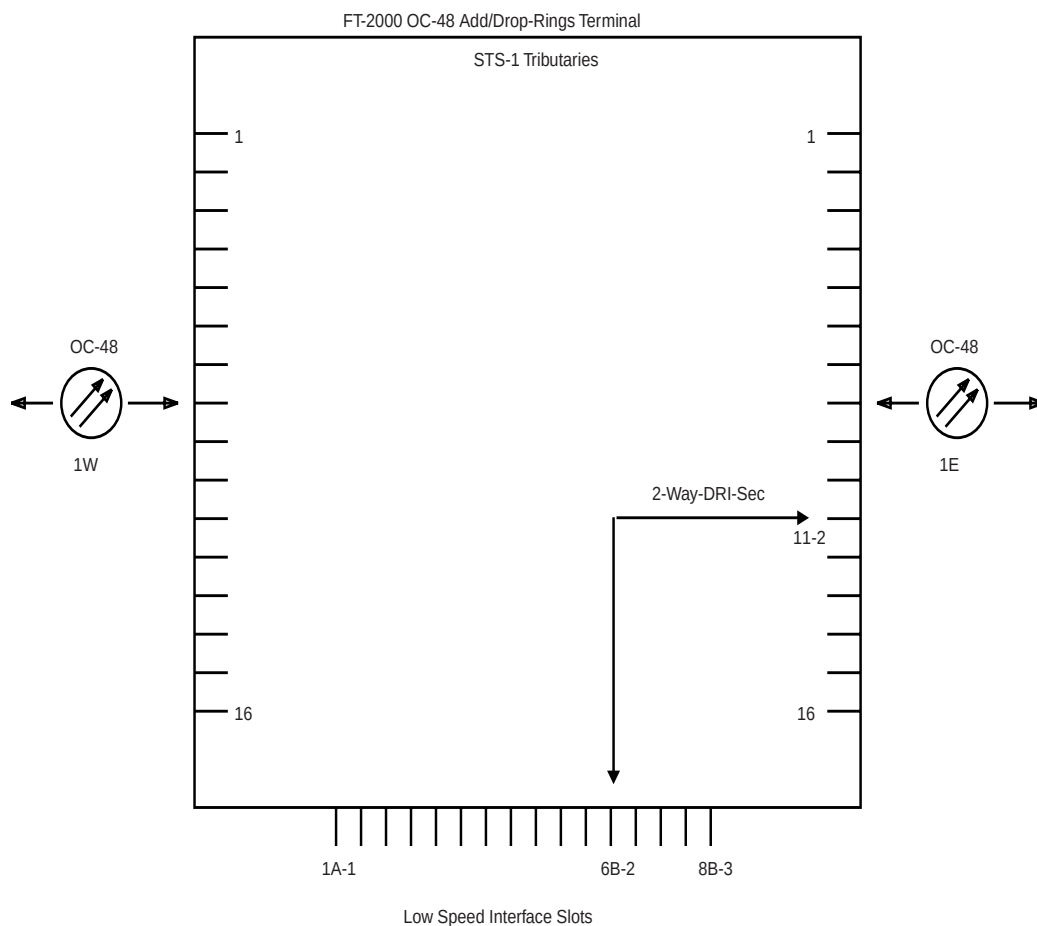
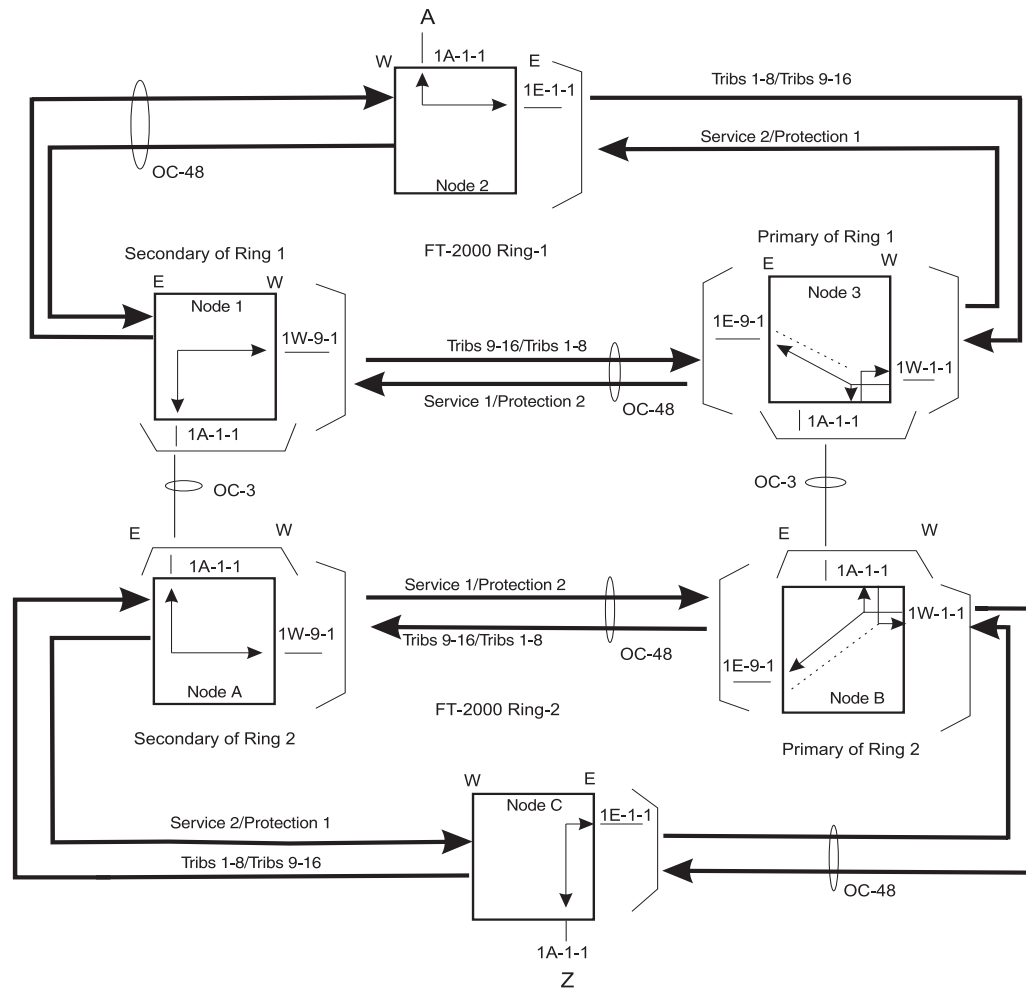


Figure 8-18. 2-Way-DRI-Sec Cross-Connection on Protection Bandwidth

Example of a DRI-P Application Depicting Both Primary and Secondary Cross-Connections

Figure 8-19 is included to further depict a typical DRI-P network arrangement.



052798-ds-1

Figure 8-19. Example DRI-P Application Depicting Primary and Secondary Cross-Connections

For clarification, the dotted-line is the switched path. While this figure shows an FT-ring to FT-ring interconnection it should be understood that other ring types are also possible, e.g., FT-ring to DDM-ring, etc. Also, the interconnection facility may be DS-3, STS1E, OC-12, in addition to OC-3. The interconnection facility may be

provisioned as 0x1, 1+1, or, and as appropriate, 0xN. It is not necessary that the two rings be connected primary node to primary node. Primary node to secondary node interconnections will work. Additionally, there are no restrictions that would limit DRI connections to just two rings. For example, three or more rings may be connected.

2-Way Cross-Connections

The FT-2000 OC-48 Add/Drop-Rings Terminal provides an STS-1 time slot assignment (TSA) capability that supports the following 2-way cross-connections:

- **Add/drop cross-connections:** Add/drop cross-connections are made between any service low-speed port and any STS-1 tributary of OC-48 high-speed line 1E or 1W. For example, Figure 8-20 shows service low-speed port 2 of slot 2B (2B-2) cross-connected to service STS-1 tributary 2 of STS-3 tributary 6 (6-2) on OC-48 high-speed line 1W.

Add/drop cross-connections are made between any service low-speed interface slot and the companion low-speed interface slot (for example, slot 2A and 2B) when the slot pair is provisioned for the OC-3 1+1 protected mode and any service STS-3 tributary. (Any low-speed port associated with the slot pair may be specified when entering the cross-connection.) A single input enters an active and a standby add cross-connection and two active drop cross-connections.

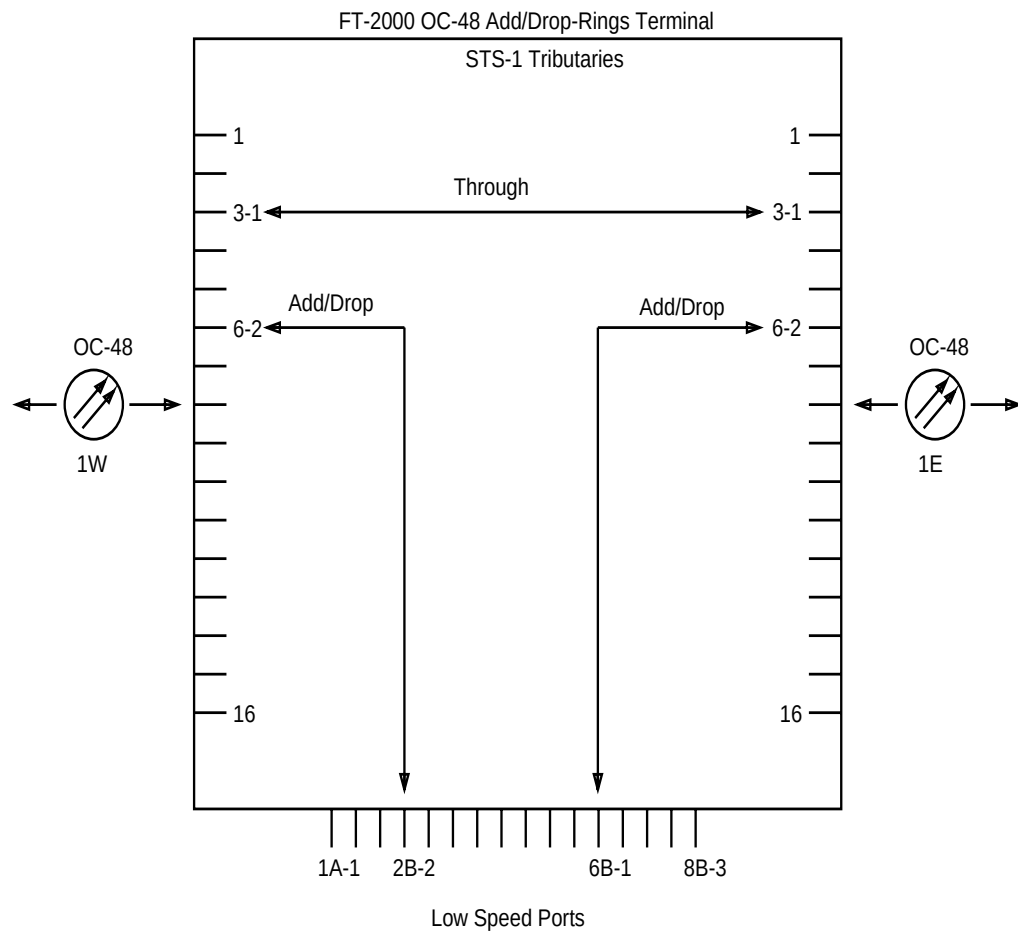


Figure 8-20. STS-1 2-Way Cross-Connections at an FT-2000 OC-48 Add/Drop-Rings Terminal

- **Through cross-connections:** Through cross-connections are made between any STS-1 tributary on OC-48 high-speed line 1E or 1W and the same-numbered STS-1 tributary of the other OC-48 high-speed line. For example, Figure 8-20 shows service STS-1 tributary 1 of STS-3 tributary (3-1) on OC-48 high-speed line 1W cross-connected to service STS-1 tributary 1 of STS-3 tributary 3 (3-1) on OC-48 high-speed line 1E.

When an STS-1 tributary of OC-48 high-speed line 1E or 1W is cross-connected to a service low-speed port, another service low-speed port may be cross-connected to the same-numbered STS-1 tributary of the other OC-48 high-speed line. For example, Figure 8-20 shows service low-speed port 2 of slot 2B (2B-2) cross-connected to service STS-1 tributary 2 of STS-3 tributary 6 (6-2) on OC-48 high-speed line 1W, and service low-speed port 1 of slot 6B (6B-1) cross-

connected to service STS-1 tributary 2 of STS-3 tributary 6 (6-2) on OC-48 high-speed line 1E. This is consistent with the 2-fiber bidirectional, line-switched ring standard.

STS-1 Cross-Connection Restrictions

STS-1 cross-connections have the following restrictions:

- The FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with the OC48 Receivers, Add/Drop [OC48 RCVR (A/D)] 839B5 or 839E5 and the following compatible OC48 Transmitter circuit packs:
 - OC48 Transmitter, Add/Drop - 1.3 μ m Standard Performance [OC48 TRMTR (A/D STS1 1.3 STD)] 739B5
 - OC48 Transmitter, Add/Drop - 1.3 μ m High Performance [OC48 TRMTR (A/D STS1 1.3 HI PERF)] 739C5
 - OC48 Transmitter, Add/Drop - 1.5 μ m Standard Performance [OC48 TRMTR (A/D STS1 1.5 STD)] 739E_
 - OC48 Transmitter, Add/Drop - 1.5 μ m High Performance [OC48 TRMTR (A/D STS1 1.5 HI PERF)] 739G_
 - OC48 Transmitter, Add/Drop - 1.5 μ m High Performance [OC48 TRMTR (A/D STS1 1.5 STD)] 739H_
 - OC48 Transmitter, Add/Drop - 1.5 μ m Standard Performance [OC48 TRMTR (A/D STS1 1.5 STD)] 739J5
 - OC48 Transmitter, Add/Drop - 1.5 μ m LBA Standard Performance [OC48 TRMTR (A/D STS1 1.5 LBA)] 739P5
 - OC48 Transmitter, Add/Drop - 1.5 μ m LBA Standard Performance [OC48 TRMTR (A/D STS1 1.5 LBA, W1)] 739R5
 - OC48 Transmitter, Add/Drop - 1.5 μ m LBA Standard Performance [OC48 TRMTR (A/D STS1 1.5 LBA, W2)] 739S5
- STS-1 cross-connections cannot be made from one low-speed port to another low-speed port or between two differently numbered STS-1 tributaries.
- The three STS-1 signals that are demultiplexed on a low-speed interface circuit pack must come from the same OC-48 high-speed line.



NOTE:

In an FT-2000 OC-48 Add/Drop-Rings Terminal equipped with Release 9.0.0-ADR or later software and the OC3 (1.3 STD) LAA10B circuit pack, the restriction listed above is removed.

Extra Traffic Capability

In 2-fiber ring protection switching, the protection STS-3 tributaries of OC-48 high-speed line 1E protect the service STS-3 tributaries of OC-48 high-speed line 1W. Conversely, the protection STS-3 tributaries of OC-48 high-speed line 1W protect the service STS-3 tributaries of OC-48 high-speed line 1E. Extra traffic allows access to the protection STS-3 and STS-1 tributaries of OC-48 high-speed line 1E or 1W for low priority traffic or for restoration purposes. The FT-2000 OC-48 Add/Drop-Rings Terminal has the capability to provide *extra traffic*.

In 2-fiber bidirectional rings, STS-3 tributaries 9 through 16 are protection tributaries. 1-way, 1-way-DRI, 2-way DRI, 2-way DRI-Pri, 2-way DRI-Sec, and 2-way cross-connections are possible between any service low-speed interface slot and any protection STS-3 tributary of OC-48 high-speed line 1E or 1W. Cross-connections are also possible between any protection STS-3 or STS-1 tributary of OC-48 high-speed line 1E or 1W and the same-numbered protection STS-3 or STS-1 tributary of the other OC-48 high-speed line.

For example, Figure 8-21 shows service low-speed interface slot 4B cross-connected to protection STS-3 tributary 10 of OC-48 high-speed line 1E (2-way) and protection STS-3 tributary 14 of OC-48 high-speed line 1W cross-connected to protection STS-3 tributary 14 of OC-48 high-speed line 1E (2-way).

For provisioning purposes, the protection tributary can carry either of two different categories (types) of extra traffic. They are referred to as:

- Preemptible Protection Access
- Non-Preemptible Protection Access (NPPA).

The extra traffic carried by non-preemptible tributaries is not dropped (preempted) by any ring loopback protection switch. Since protection switching in a ring is always bidirectional there will always be two unprotected tributaries for each tributary of NPPA traffic carried. One on the service fiber and the other on the protection fiber.

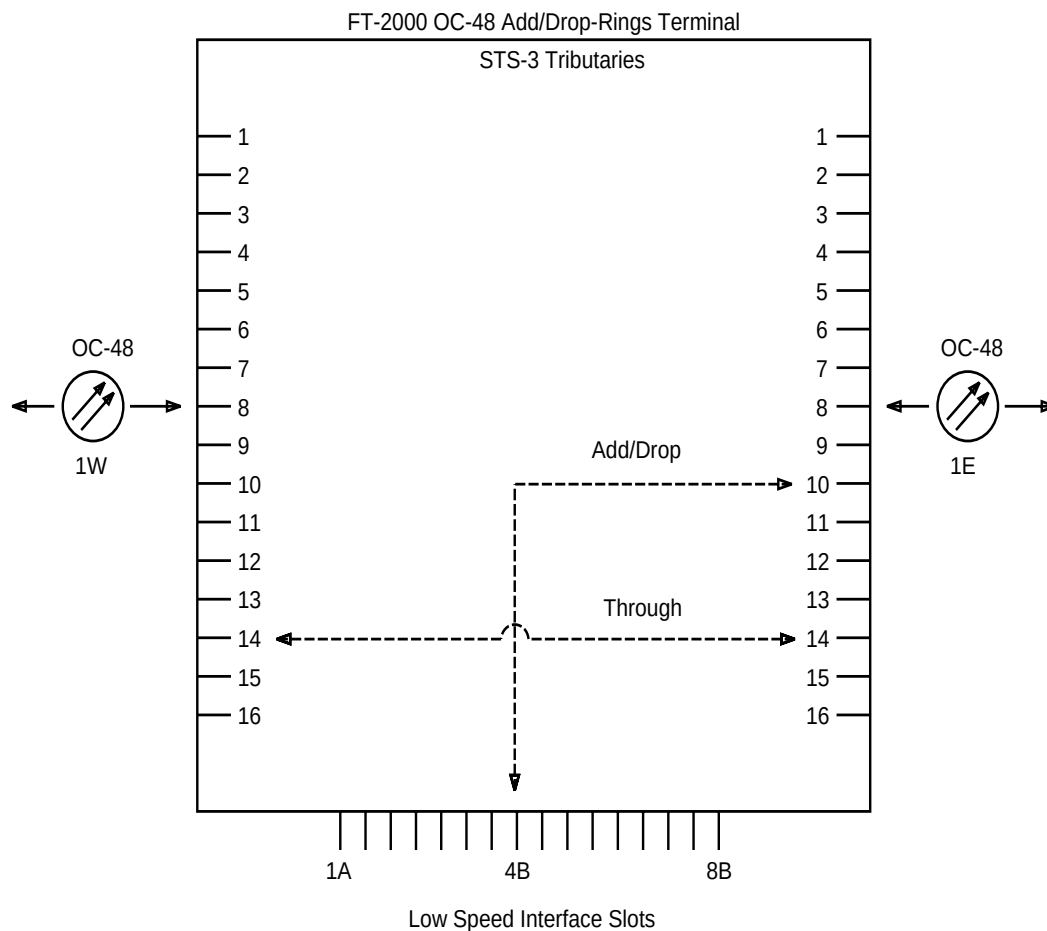


Figure 8-21. Extra Traffic Capability

Rolling Cross-Connections

The FT-2000 OC-48 Add/Drop Rings Terminal can roll traffic from an existing source port, slot, or tributary to a new source for 1-way and 1-way-DRI cross-connections. The existing 1-way or 1-way-DRI cross-connection and the new 1-way or 1-way-DRI cross-connection must have a common destination.

The existing cross-connection is deleted and a new cross-connection is entered as part in a 1-step process. This 1-step process takes less than 60 milliseconds. Both 1-way and 1-way-DRI cross-connections can be rolled from an existing source to a new source, using the **CONFIGURATION-Enter-Roll-STS3** or the **CONFIGURATION-Enter-Roll-STS1** input.

**NOTE:**

For Release 8.1 and later, it is NOT possible to “roll-to” or “roll-from” the 2-Way-DRI-Sec type cross-connection. It is possible to convert between 2-way-DRI and 2-way-DRI-pri cross-connections without changing the source.

Cross-Connection Inputs

Cross-connections must be specified and administered using the following inputs*: *

- **CONFIGURATION-Enter-Crossconnection-STS1:** This input enters a 1-way, 1-way-DRI, 2-way, 2-way-DRI, 2-way-DRI-Pri, or 2-way-DRI-Sec cross-connection.

- A *1-way* cross-connection is entered by specifying a 1-way source and destination. The source may be a low-speed port, a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-1 tributary. If the source is a low-speed port, the destination must be an STS-1 tributary. If the source is an STS-1 tributary, the destination must be a low-speed port, a low-speed port in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-1 tributary on the OC-48 high-speed line in the opposite direction. If the source is an STS-1 tributary, the source node TID must be specified. If the destination is an STS-1 tributary, the destination node TID must be specified.

An input requesting a 1-way cross-connection will be denied if the specified destination is already cross-connected to a different source, or the destination is already involved in a 1-way-DRI cross-connection. An input requesting a 1-way cross-connection will not be denied if the specified source is already cross-connected to a different destination. (The bridging capability allows two or more cross-connections to share the same source.)

- A *1-way-DRI* cross-connection is entered by specifying a 1-way source and destination. The source is always a low-speed port or a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-1 tributary. The DRI secondary node TID and the destination node TID in the ring must also be specified.

An input requesting a 1-way-DRI cross-connection will be denied if the specified destination (always an STS-1 tributary) is already involved in a 1-way, 2-way, or 1-way-DRI cross-connection. An input requesting a 1-way-DRI cross-connection will not be denied if the

* The FT-2000 OC-48 Lightwave System is menu-driven and prompts the user to enter the desired input.

specified source is already cross-connected to a different destination. (The bridging capability allows two or more cross-connections to share the same source.)

- A 2-way cross-connection is entered by first specifying a 1-way source and destination. The source may be a low-speed port, a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-1 tributary. If the source is a low-speed port, the destination must be an STS-1 tributary. If the source is an STS-1 tributary, the destination must be a low-speed port, a low-speed port in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-1 tributary on the OC-48 high-speed line in the opposite direction. If the source is an STS-1 tributary, the source node TID must be specified. If the destination is an STS-1 tributary, the destination node TID must be specified.

After the user specifies the first 1-way source and destination, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically enters the corresponding 1-way source and destination in the opposite direction. This creates a 2-way cross-connection.

An input requesting a 2-way cross-connection will be denied if the specified source is already cross-connected to a different destination, or if the specified destination is already cross-connected to a different source. This input will also be denied if the specified destination is already involved in a 1-way-DRI cross-connection.

- A 2-way-DRI cross-connection is entered by specifying a 1-way source and destination. The source (add) is always a low-speed port or a port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-1 tributary. Plus, a drop and continue cross-connection. The drop is to the low-speed port or a port in a slot pair and the continue is always an STS-1 tributary.
- A 2-way-DRI-Pri cross-connection is entered by specifying a 1-way source and destination. The source (add) is always a low-speed port or a port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-1 tributary (1-8). Plus, a drop and TSI-continue cross-connection. The drop is to the low-speed port or a port in a slot pair and the TSI-continue is always an STS-1 tributary (9-16).
- A 2-way-DRI-Sec cross-connection is entered by specifying a 2-way Add/Drop cross-connection. A low-speed port or a port in a slot pair serves as one of the cross-connection points while the other point is a STS-1 tributary (9-16), and can be on either 1E or 1W.
- AUDIT

- Red Line Service is an administrable parameter that controls whether the associated cross-connection is protected (or not protected) from being deleted. A cross-connection is termed “tagged for Red Line Service” whenever this parameter is administered as YES. The default is NO, meaning “not tagged for Red Line Service”.

**NOTE:**

Once a cross-connection is “tagged for Red Line Service” – that protection can only be removed via the **CONFIGURATION-Set - Crossconnection-STS1** command.

The source node TID and the destination node TID of an STS-1 tributary are required to support squelching during a 2-fiber ring protection switch. If an STS-1 tributary is specified as the source, the source node TID must be specified. The source node is the node in the ring where the low-speed signals on that STS-1 tributary originate. If an STS-1 tributary is specified as the destination, the destination node TID must be specified. The destination node is the node in the same ring where the low-speed signals on that STS-1 tributary terminate. If an STS-1 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node. For more information about 2-fiber ring protection switching and squelching, refer to Section 9, “Maintenance Description.”

The **CONFIGURATION-Enter - Crossconnection-STS1** input can also be used to change the values of the source and destination node parameters (node TIDs) associated with an existing cross-connection. This is accomplished by reentering the same cross-connection with the new TIDs for the source and/or destination nodes.

- **CONFIGURATION-Enter - Crossconnection-STS3:** This input enters a 1-way, 1-way-DRI, 2-way, 2-way-DRI, 2-way-DRI-Pri, or 2-way-DRI-Sec cross-connection.

- A 1-way cross-connection is entered by specifying a 1-way source and destination. The source may be a low-speed interface slot, a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-3 tributary. If the source is a low-speed interface slot, the destination must be an STS-3 tributary. If the source is an STS-3 tributary, the destination must be a low-speed interface slot, a low-speed interface slot in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-3 tributary on the OC-48 high-speed line in the opposite direction. If the source is an STS-3 tributary, the source node TID must be specified. If the destination is an STS-3 tributary, the destination node TID must be specified.

An input requesting a 1-way cross-connection will be denied if the specified destination is already cross-connected to a different source, or the destination is already involved in a 1-way-DRI cross-

connection. An input requesting a 1-way cross-connection will not be denied if the specified source is already cross-connected to a different destination. (The bridging capability allows two or more cross-connections to share the same source.)

- A *1-way-DRI* cross-connection is entered by specifying a 1-way source and destination. The source is always a low-speed interface slot or a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-3 tributary. The DRI secondary node TID and the destination node TID in the ring must also be specified.

An input requesting a *1-way-DRI* cross-connection will be denied if the specified destination (always an STS-3 tributary) is already involved in a 1-way, 2-way, or 1-way-DRI cross-connection. An input requesting a 1-way-DRI cross-connection will not be denied if the specified source is already cross-connected to a different destination. (The bridging capability allows two or more cross-connections to share the same source.)

- A *2-way* cross-connection is entered by first specifying a 1-way source and destination. The source may be a low-speed interface slot, a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-3 tributary. If the source is a low-speed interface slot, the destination must be an STS-3 tributary. If the source is an STS-3 tributary, the destination must be a low-speed interface slot, a low-speed interface slot in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-3 tributary on the OC-48 high-speed line in the opposite direction. If the source is an STS-3 tributary, the source node TID must be specified. If the destination is an STS-3 tributary, the destination node TID must be specified.

After the user specifies the first 1-way source and destination, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically enters the corresponding 1-way source and destination in the opposite direction. This creates a 2-way cross-connection.

An input requesting a 2-way cross-connection will be denied if the specified source is already cross-connected to a different destination, or if the specified destination is already cross-connected to a different source. This input will also be denied if the specified destination is already involved in a 1-way-DRI cross-connection.

- A *2-way-DRI* cross-connection is entered by specifying a 1-way source and destination. The source (add) is always a low-speed slot or slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-3 tributary. Plus, a drop and continue cross-connection. The drop is to the low-speed slot or slot pair and the continue is always an STS-3 tributary.

- A 2-way-DRI-Pri cross-connection is entered by specifying a 1-way source and destination. The source (add) is always a low-speed slot or a low-speed slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-3 tributary (1-8). Plus, a drop and TSI-continue cross-connection. The drop is to the low-speed slot or slot pair and the TSI-continue is always an STS-3 tributary (9-16).
- A 2-way-DRI-Sec cross-connection is entered by specifying a 2-way Add/Drop cross-connection. A low-speed slot or slot pair serves as one of the cross-connection points while the other point is a STS-3 tributary (9-16), and can be on either 1E or 1W.
- AUDIT
- Red Line Service is an administrable parameter that controls whether the associated cross-connection is protected (or not protected) from being deleted. A cross-connection is termed “tagged for Red Line Service” whenever this parameter is administered as YES. The default is NO, meaning “not tagged for Red Line Service”.

**NOTE:**

Once a cross-connection is “tagged for Red Line Service” – that protection can only be removed via the **CONFIGURATION-Set - Crossconnection-STS3** command.

The source node TID and the destination node TID of an STS-3 tributary are required to support squelching during a 2-fiber ring protection switch. If an STS-3 tributary is specified as the source, the source node TID must be specified. The source node is the node in the ring where the low-speed signals on that STS-3 tributary originate. If an STS-3 tributary is specified as the destination, the destination node TID must be specified. The destination node is the node in the same ring where the low-speed signals on that STS-3 tributary terminate. If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node. For more information about 2-fiber ring protection switching and squelching, refer to Section 9, “Maintenance Description.”

The **CONFIGURATION-Enter - Crossconnection-STS3** input can also be used to change the values of the source and destination node parameters associated with an existing cross-connection. This is accomplished by reentering the same cross-connection with the new node TIDs for the source and/or destination nodes.

- **CONFIGURATION-Set - Crossconnection-STS1:** Depending upon whether the Red Line Services parameter is set to YES or NO, this input either “tags” or removes the tag for one or more STS-1 cross-connections. All cross-connection types can be tagged, or have their tag removed, via this input command.

- **CONFIGURATION-Set-Crossconnection-STS3:** Depending upon whether the Red Line Services parameter is set to YES or NO, this input either “tags” or removes the tag for one or more STS-3 cross-connections. All cross-connection types can be tagged, or have their tag removed, via this input command.
- **CONFIGURATION-Delete-Crossconnection-STS1:** This input deletes a 1-way, 1-way-DRI, 2-way, 2-way-DRI, 2-way-DRI-Pri, or 2-way-DRI-Sec cross-connection.
 - A *1-way* cross-connection is deleted by specifying the source and destination. The source is a low-speed port, a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-1 tributary. If the source is a low-speed port, the destination must be an STS-1 tributary. If the source is an STS-1 tributary, the destination must be a low-speed port, a low-speed port in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-1 tributary on the OC-48 high-speed line in the opposite direction.
 - A *1-way-DRI* cross-connection is deleted by specifying the source and destination. The source is always a low-speed port or a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-1 tributary.
 - A *2-way* cross-connection is deleted by first specifying the source and destination. The source is a low-speed port, a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or STS-1 tributary. If the source is a low-speed port, the destination must be an STS-1 tributary. If the source is an STS-1 tributary, the destination must be a low-speed port, a low-speed port in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-1 tributary on the OC-48 high-speed line in the opposite direction.

After the user specifies the first 1-way source and destination, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically deletes the corresponding 1-way source and destination in the opposite direction. This deletes the 2-way cross-connection.
 - A *2-way-DRI* cross-connection is deleted by first specifying a source and destination. The source is a low-speed slot or slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination must be an STS-1 tributary.
 - A *2-way-DRI-Pri* cross-connection is deleted by first specifying the source and destination. The source is a low-speed port or a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode. The destination must be an STS-1 tributary.

- A *2-way-DRI-Sec* cross-connection is deleted by first specifying the source and destination. The source is a low-speed port or a low-speed port in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode. The destination must be an STS-1 tributary.

This input is only denied if the specified cross-connection is “tagged for Red Line Service,” or if the cross-connection does not exist.

This input does not require the node TID of the source and destination nodes to be specified.

- **CONFIGURATION-Delete-Crossconnection-STS3:** This input deletes a 1-way, 1-way-DRI, 2-way, 2-way-DRI, 2-way-DRI-Pri, or 2-way-DRI-Sec cross-connection.

- A *1-way* cross-connection is deleted by specifying the source and destination. The source is a low-speed interface slot, a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or an STS-3 tributary. If the source is a low-speed interface slot, the destination must be an STS-3 tributary. If the source is an STS-3 tributary, the destination must be a low-speed interface slot, a low-speed interface slot in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-3 tributary on the OC-48 high-speed line in the opposite direction.
- A *1-way-DRI* cross-connection is deleted by specifying the source and destination. The source is always a low-speed interface slot or a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination is always an STS-3 tributary.
- A *2-way* cross-connection is deleted by first specifying the source and destination. The source is a low-speed interface slot, a low-speed interface slot in a slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, or STS-3 tributary. If the source is a low-speed interface slot, the destination must be an STS-3 tributary. If the source is an STS-3 tributary, the destination must be a low-speed interface slot, a low-speed interface slot in a slot pair provisioned for the OC-3 1+1 protected mode, or the same-numbered STS-3 tributary on the OC-48 high-speed line in the opposite direction.

After the user specifies the first 1-way source and destination, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically deletes the corresponding 1-way source and destination in the opposite direction. This deletes the 2-way cross-connection.

- A *2-way-DRI* cross-connection is deleted by first specifying the source and destination. The source is a low-speed slot or slot pair (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode, and the destination must be an STS-3 tributary.
- A *2-way-DRI-Pri* cross-connection is deleted by first specifying the source and destination. The source is a low-speed slot or a low-speed slot (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode. The destination must be an STS-3 tributary.
- A *2-way-DRI-Sec* cross-connection is deleted by first specifying the source and destination. The source is a low-speed slot or a low-speed slot (for example, slot 2A and 2B) provisioned for the OC-3 1+1 protected mode. The destination must be an STS-3 tributary.

This input is only denied, if the specified cross-connection is “tagged for Red Line Service,” or if the cross-connection does not exist.

This input does not require the node ID or TID of the source and destination nodes to be specified.

- **CONFIGURATION-Enter-Roll-STS1:** This input performs a **CONFIGURATION-Delete-Crossconnection-STS1** input and a **CONFIGURATION-Enter-Crossconnection-STS1** input in a 1-step process. This capability allows traffic to be rolled from one source to another source as part of normal user operations. The 1-step process rolls traffic from an existing source to a new source for 1-way and 1-way-DRI cross-connections. The existing cross-connection and the new cross-connection must have the same destination. Traffic is rolled from the existing source to the new source by specifying the destination and source of the existing 1-way or 1-way-DRI cross-connection to be deleted, the type of new cross-connection (1-way or 1-way-DRI), and the new source of the 1-way or 1-way-DRI cross-connection to be entered. The node TID of the source node in the ring must be specified. The source node is the node in the ring where the low-speed signals on that STS-1 tributary originate.

This input is denied if the existing cross-connection, as specified, is not in effect or if the new cross-connection does not meet the requirements for a 1-way or 1-way-DRI cross-connection.

With an FT-2000 OC-48 Add/Drop-Rings Terminal Release 8.1 or later, it is possible to convert between 2-way-DRI and 2-way-DRI-pri cross-connections without changing the source.

- **CONFIGURATION-Enter-Roll-STS3:** This input performs a **CONFIGURATION-Delete-Crossconnection-STS3** input and a **CONFIGURATION-Enter-Crossconnection-STS3** input in a 1-step process. This capability allows traffic to be rolled from one source to another source as part of normal user operations. The 1-step process rolls traffic from an existing source to a new source for 1-way and 1-way-DRI cross-connections. The existing cross-connection and the new cross-connection must have the same destination. Traffic is rolled from the

existing source to the new source by specifying the destination and source of the existing 1-way or 1-way-DRI cross-connection to be deleted, the type of new cross-connection (1-way or 1-way-DRI), and the new source of the 1-way or 1-way-DRI cross-connection to be entered. The node TID of the source node in the ring must be specified. The source node is the node in the ring where the low-speed signals on that STS-3 tributary originate.

This input is denied if the existing cross-connection, as specified, is not in effect or if the new cross-connection does not meet the requirements for a 1-way or 1-way-DRI cross-connection.

**NOTE:**

A circuit audit alarm is automatically generated when there is a crossconnect configuration error.

- **CONFIGURATION-Retrieve-Crossconnection-All:** This input generates a report showing all the existing STS-1 cross-connections in the FT-2000 OC-48 Add/Drop-Rings Terminal. The **FAULT-Retrieve-History** input also generates a report that can be used to find out how a cross-connection was entered. For more information about the STS-1 Cross-Connection Map Report and History Report, refer to Section 11, "Craft Interface Terminal Usage."
- **FAULT-Switch-Path-STS1:** This input controls the state of an existing 1-way-DRI cross-connection. The state of the existing 1-way-DRI cross-connection is switched by specifying the destination STS-1 tributary and the protection switch priority (reset or manual).

An input requesting a DRI protection switch will be denied if the specified destination STS-1 tributary is not involved in a 1-way-DRI cross-connection or if the input is entered with a manual priority and the DRI protection switch is in the automatic switch state. For more information about dual ring interworking protection switching, refer to Section 9, "Maintenance Description."

- **FAULT-Switch-Path-STS3:** This input controls the state of an existing 1-way-DRI cross-connection. The state of the existing 1-way-DRI cross-connection is switched by specifying the destination STS-3 tributary and the protection switch priority (reset or manual).

An input requesting a DRI protection switch will be denied if the specified destination STS-3 tributary is not involved in a 1-way-DRI cross-connection or if the input is entered with a manual priority and the DRI protection switch is in the automatic switch state. For more information about dual ring interworking protection switching, refer to Section 9, "Maintenance Description."

Cross-Connection Examples

Entering 1-Way and 2-Way STS-1 Cross-Connections

Figure 8-22 shows two STS-1 circuits that have been established on a 2-fiber bidirectional ring with 1-way and 2-way STS-1 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals. The **CONFIGURATION-Enter-Crossconnection-STs1** input is used to enter 1-way and 2-way cross-connections.

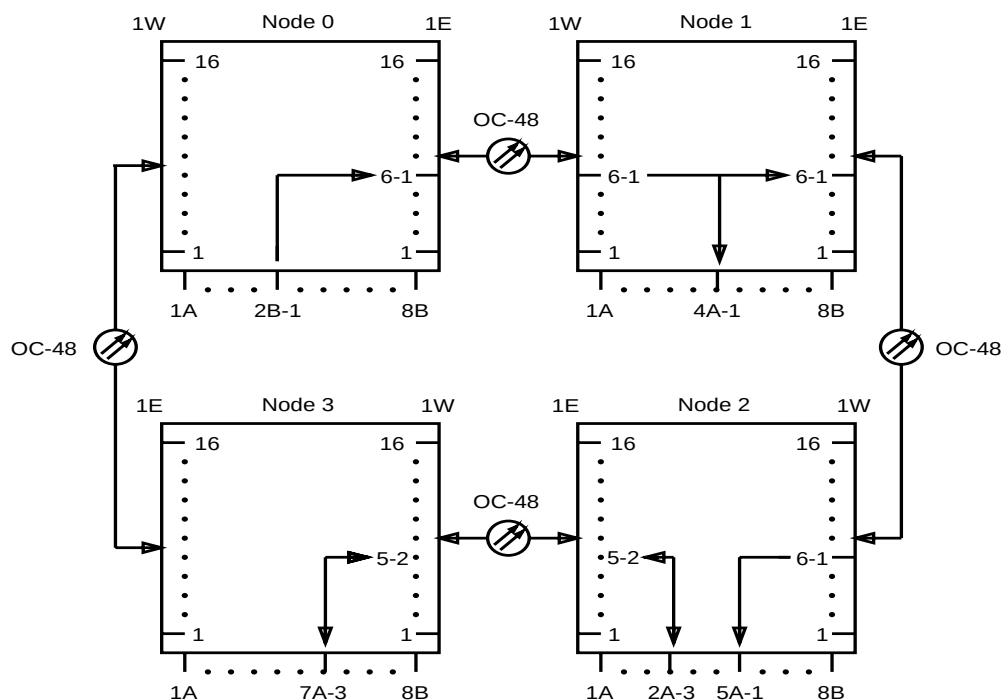


Figure 8-22. Example of 1-Way and 2-Way STS-1 Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 0, a 1-way add cross-connection is entered by specifying:
 - Source low-speed interface slot* (slot 2B)
 - Source STS-1 port (1)
 - Destination line (line 1E)

* If the specified slot is part of a slot pair that has been provisioned for the OC-3 1+1/OC-12 1+1 protected mode, specifying one slot also includes the companion slot.

- Destination STS-3 tributary (tributary 6)
- Destination STS-1 tributary (tributary 1)
- Destination node TID^{*†} (node 2 TID).

- At node 1, a 1-way through cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source STS-1 tributary (tributary 1)
 - Source node TID[†] (node 0 TID)
 - Destination (tributary)
 - Destination node TID[†] (node 2 TID).

At node 1, a bridge is also established when a 1-way drop cross-connection is entered. The 1-way drop cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source STS-1 tributary (tributary 1)
- Source node TID[†] (node 0 TID)
- Destination (STS1 port)
- Destination low-speed interface slot* (slot 4A)
- Destination low-speed port (1).

- At node 2, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source STS-1 tributary (tributary 1)
 - Source node TID[†] (node 0 TID)

* Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

† If an STS-1 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated is the destination node.

- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 5A)
- Destination low-speed port (1).

At node 2, a 2-way add/drop cross-connection is entered by specifying:

Source (STS-1 port)

- Source low-speed interface slot* (slot 2A)
- Source low-speed port (3)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 5)
- Destination STS-1 tributary (tributary 2)
- Destination node TID† (node 3 TID).

The same 2-way add/drop cross-connection may also be entered by specifying:

Source (tributary)

- Source line (line 1E)
- Source STS-3 tributary (tributary 5)
- Source STS-1 tributary (tributary 2)
- Source node TID† (node 3 TID)
- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 2A)
- Destination low-speed port (3).

- At node 3, a 2-way add/drop cross-connection is entered by specifying:

Source (tributary)

- Source line (line 1W)
- Source STS-3 tributary (tributary 5)
- Source STS-1 tributary (tributary 2)
- Source node TID† (node 2 TID)
- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 7A).
- Destination low-speed port (3).

The same 2-way add/drop cross-connection may also be entered by specifying:

- Source (STS-1 port)
- Source low-speed interface slot* (slot 7A)

- Source low-speed port (3)
- Destination line (line 1W)
- Destination STS-3 tributary (tributary 5)
- Destination STS-1 tributary (tributary 2)
- Destination node TID† (node 2 TID).



NOTE:

While cross-connections are entered, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been entered. If the trouble conditions remain after all the cross-connections have been entered, refer to the "Operation and Maintenance (TOP)" Section.

For more information about entering cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section. Figure 8-23 shows a worksheet that may be used to record STS-1 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals in a 2-fiber bidirectional ring.

	W	E		W	E		W	E		W	E		W	E
1	1	1		1	1		1	1		1	1		1	1
2	2	2		2	2		2	2		2	2		2	2
3	3	3		3	3		3	3		3	3		3	3
4	1	1		1	1		1	1		1	1		1	1
5	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	3	3		3	3		3	3		3	3		3	3
7	1	1		1	1		1	1		1	1		1	1
8	2	2	3	2	2	3	2	2	3	2	2	3	2	2
9	3	3		3	3		3	3		3	3		3	3
10	1	1		1	1		1	1		1	1		1	1
11	2	2	4	2	2	4	2	2	4	2	2	4	2	2
12	3	3		3	3		3	3		3	3		3	3
13	1	1		1	1		1	1		1	1		1	1
14	2	2	5	2	2	5	2	2	5	2	2	5	2	2
15	3	3		3	3		3	3		3	3		3	3
16	1	1		1	1		1	1		1	1		1	1
17	2	2	6	2	2	6	2	2	6	2	2	6	2	2
18	3	3		3	3		3	3		3	3		3	3
19	1	1		1	1		1	1		1	1		1	1
20	2	2	7	2	2	7	2	2	7	2	2	7	2	2
21	3	3		3	3		3	3		3	3		3	3
22	1	1		1	1		1	1		1	1		1	1
23	2	2	8	2	2	8	2	2	8	2	2	8	2	2
24	3	3		3	3		3	3		3	3		3	3
25	1	1		1	1		1	1		1	1		1	1
26	2	2	9	2	2	9	2	2	9	2	2	9	2	2
27	3	3		3	3		3	3		3	3		3	3
28	1	1		1	1		1	1		1	1		1	1
29	2	2	10	2	2	10	2	2	10	2	2	10	2	2
30	3	3		3	3		3	3		3	3		3	3
31	1	1		1	1		1	1		1	1		1	1
32	2	2	11	2	2	11	2	2	11	2	2	11	2	2
33	3	3		3	3		3	3		3	3		3	3
34	1	1		1	1		1	1		1	1		1	1
35	2	2	12	2	2	12	2	2	12	2	2	12	2	2
36	3	3		3	3		3	3		3	3		3	3
37	1	1		1	1		1	1		1	1		1	1
38	2	2	13	2	2	13	2	2	13	2	2	13	2	2
39	3	3		3	3		3	3		3	3		3	3
40	1	1		1	1		1	1		1	1		1	1
41	2	2	14	2	2	14	2	2	14	2	2	14	2	2
42	3	3		3	3		3	3		3	3		3	3
43	1	1		1	1		1	1		1	1		1	1
44	2	2	15	2	2	15	2	2	15	2	2	15	2	2
45	3	3		3	3		3	3		3	3		3	3
46	1	1		1	1		1	1		1	1		1	1
47	2	2	16	2	2	16	2	2	16	2	2	16	2	2
48	3	3		3	3		3	3		3	3		3	3

TID _____ TID _____ TID _____ TID _____

Figure 8-23. STS-1 Cross-Connection Worksheet

Entering 1-Way and 2-Way STS-3 Cross-Connections

Figure 8-24 shows two circuits that have been established on a 2-fiber bidirectional ring with 1-way and 2-way cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals. The **CONFIGURATION-Enter-Crossconnection-STs3** input is used to enter 1-way and 2-way cross-connections.

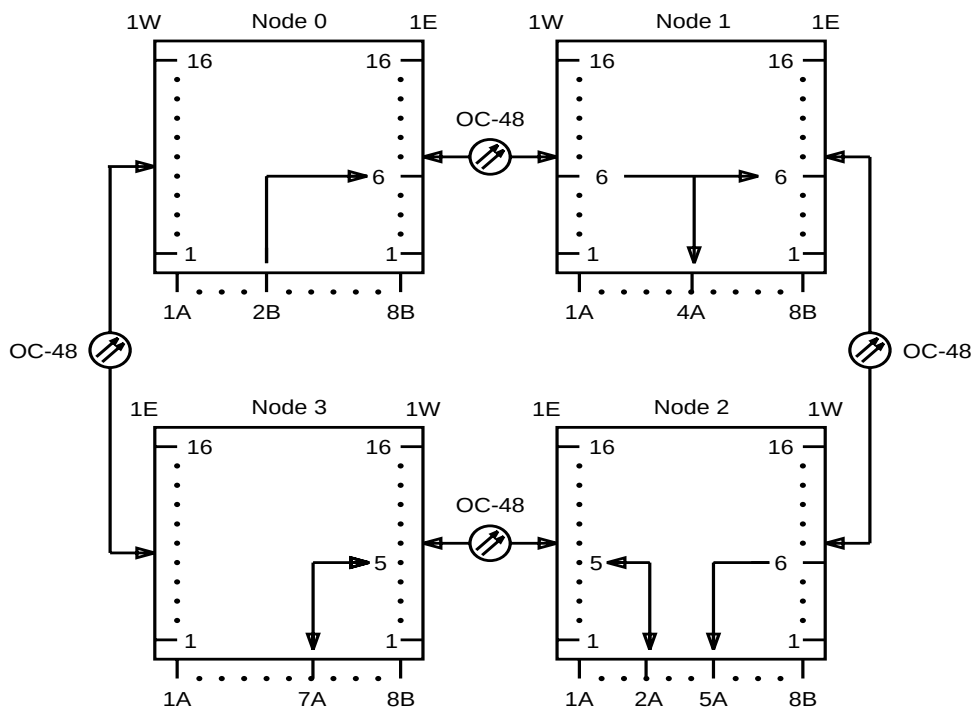


Figure 8-24. Example of 1-Way and 2-Way Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 0, a 1-way add cross-connection is entered by specifying:
 - Source (slot)
 - Source low-speed interface slot* (slot 2B)
 - Destination line (line 1E)
 - Destination STS-3 tributary (tributary 6)
 - Destination node TID^{†‡} (node 2 TID).

* In the specified slot is part of a slot pair that has been provisioned for the OC-3 1+1/OC-12 1+1 protected mode, specifying one slot also includes the companion slot.

† Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

‡ If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated is the destination node.

- At node 1, a 1-way through cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID† (node 0 TID)
 - Destination (tributary)
 - Destination node TID† (node 2 TID).

At node 1, a bridge is also established when a 1-way drop cross-connection is entered. The 1-way drop cross-connection is entered by specifying:

- Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID† (node 0 TID)
 - Destination (slot)
 - Destination low-speed interface slot* (slot 4A).
- At node 2, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID† (node 0 TID)
 - Destination (slot)
 - Destination low-speed interface slot* (slot 5A).

At node 2, a 2-way add/drop cross-connection is entered by specifying:

- Source (slot)
- Source low-speed interface slot* (slot 2A)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 5)
- Destination node TID†‡ (node 3 TID).

The same 2-way add/drop cross-connection may also be entered by specifying:

- Source (tributary)
- Source line (line 1E)
- Source STS-3 tributary (tributary 5)

- Source node TID†‡ (node 3 TID)
- Destination (slot)
- Destination low-speed interface slot* (slot 2A).

■ At node 3, a 2-way add/drop cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 5)
- Source node TID†‡ (node 2 TID)
- Destination (slot)
- Destination low-speed interface slot* (slot 7A).

The same 2-way add/drop cross-connection may also be entered by specifying:

- Source (slot)
- Source low-speed interface slot* (slot 7A)
- Destination line (line 1W)
- Destination STS-3 tributary (tributary 5)
- Destination node TID†‡ (node 2 TID).



NOTE:

While cross-connections are entered, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been entered. If the trouble conditions remain after all the cross-connections have been entered, refer to the "Operation and Maintenance (TOP)" Section.

For more information about entering cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

Figure 8-25 shows a worksheet that may be used to record STS-3 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals in a 2-fiber bidirectional ring.

	W	E	W	E	W	E	W	E
1	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
2	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
6	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
7	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
9	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
10	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
11	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
12	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
13	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
14	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
15	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
16	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3

TID _____ TID _____ TID _____ TID _____

Figure 8-25. STS-3 Cross-Connection Worksheet

Entering 1-Way-DRI STS-1 Cross-Connections in Dual Ring Interworking Applications

Figure 8-26 shows a 1-way circuit that has been established on a 2-fiber bidirectional ring that is part of a dual ring interworking application. 1-way and 1-way-DRI cross-connections are used at the primary and secondary nodes. The **CONFIGURATION-Enter-Crossconnection-STS1** input is used to enter 1-way and 1-way-DRI cross-connections. Refer to "Entering 1-Way and 2-Way STS-1 Cross-Connections" in this section for examples showing bridge and 2-way cross-connections.

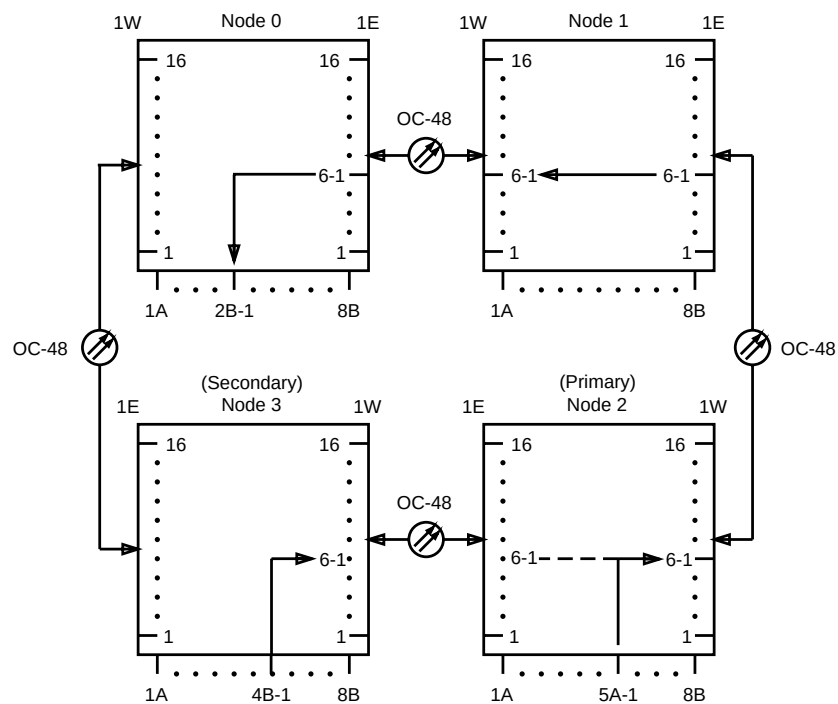


Figure 8-26. Example of STS-1 1-Way-DRI Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 2 (primary node), a 1-way-DRI cross-connection is entered by specifying:
 - Source low-speed interface slot* (slot 5A)

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

- Source low-speed port (1)
- Destination line (line 1W)
- Destination STS-3 tributary (tributary 6)
- Destination STS-1 tributary (tributary 1)
- Destination node TID (node 0 TID)
- Secondary node TID (node 3 TID).
- At node 3 (secondary node), a 1-way add cross-connection is entered by specifying:
 - Source (STS-1 port)
 - Source low-speed interface slot* (slot 4B)
 - Source low-speed port (1)
 - Destination line (line 1W)
 - Destination STS-3 tributary (tributary 6)
 - Destination STS-1 tributary (tributary 1)
 - Destination node TID^{†‡} (node 0 TID).
- At node 1, a 1-way through cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1E)
 - Source STS-3 tributary (tributary 6)
 - Source STS-1 tributary (tributary 1)
 - Source node TID (node 3 TID)
 - Destination (tributary)
 - Destination node TID^{†‡} (node 0 TID).
- At node 0, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1E)
 - Source STS-3 tributary (tributary 6)

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

† Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

‡ If an STS-1 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node.

- Source STS-1 tributary (tributary 1)
- Source node TID† (node 3 TID)
- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 2B)
- Destination low-speed port (1).



NOTE:

While cross-connections are entered, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been entered. If the trouble conditions remain after all the cross-connections have been entered, refer to the "Operation and Maintenance (TOP)" Section.

Figure 8-23 shows a worksheet that may be used to record STS-1 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals in a 2-fiber bidirectional ring.

For more information about entering cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section. For more information about DRI protection switching, refer to Section 9, "Maintenance Description."

Entering 1-Way-DRI STS-3 Cross-Connections in Dual Ring Interworking Applications

Figure 8-27 shows a 1-way circuit that has been established on a 2-fiber bidirectional ring that is part of a dual ring interworking application. 1-way and 1-way-DRI cross-connections are used at the primary and secondary nodes. The **CONFIGURATION-Enter-Crossconnection-STs3** input is used to enter 1-way and 1-way-DRI cross-connections. Refer to "Entering 1-Way and 2-Way Cross-Connections" in this section for examples showing bridge and 2-way cross-connections.

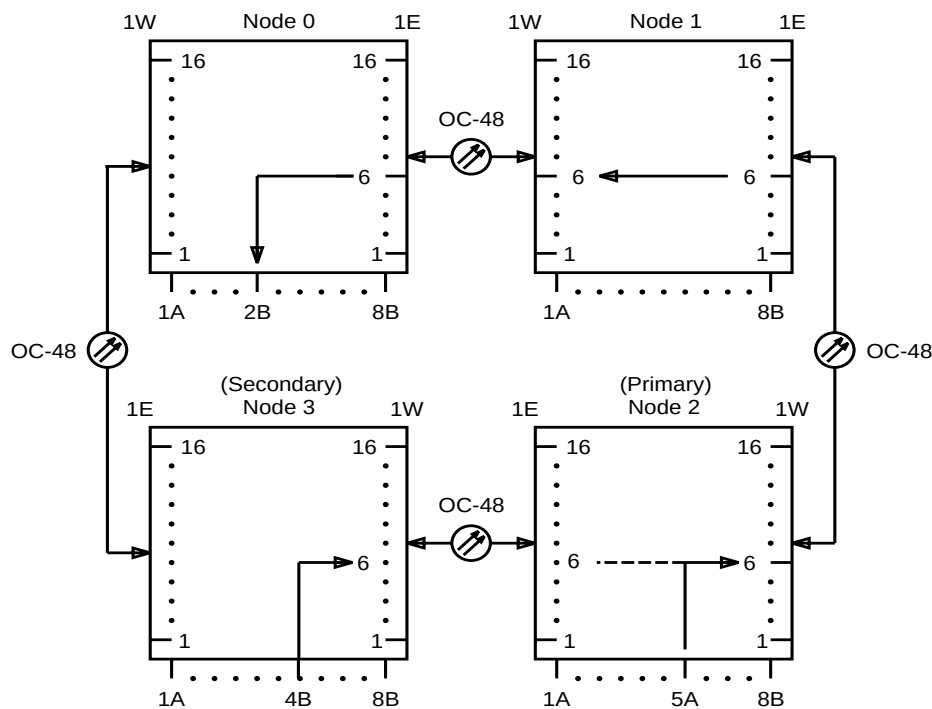


Figure 8-27. Example of STS-3 1-Way-DRI Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 2 (primary node), a 1-way-DRI cross-connection is entered by specifying:

- Source low-speed interface slot* (slot 5A)

- Destination line (line 1W)

- Destination STS-3 tributary (tributary 6)

- Destination node TID^{†‡} (node 0 TID).

- Secondary node TID[†] (node 3 TID).

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

† Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

‡ If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node.

- At node 3 (secondary node), a 1-way add cross-connection is entered by specifying:
 - Source (slot)
 - Source low-speed interface slot* (slot 4B)
 - Destination line (line 1W)
 - Destination STS-3 tributary (tributary 6)
 - Destination node TID^{† ‡} (node 0 TID).
- At node 1, a 1-way through cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1E)
 - Source STS-3 tributary (tributary 6)
 - Source node TID[†] (node 3 TID)
 - Destination (tributary)
 - Destination node TID^{†‡} (node 0 TID).
- At node 0, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1E)
 - Source STS-3 tributary (tributary 6)
 - Source node TID[†] (node 3 TID)
 - Destination (slot)
 - Destination low-speed interface slot* (slot 2B).

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

† Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

‡ If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node.



NOTE:

While cross-connections are entered, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been entered. If the trouble conditions remain after all the cross-connections have been entered, refer to the "Operation and Maintenance (TOP)" section.

Figure 8-25 shows a worksheet that may be used to record STS-3 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals in a 2-fiber bidirectional ring.

For more information about entering cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section. For more information about DRI protection switching, refer to Section 9, "Maintenance Description."

Entering 1-Way-DRI Cross-Connections in Video Applications

Figure 8-28 shows a 1-way circuit that has been established on a 2-fiber bidirectional ring that is part of a 1-way video application. The 2-fiber bidirectional ring has two nodes with 1-way-DRI cross-connections (node 0 and node 2) and each node has a 1-way drop cross-connection from line 1W. Nodes 1, 3, and 4 also have a 1-way through cross-connection.

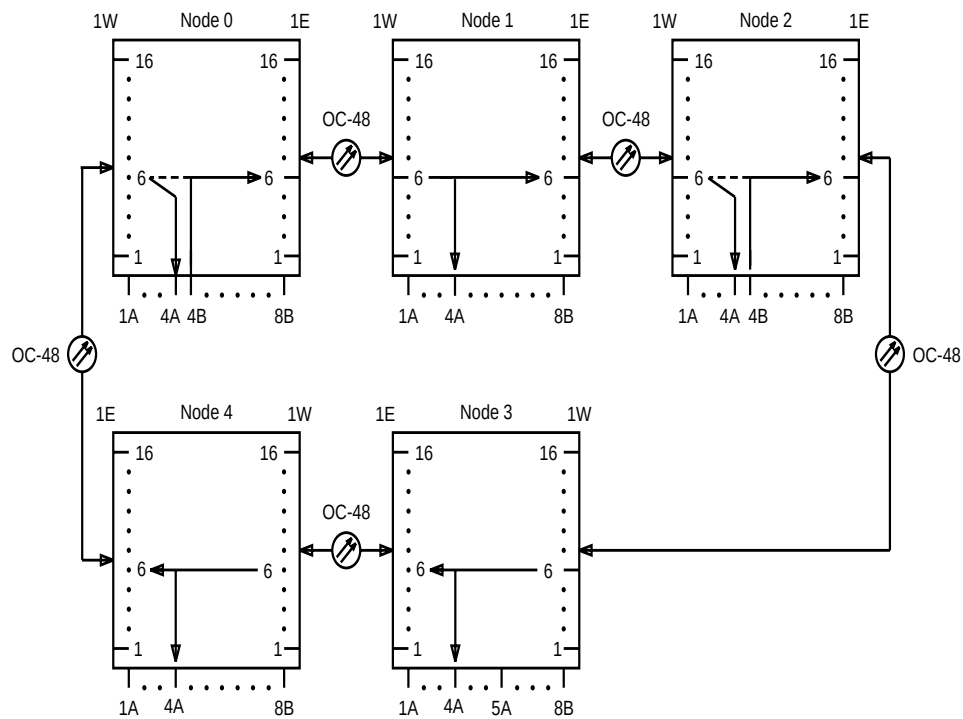


Figure 8-28. Example of 1-Way and 1-Way-DRI Cross-Connections in Video Applications

The **CONFIGURATION-Enter-Crossconnection-STS3** input is used to enter 1-way and 1-way-DRI cross-connections at the nodes. (Refer to "Entering 1-Way and 2-Way Cross-Connections" in this section for examples showing bridge and 2-way cross-connections.)

The following rules should be observed when specifying the source node TID, secondary node TID, and destination node TID parameters.

- The value of the source node TID parameter (1-way cross-connections) and the value of the secondary node TID parameter (1-way-DRI cross-connections) must be the *same* at all nodes. The value must be the TID of a node where there is a 1-way-DRI cross-connection.
- The value of the destination node TID parameter depends on exactly what cross-connections are present. To determine the value of the destination node TID at the local node, assign the following:
 - **X** is the TID of the local node.
 - **Y** is the TID of the next downstream node with a 1-way-DRI cross-connection. X and Y will never be the same node.

- Z is the TID of the last node with a 1-way drop cross-connection when following the circuit from node X to node Y. Z can be node X or Y, some other node between X and Y, or null if there are no 1-way drop cross-connections between X and Y.

If Z is X or null, use the TID of node Y as the value of the destination node TID parameter. Otherwise, use the TID of node Z as the value of the destination node TID parameter.

The following cross-connections are required to establish the circuit shown in Figure 8-28:

- At node 0, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID* (node 0 TID)
 - Destination (slot)
 - Destination low-speed interface slot (slot 4A).
- A 1-way-DRI cross-connection is entered by specifying:
- Source low-speed interface slot (slot 4B)
 - Destination line (line 1E)
 - Destination STS-3 tributary (tributary 6)
 - Destination node TID* (node 2 TID)
 - Secondary node TID* (node 0 TID).

*

- At node 1, a 1-way drop cross-connection is entered by specifying:
 - Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID* (node 0 TID)
 - Destination (slot)
 - Destination low-speed interface slot (slot 4A).

A 1-way through cross-connection is entered by specifying:

- Source (tributary)

*

Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

- Source line (line 1E)
- Source STS-3 tributary (tributary 6)
- Source node TID* (node 0 TID)
- Destination (tributary)
- Destination node TID* (node 2 TID).

■ At node 2, a 1-way drop cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source node TID* (node 0 TID)
- Destination (slot)
- Destination low-speed interface slot (slot 4A).

A 1-way-DRI cross-connection is entered by specifying:

- Source low-speed interface slot (slot 4B)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 6)
- Destination node TID* (node 0 TID).
- Secondary node TID* (node 0 TID).

*

■ At node 3, a 1-way drop cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source node TID* (node 0 TID)
- Destination (slot)
- Destination low-speed interface slot (slot 4A).

A 1-way through cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1E)
- Source STS-3 tributary (tributary 6)

*

Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

- Source node TID* (node 0 TID)
 - Destination (tributary)
 - Destination node TID* (node 0 TID).
- At node 4, a 1-way drop cross-connection is entered by specifying:
- Source (tributary)
 - Source line (line 1W)
 - Source STS-3 tributary (tributary 6)
 - Source node TID* (node 0 TID)
 - Destination (slot)
 - Destination low-speed interface slot (slot 4A).

A 1-way through cross-connection is entered by specifying:

- Source (tributary)
- Source line (line 1E)
- Source STS-3 tributary (tributary 6)
- Source node TID* (node 0 TID)
- Destination (tributary)
- Destination node TID* (node 0 TID).



NOTE:

While cross-connections are entered, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been entered. If the trouble conditions remain after all the cross-connections have been entered, refer to the "Operation and Maintenance (TOP)" section.

Figure 8-25 shows a worksheet that may be used to record STS-3 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals in a 2-fiber bidirectional ring.

For more information about entering cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and

*

Entering a question mark (?) in response to the TID prompt will display a point-and-shoot list of available addresses in the OC-48 ring. Enter the **Retrieve-Map-Ring** command to update the point-and-shoot list.

Maintenance (TOP)" Section. For more information about DRI protection switching, refer to Section 9, "Maintenance Description."

Rolling STS-1 Cross-Connections

Figure 8-29 shows a 1-way circuit that has been established on a 2-fiber bidirectional ring with 1-way STS-1 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals. The **CONFIGURATION-Roll-Crossconnection-STS1** input is used to roll traffic from an existing source to a new source.

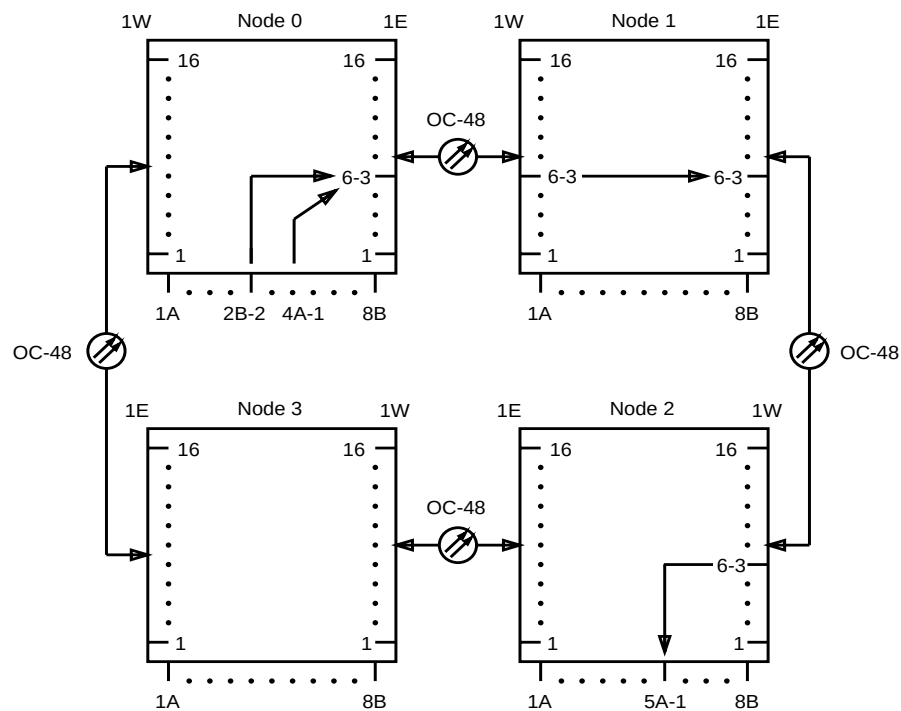


Figure 8-29. Example of Rolling STS-1 Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 0, traffic is rolled from low-speed interface slot 2B, port 2, to low-speed interface slot 4A, port 1, by specifying:
 - Source (STS-1 port)
 - Source low-speed interface slot* (slot 2B)
 - Source low-speed port (2)
 - Destination line (line 1E)
 - Destination STS-3 tributary (tributary 6)

- Destination STS-1 tributary (tributary 3)
- New cross-connection type (1-way)
- New source (STS-1 port)
- New source low-speed interface slot* (slot 4A)
- New source low-speed port (1).

Rolling STS-3 Cross-Connections

Figure 8-30 shows a 1-way circuit that has been established on a 2-fiber bidirectional ring with 1-way STS-3 cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals. The **CONFIGURATION-Roll-Crossconnection-STS3** input is used to roll traffic from an existing source to a new source.

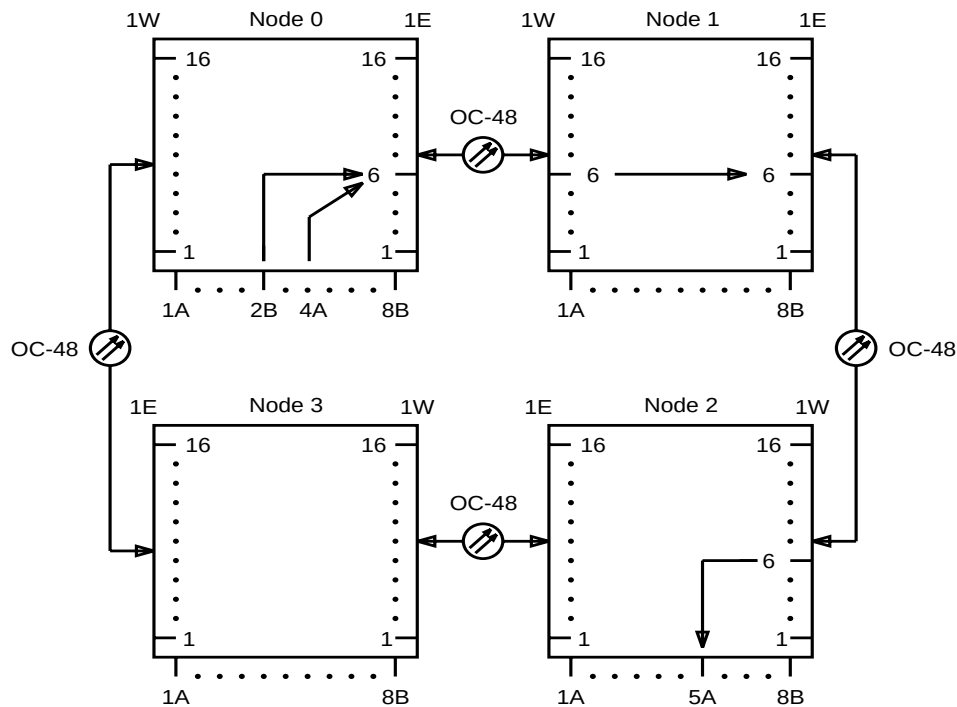


Figure 8-30. Example of Rolling STS-3 Cross-Connections in a 2-Fiber Bidirectional Ring

At node 0, traffic is rolled from low-speed interface slot 2B to low-speed interface slot 4A by specifying:

Source (slot)

- Source low-speed interface slot* (slot 2B)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 6)
- New cross-connection type (1-way)
- New source (slot 4A).

Example of an FT-2000 Ring Configuration With Cross-Connections “Tagged” for Red Line Service

The user determines which of their cross-connections are of critical importance. And, it is the user who decides which cross-connections to “tagged” for Red Line Service. Figure 8-31 is an example of an FT-2000 Ring that provides connections linking two geographically separate Air Traffic Control Centers. The cross-connections, within the respective nodes that serve the two centers, are termed critical and “tagged” for Red Line Service.

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protection mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

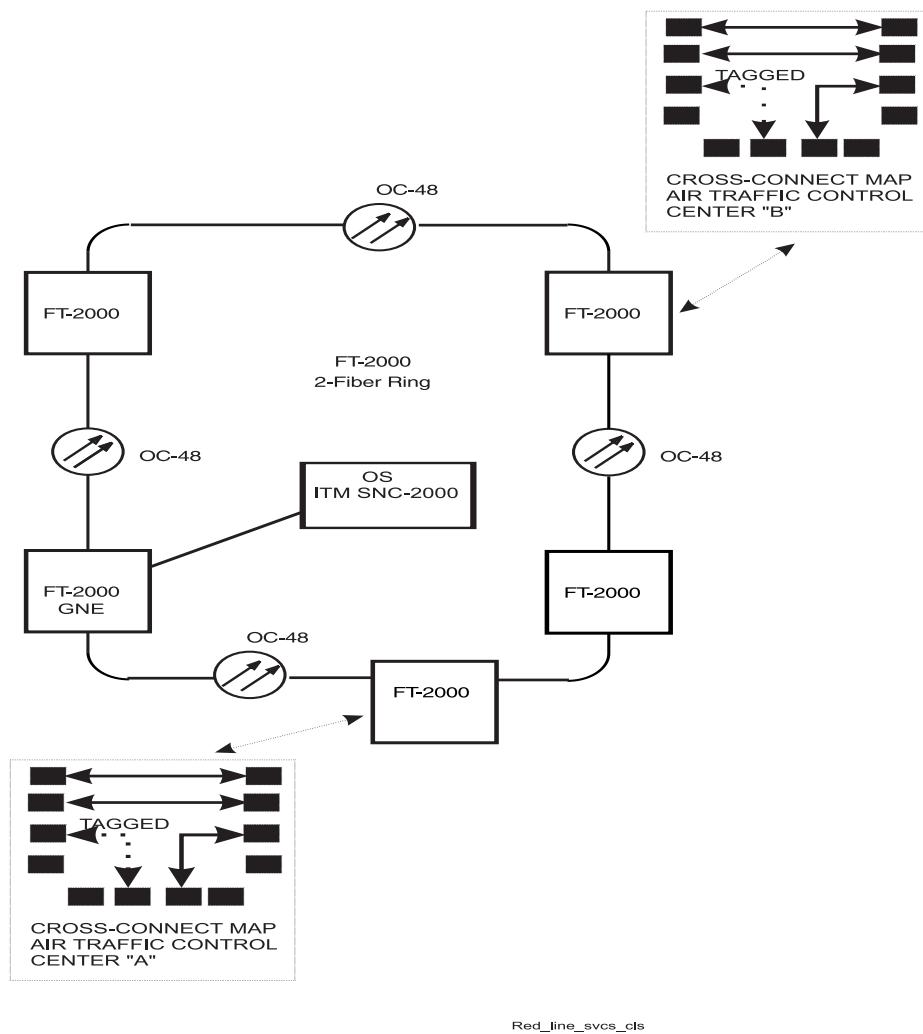


Figure 8-31. Example FT-2000 Ring Depicting Cross-Connections “Tagged” for Red Line Service

Deleting STS-1 Cross-Connections

The cross-connections shown in Figure 8-32 may be deleted using the **CONFIGURATION-Delete-Crossconnection-STS1** input.

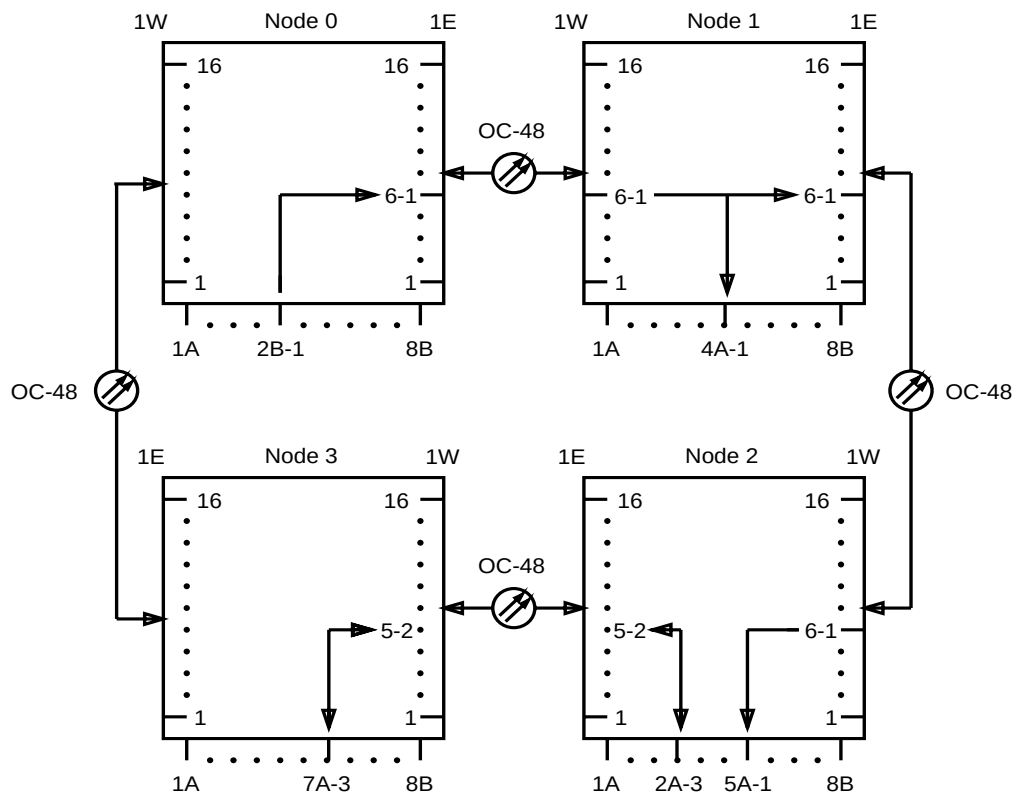


Figure 8-32. Example of STS-1 Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 0, the 1-way add cross-connection is deleted by specifying:
 - Source (STS-1 port)
 - Source low-speed interface slot* (slot 2B)
 - Source low-speed port (1)
 - Destination line (line 1E)
 - Destination STS-3 tributary (tributary 6)
 - Destination STS-1 tributary (tributary 1).
- At node 1, the 1-way through cross-connection is deleted by specifying:
 - Source (tributary)

- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source STS-1 tributary (tributary 1)
- Destination (tributary).

The 1-way drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source STS-1 tributary (tributary 1)
- Destination (STS-1 Port)
- Destination low-speed interface slot* (slot 4A)
- Destination low-speed port (1).

- At node 2, the 1-way drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Source STS-1 tributary (tributary 1)
- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 5A)
- Destination low-speed port (1).

The 2-way add/drop cross-connection is deleted by specifying:

- Source (STS-1 port)
- Source low-speed interface slot* (slot 2A)
- Source low-speed port (3)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 5)
- Destination STS-1 tributary (tributary 2).

- At node 3, the 2-way add/drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)

* If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

- Source STS-3 tributary (tributary 5)
- Source STS-1 tributary (tributary 2)
- Destination (STS-1 port)
- Destination low-speed interface slot* (slot 7A)
- Destination low-speed port (3).



NOTE:

*While cross-connections are deleted, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been deleted. If the trouble conditions remain after all the cross-connections have been deleted, refer to the "Operation and Maintenance (TOP)" section.

For more information about deleting cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

*

If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

Deleting STS-3 Cross-Connections

The cross-connections shown in Figure 8-33 may be deleted using the **CONFIGURATION-Delete-Crossconnection-STS3** input.

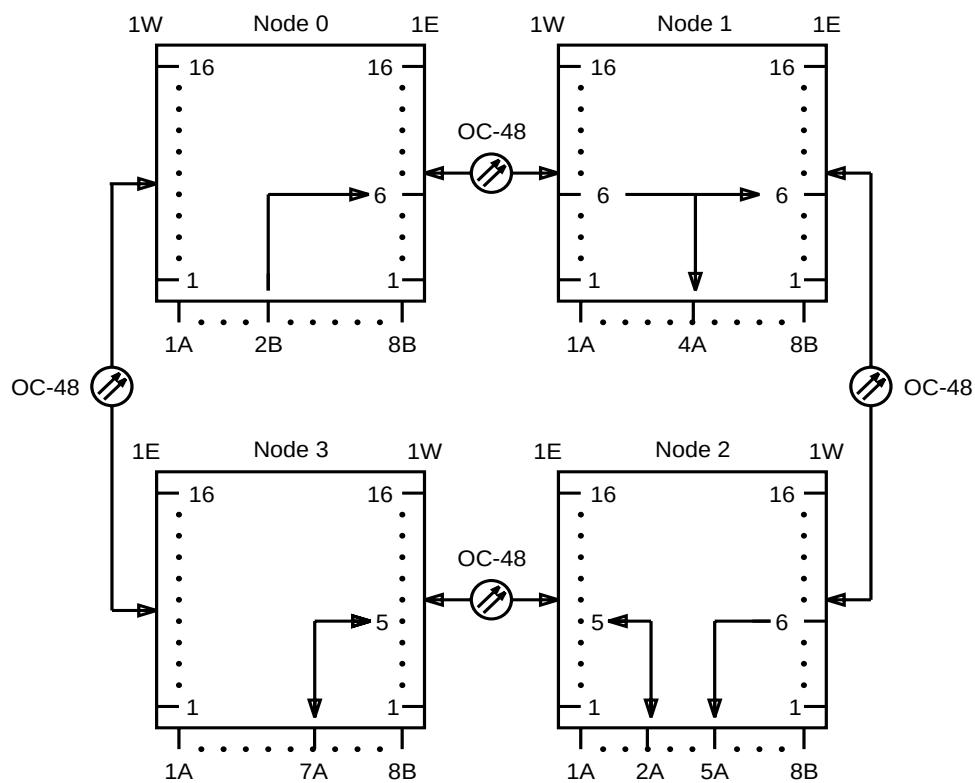


Figure 8-33. Example of STS-3 Cross-Connections in a 2-Fiber Bidirectional Ring

- At node 0, the 1-way add cross-connection is deleted by specifying:
 - Source (slot)
 - Source low-speed interface slot* (slot 2B)
 - Destination line (line 1E)
 - Destination STS-3 tributary (tributary 6).

* if the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.

- At node 1, the 1-way through cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Destination (tributary).

The 1-way drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Destination (slot)
- Destination low-speed interface slot* (slot 4A).

- At node 2, the 1-way drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 6)
- Destination (slot)
- Destination low-speed interface slot* (slot 5A).

The 2-way add/drop cross-connection is deleted by specifying:

- Source (slot)
- Source low-speed interface slot* (slot 2A)
- Destination line (line 1E)
- Destination STS-3 tributary (tributary 5).

- At node 3, the 2-way add/drop cross-connection is deleted by specifying:

- Source (tributary)
- Source line (line 1W)
- Source STS-3 tributary (tributary 5)
- Destination (slot)
- Destination low-speed interface slot* (slot 7A).

*

If the specified slot is part of a slot pair (for example, slot 1A and 1B) that has been provisioned for the OC-3 1+1 protected mode, specifying one slot also includes the companion slot. The same type of logic applies to OC-12 1+1 protected mode.



NOTE:

While cross-connections are deleted, the FT-2000 OC-48 Add/Drop-Rings Terminal will report several trouble conditions (for example, circuit provisioning error and path integrity failure). However, these trouble conditions should be ignored until all the cross-connections for a circuit have been deleted. If the trouble conditions remain after all the cross-connections have been deleted, refer to the "Operation and Maintenance (TOP)" section.

For more information about deleting cross-connections at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

OC-3 DCC Assignment Inputs

The OC-3 DCC assignments must be specified and administered using the following inputs*:

- **CONFIGURATION-Enter-Assignment-DCC:** This input assigns an OC-3 DCC to a particular low-speed interface slot or pair of low-speed interface slots. An OC-3 DCC assignment is entered by first specifying a low-speed interface slot and a DCC. The low-speed interface slot may be a single slot in the OC-3 0x1 operating mode, or a low-speed interface slot in a slot pair (for example, slot 2A and 2B) operating in the OC-3 1+1 protected mode. (When entering an assignment to a 1+1 protected slot pair, an active assignment is made to the active slot of the slot pair and a standby assignment is made to the standby slot of the slot pair.) The user must specify a single DCC (channel 1-8).

After the low-speed interface slot and DCC are specified, the user must specify the orientation (*user* or *network*). If the *user* orientation is specified at one end of the OC-3 DCC link, the *network* orientation must be specified at the other end of the OC-3 DCC link.

An input requesting an OC-3 DCC assignment will be denied if one of the following conditions is present:

- The specified slot is not equipped with an OC3 (1.3 STD) circuit pack.
- The TOHCTL slot is in the AUTO state.
- The TOHCTL circuit pack has been removed.
- The TOHCTL circuit pack has failed.

* The FT-2000 OC-48 Lightwave System is menu-driven and prompts the user to enter the desired input.

An input requesting an OC-3 DCC assignment may be denied if an automatic turnup test is running. During that part of the test cycle when the DCC connections between the OC3 (1.3 STD) and TOHCTL circuit packs are being verified, an input requesting an OC-3 DCC assignment will be denied.

The **CONFIGURATION-Enter-Assignment-DCC** input can also be used to change the value (*user* or *network*) of the orientation parameter associated with an existing OC-3 DCC assignment. This is accomplished by reentering the same OC-3 DCC assignment with the new value for the orientation parameter.



NOTE:

When the operating mode of a slot pair changes from 1+1 to 0x1 in the "from OC-48" and/or the "from OC-3" directions, any DCC assignment to the slot pair changes to an assignment to the "A" slot and there will be no assignment to the "B" slot.



NOTE:

When the operating mode of a slot pair changes from 0x1 to 1+1 in the "from OC-48" and the "from OC-3" direction, any DCC assignment to the "A" slot changes to an assignment to the slot pair and any assignment to the "B" slot is deleted.

- **CONFIGURATION-Delete-Assignment-DCC:** This input deletes an OC-3 DCC assignment to a low-speed interface slot or pair of low-speed interface slots. Deleting an OC-3 DCC assignment disables DCC communications on the supporting OC-3 line. An OC-3 DCC assignment is deleted by specifying a low-speed interface slot and a DCC. The low-speed interface slot may be a single slot in the OC-3 0x1 operating mode, or a low-speed interface slot in a slot pair (for example, slot 2A and 2B) operating in the OC-3 1+1 protected mode. The user must specify a single DCC (channel 1-8).

An input deleting an OC-3 DCC assignment will be denied if one of the following conditions is present:

- The TOHCTL slot is in the AUTO state.
- The TOHCTL circuit pack has been removed.
- The TOHCTL circuit pack has failed.

An input deleting an OC-3 DCC assignment may be denied if an automatic turnup test is running. During that part of the test cycle when the DCC connections between the OC3 (1.3 STD) and TOHCTL circuit packs are being verified, an input deleting an OC-3 DCC assignment will be denied.

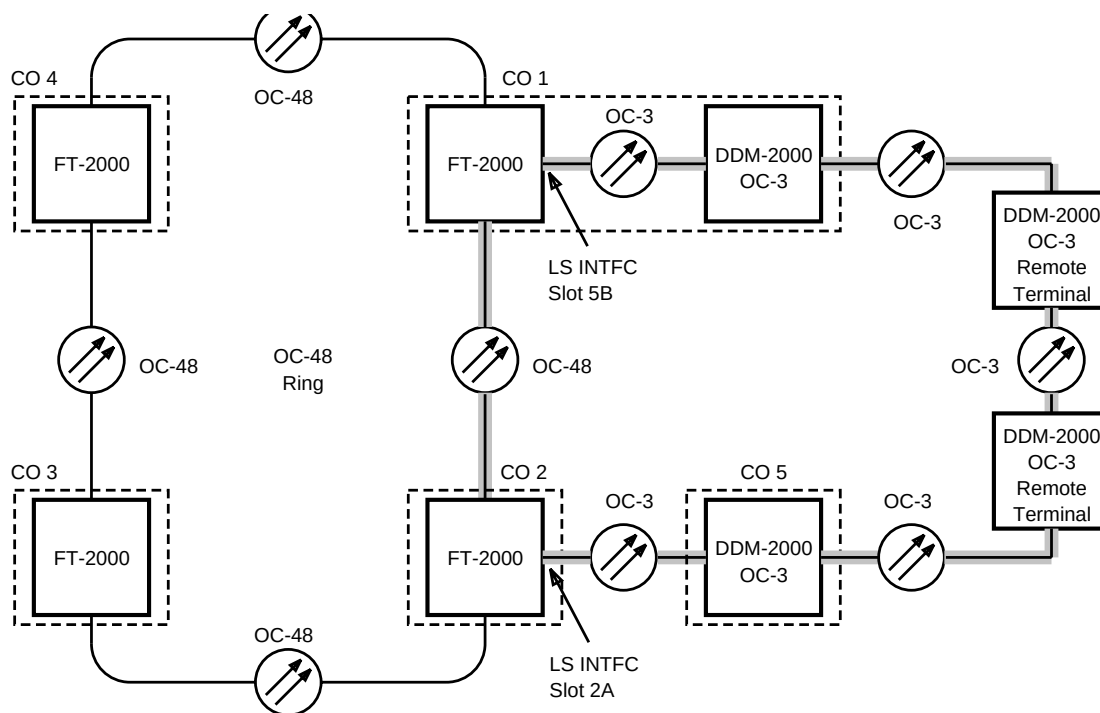
If the DCC assignment specified by the input does not exist, the input will be completed and no DCC assignment is deleted.

- **CONFIGURATION-Retrieve-Assignment-DCC:** This input generates a report showing all the OC-3 DCCs assigned to low-speed interface slots or low-speed interface slot pairs in the FT-2000 OC-48 Add/Drop-Rings Terminal. For more information about the DCC Assignment Report, refer to Section 11, "Craft Interface Terminal Usage."

OC-3 DCC Assignment Examples

Entering OC-3 DCC Assignments

Figure 8-34 shows a DDM-2000 OC-3 ring transport application with OC-3 DCC connectivity. The **CONFIGURATION-Enter-Assignment-DCC** input is used to enter the OC-3 DCC assignments.



The grey shading indicates the extent of the OC-3 ring and data communications channel.

Figure 8-34. Example of OC-3 DCC Connectivity

- At CO 1, an OC-3 DCC assignment is entered by specifying:
 - low-speed interface slot (slot 5B)
 - DCC (channel 3^{*})
 - Orientation (network[†]).
- At CO 2, an OC-3 DCC assignment is entered by specifying:
 - low-speed interface slot (slot 2A)
 - DCC (channel 6[‡])
 - Orientation (network^{*}).

For more information about entering OC-3 DCC assignments in an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

Deleting OC-3 DCC Assignments

The OC-3 DCC assignments Figure 8-34 may be deleted using the **CONFIGURATION-Delete-Assignment-DCC** input.

- At CO 1, an OC-3 DCC assignment is deleted by specifying:
 - low-speed interface slot (slot 5B)
 - DCC (channel 3).
- At CO 2, an OC-3 DCC assignment is deleted by specifying:
 - low-speed interface slot (slot 2A)
 - DCC (channel 6).

For more information about deleting OC-3 DCC assignments at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

OC-12 DCC Assignment Inputs

The OC-12 DCC assignments must be specified and administered using the following inputs[§]:

-
- * The DCC assignment may be specified as channel 1-8 at each FT-2000 OC-48 Add/Drop-Rings Terminal.
 - † If the orientation is specified "network" at the FT-2000 OC-48 Add/Drop-Rings Terminal, the DDM-2000 OC-12 Multiplexer must be specified "user."
 - ‡ The DCC assignment may be specified as channel 1-8 at each FT-2000 OC-48 Add/Drop Terminal.

- **CONFIGURATION-Enter-Assignment-DCC:** This input assigns a DCC channel to a particular low-speed interface "command" slot. Or, (whenever 1+1 protection is used) to a pair of low-speed interface "command" slots. The service command slot must be specified first and then the protection command slot will be assigned automatically.



NOTE:

The command slots are 1B, 3B, 5B and 7B.

The user must specify a single DCC (channel 1-8).

After the low-speed interface command slot and DCC channel (channel 1-8) are specified, the user must specify the orientation (*user* or *network*). If the *user* orientation is specified at one end of the OC-12 DCC link, the *network* orientation must be specified at the other end of the OC-12 DCC link.

An input requesting an OC-12 DCC assignment will be denied if one of the following conditions is present:

- The specified slot is not equipped with an OC12 (1.3 STD) circuit pack.
- The TOHCTL slot is in the AUTO state.
- The TOHCTL circuit pack has been removed.
- The TOHCTL circuit pack has failed.

An input requesting an OC-12 DCC assignment may be denied if an automatic turnup test is running. During that part of the test cycle when the DCC connections between the OC-12 (1.3 STD) and TOHCTL circuit packs are being verified, an input requesting an OC-12 DCC assignment will be denied.

The **CONFIGURATION-Enter-Assignment-DCC** input can also be used to change the value (*user* or *network*) of the orientation parameter associated with an existing OC-12 DCC assignment. This is accomplished by reentering the same OC-12 DCC assignment with the new value for the orientation parameter.

- **CONFIGURATION-Delete-Assignment-DCC:** This input deletes an OC-12 DCC assignment to a low-speed interface quad slot or pair of low-speed interface quad slots. Deleting an OC-12 DCC assignment disables DCC communications on the supporting OC-12 line. An OC-12 DCC assignment is deleted by specifying a low-speed interface command slot and a DCC channel.

An input deleting an OC-12 DCC assignment will be denied if one of the following conditions is present:

- The TOHCTL slot is in the AUTO state.
- The TOHCTL circuit pack has been removed.
- The TOHCTL circuit pack has failed.

An input deleting an OC-12 DCC assignment may be denied if an automatic turnup test is running. During that part of the test cycle when the DCC connections between the OC-12 (1.3 STD) and TOHCTL circuit packs are being verified, an input deleting an OC-12 DCC assignment will be denied.

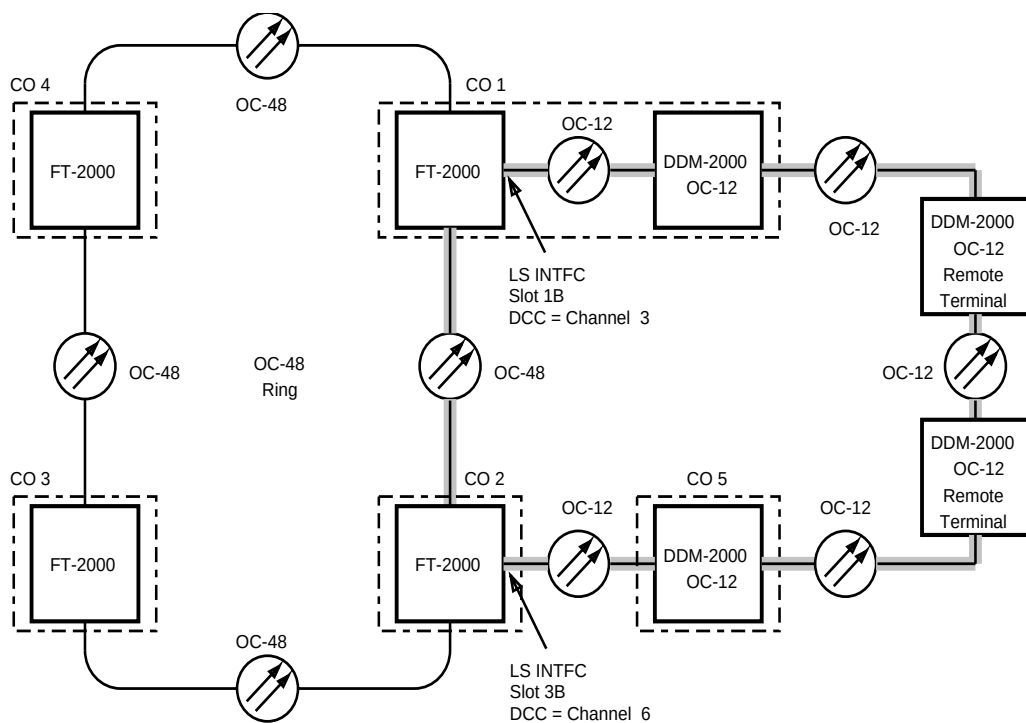
If the DCC assignment specified by the input does not exist, the input will be completed and no DCC assignment is deleted.

- **CONFIGURATION-Retrieve-Assignment-DCC:** This input generates a report showing all the assigned (both to OC-3 and to OC-12). For more information about the DCC Assignment Report, refer to Section 11, "Craft Interface Terminal Usage."

OC-12 DCC Assignment Examples

Entering OC-12 DCC Assignments

Figure 8-35 shows a DDM-2000 OC-12 ring transport application with OC-12 DCC connectivity. The **CONFIGURATION-Enter-Assignment-DCC** input is used to enter the OC-12 DCC assignments.



The grey shading indicates the extent of the OC-12 ring and data communications channel.

Figure 8-35. Example of OC-12 DCC Connectivity

- At CO 1, an OC-12 DCC assignment is entered by specifying:
 - low-speed interface slot (slot 1B)
 - DCC (channel 3^{*})
 - Orientation (network[†]).
- At CO 2, an OC-12 DCC assignment is entered by specifying:
 - low-speed interface slot (slot 3B)
 - DCC (channel 6^{*})
 - Orientation (network[†]).

* The DCC assignment may be specified as channel 1-8 at each FT-2000 OC-48 Add/Drops Terminal.

† If the orientation parameter is specified "network" at the FT-2000 OC-48 Add/Drop-Rings Terminal, the orientation parameter at the DDM-2000 OC-3 Multiplexer must be specified "user."

For more information about entering OC-12 DCC assignments in an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the CIT Tutorial in Section 11, "Craft Interface Terminal Usage," and the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

Deleting OC-12 DCC Assignments

The OC-12 DCC assignments shown in Figure 8-35 may be deleted using the **CONFIGURATION-Delete-Assignment-DCC** input.

- At CO 1, an OC-12 DCC assignment is deleted by specifying:
 - low-speed interface slot (slot 1B)
 - DCC (channel 3).
- At CO 2, an OC-12 DCC assignment is deleted by specifying:
 - low-speed interface slot (slot 3B)
 - DCC (channel 6).

For more information about deleting OC-12 DCC assignments at an FT-2000 OC-48 Add/Drop-Rings Terminal, refer to the Operation Task Index in the "Operation and Maintenance (TOP)" Section.

Access Identifiers

The access identifiers (AIDs) are used to access the functionality of the FT-2000 OC-48 Lightwave System. The FT-2000 OC-48 Lightwave System also uses AIDs to identify, address, and report on entities within the system. Entities are circuit pack slots, ports, signals, transmission lines, operations interfaces, data communications channels (DCC), and alarm interfaces.

The following tables provide the AIDs used by the FT-2000 OC-48 Lightwave System:

FT-2000 OC-48 Add/Drop-Rings Terminal Input Values	Table 8-1
FT-2000 OC-48 Add/Drop-Rings Terminal Output Values	Table 8-2
FT-2000 OC-48 Repeater Bay Input Values	Table 8-3
FT-2000 OC-48 Repeater Bay Output Values	Table 8-4

Table 8-1. FT-2000 OC-48 Add/Drop-Rings Terminal Input Values

Prompt	Values
Line	All, 1E, 1W
Single Line	1E, 1W
Type (Slot)	All, TRMTR, RCVR, LS INTFC, TG, LSSW SYSCTL, SYSMEM, LNCTL, OHCTL TOHCTL
Type (Operations Interface)	All, CIT-DCE, CIT-DTE, CIT-DCC, TL1-DCE, TL1-DTE, TL1-DCC, TL1-X25
Slot (LS INTFC)	All, 1A-8B, P1, P2
Single Slot (LS INTFC)	1A-8B, P1, P2
Service Slot (LS INTFC)	All, 1A-8B
Single Service Slot (LS INTFC)	1A-8B
Single Protection Slot (LS INTFC)	P1, P2
Slot (LNCTL)	All, 1W
Slot (TG)	All, 1, 2
Slot (LSSW)	All, OUT, IN
Port (STS-1)	All, 1-3
Single Port (STS-1)	1-3
Port (DS3)	All, 1-3
Port (EC1)	All, 1-3
Port (TIMING IN)	All, PRIMARY, SECONDARY
Port (COM)	All, DCE, DTE, DCC, X25
Quad (LS INTFC)	All, 1B, 3B, 5B, 7B
Single Quad (LS INTFC)	1B, 3B, 5B, 7B
Tributary (STS-1)	All, 1-3
Single Tributary (STS-1)	1-3
Tributary (STS-3)	All, 1-16
Single Tributary (STS-3)	1-16
DCC (OC-48)	All, DCC-1E, DCC-1W
DCC (OC-3)	All, 1-8
DCC (OC-12)	All, 1-8
Single Channel (DCC)	1-8
Point (Control)	All, 1-4
Point (Environment)	All, 1-16
PM Register	All, Day, QH

Table 8-2. FT-2000 OC-48 Add/Drop-Rings Terminal Output Values

Entity	Values
TID	1 to 20 alphanumeric characters
Filename	1 to 8 alphanumeric characters
User-Login	1 to 10 alphanumeric characters
provisionedcontrlpt	1 to 26 alphanumeric characters
provisionedenvironmentalpt	1 to 26 alphanumeric characters

Table 8-2. FT-2000 OC-48 Add/Drop-Rings Terminal Output Values—Contd

Entity	Values
System	system
Line	line-{all,1e,1w}
Slot (TRMTR)	trmtr-{all,1e,1w}
Slot (RCVR)	rcvr-{all,1e,1w}
Slot (LS INTFC)	ls-{all,1a-8b,p1,p2}
Slot (TG)	tg-{all,1,2}
Slot (LSSW)	lssw-{all,out,in}
Slot (SYSCTL)	sysctl
Slot (SYSTEM)	system
Slot (LNCTL)	lnctl-{1w}
Slot (OHCTL)	ohctl-{all,1e,1w}
Slot (TOHCTL)§	tohctl
Port (DS3)	ls-{all,1a-8b}-{all,1-3}
Port (EC1)	ls-{all,1a-8b}-{all,1-3}
Port (OC3)	ls-{all,1a-8b}
Port (IS3)	ls-{all,1a-8b}
Port (OC12)	ls-{all,1b,3b,5b,7b}
Port (STS-1)	ls-{all,1a-8b}-{all,1-3}
Port (TIMING OUT)	DS1-out-{all,1,2}
Port (TIMING IN)	DS1-in-{all,pri,secy}, OC48-in-{1e,1w}
Port (COM)	{dce,dte,dcc,x25}
Quad (LS INTFC)	ls-{all,1b,3b,5b,7b}
Operations Interface (User Panel)	user panel
Operations Interface (CIT)	cit-{dce,dte,dcc} tl1-{dce,dte,dcc,x25}
Operations Interface (UID)	<User-Login>
Operations Interface (DCC-OC48)	dcc48-{all,1e,1w}
Operations Interface (DCC-OC3)	dcc3-{all,1a-8b}
Operations Interface (DCC-OC12)	dcc12-{all,1b,3b,5b,7b}
Shelf	shlf-{1e,1w}-hs shlf-ls
Operations Interface (MISC DSCRT 1)	misc dscrt1
Operations Interface (MISC DSCRT 2)	misc dscrt2
Operations Interface (OFFICE ALARMS)	office alms
Tributary (STS-1)	sts1-{all,1e,1w}-{all,1-16}-{all,1-3}
Tributary (STS-3)	sts3-{all,1e,1w}-{all,1-16}
Channel (DCC)	dcc chan-{all,1-8}
Miscellaneous Discrete (Control Point)	cont-{all,1-4}
Miscellaneous Discrete (Environmental Point)	env-{all,1-16}
Site Address	site-{1e,1w}-{0-31}
PM Register	reg-{all,day,QH}

Table 8-3. FT-2000 OC-48 Repeater Bay Input Values

Prompt	Values
Line	All, 1E, 1W, PE, PW
Type (Slot)	All, SYSCTL, SYSMEM, REGENR, ROHCTL
Type (Operations Interface)	All, CIT-DCE, CIT-DTE
Slot (REGENR)	All, 1EW, 1WE, PEW, PWE
Slot (ROHCTL)	All, 1 P
Point (Environment)	All, 1-16

Table 8-4. FT-2000 OC-48 Repeater Bay Output Values

Entity	Values
System	system
Line	line-{all, 1e, 1w, pe, pw}
Slot (REGENR)	regenr-{all, 1ew, 1we, pew, pwe}
Slot (SYSCTL)	sysctl
Slot (SYSMEM)	sysmem
Slot (ROHCTL)	rohctl-{1,p}
Operations Interface (User Panel)	user panel
Operations Interface (CIT)	cit-{dce, dte}
Miscellaneous Discrete (Environment Point)	env-{all, 1-16}
Site ID	site-{1,p}-{1-30}
Shelf	shlf-{1,p}-{hs}

Provisioning

Provisionable Parameters and Original Values

General

Installation provisioning is minimized with provisionable parameters and original values. Each CIT provisionable parameter is assigned an original value. The provisionable parameters and original values are copied from floppy disks in the CIT to the SYSMEM circuit pack.

The SYSMEM circuit pack contains one copy of the provisionable parameters with their original values and another copy of the provisionable parameters with their current values. The SYSCTL and LNCTL circuit packs, plus the board controllers on the other circuit packs contain one copy of the provisionable parameters with their current values.

The original values cannot be changed. The current values can be changed through local provisioning.



NOTE:

The FT-2000 OC-48 Lightwave System has no switch-settable parameters.

FT-2000 OC-48 Add/Drop-Rings Terminal

Table 8-5 shows the provisionable parameters of the FT-2000 OC-48 Add/Drop-Rings Terminal. This includes the parameters that can be provisioned using the CIT, plus the parameters that are automatically provisioned or have fixed values (cannot be changed). The original value for each provisionable parameter in Table 8-5 is shown in brackets []. Table 8-5 also shows the applicable CIT-PC and TL1 commands.

Table 8-6 shows the provisionable threshold crossing alert (TCA) parameters of ADR Terminal. This includes the threshold range and original values for the quarter-hour and day bins of each performance-monitoring parameter. The original value for each provisionable parameter in Table 8-6 is shown in brackets [].

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
System Address				
- Target Identifier (TID)	[LT-FT-2000]≤20 characters	CIT	SECURITY-Set-	SECURITY-
- X.25 Packet Size	128, [256]		Network-Element	Retrieve-
- Site Address	site-line-site number	Automatic	None	Network-Element
- Network Service Access Point	[Factory set unique "system ID" sub-field] = 40 Characters	Automatic	None	Retrieve-Map-
				Ring
				[RTRV-MAP-Ring]
Level 1 Area Provisioning				
- Layer 3 Organization (L3 org)	[000000] 6 Char (0-9, A-F)	CIT	CONFIGURATION-	CONFIGURATION-
- Layer 3 Routing Domain	[0000] 4 Char (0-9, A-F)		Set-ULSDCC-L3	Retrieve-
- Layer 3 Area Address	[0000] 4 Char (0-9, A-F)		[ENT-ULSDCC-L3]	ULSDCC-L3
Level 2 IS	Enabled, [Disabled]			[RTRV-ULSDCC-L3]
TARP Data Cache (TDC)	[Enabled], Disabled	CIT	CONFIGURATION-	CONFIGURATION-
			Set-ULSDCC-L4	Retrieve-
			[ENT-ULSDCC-L4]	ULSDCC-L4
				[RTRV-ULSDCC-L4]
Synchronization				
- Provisioned Mode	[Externally Timed], Through Timed, Free Running, Line Timed	CIT	CONFIGURATION-	CONFIGURATION-
- Pri. DS1 In Format	[SF], ESF		Set-	Retrieve-
- Pri. DS1 In/Out Format*	[SF], ESF		Synchronization	Synchronization
- Sec. DS1 In Format	[SF], ESF			
- Sec. DS1 In/Out Format*	[SF], ESF			
- Pri. DS1 In Line Code	[AMI], B8ZS			
- Sec. DS1 In Line Code	[AMI], B8ZS			
- DS1 Out 1 Equalization	[20], 40, 60, 80, 100 Percent			
- DS1 Out 2 Equalization	[20], 40, 60, 80, 100 Percent			
Line Protection Switching				
- Wait to Restore	0-12 Minutes [5]	CIT	CONFIGURATION-	CONFIGURATION-
- Ring Switching-Provisioned	Enabled, [Disabled]		Set-Protection-	Retrieve-
- Signal Degrade Threshold	10 ⁻⁵ , [10 ⁻⁶], 10 ⁻⁷ , 10 ⁻⁸ , 10 ⁻⁹		Line	Protection-Line
- Sync Messages	[Enabled], Disabled		CONFIGURATION-	CONFIGURATION-
- F Byte Processing	[Enabled], Disabled		Set-OC-48	Retrieve-OC-48

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)—Contd

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
Protection Access	[Preemptible], Temporary, Permanent	CIT	CONFIGURATION- Enter- Protection-STs1 or STs3	CONFIGURATION- Retrieve- Protection-STs1
Operations				
- Operation Ports	DCE, DTE, X.25	Choice †	None	SECURITY- Retrieve- Security Port
- Operation Port Baud Rates				
CIT (DCE)	1200, 2400, 4800, 9600 [No Original Value]	Autobaud	None	None
CIT (DTE)	1200, 2400, 4800, 9600 [No Original Value]			
X.25‡	1200, 2400, 4800, 9600, 19200 [No Original Value]	Automatic		
- Network Element Security				
Logins Allowed	[Yes], No	CIT	SECURITY-Set - Security- Network Element	SECURITY- Retrieve- Security- Network Element
Password Aging	[0], 7-999 Days			
Login Aging	[0], 7-999 Days			
- Port Security				
Type	[All], X.25, DCE, DTE, DCC			
Port Access	[Enable], Disable			
Port Protocol				
DCE	[CIT], TL1			
DTE	[CIT], TL1			
Baud Rates	1200,2400,4800,[9600]			
X.25 Channel Type	Switched, Permanent [No Original Value]			
OS Type				
X.25 PVC #1	[maint.], memry-admin, test cmd-resp,other	CIT	SECURITY-Set - Security Port	SECURITY- Retrieve- Security Port
X.25 PVC #2	maint., memry-admin, test [cmd-resp],other			
X.25 SVC #1-#6	maint., memry-admin, test [cmd-resp],other,none			
SVC Calling Address				
X.25 SVC #1-#6	15 or Less Numeric Characters			
Inactivity Timeout	0-999 Minutes [15]			
- Login Security				
Logins 1-100	[luc01 or luc02††] 1 to 10 Alphanumeric Characters	CIT	SECURITY- Set -Login [ENT-USER-SECU]	SECURITY- Retrieve-Login [RTRV-USER- SECU]

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)—Contd

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
Operations <i>(Continued)</i>				
Password	[FT-2000] 6 to 10 Characters, (at least 2 characters must be non-alphabetic, and 1 of these 2 must be symbolic)	CIT	SECURITY-Set-Password [ED-PID]	None
User Privilege	Reports Only, [General]	CIT	SECURITY-Set-Login [ENT-USER-SECU]	SECURITY-Retrieve-Login [RTRV-USER-SECU]
Visitor Login	Yes, [No]	CIT	SECURITY-Set-Login [ENT-USER-SECU]	SECURITY-Retrieve-Login [RTRV-USER-SECU]
- Incoming Signal Alarm Delay	0-120 Seconds [2]	CIT	CONFIGURATION-Set-Attribute-Alarm [SET-ASTTR-ALM]	CONFIGURATION-Retrieve-Attribute-Alarm [RTRV-ATTR-ALM]
- Alarm Clear Delay	0-120 Seconds [10]			
- Tributary Reporting	NO, NR, NA, MN, MJ, CR			
- User-Settable Miscellaneous Discretes		CIT	CONFIGURATION-Set-Attribute-Control [SET-ATTR-CONT]	CONFIGURATION-Retrieve-Attribute-Control [RTRV-ATTR-CONT]
Description of Control Outputs 1-4	["Control n"] ≤26 Characters			
Description of Environmental Inputs 1-16	["Environment n"] ≤26 Characters		CONFIGURATION-Set-Attribute	CONFIGURATION-Retrieve-Attribute
Environmental Input Alarm Level	CR, MJ, [MN], NA, NR	CIT	Environment [SET-ATTR-ENV]	Environment [RTRV-ATTR-ENV]
- Date	YY-MM-DD [70-01-01]	CIT	CONFIGURATION-Set-Date [ED-DAT]	CONFIGURATION-Retrieve-Date [RTRV-HDR]
- Hours	0-23 [0]			
- Minutes	0-59 [0]			
- Seconds	0-59 [0]			
- Standard Time Zone	[blank] ≤3 Letter Characters			
- Start Daylight Savings Date	MM-DD [01-01]			
- Stop Daylight Savings Date	MM-DD [01-01]			
- Daylight Savings Time Zone	[blank] ≤3 Letter Characters			
Line Identification				
- Line Name	1E, 1W	Automatic	None	CONFIGURATION-Retrieve-OC48
Slot State Provisioning				
- All Slots	EQ, [AUTO]	Automatic	None	FAULT-Retrieve-State

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)—Contd

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
Low Speed				
- Protection Switching Priority (Service)	[Low], High	CIT	CONFIGURATION- Set-Low Speed [ENT-rr]	CONFIGURATION- Retrieve- Low Speed [RTRV-rr]
- Equipage Dependent Reports	Yes, [No]	CIT		
- Configuration	[0xN], 1xN	Automatic	None	FAULT- Retrieve-State
Performance Monitoring				
- Start Time	0-23 [0]	CIT	PERFORMANCE- Set-PM-Start time	PERFORMANCE- Retrieve-PM- Start time
- DS3 PM Mode	[P-bit], F&M-bit	CIT	PERFORMANCE- Set-PM Mode-T3	PERFORMANCE- Retrieve-PM Mode-T3
DS3 Termination				
- Violation Monitor Removal Mode	[VMR], VM, CC w/AIS, and CC w/oAIS	CIT	CONFIGURATION- Set-T3 [ENT-rr]	CONFIGURATION- Retrieve-T3 RTRV-rr]
- LBO (Electrical)	In, Out	Termination Cable	None (Manually Installed)	None
EC-1 Termination¶				
- LBO (Electrical)	In, Out	Termination Cable	None (Manually Installed)	None
OC-48 Termination				
- LBO (Optical)	0,5,10,15,or 20 dB	Lightguide Jumper	None (Manually Installed)	None (Stamping on LBO)
OC-3 Termination				
- LBO (Optical)	0 dB, 7.1 dB	Lightguide Jumper	None (Manually Installed)	None (Stamping on LBO)
OC-3 Protection Mode (From OC3) (From OC48)	[0x1], 1+1	CIT	CONFIGURATION- Set-OC3 [ENT-rr]	CONFIGURATION- Retrieve-OC3 [RTRV-rr]
OC-12 Termination				
- LBO (Optical)	0 dB, 7.1 dB	Lightguide Jumper	None (Manually Installed)	None (Stamping on LBO)
OC-12 Protection Mode (From OC12) (From OC48)	[0x1], 1+1 [0x1], 1+1	CIT	CONFIGURATION- Set-OC12 [ENT-rr]	CONFIGURATION- Retrieve-OC12 [RTRV-rr]

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)—Contd

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
Low Speed Alarm Level				
- DS3 Incoming Signal	[CR], MJ, MN, NA, NR	CIT	CONFIGURATION- Set-T3 [SET-ATTR-rr], [ENT-rr]	CONFIGURATION- Retrieve-T3 [RTRV-ATTR-rr], [RTRV-rr]
- EC-1 Incoming Signal	[CR], MJ, MN, NA, NR	CIT	CONFIGURATION- Set-EC1 [SET-ATTR-rr], [ENT-rr]	CONFIGURATION- Retrieve-EC1 [RTRV-ATTR-rr], [RTRV-rr]
- OC-3 Incoming Signal	[CR], MJ, MN, NA, NR, NO	CIT	CONFIGURATION- Set-OC3 [SET-ATTR-rr], [ENT-rr]	CONFIGURATION- Retrieve-OC3 [RTRV-ATTR-rr], [RTRV-rr]
- OC-12 Incoming Signal	[CR], MJ, MN, NA, NR, NO	CIT	CONFIGURATION- Set-OC12 [SET-ATTR-rr], [ENT-rr]	CONFIGURATION- Retrieve-OC12 [RTRV-ATTR-rr], [RTRV-rr]
Signal Degrade Threshold				
- DS3 Signal Degrade Threshold	10^{-3} , $[10^{-6}]$	CIT	CONFIGURATION- Set-T3 [ENT-rr]	CONFIGURATION- Retrieve-T3 [RTRV-rr]
- OC-12 Incoming Signal	10^{-5} , $[10^{-6}]$, 10^{-7} , 10^{-8} , 10^{-9}	CIT	CONFIGURATION- Set-OC12 [ENT-rr]	CONFIGURATION- Retrieve-OC12 [RTRV-rr]
Output AU4 Mapping	[SONET], SDH			
Sync Messaging	[Enabled], Disabled			
- EC-1 Incoming Signal	10^{-3} , $[10^{-6}]$	CIT	CONFIGURATION- Set-EC1 [ENT-rr]	CONFIGURATION- Retrieve-EC1 [RTRV-rr]
- OC-3 Incoming Signal	10^{-5} , $[10^{-6}]$, 10^{-7} , 10^{-8} , 10^{-9}	CIT	CONFIGURATION- Set-OC3 [ENT-rr]	CONFIGURATION- Retrieve-OC3 [RTRV-rr]
Output AU4 Mapping	[SONET], SDH			
Sync Messaging	[Enabled], Disabled, Kbyte, Sbyte			
OC-3/OC-12 DCC Assignment				
- DCC Channel	1,2,3,4,5,6,7,8 [No Original Value]	CIT	CONFIGURATION- Enter- Assignment-DCC [ENT-ASGNMT- DCC]	CONFIGURATION- Retrieve- Assignment-DCC [RTRV-ASGNMT- DCC]
- Orientation	user, [network]			

Table 8-5. Provisionable Parameters (FT-2000 OC-48 Add/Drop-Rings Terminal)—Contd

Parameter	Options [Original Value]	Method	CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
Port State Provisioning				
- DS3 Port	[AUTO], NMON	CIT	CONFIGURATION- Set-State-T3 [ENT-rr]	CONFIGURATION- Retrieve-T3\$\$ [RTRV-rr]
- EC1 Port			CONFIGURATION- Set-State-EC1 [ENT-rr]	CONFIGURATION- Retrieve-EC1\$\$ [RTRV-rr]
- DS3 Port	[AUTO], IS	Automatic	None	CONFIGURATION- Retrieve-T3\$\$
- EC1 Port				CONFIGURATION- Retrieve-EC1\$\$
- OC3 Incoming Signal	[AUTO], NMON	CIT	CONFIGURATION- Set-State-OC3 [ENT-rr]	CONFIGURATION- Retrieve-OC3 [RTRV-rr]\$\$
- OC12 Incoming Signal			CONFIGURATION- Set-State-OC12 [ENT-rr]	CONFIGURATION- Retrieve-OC12 [RTRV-rr]\$\$
- OC3 Incoming Signal	[AUTO], IS	Automatic	None	CONFIGURATION- Retrieve-OC3\$\$
- OC12 Incoming Signal				CONFIGURATION- Retrieve-OC12\$\$
Path Information				
- Xmit Path Trace	≤62 characters	CIT	CONFIGURATION- Set-Path-Trace [ENT-STs1]	CONFIGURATION- Retrieve-Path- Trace [RTRV-PTHTRC]
- Rcv Path Trace				
	[No original value]			
- PDI-P Switching	Enabled, [Disabled]			

* For additional details on the NSAP and its sub-fields, refer to Example 16 in Section 11 of this document.

† Select the desired port by installing the appropriate cabling.

‡ The baud rate is determined by the clock to the X.25 interface.

†† At startup, there are exactly two privileged logins and no others.

\$\$ The **FAULT-Retrieve-State** report may also be used.

Table 8-6. Provisionable Threshold Crossing Alert (TCA) Parameters

Parameter	Threshold Range [Original Value]		CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
	Current Quarter Hour	Current Day		
OC-48/OC-12/OC-3 Optics - TCA Autonomous Report	[Enable]/Disable	[Enable]/Disable	PERFORMANCE- Set-PM Threshold-Optics [SET-TH]	PERFORMANCE- Retrieve- PM Threshold- Optics [RTRV-TH]
STS-48/STS-12/STS-3 Section - TCA Autonomous Report - Section Coding Violations - Section Errored Seconds - Section Severely Errored Seconds - Section Severely Errored Frame Seconds	[Enable]/Disable -7,-8,[-9],-10,-11 1-900 [25] 1-63 [10] 1-63 [5]	[Enable]/Disable -7,-8,-9,[-10],-11,12 1-65535[250] 1-4095 [40] 1-4095 [10]	PERFORMANCE- Set-PM Threshold- Section [SET-TH]	PERFORMANCE- Retrieve- PM Threshold- Section [RTRV-TH]
OC-48/OC-12/OC-3 Line - TCA Autonomous Report - Line Coding Violations - Line Errored Seconds - Line Severely Errored Seconds - Line Unavailable Seconds - Pointer Justification Counts (OC3 and OC12 only)	[Enable]/Disable -7,-8,[-9],-10,-11 1-900 [25] 1-63 [10] 1-63 [10] 1-65535 [60]	[Enable]/Disable -7,-8,-9,[-10],-11,12 1-65535[250] 1-4095 [40] 1-4095 [10] 1-9999999 [5760]	PERFORMANCE- Set-PM Threshold- Line [SET-TH]	PERFORMANCE- Retrieve- PM Threshold- Line [RTRV-TH]
STS-1 Path - TCA Autonomous Report - Path/FEBE Coding Violations - Path/FEBE Errored Seconds - Path/FEBE Severely Errored Seconds - Path/FEBE Unavailable Seconds	[Enable]/Disable -7,-8,[-9],-10 1-900 [25] 1-63 [10] 1-63 [10]	[Enable]/Disable -7,-8,[-9],-10,-11,12 1-65535[250] 1-4095 [40] 1-4095 [10]	PERFORMANCE- Set-PM Threshold- STS1 [SET-TH]	PERFORMANCE- Retrieve- PM Threshold- STS1 [RTRV-TH]
EC-1 Section and Line - TCA Autonomous Report - Section Severely Errored Frame Seconds - Line Coding Violations - Line Errored Seconds - Line Severely Errored Seconds	[Enable]/Disable 1-63 [5] -7,-8,[-9],-10 1-900 [25] 1-63 [10]	[Enable]/Disable 1-4095 [10] -7,-8,[-9],-10,-11,12 1-65535 [250] 1-4095 [40]	PERFORMANCE- Set-PM Threshold-EC1 [SET-TH]	PERFORMANCE- Retrieve- PM Threshold-EC1 [RTRV-TH]

Table 8-6. Provisionable Threshold Crossing Alert (TCA) Parameters

Parameter	Threshold Range [Original Value]		CIT-PC Input [TL1 Command]	CIT-PC Report [TL1 Report]
	Current Quarter Hour	Current Day		
OC-48/OC-12/OC-3 Optics				
- Line Unavailable Seconds	1-63 [10]	1-4095 [10]		
- Pointer Justification Counts	1-65535 [60]	1-9999999 [5760]		
DS3 Line and Path				
- TCA Autonomous Report	[Enable]/Disable	[Enable]/Disable		
- Line Errored Seconds	1-900 [25]	1-65535[250]	PERFORMANCE- Set-PM	PERFORMANCE- Retrieve-
- Path Coding Violations	-7,-8,-[9],-10	-7,-8,-[9],-10,-11,12		
- Path Errored Seconds	1-900 [25]	1-65535[250]	Threshold- T3	PM Threshold- T3
- Path Severely Errored Seconds	1-63 [10]	1-4095 [40]	[SET-TH]	[RTRV-TH]
- Path Severely Errored Frame/ AIS Seconds	1-900 [5]	1-65535 [10]		
- Path Unavailable Seconds	1-63 [10]	1-4095 [10]		

FT-2000 OC-48 Repeater Bay

Table 8-7 shows the provisionable parameters of the FT-2000 OC-48 Repeater Bay. This includes the parameters that can be provisioned using the CIT, plus the parameters that are automatically provisioned or have fixed values (cannot be changed). The original value for each provisionable parameter in Table 8-7 is shown in brackets [].

Table 8-7. Provisionable Parameters (FT-2000 OC-48 Repeater Bay)

Parameter	Options [Original Value]	Method	Input (Command)	Report
System Address				
- Target Identifier (TID)	[LT-FT-2000] ≤20 characters	CIT	SECURITY-Set- Network Element	SECURITY- Retrieve-Network Element
- Site Address	site-line-site number	Automatic	None	
Operations				
- Operation Ports	CIT (DCE), CIT (DTE)	Choice*	None	SECURITY- Retrieve- Security Port
- Operation Port Baud Rates				
CIT (DCE)	1200, 2400, 4800, 9600 [No Original Value]	Autobaud	None	None
CIT (DTE)	1200, 2400, 4800, 9600 [No Original Value]			

Table 8-7. Provisionable Parameters (FT-2000 OC-48 Repeater Bay)

Parameter	Options [Original Value]	Method	Input (Command)	Report
- Network Element Security Logins Allowed	[Yes], No	CIT	SECURITY-Set Security- Network Element	SECURITY-Retrieve Security- Network Element
- Port Security Type	CIT-DCE, CIT-DTE, CIT-DCC, [All]	CIT	SECURITY-Set-	SECURITY-Retrieve-
Port Access	[Enable], Disable		Security Port	Security Port
Timeout†	0-999 Minutes [15]	CIT	CIT-PC Setup Menu	None
- Login Security Logins 1-12	[ATT01 or ATT02‡] 1 to 10 Alphanumeric Characters	CIT	SECURITY- Set-Login	SECURITY- Retrieve-Login
Password	[FT-2000§]6 to 10 Characters, (at least 1 numeric character and 1 symbolic character)	CIT	SECURITY-Set- Password	None
User Privilege	Reports Only, [General]	CIT	SECURITY- Set-Login	SECURITY- Retrieve-Login
- User-Settable Miscellaneous Discretes Description of Environmental Inputs 1-16 Environmental Input Alarm Level	["Environment "] ≤26 Characters CR, MJ, [MN], NA, NR	CIT	CONFIGURATION- Set-Attribute Environment	CONFIGURATION- Retrieve-Attribute Environment
- Date	YY-MM-DD [94-06-30]	CIT		
- Hours	0-23 [0]	CIT	CONFIGURATION- Set-Date	CONFIGURATION- Retrieve-Date
- Minutes	0-59 [0]			
- Seconds	0-59 [0]			
- Standard Time Zone	[blank] ≤3 Letter Characters			
- Start Daylight Savings Date	MM-DD [01-01]			
- Stop Daylight Savings Date	MM-DD [01-01]			
- Daylight Savings Time Zone	[blank] ≤3 Letter Characters			
Line Identification - Line Name	PE, PW, 1E, 1W	Automatic	None	CONFIGURATION- Retrieve-OC48
OC-48 Termination LBO (Optical)	0, 5, 10, 15, or 20 dB	Lightguide Jumper	None (Manually Installed)	None (LBO Ring Color or Stamping on LBO)
Slot State Provisioning - All Slots	EQ, [AUTO]	Automatic	None	FAULT- Retrieve-State

* Select the desired port by installing the appropriate cabling.

‡ At startup there are exactly two privileged logins and no others.

§ FT-2000 is the original value of the password for ATT01 and ATT02.
There is no original password value for any other logins.

Local Provisioning

FT-2000 OC-48 Add/Drop-Rings Terminal

The following CIT-PC inputs (listed in alphabetical order) and corresponding TL1 commands are used to provision the FT-2000 OC-48 Add/Drop-Rings Terminal. (Refer to Section 6, "Operations Interfaces," or Section 10, "Technical Specifications," for information about minimum CIT requirements.)

- **CONFIGURATION-Set-Attribute-Alarm** (TL1 = **SET-ATTR-ALM**):
This input provisions the incoming Signal Alarm Delay and the Alarm Clear Delay intervals.
 - The Incoming Signal Alarm Delay parameter sets the time (0 to 120 seconds) the network element will wait, after it finds an incoming signal condition, before reporting the event using all autonomous indicators. This parameter applies to defects in the OC-48 line signals, DS3 signals, EC-1 signals, OC-3 signals, and DS1 synchronization references.
 - The Alarm Clear Delay parameter sets the time (0 to 120 seconds) the network element will wait, after a condition clears, before reporting the clear event using all indicators. This parameter applies to all conditions.
- **CONFIGURATION-Set-Attribute-Control** (TL1 = **SET-ATTR-CONT**):
This input sets the Descriptions for the miscellaneous discrete control output points.
 - The Point parameter selects the miscellaneous discrete control output point to provision.
 - The Description parameter is the text string associated with the selected miscellaneous discrete control output point. It is a character string of up to 26 characters, where the characters are letters, digits, or spaces. It is used to identify the point in the **Retrieve-History** and **Retrieve-Alarm (and Status)** reports.
- **CONFIGURATION-Set-Attribute-Environment** (TL1 = **SET-ATTR-ENV**): This input sets the Descriptions and Alarm Levels for the miscellaneous discrete environmental input points.

- The Point parameter selects the miscellaneous discrete environmental input point to provision.
- The Alarm Level parameter provisions the severity of the condition associated with the closing of the selected miscellaneous discrete environmental input point. The choices are:
 - "CR": critical
 - "MJ": major
 - "MN": minor
 - "NA": status not alarmed
 - "NR": status not alarmed and not reported to the OS.
- The Description parameter is the text string associated with the selected miscellaneous discrete environmental input point. It is a character string of up to 26 characters, where the characters are letters, digits, or spaces. It is used to identify the point in the **Retrieve-History** and **Retrieve-Alarm (and Status)** reports. The number 1, 2, 3, and 4 inputs are reserved for the following alarms from an FT-Lightwave Booster Amplifier.

FT-LBA Miscellaneous Discrete	FT-2000 Environmental Input	Suggested Text
Fuse/Power Alarm	1	FT-LBA fuse/power failure
Fan Alarm	2	FT-LBA fan failure
1EW (Service) Failure	3	FT-LBA 1EW failure
1WE (Service) Failure	4	FT-LBA 1WE failure

- **CONFIGURATION-Set-Date** (TL1 = **ED-DAT**): This input sets the network element clock date and time and provisions automatic daylight savings time processing.
 - The Date parameter sets the current date in the network element clock. It is entered in the form YY-MM-DD where:
 - YY is the year (00-99)
 - MM is the month (1-12)
 - DD is the day (1-31).

- The Hours parameter sets the hour (0 to 23) in the network element clock. A value of "zero" may be entered as "-0", "0", or "+0". These entries are treated as the same value.
- The Minutes parameter sets the minute (0 to 59) in the network element clock. A value of "zero" may be entered as "-0", "0", or "+0". These entries are treated as the same value.
- The Seconds parameter sets the second (0 to 59) in the network element clock. A value of "zero" may be entered as "-0", "0", or "+0". These entries are treated as the same value.
- The Standard Time Zone parameter is the 3-letter string (for example, EST, MST) that is indicated as part of the date and time stamp in command responses when Standard Time is in effect.
- The Start Daylight Savings Date parameter sets the date when the network element moves the current time forward by 1 hour. It should be entered in the form MM-DD where:

- MM is the month (1-12)
- DD is the Day (1-31).

If this value is different from the Stop Daylight Savings Date parameter value, daylight savings time is enabled and the time change will occur at 02:00:00 on the chosen date. If the two values are the same, daylight savings time processing is disabled. The value 2-29 is not allowed.

- The Stop Daylight Savings Date parameter sets the date when the network element moves the current time backward by 1 hour. It should be entered in the form MM-DD where:

- MM is the month (1-12)
- DD is the Day (1-31).

If this value is different from the Start Daylight Savings Date parameter value, daylight savings time is enabled and the time change will occur at 02:00:00 on the chosen date. If the two values are the same, daylight savings time processing is disabled. The value 2-29 is not allowed.

- The Daylight Savings Time Zone parameter is the 3-letter character string (for example, EST, MST) that is printed as part of the date and time stamp in command responses when Daylight Savings Time is in effect.

- **CONFIGURATION-Set-EC1** (TL1 = **ENT-rr**): This input sets the Alarm Level and Signal Degrade Threshold of the EC-1 interface ports for signals incoming from cross-connect panel. These parameters can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any low-speed interface circuit pack. Thus, it is permissible to pre-provision low-speed interface slots for EC-1 interfaces.
 - The Alarm Level* parameter sets the severity of an incoming (from the cross-connect panel) signal failure condition. The choices are:
 - "CR": critical
 - "MJ": major
 - "MN": minor
 - "NA": status not alarmed
 - "NR": status not alarmed and not reported to the OS.
 - The Signal Degrade Threshold is the base 10 logarithm of the EC-1 line parity (B2) error rate threshold. The allowed values are "-3" or "-6". A signal degrade condition is reported for EC-1 signals received from the cross-connect panel with error rates greater than the threshold.
- **CONFIGURATION-Set-Low Speed** (TL1 = **ENT-rr**): This input sets the low-speed slot attributes.
 - The Protection Switching Priority parameter sets the protection switching priority of the selected slot(s). The priority is either "Low" or "High." For example, an Auto Switch request from a High priority slot will preempt an Auto Switch of a Low priority slot.
 - The Equipage Dependent Reports parameter determines if the EC1, T3, OC3, and OC12 reports will include entries based on equipage or on pre-provisioned values. The setting should be "Yes" for Equipage Dependent Reports and "No" for Pre-Provisioned Values.
- **CONFIGURATION-SET-OC-12** (TL1 = **ENT-rr**): This input sets the Protection Mode, Alarm Level, Signal Degrade Threshold, Output AU4 Mapping, and Sync Messaging of the OC-12 line. This input sets the provisioned protection mode parameters successfully even if the quad slot associated with addressed quad pair is not equipped with an OC-12 circuit pack type or is in the AUTO state.

* If the EC-1 port is part of a 1-way-DRI cross-connection, the alarm level should be provisioned minor (MN).

- The Protection Mode (from OC12) parameter sets the protection mode of a low-speed interface slot to "1+1" or "0x1" in the add direction (from OC-12 to OC-48). The "1+1" protection mode is provided by using a pair of adjacent quad low-speed interfaces (for example, command slots 1B and 3B, or command slots 5B and 7B). Each "1+1" protected OC12 quad pair establishes an active cross-connection between one quad of the quad pair and an STS-12/STS-12c tributary, and a standby cross-connection between the other quad and the same tributary.

To implement the OC12 operating protection mode, the following condition must exist:

- Both quads in the quad pair must be provisioned "1+1"
- Both quads in the quads pair must be EQ
- A cross-connection must exist between either quad in the quad pair and an STS-12/STS-12c tributary.

- The Protection Mode (from OC48) parameter sets the protection mode of a low-speed interface slot to "1+1" or "0x1" in the drop direction (from OC-48 to OC-12). The "1+1" protection mode is provided by using a pair of adjacent quad low-speed interfaces. For a "1+1" protected OC12 circuit pack pair, the STS-12/STS-12c tributary feeds the low-speed signal to both quads.

To implement the OC12 operating protection mode, the following conditions must exist:

- Both quads in the quad pair must be provisioned "1+1"
- Both quads in the quad pair must be EQ
- A cross-connection must exist between either quad in the quad pair and an STS-12/STS-12c tributary.



NOTE:

When two independent 1-way 1+1 circuits share the same OC12 (1.3 STD) quad pair, provision the 1+1 system in the drop direction as two 0x1 systems that are bridged. This prevents K-byte signals (used for protection switching) and certain maintenance signals that are based on 2-way service from being returned to the far end terminal.

When a quad pair transitions from 0x1 unprotected operation to 1+1 protected operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects add cross-connection from the "1B/5B command slot" to the STS-12 tributary as active and the add cross-connection from the "3B/7B command slot" to the same STS-12 tributary as standby. If the add cross-connection from the "3B/5B command slot" to the STS-12 tributary was previously active and operating unprotected (0x1), a brief service hit (<60 msec) will be observed.

When a quad pair transitions from 1+1 protected operation to 0x1 unprotected operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects the add/drop cross-connections between the "1B/5B command slot" and the STS-12 tributary as active. If the add cross-connection from the "3B/7B command slot" to the STS-12 tributary was previously active, a brief service hit (<60 msec) will be observed.

**CAUTION:**

When transitioning an OC-12 line from 1+1 protected operation to 0x1 unprotected operation, always start with the quad pair at the tail-end of the OC-12 line. When a quad pair transitions from 1+1 operation to 0x1 operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects the add/drop cross-connections between the "1B/5B command slot" and the STS-12/STS-12c tributary as active. If the drop cross-connection from the STS-12/STS-12c tributary to the "3B/7B command slot" was previously active, the OC12 (1.3 STD) in the "3B/7B command slot" transmits path AIS toward the OC-12 line. The receiving terminal accepts the path AIS as a good signal, and no trouble condition is reported.

- The Alarm Level parameter sets the severity of an incoming (from the lightguide cross-connect panel) signal failure condition. The choices are:
 - "CR": critical
 - "MJ": major
 - "MN": minor
 - "NA": status not alarmed
 - "NR": status not alarmed and not reported to the OS.
 - "NO": no failure conditions reported.
(Not applicable to slots in the 1+1 Protection Mode.)
- The Signal Degrade Threshold is the base 10 logarithm of the OC-12 line parity (B2) error rate threshold. The allowed values are "-5," "-6," "-7," "-8," or "-9". A signal degrade condition is reported for OC-12 signals received from the lightguide cross-connect panel with error rates greater than the threshold.
- The Output AU4 Mapping parameter sets the AU4 mapping bit to SONET or SDH. The OC12 circuit pack can automatically support transport of:
 - One STS-12c signal

- Twelve STS-1 signals, or STM-1 signals carrying AU-4 mapped signals. For STM-1 AU-4 mapped payloads, the OC3 circuit pack can be provisioned to output the appropriate values in the pointer bytes so that direct interface to SDH equipment is possible over an STM-1 optical interconnection. The high-speed transport of the payload is SONET, but this does not present any operational difficulties. "SONET" indicates the transport of an OC-12 signal. "SDH" indicates the transport of an AU4 signal.
 - Four STS-3 or STS-3c signals
 - A combination of STS-1 and STS-3/STS-3c signals that add up to the equivalent of 622.08 MB/s.
- The Timing Direction parameter determines which high speed line (1W, 1E) the OC12 circuit pack receives its timing from when the network element's synchronization mode is through-timed.



NOTE:

The OC12 timing direction of a 1+1 protected quad pair should be set to the same OC-48 line to avoid potential downstream synchronization problems.

- The Sync Messaging parameter determines whether synchronization messaging is enabled or disabled on the K2 byte. For synchronization messaging on the K2 byte, the setting should be "Enabled." For no synchronization messaging, the setting should be "Disabled." There is no option available for sync messaging on the S1 byte at the OC12 level.

- **CONFIGURATION-Set - OC3** (TL1 = **ENT - rr**): This input sets the Protection Mode, Alarm Level, Signal Degrade Threshold, Output AU4 Mapping, and Sync Messaging of the OC-3 line. This input sets the provisioned protection mode parameters successfully even if the slot associated with the addressed slot pair is not equipped with an OC3 circuit pack or is in the AUTO state.

- The Protection Mode (from OC3) parameter sets the protection mode of a low-speed interface slot to "1+1" or "0x1" in the add direction (from OC-3 to OC-48). The "1+1" protection mode is provided by using a pair of adjacent "A" and "B" low-speed interface slots (for example, slot 2A and 2B). Each "1+1" protected OC3 circuit pack pair establishes an active cross-connection between one slot (or port) of the slot pair and an STS-3 (or STS-1) tributary, and a standby cross-connection between the other slot (or port) and the same tributary.

To implement the OC3 operating protection mode, the following condition must exist:

- Both slots in the slot pair must be provisioned "1+1"
 - Both slots in the slot pair must be EQ
 - A cross-connection must exist between either slot (or port) in the slot pair and an STS-3 (or STS-1) tributary.
- The Protection Mode (from OC48) parameter sets the protection mode of a low-speed interface slot to "1+1" or "0x1" in the drop direction (from OC-48 to OC-3). The "1+1" protection mode is provided by using a pair of adjacent "A" and "B" low-speed interface slots. For a "1+1" protected OC3 circuit pack pair, the STS-3 tributary feeds the low-speed signal to both slots.

To implement the OC3 operating protection mode, the following conditions must exist:

- Both slots in the slot pair must be provisioned "1+1"
- Both slots in the slot pair must be EQ
- A cross-connection must exist between either slot (or port) in the slot pair and an STS-3 (or STS-1) tributary.



NOTE:

When two independent 1-way 1+1 circuits share the same OC3 (1.3 STD) circuit pack pair, provision the 1+1 system in the drop direction as two 0x1 systems that are bridged. This prevents K-byte signals (used for protection switching) and certain maintenance signals that are based on 2-way service from being returned to the far end terminal.

When a slot pair transitions from 0x1 unprotected operation to 1+1 protected operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects the add cross-connection from the "A" slot to the STS-3 tributary as active and the add cross-connection from the "B" slot to the same STS-3 tributary as standby. If the add cross-connection from the "B" slot to the STS-3 tributary was previously active and operating unprotected (0x1), a brief service hit (<60 msec) will be observed. When a slot pair transitions from 0x1 operation to 1+1 operation, any DCC assignment to the A slot changes to a DCC assignment to the slot pair. Any DCC assignment to the B slot will be deleted.

When a slot pair transitions from 1+1 protected operation to 0x1 unprotected operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects the add/drop cross-connections between the "A" slot and the STS-3 tributary as active. If the add cross-connection from the "B" slot to the STS-3 tributary was previously active, a brief service hit (<60 msec) will be observed. When a slot pair transitions from 1+1 operation to 0x1 operation, any DCC assignment to the slot pair changes to a DCC assignment to the A slot only. There will be no DCC assignment to the B slot.



CAUTION:

When transitioning an OC-3 line from 1+1 protected operation to 0x1 unprotected operation, always start with the slot pair at the tail end of the OC-3 line. When a slot pair transitions from 1+1 operation to 0x1 operation, the FT-2000 OC-48 Add/Drop-Rings Terminal automatically selects the add/drop cross-connections between the "A" slot and the STS-3 tributary as active. If the drop cross-connection from the STS-3 tributary to the "B" slot was previously active, the OC3 (1.3 STD) circuit pack in the "B" slot transmits path AIS toward the OC-3 line. The receiving terminal accepts the path AIS as a good signal, and no trouble condition is reported.

- The Alarm Level parameter sets the severity of an incoming (from the lightguide cross-connect panel) signal failure condition. The choices are:
 - "CR": critical
 - "MJ": major
 - "MN": minor
 - "NA": status not alarmed
 - "NR": status not alarmed and not reported to the OS.
 - "NO": no failure conditions reported.

(Not applicable to slots in the 1+1 Protection Mode.)
- The Signal Degrade Threshold is the base 10 logarithm of the OC-3 line parity (B2) error rate threshold. The allowed values are "-5," "-6," "-7," "-8," or "-9". A signal degrade condition is reported for OC-3 signals received from the lightguide cross-connect panel with error rates greater than the threshold.
- The Output AU4 Mapping parameter sets the AU4 mapping bit to SONET or SDH. The OC3 circuit pack can automatically support transport of STS-3, STS-3c, or STM-1 signals carrying AU-4 mapped signals. For STM-1 AU-4 mapped payloads, the OC3 circuit pack can be provisioned to output the appropriate values in the pointer bytes so that direct interface to SDH equipment is possible over an STM-1 optical interconnection. The high-speed transport of the payload is SONET, but this does not present any operational difficulties. "SONET" indicates the transport of an OC-3 signal. "SDH" indicates the transport of an AU4 signal.
- The Timing Direction parameter determines which high speed line (1W, 1E) the LAA10B circuit pack receives its timing from when the network element's synchronization mode is through-timed.

**NOTE:**

The OC3 timing direction of a 1+1 protected slot pair should be set to the same OC-48 line to avoid potential downstream synchronization problems.

- The Sync Messaging parameter determines whether synchronization messaging is enabled or disabled on the K2 byte and S1 byte. The following is a list of possible settings and their corresponding effects:
 - “Enabled”: sync messaging on K2 byte only
 - “K byte”: sync messaging on K2 byte AND S1 byte
 - “S byte”: sync messaging on S1 byte only
 - “Disabled”: no sync messaging
- **CONFIGURATION-Set-OC48** (TL1= **ENT-rr**): This input sets the Signal Degrade Threshold, F Byte Processing and Sync Messaging of high-speed lines.
 - The Line parameter selects the high-speed line(s).
 - The Signal Degrade Threshold parameter sets the line parity (B2) error rate at which a signal degrade condition is declared. It is an integer in the range “-9” to “-5.” These values are the base 10 logarithm of the error rate threshold (for example, “-7” means an error rate of 10^{-7}).
 - The Sync Messaging parameter determines whether synchronization messaging is enabled or disabled on the K2 byte. For sync messaging on the K2 byte, the setting should be “Enabled.” For no sync messaging, the setting should be “Disabled.” There is no option available for sync messaging on the S1 byte at the OC48 level.

**NOTE:**

The synchronization messaging status of the OC48 TRMTR and OC48 RCVR circuit packs on the same OC-48 high-speed line should both have the same setting (i.e., either “enabled” or “disabled”) to avoid potential synchronization problems. For example, if the OC48 TRMTR circuit pack does not have sync messaging enabled but the OC48 RCVR circuit pack does, a DUS (do not use for synchronization) message may appear when executing the **CONFIGURATION-Retrieve-Synchronization** command.

- The F-Byte Processing Parameter allows the user to enable/disable F-byte processing. In mixed FT-2000/*WaveStar* rings, F-byte processing should be disabled on each line of an FT-2000 node connected to an adjacent *WaveStar* node.

- **CONFIGURATION-Set-Path-Trace:** This input sets the transmitted and expected received path traces. This input also enables or disables DRI switching on the STS Path Payload Defect Indicator (PDI-P) in the STS SPE.

The Receive Path Trace parameter is the character string that the **Retrieve-Path-Trace** input will compare with the actual receive path trace for the selected DS3 low-speed port(s). The string must be less than or equal to 62 characters long and may use spaces, double quotes, or any of the following characters:

```
#$%&'()*+,-./0123456789;<>@ABCDEFGHIJKLMNO  
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

- The Transmit Path Trace parameter is the character string that will be transmitted toward the OC-48 line in the path trace of the selected DS3 low-speed port(s). The string must be less than or equal to 62 characters long and may use spaces, double-quotes, or any of the following characters:

```
#$%&'()*+,-./0123456789;<>@ABCDEFGHIJKLMNO  
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

The provisioned value of the Transmit Path Trace parameter **MUST** be different from the provisioned value of the Receive Path Trace parameter, at the same node. Also, the provisioned value of the Transmit Path parameter at the near end node must be **EXACTLY** the same as the provisioned value of the Receive Path Trace parameter at the far end node.

To set the path trace to all nulls, enter any number of spaces (as long as no non-space characters are entered). The spaces will be translated and stored as null characters.

- The PDI-P Switching parameter determines whether PDI-P switching is enabled or disabled.

- **CONFIGURATION-Set-Protection-Line:** This input sets the Wait to Restore interval for line protection switching.

- The Wait To Restore parameter is the time ("0" to "12" minutes) that the network element waits after a condition clears before breaking automatic high-speed protection switches.

- **CONFIGURATION-Set-Protection-Low Speed:** This input sets the Wait to Restore interval for low-speed protection switching.

- The Wait To Restore parameter is the time ("0" to "12" minutes) that the network element waits after a condition clears before breaking automatic low-speed protection switches.
- **CONFIGURATION-Set-State-EC1** (TL1 = **ENT-rr**): This input sets the Primary State of EC-1 ports to "AUTO" or "NMON." This parameter can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any type low-speed interface circuit pack. Thus, it is permissible to preprovision low-speed interface slots for EC-1 interfaces. The EC-1 port state can be provisioned separately in the add and drop directions.
 - The Direction parameter selects the direction of the selected low-speed port(s) to provision (From STSX1, From OC48).
 - The Primary State parameter provisions the state of the selected port(s) (and selected direction) to either:
 - "NMON": The EC-1 signals for the selected direction of this port are not monitored for errors. No conditions are reported and PM quantities will be "-" for this port. The port will not make a transition to the IS (in service) state if a good signal appears.
 - "AUTO": Alarms will not be raised until after a valid signal appears on the selected direction of this port. After the signal appears, it is continuously monitored, and the port transitions to the IS state.
- **CONFIGURATION-Set-State-OC3** (TL1 = **ENT-rr**): This input sets the Primary State of OC-3 ports to "AUTO" or "NMON." This parameter can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any type low-speed interface circuit pack. Thus, it is permissible to preprovision low-speed interface slots for OC-3 interfaces. The OC-3 port state can be provisioned separately in the add and drop directions.
 - The Direction parameter selects the direction of the selected low-speed port(s) to provision (From STS-3, From OC48).
 - The Primary State parameter provisions the state of the selected port(s) to either:
 - "NMON": The OC-3 signals for the selected direction of this port are not monitored for errors. No conditions are reported and PM quantities will be "-" for this port. The port will not make a transition to the IS (in service) state if a good signal appears.
 - "AUTO": Alarms will not be raised until after a valid signal appears on the selected direction of this port. After the signal appears, it is continuously monitored, and the port transitions to the IS state.

- **CONFIGURATION-Set-State-OC12** (TL1 = **ENT-rr**): This input sets the Primary State of OC12 ports to "AUTO" or "NMON." This parameter can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any type low-speed interface circuit pack. Thus, it is permissible to preprovision low-speed interface slots for OC12 interfaces.

The OC-12 port state can be provisioned separately in the add and drop directions.

- The Direction parameter selects the direction of the selected low-speed port(s) to provision (From STS-12, From OC48).
- The Primary State parameter provisions the state of the selected port(s) (and selected direction) to either:
 - "NMON": The OC-12 signals for the selected direction of this port are not monitored for errors. No conditions are reported and PM quantities will be "-" for this port. The port will not make a transition to the IS (in service) state if a good signal appears.
 - "AUTO": Alarms will not be raised until after a valid signal appears on the selected direction of this port. After the signal appears, it is continuously monitored, and the port transitions to the IS state.

- **CONFIGURATION-Set-State-T3** (TL1 = **ENT-rr**): This input sets the Primary State of DS3 input ports to "AUTO" or "NMON." This parameter can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any type low-speed interface circuit pack. Thus, it is permissible to preprovision low-speed interface slots for DS3 interfaces. The DS3 port state can be provisioned separately in the add and drop directions.

- The Direction parameter selects the direction of the selected low-speed port(s) to provision (From DSX, From OC48).
- The Primary State parameter provisions the state of the selected port(s) (and selected direction) to either:
 - "NMON": The DS3 signals for the selected direction of this port are not monitored for errors. No conditions are reported and PM quantities will be "-" for this port. The port will not make a transition to the IS (in service) state if a good signal appears.
 - "AUTO": Alarms will not be raised until after a valid signal appears on the selected direction of this port. After the signal appears, it is continuously monitored, and the port transitions to the IS state.

- **CONFIGURATION-Set-Synchronization:** This input sets the network element synchronization mode and synchronization operation parameters.
 - The Provisioned Mode specifies the primary synchronization mode of the network element. The options are:
 - “Free Running”: The network element operates asynchronously, with the timing of the transmitted high-speed signals derived from the local timing generator.
 - “Through Timed”: The network element synchronizes the transmitted high-speed signals to the high-speed signals received from the opposite direction.
 - “Line Timed”: The network element synchronizes the transmitted high-speed and low-speed signals to the selected incoming high-speed signal.
 - “Externally Timed*”: The network element synchronizes the transmitted high-speed and low-speed signals to an external DS1 reference signal.
 - The Primary DS1 In Format parameter specifies whether the primary DS1 reference signal uses superframe (SF) or extended superframe (ESF) format.
 - The Primary DS1 In/Out Format parameter specifies whether the TIMING IN PRI and TIMING OUT 1 DS1 reference signals use superframe (SF) or extended superframe (ESF) format.
 - The Secondary DS1 In Format parameter specifies whether the secondary DS1 reference signal uses superframe (SF) or extended superframe (ESF) format.
 - The Secondary DS1 In/Out Format parameter specifies whether the TIMING IN SEC and TIMING OUT 2 DS1 reference signals use superframe (SF) or extended superframe (ESF) format.
 - The Primary DS1 In Line Code parameter specifies whether the primary DS1 reference signal uses alternate mark inversion (AMI) or bipolar eight zero substitution (B8ZS) line coding.
 - The Secondary DS1 In Line Code parameter specifies whether the secondary DS1 reference signal uses alternate mark inversion (AMI) or bipolar eight zero substitution (B8ZS) line coding.
 - The Synchronization Source parameter specifies that timing is derived from the East or West high-speed lines or that timing is automatically chosen depending upon which line provides the best timing source.

- The DS1 Out 1 Equalization parameter provisions the DS1 Out 1 to drive "20, 40, 60, 80, or 100" percent of its maximum rated cable length. The cable lengths are based on YR28365 cable. Provision the equalization to the smallest value greater than the actual cable length based on the following:

Optimum Equalization Setting (Percent)	Cable Length to DSX-1 Panel (Feet)
20	0 - 133
40	133 - 267
60	267 - 400
80	400 - 533
100	533 - 655

- The DS1 Out 2 Equalization parameter provisions the DS1 Out 2 to drive "20, 40, 60, 80, or 100" percent of its maximum rated cable length. The cable lengths are based on YR28365 cable. Provision the equalization to the smallest value greater than the actual cable length based on the following:

Optimum Equalization Setting (Percent)	Cable Length to DSX-1 Panel (Feet)
20	0 - 133
40	133 - 267
60	267 - 400
80	400 - 533
100	533 - 655

- **CONFIGURATION-Set - T3** (TL1 = **ENT - rr**): This input sets the VMR mode, Alarm Level, and Signal Degrade Threshold of DS3 interface ports. These parameters can be provisioned when the selected low-speed interface slot(s) is unequipped or equipped with any type low-speed interface circuit pack. Thus, it is permissible to preprovision low-speed interface slots for DS3 interfaces.
 - The Violation Monitor Removal parameter sets the mode of the Violation Monitor and Removal (VMR) function of the addressed DS3 ports. The choices are:

- - "VMR": DS3 P-bit parity errors in the output DS3 (towards the cross-connect panel) are monitored and removed.
 - - "VM": DS3 P-bit parity error in the output DS3 (towards the cross-connect panel) are monitored and not removed.
 - - "CC w/AIS": The incoming DS3 signal (from the OC-48 line) is transmitted to the cross-connect panel without DS3 format violation monitoring (clear channel). DS3 AIS is inserted toward the OC-48 line, if there are excessive bipolar violations or there is loss of signal from the cross-connect panel. DS3 AIS is passed through in both directions.
 - - "CC w/oAIS": Same as CC w/AIS, except DS3 AIS is not inserted.
 - The Alarm Level* parameter sets the severity of an incoming (from the cross-connect panel) signal failure condition. The choices are:
 - "CR": critical
 - "MJ": major
 - "MN": minor
 - "NA": status not alarmed
 - "NR": status not alarmed and not reported to the OS. *
 - The Signal Degrade Threshold is the base 10 logarithm of the DS3 Bipolar Violation error rate threshold. The allowed values are "-3" or "-6". A signal degrade condition is reported for DS3 signals coming in from the cross-connect panel with error rates greater than the threshold.
- **PERFORMANCE-Set-PM Start-Time** (TL1= **SET-PM-STIME**): This input sets the start time for the measurement of all 24 hour performance-monitoring parameters. The start time is set relative to the current clock and time zone. When the command is executed, all parameters in the current Day bin are marked corrupt with a "?".
- The Start Hour parameter specifies the start hour for all 24 hour performance-monitoring parameters. The performance-monitoring parameters will reset and begin daily at the provisioned time.
- **PERFORMANCE-Set-PM Mode-T3** (TL1= **ENT-rr**): This input specifies the algorithm used for determining and accumulating DS3 path performance-monitoring data. The user may select F and M bit adjusted processing or P-bit processing.

* If the DS3 port is part of a 1-way-DRI cross-connection, the alarm level should be provisioned minor (MN).

- The DS3 PM Mode parameter specifies the DS3 performance-monitoring algorithm to be chosen. The user may select F and M-bit adjusted processing or P-bit processing. The raw F and M framing bit error counts are adjusted to approximate the actual error count in the DS3 path payload. When the command is executed, all parameters in the current day and quarter hour bins for DS3 path performance-monitoring data are marked corrupt with a "?".
- **PERFORMANCE-Set-PM Threshold-EC1** (TL1 = **SET-TH**): This input provisions values for the threshold crossing alert (TCA) parameters associated with EC-1 ports. Note that these parameters only apply to EC-1 signals received from the cross-connect panel:
 - The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and EC-1 port(s).
 - The Section Severely Errored Frame Seconds parameter specifies the number of EC-1 severely errored frame seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and EC-1 port(s). This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin, and an integer from 1 to 4095 (inclusive) for the day bin.
 - The Line Coding Violations parameter specifies the number of EC-1 line coding violations that will cause a threshold crossing alert (TCA) for the selected performance-monitoring bin and EC-1 port(s). This parameter is the base 10 logarithm of the desired error rate. The values are integers from -10 to -7 (inclusive) for the quarter-hour bin, and integers from -12 to -7 (inclusive) for the day bin.
 - The Line Errored Seconds parameter specifies the number of EC-1 line errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and EC-1 port(s). An EC-1 line errored second is recorded for each second during which there are one or more B2 coding violations, or an EC-1 line AIS defect is detected. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65535 (inclusive) for the day bin.
 - The Line Severely Errored Seconds parameter specifies the number of EC-1 line severely errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and EC-1 port(s). An EC-1 line severely errored second is recorded for each second during which there are nine or more B2 coding violations or an EC-1 line AIS defect is detected. For intervals with 10 or more contiguous severely errored seconds, the severely errored seconds will be recorded as unavailable seconds, not as severely errored

seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.

- The Line Unavailable Seconds parameter specifies the number of EC-1 line unavailable seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and EC-1 port(s). An EC-1 line unavailable second is recorded after 10 consecutive line severely errored seconds. These 10 seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a line severely errored second. The 10 consecutive seconds without a line severely errored second are not counted as unavailable seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
 - The Pointer Justification Counts parameter provides a count of the STS-n pointer adjustments created or absorbed by an NE due to the differences in frame rates of the incoming and outgoing SONET signals. This parameter is an integer from 1 to 65535 (inclusive) for the quarter-hour bin and an integer from 1 to 9999999 (inclusive) for the day bin.
- **PERFORMANCE-Set-PM Threshold-Line (TL1 = SET-TH):** This input provisions values for the threshold crossing alert parameters applied to the B2 line data collected for each OC-48, OC-12 and OC-3 line.
- The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s).
 - The Line Coding Violations parameter specifies the number of line composite B2 coding violations that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). This parameter is the base 10 logarithm of the desired error rate. The values are integers from -11 to -7 (inclusive) for the quarter-hour bin and integers from -12 to -7 (inclusive) for the day bin.
 - The Line Errored Seconds parameter specifies the number of line errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). A line errored second is recorded for each second during which there are one or more composite B2 coding violations, or a line AIS defect is detected. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.
 - The Line Severely Errored Seconds parameter specifies the number of line severely errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-

12 or OC-3 line(s). A line severely errored second is recorded for each second during which there are 494 or more composite B2 coding violations, or a line AIS defect is detected. For intervals with 10 or more contiguous severely errored seconds, the severely errored seconds will be recorded as unavailable seconds, not as severely errored seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.

- The Line Unavailable Seconds parameter specifies the number of line unavailable seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). A line unavailable second is recorded after 10 consecutive line severely errored seconds. These 10 seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a line severely errored second. The 10 consecutive seconds without a line severely errored second are not counted as unavailable seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
- The Pointer Justification Counts parameter provides a count of the STS-n pointer adjustments created or absorbed by an NE due to the differences in frame rates of the incoming or outgoing SONET signals. This parameter is an integer from 1 to 65535 (inclusive) for the quarter-hour bin and an integer from 1 to 9999999 (inclusive) for the day bin.

- **PERFORMANCE-Set-PM Threshold-Optics** (TL1 = **SET-TH**): This input provisions values for the threshold crossing alert parameters applied to the optical health data collected for each OC-48, OC-12 or OC-3 line.

- The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s).

- **PERFORMANCE-Set-PM Threshold-Section** (TL1 = **SET-TH**): This input provisions values for the threshold crossing alert parameters applied to the B1 section data collected for each STS-48, STS-12 or STS-3 section.

- The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s).
- The Section Coding Violations parameter specifies the number of section coding violations that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). This parameter is the base 10 logarithm of the desired

error rate. The values are integers from -11 to -7 (inclusive) for the quarter-hour bin and integers from -12 to -7 (inclusive) for the day bin.

- The Section Errored Seconds parameter specifies the number of section errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). A section errored second is recorded for each second during which there are one or more B1 coding violations, one or more loss-of-signal defects, or one or more loss-of-frame defects. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.
 - The Section Severely Errored Seconds parameter specifies the number of section severely errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). A section severely errored second is recorded for each second during which there are 249 or more B1 coding violations, one or more loss of signal defects, or one or more loss-of-frame defects. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
 - The Section Severely Errored Frame Seconds parameter specifies the number of section severely errored frame seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and OC-48, OC-12 or OC-3 line(s). A section severely errored frame second is the number of seconds during which an out-of-frame event occurred. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
- **PERFORMANCE-Set-PM Threshold-STs1** (TL1 = **SET-TH**): This input provisions values for the threshold crossing alert parameters associated with STS-1 tributaries. Note that these parameters only apply to STS-1 signals received from the OC-48 line. These parameters are applied to both the B3 (path parity) and far end block error (FEBE) data collection for each STS-1 tributary.
- The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and STS-1 tributary(s).
 - The Path/FEBE Coding Violations parameter specifies the number of STS-1 path/FEBE coding violations that will cause a threshold crossing alert for the selected performance-monitoring bin and STS-1 tributary(s). This parameter is the base 10 logarithm of the desired error rate. The values are integers from -10 to -7 (inclusive) for the quarter-hour bin and integers from -12 to -7 (inclusive) for the day bin.

- The Path/FEBE Errored Seconds parameter specifies the number of STS-1 path/FEBE errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and STS-1 tributary(s). An STS-1 path errored second is recorded for each second during which there are one or more B3 coding violations, one or more STS-1 path AIS defects, or one or more STS-1 loss-of-pointer defects. A FEBE errored second is recorded for each second during which there are one or more FEBE coding violations, or one or more remote defect indicator-path (RDI-P) defects. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.
 - The Path/FEBE Severely Errored Seconds parameter specifies the number of STS-1 path/FEBE severely errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and STS-1 tributary(s). An STS-1 path severely errored second is recorded for each second during which there are nine or more B3 coding violations, one or more STS-1 path AIS defects, or one or more STS-1 path loss-of-pointer defects. A FEBE severely errored second is recorded for each second during which there are nine or more FEBE coding violations or one or more RDI-P defects. For intervals with 10 or more contiguous severely errored seconds, the severely errored seconds will be recorded as unavailable seconds, not as severely errored seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
 - The Path/FEBE Unavailable Seconds parameter specifies the number of STS-1 path/FEBE unavailable seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and STS-1 tributary(s). An STS-1 path/FEBE unavailable second is recorded after 10 consecutive STS-1 path/FEBE severely errored seconds. These 10 seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without an STS-1 path/FEBE severely errored second. The ten consecutive seconds without an STS-1 path/FEBE severely errored second are not counted as path/FEBE unavailable seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
- **PERFORMANCE-Set-PM Threshold-T3** (TL1 = **SET-TH**): This input provisions values for the threshold crossing alert parameters applied to the DS3 line coding violations (DS3 B3ZS coding violations or bipolar violations) and to the DS3 path coding violations data collected for each DS3 port. DS3 path coding violations are based on P-bit errors. The DS3 path coding violations are based on P-bits errors or F and M framing bit errors (provisionable). The F and M framing bit error counts are adjusted to approximate the actual error count in the DS3 path payload.

- The TCA Autonomous Report parameter specifies whether autonomous reporting of threshold crossing alerts (TCAs) via TBOS and TL1 is "Enable" or "Disable" for the selected performance-monitoring bin and DS3 port(s).
- The Line Errored Seconds parameter specifies the number of DS3 line errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). A DS3 line errored second is recorded for each second during which there are one or more B3ZS coding violations (bipolar violations), or a DS3 loss-of-signal defect in the DS3 signal input from the cross-connect panel. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.
- The Path Coding Violations parameter specifies the number of DS3 path coding violations that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). This parameter is the base 10 logarithm of the desired error rate. The values are integers from -10 to -7 (inclusive) for the quarter-hour bin and integers from -12 to -7 (inclusive) for the day bin.
- The Path Errored Seconds parameter specifies the number of DS3 path errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). A DS3 path errored second is recorded for each second during which there are one or more DS3 coding violations, one or more DS3 path AIS Defects, or one or more DS3 path loss-of-frame defects detected in the DS3 signal received from the OC-48 line. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.
- The Path Severely Errored Seconds parameter specifies the number of DS3 path severely errored seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). A DS3 path severely errored second is recorded for each second during which there are 44 or more DS3 coding violations, one or more DS3 path AIS defects, or one or more DS3 path loss-of-frame defects in the DS3 signal received from the OC-48 line. For intervals with 10 or more contiguous severely errored seconds, the severely errored seconds will be recorded as unavailable seconds, not as severely errored seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.
- The Path Severely Errored Frame Seconds/AIS Seconds parameter specifies the number of DS3 path severely errored frame seconds/AIS seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). A DS3 path severely errored second/AIS second is recorded for each second during which there is an out-of-frame (OOF) or an AIS defect

detected in the DS3 signal received from the OC-48 line. This parameter is an integer from 1 to 900 (inclusive) for the quarter-hour bin and an integer from 1 to 65,535 (inclusive) for the day bin.

- The Path Unavailable Seconds parameter specifies the number of DS3 path unavailable seconds that will cause a threshold crossing alert for the selected performance-monitoring bin and DS3 port(s). A DS3 path unavailable second is recorded after 10 consecutive DS3 path severely errored seconds. These 10 seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a DS3 path severely errored second. The 10 consecutive seconds without a DS3 path severely errored second are not counted as unavailable seconds. This parameter is an integer from 1 to 63 (inclusive) for the quarter-hour bin and an integer from 1 to 4095 (inclusive) for the day bin.

- **SECURITY-Set-Login-Change** (TL1 = **ED-USER-SECU**): This input edits the user ID, password, user privileges, and status of any nonprivileged login, and changes the other privileged login's login ID and password. This input is also used to re-enable a nonprivileged login ID that has expired due to login aging.

- The Login parameter is the login ID of the login to be changed. (The **Retrieve-Login** input will list the login IDs.)
- The New Login parameter replaces the login ID for the selected login. It must be a string of from 1 to 10 alphanumeric characters, in which the difference between upper and lower case is significant, and it must be different from all other login IDs in this network element. If ENTER is pressed, the system will default to the current login ID.
- The New Password parameter becomes the new password for the selected login ID. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:
 - String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The \, @, #, ?, \$, or space not allowed)
(The comma, :, ;, or _ not allowed)
 - The difference between upper and lower case is significant.

If ENTER is pressed, the system will default to the current password.

- The Re-enter Password parameter confirms the New Password parameter. Reenter the exact characters that were entered for the New Password parameter.
- The User Privilege parameter sets the user's security level for nonprivileged users to one of the following:

- - "Reports Only": User will be able to execute only the Retrieve, Set-Password, Operate-Alarm Cutoff, and Test-LED inputs
- - "General": User will be able to execute all commands, except Initialize-System, Set-Far End Communications, Set-Login, Set-Network Element, and Set-Security.

The user privilege parameter for a privileged user can only be set to Privileged.

- The Visitor parameter specifies whether the login will be changed to a visitor login (Yes or No). A visitor login is a temporary login.
- The Status parameter enables or disables the login. The status parameter for a privileged user can only be set to Enabled.

- **SECURITY-Set-Login-Delete** (TL1 = **DLT-USER-SECU**): This input deletes a nonprivileged login. If the login is active at the time this command is executed, the user is immediately logged off the system.

- The Login parameter selects the login that is to be deleted. (The **Retrieve-Login** input will list login IDs.)

- **SECURITY-Set-Login-Enter** (TL1 = **ENT-USER-SECU**): This input enters a new login, including password and user privileges. A privileged user can create up to 98 nonprivileged logins. There are 2 privileged user IDs allowed per network element.

- The New Login parameter is the login ID for the login being created. It must be a string of from 1 to 10 alphanumeric characters, in which the difference between upper and lower case is significant, and it must be different from all other login IDs in this network element.
- The New Password parameter is the password for the login being created. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:
 - String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The \, @, #, ?, \$, or space not allowed)
 - The difference between upper and lower case is significant.
- The Re-enter Password parameter confirms the New Password parameter. Reenter the exact characters that were entered for the New Password parameter.
- The User Privilege parameter sets the user's security level to one of the following:

- - "Reports Only": User will be able to execute only the Retrieve, Set-Password, Operate-Alarm Cutoff, and Test-LED inputs
- - "General": User will be able to execute all commands, except Initialize-System, Set-Far End Communications, Set-Login, Set-Network Element, and Set-Security.
- The Visitor parameter specifies if the new login will be a visitor login (Yes or No). A visitor login is a temporary login.

- **SECURITY-Set-Network Element** (TL1 = **ENT-SYS**): This input sets the TID (Target IDentifier) and X.25 packet size.



CAUTION:

A caution should be exercised so as to NOT execute a second "Set-Network Element" command until any preceding "Set-Network Element" command has completed execution. This precaution is necessary so as to prevent generating the "ECMD_SYS_ERROR" should one of the controller boards be in an initialization state. Refer to Table B in DLP-527 for a listing of the initialization times (in minutes) for each controller.

- The TID (Target IDentifier) parameter is the name used to identify the local network element within a network. It is used on all CIT and TL1 reports, and is the destination address for all remote logins. It is a character string of up to 20 characters, where the characters are letters, digits, or hyphens (-). Lowercase letters will be translated into uppercase before they are stored in the network element. Each TID in the network must be unique.

Whenever the value of the TID parameter is changed, the user should enter the **Retrieve-Map-Ring** input or log off and log back in again to ensure that the new value of the TID parameter is included in the ring map.



NOTE:

If a user logs in to the system while a reset in progress or ring startup in progress condition is active, wait until the condition clears and enter the **Retrieve-Map-Ring** input or log off and log back in again to ensure that the list of TIDs in the ring map is complete.



NOTE:

Changing the value of the local TID will result in all *incoming* remote TL1 sessions being disconnected. This means the local network element will terminate all login sessions that were requested from TL1 gateway network elements.

- The X.25 Packet Size parameter specifies the X.25 packet size to be used for a TL1 session to the local network element.



CAUTION:

Changing the value of the X.25 packet size parameter will cause the X.25 link to be reset and all active TL1 logins will be automatically dropped. All established SVCs and PVCs on the affected X.25 link will have to be reestablished.

- **SECURITY-Set-Password** (TL1 = **ED-PID**): This input changes your password.
 - The Old Password parameter must match the user's current password.
 - The New Password parameter replaces the old password. The New Password must be different from the old password. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:
 - String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The \, @, #, ?, \$, or space not allowed)
 - The difference between upper and lower case is significant.
 - The Re-enter Password parameter confirms the New Password parameter. Reenter the exact characters that were entered for the New Password parameter.
- **SECURITY-Set-Security-Network Element**: This input sets the global security parameter for the system.
 - The Logins Allowed parameter specifies whether nonprivileged users are allowed to log in to the system. When Logins Allowed is set to "No," all nonprivileged users will be immediately logged off.
 - The Password Aging parameter specifies the password aging interval. The password aging interval must be zero (0) or a number between 7 and 999 days. If zero (0) is specified, the password aging mechanism is disabled.
 - The Login Aging parameter specifies the login aging interval. The login aging interval must be zero (0) or a number between 7 and 999 days. If zero (0) is specified, the login aging mechanism is disabled.
- **SECURITY-Set-Security-Port**: This input enables or disables user access via the CIT-DCC and CIT-DTE. This input enables a privileged user to condition a CIT/TL1 port.

- The Type parameter chooses the Operations Interface(s) to enable or disable. The choices are:
 - "DCE": access via the user panel
 - "DTE": dial-up access
 - "DCC": remote login
 - "X.25": for TL1 only.
- The Channel Type parameter selects the switched type or the permanent type virtual circuit(s) of X.25 for setting the parameters.
- The Table Entry Qualifier parameter selects the circuit(s) of the X.25 port for setting the parameters. (PVC #1, PVC #2, SVC #1-#6)
- The OS Type parameter selects the autonomous message set to be reported on the selected X.25 virtual circuit. Values are from the following:
 - "maint": all autonomous messages but REPT DBCHG
 - "memry-admin": all REPT DBCHG autonomous messages
 - "test": no autonomous messages
 - "cmd-resp": no autonomous messages
 - "other": all autonomous messages
 - "none": if no calling address is specified for SVC
- The Calling Address parameter specifies a 15-digit dial string for the X.25 switched virtual circuits (SVC #1-#6).
- The Port Access parameter enables or disables access to the selected port(s).
- The Inactivity Timeout parameter sets the period of minutes during which no activity results in automatic logout from a port. This parameter must be between zero (0) and 999 minutes. If zero (0) is specified, the inactivity timeout mechanism is disabled. The Inactivity Timeout parameter also applies to any port provisioned for TL1 input/output.
- The Port (Protocol) Type parameter sets the communications protocol used at the CIT (DCE) or CIT (DTE) port. If "CIT" is selected, the F-interface protocol is used to communicate with a PC running the FT-2000 CIT-PC software. A PC running CPro-2000 software or an ASCII-based (dumb) terminal cannot communicate with a port provisioned as "CIT." If "TL1" is selected, TL1 protocol is used to communicate with a PC running CPro-2000 software or an ASCII-based (dumb) terminal. A PC running the FT-2000 CIT-PC software cannot communicate with a port provisioned as "TL1."

**NOTE:**

When logging in to a CIT (DCE) or CIT (DTE) port that is provisioned as "TL1," enter **<Ctrl-Q><cr>** before entering the initial **ACT-USER** TL1 command. The **<Ctrl-Q>** ensures that the port is not in the X/ off state and the **<cr>** clears the input buffer.

- The Baud Rate parameter selects the baud rate used for the CIT (DCE) or CIT (DTE) port that is configured for TL1 input/output. The values are "1200, 2400, 4800, or 9600."

For more information about the CIT-PC inputs, refer to Section 11, "Craft Interface Terminal Usage." For more information about the TL1 commands, refer to 824-102-148, *2000 Family of Products Operations Systems Engineering Guide*.

FT-2000 OC-48 Repeater Bay

The following CIT inputs (listed in alphabetical order) are used to provision the FT-2000 OC-48 Repeater Bay. (Refer to Section, 6 "Operations Interfaces," or Section 10, "Technical Specifications," for information about minimum CIT requirements.)

- **CONFIGURATION-Set-Attribute-Environment:** This input reports the Alarm Level and Description parameters for each selected miscellaneous discrete environmental input point. The Description parameter is used to identify the point in the **Retrieve-History** and **Retrieve-Alarm (and Status)** reports. The Alarm Level parameter provisions the severity of the condition associated with the closing of the selected miscellaneous discrete environmental input point. For repeater applications the only choice is "MN" (minor).
 - The Point parameter selects the miscellaneous discrete environmental input point(s) to include in the report.
 - The Alarm Level parameter provisions the severity of the condition associated with the closing of the selected miscellaneous discrete environmental input point. For repeater applications, the only choice is "MN" (minor).
 - The Description parameter provisions the text string associated with the selected miscellaneous discrete environmental input point. It is a character string of up to 26 characters, where the characters are letters, digits, or spaces. It is used to identify the environmental point in the **Retrieve-Alarm (and Status)** and **Retrieve-History** reports.
- **CONFIGURATION-Set-Date:** This input sets the network element clock date and time and provisions automatic daylight savings time processing.
 - The Date parameter sets the current date in the network element clock. It is entered in the form YY-MM-DD where:
 - YY is the year (00-99)

- MM is the month (1-12)
- DD is the day (1-31).
- The Hours parameter sets the hour (0 to 23) in the network element clock.
- The Minutes parameter sets the minute (0 to 59) in the network element clock.
- The Seconds parameter sets the second (0 to 59) in the network element clock.
- The Standard Time Zone parameter is the 3-letter character string (for example, EST, MST) that is indicated as part of the date and time stamp in command responses when Standard Time is in effect.
- The Start Daylight Savings Date parameter sets the date when the network element moves the current time forward by 1 hour. It should be entered in the form MM-DD where:
 - MM is the month (1-12)
 - DD is the Day (1-31).

If this value is different from the Stop Daylight Savings Date parameter value, then daylight savings time is enabled and the time change will occur at 02:00:00 on the chosen date. If the two values are the same, daylight savings time processing is disabled.

- The Stop Daylight Savings Date parameter sets the date when the network element moves the current time backward by 1 hour. It should be entered in the form MM-DD where:
 - MM is the month (1-12)
 - DD is the Day (1-31).

If this value is different from the Start Daylight Savings Date parameter value, then daylight savings time is enabled and the time change will occur at 02:00:00 on the chosen date. If the two values are the same, daylight savings time processing is disabled.

- The Daylight Savings Time Zone parameter is the 3-letter character string (for example, EDT, MDT) that is printed as part of the date and time stamp in command responses when Daylight Savings Time is in effect.

■ **SECURITY-Set-Login-Change:** This input edits the user ID, password, user privileges and status of any nonprivileged login, and changes the other privileged login's login ID and password.

- The Login parameter is the login ID of the login to be changed. (The **Retrieve-Login** input will list login IDs.)
- The New Login parameter replaces the login ID for the selected login. It must be a string of 6 to 10 characters, in which the difference between upper and lower case is significant, and it must

be different from all other login IDs in the network element. If ENTER is pressed, the system will default to the current login ID. (The @, #, ?, or space is not allowed.)

- The New Password parameter becomes the new password for the selected login ID. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:
 - String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The @, #, ?, or space not allowed)
 - The difference between upper and lower case is significant.

If ENTER is pressed, the system will default to the current password.

- The Re-enter New Password parameter confirms the New Password. Reenter the exact characters that were entered for the New Password parameter.
- The User Privilege parameter sets the user's security level for nonprivileged users to either:
 - "Reports Only": User will be able to execute only the **Retrieve**, **Set-Password**, and **Test-LED** inputs.
 - "General": User will be able to execute all commands, except **Initialize-System**, **Set-Login**, **Set-Network Element**, and **Set-Security**.
- The Status parameter for a privileged user can only be set to "Enabled."

- **SECURITY-Set-Login-Delete**: This input deletes a nonprivileged login. If the login is active at the time this command is executed, the user is immediately logged off the system.

- The Login parameter selects the login that is to be deleted. The **Retrieve-Login** input will list the login IDs.

- **SECURITY-Set-Login-Enter**: This input enters a new login, including password and user privileges. A privileged user can create up to 10 nonprivileged logins per network element.

There are 2 privileged user IDs and up to 10 nonprivileged IDs allowed per network element.

- The New Login parameter is the login ID for the login being created. It must be a string of from 1 to 10 alphanumeric characters, in which the difference between upper and lower case is significant, and it must be different from all other login IDs in this network element.
 - The New Password parameter is the password for the login being created. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:

- String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The @, #, ?, or space not allowed)
 - The difference between upper and lower case is significant.
-
- The Re-enter New Password parameter confirms the New Password. Reenter the exact characters that were entered for the New Password parameter.
 - The User Privilege parameter sets the user's security level to one of the following:
 - "Reports Only": User will be able to execute only the Retrieve, **Set-Password**, and **Test-LED** inputs.
 - "General": User will be able to execute all commands, except **Initialize-System**, **Set-Login**, **Set-Network Element**, and **Set-Security**.
-
- **SECURITY-Set-Network Element**: This input sets the Target Identifier (TID) parameter. The TID is a unique identification of the network element within a SONET network.
 - The TID parameter determines the name used to identify the local network element within a SONET network. It is used on all CIT and TL1 reports, and it is the destination address for remote logins. It is a character string of up to 20 characters, where the characters are letters, digits, or hyphens (-). The difference between upper and lower case is significant. Each TID in the network must be unique.
 - **SECURITY-Set-Password**: This input changes your password. All users can change their own passwords, including Reports-Only users.
 - The Old Password parameter must match the user's current password.
 - The New Password parameter replaces the current password. The New Password must be different from the current password. A password consists of a string of alphabetic, numeric, or symbolic characters conforming to the following rules:
 - String must contain from 6 to 10 characters
 - At least 2 of the characters must be nonalphabetic
 - At least 1 of the characters must be symbolic
(The @, #, ?, or space not allowed)
 - The difference between upper and lower case is significant.

- The Re-enter New Password parameter confirms the New Password. Reenter the exact characters that were entered for the New Password parameter.
- **SECURITY-Set-Security-Network Element:** This input sets the Logins Allowed parameter. The Logins Allowed parameter specifies whether nonprivileged users are allowed to log in to the network element. When the Logins Allowed parameter is set to "No," all nonprivileged users will be immediately logged off.
 - The Logins Allowed parameter specifies whether nonprivileged users are allowed to log in to the network element. When the Logins Allowed parameter is set to "No," all nonprivileged users will be logged off immediately.
- **SECURITY-Set-Security-Port:** This input enables or disables user access via the CIT-DTE port.
 - The Type parameter selects the port(s) to enable or disable. The choices are:
 - "All"
 - "CIT-DCE": access via the user panel
 - "CIT-DTE": dial-up access.
 - If "All" is specified for the Type parameter, the Port Access parameter will only be set for the CIT-DTE port, since Port Access may never be disabled for the CIT-DCE.
 - The Port Access parameter enables or disables access. Disabling it will terminate any active session on the port, logging out all users including privileged users.

For more information about these inputs, refer to Section 11, "Craft Interface Terminal Usage."

Pre-provisioning Circuit Packs

To simplify circuit pack installation, parameters can be provisioned before installing the corresponding circuit pack. All system parameters and values (current and original) are preserved by the FT-2000 OC-48 Lightwave System in the nonvolatile memory of SYSMEM circuit pack. The parameters and values are protected by the nonvolatile memory if a power failure occurs and are retrievable on demand regardless of the means used for provisioning. The parameters are automatically downloaded when the affected circuit pack is installed.

Provisioning on Circuit Pack Replacement

Replacement of a failed circuit pack is simplified by the FT-2000 OC-48 Lightwave System's automatic provisioning of the original circuit pack values. The SYSCTL and SYSMEM circuit packs maintain a provisioning map of the entire system, so when a transmission or timing circuit pack is replaced, the SYSCTL and SYSMEM circuit packs automatically download provisioning parameters and current values to the new circuit pack.

Circuit Pack Slot and low-speed Port Provisioning States

The circuit pack slots may be in one of the following states:

- **AUTO (Auto):** AUTO is the original value of the circuit pack slot state parameter. AUTO refers to a circuit pack slot that is available for automatic provisioning. A circuit pack slot makes a transition from the AUTO state to the EQ state when the presence of a circuit pack is detected.
- **EQ (Equipped):** EQ refers to a circuit pack slot that is fully monitored and alarmed. A circuit pack slot makes a transition from the EQ state to the AUTO state when the **CONFIGURATION-Update** input is executed while the absence of a circuit pack is detected.

The low-speed ports (DS3, EC-1, OC3 and OC12) may be in one of the following states:

- **AUTO (Auto):** AUTO is the original value of the low-speed port state parameter. AUTO refers to a low-speed port that is available for automatic provisioning. A low-speed port makes a transition from the AUTO state to the IS state after a good signal is detected. A DS3 low-speed port in the AUTO state can also be provisioned to the NMON state, using the **CONFIGURATION-Set-State-T3** input. An EC-1 low-speed port in the AUTO state can be provisioned to the NMON state, using the **CONFIGURATION-Set-State-EC1** input. An OC3 low-speed port in the AUTO state can be provisioned to the NMON state using the **CONFIGURATION-Set-State-OC3** input. An OC12 low-speed port in the AUTO state can be provisioned to the NMON state using the **CONFIGURATION-Set-State-OC12** input.
- **IS (In Service):** IS refers to a low-speed port that is fully monitored and alarmed. A low-speed port makes a transition from the IS state to the AUTO state when the **CONFIGURATION-Update** input is executed while the absence of a good signal is detected. A low-speed port also makes a transition from the IS state to the AUTO state when the associated circuit pack slot makes an EQ-to-AUTO circuit pack slot state transition. A DS3 low-speed port in the IS state can also be provisioned to the AUTO or NMON state, using the **CONFIGURATION-Set-State-T3** input. An EC-1 low-speed port in the IS state can be provisioned to the AUTO or NMON state, using the **CONFIGURATION-Set-State-EC1** input. An OC3 low-speed port in the IS state can be provisioned to the AUTO or NMON state using the **CONFIGURATION-Set-State-OC3** input. An OC12 low-speed port in the IS state can be provisioned to the AUTO or NMON state using the **CONFIGURATION-Set-State-OC12** input.

- **NMON (Not Monitored):** NMON refers to a low-speed port that is not monitored and will not make a transition to the IS state when a good signal is detected. A DS3 low-speed port in the NMON state can be provisioned to the AUTO state, using the **CONFIGURATION-Set-State-T3** input. An EC-1 low-speed port in the NMON state can be provisioned to the AUTO state using the **CONFIGURATION-Set-State-EC1** input. An OC3 low-speed port in the NMON state can be provisioned to the AUTO state using the **CONFIGURATION-Set-State-OC3** input. An OC12 low-speed port in the NMON state can be provisioned to the AUTO state using the **CONFIGURATION-Set-State-OC12** input.

The electrical low-speed port state can be provisioned separately in the add (from the cross-connect) and drop (from the OC-48 line) directions.

The primary port states of OC3 and OC12 circuit packs can be provisioned in the "from OC3" and "from OC12" add directions, respectively.

The FT-2000 OC-48 Add/Drop-Rings Terminal monitors, reports, and alarms trouble conditions associated with low-speed signals according to the low-speed port state and the circuit pack slot state. The circuit pack slot state must be in the EQ state. Table 8-8 shows how the low-speed port state affects monitoring, reporting, alarming, and performance monitoring of low-speed signals.

Table 8-8. Monitoring, Reporting, Alarming, and Performance Monitoring of Low-Speed Signals

Low-Speed Port State	Direction	Cross-Connection	Monitoring, Reporting, Alarming and Performance Monitoring of Low-Speed Signals
AUTO	Add	Yes	No
		No	No
		Yes	No
		No	No
IS	Drop	Yes	Yes
		No	Yes
		Yes	Yes
		No	No
NMON	Add	Yes	No
		No	No
		Yes	No
		No	No

DS3 low-speed ports *in the drop direction* must be in the IS state, and the circuit pack slots must be in the EQ state for these trouble conditions to be reported.

- DS3 path unequipped
- incoming (from OC-48) DS3 AIS
- incoming (from OC-48) DS3 LOF
- inc.(from OC48) path RFI/yellow
- incoming (from OC-48) path AIS
- incoming (from OC-48) STS LOP.

EC-1 low-speed ports *in the drop direction* must be in the IS state, and the circuit pack slots must be in the EQ state for the following trouble condition to be reported.

- incoming (from OC-48) STS LOP.

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Overview

This section defines the maintenance philosophy and outlines the various features available to monitor and maintain the FT-2000 OC-48 Lightwave System.

Remote Maintenance Philosophy

The FT-2000 OC-48 Lightwave System allows operation and maintenance of a remote network element in a network from the local central office location. The FT-2000 OC-48 Lightwave System also allows operation and maintenance of a remote network element (for example, a DDM-2000 Multiplexer) in a subnetwork from any FT-2000 OC-48 ADR Terminal. The FT-2000 OC-48 Lightwave System uses the synchronous optical network (SONET) OC-48 and OC-3/OC-12 DCC to provide the following:

- Craft interface terminal (CIT) remote access: The local network element provides a remote login capability from its CIT to a remote network element in the local network. The FT-2000 OC-48 Add/Drop-Rings Terminal also provides a remote login capability to other remote network element (for example, a DDM-2000 Multiplexer) in the same subnetwork.



NOTE:

There is no remote login capability from an FT-2000 CIT to *WaveStar* network elements in mixed FT-2000/*WaveStar* rings.

A message-based operations system may also access the FT-2000 OC-48 Add/Drop-Rings Terminal, using the TL1/X.25 interface.

Maintenance Signals

The following maintenance signals are generated and detected by the FT-2000 OC-48 Lightwave System.

- **Alarm indication signals (AIS):** Alarm indication signals notify downstream equipment that a failure has been detected and alarmed by some upstream equipment, if the upstream alarm has not been suppressed. Alarm indication signals include SONET line AIS, STS-1 path AIS, and DS3 AIS.
- **Upstream failure indications signals:** Upstream failure indication signals notify upstream equipment that a downstream failure has been detected. Upstream failure indication signals include line remote defect indicator (RDI-L) and path remote defect indicator (RDI-P) signals.
- **Path unequipped signal:** The path unequipped signal is transmitted to notify downstream equipment that the STS-1 path is incomplete (for example, a low-speed interface slot in the AUTO state or the absence of a valid cross-connection). The DS3 circuit pack is the only low-speed interface circuit pack that terminates the STS-1 path overhead. Thus, the STS1E and OC3 (1.3 STD) circuit packs pass through any path unequipped signals. When a DS3 circuit pack detects a path unequipped signal on a DS3 circuit, a path integrity failure condition is reported.
- **Path trace signal:** The path trace signal is transmitted repetitively to verify the continuity of the STS-1 path. The DS3 circuit pack is the only low-speed interface circuit pack that generates or terminates the STS-1 path overhead. Thus, the STS1E and OC3 (1.3 STD) circuit packs pass through any path trace signals. The value of the transmit and receive expected path trace signals is provisionable for DS3 circuits only. The value of the provisionable receive expected path trace signal is compared to the actual received path trace signal to verify STS-1 path continuity. For more information about provisioning path trace, refer to Section 8, "Administration and Provisioning." For more information about the path trace report, refer to Section 11, "Craft Interface Terminal Usage."

The maintenance signals are SONET, ANSI*, and Bellcore compliant.*

Figure 9-1 shows the maintenance signals used by the FT-2000 OC-48 Add/Drop-Rings Terminal when interfacing with DS3 low-speed signals. Figure 9-2 shows the maintenance signals used by the FT-2000 OC-48 Add/Drop-Rings Terminal when interfacing with EC-1, OC-3, IS-3, and OC-12 low-speed signals. Figure 9-3 shows the maintenance signals used by the FT-2000 OC-48 Add/Drop-Rings Terminal for through tributaries. Figure 9-4 shows the maintenance signals used by the FT-2000 OC-48 Repeater Bay. In these figures, the labels on the arrows pointing into the FT-2000 OC-48 Lightwave System show the maintenance signals and failure conditions recognized. The labels on the arrows pointing out of the FT-

* ANSI is a registered trademark of the American National Standards Institute, Inc.

2000 OC-48 Lightwave System show the signals generated in response to the incoming maintenance signals or failure conditions. The Xs show failure points within the FT-2000 OC-48 Lightwave System or in upstream equipment. Unlabeled arrows show normal transmission.

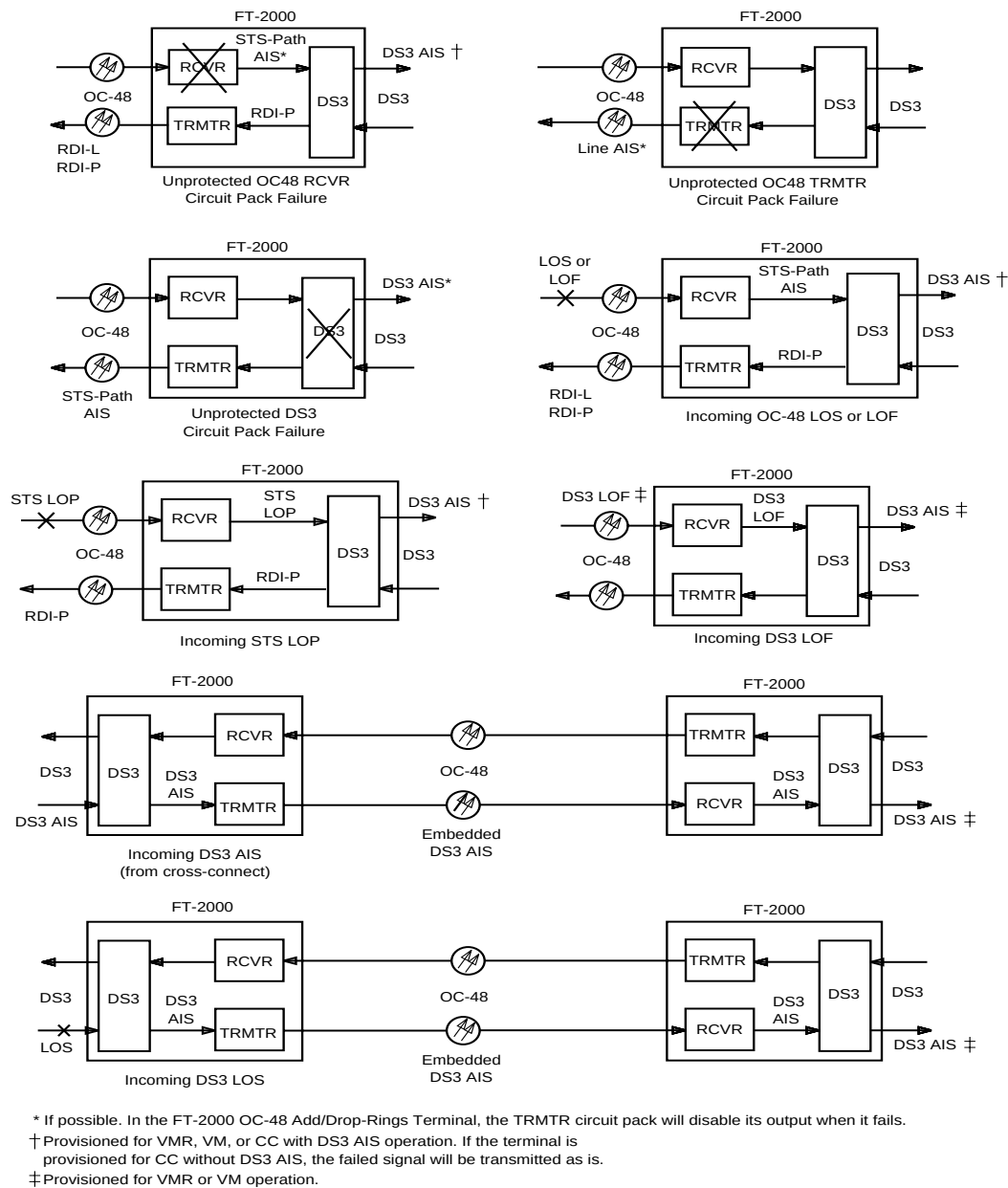
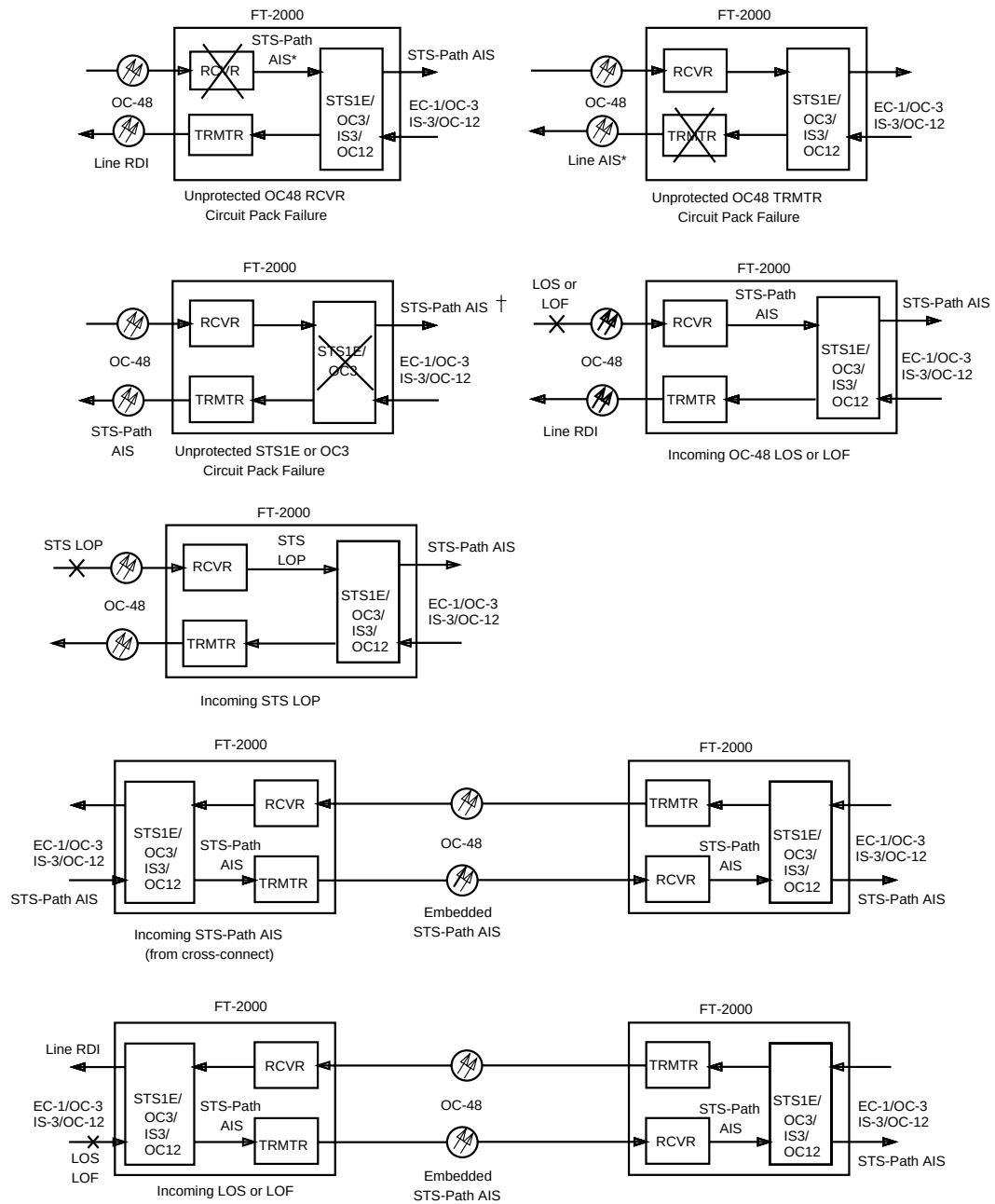


Figure 9-1. FT-2000 OC-48 Add/Drop-Rings Terminal Maintenance Signals (when Interfacing with DS3 Signals)



* If possible, The OC48 TRMTR circuit pack disables its output when it fails.

† If possible.

Figure 9-2. FT-2000 OC-48 Add/Drop-Rings Terminal Maintenance Signals (when Interfacing with EC-1, OC-3, IS-3 and OC-12 Signals)

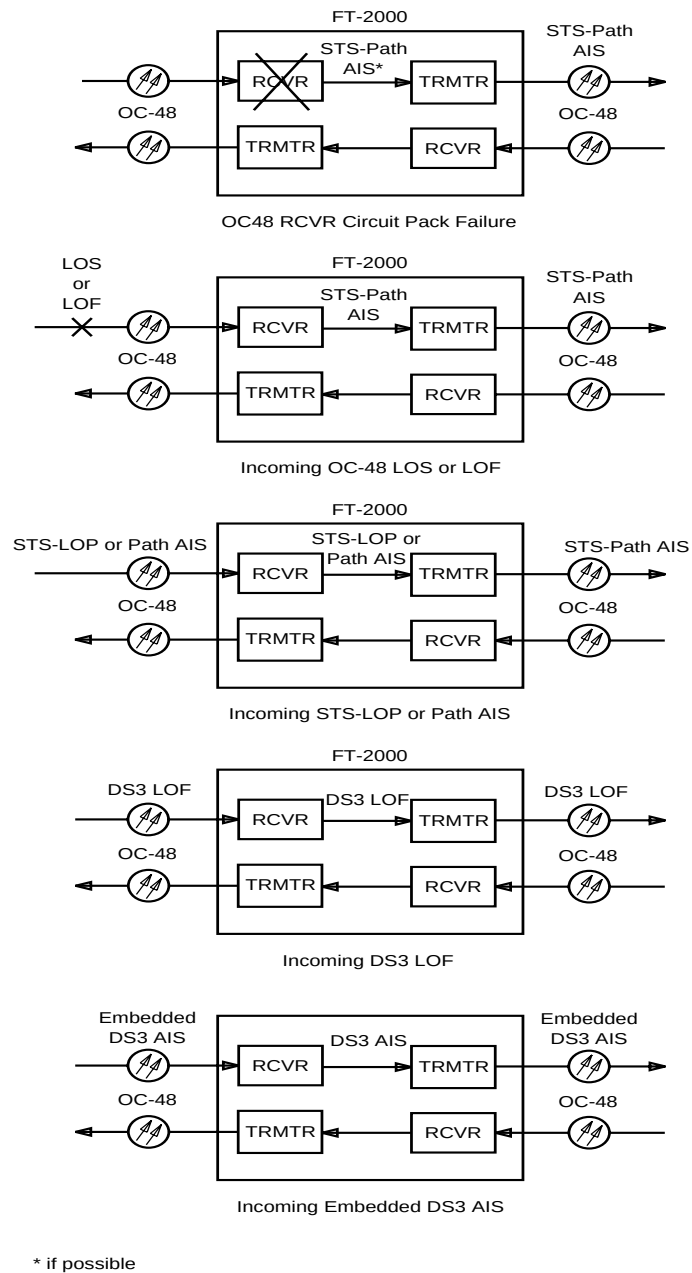


Figure 9-3. FT-2000 OC-48 Add/Drop-Rings Terminal Maintenance Signals for Through Tributaries

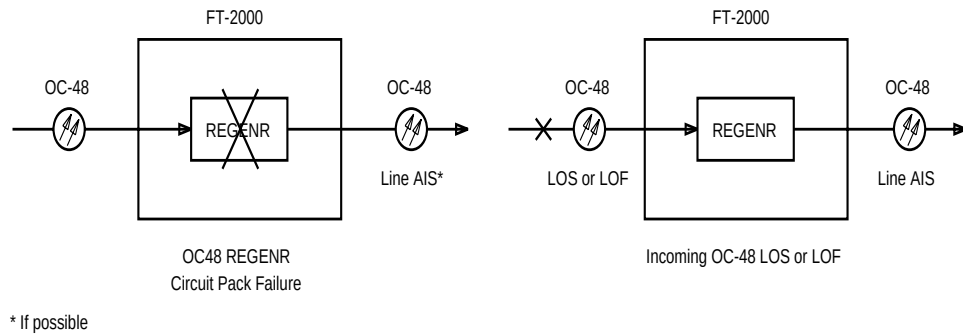


Figure 9-4. FT-2000 OC-48 Repeater Bay Maintenance Signals

Fault Detection, Isolation, and Reporting

The FT-2000 OC-48 Lightwave System continuously monitors its internal condition and incoming signals according to the state of the circuit pack slots and low-speed ports. (For information about circuit pack slot and low-speed port states and transitions, refer to Section 8, "Administration and Provisioning.") If a circuit pack slot is in the EQ state, the FT-2000 OC-48 Lightwave System monitors the circuit pack and activates the appropriate indicators when a failure occurs. Table 9-1 shows the incoming signals and the associated conditions the FT-2000 OC-48 Lightwave System monitors.

When a trouble condition is detected, the FT-2000 OC-48 Lightwave System employs automatic diagnostics to isolate the failed circuit pack or signal. Most faults are isolated to a maximum of two circuit packs, but some faults may be isolated to more than two circuit packs. Failures are reported to the local technician and operations systems so that repair decisions can be made. If desired, operations system personnel and the local technician can use the CIT to gain more detailed information on the trouble condition.

All trouble conditions detected and isolated by the FT-2000 OC-48 Lightwave System are stored and made available to be reported, on demand, through the CIT. The FT-2000 OC-48 Add/Drop-Rings Terminal maintains the past 500 alarm and status conditions and CIT events. The CIT events include condition starting events, condition clearing events, autonomous actions by the system, and user actions. Each event is date and time stamped.



NOTE:

Any reset of the FT-2000 OC-48 Add/Drop-Rings Terminal erases the alarm history file (the past 500 alarm and status conditions and CIT events).

The FT-2000 OC-48 Lightwave System also automatically reports all detected alarm and status conditions and CIT events through indicators that are subject to the provisionable incoming signal alarm delay and through indicators that are *not* subject to incoming signal alarm delay.

Table 9-1. Incoming Signals and Monitored Conditions

Incoming Signal Level	Monitored Conditions
OC-48*	Alarm Indication Signals (AIS) Automatic Protection Switch (APS) Byte Failure APS Default Byte B1 Parity Error Invalid F-Byte Line RFI/Yellow Loss of Frame (LOF) Loss of Signal (LOS) Signal Degrade (SD) Signal Fail (SF)
OC-12	Alarm Indication Signals (AIS) Automatic Protection Switch (APS) Byte Failure Line RFI/Yellow Loss of Frame (LOF) Loss of Signal (LOS) STS Loss of Pointer (LOP) (from OC-12) STS Path Payload Defect Indicator (PDI-P) Signal Degrade (SD) Signal Fail (SF) Path Unequipped
OC-3†	Alarm Indication Signals (AIS) Automatic Protection Switch (APS) Byte Failure Line RFI/Yellow Loss of Frame (LOF) Loss of Signal (LOS) STS Loss of Pointer (LOP) (from OC-3) STS Path Payload Defect Indicator (PDI-P) Signal Degrade (SD) Signal Fail (SF) Path Unequipped
DS3§	Loss of Signal (LOS) (from DSX) Signal Degrade (SD) (from DSX) Alarm Indication Signals (AIS) (from OC-48) Loss of Frame (LOF) (from OC-48) Path RFI/Yellow (from OC-48) STS Loss of Pointer (LOP) (from OC-48) Path Unequipped

Table 9-1. Incoming Signals and Monitored Conditions—(Contd)

Incoming Signal Level	Monitored Conditions
EC-1S†‡	Alarm Indication Signals (AIS) (from STSX) Line RFI/Yellow (from STSX) Loss of Frame (LOF) (from STSX) Loss of Pointer (LOP) (from STSX) Loss of Signal (LOS) (from STSX) Signal Degrade (SD) (from STSX) STS Loss of Pointer (LOP) (from STSX) STS Path Payload Defect Indicator (PDI-P) Path Unequipped
DS1**	DS1 Reference Failure

*If the TRMTR, RCVR, or REGENR slots are in the EQ state, the associated incoming OC-48 signals are also monitored and alarmed.

† If the low-speed interface slots are in the EQ state, the incoming low-speed signals are monitored and alarmed.

‡ If the low-speed interface slots are in the EQ state and the associated low-speed ports are in the IS state, the incoming low-speed signals are monitored and alarmed.

** If a DS1 input port is in the IS state, the associated incoming DS1 synchronization reference signal is monitored and alarmed when a failure occurs.

The indicators that are subject to incoming signal alarm delay are:

- Audible and visible office alarm outputs
- TL1 autonomous messages*
- Critical (CR), major (MJ), and minor (MN) LEDs on the user panel
- Status field in the upper left hand corner of the CIT screen.

The indicators that are *not* subject to incoming signal alarm delay are:

- FAULT LEDs on the circuit packs
- All CIT reports
- TL1 command response messages
- Abnormal (ABN), near-end activity (NE ACTY), far-end activity (FE ACTY), alarm cutoff/locator (ACO/LOCTR), line locator (LINE LOCTR), USE CIT, and POWER ON LEDs on the user panel.

* TL1 autonomous messages for alarm and status conditions are only available on X.25 virtual circuits when the value of the OS Type parameter is provisioned "maintenance" or "other" using the **SECURITY-Set-Security-Port** input.

The incoming signal alarm delay only applies to autonomous indications of the following incoming signal conditions:

- inc.(from DS1) sync ref fail
- inc.(from OC48) path RFI/yellow
- inc.(from OC48) sync ref fail
- inc.(from STSX) line RFI/yellow
- incoming (from DSX) DS3 LOS
- incoming (from DSX) DS3 SD
- incoming (from OC-48) DS3 AIS
- incoming (from OC-48) DS3 LOF
- incoming (from OC-48) path AIS
- incoming (from OC-48) STS LOP
- incoming (from STSX) EC1 LOF
- incoming (from STSX) EC1 LOP
- incoming (from STSX) EC1 LOS
- incoming (from STSX) EC1 SD
- incoming (from STSX) line AIS
- incoming (from STSX) path unequipped*
- incoming (from STSX) path AIS*
- incoming (from STSX) path PDI*
- incoming (from OC-3) path AIS*
- incoming (from OC-3) path unequipped*
- incoming (from OC-3) path PDI*
- incoming OC-3 APS byte fail
- incoming OC-3 line RFI/yellow
- incoming OC-3 LOF
- incoming OC-3 LOS
- incoming OC-3 SD
- incoming OC-3 SF
- incoming OC-48 AIS
- incoming OC-48 APS byte fail

* Occurs at low-speed ports provisioned with a DRI cross-connect (1-Way-DRI, 2-Way-DRI, or 2-Way-DRI-Pri).

- incoming OC-48 APS default byte
- incoming OC-48 B1 parity error
- incoming OC-48 invalid F byte
- incoming OC-48 line RFI/yellow
- incoming OC-48 LOF
- incoming OC-48 LOS
- incoming OC-48 LOS/LOF
- incoming OC-48 SD
- incoming sync ref failure.
- incoming OC-12 APS byte failure
- incoming OC-12 line RFI/Yellow
- incoming OC-12 loss of frame (LOF)
- incoming OC-12 loss of signal (LOS)
- incoming OC-12 loss of pointer (LOP)
- incoming OC-12 signal degrade (SD)
- incoming OC-12 signal fail (SF)
- incoming (from OC-12) path AIS*
- incoming (from OC-12) path Unequipped*
- incoming (from OC-12) path PDI*

The FT-2000 OC-48 Repeater Bay conveys the following conditions using the F1-bytes in the OC-48 signal to the downstream FT-2000 OC-48 Add/Drop-Rings Terminal.

- incoming OC48 B1 parity error
- incoming OC48 LOS/LOF
- incoming OC48 invalid F byte
- optical parameter out-of-range
- repeater bay environment input
- repeater bay equipment failure.

The downstream FT-2000 OC-48 Add/Drop-Rings Terminal reports these conditions locally (via the CIT interface) and remotely (via X.25/TL1 interface).

Table 9-2 contains a list of alarm and condition descriptions and their likely causes.



CAUTION:

This table is for information only and should not be used for trouble clearing. Refer to the Operation and Maintenance (TOP) section for trouble clearing information.

Table 9-2. Condition Descriptions

Description (from Retrieve-Alarm Report)	Meaning
APS channel failure	The automatic protection switching (APS) channel on the protection line has failed. Likely causes: Failure of protection line, far-end TRMTR, near-end RCVR, or far-end LNCTL circuit packs.
APS provisioning conflict	The line protection switching configuration (1xN or 1+1) or directionality (unidirectional or bidirectional) is provisioned differently at the two ends of the line.
circuit audit suspended	The circuit provisioning audits are not functioning.
circuit provisioning error	Intermediate source/destination node TID is incorrect, or the add/drop source/destination node TID is incorrect.
clock out of range	One or both of the TG3 circuit packs supplying synchronization to the TRMTR circuit pack has gone out of the recommended range.
CKP Serial EPROM corrupted	A circuit pack in the indicated slot has corrupt data in its memory.
CP reset in progress	A circuit pack has been installed and that the necessary software is being downloaded to the circuit pack.
CP (unknown type) failure	The circuit pack in the indicated slot has failed but its type is unknown.
CP (unknown type) removed	The circuit pack in the indicated slot has been removed but its type is unknown.
CPYPGM:IP tid	Copy program in progress.
DCC startup in progress	The DCC is starting up.
DRI auto switch	An automatic DRI switch is active.
DRI manual switch	A manual DRI switch is active.
DS3 INTFC failure	A DS3 circuit pack failure.
DS3 INTFC removed	A DS3 circuit pack is missing from a slot.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
DS3 loopback	A DS3 loopback is in effect. DS3 signals coming from the cross-connect panel are preempted by the loopback.
DS3 path unequipped	A path unequipped signal has been detected on an incoming OC-48 line. Likely cause: A cross-connection was deleted in an upstream node.
duplicate node ID defined	A recently entered node identifier (NID) value is a duplicate of the NID of another network element in the same OC-48 ring.
duplicate TID defined	A recently entered target identifier (TID) value is a duplicate of the TID of another network element in the same OC-48 ring.
EC1 loopback	An EC-1 loopback is in effect. EC-1 signals coming from the cross-connect panel are preempted by the loopback.
excessive holdover	The network element was either manually or automatically switched to internal synchronization and has remained in that synchronization mode for 24 hours. This excessive time (holdover) may cause degraded performance on the transmitted and/or received signals. Likely causes: Failure of TG3 or RCVR (when looped timed) circuit packs, or failure of an external synchronization reference.
extra traffic preempted	The extra traffic routed over the protection tributaries (9 through 16) has been preempted by a line protection switch.
fan failure	There is a tripped circuit breaker or defective fan assembly.
FT-LBA fan failure	There is a tripped circuit breaker or defective fan assembly at the FT-LBA.
FT-LBA fuse/power failure	The FT-LBA has a blown fuse, a power failure to a shelf, or a power failure within the bay.
FT-LBA 1EW failure	Failure of the 1EW LBA.
FT-LBA 1WE failure	Failure of the 1WE LBA.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
fuse/power failure A	The network element has a blown fuse in feeder A, a power failure to a shelf, or a power failure within the bay. Likely causes: A blown 10A fuse, a defective 1186A filter board in the filter panel, or a fault condition in the SYSCTL circuit pack.
fuse/power failure B	The network element has a blown fuse in feeder B, a power failure to a shelf, or a power failure within the bay. Likely causes: A blown 10A fuse, a defective 1186A filter board in the filter panel, or a fault condition in the SYSCTL circuit pack.
inc. (from DS1) sync ref fail	A failure of the incoming DS1 synchronization reference has been detected.
inc. (from OC3) DCC failure	The local network element cannot communicate through the SONET OC-3 data communications channel (DCC).
inc. (from OC3) path AIS	A Path AIS has been detected on an incoming STS-1 tributary of an OC3 signal. The OC3 port in question is provisioned as a DRI cross-connect (1-Way-DRI, 2-Way-DRI, or 2-Way-DRI-Pri). Likely causes: Failure of upstream equipment, which includes the STS-1 path (for equipment, failure of an OC-3 pack in the upstream OC3 equipment). If the upstream NE is an FT-2000 then a “delete” of a drop cross-connection may have been performed.
inc. (from OC3) path PDI	A path payload defect has been detected in the STS SPE. STS Path Signal Label (C2) byte values of E1 to FC identify the PDI-P condition.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
inc. (from OC48) DCC failure	The local network element cannot communicate through the SONET OC-48 data communications channel (DCC). Likely causes: In a mixed FT-2000/ <i>WaveStar</i> ring, the <i>WaveStar</i> node may be miscabled (i.e., E/E or W/W), or the user-network side may be incorrectly provisioned. Either condition will be alarmed at the <i>WaveStar</i> node.
inc (from OC48) path RFI/yellow	An STS-1 path RDI signal has been detected on a DS3 signal coming from the line. Path yellow indicates the far-end terminal is receiving a "path AIS."
inc. (from OC48) sync ref fail	A failure of the incoming line synchronization reference from the incoming OC-48 signal has been detected.
inc(from STSX) line RFI/yellow	An incoming line RFI/yellow condition has been detected on an incoming EC-1 line from the STSX-1. Likely causes: Failure of an outgoing EC-1 line (transmit) or local STS1E circuit pack.
incoming DCC failure	The local network element cannot communicate through the SONET data communications channel (DCC). A defective incoming DCC can affect the following: - remote logins - TL1 messages. Likely causes: Failure of far-end OHCTL, SYSMEM, or SYSCTL circuit packs; failure of both TG3 circuit packs.
incoming (from DSX) DS3 LOS	Failure of one or more of the DS3 signals coming from the low speed cross-connect panel. A DS3 signal failure causes insertion of DS3 AIS at a remote FT-2000 terminal. Likely cause: Incoming DS3 loss of signal.
incoming (from DSX) DS3 SD	A signal degrade (SD) condition has been detected on one or more of the DS3 signals coming from the low-speed cross-connect panel.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
incoming (from OC3/OC12) STS LOP	An STS-1 loss-of-pointer (LOP) condition has been detected on an incoming synchronous transport signal (STS-1) from an OC-3 or OC12 line. Likely cause: Failure of the upstream TRMTR circuit pack.
incoming OC12 AIS	A OC12 alarm condition signal (AIS) has been detected on one or more of the OC-12 signals coming from an OC-48 line. Likely causes: Failure of an upstream OC-12 source equipment or OC12 circuit pack.
incoming (from OC12) path AIS	A Path AIS has been detected on an incoming STS-1 tributary of an OC12 signal. The OC12 port in question is provisioned as a DRI cross-connect (1-Way-DRI, 2-Way-DRI, or 2-Way-DRI-Pri). Likely causes: Failure of upstream equipment, which includes the STS-1 path (for example, failure of an OC-12 pack in the upstream OC12 equipment). If the upstream NE is an FT-2000 then a “delete” of a drop cross-connection may have been performed.
incoming (from OC-12) path PDI	A path payload defect has been detected in the STS SPE. STS Path Signal Label (C2) byte values of E1 to FC identify the PDI-P condition.
incoming (from OC-48) DS3 AIS	A DS3 alarm indication signal (AIS) has been detected on one or more of the DS3 signals coming from an OC-48 line. Likely causes: Failure of an upstream DS3 source equipment.
incoming (from OC-48) DS3 LOF	A DS3 loss of frame (LOF) condition has been detected on an incoming DS3 signal from the OC-48 line. Likely causes: Failure of an upstream DS3 source equipment or DS3 circuit pack.
incoming (from OC48) path AIS	An STS-1 path alarm indication signal (AIS) has been detected on one or more of the STS-1 tributaries of the OC-48 line. Likely cause: Failure of far-end DS3 or STS1E circuit pack.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
incoming (from OC48) STS LOP	An STS-1 loss-of-pointer (LOP) condition has been detected on an incoming synchronous transport signal (STS-1) from an OC-48 line. Likely cause: Failure of the upstream TRMTR circuit pack.
incoming (from STSX1) EC1 LOF	An EC-1 loss-of-frame (LOF) condition has been detected on an incoming EC-1 line from the STSX-1.
incoming (from STSX1) EC1 LOP	An EC-1 loss-of-pointer (LOP) condition has been detected on an incoming EC-1 line from the STSX-1.
incoming(from STSX1) EC1 LOS	An EC-1 loss-of-signal (LOS) condition has been detected on an incoming EC-1 line from the STSX-1.
incoming(from STSX1) EC1 SD	A signal degrade (SD) condition has been detected on an incoming EC-1 line.
incoming(from STSX1) line AIS	An EC-1 alarm indication signal (AIS) has been detected on an incoming EC-1 line.
incoming (from STSX1) path AIS	A Path AIS has been detected on an incoming STS-1 tributary of an OC3 signal. The OC3 port in question is provisioned as a DRI cross-connect (1-Way-DRI, 2-Way-DRI, Pri). Likely causes: Failure of an upstream EC-1 equipment.
incoming (from STSX1) path PDI	A path payload defect has been detected in the STS SPE. STS Path Signal Label (C2) byte values of E1 to FC identify the PDI-P condition.
incoming OC3/OC12 AIS	An STS-1 path alarm indication signal (AIS) has been detected on one or more of the STS-1 signals within an STS-3/STS-12 signal coming from an OC-48 line. Likely cause: Failure of an upstream REGENR or TRMTR circuit pack.
incoming OC3/OC12 APS byte fail	This condition is associated with a signal degrade (SD) or an automatic protection switch (APS) channel failure on the protection line.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
incoming OC3/OC12 line RFI/yellow	The far end OC-3/OC-12 terminal is receiving a line failure from the local FT-2000 terminal. The far end terminal is notifying the local FT-2000 terminal of the failure. Likely causes: Failure of an outgoing OC-3/OC-12 line (transmit fiber). Failure of local OC3/OC-12 circuit pack or far end OC3/OC-12 circuit pack.
incoming OC3/OC12 LOF	An OC-3/OC-12 loss-of-frame (LOF) condition has been detected on an incoming OC-3/OC-12 line. Likely cause: Failure of the far end OC3/OC12 circuit pack or local OC3/OC12 circuit pack.
incoming OC3/OC12 LOS	An OC-3/OC-12 loss-of-signal (LOS) condition has been detected on an incoming OC-3/OC-12 line. Likely causes: Failure of the far end OC3/OC12 circuit pack, the incoming OC-3/OC-12 line (receive fiber) or the local OC3/OC12 circuit pack.
incoming OC3/OC12 SD	A signal degrade (SD) condition has been detected on an incoming OC-3/OC-12 line. The line parity error rate threshold setting has been exceeded (10^{-5} through 10^{-9} with an original value of 10^{-6}). Likely causes: Failure of the far end OC3/OC12 circuit pack or the local OC3/OC12 circuit pack.
incoming OC3/OC12 SF	A signal failure (SF) condition has been detected on an incoming OC3/OC12 line. Likely causes: Failure of the far end OC3/OC12 circuit pack, the incoming OC-3/OC-12 line (receive fiber), or the local OC3/OC12 circuit pack.
Inconsistent DCC Values	The OC-3 or OC-12 DCC orientation (user or network) is the same at both ends of the DCC, but should be different.
incoming OC-48 AIS	An OC-48 alarm indication signal (AIS) has been detected on an incoming OC-48 line. Likely cause: Failure of an upstream REGENR or TRMTR circuit pack.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
incoming OC-48 APS byte fail	This condition is associated with a signal degrade (SD) or an automatic protection switch (APS) channel failure on the protection line.
incoming OC-48 APS default byte	This condition is normally a transient condition caused by a "Reset in Progress" condition at an upstream OC-48 source.
incoming OC48 B1 parity error	A parity error has been detected in the B1 SONET overhead byte at a repeater bay site. Likely cause: Failure of the upstream TRMTR or REGENR circuit pack, or the local RCVR or REGENR. CIT _ incoming OC-48 invalid F byte; An invalid SONET overhead F byte has been detected at a repeater bay site. Likely cause: Failure of the upstream TRMTR or REGENR circuit pack, or the local RCVR or REGENR.
incoming OC48 LCLAN failure	This condition indicates that a failure has been detected in the Line Controller (LNCTL) or in the System Controller (SYSCTL).
incoming OC-48 line RFI/yellow	The remote FT-2000 terminal is receiving a line failure from the local FT-2000 terminal. The remote FT-2000 terminal is notifying the local FT-2000 terminal of the failure. Likely causes: Failure of an outgoing OC-48 line (transmit fiber). Failure of local TRMTR circuit pack, remote RCVR circuit pack, or intervening REGENR circuit packs.
incoming OC-48 LOF	An OC-48 loss-of-frame (LOF) condition has been detected on an incoming OC-48 line. Likely cause: Failure of an upstream TRMTR or REGENR circuit pack or local RCVR.
incoming OC-48 LOS	An OC-48 loss-of-signal (LOS) condition has been detected on an incoming OC-48 line. Likely causes: Failure of an upstream TRMTR or REGENR circuit pack, the incoming OC-48 line (receive fiber), or the local RCVR circuit pack.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
incoming OC48 LOS/LOF	An OC-48 loss-of-signal (LOS) and/or loss-of-frame (LOF) condition has been detected on an incoming OC-48 line. Likely causes: Failure of an upstream TRMTR or REGENR circuit pack, the incoming OC-48 line (receive fiber), or the local RCVR circuit pack.
incoming OC-48 SD	A signal degrade (SD) condition has been detected on an incoming OC-48 line. The line parity error rate threshold setting has been exceeded (10^{-5} through 10^{-9} with an original value of 10^{-6}). Likely causes: Failure of the upstream TRMTR or REGENR circuit pack, or the local RCVR circuit pack.
incoming OC-48 SF	A signal failure (SF) condition has been detected on an incoming OC-48 line. Likely causes: Failure of the upstream TRMTR or REGENR circuit pack, or the local RCVR circuit pack.
incoming sync ref failure	A failure of the incoming synchronization reference has been detected. Likely causes: Failure of a synchronization reference (signal source).
inhibit alarms-office alarms	Alarm reporting via the office alarms interface is disabled.
inhibit alarms-X.25	Alarm reporting via the X.25 (TL1) interface is disabled.
laser bias current-out-of-range	This condition indicates that one or more of the optical parameters of a RCVR, TRMTR, or REGENR circuit pack has exceeded the recommended range.
line auto switch	An automatic line protection switch is active. Likely causes: Failure of incoming OC-48 line.
line FERF	The remote FT-2000 terminal is receiving a line failure from the local FT-2000 terminal. The remote FT-2000 terminal is notifying the local FT-2000 terminal of the failure. Likely causes: Failure of an outgoing OC-48 line (transmit fiber). Failure of local TRMTR circuit pack, remote RCVR circuit pack, or intervening REGENR circuit packs.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
line forced switch	An automatic line protection switch is active with a priority of "forced switch."
line forced switch at far end	An automatic line protection switch is active with a priority of "forced switch" at the far end of the OC-48 line.
line forced switch at near end	An automatic line protection switch is active with a priority of "forced switch" at the near end of the OC-48 line.
line lockout	The protection line is locked out and will not be used to protect a service line failure.
line lockout at far end	The protection line is locked out and will not be used to protect a service line failure at the far end of the OC-48 line.  NOTE: If either one of the two OC48 lines are "locked-out" from any node on the ring; then, protection is inhibited throughout the whole ring.
line lockout at near end	The protection line is locked out and will not be used to protect a service line failure. Because of the architecture of OC48 Add/Drop rings, this implies that protection is unavailable throughout the ring.  NOTE: If either one of the two OC48 lines are "locked-out" from any node on the ring; then, protection is inhibited throughout the whole ring.
line manual switch	An automatic line protection switch is active with a priority of "manual switch."
line manual switch at far end	An automatic line protection switch is active with a priority of "manual switch" at the far end of the OC-48 line.
line manual switch at near end	An automatic line protection switch is active with a priority of "manual switch" at the near end of the OC-48 line.
line switch inhibit	High speed line switching is disabled.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
line switch inhibit - far end	High speed line switching is disabled at the far end of the OC-48 line.
line switch inhibit - near end	High speed line switching is disabled at the near end of the OC-48 line.
line TCA	A threshold crossing alert (TCA) has been issued. The alert means the signal degrade threshold has been exceeded for an incoming OC-48 line.
LNCTL failure	Failure of LNCTL circuit pack.
LNCTL removed	LNCTL circuit pack is missing from slot.
logins inhibited	Logins are disabled.
LS auto switch	A low-speed interface circuit pack has been automatically switched to protection. Likely cause: Failure of the DS3 or STS1E circuit pack.
LS forced switch	A low-speed slot was switched to the protection slot with a priority of "forced switch."
LS lockout	A low-speed slot is locked out and will not be switched.
LS loopback	A low-speed receive signal from a high-speed line is electronically looped back to the transmit signal for the high-speed line. Signals coming from the low-speed cross-connect panel are preempted by the loopback. Likely cause: Operate-Loopback has been executed.
LS manual switch	A low-speed slot was switched to protection with a priority of "manual switch."
LSSW failure	Failure of LSSW circuit pack.
LSSW removed	LSSW circuit pack is missing from slot.
node ID conflict	This normally indicates a transient condition at the local network element.
non-preemptible protection access	The Low Speed Shelf - Complementary is connected to the protection line during the switching function and cannot be preempted by an automatic switch to protection.
OC3 auto switch at far end	An automatic line protection switch is active at the far end of the OC-3 line.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
OC3 auto switch at near end	An automatic line protection switch is active at the near end of the OC-3 line.
OC3 INTFC failure	Failure of OC3 circuit pack.
OC3 INTFC removed	OC3 circuit pack is missing from slot.
OC3 forced switch at far end	An automatic line protection switch is active with the priority of "forced switch" at the far end of the OC-3 line.
OC3 forced switch at near end	An automatic line protection switch is active with the priority of "forced switch" at the far end of the OC-3 line.
OC3 inhibit at near end	Line protection switching is disabled at the near end of the OC-3 line.
OC3 lockout at far end	The protection line is locked out and will not be used to protect a service line failure at the far end of the OC-3 line.
OC3 lockout at near end	The protection line is locked out and will not be used to protect a service line failure at the near end of the OC-3 line.
OC3 loopback (from OC3)	The input from the OC-3 line is looped back to the output of the OC-3 line.
OC3 loopback (from OC48)	The STS-3/3c signal from the OC-48 line is looped back to the OC-48 line.
OC3 mode conflict (equipment)	One slot of a slot pair provisioned for 1+1 operation is equipped with an OC3 circuit pack and the other slot of the slot pair is equipped with a DS3 or STS1E circuit pack.
OC3 mode conflict (slot pair)	One slot of a slot pair is provisioned "1+1" and the other slot of the slot pair is provisioned "0x1."
OC3 mode conflict (x-connect)	The two slots of a slot pair provisioned for 1+1 operation are cross-connected to two different STS-3 tributaries.
OC3 path unequipped	A path unequipped condition has been detected on an incoming STS-1 tributary of an OC3 signal. The OC3 port in question is provisioned as a DRI cross-connect (1-Way-DRI, 2-Way-DRI or 2-Way-DRI-Pri). Likely causes: A cross-connect in an upstream OC3 equipment has been deleted.
OC3 removed	OC3 circuit pack is missing from slot.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
OC12 mode conflict (equipment)	The alarm condition that occurs when the addressed slot or slot pair is provisioned for 1+1 mode and one or both slots are not in the "equipped" state.
OC12 mode conflict (quad pair)	The alarm condition that occurs when the addressed slot or slot pair is provisioned for 1+1 mode and the other slot is provisioned for 0x1 mode (in the same direction).
OC12 mode conflict (x-connect)	The alarm condition that occurs when the addressed slot, of the slot pair, is provisioned for 1+1 mode and the two slots are cross-connected to different tributaries.
OC12 INTFC failure	A OC12 circuit pack failure.
OC12 INTFC removed	A OC12 circuit pack is missing from a slot.
OC12 auto switch at far-end	An automatic switch has occurred at the far-end.
OC12 auto switch at near-end	An automatic switch has occurred at the near-end.
OC12 forced switch at the far-end	A forced switch has been performed on the far-end.
OC12 forced switch at the near-end	A forced switch has been performed at the near-end.
OC12 inhibit at near-end	Line protection switching is disabled at the near end of the OC-12 line.
OC12 lockout at far-end	The protection line is locked out and will not be used to protect a service line failure at the near end of the OC-12 line.
OC12 lockout at near-end	The protection line is locked out and will not be used to protect a service line failure at the near end of the OC-12 line.
OC12 loopback (from OC48)	The STS-12/12c signal from the OC-48 line is looped back to the OC-48 line.
OC-12 path unequipped	A path unequipped condition has been detected on an incoming STS-1 tributary of an OC12 signal. The OC12 port in question is provisioned as a DRI cross-connect (1-Way-DRI, 2-Way-DRI, or 2-Way-DRI-Pri). Likely causes: A cross-connect in an upstream OC12 equipment has been deleted.
OHCTL failure	Failure of OHCTL circuit pack.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
OHCTL removed	OHCTL circuit pack is missing from slot.
optical parameter out-of-range	The laser bias current level, optical power transmit level, or optical power receive level has exceeded the allowed range at an FT-2000 repeater bay.
path AIS	An STS-1 path alarm indication signal (AIS) has been detected on one or more of the STS-1 tributaries of the OC-48 line. Likely cause: Failure of far-end DS3 or STS1E circuit pack.
path integrity failure	A cross-connection within a circuit has been broken.
path TCA	A threshold crossing alert (TCA) has been issued. The alert means the signal degrade threshold has been exceeded.
path yellow	An STS-1 path yellow has been detected on a DS3 signal coming from the line. Path yellow indicates the far-end terminal is receiving a "path AIS." Likely causes: Unprotected failure of far-end DS3 circuit pack.
preemptible protn access	The Low Speed Shelf - Complementary is connected to the protection line during the switching function and can be preempted by an automatic switch to protection.
provisioned control pt	The specified control point (miscellaneous discrete output) is active. Note: The actual message that appears in the condition description report for this condition can be provisioned; this is the default message. See the Retrieve-Attribute-Control and Set-Attribute-Control commands. Likely cause: The system was instructed to close the control point.
provisioned environmental pt	A contact closure is present at an environmental input point of the network element. Note: The actual message that appears in the condition description report for this condition can be provisioned; this is the default message. See the Retrieve-Attribute-Control and Set-Attribute-Control commands.
RCVR failure	Failure of RCVR circuit pack.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
RCVR removed	RCVR circuit pack is missing from slot.
receiver parameter-out-of-range	One or more of the operating parameters of a RCVR, TRMTR, or REGENR circuit pack has exceeded the recommended range.
REGENR failure	Failure of REGENR circuit pack.
REGENR removed	REGENR circuit pack is missing from slot.
repeater bay environment input	An environmental input has been activated at the indicated repeater site.
repeater bay equipment failure	An equipment failure has occurred at the indicated repeater site.
reset in progress	The FT-2000 network element is in progress of downloading its software from SYSMEM to SYSCTL, to LNCTLs, to OHCTLs, and to all other circuit pack board controllers. Likely cause: Reset or Initialize-System has been executed.
ring incomplete/open	The designated network element is unable to create a complete ring map because of a controller or transmission failure in the OC-48 ring.
ring startup in progress	This is normally a transient condition that indicates the ring network is starting up.
section TCA	A threshold crossing alert (TCA) has been issued. The alert means the signal degrade threshold has been exceeded.
site provisioning conflict	Two network elements in a network are provisioned as "Site 0." One and only one FT-2000 terminal in a network must be provisioned to be "Site 0."
software download in progress	A software download from the PC-CIT to the SYSMEM is currently in progress.
STS1 squelch map conflict	The controller circuits are unable to associate any network element's target identifier (TID) with the value supplied for a source or destination node of an STS-1 cross-connection.
STS1E INTFC failure	Failure of STS1E circuit pack.
STS1E INTFC removed	STS1E circuit pack is missing from slot.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
STSX1 path unequipped	A path unequipped condition has been detected on an incoming EC-1 signal. The EC-1 port in question is provisioned as a DRI cross-connection (1-Way-DRI, 2-Way-DRI, or 2-Way-DRI-Pri). Likely causes: A cross-connect in an upstream EC-1 equipment has been deleted.
STS1 squelch map inconsistent	The intermediate source/destination node TIDs are incorrect for the circuit.
STS3 squelch map conflict	The controller circuits are unable to associate any network element's target identifier (TID) with the value supplied for a source or destination node of an STS-3 cross-connection.
STS3 squelch map inconsistent	The intermediate source/destination node TIDs are incorrect for the circuit.
squelch map conflict	The controller circuits are unable to associate any network element's target identifier (TID) with the value supplied for a source or destination node of a cross-connection.
sync mode auto switch	An automatic switch from the provisioned operating mode to holdover mode has occurred. Likely cause: All incoming synchronization references have failed.
sync mode/equipment conflict	S1 byte synchronization messaging is enabled on a low-speed slot that is equipped with a circuit pack that cannot support S1 byte sync messaging.
sync mode forced switch	A forced switch from the provisioned operating mode to holdover mode has occurred.
sync reference auto switch	The FT-2000 terminal has automatically switched its synchronization reference. Likely causes: When provisioned for phase-locked synchronization mode, failure of the external DS1 synchronization reference. When provisioned for loop timed mode, failure of the incoming OC-48 line, failure of the RCVR circuit pack, or failure of the external DS1 synchronization reference.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
sync reference forced switch	The FT-2000 terminal has switched its synchronization reference with a priority of "forced switch."
sync reference lockout	A synchronization reference signal is locked out and FT-2000 terminal will go into holdover mode if it fails.
sync reference manual switch	The FT-2000 terminal has switched its synchronization reference with a priority of "manual switch."
SYSCTL failure	Failure of SYSCTL circuit pack.
SYSMEM failure	Failure of SYSMEM circuit pack.
SYSMEM removed	SYSMEM circuit pack is missing from slot.
SYSMEM/SYSCTL code mismatch	A software mismatch has been detected between the software stored in the SYSMEM circuit pack and the software version running in the FT-2000 network element. Likely cause: A software upgrade procedure is in progress.
SYSMEM unrecognizable code	The software stored in the SYSMEM circuit pack has become corrupted and is no longer usable. Likely causes: Corrupted software download to SYSMEM circuit pack or spontaneous corruption of the software in the SYSMEM circuit pack.
test alarm in progress	An office alarm test is in progress.
test auto turnup in progress	An auto turnup test is in progress.
TG auto switch	A TG3 circuit pack has been automatically switched to protection. Likely cause: Failure of a TG3 circuit pack, removal of a TG3 circuit pack, or a TG3 circuit pack warming up.
TG manual switch	A TG3 circuit pack was switched to protection with a priority of "manual switch."
TG warming up	A TG circuit pack has been installed and is warming up to a stable operating temperature.
TG3 failure	Failure of TG3 circuit pack.
TG3 removed	TG3 circuit pack is missing from slot.
TL-1 link failure	An incoming TL1 link failure has been detected.

Table 9-2. Condition Descriptions—(Contd)

Description (from Retrieve-Alarm Report)	Meaning
TOHCTL failure	Failure of TOHCTL circuit pack.
TOHCTL removed	TOHCTL circuit pack is missing from slot.
traffic squelched	Multiple failures in the ring network have resulted in traffic being squelched to eliminate any possibility of its being misrouted.
transmit parameter-out-of-range	One or more of the operating parameters of a RCVR, TRMTR, or REGENR circuit pack has exceeded the recommended range.
TRMTR failure	Failure of TRMTR circuit pack.
TRMTR removed	TRMTR circuit pack is missing from slot.
unexpected CP type	A circuit pack has been replaced with a defective circuit pack.
x-conn provisioned but not est	A cross-connection has been entered between a tributary of an OC-48 line and a low-speed interface slot in the AUTO state.
x-conn/equipment conflict	Bidirectional STS-1 drop cross-connections are provisioned to a slot equipped with a circuit pack that does not support bidirectional drop cross-connections.

Protection Switching

High-Speed Protection

General

The FT-2000 OC-48 Add/Drop-Rings Terminal performs 2-fiber ring protection switching in response to automatically detected faults in the OC-48 high-speed lines, as well as external commands from a technician at a local/remote CIT or operations system. Refer to the **FAULT-Switch-Line** input in Section 11, "Craft Interface Terminal Usage."

Table 9-3 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-3. 2-Fiber Ring Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Automatic protection switch (APS) channel failure†	Automatic
Protection hardware failure†	Automatic
Lockout of protection	CIT/OS
Forced switch	CIT/OS
Signal fail	Automatic
Signal degrade	Automatic
Manual switch	CIT/OS
Wait to restore	Automatic

* Resetting the line switch priority (**FAULT-Switch-Line-Priority:Reset**) has no effect on any automatic switch priority except wait to restore.

† An APS channel failure and a protection hardware failure are the same priority.

The FT-2000 OC-48 Add/Drop-Rings Terminal uses bidirectional revertive 2-fiber ring protection switching. Bidirectional refers to when protection switching is performed in the transmit and receive directions. In revertive 2-fiber ring protection switching, the traffic switches from the service STS-3 tributaries of an OC-48 high-speed line to the protection STS-3 tributaries of the other OC-48 high-speed line

when a fault occurs. When the fault clears, the traffic switches back (reverts) to the service STS-3 tributaries.

There are eight STS-3 tributaries carrying service on OC-48 high-speed line 1W and eight STS-3 tributaries carrying service on OC-48 high-speed line 1E. The eight STS-3 tributaries not carrying service on each OC-48 high-speed line are the protection STS-3 tributaries. The protection STS-3 tributaries on OC-48 high-speed line 1W are used to protect the service STS-3 tributaries on OC-48 high-speed line 1E, and the protection STS-3 tributaries on OC-48 high-speed line 1E are used to protect the service STS-3 tributaries on high-speed line 1W. Table 9-4 shows the mapping between the service STS-3 tributaries and their protection STS-3 tributaries.

Table 9-4. 2-Fiber Ring Tributary Mapping

Service STS-3 Tributary	Protection STS-3 Tributary
1	9
2	10
3	11
4	12
5	13
6	14
7	15
8	16

2-Fiber Ring Protection Switching Architecture

Figure 9-5 shows the 2-fiber ring protection switching architecture of the FT-2000 OC-48 Add/Drop-Rings Terminal.

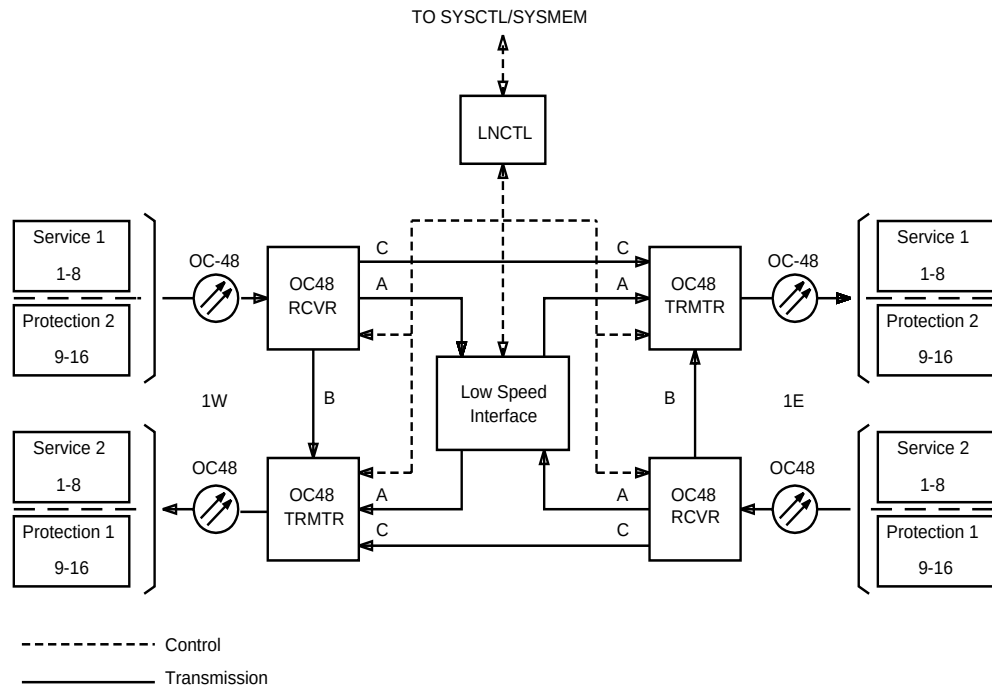


Figure 9-5. 2-Fiber Ring Protection Switching Architecture (FT-2000 OC-48 Add/Drop-Rings Terminal)

The FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with the following circuit packs to support bidirectional 2-fiber ring protection switching:

- **OC48 Receiver, Add/Drop [OC48 RCVR (A/D)]:** Two OC48 RCVR (A/D) circuit packs are required to interface with OC-48 high-speed lines 1W and 1E. The OC48 RCVR (A/D) circuit pack constantly monitors the incoming OC-48 signal on the OC-48 high-speed line. If a defect is detected, the OC48 RCVR circuit pack notifies the OC48 TRMTR (A/D) and LNCTL (4 MEG) circuit packs. The OC48 RCVR (A/D) circuit packs have the following transmission buses that make 2-fiber ring protection switching possible:
 - **A bus:** This bus allows the local traffic to be dropped.
 - **B bus:** This bus allows the through traffic from the service STS-3 tributaries of the OC-48 high-speed line to be looped back to the OC48 TRMTR (A/D) circuit pack and bridged to the protection STS-3 tributaries when a 2-fiber ring protection switch is required. (Refer to Table 9-4 for the mapping between the service STS-3 tributaries and the protection STS-3 tributaries.)
 - **C bus:** This bus allows through traffic to be routed from OC-48 high-speed line 1W to 1E, or from OC-48 high-speed line 1E to 1W.

- **OC48 Transmitter, Add/Drop [OC48 TRMTR (A/D)]:** Two OC48 TRMTR (A/D) circuit packs are required to interface with OC-48 high-speed lines 1W and 1E. If an incoming OC-48 signal defect or an internal equipment defect is detected, the OC48 TRMTR (A/D) circuit pack transmits maintenance signals to remote FT-2000 OC-48 Add/Drop-Rings Terminals. The OC48 TRMTR (A/D) circuit packs have the following transmission buses that make 2-fiber ring protection switching possible:
 - **A bus:** This bus allows the local traffic to be added.
 - **B bus:** This bus allows the through traffic from the OC48 RCVR (A/D) circuit pack to be looped back to the OC48 TRMTR (A/D) circuit pack and bridged to the protection STS-3 tributaries of the OC-48 high-speed line when a 2-fiber ring protection switch is required. (Refer to Table 9-4 for the mapping between the service STS-3 tributaries and the protection STS-3 tributaries.)
 - **C bus:** This bus allows through traffic to be routed from OC-48 high-speed line 1E to 1W or from OC-48 high-speed line 1W to 1E.
- **Line Controller - 4 Megabyte [LNCTL (4 MEG)]:** One LNCTL (4 MEG) circuit pack is required to interface with the circuit packs on OC-48 high-speed lines 1W and 1E. The LNCTL (4 MEG) circuit pack controls 2-fiber ring protection switching and performs line specific computations. The LNCTL (4 MEG) circuit pack uses the board controller local area network (BCLAN) to communicate with the board controllers on the OC48 TRMTR (A/D), OC48 RCVR (A/D), DS3, STS1E, and OC3 circuit packs for OC-48 high-speed lines 1W and 1E.
- **Low Speed Interface:** The FT-2000 OC-48 Add/Drop-Rings Terminal may be equipped with up to 16 service DS3 and/or STS1E circuit packs, eight 1+1 protected OC3 circuit packs (16 unprotected), or a mixture of DS3, STS1E and OC3 circuit packs. If an incoming OC-48 signal defect occurs on the OC-48 high-speed line 1W, the service low-speed interface circuit packs switch to OC-48 high-speed line 1E in response to switch requests from the LNCTL (4 MEG) circuit pack. When the defect clears, the service low-speed interface circuit packs switch back (revert) to OC-48 high-speed line 1W.

2-Fiber Ring Protection Switching Example

Figure 9-6 shows an example of a 2-fiber bidirectional, line-switched ring with four nodes during normal transmission. (STS-3 tributaries 1 through 8 are service STS-3 tributaries and STS-3 tributaries 9 through 16 are protection tributaries.) Service STS-3 tributary 6 is used to carry service traffic between low-speed interface slot 4A at node 0 and low-speed interface slot 5A at node 2. Service STS-3 tributary 3 is used to carry service traffic between low-speed interface slot 3A at node 1 and low-speed interface slot 2A at node 3. Protection STS-3 tributary 14 is used to carry extra traffic between low-speed interface slot 2B at node 0 and low-speed interface slot 4B at node 3. For more information about cross-connections at FT-2000 OC-48 Add/Drop-Rings Terminals, refer to Section 8, "Administration and Provisioning."

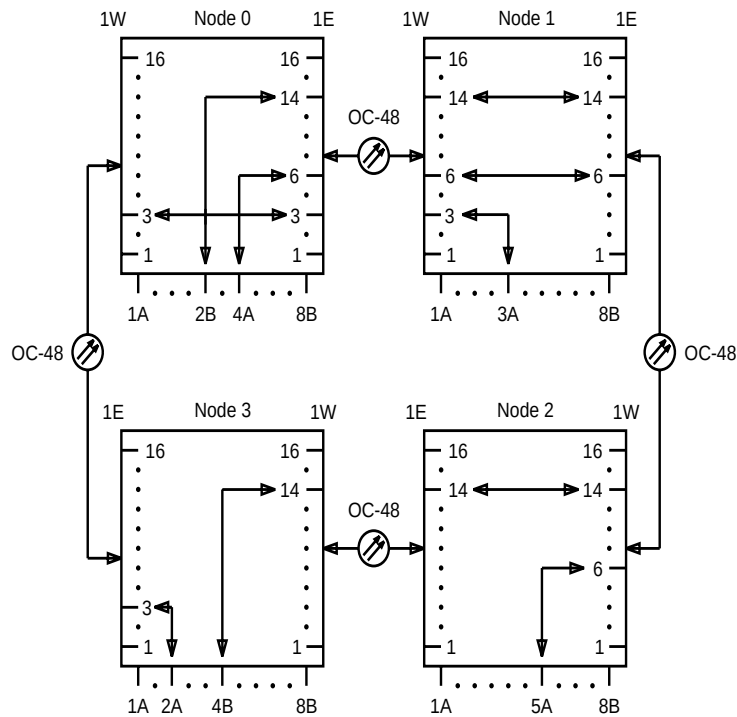


Figure 9-6. Bidirectional Line-Switched 2-Fiber Ring (Normal Transmission)

Figure 9-7 shows a 2-fiber bidirectional, line-switched ring when a fiber cut occurs between two nodes. Automatic 2-fiber ring protection switching occurs in response to a signal fail or signal degrade condition on an incoming OC-48 high-speed signal.

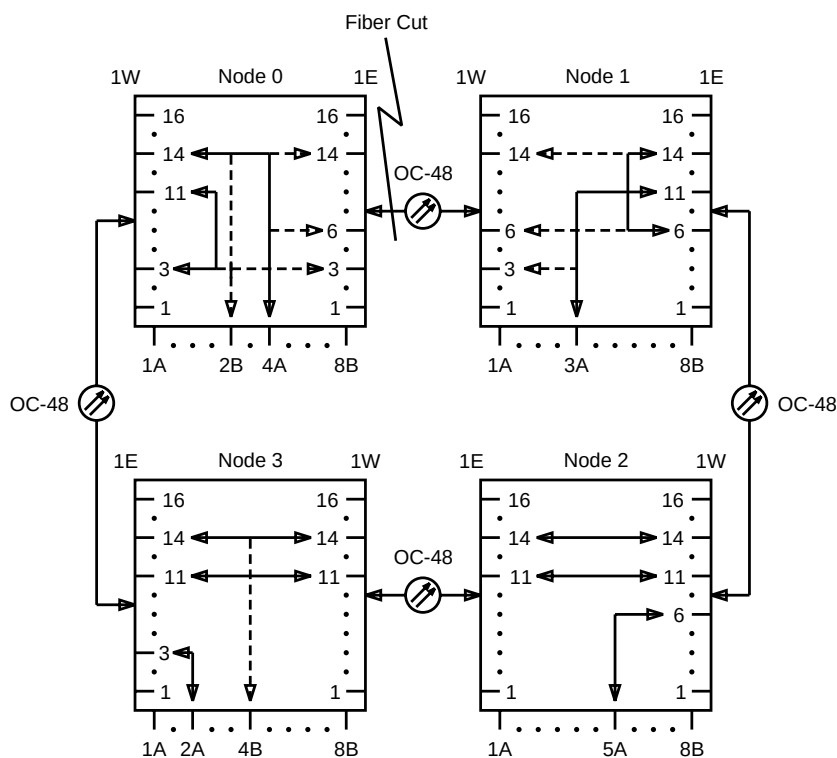


Figure 9-7. Bidirectional Line-Switched 2-Fiber Ring (Single Failure)

When a signal degrade or signal fail defect is detected by the east OC48 RCVR (A/D) circuit pack at node 0, the following occurs:

- The east OC48 RCVR (A/D) circuit pack notifies the LNCTL (4 MEG) circuit pack.
- The LNCTL (4 MEG) circuit pack enters a protection switch request and the provisionable alarm delay interval is started. After the alarm delay interval is reached, the autonomous indicators are enabled. The LNCTL (4 MEG) circuit pack also notifies the west OC48 TRMTR (A/D) circuit pack.
- The west OC48 TRMTR (A/D) circuit pack transmits a switch request to the other nodes in the ring using the automatic protection switch (APS) channel on OC-48 high-speed line 1W.

Nodes 2 and 3 are not actively involved in 2-fiber ring protection switching and are referred to as intermediate nodes. At nodes 2 and 3, the following occurs:

- The east OC48 RCVR (A/D) circuit pack receives the switch request via the APS channel and notifies the LNCTL (4 MEG) circuit pack.

- The LNCTL (4 MEG) circuit pack transmits a request to preempt any extra traffic to the board controllers of the transmission circuit packs. After extra traffic is preempted, through cross-connections are established for the protection STS-3 tributaries. Through cross-connections are established using the C bus between the west OC48 RCVR (A/D) and east OC48 TRMTR (A/D) circuit packs and the east OC48 RCVR (A/D) and west OC48 TRMTR (A/D) circuit packs. Figure 9-7 shows that extra traffic has been preempted and through cross-connections have been established for the protection STS-3 tributaries at nodes 2 and 3. The add/drop cross-connections to the service STS-3 tributaries are not affected.
- The west OC48 TRMTR (A/D) circuit pack passes through the switch request to the other nodes using the APS channel on OC-48 high-speed line 1W.

At node 1, the following occurs:

- The east OC48 RCVR (A/D) circuit pack receives the switch request via the APS channel and notifies the LNCTL (4 MEG) circuit pack.
- The LNCTL (4 MEG) circuit pack transmits a protection switch request to the board controllers on all the circuit packs and notifies the east OC48 TRMTR (A/D) circuit pack.
- The low-speed interface circuit packs that add/drop traffic to/from the failure, and the east OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs switch traffic to the protection STS-3 tributaries of OC-48 high-speed line 1E. An add/drop cross-connection is established between the affected low-speed interface slot and the protection STS-3 tributaries of OC-48 high-speed line 1E. The add/drop cross-connection is established using the A bus between the affected low-speed interface circuit pack and the east OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs. Figure 9-7 shows low-speed interface slot 3A cross-connected to the protection STS-3 tributary 11 of OC-48 high-speed line 1E.
- The east OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs loop back all the through STS-3 tributaries transmitted toward the failure from the service STS-3 tributaries to the protection STS-3 tributaries of OC-48 high-speed line 1E. The loopback is established using the B bus between the east OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs. Figure 9-7 shows extra traffic is preempted and service STS-3 tributary 6 of OC-48 high-speed line 1E is looped back to protection STS-3 tributary 14. (Table 9-4 shows the mapping between the service STS-3 tributaries and their protection STS-3 tributaries.)
- The east OC48 TRMTR (A/D) circuit pack also returns a switch confirmation to node 0 using the APS channel on OC-48 high-speed line 1E.

At node 0, the following occurs:

- The west OC48 RCVR (A/D) circuit pack receives the switch confirmation and notifies the LNCTL (4 MEG) circuit pack.
- The LNCTL (4 MEG) circuit pack transmits a protection switch request to the board controller on all the circuit packs.
- The low-speed interface circuit packs that add/drop traffic to/from the failure, and the west OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs switch traffic to the protection STS-3 tributaries of OC-48 high-speed line 1W. An add/drop cross-connection is established between the affected low-speed interface slot and the protection STS-3 tributaries of OC-48 high-speed line 1W. The add/drop cross-connection is established using the A bus between the affected low-speed interface circuit pack and the west OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs. Figure 9-7 shows low-speed interface slot 4A cross-connected to the protection STS-3 tributary 14 of OC-48 high-speed line 1E.
- The west OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs loop back all the through STS-3 tributaries transmitted toward the failure from the service STS-3 tributaries to the protection STS-3 tributaries of OC-48 high-speed line 1W. The loopback is established using the B bus between the west OC48 TRMTR (A/D) and OC48 RCVR (A/D) circuit packs. Figure 9-7 shows extra traffic is preempted and service STS-3 tributary 3 of OC-48 high-speed line 1W is looped back to protection STS-3 tributary 11. (Table 9-4 shows the mapping between the service STS-3 tributaries and their protection STS-3 tributaries.)

In order to prevent misconnections during single node or multiple ring failures, the FT-2000 OC-48 Add/Drop-Rings Terminal squelches all traffic that cannot be terminated.

Figure 9-8 shows a 4-node ring with multiple ring failures that isolate node 1 and cause traffic that cannot be terminated to be squelched. Nodes 0 and 2 perform a 2-fiber ring protection switch and squelch traffic originating from or terminating at node 1 to prevent any misconnections. Squelching is done by inserting STS-1 path AIS on the protection tributaries that carry traffic terminating at or originating from node 1. The STS-1 path AIS is returned to the node(s) sending traffic to node 1. At these node(s), the STS-1 path AIS or DS3 AIS is sent to the cross-connect panels (or equivalent). If nodes 0 and 2 originate or terminate any traffic, STS-1 path AIS or DS3 AIS is also inserted and sent to the local cross-connect panels (or equivalent).

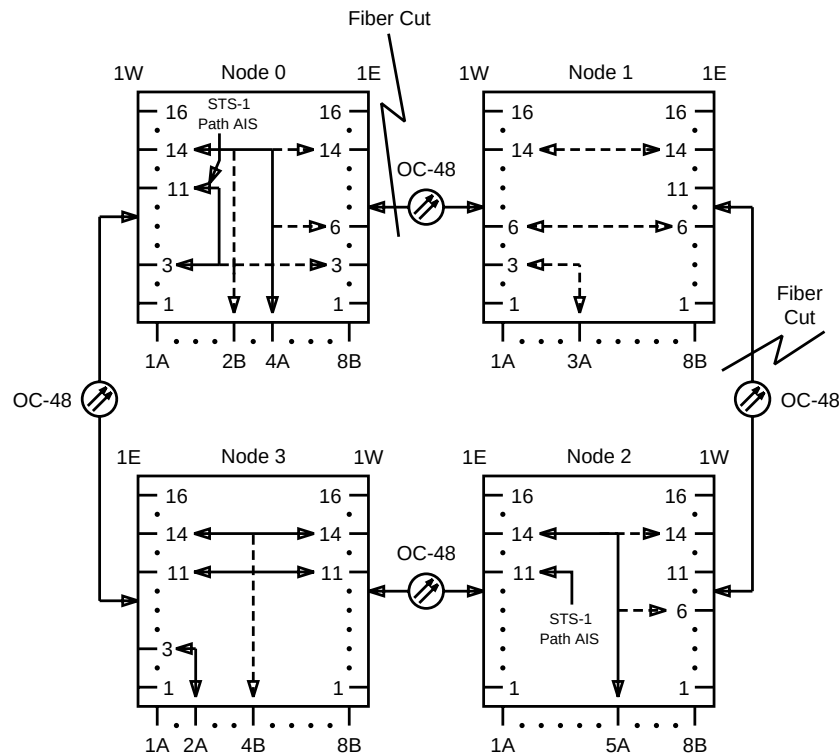


Figure 9-8. Bidirectional Line-Switched 2-Fiber Ring (Multiple Failures)

Nodes 0 and 2 do not squelch traffic that passes through node 1. Squelching is only done by nodes that have an active 2-fiber ring protection switch. An isolated node does not perform a 2-fiber ring protection switch; thus an isolated node does not squelch.

If any FT-2000 OC-48 Add/Drop-Rings Terminals in the 2-fiber ring are equipped to provide extra traffic, a 2-fiber ring protection switch will preempt extra traffic.

This applies to the secondary circuit of a DRIP circuit as well, which is carried on protection capacity, and hence treated as being extra traffic. The secondary circuit is the combination of the continue segment of the drop and continue (from the primary node to the secondary node), along with the duplicate segment from the other ring (from the secondary node to the primary node).

An exception to this occurs during isolation of the primary node of a DRIP circuit. In a DRIP circuit without failures, the secondary node of the DRIP circuit:

- Adds traffic to a protection tributary on the span towards the primary node, and

- Selects traffic from a protection tributary on the span towards the primary node.



NOTE:

This is done by provisioning the 2-Way-DRI-Sec cross-connection at the secondary node.

When the primary node of the DRIP circuit is isolated, and the other end of the circuit is visible to the secondary node, the secondary node:

- Bridges traffic on the same protection tributary on the span *away* from the primary node, and
- Selects traffic from the same protection tributary on the span *away* from the primary node.

In effect, the secondary node acts like it is protecting traffic on a *service* tributary on the span towards the primary node.

Bidirectional 2-fiber ring protection switching is completed within 60 milliseconds of the onset of a hard failure such as a fiber cut and is compliant with the applicable Bellcore Technical Advisories and Technical Requirements.

When the signal fail or signal degrade defect clears, the provisionable alarm clear delay is initiated. Before the defect is declared clear, the OC-48 signal's BER must be 10 times better than the provisioned signal degrade threshold. For example, if the provisionable signal degrade threshold is 10^{-9} , the OC-48 signal's BER must fall below 10^{-10} to clear the defect.

When the defect is declared clear, the FT-2000 OC-48 Add/Drop-Rings Terminal enters the provisionable wait-to-restore interval. This prevents any oscillating between the service and protection STS-3 tributaries. During the wait-to-restore interval, the service STS-3 tributaries are monitored and should perform better than the signal degrade threshold.

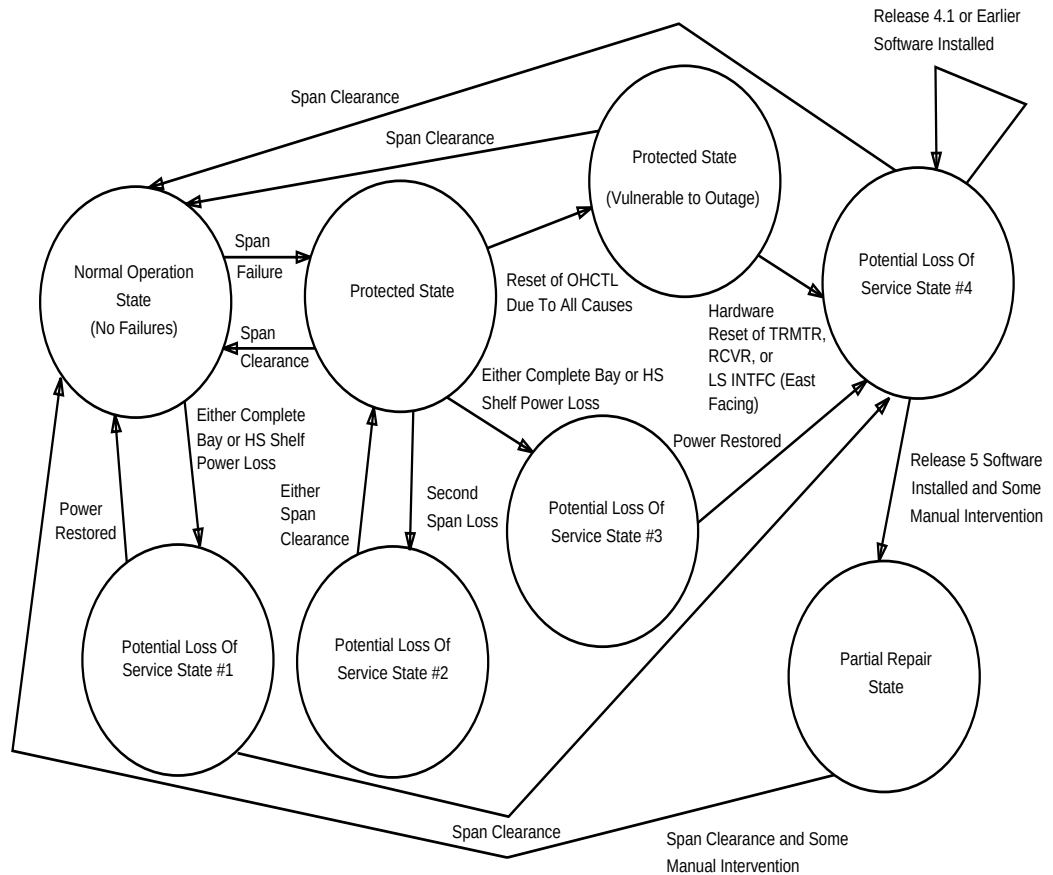
When the alarm clear delay is reached all indicators are updated. When the wait-to-restore interval is reached, traffic is revertively switched back to the service STS-3 tributaries.

Single and Double Failure States

Figure 9-9 shows how the FT-2000 OC-48 Add/Drop-Rings Terminal reacts to single and double failures. Since the probability of double failures in a ring is significantly less likely than a single failure, and the probability of three failures is even less likely than a double failure, Figure 9-9 shows how the FT-2000 OC-48 Add/Drop-Rings Terminal reacts to only single and double failures. However, some of the logic will carry over to highly unlikely multiple failure cases.

In Figure 9-9, the circles represent the states the FT-2000 OC-48 Add/Drop-Rings Terminal can enter, with respect to 2-fiber ring protection switching. The arrows

between the states show transition paths. The labels associated with the arrows are the stimulus that produce the transitions.



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Figure 9-9. Single and Double Failure States

The FT-2000 OC-48 Add/Drop-Rings Terminal may enter the following states when reacting to single and double failures (Figure 9-9):

- **Normal Operation State:** In this state there are no failures that affect 2-fiber ring protection switching. The FT-2000 OC-48 Add/Drop-Rings Terminal remains in this state the overwhelming majority of time. The following types of failures cause transitions:

- Span failures are cable cuts and transmission electronics failures (for example, transmitter or receiver circuit pack failures)
 - Failures that cause hardware resets to transmitters, receivers, and low-speed interfaces if they are the second failure within the ring. This also includes shelf power failures, removing circuit packs, and reinserting circuit packs.
- **Protected State:** Most single failures are span failures and cause the system to enter the protected state. In this state, 2-fiber ring protection switching restores all service traffic. Single failures (other than node failures) never cause service outages.
- **Potential Loss of Service State #1:** If a node has a power loss (Failure A in Figure 9-10), the system enters this state. In this state, only add/drop traffic at the node where the power loss occurs is lost. All other traffic in the ring is protected using 2-fiber ring protection switching. (For this reason, this state is labeled as a potential loss of traffic.) When power is restored, the node transitions automatically to the "Normal Operation State."
- **Potential Loss of Service State #2:** If two spans fail (Failures B and C in Figure 9-10), the system enters this state. In this state, the ring is segmented and any loss of traffic will be from paths between the two segments, if any existed. Like the "Potential Loss of Service State #1," the degree of service outage depends on how traffic is provisioned (routed) on the ring. When either of the two span failures is cleared, the system transitions automatically to the "Protected State."
- **Potential Loss of Service State #3:** If a node has a power loss and a single span failure (Failures A and B in Figure 9-10), the system enters this state. In this state, the ring is segmented and any loss of traffic will be from paths between the two segments, if any existed. Any add/drop traffic at the node where the power loss occurs is also lost. The degree of traffic loss depends on how traffic is provisioned (routed) on the ring. In some cases, traffic loss could be nonexistent.
- **Potential Loss of Service State #4:** A node enters this state when power is restored from the "Potential Loss of Service State #3", or from the "Protected State (Vulnerable to Outage)." In this state, the node "wakes up" into an incomplete ring due to the span failure. Since the ring is incomplete, some traffic, which might be thought to be restored, will not be restored until the span failure is cleared.
- **Protected State (Vulnerable to Outage):** In this state, service is fully protected following the reset of either OHCTL circuit pack (for any reason). However, any hardware reset of transmitters, receivers, or east-facing low-speed interfaces will cause the system to enter the "Potential Loss of Service State #4."
- **Partial Repair State:** A node can enter this state with some manual intervention. In this state, some additional traffic can be restored before the span failure is cleared. When the span failure clears, the node can enter

the "Normal Operation State" with some manual intervention. For more information about clearing a potential loss of service due to a double failure, refer to the "Operation and Maintenance (TOP)" section.

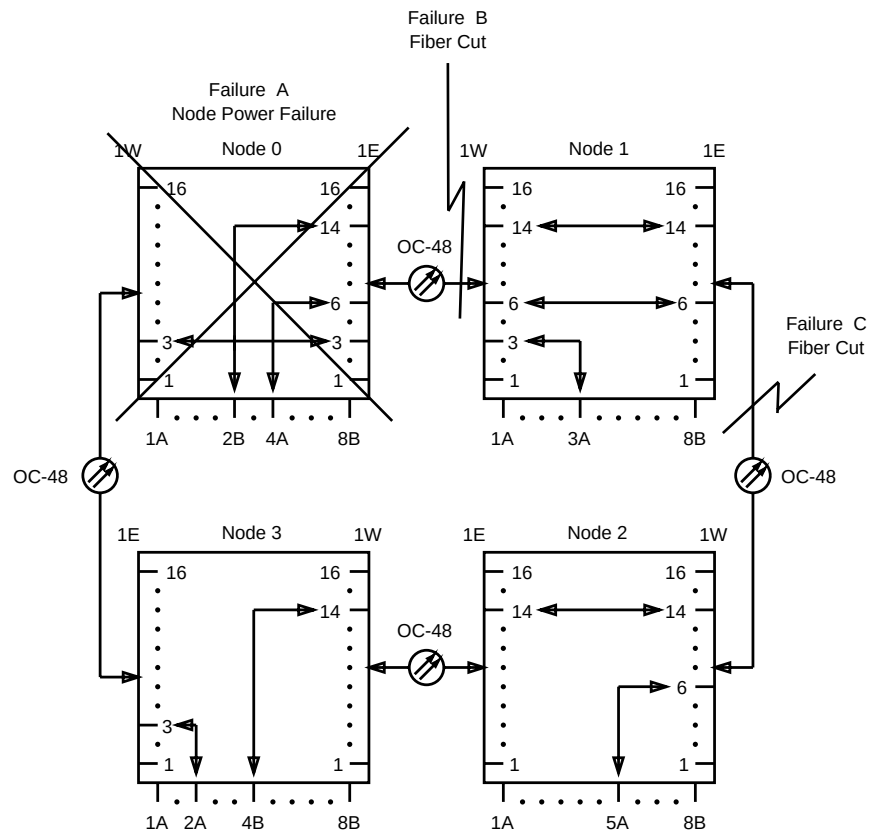


Figure 9-10. Single and Double Failures

Electrical Low Speed Protection

The FT-2000 OC-48 Lightwave System provides protection for all the low-speed interface circuit packs. The DS3 Interface circuit packs and STS-1 Electrical Interface circuit packs are 1xM ($M \leq 16$) protected and use bidirectional reverte switching. Low speed protection switching takes place in response to automatically detected faults and external commands from a local/remote CIT or operations system. Refer to the **FAULT-Switch-Low Speed** input in Section 11, "Craft Interface Terminal Usage."

One dedicated protection DS3 circuit pack* provides protection for the service DS3 circuit packs, and one dedicated protection STS1E circuit pack* provides

protection for the service STS1E circuit packs. However, only one protection low-speed interface circuit pack (DS3 or STS1E) can be switched into service at a time. Two Low Speed Switch (LSSW) circuit packs are used to perform low-speed protection switching. *

Table 9-5 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-5. Electrical low Speed Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Protection hardware failure	Automatic
Lockout of protection	CIT/OS
Lockout of service	CIT/OS
Forced switch	CIT/OS
Circuit pack failure/removal	Automatic
Manual switch	CIT/OS
Wait to restore	Automatic

* Resetting the low-speed switch priority (**FAULT-Switch-Low Speed-Priority:Reset**) has no effect on any automatic switch priority except wait to restore.

Each Low Speed Shelf can be equipped with one protection DS3 and/or one protection STS1E circuit pack. However, only one service DS3 or STS1E circuit pack can be protected at a time.

Each service low-speed interface circuit pack (DS3 or STS1E) can be assigned a high or low protection priority. This allows a high priority circuit pack to preempt any previous switch to protection by a lower priority circuit pack. Switch requests of equal priority will be met in the order in which they are received. If two requests occur simultaneously, the one with the lower slot address will take priority.

Figure 9-11 shows the low-speed protection switching architecture.

* The protection DS3 and STS1E circuit packs may be placed in the P1 or P2 slot of the Low Speed Shelf - System Controller.

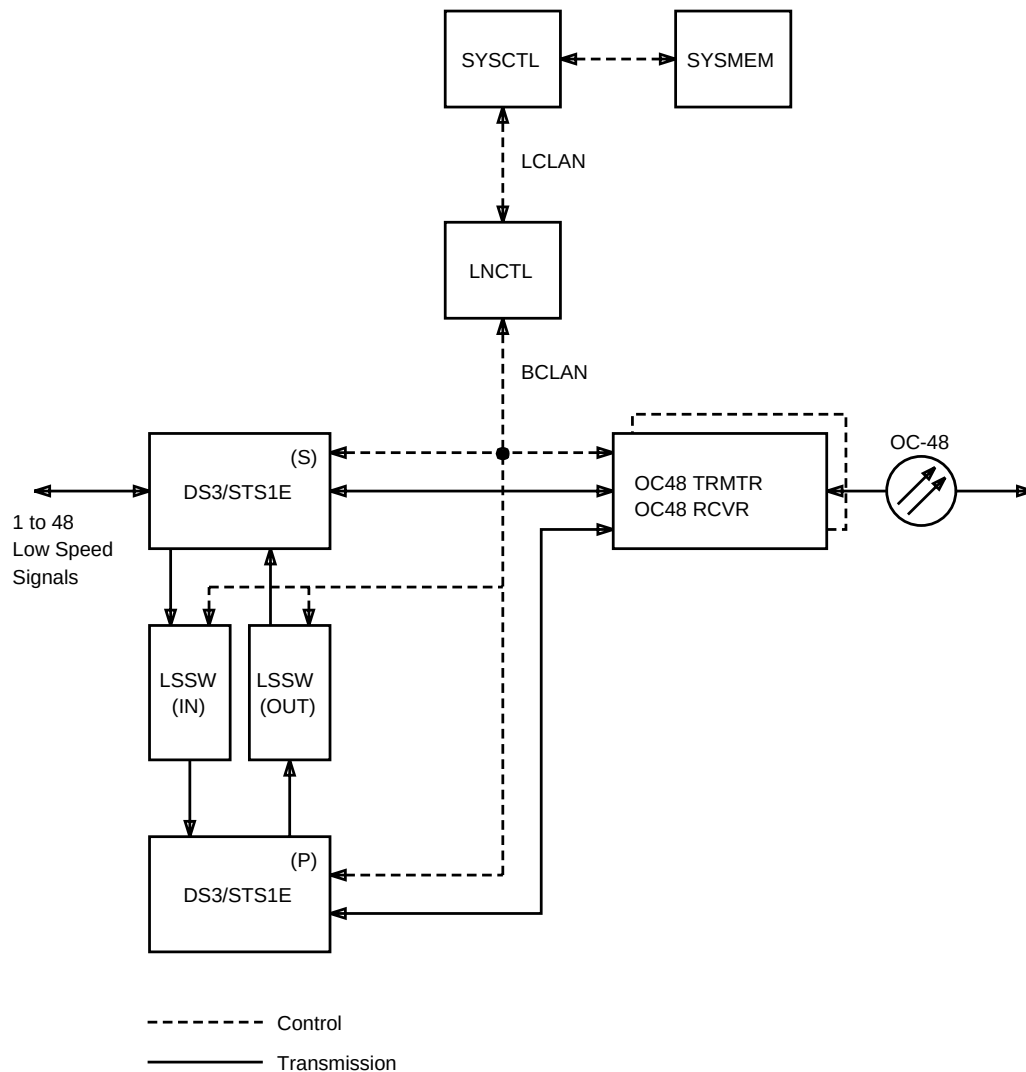


Figure 9-11. Electrical Low Speed Protection Switching

If a service low-speed interface circuit pack fails, the board controller on the circuit pack sends the information to the LNCTL circuit pack via the BCLAN. If appropriate, the LNCTL circuit pack broadcasts a bidirectional switch request to the board controllers on the LSSW circuit packs, the service OC48 TRMTR circuit pack, and the service OC48 RCVR circuit pack.

The board controller on the LSSW circuit packs activates the protection relays on the failed low-speed interface circuit pack and the relays on the LSSW circuit pack

to build a low-speed protection bus in the transmit direction. The LSSW circuit pack in the IN slot controls the protection relays on the low-speed interface circuit packs in slots 1A through 4B. The LSSW circuit pack in the OUT slot controls the protection relays on the low-speed interface circuit packs in slots 5A through 8B. The protection relays on the failed low-speed interface circuit pack switch the three low-speed signals from DSX-3 or STSX-1 through the LSSW (IN) circuit pack to the protection low-speed interface circuit pack. The protection low-speed interface circuit pack processes the low-speed signals and sends a 155 Mb/s signal to the OC48 TRMTR circuit pack. The board controller on the OC48 TRMTR circuit pack activates the selector circuitry to choose the 155 Mb/s signal from the protection low-speed interface circuit pack.

In the receive direction, the board controller on the OC48 RCVR circuit pack activates the switch circuitry to route the 155 Mb/s signal to the protection low-speed interface circuit pack instead of the failed service low-speed interface circuit pack. The board controller on the LSSW circuit packs activate the protection relays on the failed low-speed interface circuit pack and the relays on the LSSW (OUT) circuit pack to build a low-speed protection bus in the receive direction. The protection low-speed interface circuit pack accepts the 155 Mb/s signal from the OC48 RCVR circuit pack, processes the signal, and sends the three low-speed signals through the LSSW (OUT) circuit pack to the failed low-speed interface circuit pack where the switch is completed to the DSX-3 or STSX-1 panel (or equivalent).

The FT-2000 OC-48 Lightwave System also supports unprotected low-speed operation. It may be equipped without a protection DS3 or STS1E circuit pack.

Optical Low Speed Protection — (OC-3 Only)

General

The FT-2000 OC-48 Add/Drop-Rings Terminal provides optical low-speed protection of an OC-3 line. Optical low-speed protection switching takes place in response to automatically detected faults and external commands from a local/remote CIT or operations system. Refer to the **FAULT-Switch-OC3** input in Section 11, "Craft Interface Terminal Usage."



NOTE:

For intra-office applications, the IS-3 Optical Interface may be used and it retains all of the same considerations given to the OC-3.

Table 9-6 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-6. Optical Low Speed Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Switch inhibit	CIT/OS
APS channel failure	Automatic
Lockout of protection	CIT/OS
Lockout of service	CIT/OS
Forced switch	CIT/OS
Signal fail	Automatic
Signal degrade	Automatic
Manual switch	CIT/OS

* Resetting the OC-3 switch priority (**FAULT-Switch-OC3-Priority:Reset**) has no effect on any automatic switch priority.

An OC-3 line may operate unprotected (0x1) or use provisionable unidirectional 1+1 nonrevertive protection switching. In unidirectional 1+1 nonrevertive switching, the transmitting terminal transmits the same signal on two lines. The receiving terminal monitors the two lines independently and chooses one line as the active line and the other line as the standby line. When a protection switch occurs, the receiving terminal selects the signal from the standby line which causes the standby line to be the new active line. The original active line becomes the standby line. This status remains the same (nonrevertive) after the fault clears. Protection switching is performed in one direction only (unidirectional).

OC-3/IS-3 Specific Information

The following is required for 1+1 OC-3 line protection:

- Two adjacent slots (for example, LS INTFC slot 2A and 2B) of the Low Speed Shelf - System Controller must be equipped (EQ state) with the same OC3 Optical Interface - 1.3 μ m Standard Performance [OC3 (1.3 STD)] circuit packs (either LAA10 or LAA10B, but not a mix of the two). The Low Speed Shelf - System Controller can be equipped with 8 1+1 protected OC3 (1.3 STD) circuit packs, or 16 unprotected OC3 circuit packs, or a mixture of protected and unprotected OC3 (1.3 STD) circuit packs.
- The OC3 Protection Mode parameter of both slots must be provisioned "1+1" using the **CONFIGURATION-Set -OC3** input. To provision for "1+1" configuration, both slots **MUST** be equipped with either the OC-3 (1.3 STD) LAA10 circuit pack or the OC-3 (1.3 STD) LAA10B circuit pack (but not a mix of the two). For example, a "1+1" configuration will not work if slot 2A is

equipped with an LAA10 circuit pack, while slot 2B is equipped with an LAA10B circuit pack. The OC3 Protection Mode parameter has separate values for the add (OC-3 to OC-48) and drop (OC-48 to OC-3) directions. For information about provisioning the OC3 Protection Mode parameter, refer to the information describing the **CONFIGURATION-Set-OC3** input in Section 8, "Administration and Provisioning."

- One slot of the slot pair must be cross-connected to a service STS-3 tributary using the **CONFIGURATION-Enter-Crossconnection-STS3** input. One port of the slot pair must be cross-connected to a service STS-1 tributary using the **CONFIGURATION-Enter-Crossconnection-STS1** input. The FT-2000 OC-48 Add/Drop-Rings Terminal automatically enters an active cross-connection between one slot of the slot pair and an STS-3 tributary, and a standby cross-connection between the companion slot and the same STS-3 tributary. The slot pair cannot be cross-connected to different STS-3 tributaries. The FT-2000 OC-48 Add/Drop-Rings Terminal automatically enters an active cross-connection between one port of the slot pair and an STS-1 tributary, and a standby cross-connection between the same port of the companion slot and the same STS-1 tributary. The ports cannot be cross-connected to different STS-1 tributaries. For information about entering cross-connections, refer to Section 8, "Administration and Provisioning."

Unprotected (0x1) OC-3 line operation results when one or more of the following occur:

- The slot and/or the adjacent slot is equipped (EQ state) with DS3 or STS1E circuit packs, or is in the AUTO state.
- The OC3 Protection Mode parameter of the slot and/or the adjacent slot is provisioned "0x1" using the **CONFIGURATION-Set-OC3** input.
- The slot (or port) and the adjacent slot (or port) are cross-connected to different tributaries.

Optical Low Speed Protection Switching Architecture

Figure 9-12 shows the optical low-speed protection switching architecture.

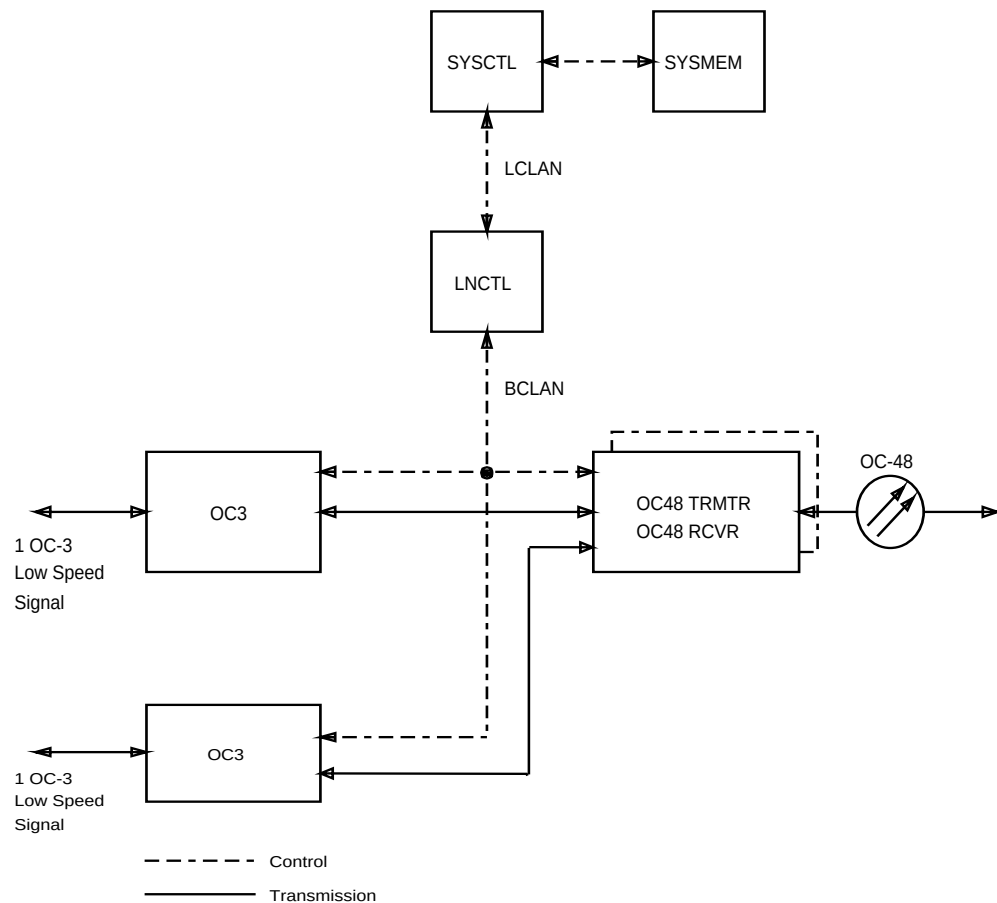


Figure 9-12. Optical Low Speed Protection Switching

Optical low-speed protection switching is only performed in the add (OC-3 to OC-48) direction by an FT-2000 OC-48 Add/Drop-Rings Terminal. If the active OC-3 line fails in the add (OC-3 to OC-48) direction, the board controller on the OC3 (1.3 STD) circuit pack sends the information to the LNCTL circuit pack via the BCLAN. If appropriate, the LNCTL circuit pack broadcasts a switch request to the board controller on the OC48 TRMTR circuit pack. The board controller on the OC48 TRMTR circuit pack activates the selector circuitry to choose the 155 Mb/s signal from the standby OC3 (1.3 STD) circuit pack. The standby OC3 (1.3 STD) circuit pack becomes the new active OC3 (1.3 STD) circuit pack.

In the drop (OC-48 to OC-3) direction, the OC48 RCVR circuit pack routes the same 155 Mb/s signal to the active and standby OC3 (1.3 STD) circuit packs.

Optical Low Speed Protection Switching Example

Figure 9-13 shows two OC-3 lines (only one direction of transmission is shown) and two FT-2000 OC-48 Add/Drop-Rings Terminals. The FT-2000 OC-48 Add/Drop-Rings Terminal at Office A transmits service traffic on both OC-3 lines. The FT-2000 OC-48 Add/Drop-Rings Terminal at Office B monitors the two OC-3 lines independently and chooses one OC-3 line as the active line and the other OC-3 line as the standby line.

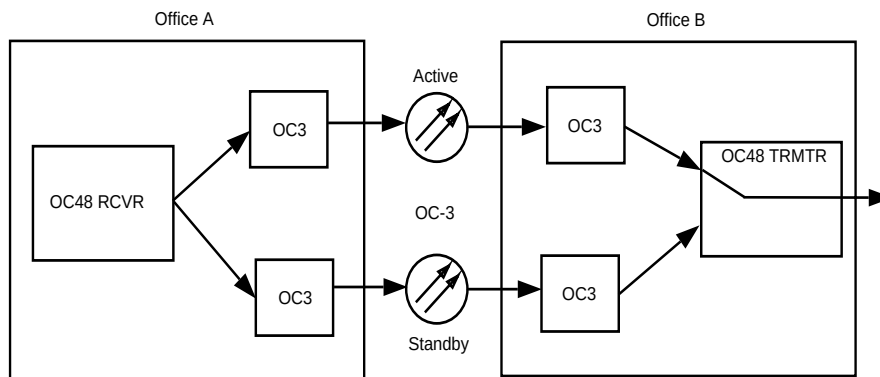


Figure 9-13. 1+1 OC-3 Line (Normal Transmission)

Figure 9-14 shows two OC-3 lines (only one direction of transmission is shown) and two FT-2000 OC-48 Add/Drop-Rings Terminals when a fiber cut occurs on the active OC-3 line. Automatic 1+1 OC-3 line protection switching occurs in response to a signal fail or signal degrade condition on the incoming OC-3 signal.

Optical low-speed protection switching is only performed in the add (OC-3 to OC-48) direction by the FT-2000 OC-48 Add/Drop-Rings Terminal at Office B. The board controller on the OC48 TRMTR circuit pack activates the selector circuitry to choose the 155 Mb/s or 622 Mb/s signal from the standby OC3 (1.3 STD) or OC12 (1.3 STD) circuit pack. The standby OC3 (1.3 STD) circuit pack becomes the new active OC3 (1.3 STD) circuit pack. The original active OC-3 line becomes the standby OC-3 line.

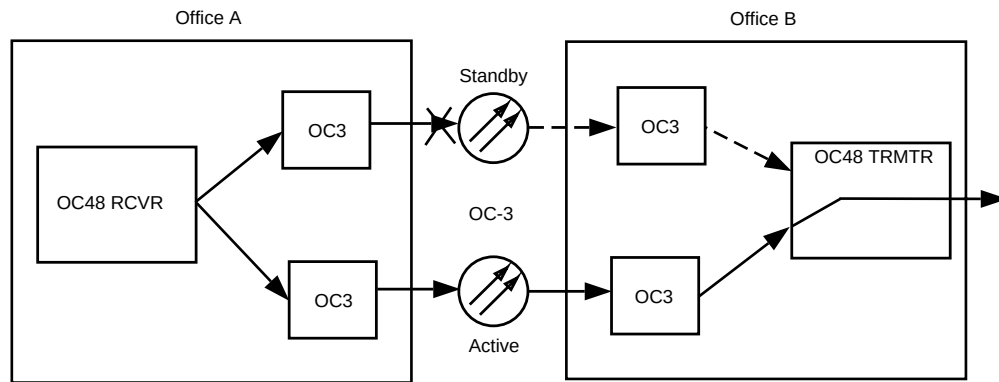


Figure 9-14. 1+1 OC-3 Line (Fiber Cut)

Dual Ring Interworking Protection

DRI protection switching protects a circuit with a termination in one ring and the other termination in another ring when an interconnecting node fails. DRI protection switching takes place in response to an automatically detected incoming SONET EC-1, DS3, OC-3, or OC-12 loss-of-signal (LOS) condition or external commands from a local/remote CIT or operations system. DRI protection switching also takes place in response to an automatically detected unprotected OC-3/IS-3/OC-12 LOS or loss-of-frame (LOF) condition. Additionally, a path AIS (AIS-P) triggers a DRI switch. Refer to the **FAULT-Switch-Path-ST53** input in Section 11, "Craft Interface Terminal Usage."



NOTE:

A Signal Degrade (SD) on the SONET low-speed interfaces (STS1E, OC-3, IS-3, OC-12) triggers a DRI switch. A Path Unequipped on the SONET low-speed interfaces also causes an active DRI switch. This feature is referred to as "DRI Switch on Path Unequipped."

Table 9-7 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-7. Dual Ring Interworking Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
DS3/EC1 loss of signal (LOS)†	Automatic
Unprotected OC-3/OC-12 LOS or loss of frame (LOF)†	Automatic
Manual switch	CIT/OS

* Reset performed using the **FAULT-Switch-Path-STS3** or the **FAULT-Switch-Path-STS1** input.

† A DS3/EC1 LOS and an unprotected OC-3/OC-12 LOS or LOF are the same priority.

The DRI Auto Switch or DRI Manual Switch condition indicates a DRI switch is active. These conditions are shown in the reports generated by the **FAULT-Retrieve-Alarm (and Status)** and **FAULT-Retrieve-Network Alarms** inputs. Table 9-8 provides a summary of the DRI feature capabilities.

Table 9-8. Summary of DRI Feature Capabilities

Parameter Functionality	Release			
	7.2	8.1	9.0	9.1
Unidirectional Revertive	X	X	X	X
Alarm/Event				
*LOS(DS3)	X	X	X	X
*LOS(EC1, OC3)	X	X	X	X
*LOS(IS3/OC12)	X	X	X	X
*LOF(EC1, OC3/IS3, OC12)	X	X	X	X
*LOP-P (EC1, OC3/IS3, OC12)				X
*AIS-P(EC1, OC3/IS3, OC12)	X+	X+	X+	X+
*STS Path Unequipped		X+	X+	X+
*SD (Signal Degrade)	X	X	X	X
*SF (Signal Fail)	X	X	X	X
*PDI-P (Path Payload Defect Indicator)			X+	X+

*Generates an alarm (or near end activity) to the local CIT and corresponding TL1 autonomous messages (alarm or event) are sent to the OS.

+In the event an path signal is detected on an STS-1 that is not DRI protected——CIT reports and TL1 autonomous messages will NOT be generated.

Figure 9-15 shows a dual ring interworking application with two rings and a 2-way DRI circuit. One ring is a line-switched ring equipped with the FT-2000 OC-48 Add/Drop-Rings Terminals. The other ring could be another line-switched ring equipped with FT-2000 OC-48 Add/Drop-Rings Terminals or a path-switched ring equipped with DDM-2000 OC-3 Multiplexers or DDM-2000 OC-12 Multiplexers.

The 2-way DRI circuit is routed to/from the termination node (node 5) in the FT-2000 line-switched ring through the primary node (node 4) and secondary node (node 3) to the other ring. (The primary and secondary nodes are not required to be adjacent nodes.)

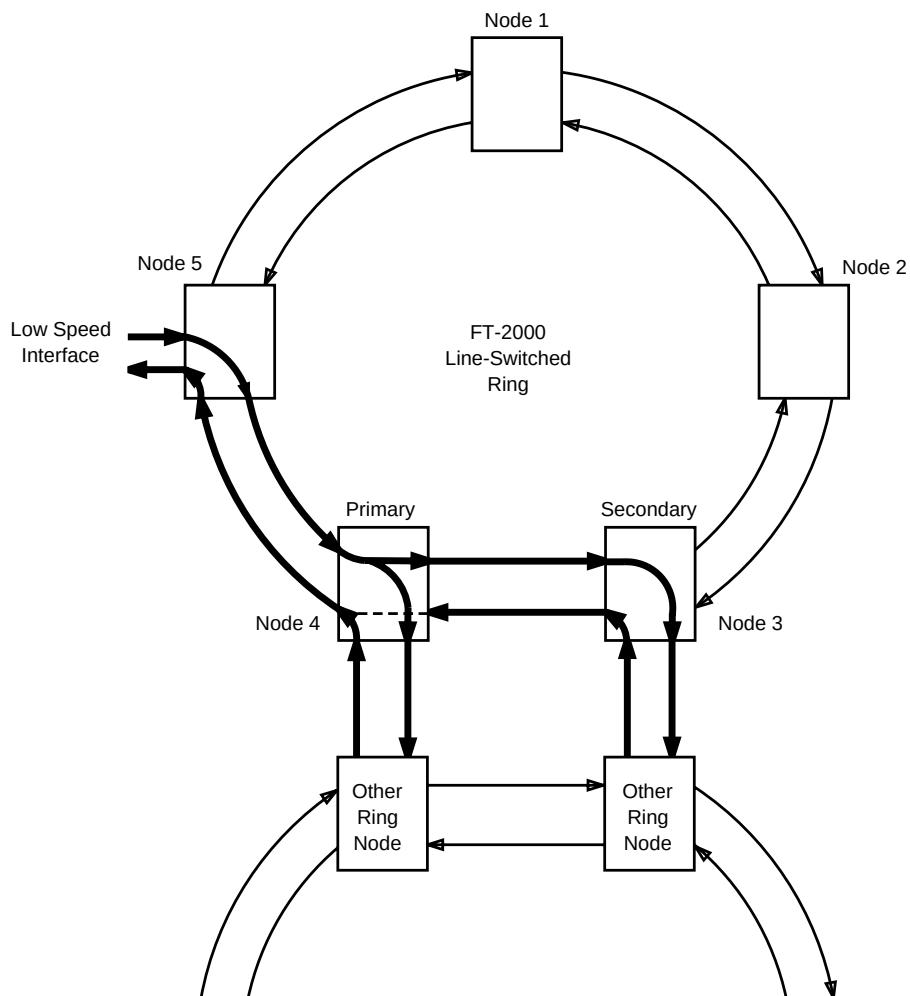


Figure 9-15. Dual Ring Interworking Circuit (Normal Transmission)

A 2-way DRI circuit consists of cross-connections in the drop direction (from the FT-2000 line-switched ring to another ring) and cross-connections in the add direction (to the FT-2000 line-switched ring from another ring). The following cross-connections must be entered in the drop direction (Figure 9-15):

- At the termination node (node 5), a 1-way add cross-connection is entered. When entering the 1-way add cross-connection, the secondary node (node 3) must be specified as the destination node. (If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low-speed signals are terminated must be specified as the destination node.)

- At the primary node (node 4), a 1-way drop cross-connection and a 1-way through cross-connection from the same STS-3 tributary are entered. This creates a bridge (drop and continue) cross-connection. When entering the drop and through cross-connections, the termination node (node 5) must be specified as the source node. When entering the through cross-connection, the secondary node (node 3) must be specified as the destination node.
- At the secondary node (node 3), a 1-way drop cross-connection from the same STS-3 tributary is entered. When entering the drop cross-connection, the termination node (node 5) must be specified as the source node.

The following cross-connections are entered in the add direction (Figure 9-15):

- At the primary node (node 4), a 1-way-DRI cross-connection is entered. A 1-way-DRI cross-connection consists of a 1-way add cross-connection and a 1-way through cross-connection. When entering the 1-way-DRI cross-connection, the termination node (node 5) must be specified as the destination node, and node 3 must be specified as the secondary node. Initially, the add cross-connection is in the active state and the through cross-connection is in the standby state.
- At the secondary node (node 3), a 1-way add cross-connection to the same STS-3 tributary is entered. When entering the 1-way add cross-connection, the termination node (node 5) must be specified as the destination node.
- At the termination node (node 5), a 1-way drop cross-connection from the same STS-3 tributary is entered. When entering the drop cross-connection, the secondary node (node 3) must be specified as the source node.

The add and drop directions are completely independent. During normal transmission, traffic is routed from the termination node (node 5) through the primary node (node 4) and secondary node (node 3) to the other ring. Traffic from the other ring is routed through the primary node (node 4) to the termination node (node 5).

Figure 9-16 shows a dual ring interworking application with a node failure in the other ring causing an unprotected incoming low-speed loss-of-signal condition at the primary node (node 4) in the FT-2000 line-switched ring.

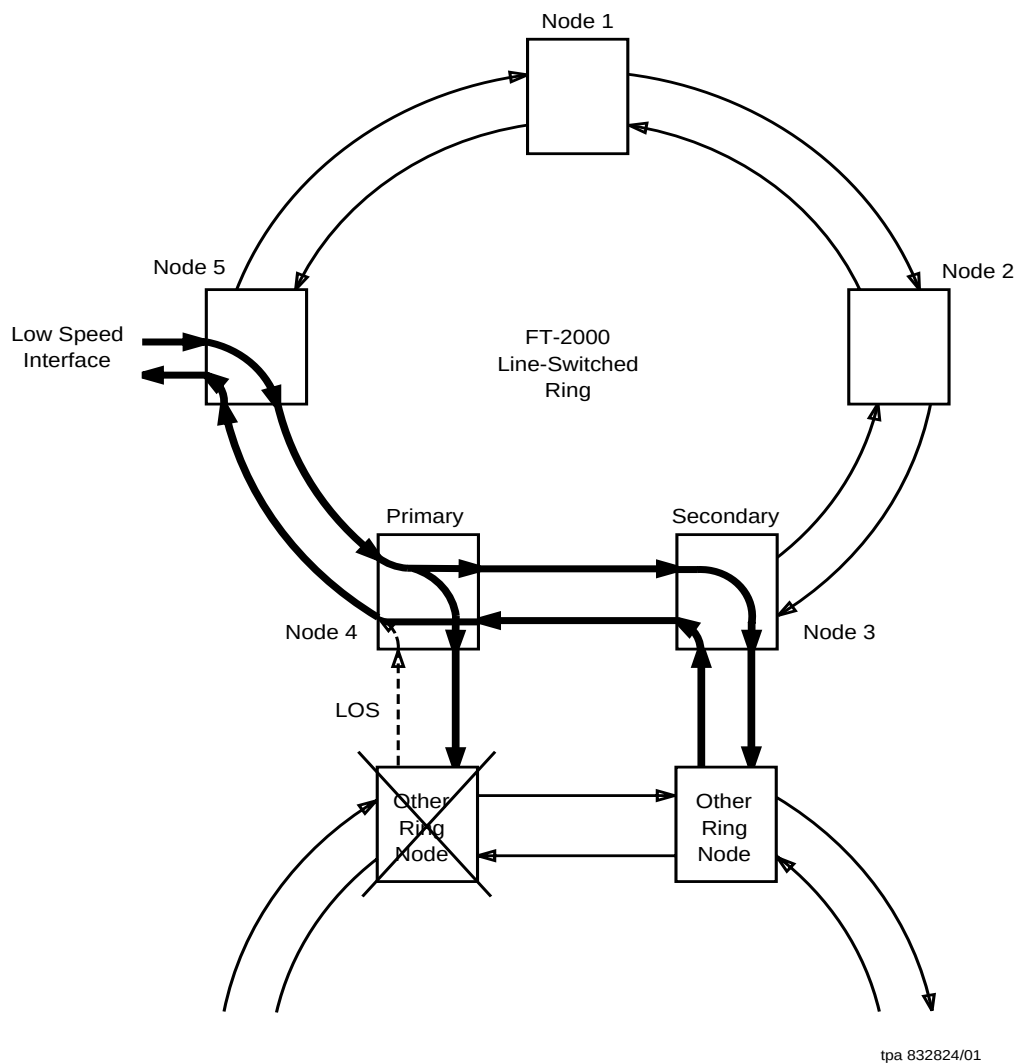


Figure 9-16. Dual Ring Interworking Circuit (Node Failure in Other Ring)

When an unprotected incoming low-speed loss of signal (LOS) or OC-3 loss of frame (LOF) is detected by the low-speed interface circuit pack at the primary node (node 4), the low-speed interface circuit pack notifies the LNCTL (4 MEG) circuit pack via the BCLAN. The LNCTL (4 MEG) circuit pack enters an automatic DRI switch request and sends it to the board controller on the OC48 TRMTR (A/D) circuit pack. An LOS condition on one or more of the DS3 or EC-1 inputs to a low-speed interface circuit pack or an unprotected OC-3 LOS/LOF condition results in an automatic DRI switch request for that STS-3 tributary or STS-1 tributary. A DRI

protection switch will not occur in response to any other low-speed line failure (for example, AIS or signal degrade).

The board controller on the OC48 TRMTR (A/D) circuit pack activates the selector circuitry to choose the incoming STS-3 tributary or STS-1 tributary from the secondary node. This causes the through cross-connection at the primary node to switch to the active state and the add cross-connection to switch to the standby state. This completes the DRI circuit through the secondary node.

An automatic or manual DRI protection switch request will complete successfully even if there is a corresponding incoming loss of signal condition at the secondary node (node 3). The primary node does not monitor the condition of the incoming low-speed signal at the secondary node.

The DRI protection switch will not work if the DRI circuit is being used for extra traffic and a high-speed protection switch is active.

Figure 9-17 shows a dual ring interworking application with a primary node failure.

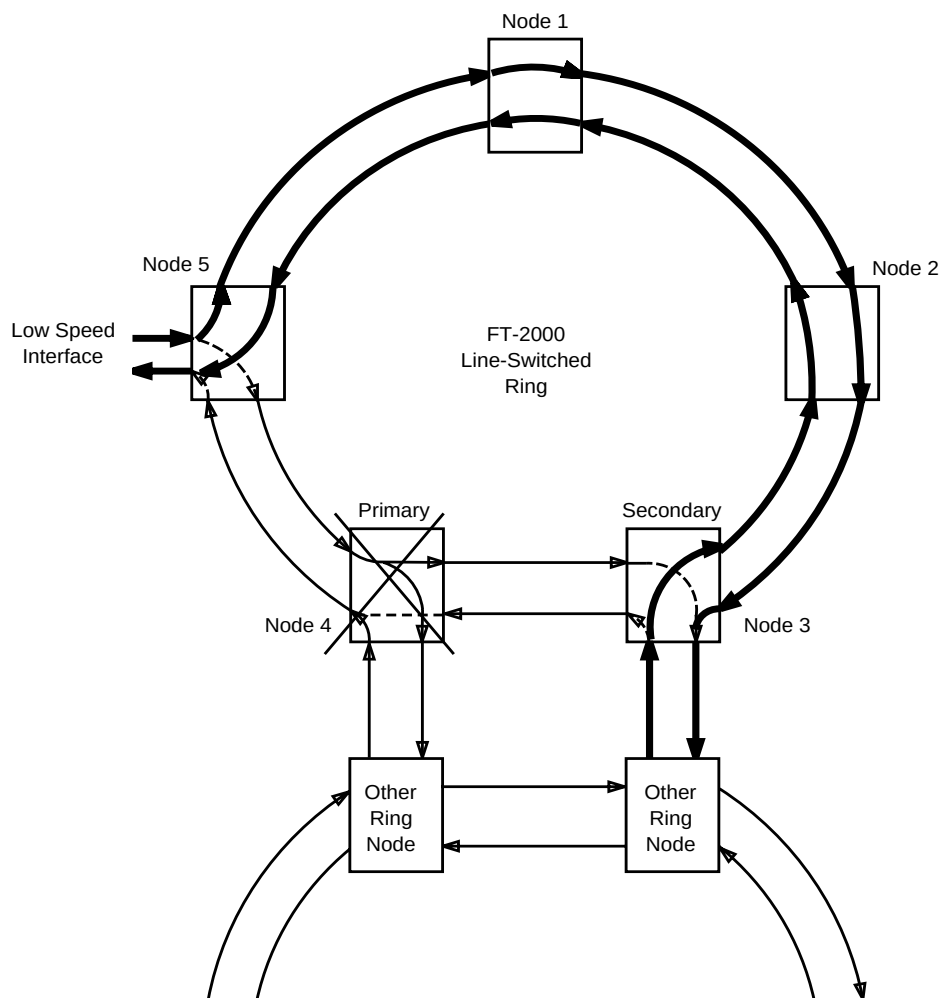


Figure 9-17. Dual Ring Interworking Circuit (Primary Node Failure)

When an incoming OC-48 loss-of-signal condition is detected by the secondary node (node 3) and the termination node (node 5), the secondary node and the termination node perform 2-fiber ring protection switching. The termination node routes traffic on the DRI circuit around the ring through the secondary node to the other ring. Traffic from the other ring is routed through the secondary node (node 3) to the termination node (node 5). For more information about 2-fiber ring protection switching, refer to "2-Fiber Ring Protection Switching" in this section.

Figure 9-18 shows a dual ring interworking application with a secondary node failure.

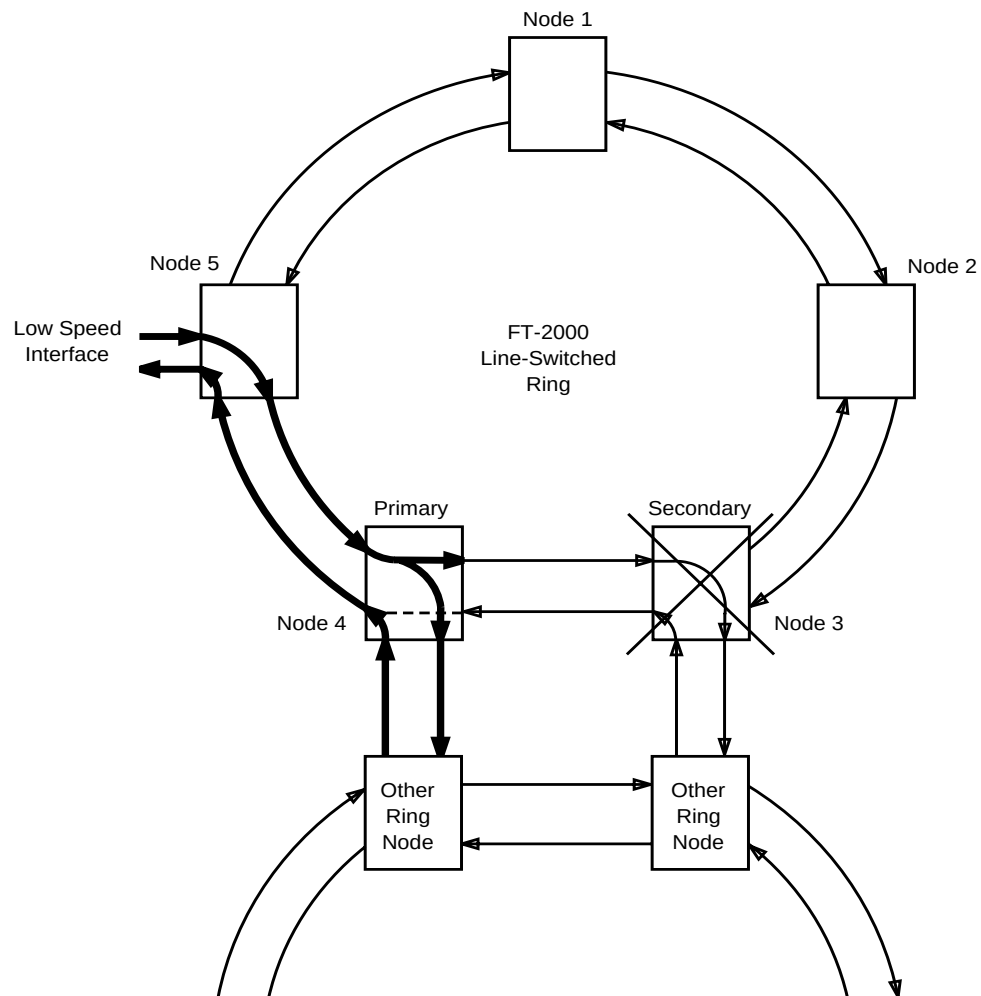


Figure 9-18. Dual Ring Interworking Circuit (Secondary Node Failure)

When an incoming OC-48 loss of signal condition is detected by the primary node (node 4) and node 2, the primary node (node 4) and node 2 perform 2-fiber ring protection switching. The 2-fiber ring protection switch does not affect the DRI circuit.

For more information about the DRI application, refer to Section 3, "Applications." For more information about cross-connections, refer to Section 8, "Administration and Provisioning."

Synchronization Protection

General

The FT-2000 OC-48 Lightwave System provides three types of synchronization protection: synchronization hardware protection, synchronization reference protection, and synchronization mode protection.

Synchronization Hardware Protection

General

Synchronization hardware protection switching occurs in response to automatically detected faults and external commands from a local/remote CIT or operations system. Refer to the **FAULT-Switch-Synchronization** input in Section 11, "Craft Interface Terminal Usage."

Table 9-9 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-9. Synchronization Hardware Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Circuit pack failure/removal	Automatic
Manual switch	CIT/OS
Circuit pack warming up	Automatic

* Resetting the synchronization switch priority (**FAULT-Switch-Synchronization- Hardware-Priority:Reset**) has no effect on any automatic switch priority.

The FT-2000 OC-48 Lightwave System provides protection for all the synchronization circuit packs. The Timing Generator, Stratum 3 - DS1 [TG3 (DS1)] circuit packs are 1x1 protected and use revertive switching. The FT-2000 OC-48 Add/Drop-Rings Terminal must be equipped with two TG3 (DS1) circuit packs on the Low Speed Shelf - System Controller.

FT-2000 OC-48 Add/Drop-Rings Terminal

Figure 9-19 shows the TG3 (DS1) circuit pack protection architecture of the FT-2000 OC-48 Add/Drop-Rings Terminal.

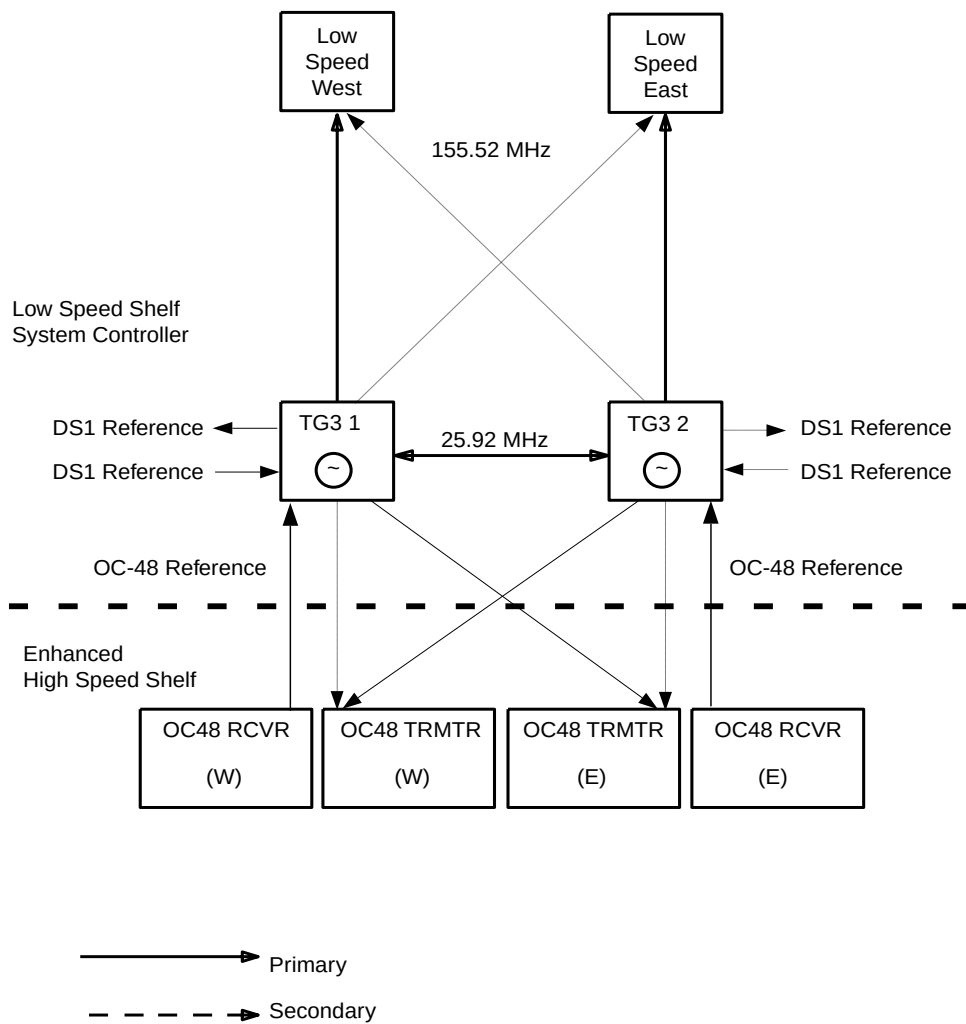


Figure 9-19. TG3 (DS1) Circuit Pack Protection (FT-2000 OC-48 Add/Drop-Rings Terminal)

The number 1 TG3 (DS1) circuit pack on the Low Speed Shelf - System Controller provides the following:

- Primary timing to the STS1E, IS3, OC3 (1.3 STD) and OC12 (1.3 STD) circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1W and the DS3 circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1E
- Primary timing to the east OC48 TRMTR circuit pack on the Enhanced High Speed Shelf (or high-speed Shelf)

- Secondary timing to the STS1E, IS3, OC3 (1.3 STD) and OC12 circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1E and the DS3 circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1W
- Secondary timing to the west OC48 TRMTR circuit pack on the Enhanced High Speed Shelf (or high-speed Shelf)
- An internal synchronization signal to the number 2 TG3 (DS1) on the Low Speed Shelf - System Controller.

The number 2 TG3 (DS1) circuit pack on the Low Speed Shelf - System Controller provides the following:

- Primary timing to the STS1E, IS3, OC3 (1.3 STD) and OC12 (1.3 STD) circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1E and the DS3 circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1W
- Primary timing to the west OC48 TRMTR circuit pack on the Enhanced High Speed Shelf (or High Speed Shelf)
- Secondary timing to the STS1E, IS3, OC3 (1.3 STD) and OC12 (1.3 STD) circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1W and the DS3 circuit packs that terminate add/drop traffic to/from the OC-48 high-speed line 1E
- Secondary timing to the east OC48 TRMTR circuit pack on the Enhanced High Speed Shelf (or High Speed Shelf)
- An internal synchronization signal to the number 1 TG3 (DS1) on the Low Speed Shelf - System Controller.

If the number 1 TG3 (DS1) circuit pack fails, the number 2 TG3 (DS1) circuit pack will provide timing for the transmit circuits. Conversely, if the number 2 TG3 (DS1) circuit pack fails, the number 1 TG3 (DS1) circuit pack will provide timing.

Synchronization Reference Protection

General

Synchronization reference protection switching occurs in response to automatically detected faults and external commands from a local/remote CIT or operations system. Refer to the **FAULT-Switch-Synchronization** input in Section 11, "Craft Interface Terminal Usage."

Table 9-10 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-10. Synchronization Reference Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Lockout	CIT/OS
Forced switch	CIT/OS
Signal failure	Automatic
Manual switch	CIT/OS
Wait to restore	Automatic

* Resetting the synchronization switch priority (**FAULT-Switch-Synchronization-Reference-Priority:Reset**) has no effect on any automatic switch priority except wait to restore.

DS1 Reference Protection

In the externally timed mode, the TG3 (DS1) circuit packs on the Low Speed Shelf - System Controller derive timing from two external DS1 reference signals as shown in Figure 9-20.

The number 1 TG3 (DS1) circuit pack accepts the primary DS1 reference signal and the number 2 TG3 (DS1) circuit pack accepts the secondary DS1 reference signal.

If the primary DS1 reference signal fails, the FT-2000 OC-48 Add/Drop-Rings Terminal switch to the secondary DS1 reference signal and the number 2 TG3 (DS1) circuit pack. If both DS1 reference signals fail, the TG3 (DS1) circuit pack holds the on-board oscillator frequency at the last good reference sample (holdover mode) until the DS1 reference signals are repaired. In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

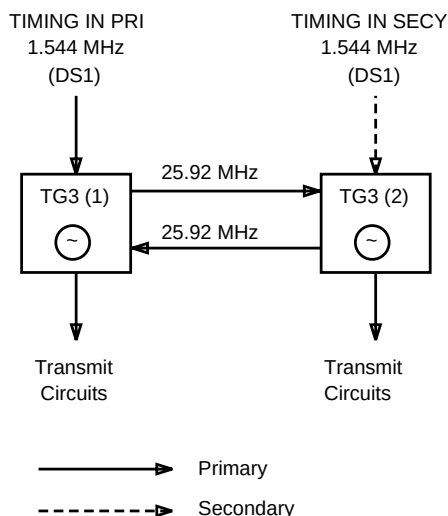


Figure 9-20. DS1 Reference Protection

OC-48 Line Reference Protection

FT-2000 OC-48 Add/Drop-Rings Terminal . When the FT-2000 OC-48 Add/Drop-Rings Terminal is provisioned for the through timed mode, the TG3 (DS1) circuit packs on the Low Speed Shelf - System Controller derive timing from two 25.92 MHz reference signals obtained from the incoming OC-48 signals as shown in Figure 9-21.

The west OC48 RCVR circuit pack recovers the 2.5 GHz clock signal from the incoming OC-48 signal on OC-48 high-speed line 1W and generates the primary 25.92 MHz reference signal for the number 1 TG3 (DS1) circuit pack. The east OC48 RCVR circuit pack recovers the 2.5 GHz clock signal from the incoming OC-48 signal on OC-48 high-speed line 1E and generates the primary 25.92 MHz reference signal for the number 2 TG3 (DS1) circuit pack.

If an OC-48 line reference signal or the OC-48 high-speed line fails, the TG3 (DS1) circuit pack switches to the secondary OC-48 line reference signal. If both OC-48 line reference signals fail, the TG3 (DS1) circuit pack holds the on-board oscillator frequency at the last good reference sample (holdover mode). In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

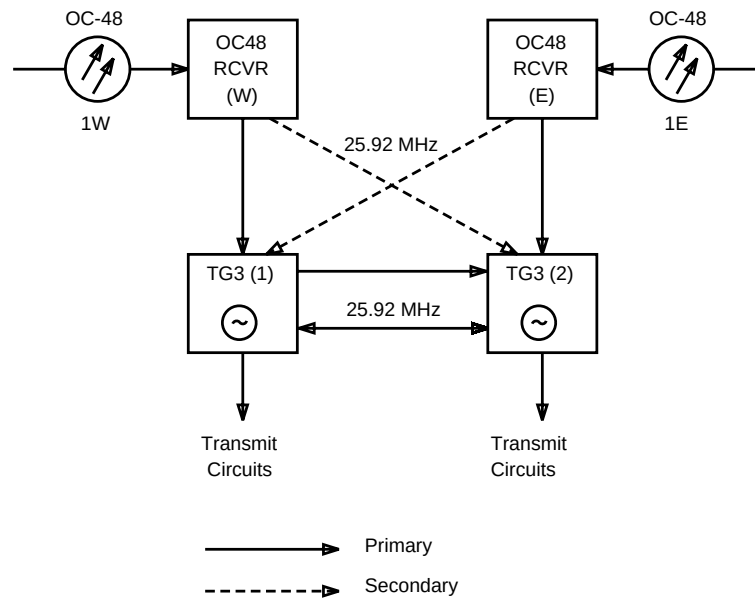


Figure 9-21. OC-48 Line Reference Protection (FT-2000 OC-48 Add/Drop-Rings Terminal)

Synchronization Mode Protection

Synchronization mode protection switching occurs in response to automatically detected faults and external commands from a local/remote CIT or operations system. Refer to the **FAULT-Switch-Synchronization** input in Section 11, "Craft Interface Terminal Usage."

Table 9-11 shows the standard protection switching priorities in descending order of priority used by the FT-2000 OC-48 Add/Drop-Rings Terminal.

Table 9-11. Synchronization Mode Protection Switching Priorities

Switch Priority (Descending Order)	Source of Request
Reset*	CIT/OS
Forced switch	CIT/OS
Synchronization reference failure	Automatic

* Resetting the synchronization switch priority (**FAULT-Switch-Synchronization- Mode-Priority:Reset**) has no effect on any automatic switch priority.

If the FT-2000 OC-48 Add/Drop-Rings Terminal is provisioned to operate in the through timed mode, or externally timed mode and all reference signals fail, the TG3 (DS1) circuit pack holds the on-board oscillator frequency at the last good reference sample (holdover mode) until the DS1 reference signals are repaired. In the holdover mode, the on-board oscillator frequency will not degrade below the stratum 3 level.

Loopbacks

Low Speed (DS3, EC-1, OC-3, and OC-12)

The FT-2000 OC-48 Lightwave System allows the following loopbacks to be performed:

- A low-speed DS3 loopback allows a single DS3 signal or all the DS3 signals to be looped back toward the OC-48 high-speed line. The DS3 loopback only allows a single DS3 signal to be looped back toward the OC-48 high-speed line. The input DS3 signal(s) from the DSX-3 cross-connect panel are preempted by this loopback, but the output DS3 signal(s) to the DSX-3 cross-connect panel remain connected.
- A low-speed EC-1 loopback allows an EC-1 signal or all the EC-1 signals to be looped back toward the OC-48 high-speed line. The EC-1 loopback only allows a single EC-1 signal to be looped back toward the OC-48 high-speed line. The input EC-1 signal(s) from the STSX-1 cross-connect panel are preempted by this loopback, but the output EC-1 signal(s) to the STSX-1 cross-connect panel remain connected.
- low-speed OC-3 loopbacks allow a single OC-3 signal to be looped back toward the OC-48 high-speed line or toward the OC-3 line. A loopback may be active in only one direction at a time. Simultaneous loopbacks in both directions are not supported. When a loopback is established toward the OC-48 high-speed line, the input OC-3 signal from the OC-3 line is preempted, but the output OC-3 signal transmitted toward the OC-3 line remains connected. When a loopback is established toward the OC-3 line, the OC-3 signal from the OC-48 high-speed line is preempted, but the OC-3 signal transmitted toward the OC-48 high-speed line remains connected.
- low-speed OC-12 loopback can only be done on one side of the circuit. The loopback allows an OC-12 signal to be looped back toward the OC-12 line (referred to as "toward the LGX"). It does not provide a loopback test toward the cross-connect/OC-48 side. When a loopback is established toward the OC-12 line, the OC-12 signal from the OC-48 high-speed line is preempted, but the OC-12 signal transmitted toward the OC-48 high-speed line remains connected.

These loopbacks are made electronically within the DS3, STS1E, OC3 (1.3 STD), and OC12 (1.3 STD) circuit packs in response to the **FAULT-Operate-Loopback-T3**, **FAULT-Operate-Loopback-EC1**, **FAULT-Operate-Loopback-OC3** and **FAULT-Operate-Loopback-OC12** inputs entered at the CIT. The **FAULT-Release-Loopback-T3**, **FAULT-Release-Loopback-EC1**, **FAULT-Release-Loopback-OC3**, **FAULT-Release-Loopback-OC12** inputs are used to take down loopbacks.

⇒ **NOTE:**
For Release 8.1 and previous releases, the **FAULT-Operate-Loopback-T3**, **FAULT-Operate-Loopback-EC1**, and **FAULT-Operate-Loopback-OC3** and **FAULT-Operate-Loopback-OC12** inputs will complete regardless of whether the selected low-speed interface slot(s) is equipped (EQ).

⇒ **NOTE:**
For Release 9.0 and later, the **FAULT-Operate-Loopback-T3**, **FAULT-Operate-Loopback-EC1**, **FAULT-Operate-Loopback-OC12**, and **FAULT-Operate-Loopback-OC3** inputs will be denied if the pack inserted in the addressed slot is of the wrong type or the addressed slot is not equipped.

⇒ **NOTE:**
For Release 9.0 and later, the **FAULT-Operate-Loopback-T3**, **FAULT-Operate-Loopback-EC1**, **FAULT-Operate-Loopback-OC12**, and **FAULT-Operate-Loopback-OC3** inputs require that a LNCTL circuit pack be installed and operating in order to execute. If the LNCTL slot is in the AUTO state, if the LNCTL has been removed, or if the LNCTL has failed, the command shall be denied with error code EMCD_NOLNCTL.

DS3 and EC-1 loopbacks can also be made through the message-based operations system interface, using X.25 protocol and Transaction Language 1 (TL1) messages. OC-3 and OC-12 loopbacks can be made through the message-based operations system interface.

Active electronic loopbacks are noted by the abnormal (ABN) LED on the user panel and in the alarm and status report.

A remote DS3, EC-1, OC-3 or OC-12 loopback can be done through a remote login. This loops the remote low-speed signal back toward the local terminal.

High-Speed (OC-48)

The FT-2000 OC-48 Lightwave System allows loopbacks to be performed on all high-speed interfaces. Front access to the optical connectors on the circuit pack faceplates allows a manual OC-48 optical loopback. This loopback is performed by connecting the optical connector on the faceplate of the OC48 TRMTR circuit pack to the optical connector on the faceplate of the OC48 RCVR circuit pack with a single-mode fiber jumper and lightguide buildouts. A loopback can also be performed on an OC48 REGENR circuit pack by connecting the IN and OUT connector on the circuit pack faceplate with a single-mode fiber jumper and lightguide buildouts.

Tests

Auto Turnup

The auto turnup tests are performed by the FT-2000 OC-48 Lightwave System to verify that the system has been installed correctly. These tests verify the system transmission capabilities and include testing all the service and protection transmission paths to detect any cabling errors.

The auto turnup tests are controlled using the CIT and should only be performed on an out-of-service system. Before executing an auto turnup test at the CIT, no trouble conditions should be present in the system except conditions associated with the test setup. After executing an auto turnup test, the CIT will not accept any commands until the test is complete. An auto turnup test can be aborted at any time or terminated prematurely if a condition exists that prevents the test from completing. The test results are displayed on the CIT. For more information about auto turnup tests, refer to the "Operation and Maintenance (TOP)" Section.

The following auto turnup tests are provided:

- **Local (Terminal Self-Test):** The **FAULT-Test-Auto Turnup-Local** input verifies the internal health of the FT-2000 OC-48 Add/Drop-Rings Terminal itself. It tests the transmission path between the low-speed interface circuit packs [DS3, STS1E, OC-3, and OC12 (1.3 STD)] and the OC48 RCVR and OC48 TRMTR circuit packs (Figure 9-22). The FT-2000 OC-48 Add/Drop-Rings Terminal also tests the through and loopback transmission paths between OC48 RCVR and OC48 TRMTR circuit packs.

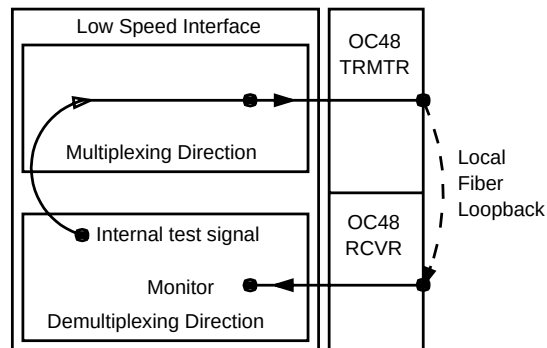


Figure 9-22. Local (Terminal Self-Test)

For the local test, the output of the OC48 TRMTR circuit pack must be looped back with a single-mode fiber jumper and a lightguide buildout to the input of the OC48 RCVR circuit pack on the line(s) to be tested. For example, when all lines are being tested, all OC48 TRMTR and OC48 RCVR circuit pack pairs must be manually looped back.

The FT-2000 OC-48 Add/Drop-Rings Terminal performs the following tests:

- To verify the continuity of each add/drop transmission path, each DS3 circuit pack inserts one parity bit error on each DS3 signal toward each high-speed line. The output of the OC48 TRMTR circuit pack is looped back to the OC48 RCVR circuit pack and the DS3 circuit pack monitors each DS3 signal from the high-speed line. If only one parity bit error is detected within 1 second, the test passes.

Rather than checking parity, the STS1E and OC3/OC12 (1.3 STD) circuit packs use special test signals with a known content to verify the continuity of add/drop transmission path.
- To verify the parity error rate of each add/drop transmission path, each DS3 circuit pack monitors each DS3 signal from the high-speed line for errors over a 4-second period. If no errors are detected in the 4-second period, the test passes.
- To verify the continuity of each through transmission path, the east OC48 RCVR circuit pack inserts one parity bit error on each STS-3 tributary toward the west OC48 TRMTR circuit pack. The west OC48 RCVR circuit pack also inserts one parity bit error on each STS-3 tributary toward the east OC48 TRMTR circuit pack. The OC48 TRMTR circuit packs monitor each STS-3 tributary. If only one parity bit error is detected within 1 second, the test passes.
- To verify the parity error rate of each through transmission path, each OC48 TRMTR circuit pack monitors each STS-3 tributary (from the OC48 RCVR circuit pack of the other high-speed line) for errors over a 4-second period. If no errors are detected in the 4-second period, the test passes.
- To verify the continuity of each loopback transmission path, the east OC48 RCVR circuit pack inserts one parity bit error on each STS-3 tributary toward the east OC48 TRMTR circuit pack. The west OC48 RCVR circuit pack also inserts one parity bit error on each STS-3 tributary toward the west OC48 TRMTR circuit pack. The OC48 TRMTR circuit packs monitor each STS-3 tributary. If only one parity bit error is detected within 1 second, the test passes.
- To verify the parity error rate of each loopback transmission path, each OC48 TRMTR circuit pack monitors each STS-3 tributary (from the OC48 RCVR circuit pack of the same high-speed line) for errors over a 4-second period. If no errors are detected in the 4-second period, the test passes.

The LSSW circuit packs are tested to verify they can perform a low-speed protection switch for each low-speed interface circuit pack. The transmission path through the LSSW circuit packs is tested in the DSX test.

Each TG3 (DS1) circuit pack is also tested individually to detect transmission and cross-cabling errors. The local test disables the reference signals on each TG3 (DS1) circuit pack and verifies the correct TG3 (DS1) circuit pack detects the loss of reference signal. If the correct TG3 (DS1) circuit pack detects the loss of reference signal, the test passes.

- **DSX (Low Speed Cabling Self-Test):** The **FAULT-Test-Auto Turnup-DSX** input verifies the low-speed cabling between the FT-2000 OC-48 Add/Drop-Rings Terminal and the cross-connect panel (or equivalent) was installed properly and supports transmission. The test verifies that the input and output low-speed interface cables are connected to the same port at the terminal and the cross-connect panel (or equivalent). The DSX test also performs low-speed switches for each electrical low-speed interface circuit pack (DS3 and STS1E) and tests the transmission path through the LSSW circuit packs. The LSSW circuit packs are in the transmission path between the protection electrical low-speed interface circuit pack and the cross-connect panel (or equivalent).

For the DSX test, the fiber(s) for the line(s) to be tested must be disconnected and each low-speed port of the line(s) to be tested must be looped back at the DSX-3 cross-connect panel (or equivalent). See Figure 9-23.

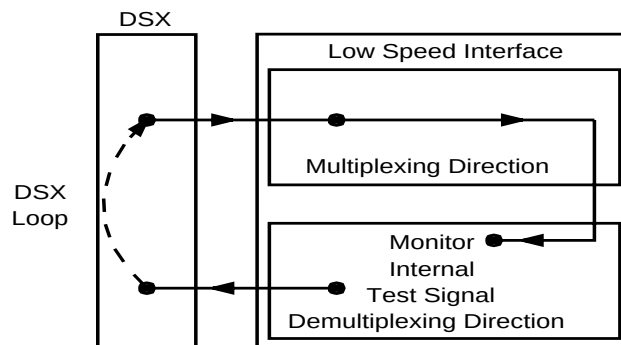


Figure 9-23. DSX (Low Speed Cabling Self-Test)

The following tests are performed:

- To verify the continuity of each transmission path, each DS3 circuit pack inserts one parity bit error on each DS3 signal toward the cross-connect panel (or equivalent). The DS3 signals are looped

back at the cross-connect panel and the DS3 circuit pack monitors each DS3 signal. If only one parity bit error is detected within 1 second, the test passes.

Rather than checking parity, the STS1E and OC3 (1.3 STD) circuit packs use special test signals with a known content to verify the continuity of each transmission path.

- To verify the parity error rate of each transmission path, each DS3 circuit pack monitors each DS3 signal from the cross-connect panel (or equivalent) for errors over a 4-second period. If no errors are detected in the 4-second period, the test passes.

- **Regenerator Self-Test:** The **FAULT-Test-Auto Turnup** input verifies each individual OC48 REGENR circuit pack in an FT-2000 OC-48 Repeater Bay. The regenerator test verifies the transmission and fault isolation capabilities of an OC48 REGENR circuit pack.

For the regenerator test, the output of each OC48 REGENR circuit pack to be tested must be looped back to its input with a single-mode fiber jumper and a lightguide buildout in the optical path simulating the outside plant loss (Figure 9-24).

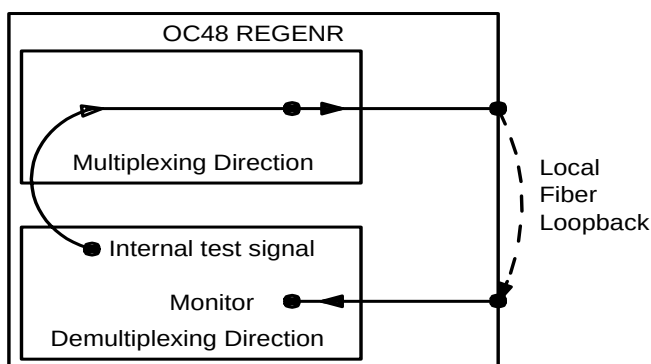


Figure 9-24. Regenerator Self-Test

The OC48 REGENR circuit pack inserts an AIS signal embedded with F1-bytes (site address and line status codes) in the outgoing high-speed signal. The OC48 REGENR circuit pack reads the F1-bytes on the incoming high-speed signal. If the F1-bytes line status codes are read and no conditions are observed that would set the outgoing F1-byte to anything other than normal, the test passes.

Operations Interface Tests

The FT-2000 OC-48 Lightwave System provides the following inputs to test LEDs, serial and parallel telemetry interfaces, and office alarms:

- **FAULT-Test-LED:** This input lights the specified LEDs. The test consists of one or more test cycles repeated as many times as specified. Each test cycle the LED(s) is lighted for 10 seconds, then turned off for 10 seconds. The LED(s) reverts to normal operation after the test is completed. The PWR ON LED is always on if the bay is powered and cannot be tested with this input.
- **FAULT-Test-Alarm:** This input tests the audible and visible office alarm outputs and their corresponding user panel LEDs (CR, MJ, and MN). The test consists of one or more test cycles repeated as many times as specified. The alarms revert to normal operation after the test is completed.

Circuit Provisioning Audits

The FT-2000 OC-48 Add/Drop-Rings Terminal audits (monitors) the following circuit provisioning information related to ring administration and cross-connections.

- **Target Identifier (TID) and Node Identifier (NID):** Each FT-2000 OC-48 ADR Terminal in an OC-48 ring must have a unique TID. The FT-2000 OC-48 Add/Drop-Rings Terminal automatically detects and reports any duplicated TIDs.
- **Circuit Add/Drop Continuity:** Each FT-2000 OC-48 Add/Drop-Rings Terminal in a ring checks each local drop cross-connection. The FT-2000 OC-48 Add/Drop-Rings Terminal ensures that there is a continuous path from each local drop cross-connection back through the ring to a valid add cross-connection. The FT-2000 OC-48 Add/Drop-Rings Terminal automatically detects and reports breaks in circuit continuity. Conditions are reported when cross-connections are missing, intermediate source/destination TIDs are incorrect, and add/drop source/destination TIDs are incorrect.



NOTE:

Incorrectly provisioned TIDs are not alarmed in cross-connections in which the circuit drops at a *WaveStar* node.

The FT-2000 OC-48 Add/Drop-Rings Terminal also makes circuit provisioning information available with the following reports.

- **STS-1 Tributary Map Report:** The STS-1 Tributary Map Report displays the cross-connections involving a single time slot throughout the ring. For more information about the STS-1 Tributary Map Report, refer to the **CONFIGURATION-Retrieve-Timeslot-STs1** input in Section 11, "Craft Interface Terminal Usage."
- **STS-1 Circuit Map Report:** The STS-1 Circuit Map Report follows a circuit path and reports all cross-connections that make up a circuit. For more information about the STS-1 Circuit Map Report, refer to the **CONFIGURATION-Retrieve-Circuit-STs1** input in Section 11, "Craft Interface Terminal Usage."

Performance Monitoring

SONET Performance Parameters

The FT-2000 OC-48 Lightwave System provides performance monitoring to support proactive maintenance of a network. Proactive maintenance refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming, but indicative of an impending hard or soft failure.

Proactive maintenance consists of monitoring performance parameters associated with the SONET sections, lines, and paths within the SONET network (Figure 9-25). (Refer to Appendix A, "A SONET Overview," for definitions of SONET sections, lines, and paths.) Table 9-12 lists the SONET performance parameters monitored.

These parameters are thresholded to show degraded performance. When a performance-monitoring threshold is crossed, it is reported to the operations system where all threshold crossings associated with a particular path can be correlated, and the likely source of the degradation can be identified.

For more information about provisioning thresholds and enabling/disabling the reporting of threshold crossing alerts (TCAs) to an operations system, refer to Section 8, "Administration and Provisioning."

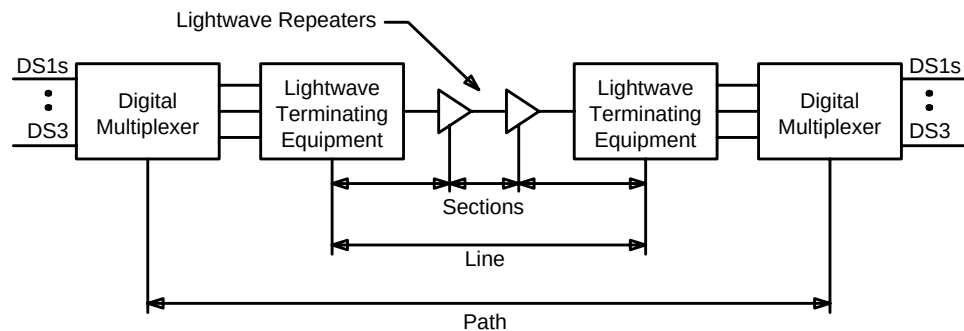


Figure 9-25. SONET Section, Line, and Path

Table 9-12. Performance-Monitoring Parameters

Facility	Measured Parameter	Maximum Counts	
		Current Quarter Hour	Current Day
OC-48/ OC-3/OC-12 Optics	Laser Bias Current	—	—
	Optical Power Transmit	—	—
	Optical Power Receive	—	—
STS-48/ STS-12/ STS-3 Section	STS-3 Section (B1) Coding Violations (CV-S)	14000	1343750
	STS-3 Section (B1) Errored Seconds (ES-S)	900	65535
	STS-3 Section (B1) Severely Errored Seconds (SES-S)	900	65535
	STS-3 Section (B1) Severely Errored Frame Seconds (SEFS-S)	900	65535
	STS-12 Section (B1) Coding Violations (CV-S)	56000	5375000
	STS-12 Section (B1) Errored Seconds (ES-S)	900	65535
	STS-12 Section (B1) Severely Errored Seconds (SES-S)	900	65535
	STS-12 Section (B1) Severely Errored Frame Seconds (SEFS-S)	900	65535
	STS-48 Section (B1) Coding Violations (CV-S)	224000	21500000
	STS-48 Section (B1) Errored Seconds (ES-S)	900	65535
	STS-48 Section (B1) Severely Errored Seconds (SES-S)	900	65535
	STS-48 Section (B1) Severely Errored Frame Seconds (SEFS-S)	900	65535
OC-48/ OC-12/ OC-3 Line	OC-3 Line (B2) Coding Violations (CV-L)	14000	1343750
	OC-3 Line (B2) Errored Seconds (ES-L)	900	65535
	OC-3 Line (B2) Severely Errored Seconds (SES-L)	900	4095
	OC-3 Line (B2) Unavailable Seconds (UAV-L)	900	4095
	OC-3 Line (B2) Protection Switch Count (PSC-L)	63	255
	OC-3 Line Pointer Justification Counts (PJC)	65535	9999999
	OC-12 Line (B2) Coding Violations (CV-L)	56000	5375000
	OC-12 Line (B2) Errored Seconds (ES-L)	900	65535
	OC-12 Line (B2) Severely Errored Seconds (SES-L)	900	4095
	OC-12 Line (B2) Unavailable Seconds (UAV-L)	900	4095
	OC-12 Line (B2) Protection Switch Count (PSC-L)	63	255
	OC-12 Line Pointer Justification Counts (PJC)	65535	9999999
	OC-48 Line (B2) Coding Violations (CV-L)	224000	21500000
	OC-48 Line (B2) Errored Seconds (ES-L)	900	65535
	OC-48 Line (B2) Severely Errored Seconds (SES-L)	63	4095
	OC-48 Line (B2) Unavailable Seconds (UAS-L)	63	4095
	OC-48 Line (B2) Protection Switch Count (PSC-L)	63	255
STS-1 Path/ Far End	Path (B3) Coding Violations (CV-P)	16383	1048575
	Path (B3) Errored Seconds (ES-P)	900	65535
	Path (B3) Severely Errored Seconds (SES-P)	900	65535
	Path (B3) Unavailable Seconds (UAS-P)	900	65535
	Far End (FEBE) Coding Violations (CV-F)	16383	1048575
	Far End (FEBE) Errored Seconds (ES-F)	900	65535

Table 9-12. Performance-Monitoring Parameters

Facility	Measured Parameter	Maximum Counts	
		Current Quarter Hour	Current Day
	Far End (FEBE) Severely Errored Seconds (SES-F)	900	65535
	Far End (FEBE) Unavailable Seconds (UAS-F)	900	65535
EC-1 Section/ Line	Section Severely Errored Frame Seconds (SEFS-S)	900	65535
	EC-1 Line (B2) Coding Violations (CV-L)	16383	1048575
	EC-1 Line (B2) Errored Seconds (ES-L)	900	65535
	EC-1 Line (B2) Severely Errored Seconds (SES-L)	900	65535
	EC-1 Line (B2) Unavailable Seconds (UAS-L)	900	65535
	EC-1 Line Pointer Justification Counts (PJC)	65535	9999999
DS3 Line/Path	DS3 Line Errored Seconds (ES-L)	900	65535
	DS3 Path Coding Violations (CV-P)	16383	1048575
	DS3 Path Errored Seconds (ES-P)	900	65535
	DS3 Path Severely Errored Seconds (SES-P)	900	65535
	DS3 Path Severely Errored Frame/AIS Seconds (SAS-P)	900	65535
	DS3 Path Unavailable Seconds (UAS-P)	900	65535

OC-48 Optical Parameters

The following OC-48 optical parameters are monitored continuously to detect degraded performance of the laser:

- **Laser Bias Current:** This parameter indicates whether the system optics are working within normal margins (in range or out of range). The upper limit is 1.5 times the initial factory (nominal) value. There is no lower limit.
- **Optical Transmit Power:** This parameter indicates whether the signal power (facet power) generated by the laser is within normal margins (in range and out of range). The upper limit is 0.8 dBm above the initial factory (nominal) value, and the lower limit is 1.0 dBm below the initial factory (nominal) value.
- **Optical Power Receive:** This parameter is not an absolute measure of the received optical power and, therefore, should not be used as a proactive performance-monitoring parameter. The optical power receive parameter indicates whether the received optical power is currently within the nominal sensitivity limits of the receiver (in range or out of range). The optical power receive parameter can be used with other proactive performance-monitoring parameters to isolate the source of an impending high-speed failure.

Threshold crossing alerts (TCAs) are generated if an OC-48 optical parameter exceeds the set thresholds. The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-Optics** input.

OC-3/OC-12 Optical Parameters

The following OC-3/OC-12 optical parameters are monitored continuously to detect degraded performance of the laser:

- **Laser Bias Current:** This parameter indicates whether the system optics are working within normal margins (in range or out of range). The OC-3/OC-12 laser bias current varies widely with temperature because the laser does not have a thermoelectric cooler to maintain a constant laser temperature. Typical nominalized values are expected to range from 0.5 to 2, or even higher. The upper limit is 1.5 times the maximum (beginning of life) laser bias current limit. There is no lower limit.
- **Optical Transmit Power:** This parameter indicates whether the signal power (facet power) generated by the laser is within normal margins (in range and out of range). The upper limit is 0.8 dBm above the initial factory (nominal) value, and the lower limit is 1.0 dBm below the initial factory (nominal) value.
- **Optical Power Receive:** This parameter indicates whether or not the received optical power is currently within the nominal sensitivity limits of the receiver (in range or out of range). The upper limit is –6 dBm (nominal), and the lower limit is –35 dBm (nominal).

Threshold crossing alerts (TCAs) are generated if an OC-3/OC-12 optical parameter exceeds the set thresholds. The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-Optics** input.

STS-48/STS-12/STS-3 Section Parameters

The following STS-48, STS-12 and STS-3 section parameters are monitored:

- **Section (B1) Coding Violations (CV-S):** To monitor the performance of an STS-48, STS-12 or STS-3 section, the section B1 parity is calculated, written, and checked for errors. The section B1 parity violation counter is incremented for each section error detected.
- **Section (B1) Errored Seconds (ES-S):** An errored second (ES) is a second in which there are one or more B1 parity violations detected, one or more LOS defects, or one or more LOF defects.
- **Section (B1) Severely Errored Seconds (SES-S):** A severely errored second (SES) is a second in which there are 249 or more B1 parity violations detected, one or more LOS defects, or one or more LOF defects.
- **Section (B1) Severely Errored Frame Seconds (SEFS-S):** A section severely errored frame second (SEFS) is the number of seconds during which an out-of-frame event occurred.

A threshold crossing alert* (TCA) is generated if an STS-48 or STS-3 section parameter exceeds the provisionable threshold. The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-Section** input.

OC-48/OC-12/OC-3 Line Parameters

The following OC-48, OC-12, and OC-3 line parameters are monitored:

- **Line (B2) Coding Violations (CV-L):** To monitor the performance of the OC-48, OC-12, or OC-3 line, the line B2 parity is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line bit interleaved parity (BIP) error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. The contents of the B2 parity violation counters associated with the OC-48, OC-12, or OC-3 line are added to form a composite B2 parity violation count.
- **Line (B2) Errored Seconds (ES-L):** An errored second (ES) is a second in which there are one or more B2 parity violations or a line AIS defect detected.
- **Line (B2) Severely Errored Seconds (SES-L):** A severely errored second (SES) is a second in which there are 494 or more B2 parity violations or a line AIS defect is detected.
- **Line (B2) Unavailable Seconds (UAS-L):** An unavailable second (UAS-L) is a second during which the OC-48, OC-12 or OC-3 line is "unavailable." Unavailable seconds are counted after 10 consecutive line (B2) severely errored seconds (SES-L). These 10 severely errored seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a severely errored second. The 10 consecutive seconds without a severely errored second are not counted as unavailable seconds.
- **Protection Switch Counts (PSC-L):** The protection switch count (PSC-L) parameter is the number of times that a protection switch has been performed. This count includes the actual automatic and manual switches (not switch requests) to protection and the revertive switches back to service.
- **Pointer Justification Counts (PJC):** The pointer justification count (PJC) is a count of the STS-n pointer adjustments created or absorbed by an NE due to the differences in frame rates of the incoming and outgoing SONET signals.

A threshold crossing alert (TCA) is generated if an OC-48, OC-12, or OC-3 line parameter exceeds the provisionable threshold. (The protection switch counts parameter does not have a provisionable or fixed threshold.) The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-Line** input.

STS-1 Path Parameters

The following STS-1 path parameters are monitored:

- **Path (B3)/Path Far End (FEBE) Coding Violations (CV-P and CV-F):** To monitor the performance of the STS-1 path, the "B3" byte in the STS-1 path overhead is written when the path is originated and is checked for errors when the path is terminated. The B3 coding violation counter is incremented for each error detected. Up to eight errors can be detected in each STS-1 path. The near end path (B3) terminating status is relayed back to the originating end where it is monitored as far end path (FEBE).
- **Path (B3)/Path Far End (FEBE) Errored Seconds (ES-P and ES-F):** An STS-1 path (B3) errored second (ES) is a second in which there are one or more B3 parity violations, one or more STS-1 path AIS defects, or one or more STS-1 path LOP defects. A path far end (FEBE) errored second (ES) is a second in which there are one or more FEBE coding violations or one or more remote defect indicator-path (RDI-P) defects.
- **Path (B3)/Path Far End (FEBE) Severely Errored Seconds (SES-P and SES-F):** An STS-1 path (B3) severely errored second (SES) is a second in which there are nine or more B3 parity violations, one or more STS-1 path AIS defects, or one or more STS-1 path LOP defects. A path far end (FEBE) severely errored second (SES) is a second in which there are nine or more FEBE coding violations or one or more RDI-P defects.
- **Path (B3)/Path Far End (FEBE*) Unavailable Seconds (UAS-P and UAS-F):** An unavailable second (UAS) is a second during which the STS-1 path is "unavailable." Unavailable seconds are counted after 10 consecutive path (B3)/path far end (FEBE) severely errored seconds (SES). These 10 severely errored seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a severely errored second. The 10 consecutive seconds without a severely errored second are not counted as unavailable seconds.

A threshold crossing alert (TCA) is generated if an STS-1 path (B3)/far end (FEBE) parameter exceeds the provisionable threshold. The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-STs1** input.

EC-1 Section/Line Parameters

The following EC-1 section/line parameters are monitored:

- **Section (B1) Severely Errored Frame Seconds (SEFS-S):** A section severely errored frame second (SEFS) is the number of seconds during which an out-of-frame event occurred.
- **Line (B2) Coding Violations (CV-L):** To monitor the performance of the EC-1 line, the line B2 parity is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line bit interleaved parity (BIP) error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame.
- **Line (B2) Errored Seconds (ES-L):** An errored second (ES) is a second in which there are one or more B2 parity violations or an EC-1 line AIS defect detected.
- **Line (B2) Severely Errored Seconds (SES-L):** A severely errored second (SES) is a second in which there are 9 or more B2 parity violations or an EC-1 line AIS defect detected.
- **Line (B2) Unavailable Seconds (UAS-L):** An unavailable second (UAS) is a second during which the EC-1 line is "unavailable." Unavailable seconds are counted after 10 consecutive line (B2) severely errored seconds (SES). These 10 severely errored seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a severely errored second. The 10 consecutive seconds without a severely errored second are not counted as unavailable seconds.
- **Pointer Justification Count (PJC):** The pointer justification count (PJC) is a count of the STS-n pointer adjustments created or absorbed by an NE due to the differences in frame rates of the incoming and outgoing SONET signals.

A threshold crossing alert (TCA) is generated if an EC-1 section/line parameter exceeds the provisionable threshold. The generation of TCAs can be enabled or disabled using the **PERFORMANCE - Set - PM Threshold - EC1** input.

DS3 Line/Path

The following DS3 line/path parameters are monitored:

- **DS3 Line Errored Seconds (ES-L)*:** An errored second (ES) is a second in which there are one or more B3ZS coding violations or a DS3 LOS defect detected in the DS3 signal input from the cross-connect panel.
- **DS3 Path Coding Violations (CV-P):** To monitor the performance of the DS3 path, the P-bit parity of the DS3 signal received from the OC-48 line is calculated, written, and checked for errors. Path coding violation may be based on P bits or F and M framing bits (provisionable on a per DS3 basis). The F and M bit error counts are adjusted to estimate the equivalent P-bit

error count in the DS3 path payload. This may be used as an approximate end-to-end DS3 path performance measure, even if the path passes through intermediate equipment that corrects P-bit errors. For more information about provisioning the DS3 performance-monitoring mode, refer to Section 8, "Administration and Provisioning."

- **DS3 Path Errored Seconds (ES-P):** An errored second (ES) is a second in which there are one or more DS3 coding violations, one or more DS3 path AIS defects, or one or more DS3 path LOF defects detected in the DS3 signal received from the OC-48 line.
- **DS3 Path Severely Errored Seconds (SES-P):** A severely errored second (SES) is a second in which there are 44 or more DS3 coding violations, one or more DS3 path AIS defects, or one or more DS3 path LOP defects in the DS3 signal received from the OC-48 line.
- **DS3 Path Severely Errored Frame/AIS Seconds (SAS-P):** A severely errored frame/AIS second (SAS) is a second in which there is an out-of-frame or AIS defect detected in the DS3 signal received from the OC-48 line.
- **DS3 Path Unavailable Seconds (UAS-P):** An unavailable second (UAS) is a second during which the DS3 path is "unavailable." Unavailable seconds are counted after 10 consecutive DS3 path severely errored seconds (SES). These 10 severely errored seconds are counted, and each subsequent second is counted until there are 10 consecutive seconds without a severely errored second. The 10 consecutive seconds without a severely errored second are not counted as unavailable seconds.

A threshold crossing alert (TCA) is generated if a DS3 line/path parameter exceeds the provisionable threshold. The generation of TCAs can be enabled or disabled using the **PERFORMANCE-Set-PM Threshold-T3** input.

Performance-Monitoring Data Storage and Reports

The FT-2000 OC-48 Lightwave System provides current quarter-hour and current day registers for all accumulated performance parameters. There is also 1 previous day register and 32 previous quarter-hour registers (8 hours).

The FT-2000 OC-48 Lightwave System can initialize the current quarter-hour and/or current day registers through the CIT locally or remotely at any time, as well as retrieve and report the contents of any parameter storage register at any time. When performance-monitoring data is retrieved, any previous day or quarter-hour register with all zero data is not reported. The current day and quarter-hour registers are always reported, even when they contain all zero data. For more information, refer to the **PERFORMANCE-Initialize-PM**, **PERFORMANCE-Retrieve-PM-Line**, **PERFORMANCE-Retrieve-PM-Optics**, **PERFORMANCE-Retrieve-PM-Section**, **PERFORMANCE-Retrieve-PM-STs1**,

PERFORMANCE-Retrieve-PM-EC1*, and **PERFORMANCE-Retrieve-PM-T3** inputs in Section 11, "Craft Interface Terminal Usage."

A single start time can be provisioned for measuring all the current day performance-monitoring parameters. The start time can be provisioned to start at any hour. The performance-monitoring parameters will reset and begin daily at the provisioned start time. For more information about provisioning the performance-monitoring start time, refer to Section 8, "Administration and Provisioning."

Performance Monitoring During Failed Conditions

When a trouble condition is detected, the FT-2000 OC-48 Lightwave System stops accumulating affected performance parameters per Bellcore requirements. All unaffected performance parameters continue to be accumulated during the trouble condition.

The coding violations (CV) and errored seconds (ES) counts are accumulated until a severely errored second (SES) is counted. When a severely errored second (SES) is counted, the coding violations (CV) count is inhibited. The errored seconds (ES) and severely errored seconds (SES) counts continue to be accumulated until an unavailable second (UAS) is counted. When an unavailable second (UAS) is counted, the coding violations (CV), errored seconds (ES), and severely errored seconds (SES) counts are inhibited.

The unavailable seconds (UAS) and protection switch count (PSC-L) parameter counts are not inhibited.

Performance-Monitoring Parameter Thresholds

The current quarter-hour and current day thresholds for each performance-monitoring parameter are provisionable using the CIT. Whenever the current quarter-hour or the current day threshold for a given performance-monitoring parameter is reached or exceeded, the FT-2000 OC-48 Add/Drop-Rings Terminal generates a threshold crossing alert (TCA). The TCA is then entered into the appropriate performance-monitoring report. For more information about provisioning thresholds using the CIT, refer to the **PERFORMANCE-Set-PM Threshold-Optics**, **PERFORMANCE-Set-PM Threshold-Section**, **PERFORMANCE-Set-PM Threshold-Line**, **PERFORMANCE-Set-PM Threshold-STs1**, **PERFORMANCE-Set-PM Threshold-EC1**, and **PERFORMANCE-Set-PM Threshold-T3** inputs in the "Local Provisioning" part of Section 8, "Administration and Provisioning." Also refer to the **PERFORMANCE-Retrieve-PM Threshold-Optics**, **PERFORMANCE-Retrieve-PM Threshold-Section**, **PERFORMANCE-Retrieve-PM Threshold-Line**, **PERFORMANCE-Retrieve-PM Threshold-STs1**, **PERFORMANCE-Retrieve-PM Threshold-EC1**, and **PERFORMANCE-Retrieve-PM Threshold-T3** inputs in Section 11, "Craft Interface Terminal Usage."

Threshold Crossing Alert Transmission to an OS

Threshold crossing alerts are also reported to an OS via the X.25 interface using TL1 messages.

Reports

Active Alarms and Status

The FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay provide a report that shows all the local active alarm and status conditions. The FT-2000 OC-48 Add/Drop-Rings Terminal also provides a report that shows the active alarm level at each FT-2000 OC-48 Add/Drop-Rings Terminal with active alarm and status conditions. This report also shows the actual alarm and status conditions at FT-2000 OC-48 Repeater Bays with active conditions.

The local active alarms and status report is automatically displayed on the CIT immediately after a user logs in. The report shows the following alarm levels:

- Critical (CR)
- Major (MJ)
- Minor (MN)
- Abnormal (ABN)
- Near-end activity (NE ACTY).

The source address and description of the alarm condition (for example, controller failure, incoming high-speed signal failure, etc.) are included in the report, along with the date and time detected. The report also shows if the condition affects service. The option to display specified subsets of conditions by alarm level is also provided.

If no LEDs are lighted on the user panel (no active conditions), the report states "There are no active alarms or status conditions."

If the NE ACTY LED is lighted at the local FT-2000 OC-48 Repeater Bay or FT-2000 OC-48 Add/Drop-Rings Terminal, use the local active alarm and status report. For more information, refer to the **FAULT-Retrieve-Alarm (and Status)**, inputs in Section 11, "Craft Interface Terminal Usage."

Provisioning Reports

Provisioning reports list the current state of all provisionable options in the FT-2000 OC-48 Lightwave System. For more information, refer to the following inputs in Section 11, "Craft Interface Terminal Usage" within the **CONFIGURATION** category:

Retrieve-Assignment-DCC	Retrieve-Attribute-Alarm
Retrieve-Attribute-Control	Retrieve-Attribute-Environment
Retrieve-Circuit-STs1	Retrieve-Crossconnection-All
Retrieve-Crossconnection-TIRKS	
Retrieve-Date	Retrieve-EC1
Retrieve-Equipment	Retrieve-Low Speed
Retrieve-Map-Neighbor	Retrieve-Map-Network
Retrieve-Map-Ring	
Retrieve-OC12	Retrieve-OC3
Retrieve-OC48	Retrieve-Path-Trace
Retrieve-Protection-Line	Retrieve-Protection-Low Speed
Retrieve-Protection-STs1	Retrieve-Synchronization
Retrieve-T3	Retrieve-Timeslot-STs1
Retrieve-ULSDCC-L3	Retrieve-ULSDCC-L4

Also refer to the following inputs in Section 11, "Craft Interface Terminal Usage" within the **SECURITY** category:

Retrieve-Security-Network Element
Retrieve-Security-Port
Retrieve-Login
Retrieve-Network Element

Also refer to the **FAULT-Retrieve-State** input in Section 11, "Craft Interface Terminal Usage."

Performance Monitoring

The FT-2000 OC-48 Add/Drop-Rings Terminal provides a report that contains a snapshot of all the performance-monitoring registers at the time the report is requested. The time each register was last reinitialized is also included. The report contains a summary of all requested performance parameters that have crossed their quarter-hour and day threshold within the last 24 hours. For more information, refer to the **PERFORMANCE-Retrieve-PM-Line**, **PERFORMANCE-Retrieve-PM-Threshold-Line**, **PERFORMANCE-Retrieve-PM-Optics**, **PERFORMANCE-PM-Threshold-Optics**, **PERFORMANCE-Retrieve-PM-Section**, **PERFORMANCE-PM-Threshold-Section**, **PERFORMANCE-Retrieve-PM-STs1**, **PERFORMANCE-Retrieve-PM-Threshold-STs1**, **PERFORMANCE-Retrieve-PM-EC1**, **PERFORMANCE-Retrieve-PM-Threshold-EC1**, **PERFORMANCE-Retrieve-PM-Start Time**, **PERFORMANCE-Retrieve-PM-STs1**, **PERFORMANCE-Retrieve-PMMode-T3**, **PERFORMANCE-Retrieve-PM-T3**, and **PERFORMANCE-Retrieve-PM-Threshold-T3** inputs in Section 11, "Craft Interface Terminal Usage."

State

An on-demand report displays the state of each addressed slot and the external DS1 references in the FT-2000 OC-48 Add/Drop-Rings Terminal. For each slot and external DS1 reference, the report includes the following:

- Address: This shows the slot or external DS1 reference address.
- Circuit pack: This shows the functional name of the circuit pack.
- Port state: This shows the state of low-speed ports as AUTO, NMON, or IS. The port states for the add (from the cross-connect) and drop (from the OC-48 line) directions are shown separately. For more information about circuit pack slot and low-speed port states and transitions, refer to Section 8, "Administration and Provisioning."
- Switch state: This shows whether the circuit pack or external DS1 reference is active (carrying traffic or providing timing) or standby (not in use).
- Switch priority: This shows the priority of an automatic protection switch, manual switch, an inhibit switch, or a lockout switch.
- Active switch priority: This shows the current protection switching priority of circuit pack or external DS1 reference. The "ring" designation for a high-speed switch priority means that the circuit pack is signaling a switch request for a switch at the other side of the node or at another node. An external high-speed switch request results in an "ne" (near end) designation at the node where the request was entered, and a "fe" (far end) designation at the other end of the line. If the same priority request was entered at both ends of a line, both ends show "ne."

- Deferred switch priority: This shows the priority of any pending switch request for a circuit pack or external DS1 reference.

For more information, refer to the **FAULT-Retrieve-State** input in Section 11, "Craft Interface Terminal Usage."

Version/Equipment List

The version/equipment list report is an on-demand report that lists the circuit pack version and the software release (if applicable) for the FT-2000 OC-48 Add/Drop-Rings Terminal and FT-2000 OC-48 Repeater Bay. This report also lists all the circuit packs that are present. For more information, refer to the **CONFIGURATION-Retrieve-Equipment** input in Section 11, "Craft Interface Terminal Usage."

Synchronization Report

The synchronization report is an on-demand report that lists the status of the system synchronization at the FT-2000 OC-48 Add/Drop-Rings Terminal. This report lists all the clock parameters that can be interrogated from a craft interface terminal or from remote telemetry. For more information, refer to the **CONFIGURATION-Retrieve-Synchronization** input in Section 11, "Craft Interface Terminal Usage."

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Overview

This section contains the technical specifications for the FT-2000 OC-48 Lightwave System. Bellcore Technical Reference 253 (GR-253-CORE) is the basis for this information.

Optical Line Interface

Optical Output.....	2.488 Gb/s
Optical Line Code	Scrambled nonreturn to zero (NRZ)

Optical Connector Interfaces

The OC48 Transmitter, OC48 Receiver, and OC48 Regenerator circuit packs use ST® lightguide connectors (standard), FC/PC lightguide connectors, or SC lightguide connectors.

Transmission Medium

Single-Mode Fiber

Lightguide Jumpers

Single-mode lightguide jumpers are used on the OC48 Transmitter, OC48 Receiver, and OC48 Regenerator circuit packs.

Optical Source

Distributed Feedback (DFB) Laser

Optical Detector

Avalanche Photodiode (APD)

Optical Safety (CDRH Classification)

OC-48 standard performance (1.310 μm)	Class IIIB
OC-48 high performance (1.310 μm)	Class IIIB
OC-48 standard performance (1.550 μm)	Class I
OC-48 WDM/LBA compatible (1.538 μm)	Class I
OC-48 WDM/LBA compatible (1.558 μm)	Class I
OC-48 739E_ standard performance (1.5 μm)	Class I
OC-48 739G_ high performance (1.5 μm)	Class I

Operating Wavelength

739B_/C_	1.310 μm ($\pm 0.020 \mu\text{m}$)
739J_/P_	1.550 μm ($\pm 0.015 \mu\text{m}$)
739R2	1.538 μm ($\pm 0.003 \mu\text{m}$)
739S2	1.558 μm ($\pm 0.003 \mu\text{m}$)
739E1/G1	1.549315 μm
739E2/G2	1.550918 μm
739E3/G3	1.552524 μm
739E4/G4	1.554134 μm
739E5/G5	1.555747 μm
739E6/G6	1.557363 μm
739E7/G7	1.558983 μm
739E8/G8	1.560606 μm
739H1	1560.61 μm
739H2	1558.98 μm
739H3	1557.36 μm
739H4	1555.75 μm
739H5	1552.52 μm
739H6	1550.92 μm
739H7	1549.32 μm
739H8	1547.72 μm
739H9	1542.94 μm
739H10	1541.35 μm
739H11	1539.77 μm
739H12	1538.19 μm
739H13	1535.04 μm
739H14	1533.47 μm
739H15	1531.90 μm
739H16	1530.33 μm

Optical Dispersion

OC-48 standard performance (1.310 μm)	300 ps/nm
OC-48 high performance (1.310 μm)	300 ps/nm
OC-48 standard performance (1.550 μm)	1800 ps/nm
OC-48 WDM/LBA compatible (1.538 μm)	2520 ps/nm
OC-48 WDM/LBA compatible (1.558 μm)	2520 ps/nm
OC-48 739E_ TRMTR (1.550 μm)	6800 ps/nm
OC-48 739G_ TRMTR (1.550 μm)	10900 ps/nm
OC-48 739H_ TRMTR (1.550 μm)	1560 ps/nm

Optical Return Loss

Maximum system optical return loss	24.0 dB
Maximum receiver reflectance	-27.0 dB
Maximum discrete reflectance.....	-27.0 dB

Lucent Technologies has a computer tool that determines in-depth return loss characteristics. Users who have concerns about return loss limitations should contact their local Account Executive.

Outside Plant Loss

OC-48 standard performance (1.310 μm)	24.0 dB
OC-48 high performance (1.310 μm)	27.0 dB
OC-48 standard performance (1.550 μm)	23.0 dB
OC-48 WDM/LBA compatible (1.538 μm)	20.5 dB
OC-48 WDM/LBA compatible (1.558 μm)	20.5 dB

Optical Line Loss Budgets

FT-2000 OC-48 Lightwave System

The FT-2000 OC-48 Lightwave System is designed to meet the OC-48 loss budget specifications shown in Table 10-1, Table 10-2, and Table 10-3. The transmit and receive powers are referenced to points S and R in Figure 10-1.

Table 10-1. OC-48 Loss Budget Specifications

Parameter	1.310 μm		1.550 μm Performance
	Standard Performance	High Performance	
Maximum Transmitter Power (P_{Tmax}) [*]	2.5 dBm	5.5 dBm	4.0 dBm
Minimum Transmitter Power (P_{Tmin}) [†]	−2.0 dBm	1.0 dBm	−2.0 dBm
Maximum Received Power (P_{Rmax}) [‡]	−10.0 dBm	−10.0 dBm	−9.0 dBm
Receiver Sensitivity (P_{Rmin}) [§]	−27.0 dBm	−27.0 dBm	−27.0 dBm
Minimum System Gain (S-R)	+25.0 dB	28.0 dB	25.0 dB
Optical Path Penalty (P_{O})	1.0 dB	1.0 dB	2.0 dB
Maximum Loss Budget	24.0 dB	27.0 dB	23.0 dB
Minimum Loss Budget [¶]	10.0 dB	10.0 dB	10.0 dB

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† These values include transmitter/receiver connectors @ 0.7 dB each (worst case) and the system margins

‡ The receiver sensitivity and maximum received power values are measured at a Bit-Error-Rate (BER) of 1×10^{-10} .

§ The 1.5 μm Standard Performance optics is dispersion limited to 92 kilometers.

¶ The 1.5 μm Standard Performance optics is dispersion limited to 92 kilometers.

For detailed circuit pack information and software compatibility, refer to Table 7-1 and the circuit pack descriptions in Section 7, "Circuit Pack Descriptions."

Table 10-2. OC-48 Loss Budget Specifications (739E/G[1-8] OC48 TRMTR Circuit Packs)

Parameter	OC48 Transmitter Circuit Pack Wavelength							
	W1	W2	W3	W4	W5	W6	W7	W8
Maximum Transmitter Power (P_{Tmax})*	-3.3 dBm	-4.6 dBm	-5.8 dBm	-6.5 dBm	-6.5 dBm	-7.2 dBm	-7.3 dBm	-5.0 dBm
Minimum Transmitter Power (P_{Tmin})†	-6.2 dBm	-7.5 dBm	-8.7 dBm	-9.4 dBm	-9.9 dBm	-10.4 dBm	-10.7 dBm	-8.7 dBm
Maximum Received Power (P_{Rmax})‡	-11.0 dBm	-11.0 dBm	-11.0 dBm	-11.0 dBm	-11.0 dBm	-11.0 dBm	-11.0 dBm	-11.0 dBm
Receiver Sensitivity (P_{Rmin})†‡	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm
Minimum System Gain (S-R)	20.8 dB	19.5 dB	18.3 dB	17.6 dB	17.1 dB	16.6 dB	16.3 dB	18.3 dB
Optical Path Penalty (P_O)	0.05 dB	0.05 dB	0.05 dB	0.05 dB	0.05 dB	0.05 dB	0.05 dB	0.05 dB
Maximum Loss Budget	20.3 dB	19.0 dB	17.8 dB	17.1 dB	16.6 dB	16.1 dB	15.8 dB	17.8 dB
Minimum Loss Budget	10.0 dB	10.0 dB	10.0 dB	10.0 dB	10.0 dB	10.0 dB	10.0 dB	10.0 dB
Typical Maximum Distance	81.2 km	76 km	71.2 km	68.4 km	66.4 km	64.4 km	63 km	71.2 km

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† These values include transmitter/receiver connectors @ 0.7 dB each (worst case) and the system margins.

‡ The receiver sensitivity and maximum received power values are measured at a BER of 1×10^{-10} .

§ These values assume that the maximum received power limitations are not exceeded.

¶ These distances are based on an assumption of 0.25 dB/km loss, including fiber loss and splice loss.

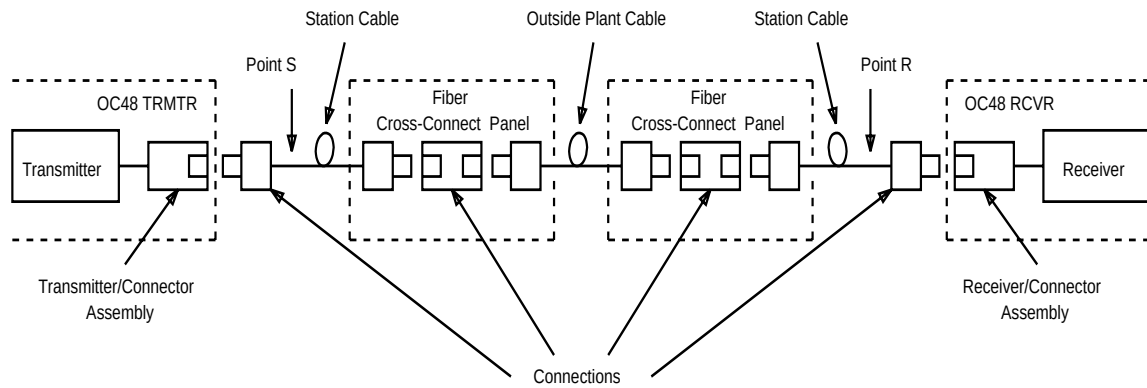


Figure 10-1. Optical System Interfaces

FT-2000 OC-48 Lightwave System and FT-Lightwave Booster Amplifier

The FT-2000 OC-48 Lightwave System is also designed to meet the OC-48 loss budget specifications shown in Table 10-3 when operating with the FT-Lightwave Booster Amplifier.

Table 10-3. FT-2000 OC-48 Lightwave System and FT-Lightwave Booster Amplifier Loss Budgets

Parameter	9-dBm FT-LBA		12-dBm FT-LBA		16-dBm FT-LBA	
	Standard Fiber	Dispersion Shifted Fiber	Standard Fiber	Dispersion Shifted Fiber	Standard Fiber	Dispersion Shifted Fiber
Maximum Transmitter Power (PTmax)	11.0 dBm	11.0 dBm	15.0 dBm	15.0 dBm	17.0 dBm	17.0 dBm
Nominal Transmitter Power	9.0 dBm	9.0 dBm	12.0 dBm	12.0 dBm	16.0 dBm	16.0 dBm
Minimum Transmitter Power (PTmin)*	7.0 dBm	7.0 dBm	10.0 dBm	10.0 dBm	14.0 dBm	14.0 dBm
Receiver Sensitivity (PRmin)*	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm	-27.0 dBm
Minimum System Gain (S-R)	34.0 dB	34.0 dB	37.0 dB	37.0 dB	41.0 dB	41.0 dB
Optical Path Penalty (PO)	2.0 dB	1.0 dB	2.0 dB	1.0 dB	2.0 dB	1.0 dB
Maximum Loss Budget	32.0 dB	33.0 dB	35.0 dB†	36.0 dB†	39.0 dB†	40.0 dB†
Dispersion Limit	120 km‡	—	140 km§	—	140 km§	—

* These values include transmitter/receiver connectors @ 0.7 dB each (worst case) and the system margins.

† Optional: Subtract 3.5 dB for pump redundancy.

‡ These values are based on a system performance of 2100 psec/nm which yields 120 km for a fiber dispersion of 18 psec/nm km.

§ These values are based on a system performance of 2520 psec/nm which yields 140 km for a fiber dispersion of 18 psec/nm km.

FT-2000 OC-48 Lightwave System and Wavelength Division Multiplexing Systems

The FT-2000 OC-48 Lightwave System is also designed to meet the OC-48 loss budget specifications shown in Table 10-4 when operating with wavelength division multiplexing (WDM) systems.

Table 10-4. FT-2000 OC-48 Lightwave System and Wavelength Division Multiplexing Systems Loss Budgets

Parameter	OC48 TRMTR (A/D 1.5 LBA, W1 and W2) OC48 TRMTR (A/D STS1 1.5 LBA, W1 and W2)
Maximum Transmitter Power (P_{Tmax})*	3.3 dBm
Minimum Transmitter Power (P_{Tmin})†	0.0 dBm
Maximum Received Power (P_{Rmax})‡	-11.0 dBm
Receiver Sensitivity (P_{Rmin})†‡	-27.0 dBm
Minimum System Gain (S-R)	27.0 dB
MXR/DMXR Loss	4.5 dB
Optical Path Penalty (P_O)	2.0 dB
Maximum Loss Budget§	20.5 dB
Minimum Loss Budget¶	10.0 dB
Optical Dispersion	2520 ps/nm

*Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

†These values include transmitter/receiver connectors @ 0.7 dB each (worst case) and the system margins.

‡ The receiver sensitivity and maximum received power values are measured at a BER of 1×10^{-10} .

§ The 1.5 μm Standard Performance optics is dispersion limited to 92 kilometers.

¶ These values assume that the maximum received power limitations are not exceeded.

FT-2000 OC-48 Lightwave System with Wavelength Division Multiplexing and FT-LBA Systems

The FT-2000 OC-48 Lightwave System is also designed to meet the OC-48 loss budget specifications shown in Table 10-5 when operating with wavelength division multiplexing (WDM) systems and the FT-LBA (+16 dBm system).

Table 10-5. FT-2000 OC-48 Lightwave System with Wavelength Division Multiplexing Systems and FT-LBA Loss Budgets

Parameter	OC48 TRMTR (A/D 1.5 LBA, W1 and W2) OC48 TRMTR (A/D STS1 1.5 LBA, W1 and W2)
Maximum Transmitter Power (P_{Tmax})*	17.0 dBm
Minimum Transmitter Power (P_{Tmin})†	14.0 dBm
Minimum Transmitter Power per Channel	11.0 dBm
Maximum Received Power (P_{Rmax})‡	-11.0 dBm
Receiver Sensitivity (P_{Rmin})†‡	-27.0 dBm
Minimum System Gain (S-R)	38.0 dB
FT-LBA Asymmetric Gain Penalty	2.5 dB
DMXR Loss	2.5 dB
Optical Path Penalty (P_O)	2.0 dB
Maximum Loss Budget§	31.0 dB
Minimum Loss Budget¶	10.0 dB
Optical Dispersion	2520 ps/nm

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† These values include transmitter/receiver connectors @ 0.7 dB each (worst case) and the system margins.

‡ The receiver sensitivity and maximum received power values are measured at a BER of 1×10^{-10} .

§ The 1.5 μm Standard Performance optics is dispersion limited to 92 kilometers.

¶ These values assume that the maximum received power limitations are not exceeded.

Transmission Distances

FT-2000 OC-48 Lightwave System without Optical Amplifiers

Table 10-6 shows the transmission distances of the FT-2000 OC-48 Lightwave System without optical amplifiers (for example, the FT-Lightwave Booster Amplifier).

Table 10-6. Transmission Distances without Optical Amplifiers

Circuit Pack	Loss Budget	Standard Fiber (Note 1)	Low Loss Fiber (Note 2)	Dispersion-Shifted Fiber (Note 3) (Note 4)
OC48 TRMTR (A/D 1.3 STD)	24 dB	53 km	64 km	—
OC48 TRMTR (A/D STS1 1.3 STD)		33 miles	40 miles	
OC48 TRMTR (A/D 1.3 HI PERF)	27 dB	60 km	72 km	—
OC48 TRMTR (A/D STS1 1.3 HI PERF)		37 miles	45 miles	
OC48 TRMTR (A/D 1.5 STD)*	23 dB (SF)	92 km	105 km	96 km
OC48 TRMTR (A/D STS1 1.5 STD)	24 dB (DSF)	57 miles	65 miles	60 miles
OC3 (1.3 STD)	23 dB	51 km 32 miles	61 km 38 miles	—
OC12 (1.3 STD)	23 db	51 km 32 miles	61 km 38 miles	—
OC48 739E_ TRMTR (A/D 1.5 STD)	23 db			
OC48 739G_ TRMTR (A/D 1.5 STD)	23 db			
OC48 739H_ TRMTR (A/D 1.5 STD)	23 db			

Notes:

- Standard fiber assumes the following fiber loss (including splice loss) with a dispersion limit of 18 psec/nm per kilometer:
1.3 μm — 0.45 dB/km
1.5 μm — 0.25 dB/km.
- Low loss fiber assumes the following fiber loss (including splice loss) with a dispersion limit of 18 psec/nm per kilometer:
1.3 μm — 0.375 dB/km
1.5 μm — 0.22 dB/km.
- Dispersion-shifted fiber assumes a 0.25 dB/km loss at 1.5 μm .
- Only 1.5 μm transmitters will work with dispersion-shifted fiber.

* The dispersion limit only applies to the OC48 TRMTR (A/D 1.5 STD) circuit pack using standard fiber. The limit is 1800 psec/nm or 100 km.

FT-2000 OC-48 Lightwave System and the FT-Lightwave Booster Amplifier

Table 10-7 shows the transmission distances of the FT-2000 OC-48 Lightwave System with the FT-Lightwave Booster Amplifier.

Table 10-7. Transmission Distances with the FT-Lightwave Booster Amplifier

FT-LBA Loss Budget		Dispersion Limit (Note 1)		Maximum Distance		
				Standard Fiber (SF) (Note 2)		Dispersion-Shifted Fiber (DSF) (Note 3)
		OC48 TRMTR (A/D 1.5 STD)	OC48 TRMTR A/D (1.5 LBA) (1.5 LBA, W1) (1.5 LBA, W2) (STS1 1.5 LBA, W1) (STS1 1.5 LBA, W2) (Note 4)	OC48 TRMTR (A/D 1.5 STD)	OC48 TRMTR A/D (1.5 LBA) (1.5 LBA, W1) (1.5 LBA, W2) (STS1 1.5 LBA, W1) (STS1 1.5 LBA, W2) (Note 4)	OC48 TRMTR A/D (1.5 STD) (1.5 LBA) (1.5 LBA, W1) (1.5 LBA, W2) (STS1 1.5 LBA, W1) (STS1 1.5 LBA, W2)
9 dBm	32 dB (SF) 33 dB (DSF)	1800 psec/nm 100 km	2160 psec/nm 120 km	100 km 62 miles	120 km 75 miles	132 km 82 miles
12 dBm	35 dB (SF) 36 dB (DSF)	1800 psec/nm 100 km	2510 psec/nm 140 km	100 km 62 miles	140 km 87 miles	144 km 89 miles
16 dBm	39 dB (SF) 40 dB (DSF)	1800 psec/nm 100 km	2520 psec/nm 140 km	100 km 62 miles	140 km 87 miles	160 km 99 miles

Notes:

1. This dispersion limit applies only to 1.5 μ m STD and LBA performance transmitters used with standard fiber.
2. Standard fiber assumes a dispersion limit of 18 psec/nm per km. It also assumes a fiber loss (including splice loss) of 0.25 dB/km at 1.5 μ m.
3. Dispersion-shifted fiber assumes a 0.25 dB/km loss at 1.5 μ m. On dispersion-shifted fiber, both versions of the 1.5 μ m transmitters support the same distance.
4. The 1.5 μ m LBA transmitter is screened for dispersion.

FT-2000 OC-48 Lightwave System with Wavelength Division Multiplexing and FT-LBA Systems

Table 10-8 shows the transmission distances of the FT-2000 OC-48 Lightwave System with wavelength division multiplexing only, and with wavelength division multiplexing and the FT-Lightwave Booster Amplifier.

Table 10-8. Transmission Distances with Wavelength Division Multiplexing and the FT-LBA

OC48 TRMTR A/D (1.5 LBA, W1 and W2) (STS1 1.5 LBA, W1 and W2) Circuit Packs (Note 1)	Loss Budget	Standard Fiber (SF) (Note 2)	Low Loss Fiber (LLF) (Note 3)	Dispersion- Shifted Fiber (DSF) (Note 4) (Note 5)
Used with Wavelength Division Multiplexing	20.5 dB (SF, LLF) 21.5 dB (DSF)	82 km 51 miles	93 km 58 miles	86 km 53 miles
Used with Wavelength Division Multiplexing and FT-LBA	31.0 dB (SF, LLF)	124 km 77 miles	140 km 87 miles	—

Notes:

1. The dispersion limit only applies to the 1.5 μ m standard performance transmitters using standard fiber. The limit is 2520 psec/nm or 140 km.
2. Standard fiber assumes the following fiber loss (including splice loss) with a dispersion limit of 18 psec/nm per kilometer:
1.3 μ m — 0.45 dB/km
1.5 μ m — 0.25 dB/km.
3. Low loss fiber assumes the following fiber loss (including splice loss) with a dispersion limit of 18 psec/nm per kilometer:
1.3 μ m — 0.375 dB/km
1.5 μ m — 0.22 dB/km.
4. Dispersion-shifted fiber assumes a 0.25 dB/km loss at 1.5 μ m.
5. Only 1.5 μ m transmitters will work with dispersion-shifted fiber. On dispersion-shifted fiber, both versions of 1.5 μ m transmitters support the same distances.

Capacity

48 DS3 Equivalent Signals (32,256 two-way voice circuits per fiber pair)

Transmission Characteristics

The FT-2000 OC-48 Lightwave System meets single-mode interoffice digital fiber optic systems requirements and objectives as specified in GR-253-CORE and TR 499.

Error Rate	<10 ⁻⁹ accumulated error rate for systems up to 400 kilometers (250 miles)
Maximum Repeater Spacing	60 kilometers at 1.3 μ m on 0.46 dB/km fiber
Maximum Repeater Spacing	92 kilometers at 1.5 μ m on 0.28 dB/km fiber (dispersion limited)

DS3 Access

Interface.....	Standard DS3 interface as specified in T1.102-1987
Growth Increment.....	Three DS3s per circuit pack; ports can be provisioned one at a time
Line Code	Bipolar 3-zero substitution (B3ZS)
Protection Ratio	1xM (M $\leq$ 16)



CAUTION:

All DS3 signal outputs from the FT-2000 OC-48 Lightwave System must be properly terminated at all times. Therefore, these outputs must be connected to DSX-3 cross-connect panels that have internal 75-ohm terminations (for example, Lucent Technologies cross-connect panels meet this requirement) or other working transmission equipment (for example, DACS III-2000 Cross-Connect System or DDM-2000 Multiplexer) where the associated low speed interfaces are equipped. When operating the FT-2000 OC-48 Lightwave System with cross-connect panels that do not automatically terminate the DS3 signal outputs, 75-ohm termination plugs must be placed at the cross-connect panel.

It is recommended that DS3 output ports be terminated properly. However, if unterminated ports in the drop direction (from OC-48 line) are in the AUTO state, false trouble conditions will not be reported by the FT-2000 OC-48 Add/Drop-Rings Terminal.

EC-1 Access

Interface.....	Standard EC-1 interface as specified by GR-253-CORE and T1X1.4
Growth Increment.....	Three EC-1s per circuit pack; ports can be provisioned one at a time
Line Code	Scrambled B3ZS
Protection Ratio	1xM (M≤16)



CAUTION:

All EC-1 signal outputs from the FT-2000 OC-48 Lightwave System must be properly terminated at all times. Therefore, these outputs must be connected to STSX-1 cross-connect panels that have internal 75-ohm terminations (for example, Lucent Technologies cross-connect panels meet this requirement) or other working transmission equipment (for example, DACS III-2000 Cross-Connect System or DDM-2000 Multiplexer) where the associated low speed interfaces are equipped. When operating the FT-2000 OC-48 Lightwave System with cross-connect panels that do not automatically terminate the EC-1 signal outputs, 75-ohm termination plugs must be placed at the cross-connect panel.

It is recommended that EC-1 output ports be terminated properly. If unterminated ports in the drop direction (from OC-48 line) are in the AUTO state, false trouble conditions will not be reported by the FT-2000 OC-48 Add/Drop-Rings Terminal.

OC-3 Access

Optical Line Interface

Optical output.....	155.52 Mb/s
Optical line code	Scrambled nonreturn to zero (NRZ)
Growth Increment	One OC-3 per circuit pack
Protection Ratio	1+1



NOTE:

The protection ratio of 1+1 is not valid when two adjacent slots of an OC-3 Optical Interface are equipped with both an OC-3 (1.3 STD) LAA10 circuit pack and an OC-3 (1.3 STD) LAA10B circuit pack. To operate in a 1+1 configuration, both adjacent slots (for example, 2A and 2B) **MUST** be equipped with either the LAA10 or the LAA10B, but not a mix of the two.

The OC3 Optical Interface - 1.3 μ m Standard Performance [OC3 (1.3 STD)] circuit pack complies with the OC-3 short reach and intermediate reach optical interface standards (TR-253). The OC3 (1.3 STD) circuit pack also supports applications with span lengths up to 51 kilometers.

Optical Connector Interfaces

The OC3 (1.3 STD) circuit pack uses *ST* lightguide connectors (standard), *FC/PC* lightguide connectors, or *SC* lightguide connectors.

Transmission Medium

Single-mode fiber or multimode fiber

Lightguide Jumpers

Single-mode or multimode lightguide jumpers

Optical Source

Multi-longitudinal mode (MLM) laser

Optical Detector

PIN diode

Optical Safety (BRH Classification)

OC-3 standard performance (1.31 μm) Class I

Operating Wavelength

OC-3 receiver	1.31 μm +0.070 or –0.050 μm
OC-3 transmitter	1.31 μm +0.040 or –0.038 μm

Spectral Width

3.0 nm (RMS)

Optical Dispersion

OC-3 standard performance (1.31 μm) 270 ps/nm

OC-3 Line Loss Budgets

The FT-2000 OC-48 Lightwave System is designed to meet the OC-3 loss budget specifications shown in Table 10-9. The transmit and receive powers are referenced to points S and R in Figure 10-1.

Table 10-9. OC-3 Line Loss Budget Specifications (Note)

Parameter	1.31 μ m Standard Performance
Maximum Transmitter Power (P_{Tmax})*	0.0 dBm
Minimum Transmitter Power (P_{Tmin})	-7.0 dBm
Maximum Received Power (P_{Rmax})	-7.0 dBm
Receiver Sensitivity (P_{Rmin})	-34.0 dBm
Minimum System Gain (S-R)†	27.0 dB
Optical Path Penalty (P_O)‡	1.0 dB
Connector Loss§	1.5 dB
Unallocated Margin¶	1.5 dB
Maximum Loss Budget**	23.0 dB
Minimum Loss Budget	7.0 dB

Note: The output of the OC3 (1.3 STD) circuit pack is shipped with a 7.1-dB LBO. For spans greater than 15-dB, replace the 7.1-dB LBO with a 0-dB LBO. The 7.1-LBO (or equivalent) optical attenuation must be used for optical loopbacks.

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† The minimum system gain allows for account aging, temperature, and manufacturing tolerances (these figures are built into the minimum transmitter power).

‡ Optical path penalty includes the effects of dispersion, reflection, and jitter that occur on the optical path.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is usually used for fiber repairs. This can be used to increase the loss budget if needed.

** The budget is available for both station and transmission cable and splices.

IS-3 Access

Optical Line Interface

Optical output	155.52 Mb/s
Optical line code	Scrambled nonreturn to zero (NRZ)
Growth Increment	One IS-3 per circuit pack
Protection Ratio	1+1

The IS3 Optical Interface (IS3) circuit pack supports intraoffice signal transmission distances up to 2000 feet. The IS-3 signal is based on proprietary optical specifications that are common across the SONET family of products.

Optical Connector Interfaces

The IS3 circuit pack uses *ST* lightguide connectors (standard), *FC/PC* lightguide connectors, or *SC* lightguide connectors.

Transmission Medium

Multimode fiber

Lightguide Jumpers

Multimode lightguide jumpers

Optical Source

LED

Optical Detector

PIN diode

Optical Safety (BRH Classification)

IS3 Optical Interface Class I

Operating Wavelength

IS-3 1.31 μm +0.070 or –0.040 μm

Spectral Width

170.0 nm (RMS)

Optical Dispersion

IS-3 (1.31 μm)..... 270 ps/nm

IS-3 Line Loss Budgets

The FT-2000 OC-48 Lightwave System is designed to meet the IS-3 loss budget specifications shown in Table 10-10. The transmit and receive powers are referenced to points S and R in Figure 10-1.

Table 10-10. IS-3 Line Loss Budget Specifications

Parameter	1.31 μm Standard Performance
Maximum Transmitter Power ($P_{T\text{max}}$)*	−14.0 dBm
Minimum Transmitter Power ($P_{T\text{min}}$)	−20.8 dBm
Maximum Received Power ($P_{R\text{max}}$)	−14.0 dBm
Receiver Sensitivity ($P_{R\text{min}}$)	−30.8 dBm
Minimum System Gain (S-R)†	10.0 dB
Optical Path Penalty (P_O)‡	1.0 dB
Connector Loss§	1.5 dB
Unallocated Margin¶	2.0 dB
Maximum Loss Budget**	5.5 dB
Minimum Loss Budget	0.0 dB

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† The minimum system gain allows for account aging, temperature, and manufacturing tolerances (these figures are built into the minimum transmitter power).

‡ Optical path penalty includes the effects of dispersion, reflection, and jitter that occur on the optical path.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is usually used for fiber repairs. This can be used to increase the loss budget if needed.

** The budget is available for both station and transmission cable and splices.

OC-12 Access

Optical Line Interface

Optical output.....	622.08 Mb/s
Optical line code	Scrambled nonreturn to zero (NRZ)
Growth Increment	One OC-12 per circuit pack
Protection Ratio	0x1
Protection Ratio	1+1

The OC12 Optical Interface - 1.3 μ m Standard Performance [OC12 (1.3 STD)] circuit pack complies with the OC-12 long reach standard (GR-253-CORE).

Optical Connector Interfaces

The OC12 (1.3 STD) circuit pack uses *ST* lightguide connectors (standard), *FC*/*PC* lightguide connectors, or *SC* lightguide connectors.

Transmission Medium

Single-mode fiber or multimode fiber

Lightguide Jumpers

Single-mode or multimode lightguide jumpers

Optical Source

InGaAsP, Multi-longitudinal mode (MLM) laser

Optical Detector

PIN diode

Optical Safety (BRH Classification)

OC-12 standard performance (1.31 μm) Class I

Operating Wavelength

OC-12 1.31 μm +0.015 or –0.012 μm

Spectral Width

2.0 nm (RMS)

Optical Dispersion

OC-12 standard performance (1.31 μm) 270 ps/nm

OC-12 Line Loss Budgets

The FT-2000 OC-48 Lightwave System is designed to meet the OC-12 loss budget specifications shown in Table 10-11. The transmit and receive powers are referenced to points S and R in Figure 10-1.

Table 10-11. OC-12 Line Loss Budget Specifications

Parameter	1.31 mm Standard Performance
Maximum Transmitter Power (P_{Tmax})*	2.0 dBm
Minimum Transmitter Power (P_{Tmin})	-2.5 dBm
Maximum Received Power (P_{Rmax})	-8.0 dBm
Receiver Sensitivity (P_{Rmin})	-30.5 dBm
Minimum System Gain (S-R)†	28.0 dB
Optical Path Penalty (P_O)‡	2.0 dB
Connector Loss§	1.5 dB
Unallocated Margin¶	1.5 dB
Maximum Loss Budget**	23.0 dB
Minimum Loss Budget	10.0 dB

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

† The minimum system gain allows for account aging, temperature, and manufacturing tolerances (these figures are built into the minimum transmitter power).

‡ Optical path penalty includes the effects of dispersion, reflection, and jitter that occur on the optical path.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is usually used for fiber repairs. This can be used to increase the loss budget if needed.

** The budget is available for both station and transmission cable and splices.

OC-3 to IS-3 Interface Interconnection

For intraoffice applications, the OC-3 interface can interwork with another OC-3 interface or an IS-3 interface using multimode fiber.

The IS-3 interface is a Lucent Technologies proprietary interface that operates at the same rate and format as the OC-3 interface.

Table 10-12 shows the span maximum distances, using dispersion limited fiber, for OC-3 to OC-3 connections and OC-3 to IS-3 connections.

Table 10-12. Maximum Distances

Fiber (Note) Bandwidth	OC-3 to OC-3 Connections	OC-3 to IS-3 Connections
1000 MHz-km	6.5 km	3.4 km
800 MHz-km	5.1 km	3.3 km
500 MHz-km	3.1 km	2.7 km
300 MHz-km	1.8 km	1.9 km

For details (including LBO values) and ordering information about connecting to a DDM-2000 IS-3 interface, refer to 365-206-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*.

Transmission Delay

The FT-2000 OC-48 Add/Drop-Rings Terminal has the following worst-case measured one-way transmission delay times:

Add or Drop DS3 Circuit	8.2 μ sec
Add or Drop EC-1 Circuit	4.0 μ sec
Add or Drop OC-3 Circuit	4.5 μ sec
Add or Drop IS-3 Circuit	4.5 μ sec
Add or Drop OC-12 Circuit	4.5 μ sec
Through Circuit (OC-48 to OC-48)	5.2 μ sec

Protection Switching (OC-3, OC-12, OC-48 Lines)

Switching Bit Error Rate (BER)	10^{-5} to 10^{-9} (user provisionable)
Restoral BER	One-tenth of the switching BER
Switching Time	60 msec ($\text{BER} \geq 10^{-3}$ line signal failure)

Electrical Line Buildout Specifications

Electrical line buildouts may be required to be connected in series with the transmit LS INTFC cable connections depending on the application, cable type, and cable length associated with that particular LS INTFC cable. Table 10-13 shows when electrical line buildouts should be used based on the actual cable length (or equivalent measured signal level) for each transmit cable.

Table 10-13. Electrical Line Buildout Specifications

Application Connection to FT-2000	Length in Feet from FT-2000 Eqpt. to Connected Eqpt. for LS INTFC Signal In/Out Cables		LBO Req'd. for LS INTFC Signal Out Cable
	735A Cable (Note 1)	734D (Notes 2 and 3) or 735A/734D (Note 4) or 735A/734D/735A (Note 5) Combination Cable	
DS3 or EC-1 Cross-Connect Equipment	0-125	0-225*	Yes
	>125-250	>225-450	No
DACS III-2000, DACS IV-2000, DDM-2000, FT-2000, or Equiv. Non- Cross-Connect Equipment	0-125	0-225*	Yes
	>125-500	>225-900	No

Notes:

1. The exclusive use of 735A coaxial cable for connections between the FT-2000 and terminating equipment is strongly recommended. This is an important consideration when deciding office layout and equipment arrangements during site planning. Use the cable length figures in the table to aid in office layout.
2. 734D coaxial cable is electrically equivalent to 734A cable and has a silver coating on the center conductor to enhance crimping the connectors.
3. Direct connection of 734D cables to FT-2000 equipment is *not* recommended due to space limitations in the interconnection panel. 735A cables should be used for these connections.
4. If cable length requirements exceed the lengths specified for 735A cable, 735A/734D or 735A/734D/735A cable combinations may be used.

* This is a nonpreferred cable combination; a preferred cable type that does not require an LBO should be used in its place if possible.

Cable Access

- Rear only required for adding shelves or upgrading FT-2000 terminal bays
- Front for all customer access
- Connectorized cabling with commercially available connectors

Figure 10-2 depicts various “Inter-office” options for connecting two NEs via coaxial cable.

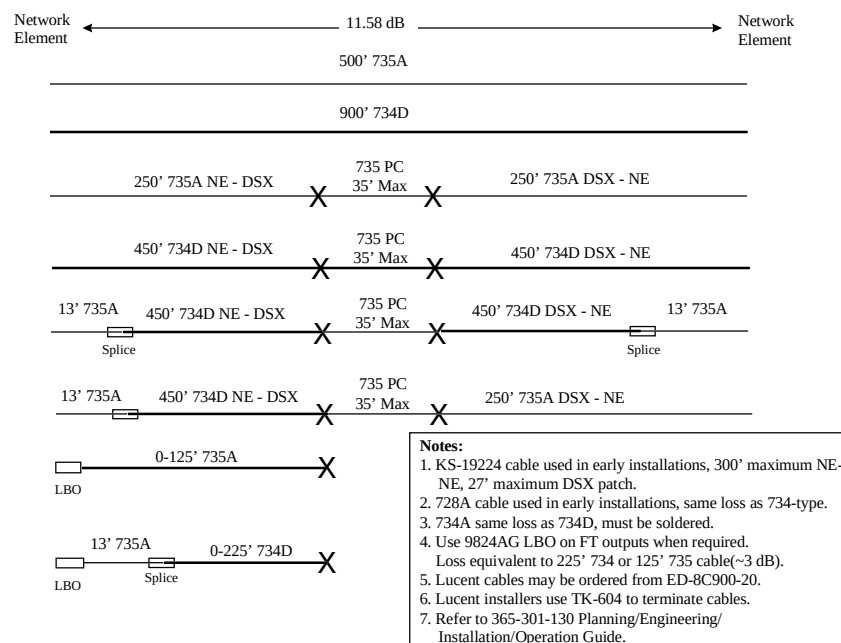


Figure 10-2. Common Coaxial Cable Interoffice Cross-Connect Options for DS-3 and STS-1E

Power Specifications

 **NOTE:**
Consult FPD 804-911-168 for complete engineering of battery plant and feeders.

Voltage Range, all components	–42.75 to –60 V DC
Power Feeders	Two –48 V power feeders ("A" and "B")
Fuse Size (per shelf) Maximum Power Dissipation	10 amps
— FT-2000 OC-48 Add/Drop-Rings Terminal	487 watts (69 watts/ft ²)
for 2-Fiber Rings	
— FT-2000 OC-48 Dual Lightwave	1000 watts (142 watts/ft ²)
Terminating Bay	
Current Drains per Feeder Cables	
Nominal (List 1 [*]) (@ –48 V DC)	
—FT-2000 OC-48 Add/Drop-Rings	5.1 amps
Terminal for 2-Fiber Ring	
—FT-2000 OC-48 Dual Lightwave Terminating Bay ..	10.4 amps
Maximum (List 2 [†]) (@ –42.75 V DC)	
—FT-2000 OC-48 Add/Drop-Rings	11.4 amps
Terminal for 2-Fiber Ring	
—FT-2000 OC-48 Dual Lightwave Terminating Bay ..	23.4 amps

* Nominal (List 1) current drains used to size batteries and rectifiers. To size batteries and rectifiers, use twice the nominal (List 1) current drain per feeder. These current drains represent the average busy-hour current at normal operating voltages.

† Maximum (List 2) current drains used to size each feeder cable and fuse. To size feeder cables and fuses, use the maximum (List 2) current drain per feeder. These current drains represent the peak current under worst-case operating conditions. Normally the current for the system is shared equally by both feeders. If one feeder fails, the other feeder carries the total load for both feeders (feeder A + feeder B current).

Bay/Shelf Dimensions

FT-2000 OC-48 Lightwave System Bays*	84 inches (213 cm) high 26 inches (66 cm) wide 12 inches (30 cm) deep
FT-2000 OC-48 Lightwave System Bays (Packaged)	33 inches (84 cm) high 90 inches (229 cm) wide 29 inches (74 cm) deep
Enhanced High-Speed Shelf.....	21.5 inches (54 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
Condensed High-Speed Shelf	14.3 inches (36 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
Low Speed Shelf—System Controller	21.5 inches (54 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
Low Speed Shelf—Complementary.....	21.5 inches (54 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
Repeater Shelf—System Controller.....	21.5 inches (54 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
FT-2000 OC-48 Repeater Shelf.....	25.5 inches (65 cm) high 21.5 inches (54 cm) wide 12 inches (30 cm) deep
PC Tray.....	4 inches (10 cm) high 21.5 inches (54 cm) wide 10 inches (25 cm) deep
Heat Baffle	4 inches (10 cm) high 21.5 inches (54 cm) wide 10 inches (25 cm) deep
Fan Assembly	4 inches (10 cm) high 21.5 inches (54 cm) wide 10 inches (25 cm) deep

Circuit Pack Dimensions

LAA2 DS3.....	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA4 STS1E	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA10/LAA10B OC3	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA5 IS3	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
T939A OC12	13 inches (32 cm) high 3.00 inch (7.5 cm) wide 7 inches (19 cm) deep
LAA12 LSSW	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA14 OW	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA18 TG3 (DS1)	13 inches (32 cm) high 1 inch (2.5 cm) wide 7 inches (19 cm) deep
LAA21 OHCTL (TERM).....	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA22 OHCTL (TERM).....	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep
LAA23B SYSCTL	13 inches (32 cm) high 1 inch (2.5 cm) wide 7 inches (19 cm) deep
LAA25 SYSMEM	13 inches (32 cm) high 0.75 inch (1.9 cm) wide 7 inches (19 cm) deep

LAA26 TOHCTL.....	13 inches (32 cm) high 1 inch (2.5 cm) wide 7 inches (19 cm) deep
LAA28 LNCTL.....	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
39B2 OC48 REGENR	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
39C2 OC48 REGENR	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
39J2 OC48 REGENR	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
39R2 OC48 REGENR	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
39S2 OC48 REGENR	13 inches (32 cm) high 3.25 inches (8.3 cm) wide 7 inches (19 cm) deep
739B2 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739B4 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739B5 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739C2 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739C5 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739E_ OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep

739G_ OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739H_ OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739J2 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739J3 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739J4 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739J5 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739P5 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739R2 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739R5 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739S2 OC48 TRMTR	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
739S5 OC48 TRMTR.....	13 inches (32 cm) high 4.5 inches (11.4 cm) wide 7 inches (19 cm) deep
839B2 OC48 RCVR	13 inches (32 cm) high 2.25 inches (5.7 cm) wide 7 inches (19 cm) deep

839B4B OC48 RCVR	13 inches (32 cm) high 2.25 inches (5.7 cm) wide 7 inches (19 cm) deep
839B5 OC48 RCVR	13 inches (32 cm) high 2.25 inches (5.7 cm) wide 7 inches (19 cm) deep
839E5 OC48 RCVR	13 inches (32 cm) high 2.25 inches (5.7 cm) wide 7 inches (19 cm) deep

Floor Loading Specifications

1 Shelf Bay	< 220 lbs (31 lbs/ft ²)
2 Shelf Bay	< 375 lbs (53 lbs/ft ²)
3 Shelf Bay	< 420 lbs (60 lbs/ft ²)
4 Shelf Bay	< 465 lbs (67 lbs/ft ²)
Packaged Bay.....	< 520 lbs

Environmental Specifications

Normal Operating Temperature.....	41°F to 104°F (5°C to 40°C)
Short Term* Operating Temperature	23°F to 122°F (–5°C to 50°C)
Operating Temperature Change Rate	1.8°F/minute (1°C/minute)
Normal Operating Humidity†	5 to 85 percent
Short Term* Operating Humidity†.....	5 to 90 percent

Earthquake and vibration, fire resistance, and airborne contaminant requirements meet GR-63-CORE Network Equipment Building Systems (NEBS) Generic Equipment Requirements. Electrostatic, electromagnetic, electrical grounding, and safety requirements meet GR-1089-CORE standards. The FT-2000 OC-48 Lightwave System is also designed to meet the electromagnetic compatibility requirements of FCC Title 47, Part 15, Subpart J for Class A equipment.

The FT-2000 OC-48 Lightwave System is *UL*^{*} and *CSA*[†] listed.

Craft Interface Terminal

Personal Computer Requirements

A PC must meet the following minimum requirements to be loaded with FT-2000 CIT-PC software and used as a CIT:

- 386SX *IBM*[‡] compatible computer (desktop or lap top) (25 MHz clock or greater)
- Floppy Disk drive — one 1.44 Megabyte (3.5 inch)
- Hard disk with approximately 5 Megabytes of free space
- 4 Megabytes RAM[§]
- *MS-DOS*[¶] computer program, version 5.0 or later
- Serial port (EIA-232-D) — configured as COM1, COM2, COM3, or COM4
- Parallel port — configured as LPT1
- VGA color monitor.

A PC must meet the following minimum requirements to be loaded with the CPro-2000 software and used as a CIT:

- 386SX *IBM* compatible computer (desktop or lap top) (25 MHz clock or greater)
- Disk drive — one 1.44 Megabyte (3.5 inch)
- Hard disk with approximately 5 Megabytes of free space
- 8 Megabyte RAM^{**}
- *MS-DOS* computer program, version 5.0 or later
- *Windows*^{††} program version 3.1

* Registered trademark of Underwriters Laboratories Inc.

† Registered trademark of Canadian Standards Association.

‡ Registered trademark of International Business Machine Corporation.

§ No memory resident programs running in the background. 565 kilobytes of conventional memory is also required. Two megabytes of extended extended memory is also required. If less than 565 kilobytes of free conventional memory is available, a memory manager (for example, HIMEM.SYS with *MS-DOS* 5.0 and later) is required to increase the free conventional memory.

¶ Registered trademark of Microsoft Corporation.

- Serial port (EIA-232-D) — configured as COM1 or COM2
- Mouse
- VGA color monitor.

ASCII-Based Terminal Requirements

An ASCII-based (dumb) terminal may be used as a CIT. The ASCII-based terminal must meet the following minimum requirements:

- ASCII-based data communications terminal with an 80-column display
- Scroll capability
- Local echo
- Serial port (EIA-232-D)
- Data transmission speed should be from 1200 to 9600 baud
- XON/XOFF flow control capability.

The ASCII-based terminal should be configured for byte serial data transmission of eight-bit bytes with one start bit and one stop bit. Parity should be "none" and the flow control should be "DC1/DC3."

Modem Requirements

A compatible modem or digital data network must meet the following minimum requirements:

- Full duplex
- Asynchronous
- Byte serial data transmission of eight-bit bytes
- One start bit
- One stop bit
- Data transmission speed should be from 1200 to 9600 baud.

The modem must comply with one of the following transmission standards, depending on the desired baud rate.

** No memory resident programs running in the background. No memory resident programs running in the background. 565 kilobytes of conventional memory is also required. Two megabytes of extended extended memory is also required. If less than 565 kilobytes of free conventional memory is available, a memory manager (for example, HIMEM.SYS with *MS-DOS* 5.0 and later) is required to increase the free conventional memory.

†† Registered trademark of Microsoft Corporation.

Standard	Baud Rate(s)
Bell 212A	1200
V.22	1200
V.22 bis	2400
V.32	4800,9600
V.32 bis	9600 (fax), 14400 (data)



NOTE:

These standards apply to signaling used between modems.

Operations Interfaces

- Office alarms: The steady state current for office alarm connections should not exceed 0.9 A at 60 V or 1.8 A at 30 V. The maximum transient currents (20 msec duration) during initial contact closure should not exceed 9 A at 60 V or 18 A at 30 V.
- Miscellaneous Discretes: Any external customer equipment to be monitored by the FT-2000 OC-48 Lightwave System must provide the electrical equivalent of a contact closure across the corresponding environmental input wiring pairs. The contact closure must be capable of passing at least 10 mA of drive current.

The power source to enable the FT-2000 OC-48 Lightwave System to control external customer equipment may be from a minimum of 3 V to a maximum of 72 V. The FT-2000 OC-48 Lightwave System provides a unidirectional opto-isolator connection across each corresponding control output wiring pair. The load current across each control output wiring pair must be limited by the external customer equipment and must not exceed 35 mA.

- X.25 Protocol/Transaction Language 1 (TL1): The TL1/X.25 interface operates at 1200 to 19,200 baud through an EIA-232-D port.

TL1/X.25 Interface

General

FT-2000 OC-48 Lightwave System supports an TL1/X.25 interface to report alarm and status conditions and performance-monitoring data to operations systems (OS) such as Bellcore's *NMA** OS. The FT-2000 OC-48 Lightwave System TL1 messages are based on Bellcore's TR-TSY-000833, Issue 3, Rev. 1.[†]

FT-2000 also supports TL1 provisioning messages for use with memory administration OSs such as Lucent's ITM SNC.Provisioning TL1 Autonomous Messages

Up to eight logical channels (two PVCs and up to six SVCs) are supported. All logical channels may be used for command/response messages. In addition, TL1 autonomous messages are optionally available on all of the logical channels via user provisioning. There are five OS types, that can be provisioned per PVC logical channel. An OS type is a filter that determines the types of TL1 autonomous messages that appear at a logical channel.

The following five OS types are available for autonomous messages:

- **Maintenance:** A maintenance OS type will send autonomous messages that report on the status of the system (**REPORT ALARM, REPORT ALARM ENVIRONMENT, REPORT CONDITION, REPORT EVENT, and REPORT SWITCH**).
- **Memory administration:** A memory administration OS type will send autonomous messages that report on changes in the provisioning status of equipment (**REPORT DATA BASE CHANGE**).
- **Test:** A test OS type will send no autonomous messages.
- **Command/response only:** A command/response only OS type will send no autonomous messages.
- **Other:** An OS type will send all available autonomous messages.

For SVCs, the OS type is provisioned indirectly, in conjunction with the X.25 calling address. The user can specify what OS type to associate with a given X.25 calling address. When an SVC is set up using one of the provisioned calling addresses, then the call is assigned the associated OS type. If the SVC does not supply an X.25 calling address or if the X.25 calling address does not match any of the provisioned X.25 calling addresses, then command/response only is assumed.

* Trademark of Bell Communications Research, Inc.

† Where TR-TSY-000833, Issue 3, Rev. 1 was deficient, the FT-2000 OC-48 Lightwave System conforms to Bellcore's TR-NWT-000833, Issue 4.

When an OS establishes an SVC call, an available SVC is selected by the packet network. The user does not control SVC selection. Table 10-14 shows the FT-2000 TL1-GNE-X.25 default assignments.

Table 10-14. FT-2000 TL1/X.25 Interface, Default VC Assignments

PVC ID	SVC ID	Logical Group	Logical Channel	Default Use
1		0	1	Autonomous Maintenance and Command/Response Messages
1		0	2	Command/Response Messages
	1	0	3	Command/Response Messages
	2	0	4	Command/Response Messages
	3	0	5	Command/Response Messages
	4	0	6	Command/Response Messages
	5	0	7	Command/Response Messages
	6	0	8	Command/Response Messages

DTE Configuration

At the packet layer, the FT-2000 OC-48 Lightwave System is configured as a passive data terminating equipment (DTE) with the parameters listed in Table 10-15.

Table 10-15. TL1/X.25 Interface — X.25 Packet Layer Parameters

Parameter	Value
Packet Size	256 bytes
Window Size	2 packets
D bit support	No
M bit support	Yes
Q bit support	No

At the link layer, the FT-2000 OC-48 Lightwave System uses the standard link access procedure B (LAPB) protocol with the parameters listed in Table 10-16.

Table 10-16. TL1/X.25 Interface — LAPB Link Layer Parameters

Parameter	Value
Maximum Frame Size	2104 bits
Modulo	8
Window Size	7 frames
n2	6 retries
T1	3 seconds
T3	not supported

The FT-2000 OC-48 Lightwave System uses synchronous, full duplex, continuous carrier communication. Data rates of 1200, 2400, 4800, 9600, and 19200 are supported.

The EIA-232D interface is configured as DTE, using the pins listed in Table 10-17.

Table 10-17. TL1/X.25 Interface — EIA-232D Pin Connections

Pin	Description
1	Protective Ground (Shield)
2	Transmitted Data
3	Received Data
4	Request to Send (RTS)*
5	Clear to Send (CTS)†
6	DCE Ready
7	Signal Ground
8	Received Line Signal Detector
15	Transmit Clock (TC)
17	Receive Clock (RC)
20	Data Terminal Ready (DTR)*

* DTR and RTS are always on when FT-2000 is powered.

† FT-2000 will only transmit data via X.25 when CTS is on.

External Synchronization Interface

External Synchronization Cabling	
— to a DSX-1 cross-connect panel.....	655 feet maximum
— to other sources	1310 feet maximum
DS1 Synchronization Inputs	
— Source	Two references; must be derived from a stratum 3 or better timing source
— Line Coding.....	AMI (original value) or B8ZS
— Frame Format.....	SF (original value) or ESF
— Connector	DB9
— Protection Switching..... Between References	Revertive, Automatic on LOS, AIS, LOF, OOF, or BER
DS1 Synchronization Outputs	
— Source	Two references; derived directly from the OC-48 line
Point-to-Point.....	Reference 1 derived from Service Line; Reference 2 derived from Protection Line
Rings	Reference 1 derived from West Direction; Reference 2 derived from East Direction
— Frame Format.....	SF or ESF
— DS1.....	AIS inserted if reference becomes unsuitable
— Connector	DB9
— LBO.....	CIT provisionable

Reliability Specifications

DS3/EC-1 Channel Unavailability (hardware only)	
— FT-2000 OC-48 Add/Drop-Rings* Terminal for 2-Fiber Rings (equipped with DS3 and/or STS1E interfaces)	0.20 minutes/year, per DS3 channel
— 566 mile, 16-node ring circumference† (DS3/STS1E channel traversing 9 FT-2000 OC-48 Add/Drop-Rings Terminals)	0.50 minutes/year, per DS3/STS1E channel
OC-3/IS-3 Channel Unavailability (hardware only)	
— FT-2000 OC-48 Add/Drop-Rings* Terminal for 2-Fiber Rings (equipped with protected OC-3/IS-3 interfaces)	0.0005 minutes/year, per OC-3/IS-3 channel
— FT-2000 OC-48 Add/Drop-Rings* Terminal for 2-Fiber Rings (equipped with unprotected OC-3/IS-3 interfaces)	2.9 minutes/year, per OC-3/IS-3 channel
— 566 mile, 16-node ring circumference† (OC-3 channel traversing 9 FT-2000 OC-48 Add/Drop-Rings Terminals with protected OC-3/IS-3 interfaces)	0.09 minutes/year, per OC-3/IS-3 channel
— 566 mile, 16-node ring circumference† (OC-3 channel traversing 9 FT-2000 OC-48 Add/Drop-Rings Terminals with unprotected OC-3/IS-3 interfaces)	5.90 minutes/year, per OC-3/IS-3 channel
OC-12 Channel Unavailability (hardware only)	
— FT-2000 OC-48 Add/Drop-Rings* Terminal for 2-Fiber Rings (equipped with protected OC-12 interfaces)	0.0006 minutes/year, per OC-12 channel
— FT-2000 OC-48 Add/Drop-Rings* Terminal for 2-Fiber Rings (equipped with unprotected OC-12 interfaces)	6.6 minutes/year, per OC-12 channel
— 566 mile, 16-node ring circumference† (OC-12 channel traversing 9 FT-2000 OC-48 Add/Drop-Rings Terminals with protected OC-12 interfaces)	0.10 minutes/year, per OC-12 channel

— 566 mile, 16-node ring circumference† (OC-12 channel traversing 9 FT-2000 OC-48 Add/Drop-Rings Terminals with unprotected OC-12 interfaces)	13.30 minutes/year, per OC-12 channel
Silent Failure Unavailability*	
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings (equipped with DS3 and STS1E interfaces)	0.10 minutes/year per DS3 channel
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings (equipped with protected and/or unprotected OC-3/IS-3/OC-12 interfaces)	0
Operations System Interface Unavailability*	
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings Mean Time [‡] Between Maintenance Activities	11.0 minutes/year
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings (equipped with DS3 and/or STS1E interfaces)	34.0 months
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings (equipped with protected and/or unprotected OC-3/IS-3 interfaces)	43.0 months
— FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Rings (equipped with protected and/or unprotected OC-12 interfaces)	59.0 months
— FT-2000 OC-48 Repeater Bay..... One Repeater Shelf - System Controller	109.0 months
— FT-2000 OC-48 Repeater Bay..... Two Repeater Shelf - System Controllers	55.0 months
— FT-2000 OC-48 Repeater Bay..... Three Repeater Shelf - System Controllers	34.0 months
— FT-2000 OC-48 Repeater Shelf.....	10.9 months

Mean Time to Repair	≤ 4 hours (includes dispatch, diagnostics, and repair time)
Infant Mortality	≤ 1.5 times the steady state failures/10 ⁻⁹ hours (FIT) as defined in Bellcore TA-418, Issue 2
Product Design Life	25 years

* Based on Method 1 of the Bellcore, Reliability Prediction Procedure for Electronic Equipment, Issue 5, December 1995.

† Assuming one fiber failure event every 3 years, and an average fiber repair time of 3 hours.

‡ Based on the AT&T Reliability Information Notebook, 7th Edition, August 1995.

Circuit Pack FIT Rates

Circuit Pack	Failures/10 ⁹ hours* (FIT)
LAA2B DS3	2633
LAA4 STS1E	2340
LAA10 OC3	2739
LAA10B OC3	2739
LAA5 IS3	2402
T939A OC12	6312
LAA12 LSSW	5908
LAA12B LSSW	5908
LAA14 OW	399
LAA18 TG3 (DS1)	2804
LAA21 OHCTL (TERM)	2028
LAA22 OHCTL (TERM)	790
LAA23B SYSCTL	1811
LAA25 SYSMEM	3151

Circuit Pack	Failures/10 ⁹ hours* (FIT)
LAA26 TOHCTL.....	2142
LAA28 LNCTL (4 MEG)	2329
39B2 OC48 REGENR (1.3 STD)	7214
39C2 OC48 REGENR (1.3 HI PERF)	7214
39J2 OC48 REGENR (1.5 STD).....	7214
39R2 OC48 REGENR (1.5 LBA W1)	7214
39S2 OC48 REGENR (1.5 LBA W2)	7214
739B2 OC48 TRMTR (A/D 1.3 STD)	7100
739B4 OC48 TRMTR (A/D 1.3 STD)	7022
739B5 OC48 TRMTR (A/D STS1 1.3 STD)	7614
739C2 OC48 TRMTR (A/D 1.3 HI PERF).....	7100
739C5 OC48 TRMTR (A/D STS1 1.3 HI PERF).....	7614
739E1-E8 OC48 TRMTR (A/D STS1 1.5 360km DISP)	8114
739G1-G8 OC48 TRMTR (A/D STS1 1.5 640km DISP)	8114
739H1-H16 OC48 TRMTR (A/D STS1 1.5 60km DISP)	8114
739J2 OC48 TRMTR (A/D 1.5 STD).....	7100
739J3 OC48 TRMTR (A/D 1.5 LBA)	7100
739J4 OC48 TRMTR (A/D 1.5 STD).....	7022
739J5 OC48 TRMTR (A/D STS1 1.5 STD).....	7614
739P5 OC48 TRMTR (A/D STS1 1.5 LBA)	7614
739R2 OC48 TRMTR (A/D 1.5 LBA W1).....	7100
739R5 OC48 TRMTR (A/D STS1 1.5 LBA W1).....	7614
739S2 OC48 TRMTR (A/D 1.5 LBA W2)	7100
739S5 OC48 TRMTR (A/D STS1 1.5 LBA W2)	7614
839B2 OC48 RCVR (A/D).....	3700
839B4B OC48 RCVR (A/D)	3623
839B5 OC48 RCVR (A/D STS1).....	3460
839E5 OC48 RCVR (A/D STS1).....	3460

* Based on Method 1 of the Bellcore, *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995.

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Contents

Overview

This section covers the following topics:

- CPro 2000
- FT-2000 CIT-PC Software Introduction
- Inputs
- Notice Frames, Confirmation Requests, and Aborting Commands
- Context-Sensitive Help
- CIT Function Keys
- PC Screen Header Line
- Outputs
- Examples of Reports
- Craft Interface Terminal (CIT) Tutorial.

The user should be familiar with the information in this tab before using the Operation and Maintenance Task Oriented Practices (TOP) procedures in this manual.

CPro-2000

CPro-2000 is a *Microsoft Windows*^{*}-based application (software) that provides access to SONET network elements. The network elements are accessed via the software through a command-based ASCII User Interface (AUI) and/or a

Graphical User Interface (GUI). Network elements currently include DDM-2000 OC-3, DDM-2000 OC-12, DDM-2000 FiberReach, and FT-2000 OC-48.

CPro-2000 is typically used by centralized work center personnel (operations systems) or maintenance personnel to analyze, provision, cross-connect, and test the network. If trouble is found, it is localized to a network element, then repair personnel are dispatched to complete the trouble clearing activity.

CPro-2000 is documented in 190-523-101, *CPro-2000 User Manual*. The features are described in the manual along with procedures for using them. Specific procedures for network elements are documented in the appendixes. For example, Appendix C provides a cross-reference list of commands for the FT-2000 OC-48 Add/Drop-Rings Terminal. Also supported is a cross-reference table of Operation and Maintenance tasks (Table 11-1) which lists the procedures that have been identified where CPro-2000 could be used. And in Appendix D, Script Files are very helpful in setting up remote access to network elements in different configurations.

Table 11-1. Table 11-1 - CPro-2000 Cross-Reference Procedures

Data Element	
Circuit Order: NTP-002	Add DS3 and/or EC1 Low Speed Port(s)
Circuit Order: NTP-003	Delete DS3 and/or EC1 Low Speed Port(s)
Circuit Order: NTP-010	Add OC3 Low Speed Slot(s)
Circuit Order: NTP-011	Delete OC3 Low Speed Slot(s)
Circuit Order: NTP-012	Add OC12 Low Speed Slot(s)
Circuit Order: NTP-013	Delete OC12 Low Speed Slot(s)
Operation: NTP-003	Establish Dual Ring Interworking (DRI) Connections
Operation: NTP-004	Disconnect Dual Ring Interworking (DRI) Connections
Detailed Level Procedure: DLP-517	Provision Low Speed Slot and Port Parameters
Detailed Level Procedure: DLP-522	Change, Delete, or Enter a User's Login
Detailed Level Procedure: DLP-536	Enter/Delete/Edit STS-1 Cross-Connections at Network Elements for 2-Fiber Ring Network

* Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

FT-2000 CIT-PC Software Introduction

FT-2000 CIT-PC software is the user-friendly, menu-driven interface used with the FT-2000 OC-48 Lightwave System. FT-2000 CIT-PC software consists of a series of menus with different security levels (cit or cit expert). The software package runs on an *MS-DOS*[†] compatible personal computer (PC). The PC and the FT-2000 CIT-PC software together make up the craft interface terminal (CIT). The CIT connects to an FT-2000 network element (also referred to as an FT-2000 terminal or an FT-2000 repeater bay/shelf in this manual).

Inputs

Inputs to FT-2000 CIT-PC consist of a series of selections from menus and parameter inputs followed by the pressing of function key **F9**, labeled EXECUTE. This sequence of selecting and executing can be called an "input" or a "command."

I Table 11-2 lists the inputs (commands) menu for a R9.1 **FT-2000 OC-48 Add/Drop-Rings Terminal**.

I Table 11-3 lists the inputs (commands) menu for a R8.1 **FT-2000 OC-48 Add/Drop-Rings Terminal**.

Table 11-4 provides a brief description of inputs (commands) which are arranged alphabetically by the verb.

Table 11-5 provides a list of inputs (commands) that generate reports for the FT-2000 network elements.

Notice Frames, Confirmation Requests, and Aborting Commands

Some inputs are potentially service-affecting and will cause a notice frame or confirmation request to appear on the screen. This alerts the user to the possible consequences of executing the selected inputs.

A notice frame is acknowledged and cleared by pressing **(ESC)**.

A confirmation request consists of a caution message followed by inputs entered and the prompt "Execute? (Yes/No)". Pressing y and **(ENTER)** causes inputs to be executed. Pressing n and **(ENTER)** causes the parameter value entry frame to be displayed again.

Inputs can be aborted by pressing function key **F8**, when labeled CANCEL.

Context-Sensitive Help

Help for inputs is provided in three forms:

1. Message Line Help — This appears near the bottom of the screen immediately above the display of the function keys. This line provides procedural information, status of the FT-2000 OC-48 Lightwave System, or yes/no response information; for example, "Highlight the desired item and press return to select" or "Execution in progress".
2. Function key **F1** Help — When function key **F1** is labeled HELP, it can be pressed to display a context-sensitive description of the highlighted menu item, parameter, notice frame, etc.
3. Question mark (?) Help — When a parameter is highlighted in a parameter frame, a menu of allowable values (point-and-shoot) or the parameter range is displayed when a question mark (?) or a wrong value is entered.

CIT Function Keys

The function keys, **F1** through **F9**, displayed at the bottom of the screen provide a particular function when labeled. The nine function keys are available to expedite certain operations. All function keys are not active at all times. An active function key is shown by its label. Inactive function keys are not labeled. The function of a function key may vary with time and this is indicated by changes in the labeling.

- F1** When labeled HELP, context-sensitive information is available for the highlighted menu item. By pressing the **F1** key, this additional and specific information is displayed.
- F2** When labeled REMOTE in the local only state or session, this key initiates a connection to a remote FT-2000 network element. **F2** is labeled REMOTE in the local state and LOCAL in the remote state, thereby allowing local/remote toggling.
- F3** When labeled OUTPUT, this key clears the screen of menus and parameter frames so the output frame can be viewed. By pressing **F3** again (now labeled INPUT), the screen is restored with the menus or parameter frames. This capability is particularly useful while entering parameters because the user can review information that was displayed just previously, and then resume the entry of parameters from the same point, without repeating what has already been done.

When labeled DIAL in the local connect state, this key allows the user to enter control data for a modem.

When labeled BREAK in the dial state, this key sends a break character to the communications port.

- F4** When labeled LOGOUT, this key permits the user to terminate the connection to the FT-2000 network element.
- When labeled CHECK, this key sends the autobaud character sequence (break, enter, enter) to an FT-2000 network element.
- F5** When labeled EXIT, this key permits the user to terminate the connection and exit the FT-2000 CIT-PC software, returning the user back to the *MS-DOS* prompt.
- F6** When labeled SETUP, this key permits the user to configure the operating parameters of the PC.
- F7** When labeled PRINT, this key permits the user to send the FT-2000 network element output to a printer, to a file, or to both.
- F8** When labeled CANCEL, this key permits the user to discard all user entries for the current command or cancels the dial request. If **F8** is pressed after executing a command, an attempt to cancel the command is sent to the FT-2000 network element.
- F9** When labeled EXECUTE, this key permits the user to execute the completed command (valid parameter values).
- When labeled REPEAT, this key permits the user to repeat the last command or display the last command and edit it.
- When labeled ALARM, this key permits the user to execute a **Retrieve-Alarm:All** command with a single keystroke.
- F10** Currently, this key is not being used.

PC Screen Header Line

The six fields displayed from left to right across the **top of the screen** are as follows:

- Network element status indicator (displays highest current system status. This field is blank when there are no alarms or any NE or FE activity present.)
- Lucent Technologies (fixed in program)
- PF-2000 (fixed in program)
- Software release and platform string (currently running in the SYSCTL)
- Terminal identification [target identifier (TID) of the network element]
- Session context (CIT connection state as follows):
 - LOCAL ONLY — CIT is only connected to local network element.
 - REMOTE (Flashing) — CIT is connected to remote network element from local network element.
 - LOCAL — CIT is connected to remote network element, but it is toggled back to local network element.

Table 11-2. Release 9.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
FAULT	Retrieve	Alarm (and Status)		Report Only	2
		History		Report Only	12
		State		Report Only	41
	Switch	Line		General	
		Low Speed		General	
		OC3		General	
		OC12		General	
		Path	STS1	General	
			STS3	General	
		Synchronization	Hardware	General	
			Mode	General	
			Reference	General	
	Test	Alarm		Report Only	
		Auto Turnup	DSX	Privileged/Expert	
			Local	Privileged/Expert	
		LED		Report Only	
	Operate	Alarm Cutoff		Report Only	
		Control	Point	General	
		Loopback	EC1	General	
			OC3	General	
			OC12	General	
			T3	General	
	Release	Control	Point	General	
		Loopback	EC1	General	
			OC3	General	
			OC12	General	
			T3	General	
	Allow	Alarm		General	
	Inhibit	Alarm		General	
	Reset			General	
CONFIGURATION	Retrieve	Assignment	DCC	Report Only	3
		Attribute	Alarm	Report Only	4
			Control	Report Only	5
			Environment	Report Only	6
		Circuit	STS1	Report Only	7
		CrossConnect	All	Report Only	8
			TIRKS	Report Only	47
		Date		Report Only	9
		EC1		Report Only	10

Table 11-2. Release 9.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
CONFIGURATION (Contd)	Retrieve (Contd)	Equipment		Report Only	11
		Low Speed		Report Only	14
		Map	Neighbor	Report Only	15
			Network	Report Only	16
			Ring	Report Only	17
		OC3		Report Only	19
		OC12		Report Only	20
		OC48		Report Only	21
		Path	Trace	Report Only	22
		Protection	Line	Report Only	37
			Low Speed	Report Only	38
			STS1	Report Only	
		Synchronization		Report Only	42
		T3		Report Only	43
		Timeslot	STS1	Report Only	44
		Translate	Trib	Report Only	48
			OC12	Report Only	49
		ULSDCC	L3	Report Only	45
			L4	Report Only	46
	Set	Attribute	Alarm	General	
			Control	General	
			Environment	General	
		Crossconnection	STS1	Privileged/Expert	
			STS3	Privileged/Expert	
		Date		Privileged	
		EC1		General, Privileged/Expert	
		Low Speed		General	
		OC3		General, Privileged/Expert	
		OC12		General, Privileged/Expert	
		OC48		General	
		Path	Trace	General	
		Protection	Line	General	
			Low Speed	General	
		State	EC1	General	
			OC12	General	
			OC3	General	

Table 11-2. Release 9.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
CONFIGURATION (Contd)	Set (Contd)	State (Contd)	T3	General	
		Synchronization		Privileged/Expert	
		T3		General, Privileged/Expert	
		ULSDCC	L3	Privileged/Expert	
			L4	Privileged/Expert	
	Copy	EC1		General, Privileged/Expert	
		OC3		General, Privileged/Expert	
		OC12		General, Privileged/Expert	
		OC48		General	
		Path	Trace	General	
		Program		Privileged/Expert	
		T3		General, Privileged/Expert	
	Enter	Assignment	DCC	General	
		Crossconnection	STS1	General	
			STS3	General	
		Protection	STS1	General	
			STS3	General	
		Roll	STS1	General	
	Delete	Assignment	DCC	General	
		Crossconnection	STS1	General	
			STS3	General	
	Update			General	
	Initialize	System		Privileged/Expert	
PERFORMANCE	Retrieve	PM	EC1	Report Only	23
			Line	Report Only	24
			Optics	Report Only	26
			Section	Report Only	27
			Start Time	Report Only	28
			STS1	Report Only	29
			T3	Report Only	30
		PM Mode	T3	Report Only	25
		PM Threshold	EC1	Report Only	31
			Line	Report Only	32
			Optics	Report Only	33

Table 11-2. Release 9.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
PERFORMANCE (Contd)	Retrieve (Contd)	PM Threshold (Contd)	Section	Report Only	34
			STS1	Report Only	35
			T3	Report Only	36
	Set	PM	Start Time	General	
		PM Mode	T3	General	
		PM Threshold	EC1	General	
			Line	General	
			Optics	General	
			Section	General	
			STS1	General	
			T3	General	
	Initialize	PM	All, Day, QH	General	
SECURITY	Retrieve	Login		Report Only	13
		Network Element		Report Only	18
		Security	Network Element	Report Only	39
			Port	Report Only	40
		Active	User	Report Only	1
	Set	Login	Change	Privileged	
			Delete	Privileged	
			Enter	Privileged	
		Network Element		Privileged	
		Password		Report Only	
		Security	Network Element	Privileged	
			Port	Privileged	

Table 11-3. Release 8.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
FAULT	Retrieve	Alarm (and Status)		Report Only	2
		History		Report Only	12
		State		Report Only	41
	Switch	Line		General	
		Low Speed		General	
		OC3		General	
		OC12		General	
		Path	STS1	General	
			STS3	General	
		Synchronization	Hardware	General	
			Mode	General	
			Reference	General	
	Test	Alarm		Report Only	
		Auto Turnup	DSX	Privileged/Expert	
			Local	Privileged/Expert	
		LED		Report Only	
	Operate	Alarm Cutoff		Report Only	
		Control	Point	General	
		Loopback	EC1	General	
			OC3	General	
			OC12	General	
			T3	General	
	Release	Control	Point	General	
		Loopback	EC1	General	
			OC3	General	
			OC12	General	
			T3	General	
	Allow	Alarm		General	
	Inhibit	Alarm		General	
	Reset			General	
CONFIGURATION	Retrieve	Assignment	DCC	Report Only	3
		Attribute	Alarm	Report Only	4
			Control	Report Only	5
			Environment	Report Only	6
		Circuit	STS1	Report Only	7
		CrossConnect	All	Report Only	8
		Date		Report Only	9
		EC1		Report Only	10
		Equipment		Report Only	11

Table 11-3. Release 8.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
CONFIGURATION (Contd)	Retrieve (Contd)	Low Speed		Report Only	14
		Map	Neighbor	Report Only	15
			Network	Report Only	16
			Ring	Report Only	17
		OC3		Report Only	19
		OC12		Report Only	20
		OC48		Report Only	21
		Path	Trace	Report Only	22
		Protection	Line	Report Only	37
			Low Speed	Report Only	38
			STS1	Report Only	
		Synchronization		Report Only	42
		T3		Report Only	43
		Timeslot	STS1	Report Only	44
		ULSDCC	L3	Report Only	45
			L4	Report Only	46
	Set	Attribute	Alarm	General	
			Control	General	
			Environment	General	
		Crossconnection	STS1	Privileged/Expert	
			STS3	Privileged/Expert	
		Date		Privileged	
		EC1		General, Privileged/Expert	
		Low Speed		General	
		OC3		General, Privileged/Expert	
		OC12		General, Privileged/Expert	
		OC48		General	
		Path	Trace	General	
		Protection	Line	General	
			Low Speed	General	
		State	EC1	General	
			OC12	General	
			OC3	General	

Table 11-3. Release 8.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
CONFIGURATION (Contd)	Set (Contd)	State (Contd)	T3	General	
		Synchronization		Privileged/Expert	
		T3		General, Privileged/Expert	
		ULSDCC	L3	Privileged/Expert	
			L4	Privileged/Expert	
	Copy	EC1		General, Privileged/Expert	
		OC3		General, Privileged/Expert	
		OC12		General, Privileged/Expert	
		OC48		General	
		Path	Trace	General	
		Program		Privileged/Expert	
		T3		General, Privileged/Expert	
	Enter	Assignment	DCC	General	
		Crossconnection	STS1	General	
			STS3	General	
		Protection	STS1	General	
			STS3	General	
		Roll	STS1	General	
	Delete	Assignment	DCC	General	
		Crossconnection	STS1	General	
			STS3	General	
	Update			General	
	Initialize	System		Privileged/Expert	
PERFORMANCE	Retrieve	PM	EC1	Report Only	23
			Line	Report Only	24
			Optics	Report Only	26
			Section	Report Only	27
			Start Time	Report Only	28
			STS1	Report Only	29
			T3	Report Only	30
		PM Mode	T3	Report Only	25
		PM Threshold	EC1	Report Only	31
			Line	Report Only	32
			Optics	Report Only	33

Table 11-3. Release 8.1 Inputs (Commands) Menu for FT-2000 Add/Drop-Rings Terminal—
Contd

Management Category	Verb	First Modifier	Second Modifier	Security Level	Report Example
PERFORMANCE (Contd)	Retrieve (Contd)	PM Threshold (Contd)	Section	Report Only	34
			STS1	Report Only	35
			T3	Report Only	36
	Set	PM	Start Time	General	
		PM Mode	T3	General	
		PM Threshold	EC1	General	
			Line	General	
			Optics	General	
			Section	General	
			STS1	General	
			T3	General	
	Initialize	PM	All, Day, QH	General	
SECURITY	Retrieve	Login		Report Only	13
		Network Element		Report Only	18
		Security	Network Element	Report Only	39
			Port	Report Only	40
		Active	User	Report Only	1
	Set	Login	Change	Privileged	
			Delete	Privileged	
			Enter	Privileged	
		Network Element		Privileged	
		Password		Report Only	
		Security	Network Element	Privileged	
			Port	Privileged	

Table 11-4. - Input (Command) Definitions

Selected Input	Purpose
FAULT- <i>Allow-Alarm</i>	Allows the user to enable the reporting of alarms at an alarm-reporting interface.
CONFIGURATION- <i>Copy-EC1</i>	Copies the software provisionable attributes of an EC1 port (source) to one or more EC1 ports (destinations).
CONFIGURATION- <i>Copy-OC3</i>	Copies the software provisionable attributes of an OC3 slot (source) to one or more OC3 slots (destinations).
CONFIGURATION- <i>Copy-OC12</i>	Copies the software provisionable attributes of an OC12 slot (source) to one or more OC12 slots (destinations).
CONFIGURATION- <i>Copy-OC48</i>	Copies the software provisionable attributes of an OC-48 line to one or more OC-48 lines.
CONFIGURATION- <i>Copy-Path-Trace</i>	Copies the transmit and receive path trace fields from an STS-1 signal (source) to one or more STS-1 signals (destinations).
CONFIGURATION- <i>Copy-Program</i>	Copies the software contained in one SYSMEM (source NE) to another SYSMEM (destination NE) via the DCC.
CONFIGURATION- <i>Copy-T3</i>	Copies the software provisionable attributes of a DS3 port to one or more DS3 ports.
CONFIGURATION- <i>Delete-Assignment-DCC</i>	Removes a DCC channel assignment from a particular LS INTFC slot or pair of slots, thereby disabling DCC communication on the supporting OC-3/OC-12 as well as disabling DCC access to a particular remote network element.
CONFIGURATION- <i>Delete-Crossconnections-STS1</i>	Removes STS1 level cross-connections in both directions in the FT-2000 add/drop-rings terminal.
CONFIGURATION- <i>Delete-Crossconnections-STS3</i>	Removes STS3 level cross-connections in both directions in the FT-2000 add/drop-rings terminal.
CONFIGURATION- <i>Enter-Assignment-DCC</i>	Assigns a DCC channel to a particular LS INTFC slot or pair of slots. It also sets the orientation of the addressed channel to "User" or "Network."
CONFIGURATION- <i>Enter-Crossconnections-STS1</i>	Makes STS1 level cross-connections as add/drop or through cross-connection. Also, used to make a DRI cross-connection between a low speed port and an STS-1 line tributary.
CONFIGURATION- <i>Enter-Crossconnections-STS3</i>	Makes STS3 level cross-connections in both directions in the FT-2000 add/drop-rings terminal.

Table 11-4. - Input (Command) Definitions —*Contd*

Selected Input	Purpose
CONFIGURATION- <i>Enter</i> -Protection-STS1	This command controls values of the protection access state variables associated with the STS-1 protection tributaries of the local NE. NOTE: In mixed FT-2000/ <i>WaveStar</i> rings where NPPA is disabled, any attempt to provision NPPA tributaries by changing the protection access value to “temporary” or “permanent” will be denied.
CONFIGURATION- <i>Enter</i> -Protection-STS3	This command controls values of the protection access state variables associated with the STS-3 protection tributaries of the local NE. NOTE: In mixed FT-2000/ <i>WaveStar</i> rings where NPPA is disabled, any attempt to provision NPPA tributaries by changing the protection access value to “temporary” or “permanent” will be denied.
CONFIGURATION- <i>Enter</i> -Roll-STS1	This command rolls the source of a 1-way STS1 cross-connection to a new source and/or changes a 1-way cross-connection type to/from a 1-way-dri cross-connection type. This is accomplished by deleting the existing cross-connection between the source and destination and immediately establishing a new 1-way cross-connection between the new source and the (existing) destination.
CONFIGURATION- <i>Enter</i> -Roll-STS3	This command rolls the source of a 1-way STS3 cross-connection to a new source and/or changes a 1-way cross-connection type to/from a 1-way-dri cross-connection type.
FAULT- <i>Inhibit</i> -Alarm	Inhibits the reporting of alarms.
PERFORMANCE- <i>Initialize</i> -PM	Initializes the performance-monitoring storage registers (to zero).
CONFIGURATION- <i>Initialize</i> -System	Causes current values in the SYSMEM to be replaced by the original values in the SYSMEM and then restarts the software.
FAULT- <i>Operate</i> -Alarm Cutoff	Silences the office audible alarms.
FAULT-Operate-Control Point	Operates an external miscellaneous discrete control, such as a relay activation, a fan, a light or sprinkler. The miscellaneous discrete control can be operated momentarily or continuously.
FAULT- <i>Operate</i> -Loopback-EC1	Executes a loopback on an EC1 port in the direction towards the OC-48 line.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
FAULT- <i>Operate</i> -Loopback-OC3	Executes a loopback on an OC3 slot in the multiplex direction (towards the OC-48 line) or demultiplex direction (towards the low speed cross-connect panel).
FAULT- <i>Operate</i> -Loopback-OC12	Executes a loopback on an OC12 slot in the multiplex direction (towards the OC-48 line) or demultiplex direction (towards the low speed cross-connect panel).
FAULT- <i>Operate</i> -Loopback-T3	Executes a loopback on a DS3 port in the direction towards the OC-48 line.
FAULT-Release-Control Point	Releases an external miscellaneous discrete control, such as a relay activation, a fan, a light or sprinkler.
FAULT- <i>Release</i> -Loopback-EC1	Releases a loopback on an EC1 port.
FAULT- <i>Release</i> -Loopback-OC3	Releases a loopback on an OC3 slot.
FAULT- <i>Release</i> -Loopback-OC12	Releases a loopback on an OC12 slot.
FAULT- <i>Release</i> -Loopback-T3	Releases a loopback on a DS3 port.
FAULT- <i>Reset</i>	Restarts the FT-2000 network element software as follows: (1) Current memory values are copied from the SYSCTL to the SYSMEM, (2) executable code is copied from the SYSMEM to the SYSCTL, (3) the executable code in the SYSCTL is restarted, and (4) the current values in the SYSMEM are reformatted as necessary to work properly with the executable code running in the SYSCTL.
SECURITY- <i>Retrieve</i> -Active User	Allows a user to retrieve the current CIT and TL1 port provisioning and who is currently logged into each port.
FAULT- <i>Retrieve</i> -Alarm (and Status)	Generates an active alarm and status report on the FT-2000 System.
CONFIGURATION- <i>Retrieve</i> -Assignment-DCC	Retrieves the DCC channel assignment to the LS INTFC slot or pair of slots.
CONFIGURATION- <i>Retrieve</i> -Attribute-Alarm	Retrieves the alarm attributes for the FT-2000 network element.
CONFIGURATION- <i>Retrieve</i> -Attribute-Control	Retrieves the descriptive name associated with the user-settable miscellaneous discrete control output points.
CONFIGURATION- <i>Retrieve</i> -Attribute-Environment	Retrieves the alarm and descriptive name associated with the user-settable miscellaneous discrete environmental input points.
CONFIGURATION- <i>Retrieve</i> -Circuit-STS1	Retrieves all cross-connections that make up that particular circuit path.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
CONFIGURATION- <i>Retrieve-Crossconnection-TIRKS</i>	Retrieves information on the add/drop/through configuration. The report is the same as RTRV-CRS-ALL except that the AIDs are TIRKS compatible and only STS-1 tributaries are reported.
CONFIGURATION- <i>Retrieve-Crossconnection-All</i>	Retrieves provisioned information on the current cross-connections in the FT-2000 add/drop-rings terminal.
CONFIGURATION- <i>Retrieve-Date</i>	Retrieves provisioned information on current date and time, and start and stop dates for daylight-saving time.
CONFIGURATION- <i>Retrieve-EC1</i>	Retrieves provisioned information and attributes of an EC1 port. Also, information on alarm severity that is implied by failure of the EC1 port, signal degrade threshold, and the memory administrative state.
CONFIGURATION- <i>Retrieve-Equipment</i>	Retrieves the equipment and version information for the FT-2000 network element.
FAULT- <i>Retrieve-History</i>	Retrieves the maintenance history information on about 500 events for the FT-2000 network element.
SECURITY- <i>Retrieve-Login</i>	Retrieves at the privilege user level a complete list containing all user logins and their assigned security level but not their password.
CONFIGURATION- <i>Retrieve-Low Speed</i>	Retrieves characteristics of a low speed slot.
CONFIGURATION- <i>Retrieve-Map-Neighbor</i>	Retrieves a list of all Network Elements that are optically connected to this NE.
CONFIGURATION- <i>Retrieve-Map-Network</i>	Retrieves a list of all network elements in the local NE's area, or if the local NE is a level 2 IS, all level 2 IS's in the subnetwork.
CONFIGURATION- <i>Retrieve-Map-Ring</i>	Retrieves the current values of the addressing parameters of the nodes in an OC-48 ring.
SECURITY- <i>Retrieve-Network Element</i>	Retrieves characteristics of the FT-2000 network element.
CONFIGURATION- <i>Retrieve-OC3</i>	Retrieves provisioning information and the attributes of an OC3 slot.
CONFIGURATION- <i>Retrieve-OC12</i>	Retrieves provisioning information and the attributes of an OC12 slot.
CONFIGURATION- <i>Retrieve-OC48</i>	Retrieves provisioning information and the attributes of an OC-48 line.
CONFIGURATION- <i>Retrieve-Path-Trace</i>	Retrieves the provisioned transmit and receive path traces, and outputs the actual receive path trace indicating if it differs from the provisioned path trace. This command also displays the STS Path Signal Label and status of PDI-P switching.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
PERFORMANCE- <i>Retrieve</i> -PM-EC1	Generates a status report containing EC1 section and line performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM-Line	Generates a status report containing OC-48/OC-12/OC-3 line performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM-Optics	Generates a status report containing OC-48/OC-12/OC-3 optics performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM-Section	Generates a status report containing OC-48/OC-12/OC-3 section performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM-Start Time	Generates a status report stating the start time for measuring the day bins.
PERFORMANCE- <i>Retrieve</i> -PM-STS1	Generates a status report containing STS-1 path performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM-T3	Generates a status report containing DS3 performance-monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Mode-T3	Reports via the P-bit processing or the F and M bit adjusting processing the determined and accumulated DS3 path performance monitored data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-EC1	Reports the performance monitoring TCA threshold values for the EC1 performance monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-Line	Reports the performance monitoring TCA threshold values for the line performance monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-Optics	Reports the performance monitoring TCA threshold values for the optical performance monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-Section	Reports the performance monitoring TCA threshold values for the section performance monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-STS1	Reports the performance monitoring TCA threshold values for the STS1 performance monitoring data.
PERFORMANCE- <i>Retrieve</i> -PM Threshold-T3	Reports the line and path performance monitoring TCA threshold values for the T3 performance monitoring data.
CONFIGURATION- <i>Retrieve</i> -Protection-Line	Retrieves the line protection switching characteristics for the FT-2000 end terminal.
CONFIGURATION- <i>Retrieve</i> -Protection-Low Speed	Retrieves the low-speed protection switching characteristics of the network element.
CONFIGURATION- <i>Retrieve</i> -Protection-STS1	Retrieves the current values of the local protection access state variables.
SECURITY- <i>Retrieve</i> -Security-Network Element	Retrieves only at the privileged user level the security provisioning of login aging, password aging, and allowed logins of the FT-2000 network elements.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
SECURITY- <i>Retrieve</i> -Security-Port	Retrieves only at the privileged user level the security provisioning of login aging, password aging, and allowed logins of the timeout information on the craft access ports.
FAULT- <i>Retrieve</i> -State	Retrieves the slot, port, and protection switching state information for the FT-2000 terminal.
CONFIGURATION- <i>Retrieve</i> -Synchronization	Retrieves provisioning and operational information and the attributes of the synchronization characteristics of the FT-2000 terminal.
CONFIGURATION- <i>Retrieve</i> -T3	Retrieves provisioning information on the attributes if a DS3 port.
CONFIGURATION- <i>Retrieve</i> -Translate-OC12	Retrieves the FT-2000 to TIRKS OC-12 AID translation table. The intent of this report is to facilitate the manual translation required during the maintenance process.
CONFIGURATION- <i>Retrieve</i> -Translate-Trib	Retrieves the FT-2000 to TIRKS tributary AID translation table. The intent of this report is to facilitate the manual translation required during the maintenance process.
CONFIGURATION- <i>Retrieve</i> -Timeslot-STS1	Retrieves Tributary Map Report, organized by node, for all nodes in a ring. The report shows all cross-connections on a single user-specified time slot throughout the entire ring, indicating parts of the ring available for new circuits.
CONFIGURATION- <i>Retrieve</i> -USLDCC-L3	Retrieves the provisioning information for the Area Address and the Level 2 IS.
CONFIGURATION- <i>Retrieve</i> -USLDCC-L4	Retrieves the provisioning information (enabled or disabled) of the TARP Data Cache.
CONFIGURATION- <i>Set</i> -Attribute-Alarm	Provisions the alarm attributes of the FT-2000 terminal.
CONFIGURATION- <i>Set</i> -Attribute-Control	Provisions the character strings associated with the miscellaneous discrete control output points.
CONFIGURATION- <i>Set</i> -Attribute-Environment	Provisions the character strings associated with the miscellaneous discrete environmental input points.
CONFIGURATION- <i>Set</i> -Crossconnection	Provisions one or more cross-connections as "tagged for Red Line Service."
CONFIGURATION- <i>Set</i> -Date	Provisions the correct time, calendar date, and time zone.
CONFIGURATION- <i>Set</i> -EC1	Provisions the characteristics of an EC1 port.
SECURITY- <i>Set</i> -Login-Change	Only a privileged user can make changes to the provisioned login parameters (which are new login, password, verify password, user privilege, and status).
SECURITY- <i>Set</i> -Login-Delete	Only a privileged user can delete the provisioned nonprivileged user logins.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
SECURITY-Set-Login-Enter	Only a privileged user can provision the login parameters (which are new login, password, verify password, and user privilege).
CONFIGURATION-Set-Low Speed	Provisions the protection switch priority and the equipage dependent reporting capability of a low-speed slot.
SECURITY-Set-Network Element	Provisions the FT-2000 network element identification (TID).
CONFIGURATION-Set-OC3	Provisions the "0x1"/"1+1" protection mode, severity of the alarm assigned to the OC3 failures, the signal degrade threshold, the AU-4 S bit, and the sync messaging state.
CONFIGURATION-Set-OC12	Provisions the "0x1"/"1+1" protection mode, severity of the alarm assigned to the OC12 failures, the signal degrade threshold, the AU-4 S bit, and the sync messaging state.
CONFIGURATION-Set-OC48	Provisions the signal degrade threshold and the sync messaging state.
CONFIGURATION-Set-Path-Trace	Provisions the transmit and receive path traces, as well as the setting of PDI-P switching.
PERFORMANCE-Set-PM Mode T3	Provisions one of two different methods (either (a) P-bit processing or (b) F and M-bit adjusted processing)) for accumulating DS3 path performance monitoring data.
PERFORMANCE-Set-PM Start Time	Provisions the start-time for the measurement of all twenty-four hour performance monitoring parameters.
PERFORMANCE-Set-PM Threshold-EC1	Provisions the performance monitoring TCA threshold values for the EC1 data.
PERFORMANCE-Set-PM Threshold-Line	Provisions the performance monitoring TCA threshold values for the line performance monitoring data.
PERFORMANCE-Set-PM Threshold-Optics	Provisions by enabling or disabling the automatic reporting of TCAs for the optical performance monitoring data.
PERFORMANCE-Set-PM Threshold-Section	Provisions the performance monitoring TCA threshold values for the section performance monitoring data.
PERFORMANCE-Set-PM Threshold-STS1	Provisions the performance monitoring TCA threshold values for the STS1 path performance monitoring data.
PERFORMANCE-Set-PMThreshold-T3	Provisions the performance monitoring TCA threshold values for the DS3 performance monitoring data.
CONFIGURATION-Set-Protection-Line	Provisions these parameters (configuration, directional, wait to restore, and restoration protection access) for an OC-48 line. Currently, only the restoration protection access parameter can be set which turns off the ACTY and ABN LEDs for a preemptible protection access line.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
CONFIGURATION-Set-Protection-Low Speed	Provisions the low-speed protection characteristics for the network element.
SECURITY-Set-Security-Network Element	Provisions (only by the privilege user) the network element parameters.
SECURITY-Set-Security-Port	Provisions (only by the privilege user) the port access parameters.
CONFIGURATION-Set-State-EC1	Provisions the memory administrative state of a low-speed EC1 port.
CONFIGURATION-Set-State-OC3	Provisions the memory administrative state of low-speed OC3 port.
CONFIGURATION-Set-State-OC12	Provisions the memory administrative state of low-speed OC12 port.
CONFIGURATION-Set-State-T3	Provisions the memory administrative state of a low-speed DS3 port.
CONFIGURATION-Set-Synchronization	Provisions the synchronization characteristics of the FT-2000 network.
CONFIGURATION-Set-T3	Provisions the characteristics of a DS3 port.
CONFIGURATION-Set-ULSDCC-L3	Provisions (a) the Area Address, and (b) Level 2 IS.
CONFIGURATION-Set-ULSDCC-L4	Provisions the TARP data cache (Enable, Disable).
FAULT-Switch-Line	Makes or breaks the protection switching of an OC-48 line.
FAULT-Switch-Low Speed	Makes or breaks the protection switching of the low-speed slots.
FAULT-Switch-OC3	Controls the "1+1" protection switching operation (OC3 equipped slot pair) according to priority (reset, lockout of protection, inhibit, forced switch, and manual switch).
FAULT-Switch-OC12 operation	Controls the "1+1" protection switching (OC12 equipped slot pair) according to priority (reset, lockout of protection, inhibit, forced switch, and manual switch).
FAULT-Switch-Path-STS1	Controls the DRI protection switching operation through external switch requests according to reset (first) and manual switch (second) priorities.
FAULT-Switch-Path-STS3	Controls the DRI protection switching operation through external switch requests according to reset (first) and manual switch (second) priorities.
FAULT-Switch-Synchronization-Hardware	Controls the protection switching operation of the synchronization hardware.

Table 11-4. - Input (Command) Definitions —Contd

Selected Input	Purpose
FAULT- <i>Switch</i> -Synchronization-Mode	Controls the protection switching operation of the FT-2000 network element timing mode.
FAULT- <i>Switch</i> -Synchronization-Reference	Controls the protection switching operation of the synchronization timing reference.
FAULT- <i>Test</i> -Alarm	Tests the audible and visible office alarms and their corresponding user panel LEDs.
FAULT- <i>Test</i> -Auto Turnup-DSX	Initiates an automatic turnup test of the low-speed cabling between the FT-2000 network element and the DSX (STSX).
FAULT- <i>Test</i> -Auto Turnup-Local	Initiates an automatic turnup test of the internal transmission health of the FT-2000 network element. Testing must be done when FT-2000 System is out of service.
FAULT- <i>Test</i> -LED	Tests the alarm and status LEDs on the user panel and circuit packs.
CONFIGURATION- <i>Update</i>	Updates the FT-2000 System data base for the FT-2000 network element to reflect the existing hardware and incoming signals. For example, an empty operational slot would change to the AUTO state and the in-service ports receiving bad signals would change to the AUTO state.

Table 11-5. List of Inputs (Commands) That Generate Reports

[Alphabetized by Qualifier(s)]		
Input (Command)	Report (Note)	Example
SECURITY-Retrieve-Active-User	Active User Report	1
FAULT-Retrieve-Alarm	Active Alarm and Status Report	2
CONFIGURATION-Retrieve-Assignment-DCC	DCC Assignment Report	3
CONFIGURATION-Retrieve-Attribute-Alarm	System Alarm Attributes Report	4
CONFIGURATION-Retrieve-Attribute-Control	Control Point Provisioning Report	5
CONFIGURATION-Retrieve-Attribute-Environment	Environmental Alarm Provisioning Report	6
CONFIGURATION-Retrieve-Circuit-STS1	STS-1 Circuit Map Report	7
CONFIGURATION-Retrieve-Crossconnection-All	Cross-Connection Map Report	8
CONFIGURATION-Retrieve-Date	Date and Time Report	9
CONFIGURATION-Retrieve-EC1	EC1 Port Provisioning Report	10
CONFIGURATION-Retrieve-Equipment	Equipage and Version Report	11
FAULT-Retrieve-History	Maintenance History Report	12
SECURITY-Retrieve-Login	Login Provisioning Report	13
CONFIGURATION-Retrieve-Low Speed	Low Speed Slot Report	14
CONFIGURATION-Retrieve-Map-Neighbor	Neighbor Map Report	15
CONFIGURATION-Retrieve-Map-Network	Network Map Report	16
CONFIGURATION-Retrieve-Map-Ring	Ring Map Report	17
CONFIGURATION-Retrieve-Neighbor	DCC Neighbors Report	
SECURITY-Retrieve-Network Element	FT-2000 System Provisioning Report	18
CONFIGURATION-Retrieve-OC3	OC3 Provisioning Report	19
CONFIGURATION-Retrieve-OC12	OC12 Provisioning Report	20
CONFIGURATION-Retrieve-OC48	OC-48 Line Provisioning Report	21
CONFIGURATION-Retrieve-Path-Trace	Path Trace Report	22
PERFORMANCE-Retrieve-PM-EC1	EC1 Performance Monitoring Status Report	23
PERFORMANCE-Retrieve-PM-Line	Line Performance Monitoring Status Report	24
PERFORMANCE-Retrieve-PM Mode-T3	DS-3 Performance Monitoring Mode Report	25
PERFORMANCE-Retrieve-PM-Optics	Optics Performance Monitoring Status Report	26
PERFORMANCE-Retrieve-PM-Section	Section Performance Monitoring Status Report	27
PERFORMANCE-Retrieve-PM-Start Time	Performance Monitoring Day Bin Start Time Report	28
PERFORMANCE-Retrieve-PM-STS1	STS-1 Path Performance Monitoring Status Report	29
PERFORMANCE-Retrieve-PM-T3	DS-3 Performance Monitoring Status Report	30
PERFORMANCE-Retrieve-PM Threshold-EC1	EC1 Performance Monitoring Threshold Value Report	31
PERFORMANCE-Retrieve-PM Threshold-Line	Line Performance Monitoring Threshold Value Report	32

Table 11-5. List of Inputs (Commands) That Generate Reports—Contd

[Alphabetized by Qualifier(s)]		
Input (Command)	Report (Note)	Example
PERFORMANCE-Retrieve- <i>PM Threshold-Optics</i>	Optics Performance Monitoring Threshold Value Report	33
PERFORMANCE-Retrieve- <i>PM Threshold-Section</i>	Section Performance Monitoring Threshold Value Report	34
PERFORMANCE-Retrieve- <i>PM Threshold-STs1</i>	STs1 Performance Monitoring Threshold Value Report	35
PERFORMANCE-Retrieve- <i>PM Threshold-T3</i>	T3 Performance Monitoring Threshold Value Report	36
CONFIGURATION-Retrieve- <i>Protection-Line</i>	Network Element Protection Switching Provisioning Report	37
CONFIGURATION-Retrieve- <i>Protection-LS</i>	Low Speed Protection Switching Provisioning Report	38
SECURITY-Retrieve- <i>Security-NE</i>	Access Security Global Configuration Report	39
SECURITY-Retrieve- <i>Security-Port</i>	Access Port Security Configuration Report	40
FAULT-Retrieve- <i>State</i>	State Report	41
CONFIGURATION-Retrieve- <i>Synchronization</i>	Synchronization Report	42
CONFIGURATION-Retrieve- <i>T3</i>	T3 Port Provisioning Report	43
CONFIGURATION-Retrieve- <i>Timeslot-STs1</i>	STs-1 Tributary Map Report	44
CONFIGURATION-Retrieve-ULSDCC-L3	Displays (a) the Area Address, and (b) Level 2 IS	45
CONFIGURATION-Retrieve-ULSDCC-L4	Reports status (Enabled or Disabled) of the TARP data cache	46
CONFIGURATION-Retrieve-Crossconnection-TIRKS	STs-1 cross-connect map report with TIRKS AIDs	47
CONFIGURATION-Retrieve-Translate-Trib	Reports equivalent relationships between FT-2000 STs-3, FT-2000 STs-1, and TIRKS STs-1 tributaries.	48
CONFIGURATION-Retrieve-Translate-OC-12	Reports equivalent relationships between FT-2000 OC-12 quad/slot/port and TIRKS OC-12 port .	49
Note: These reports appear on the following pages.		

Outputs

Every FT-2000 CIT-PC input that is executed will result in an output on the CIT screen. The output response is in a two-line standard format and consists of the FT-2000 network element identification, date and time (line 1), and the command name (executed input is echoed back), followed by either COMPLD or DENY (line 2).

COMPLD indicates that the action requested by the input was completed. The output may include a report, if applicable.

DENY indicates that the input was denied. The output includes a four-letter Bellcore error code and an explanation of the denial.

Tables 11-2 through 11-8 have a column that shows the number of the report example. Each example is introduced by its heading that shows the FT-2000 CIT-PC input that produces the report. An example is shown for each report, along with a explanation of the column headings and parameters. Table 11-9 lists the FT-2000 CIT-PC inputs (commands) that produce reports.

Some reports are too long to fit on a single screen and the question Continue report page-by-page?(y/n)Yes is displayed on the message line (help). Pressing selects the default (Yes) and the next page of the report is then displayed. If No was selected, then the question Continue report without paging?(y/n)Yes is displayed and must be answered. Scrolling (, keys) allows the user to bring information back to the screen after it has scrolled off, especially the long reports.

Examples of Reports [Generated by Various Inputs (Commands)]

Example 1 - SECURITY-Retrieve-Active-User

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Active-User:All: COMPLD
/* Active User Report
=====
Access   Port Type/   TL1 Calling   Active
Port     Channel  OS Type      Address/GNE  TID   User
=====
dce      -        cit          -             -     -
dte      -        tl1          -             -     -
-----
dcc      vc-0      cit          -             -     LUC02
dcc      vc-1      memry-admin  -             -     LUC01
dcc      vc-2      cmd-resp     -             -     LUC03
:
dcc      vc-8      -            -             -     -
-----
x25      pvc-1     maintenance  -             -     NMA01
x25      pvc-2     other        -             -     TRANSVU
-----
x25      svc-1     other        1234          -     ITM-SNC
:
x25      svc-6     -            -             -     -
*/
;

```

The above report shows the current CIT and TL1 port provisioning and who is currently logged in on each port.

- Access Port - Shows a specific operations interface (physical port) for which the status is being displayed.
- Channel - Shows a virtual channel (vc) associated with the Access Port. For dte and dce ports, a blank (" ") is always reported. For the dcc port, virtual channel 1 through 8 is reported. For the X.25 port, the permanent virtual channel (pvc) 1 or 2 and the switched virtual channels (svc) from 1 through 6.

Port Type/ OS Type	-	Shows how a given port is operating; for example, the dce and dte ports are either "cit" or "tl1." All virtual channels of the X.25 port are "maintenance," "memory-admin," "test," "cmd-resp," or "other." The dcc port, virtual channel 0, is the "cit" and virtual channels 1 through 8 are either "maintenance," "memory-admin," "test," "cmd-resp," "other," or "none." A dash (—) means that no user is currently logged in to the port.
TL1 Calling Address/ GNE TID	-	Shows the calling address the user entered as part of the X.25 dial string and is reported for X.25 virtual channels only or for DCC virtual channels (vc 1 through 8) for the TL1 gateway network element (GNE) at the time of the report. The GNE TID on the report may not be current due to some provisioning after logging into the GNE. (The GNE routes TL1 alarm messages over the X.25 port to the OSs.) For all other ports (and associated virtual channels), this parameter is reported as a blank (" ").
Active User	-	Shows the current login of the user. A dash (—) indicates the user is not currently logged in on the port/(virtual channel).

Example 2 - FAULT-Retrieve-Alarm

```

Node-0  97-11-01 23:15:15 EST
M Retrieve-Alarm:All:  COMPLD
/* Active Alarms and Status Report
=====
Alarm      Source      Date      Time      Srv      Description
Level      Address      Detected
=====
NE ACTY    sts1-1w-6-3  11-01     23:15:42  nsa      path yellow
NE ACTY    sts1-1w-6-2  11-01     23:15:42  nsa      path yellow
NE ACTY    sts1-1w-6-1  11-01     23:15:42  nsa      path yellow

* /
;

```

The preceeding report shows no active alarm conditions, but three status conditions are shown (near-end activities or an abnormal and two near-end activities) in the FT-2000 network element. The greatest severity condition appears first and the least severity condition appears last. Equal severity conditions are listed chronologically, starting with the most recent at the top of the group listing.

Alarm Level - Shows the alarm and status level with the greatest severity to the least severity. Highest alarm level also corresponds to associated user panel LED. If no LEDs are lit at the user panel (no active alarms), then an output status message is shown.

Alarm level/status condition will be one or more of the following:

CR (critical alarm)

MJ (major alarm)

MN (minor alarm)

ABN (abnormal status)

NE ACTY (near-end activity status)

If a protected (non-service-affecting) failure becomes unprotected (service-affecting) because of a failure to the protecting circuit pack or line, then both failures are adjusted accordingly. Similarly, if an unprotected failure becomes protected, the alarm level of that failure is adjusted accordingly.

Source Address - Shows the address for the condition within the FT-2000 network element. A dash (-) indicates no particular address for a condition (for example, a protected power failure). Some conditions give an address, for example, for example "sts1-1w-6-3", meaning an incoming sts1 (DS3) signal on line 1w at tributary 6 on port 3 is receiving "path yellow."

Alarm Level	-	Shows the alarm and status level with the greatest severity to the least severity. Highest alarm level also corresponds to associated user panel LED. If no LEDs are lit at the user panel (no active alarms), then an output status message is shown.
Date Time Detected	-	Shows the month, day, and time in hours, minutes, and seconds that the alarm condition was first detected. If an alarm level changes because of a second failure (higher alarm level), the time will change to correspond to the second failure.
Srv	-	Shows when service is affected (SA), or not affected (nsa). SA could be a DS3 INTFC failure, and an nsa could be an APS channel failure.
Description	-	Shows a brief description of the condition. Explanations of these conditions are provided in table in Section 9, "Maintenance Description."

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Alarm:All:  COMPLD
/* Active Alarms and Status Report
=====
There are no active alarms or status conditions of the requested level.
*/
;

```

The report above shows that no active alarms or status conditions of the requested level are reported for the addressed FT-2000 network element.

Example 3 - CONFIGURATION-Retrieve-Assignment-DCC

This report shows the DCC channel assignment to an LS INTFC slot or pair of slots and the DCC channel orientation (network or user). In the report, slots 1A and 1B of Low Speed Shelf 1 are operating in the 1+1 mode and are assigned to DCC Channel 1. Slots 3B, 5A, and 5B are operating in the 0x1 mode and are individually assigned to DCC Channels 5, 3, and 2, respectively. The remaining 11 slots have no DCC Channel assignments and are indicated by dashes (—).

- Slot - Shows a single service LS INTFC slot designation.
- DCC Channel - Shows the DCC channel assigned to the specified slot. Eight DCC channels are available.
- Orientation - Shows either "User" or "Network" parameter. Network is the default setting. User setting allows the customer to perform OAM&P functions from a single access point.

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Attribute-Environment: COMPLD
/* Environmental Alarm Provisioning Report
=====
Slot          DCC Channel          Orientation
=====
1s-1a         -                      -
1s-1b         -                      -
1s-2a         -                      -
1s-2b         -                      -
1s-3a         -                      -
1s-3b         -                      -
1s-4a         -                      -
1s-4b         -                      -
*/
```


Example 4 - CONFIGURATION-Retrieve-Attribute-Alarm

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Attribute-Alarm: COMPLD
/* System Alarm Attributes Report
=====
Parameter                               Value
=====
Incoming Signal Alarm Delay             20
Alarm Clear Delay                       20
Protection Availability                 NO
Tributary Reporting                     NO
*/

```

These reports show the provisioned delay values of the alarm attributes at the FT-2000 OC-48 Lightwave System level.

- Incoming Signal Alarm Delay - Shows how many seconds the FT-2000 end terminal will wait after declaration of an incoming signal defect before activating all indicators.
- Alarm Clear Delay - Shows how many seconds the FT-2000 end terminal will wait after the alarm retires before reporting it to the external maintenance interfaces (for example, user panel, operations systems).
- Protection Access Availability - The alarm level associated with the "protection access unavailable" condition.
- Tributary Reporting - The alarm level associated with the "tributary failed" condition.

Example 5 - CONFIGURATION-Retrieve-Attribute-Control

```

M  NODE-0  97-11-01 23:15:15 EST
   Retrieve-Attribute-Control:All:  COMPLD
   /* Control Point Provisioning Report
   =====
   Address          Description
   =====
   cont-1           start generator
   cont-2           stop pump
   cont-3           control 3
   cont-4           control 4
   */

```

The above report shows the descriptive name associated with the user-settable miscellaneous discrete control output points. These output points are wired to control/identify the output control points at a remote site.

- Address - Shows number selected (up to four) output points for the report.
- Description - Shows the name (26-character string) associated with the output points, such as "start pump," "start generator," etc.

Example 6 - CONFIGURATION-Retrieve-Attribute-Environment

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Attribute-Environment:  COMPLD
/* Environmental Alarm Provisioning Report
=====
Address      Alarm      Description
Level
=====
env-1        CR          fire
env-2        NA          open door
env-3        MN          environment #3
.            .            .
.            .            .
.            .            .
env-16       MN          environment #16
*/

```

The above report shows the descriptive name associated with the user-settable miscellaneous discrete environmental input points. Usually, these input points are wired to monitor equipment at a remote site.

Address	-	Shows number selected (up to 16) input points.
Alarm Level	-	Shows the provisioned alarm level (severity) of the environmental input, such as: - CR (critical alarm) - MJ (major alarm) - MN (minor alarm) - NA (status not alarmed) - NR (status not alarmed and not reported to the OS)
Description	-	Shows descriptive name the user specified for the alarm condition, such as "fire," "open door," etc. This information is also reported in the condition description of the Active Alarms and Status Report and the History Report.

Example 7 - CONFIGURATION-Retrieve-Circuit-STS1

```

Worcester-MA 97-11-01 13:15:15 EST
M Retrieve-Circuit-STS1:1: COMPLD
/*
      STS-1 Circuit Map Report
=====
Status: good      Source   Destination   Ring   Primary
      Ring Node      AID         AID        Direction   State   Audit
=====
      Worcester-MA    1e-1-3      ls-1a-1
      Salem-NH      1e-1-3      1w-1-3      East to West
      Concord-MA     1e-1-3      1w-1-3      East to West
      Chicopee-MA    ls-4a-2     1w-1-3      East to West
      y
      y
      y
      y
*/

```



NOTE:

In mixed FT-2000/*WaveStar* rings, the "Source AID" and "Destination AID" columns in this report may appear different than is pictured. If the specified add or drop cross-connection is part of an add/drop at a *WaveStar* NE, the "AID" shown in the "Source AID" or "Destination AID" column is displayed as "WAV-LOC".

For these reports, the ring topology is:

- West to East from Worcester-MA
- West-East between Worcester and Salem-NH
- West-East between Salem and Concord-MA
- West-East between Concord and Chicopee-MA.

The above report was requested from Worcester and lists the complete circuit from Chicopee to Worcester in the West to East direction.

The following report was requested from Worcester and lists the complete circuit from Chicopee to Worcester in the West to East direction:

```

/*                               STS-1 Circuit Map Report
=====
Status: audit disabled           Source   Destination   Ring   Primary
      Ring Node                AID      AID      Direction  State   Audit
=====
      12345678901234567890      123456789  123456789  12345678901  1234    12
      Worcester-MA              1e-1-3    ls-1a-1
      Salem-NH                 1e-1-3    1w-1-3    East to West    y
      Concord-MA                 1e-1-3    1w-1-3    East to West    y
      Chicopee-MA                ls-4a-2    1w-1-3    East to West    y
*/
  
```

The following report was requested from Worcester when the slot is not cross-connected in the drop direction:

```

/*                               STS-1 Circuit Map Report
=====
Status: Not Cross-Connected
      The specified slot is not cross-connected in
      the drop direction.
*/
  
```

The following report was requested from Worcester when the topology was not available at Worcester:

```

/*                               STS-1 Circuit Map Report
=====
Status: Unavailable
      The ring topology is incomplete.
*/
  
```

Only one status condition is reported in order of precedence as shown below:

Not Cross-Connected	- The selected slot is not cross-connected in the drop direction.
Unavailable	- The topology is not available at the local node (for example, the ring is incomplete/open), all or part of the cross-connection table is missing, or circuit audit is suspended.
Path Integrity Failure	- The circuit path is open.
Squelch Map Inconsistent	- The circuit audit algorithm has declared an STS1 Squelch Map Inconsistent condition for this circuit.
Circuit Provisioning Error	- The circuit audit algorithm has declared a Circuit Provisioning Error condition for this circuit.
audit disabled	- One or more of the cross-connections which make up the circuit has its AUDIT parameters set to "NO."
good	- No errors were detected.
Source AID	- The STS-1 tributary or port address identifier.
Destination AID	- The STS-1 tributary or port address identifier.
Ring Direction	- The circuit path direction as specified in the command.
Primary State	- The status of 1WAYDRI and 1+1 protected OC-3 interface cross-connections.
Audit	- The cross-connection AUDIT parameter.

Example 8 - CONFIGURATION-Retrieve-Crossconnection-All

```

NODE-0
M Retrieve Crossconnection-All: COMPLD
/* Cross-Connection Map Report
(..stby STS1,::stby STS3,--act STS1,==act STS3,*Invalid Flag,+AUDIT set to No)
(..# Red Line Service set to Yes, & DRI Primary Node TID)
=====
Destination/Source      Cross-Connection      Source/Destination
=====
      Worcester-MA  1w-1-1  <----->  1e-1-1  Chicopee-MA
      Worcester-MA  1w-1-2  -->2b-1 4a-1<->  1e-1-2  Chicopee-MA
      -             1w-1-3             1e-1-3  -
      West-Ossipee-NH 1w-2-1  -->5a-1      1e-2-1  -
      West-Ossipee-NH 1w-2-1  -->5b-1      1e-2-1  -
      West-Ossipee-NH 1w-2-1  <- -5a-1      1e-2-1  -
      West-Ossipee-NH 1w-2-1  <..5b-1      1e-2-1  -
      West-Ossipee-NH# 1w-2-2  -->1e-10-2  1e-2-2  -
      West-Ossipee-NH# 1w-2-2  -->1a-3 2a-2<->  1e-2-2  #Newburyport-MA
      West-Ossipee-NH# 1w-2-2  <- -1a-3      1e-2-2  -
      West-Ossipee-NH# 1w-2-2  <..1e-10-2  1e-2-2  -
      -             1w-2-3             1e-2-3  -
      -             1w-3-1             1e-3-1  -
      Quabbin-MA#    1w-3-2  <----->  1e-3-2  #Lenox-MA
      Quabbin-MA     1w-3-3  .....>  1e-3-3  #Lenox-MA
      -             1w-3-3             2a-1-->  1e-3-3  #Lenox-MA
      -             1w-3-3             2a-1<-  1e-3-3  #Lenox-MA
      Quabbin-MA#    1w-3-3  <----->  1e-3-3  Lenox-MA
      Boscawen-NH    1w-4-1  -->6a-2      1e-4-1  -
      Boscawen-NH    1w-4-1  <- -6a-1      1e-4-1  -
      Boscawen-NH    1w-4-1  <.....>  1e-4-1  Keene-NH

```

The above report shows information on the add/drop/through configuration of an FT-2000 Add/Drop Rings Terminal. If no cross-connections are found, the heading of this report will print, followed by the message:

The output parameters are:

- Source AID - The STS-1 Tributary or Port Address identifier.
- Destination AID - The STS-1 Tributary or Port Address identifier.
- Type - The type of connection.
- Source TID - The signal entry source destination (LOCA).
- Destination TID - The signal exit destination (LOCZ).
- Primary State - The status of 1WAYDRI and 1+1 protected OC-3 interface cross-connections. The values are ACT (active) or STBY (standby).

Source AID	-	The STS-1 Tributary or Port Address identifier.
Invalid Flag	-	An asterisk displays (first character of the Source/Destination TID) if a provisioned cross-connection does not exist in the ring.
AUDIT parameter Flag	-	A "+" displays (last character of the Type field) if a provisioned cross-connection has its AUDIT parameter set to "No." If the AUDIT parameter is set to "Yes," the last character is blank.
Red Line Service	-	A "#" displays (last character of the Destination/Source field and/or first character of the Source/Destination field) if that cross-connection is tagged for Red Line Service.
DRI Primary Node TID	-	A "&" displays with the provisioned DRI Primary Node TID for all 2-way-dri-sec cross-connections in place of the Source TID. The "&" is reported as the last character of the Destination/Source (West Tributary) or as the first character of the Source/Destination (East Tributary) TID value.

Although the Source TID of the 2-way-dri-sec drop cross-connection is not shown, it will always match the Destination TID of the 2-way-dri-sec add cross-connection.

Example 9 - CONFIGURATION-Retrieve-Date

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Date: COMPLD
/* Date and Time Report
=====
Parameter                               Value
=====
Current Date                            97-11-01
Current Time                            23:15:15
Standard Time Zone                       EST
Start Daylight Savings Time              04-15
Stop Daylight Savings Time               10-05
Daylight Savings Time Zone               EDT
*/

```

The above report shows the provisioned daylight savings time information. If the start and stop daylight savings time dates are the same, automatic switching to daylight savings time is disabled.

Current Date	-	Shows current year, month, and date.
Current Time	-	Shows current time in hours, minutes, and seconds.
Standard TimeZone	-	Shows the standard time zone that is outside of daylight savings time (for example, EST, CST, MST, and PST).
Start Daylight Savings Time*	-	Shows the month and day that daylight savings time is to start.
Stop Daylight Savings Time*	-	Shows the month and day that daylight savings time is to stop
Daylight Savings Time Zone	-	Shows the daylight savings time zone (for example EDT, CDT, MDT, and PDT).

* The Daylight Savings Time feature is "disabled" (disabled will be shown on the report) when the same date is entered for Start Daylight Savings Time and Stop Daylight Savings Time.

Example 10 - CONFIGURATION-Retrieve-EC1

```

Delta-1 97-11-01 09:15:15 EST
M Retrieve-EC1:All: COMPLD
/* EC1 Port Provisioning Report
=====
Port Address      Alarm Level      Signal Degrade Threshold      --Port State--
                                     from STSX1      from OC48
=====
ls-1a-1          MJ          -6              is              is
ls-1a-2          MJ          -6              auto            auto
ls-1a-3          CR          -6              is              is
.
.
ls-8b-3          MN          -3              is              is
;

```

- Port Address** - Shows a specific slot and low-speed port (1, 2, or 3) of an STS1E circuit pack (and line only for 1x1 end terminal).
- Alarm Level** - Shows the highest severity user panel LED that is lit which is the alarm that is assigned to the incoming EC1 signal failure. If no LEDs are lit, then status is shown as NA (not alarmed) or NR (not reported) if provisioned as such.
- Signal Degrade Threshold** - Shows the provisioned signal degrade threshold, either -3 or -6. The example shows a -6, meaning the error rate 10^{-6} .
- Port State** - Shows the memory administrative state of the port from the STS1X or from the OC-48 line; such as, is for in service, auto for automatic, and nmon for not monitored.

Example 11 - CONFIGURATION-Retrieve-Equipment

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Equipment:All: COMPLD
/* Equipage and Version Report
=====
Slot      Circuit  Apparatus Series  CLEI      ECI      Serial
Address   Pack    Code    Number  Code     Code     Number
=====
sysctl    SYSCTL    LAA23    S1:2    SNPQAWAAA 673254    91MV08616574
          FT-2000  RELEASE 8.0.0-TRM
sysmem    SYSMEM    LAA25    S1:2    SNPQWA1AAA 673230    91MV08616747
          FT-2000  RELEASE 8.0.0-TRM
-----
lnctl-1w  LNCTL     LAA28    S1:1    SNPQAHWAAA 680009    91MV06581722
lnctl-p   LNCTL     LAA28    S1:1    SNPQAHWAAA 680009    91MV06581063
-----
ohctl-1e  OHCTL     LAA21    S2:4    SNPQAHWAAA 679492    96MV08615555
ohctl-1w  OHCTL     LAA21    S2:4    SNPQAHWAAA 679492    96MV08624690
-----
tg-1-1    TG3       LAA18    S1:5    SNPQAHWAAA 679113    91MV08615527
          Continue report page-by-page?(y/n)Yes

```

```

NODE-0                      FT-2000                      LOCAL ONLY
=====
Slot      Circuit  Apparatus Series  CLEI      ECI      Serial
Address   Pack    Code    Number  Code     Code     Number
=====
ls-1-6a   DS3      LAA2     S4:4    SNCLG0XAAA 683010    92MV07632228
.         .        .        .        .          .          .
.         .        .        .        .          .          .
ls-p-p1   -        -        -        -          -          -
ls-p-p2   -        -        -        -          -          -
-----
lssw-1-in LSSW     LAA12    S1:5    SNCLFLOAAA 673248    91MV06581726
lssw-1-out LSSW     LAA12    S1:5    SNCLFLOAAA 673248    91MV08616846
lssw-p-in -        -        -        -          -          -
lssw-p-out -        -        -        -          -          -
-----
sw-1      -        -        -        -          -          -
sw-p      -        -        -        -          -          -
*/
Press F9 to repeat last command or F3 to return to input mode.

```

These reports show the equipage and version information for the FT-2000 end terminal (previous page) and for an FT-2000 repeater bay/shelf (below). If either the SYSCTL or SYSMEM is addressed, a software version is displayed. The currently running software release is displayed when SYSCTL is addressed, and the stored software release is displayed when SYSMEM is addressed (for example, after a download or before a Reset is entered). If the requested

information is not available, a report is generated stating "Equipment Data Unavailable."

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Equipment:All: COMPLD
/* Equipage and Version Report
=====
Slot      Circuit  Apparatus  Series  CLEI    ECI      Serial
Address   Pack      Code      Number  Code    Code     Number
=====
sysctl    SYSCTL    LAA23     S1:2    SNPQWAAAA 673255    91MV08616575
          FT-2000  RELEASE  2.1.0-RPTR
sysmem    SYSEM     LAA25     S1:2    SNPQAH1AAA 673231    91MV08616748
          FT-2000  RELEASE  2.1.0-RPTR
-----
rohctl-1  -         -         -         -         -         -
rohctl-p  -         -         -         -         -         -
-----
regenr-1ewREGENR  39B1     S1:1    SNPQARAAAJ 684568    93MV06876543
regenr-1weREGENR  39B1     S1:1    SNPQARAAAJ 684568    93MV06876542
regenr-pewREGENR  39B1     S1:1    SNPQARAAAJ 684569    93MV06876541
regenr-pweREGENR  39B1     S1:1    SNPQARAAAJ 684510    93MV06876549
*/

```

Slot Address - Shows the address of the slot for the selected line.

Circuit Pack* - Shows the functional name of the circuit pack.

Apparatus Code* - Shows the assigned code of the circuit pack.

Series Number* - Shows the series number of the circuit pack.

CLEI[†] Code* - Shows the COMMON Language of the circuit pack.

ECI Code* - Shows the equipment catalog item code of the circuit pack.

Serial Number* - Shows the serial number of the circuit pack.

* A dash ("-") is displayed when a field is not applicable; for example, a slot is not equipped. A question mark (" ") is displayed when the field information is not available; for example, a failed circuit pack.

† COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

Example 12 - FAULT-Retrieve-History

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-History:  COMPLD
/* Maintenance History Report
=====
Date   Time   System   Source   Event
of Event      Alarm   Address  Description
=====
11-01 21:18:47 -       cit-dce   Set-Date
11-01 21:17:47 -       cit-dce   Retrieve Equipment Report
11-01 21:16:17 -       system    Reset in progress - cleared
11-01 21:14:07 MJ       system    Reset in progress
11-01 21:12:47 -       cit-dte   Login:LUC01
11-01 21:12:23 MN       Site-1-02 repeater bay environment input-
cleared
      .      .      .
      .      .      .
      .      .      .
01-30 19:49:32 MN       Site-1-02 repeater bay environment input
*/

```

The above report, normally a multiple page report, shows up to 500 of the most recent events that have occurred in the FT-2000 System. The events are shown with the most recent events at the top and include:

- The beginning and end of FT-2000 System alarm and status conditions
- Completed CIT inputs, except for Retrieve-modifier(s), Operate-Alarm-Cutoff, and Test-LED inputs
- Automatic provisioning state transitions
- Operations systems interface
- All login and logout attempts.

Date of Event	-	Shows the month, day, hours, minutes, and seconds the event occurred.
System Alarm	-	Shows the active alarm level at the time and date shown. Possible alarms are CR, MJ, MN, ABN, NE ACTY, and dash (-) when no alarms exist in the system.
Source Address	-	Shows the address of where the event occurred.
Event Description	-	A brief description of the event.

Example 13 - SECURITY-Retrieve-Login

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Login:  COMPLD
/* Login Provisioning Report
=====
Login      Privilege  Visitor  Expiration  Last Logged In
=====
LUC01      privileged -        -           12:20:09  97-11-01
LUC02      privileged -        -           -
-----
crafta     general   no       -           11:01:09  97-11-01
craftb     general   yes      97-11-01   14:02:50  97-11-01
-----
clerk1     reports only no       -           -
*/
;

```

The above report shows a user the authorization information on that FT-2000 network element. The report lists each user's login and their authorization privileges but not the user's password. Different groups of users are separated by a row of hyphens (---).

- Login - Shows the user's login (up to 10 characters) as assigned by Set-Login-Enter.
- Privilege - Shows the assigned privilege (reports only, general, and privileged).
- Visitor - Shows the login to be a visitor (yes) or not (no).
- Expiration - Shows the date that the visitor login expires. A dash (-) is shown for nonvisitor logins.
- Last Logged In - Shows the time in hours, minutes, and seconds and the date by year, month, and day that the user last successfully logged into the FT-2000 network element. A dash "-" is shown if a user has never logged in.

Example 14 - CONFIGURATION-Retrieve-Low Speed

```

M NODE-0 97-11-01 23:15:15 EST
  Retrieve-Low Speed:All: COMPLD
  /* Low Speed Slot Report
=====
  Slot      PS      Equip Dependent
  Address   Priority  Reports
=====
  ls-1a     HIGH     no
  ls-1b     HIGH     no
  ls-2a     low      no
  ls-2b     low      no
  .         .
  .         .
  .         .
  ls-8a     HIGH     no
  ls-8b     HIGH     no
  */
;

```

The above report shows the protection switching priority of each low speed slot that is addressed.

Slot Address	-	Shows the line and slot address of the low speed interface.
PS Priority	-	Shows the provisioned protection switching priority, either "HIGH" or "low," for an electrical low speed slot.
Equipment Dependent Reports	-	Shows if the EC1, T3, OC-3 and OC-12 reports will include entries based on equipment ("yes" result) or based on pre-provisioned values ("no" result).

Example 15- CONFIGURATION-Retrieve-Map-Neighbor

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Map-Neighbor:  COMPLD
/* DCC Neighbors Report
=====
TID              Product      Connected      Level 2      DCC
      NSAP        TYPE        Through      IS      Status
=====
NODE-0              FT-2000          -            NO        good
      39 840f 80 000000 0000 0000 0000 08006a060102 00
NODE-1              line-1e            NO        FAIL
      39 840f 80 000000 0000 0000 0000 08006a06261f 00
NODE-2              line-1w            NO        good
      39 840f 80 000000 0000 0000 0000 08006a06261f 00

*/
;

```

This report lists all NEs that are immediate DCC neighbors to the local NE.

For Releases 8.1 through 9.0:

If the command is issued to an NE provisioned as a Level 1 IS, the report will list all neighboring NEs provisioned as Level 2 (if any) and/or Level 1 ISs within the local area.

If the command is issued to an NE provisioned as a Level 2 IS, the report will list all neighboring NEs provisioned as Level 2 (if any) and/or Level 1 ISs within the local area, as well as other Level 2 neighboring ISs included in other areas.

For Release 9.1 and later:

The report lists all neighboring NEs regardless of assigned area address.

TID	- Shows the target identifier assigned of each NE in the OC-48 ring (up to 20 characters).
Product Type	- Indicates the type of the local NE. This parameter is left blank for all other NEs.
NSAP	- The NSAP is the OSI stack layer-3 address of each NE in the OC-48 ring and is 40 hexadecimal characters in length. For additional details refer to the following table of parameters and their attributes.
Connected Through	- The AID of the optical interface associated with the DCC linking the local NE and the neighboring NE identified by TID.
Level 2 IS	- Identifies whether the listed NE is provisioned as a Level 2 IS. Possible values are either "yes" or "no".
DCC Status	- Indicates the communications status to the NE identified by TID. Possible values are either "good" or "FAIL".

Example 16 - CONFIGURATION-Retrieve-Map-Network

```

NODE-0 97-10-26 19:16:47
M Retrieve-Map-Network: Compld
/* Network Map Report
=====
TID                      Product      Level 2
      NSAP              Type          IS
=====
NODE-0                   FT-2000
      39 840f 80 000000 0000 0000 08606a060102 00      no
NODE-1
      39 840f 80 000000 0000 0000 08606a060400 00      no
*/

```

I This report lists all reachable NEs (including Level 2 ISs) in the local Level 1 area only, or reachable Level 2 IS NEs across all areas (if the local NE is provisioned to be a Level 2 IS). The topmost entry is the node where the report is requested (local node), followed by all remaining nodes in a west-to-east direction.

- TID - Shows the target identifier assigned of each NE in the OC-48 ring (up to 20 characters).
- Product Type - Indicates the type of the local NE. This parameter is left blank for all other NEs.
- Level 2 IS - Identifies whether the listed NE is provisioned as a Level 2 IS. Possible values are either "yes" or "no".
- NSAP - The NSAP is the OSI stack layer-3 address of each NE in the OC-48 ring and is 40 hexadecimal characters in length. For additional details refer to the following table of parameters and their attributes.

NSAP Field:	AFI	IDI	IDI PAD	DFI ID	Organization	RES	RD	Area Identifier	System	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value (hex)	39	840	F	80	000000	0000	0000	0000	none	00
User Provisionable	No	No	No	No	Yes	Yes	Yes	Yes	No	No

Example 17 - CONFIGURATION-Retrieve-Map-Ring

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Map-Ring:  COMPLD
/* Ring Map Report
=====
TID          Ring          NSAP
Continuity
=====
NODE-0      good   39 840F 80 000000 0000 0000 0000 086066a060102 00
NODE-1      good   39 840F 80 000000 0000 0000 0000 086066a06261f 00
NODE-2      good   39 840F 80 000000 0000 0000 0000 0800066a06258 00

NODE-2 ->(W) NODE-0  (E)->  NODE-1

*/
;
```

This report displays the current ring topology based on the FT-2000 Ring Directory Information Database and reports on the communication status of each node. The topmost entry is the node where the report is requested (local node), followed by all remaining nodes in a West-to-East direction.

TID	- Shows the target identifier assigned of each NE in the OC-48 ring (up to 20 characters).
Ring Connectivity	- Shows if a node is isolated or segmented from the other nodes in the ring by either a “good”, “ISOL” or “-” indication. All hyphens (-) in this column indicate an “incomplete/open” ring.
NSAP	- The NSAP is the OSI stack Layer 3 address of each NE in the OC-48 ring and is 40 hexadecimal characters in length.

Example 18 - SECURITY-Retrieve-Network Element

```

NODE-0 97-10-26 18:45:12
M Retrieve-Network Element
/* System Provisioning Report
=====
Parameter                               Value
=====
TID                                     NODE-0
X.25 Packet Size                       256
Site Address (SADD)                    site-1e-0
                                         site-1w-4
TSA Granularity                        STS1
*/

```

The above report shows the provisioned parameters and values for an individual network element (NE). The retrieved parameter values include target ID (TID), the X.25 packet size, the site address (SADD), and TSA granularity indicates whether the node is operating in an STS3 or STS1 granular mode.

TID	- Shows the unique identification of the node.
X.25 Packet Size	- Shows the X.25 packet size to be used for a TL1 session to this network element. The original value (size) is 256 but may be 128.
Site Address (SADD)	- Shows the confirmed F-byte address (site address) of the FT-2000 network element as reported on both the East and West lines for FT-2000 Release 4.0 and later. The site address for the 1W line of the network is derived from the auto-provisioning function based on the number of sections in the OC-48 line on the west side of the network element. The site address for the 1E line of the network element is always zero in a ring application. If a question mark (?) appears as part of the value, then auto-provisioning has not been completed or has failed (for example, a removed or failed LNCTL). The site address is calculated with respect to the East side of the adjacent FT-2000 ADR node. Each FT-2000 ADR node will first label the East side as 1E-0 (SECURITY-Retrieve-Network Element). The next regenerator away from 1E-0 becomes 1E-1, the next 1E-2, and so on. This is done on a section/line basis between each pair of FT-2000 ADR nodes. In the example above, site 1W-4 indicates that there are three regenerator sites. The regenerators on the West side of an FT-2000 node are identified using the same numbering scheme. Regenerator alarms received on the East or West side of an FT-2000 ADR terminal are reported as site 1E-x or site 1W-x, where "x" is the regenerator address.
TSA Granularity	- Shows whether or not the local NE is operating in an STS3 or STS1 granular mode (dependent on TRMTR and RCVR).

Example 19 - CONFIGURATION-Retrieve-OC3

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-OC3:All: COMPLD
/* OC3 Provisioning Report
=====
Port   Alarm  SD   Output  Provisioned   Operating   Payload      Port   Sync
Addr   Level  THR  AU4     Mode         Mode         Mode         state  Messages
      (from (from (from (from (from (from (from
      OC48) OC3)  OC48) OC3)  OC48) OC3)  OC3)
=====
ls-1a  CR    -6   SONET   1+1   1+1   1+1   1+1   -3   -3C   i   enabled
ls-1b  CR    -6   SONET   1+1   1+1   1+1   1+1   -3C  -3C   i   disabled
ls-2a  MJ    -8   SONET   0x1   0x1   0x1   0x1   -3   -3   i   disabled
ls-2b  MJ    -8   SONET   0x1   0x1   0x1   0x1   -3   -3   i   disabled
ls-3a  MN    -6   SDH     1+1   1+1   1x1   1+1   -3   -3   i   disabled
ls-3b  NA    -6   SDH     1+1   1+1   1+1   1+1   -3C  -3C   i   disabled
.
.
ls-8b  NA    -8   SDH     0x1   0x1   0x1   0x1   -3C  -3C   i   disabled
*/

```

The above report shows the provisioning information and attributes of an OC3 slot. It provides information on the severity of the alarm implied by the failure of the OC3 slot, the signal degrade threshold, and the memory administrative state.

Port Addr	-	Shows a specific low speed interface slot (physical) address.
Alarm Level	-	Shows the provisioned alarm level for incoming OC-3 signal conditions. Possible values: (CR, MJ, MN, NA, NR, NO).
Near End	-	
Alarm Level	-	Shows the provisioned alarm level for incoming conditions from the NE. Possible values: (CR, MJ, MN, NA, NR).
Far End	-	
SD Thr	-	Shows the provisioned signal degrade threshold value (-5, -6, -7, -8, -9) to base 10 of the bit error rate.
Output AU4 Map	-	Shows the provisioned AU4 mapping of either SONET or synchronous digital hierarchical (SDH).
Wave-Lngth	-	Shows the optical wavelength of "1310".
Provisioned-Mode	-	Shows the provisioned protection switching mode (1+1 or 0x1) in the "from OC48" direction and the "from OC3" direction.
Operating-Mode	-	Shows the actual operating protection switching mode (1+1 or 0x1) in the "from OC48" direction and the "from OC3" direction.

Payload-	- Shows the signal type (-3 or -3C) being forwarded through the OC3 circuit pack in the "from OC48" direction and the "from OC3" direction.
Port State	- Shows the memory administrative state in the "from OC3" direction.
Sync Messaging	- Shows the provisioned "sync messaging state" in the "from OC48" direction.

Example 20 - CONFIGURATION-Retrieve-OC12

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-OC12:All: COMPLD
/* OC3 Provisioning Report
=====

```

Cmmd Slot	Alm Lvl	SD Thr	Output AU4 Map	Provisioned Mode (from OC48)	Provisioned Mode (from OC12)	Operating Mode (from OC48)	Operating Mode (from OC12)	Payload (from OC48)	Payload (from OC12)	Port State (from OC12)	Prov OC12 Time Dir	Sync Messages
ls-1b	CR	-6	SONET	0x1	0x1	0x1	0x1	-12	-12	a	1W	enabled
ls-3b	MJ	-8	SDH	1+1	0x1	0x1	0x1	-12C	-12C	i	1E	enabled
ls-5b	MN	-6	SDH	1+1	1+1	1+1	1+1	-12c	-12c	i	1E	disabled
ls-7b	NA	-6	SDH	1+1	1+1	1+1	1+1	-12c	-12c	n	1W	disabled

```

*/

```

The above report shows provisioning information and attributes for each and all OC-12s within the NE.

Cmmd Slot	-	Shows the Command Slot Address for the target Quadcircuit pack.
Alarm Level	-	Shows the severity of the alarm assigned to an incomin OC-12 signal failure.
Wave-Lngth	-	Shows the optical wavelength of "1310".
SD Thr	-	Specifies the signal degrade threshold in terms known as "bit error rate" (BER). It is an integer with values from the damain (-5, -6, -7, -8, -9).
Output AU4 Map	-	Specifies the AU4 mapping as either SONET or SDH.
Provisioned Mode (from OC48) and (from OC12)	-	Specifies the provisioned protection mode in the "from OC48" direction and the "from OC12" direction. Values are either ("0x1" or "1x1").
Operating Mode (from OC48) and (from OC12)	-	Specifies the actual operating protection switching mode in teh "from OC48" direction and the "from OC12" direction. Values are either ("0x1" or "1x1").
Payload (from OC48)	-	Specifies the signal type being forwarded through the OC12 circuit pack in the "from OC48" direction and the "from OC12" direction. Values are either ("-12" or "-12c").

Port State (from OC48)	- Specifies the memory administration state in the "from OC12" direction. Values are either ("i", "a" or "n").
Prov OC12 Time Dir	- Specifies the OC48 line from which the OC-12 derives its timing source when the node's synchronization is provisioned to be through mode. Values are either (1W or 1E).
Sync Messages	- Specifies the provisioned sync messaging state in teh "from OC48" Values are either ("enabled" or "disabled").

Example 21 - CONFIGURATION-Retrieve-OC48

```

Delta-1 97-11-01 23:15:15 EST
M Retrieve-OC48:All: COMPLD
/* OC-48 Line Provisioning Report
=====
Line      Line      Signal Degrade      Syns      F Byte
Address   Code      Threshold      Messages  Processing
=====
line-1e   nrz        -6              disabled  disabled
line-1w   nrz        -6              disabled  enabled
*/
;

```

The above report shows provisioned information for each addressed high-speed line at an **FT-2000 add/drop-rings terminal**.

Line Address	-	Shows the OC-48 line(s) selected for the report.
Line Code	-	Shows the non-return-to-zero (nrz) line code.
Signal Degrade Threshold	-	Shows the provisioned threshold value. This value determines when a signal degrade condition will be declared. The value is the line parity error rate for the specified line(s); for example, -5 is error rate 10^{-5} .
Sync Messaging	-	Shows the provisioned sync messaging state in the "from OC48" direction.
F-Byte Processing		Shows the provisioned F-byte processing value (enabled or disabled). F-byte processing is used by FT-2000 terminals to fault locate FT-2000 Repeaters.

Example 22 - CONFIGURATION-Retrieve-Path-Trace

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Path-Trace:Slot=All: COMPLD
/* Path Trace Report
=====
Address
Parameter Value
=====
ls-1a-1
Status: MISMATCH          Label: 01 equipped-non specific payload
ActRx: ActualReceiveTraceWhichDoesNotMatchProvisionedReceiveTrace
PrvRx: ProvisionedReceiveTrace
PrvTx: ProvisionedTransmitTrace
PDI-P Switching: Enabled
-----
ls-1a-2
Status: good              Label: 01 equipped-non specific payload
ActRx: AID2Receive
PrvRx: AID2Receive
PrvTx: AID2Transmit
PDI-P Switching: Disabled
-----
ls-1a-3
Status: MISMATCH          Label: 01 equipped-non specific payload
ActRx: ?????????????????????????????????????????????????????????????
PrvRx: AID2Receive
PrvTx: AID2Transmit
PDI-P Switching: Disabled
-----
ls-1b-1
Status: NOT APPLICABLE    Label: -
ActRx: -
PrvRx: ProvisionedReceiveTrace
PrvTx: ProvisionedTransmitTrace
PDI-P Switching: Disabled
-----
ls-1b-2
Status: UNAVAILABLE       Label: ?
ActRx: ?
PrvRx: ProvisionedReceiveTrace
PrvTx: ProvisionedTransmitTrace
PDI-P Switching: Disabled
:

```

This command retrieves the provisioned transmit and receive path strings and the actual receive path trace string for a DS3 circuit pack only (not for STS1E or OC-3). The actual receive string at this node should be the provisioned transmit string from another node. If the strings match, then the circuit path is good. The provisioned receive string is what is expected at this node and may be different than the actual receive string. If they differ, then the circuit path is a mismatch.

The path trace is for one STS-1 signal that is reported in either a text format or a binary format. The first report (text format) displays only an ASCII text interpretation. The second report (binary format) displays raw hexadecimal values, followed by an ASCII text interpretation. Periods (...) indicate unprintable ASCII characters for both formats.

Additional information on path trace is in Sections 8 and 9, "Administration and Provisioning," and "Maintenance Description," respectively.

Address	- Shows the OC-48 line, DS3 circuit pack slot, and port of the STS-1 path.
Parameter Value	- Shows the status, the actual received data string (ActRx), the provisioned received (PrvRx), and/or transmit (PrvTx) data strings.
ActRx	- Shows the actual incoming STS-1 data string for the specified port.
PrvRx	- Shows the expected incoming STS-1 data string for the specified port.
PrvTx	- Shows the provisioned outgoing STS-1 data string for the specified port.
Status:	- Shows the ActRx (actual received) data string as follows: good means ActRx path is the same as PrvRx path. MISMATCH means ActRx path is different than PrvRx path. NOT APPLICABLE means the addressed slot is in the AUTO state or is not equipped with a DS3 circuit pack.UNAVAILABLE means that there is an incoming OC-48 line failure, a missing slot cross-connection, or an unprotected failure.
Label:	- Shows the C2 byte value in hexadecimal code for the received path signal and a corresponding text description of the STS payload type. C2 byte values of E1 to FC identifies a PDI-P condition.
PDI - P Switching	- Shows whether DRI switching on STS Path Payload Defect Indicators (PDI-P) is enabled or disabled. For concatenated signals, this parameter is only valid for the first STS-1.

Example 23 - PERFORMANCE-Retrieve-PM-EC1

```

Node-0 97-11-01 23:15:15 EST
M Retrieve-PM-EC1:All: COMPLD
/* EC1 Performance Monitoring Status Report
   Bin Start Time: quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address      Start   Section  ----- EC1 Line (B2) -----
              Time      SEFS-S    CV-L   ES-L   SES-L   UAS-L   PJC
=====
ls-1a-1      Today      5         1       0       0      34000   5413>
              09:00      5         1       0       0        5    600
=====
ls-1a-2      Today     12345*     25       2       0     12345*  4333
              09:00      5         1       0       0        5    25
=====
ls-1a-3      Today     12345?     25?      2?      0?     12345?
              09:00      -         -         -         -         -
=====
ls-2b-1      Today      5         1       0       0        5     0
              09:00      5         1       0       0        5     0
=====
ls-2b-2      Today     12345     25       2       0     12345   4333
              09:00      5         1       0       0        5    25
=====
ls-2b-3      Today     12345     25       2       0     12345   4333
              09:00      5         1       0       0        5    25
*/
;

```

The above report, which can be a multiple page report, shows the EC1 section and line performance-monitoring data (day and quarter-hour). Data is collected from the signal coming from the OC-48 line (section) and from the cross-connections (EC1 line). When a greater than sign (>) is displayed, it means the violations are greater than the maximum value for the parameter. When a question mark (?) is displayed, it means corrupted data or an incomplete time interval for that parameter. When a hyphen (-) is displayed, it means the data is unavailable. An asterisk (*) is displayed whenever the threshold-crossing alert (TCA) is reached. This report is not available at the repeater site.

Example 24 - PERFORMANCE-Retrieve-PM-Line

Address	-	Shows the AID of the line, slot, and ports for point-to-point network or slot and ports for a ring network.
Start Time	-	Shows the time in hours and minutes (quarter-hour increments) that data collection started. Yesterday is shown by MM-DD.
Section SEFS-S	-	Shows the number of severely frame errored seconds reported in the bin during the specified time.
CV-L	-	Shows the number of EC1 line code violations reported in the bin during the specified time.
ES-L	-	Shows the number of EC1 line errored seconds reported in the bin during the specified time.
SES-L	-	Shows the number of EC1 line severely errored seconds reported in the bin during the specified time.
UAS-L	-	Shows the number of EC1 line unavailable seconds reported in the bin during the specified time.
PJC	-	Shows the Pointer Justification Count reported in the bin during the specified time.

Example 24 - PERFORMANCE-Retrieve-PM-Line

```

NODE-0 97-11-01 13:15:15 EST
M Retrieve-Performance Monitoring-Line-OC12:1b: COMPLD
/* OC-12 Line Performance Monitoring Status Report
   Bin Start Time: quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address      Start  ----- OC-12 Line (B2) -----
              Time    CV-L    ES-L    SES-L    UAS-L    PSC    PJC
=====
1s-1b      Today    133456?    0?    0?    0?    0?    0?
              03-20      1      3      1      1      0      0?
              03-19      1      3      1      1      0      0?
              03-18      0      0      1      0      1      0?
-----
              09:00      1      0      0      0      0      0?
              08:45      3      0      0      5      0      0?
              08:30      8      8      3     900      0      0?
              08:15    5315000>    115*      0      0      0?
*/
;

```

The above report shows the current performance-monitoring data for the OC-48 line(s). When a greater than sign (">") is displayed, it means the violations are greater than the maximum value for the parameter (overflow). When a question mark ("?") is displayed, it means corrupted data or incomplete time cycle for that parameter. An asterisk is displayed whenever the threshold-crossing alert (TCA) is reached. This report is not available at the repeater site.

- Address - Shows the specified OC-12 quad.
- Start Time - Shows the time by month, day, hour, and minutes.
- B2 CV-L - Shows the number of code violations reported in B2 during the specified time.
- B2 SES-L - Shows the number of severely errored seconds reported in B2 during the specified time.
- B2 ES-L - Shows the number of errored seconds reported in B2 during the specified time.
- PSC - Shows the number of protection switching counts during the specified time.
- PJC - Shows the Pointer Justification count reported in the bin during the specified time that.

Example 25 - PERFORMANCE-Retrieve-PM Mode-T3

```

M  NODE-0 97-11-01 23:15:15 EST
    Retrieve-PM Mode-T3:All:  COMPLD
    /* DS-3 Performance Monitoring Mode Report
    =====
    Port      DS3
    Address    Mode
    =====
    ls-1a-1    P-bit
    ls-1a-2    P-bit
    ls-1a-3    F&M-bit
    .
    .
    .
    ls-8b-3    P-bit
    */
;

```

The above report shows the algorithm used for determining and accumulating DS3 path performance monitoring data, either P-bit processing or F-bit and M-bit, adjusted processing.

- Port Address - Shows the AID of low-speed port.
- DS3 Mode - Shows the provisioned algorithm used to determine and accumulate the DS3 path performance data (P-bit or F&M-bit).

Example 26 - PERFORMANCE-Retrieve-PM-Optics

```

NODE-0 97-11-01 09:15:15 EST
M Retrieve-Performance Monitoring-Optics-OC48-All: COMPLD
/* OC48 Optics Performance Monitoring Status Report
   Bin Start Time: quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address  Start   Transmit   Receive   Laser Bias
         Time    Power      Power      Current
=====
line-1e  Today   in range   in range   1.04 in range
         09:15   in range   in range   1.03 in range
=====
line-1w  Today   in range   in range   0.97 in range
         09:15   in range   in range   0.99 in range
*/
;

```

The above report shows the current performance-monitoring data for the OC-48 transmitter and receiver optics for all lines at an FT-2000 terminal.

- Address - Shows the address of the transmitter or receiver in the FT-2000 terminal.
- Start Time - Shows the time in hours and minutes for today only, or the month and day are shown.
- Transmit Power - Shows if the transmit power is within the specifications.
- Receive Power - Shows if the receive power is within the specifications. A hyphen (-) indicates that the quarter-hour bin data is unavailable for the TRMTR circuit pack.
- Laser bias Current - Shows if the laser bias current is within the specifications.

Example 27 - PERFORMANCE-Retrieve-PM-Section

```

NODE-0 97-11-01 13:15:15 EST
M Retrieve-Performance Monitoring-Section-OC48-All: COMPLD
/* STS-48 Section Performance Monitoring Status Report
   Bin Start Time: quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address      Start      --- STS-48 (B1) Section ---
              Time      CV-S    ES-S    SES-S    SEFS-S
=====
line-1e      Today      133456*    0      0      0
              09:00      1      0      0      0
=====
line-1w      Today      133456*    0      1238*    0
              09:00      1      1200*    0      0
              08:45      3      0      1200*    0
*/
;

```

The above report shows the current section performance-monitoring data for an OC-48 line section. When a greater than sign (">") is displayed, it means the violations are greater than the maximum value for the parameter. When a question mark ("?",) is displayed, it means corrupted data or an incomplete time cycle for that parameter. An asterisk (*) is displayed whenever the threshold-crossing alert (TCA) is reached. This report is not available at the repeater site.

Address	- Shows the line containing the section.
Start Time	- Shows the time in hours and minutes (quarter-hour increments) that data collection started. But if month and day are shown, the data is for yesterday.
CV-S	- Shows the number of code violations reported in B1 during the specified time.
ES-S	- Shows the number of errored seconds reported in B1 during the specified time.
SES-S	- Shows the number of severely errored seconds reported in B1 during the specified time.
SEFS-S	- Shows the number of severely errored frame seconds reported for the specified section during the specified time.

Example 28- PERFORMANCE-Retrieve-PM-Start Time

```
Delta-1 97-11-01 23:15:15 EST
M Retrieve-PM-Start Time:All: COMPLD
/* Performance Monitoring Day Bin Start Time Report
=====
Parameter      Value
=====
Start Time     13:00
*/
;
```

The above report shows the start time for measuring the day bins for the performance monitoring data.

Start Time - Shows the provisioned hours:minutes. Hours may be 00 to 23 and minutes is always "00".

Example 29 - PERFORMANCE-Retrieve-PM-STs1

```
NODE-0 97-11-01 13:15:15 EST
M Retrieve-Performance Monitoring-STs1:1e-All: COMPLD
/* STs1 Path Performance Monitoring Status Report
   Bin Start Time: quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address      Start  ----- Path (B3) ----- ----- Far End (FEBE)-----
              Time   CV-P  ES-P  SES-P  UAS-P      CV-F  ES-F  SES-F  UAS-F
=====
sts1-1e-1-1  Today  3449*   1    0    0        5    1    0    0
              09:00   5    1    0    0        5    1    0    0
=====
sts1-1e-1-2  Today  8912345> 25    2    0    12345  25    2    0
.
.
.
=====
sts1-1e-16-3 Today  12345?  25?   2?   0?  12345?  25?   2?   0?
              09:00   0?   0?   0?   0?   0?   0?   0?   0?
*/
;
```

The above report (can be a multiple page report) shows the current STS-1 path performance-monitoring data (day and quarter-hour) for an electrical low-speed signal on line 1, slot 1, ports 1, 2, and 3 received from the OC-48 line. Data is collected at the near end (B3) and at the far end (FEBE). When a greater than sign (">") is displayed, it means the violations are greater than the maximum value for the parameter. When a question mark ("?") is displayed, it means corrupted data or an incomplete time cycle for that parameter. When a hyphen ("-") is displayed, it means the data is unavailable, such as any port in the NMON or AUTO state. An asterisk (*) is displayed whenever the threshold-crossing alert (TCA) is reached. This report is not available at the repeater site.

Address	-	Shows the path name including the line, slot or tributary, and port.
Start Time	-	Shows the time in hours and minutes (quarter-hour increments) that data collection started. But if month and day are shown, the data is for yesterday.
CV-P	-	Shows the number of code violations reported in the bin during the specified time.
ES-P	-	Shows the number of errored seconds reported in the bin during the specified time.
SES-P	-	Shows the number of severely errored seconds reported in the bin during the specified time.
UAS-P	-	Shows the number of unavailable seconds reported in the bin during the specified time.

Example 30 - PERFORMANCE-Retrieve-PM-T3

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Performance Monitoring-T3:1-1A-All:  COMPLD
/* DS-3 Performance Monitoring Status Report
   Bin Start Time:  quarter hour registers at yy-mm-dd hh:mm:ss
                   day registers at yy-mm-dd hh:mm:ss
=====
Address      Start   -DS3 Line-   ----- DS3 Path -----
              Time      ES-L         CV-P      ES-P    SES-P    SAS-P    UAS-P
=====
ls-1a-1      Today      1*           11         0         5         4         3
(F&M-bit)    -----
              09:00      0            0          3         3         3        19
=====
ls-1a-2      Today      25           2          0         45        3        19
(F&M-bit)    -----
              09:00      0            0          0         0         0         0
=====
ls-1a-3      Today      0            0          0         0         0         0
(P-bit)      -----
              09:00      0            0          0         0         0         0
=====
ls-1b-1      Today      111*         10         0         5         4         3
(P-bit)      -----
              09:00      0            80         3         3         3        19
=====
ls-1b-2      Today      25           2          0         5         3        19
(F&M-bit)    -----
              09:00      0            0          0         0         0         0
=====
ls-1b-3      Today      1            0          0         0         0         0
(F&M-bit)    -----
              09:00      0            0          0         0         0         0
=====
*/
;

```

The above report, which can be a multiple page report, shows the current performance-monitoring data (day and quarter-hour) for a T3 (DS3 line and DS3 path). Data is collected from the signal coming from the cross-connections (DS3 line) and from the OC-48 line (DS3 path). When a greater than sign (>) is displayed, it means the violations are greater than the maximum value for the parameter. When a question mark ("?") is displayed, it means corrupted data or an incomplete time cycle for that parameter. When a hyphen ("-") is displayed, it means the data is unavailable, such as any port in the NMON or AUTO state. An asterisk (*) is displayed whenever the threshold-crossing alert (TCA) is reached. This report is not available at the repeater site.

Address	- Shows the address within the FT-2000 end terminal; for example, low-speed shelf, line 1, slot 1b, and port 1. The address for an FT-2000 add/drop-rings terminal would show the low-speed shelf, slot, and port.
Start Time	- Shows the time in hours and minutes (quarter-hour increments) that data collection started.
ES-L	- Shows the number of errored seconds reported in the bin during the specified time.
CV-P	- Shows the number of code violations reported in the bin during the specified time.
ES-P	- Shows the number of errored seconds reported in the bin during the specified time.
SES-P	- Shows the number of severely errored seconds reported in the bin during the specified time.
SAS-P	- Shows the number of severely errored frame/AIS seconds reported in the bin during the specified time.
UAS-P	- Shows the number of unavailable seconds reported in the bin during the specified time.

Example 31 - PERFORMANCE-Retrieve-PM Threshold-EC1

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-PM Threshold-EC1:1a:All: COMPLD
/* EC1 Performance Monitoring Threshold Value Report
=====
Address      Bin      TCA      Section  ----- EC1 Line (B2) -----
Report      SEFS-S   BER    CV-L    ES-L    SES-L    UAS-L    PJC
=====
ls-1a-1      QH      Enable   5        -9      900      25      10      50      60
              Day      Enable  10        -9      900      250     10      50      5760
ls-1a-2      QH      Enable   5        -9      900      25      10      50      60
              Day      Enable  10        -9      900      250     10      50      5760
ls-1a-3      QH      Enable   5        -9      900      25      10      50      60
              Day      Enable  10        -9      900      250     10      50      5760
*/

```

The report shows the current performance-monitoring threshold crossing alert (TCA) values for the EC1 low-speed line.

- Address - Shows the specific slot and port for the EC-1 line.
- Bin - Shows the quarter-hour (QH) and day bins.
- Section SEFS-S - Shows the provisioned number of section severely errored frame seconds for the QH bin and the day bin that will cause a TCA.
- BER - Shows the provisioned bit error rate; for example, -9 is 10^{-9} , for the QH bin and day bin.
- CV-L - Shows the provisioned number of line code violations for the QH bin and the day bin that will cause a TCA.
- ES-L - Shows the provisioned number of line errored seconds for the QH bin and the day bin that will cause a TCA.
- SES-L - Shows the provisioned number of line severely errored seconds for the QH bin and the day bin that will cause a TCA.
- UAS-L - Shows the provisioned number of unavailable seconds for the QH bin and the day bin that will cause a TCA.
- TCA Report - Shows if the automatic reporting of TCAs is enabled or disabled.
- PJC - Shows the provisioned number of STS Pointer Justification Counts for the QH bin and Day bin that will cause a TCA.

Example 32 - PERFORMANCE-Retrieve-PM Threshold-Line

```

NODE-0 97-11-01 13:15:15 EST
M Retrieve-PM Threshold-Line:OC3:All: COMPLD
/* OC-3 Line Performance Monitoring Threshold Value Report
=====
----- OC-3 Line (B2) -----
TCA
Address      Bin  Report  BER   CV-L   ES-L   SES-L   UAS-L   PJC
=====
1s-1a       QH   Enable  -9    9000   25     10      10      60
             Day  Enable  -9    9000   250     10      10     5760
1s-1b       QH   Enable  -9    9000   25     10      10      60
             Day  Enable  -9    9000   250     10      10     5760
*/

```

The report shows the current performance-monitoring threshold crossing alert (TCA) values for the OC-3 lines.

Address	-	Shows the specific OC-3 slot.
Bin	-	Shows the quarter-hour (QH) and day bins.
BER	-	Shows the provisioned bit error rate; for example, -9 is 10^{-9} , for the QH bin and Day bin.
CV-L	-	Shows the provisioned number of line code violations for the QH bin and the day bin that will cause a TCA.
ES-L	-	Shows the provisioned number of errored seconds for the QH and Day bin that will cause a TCA.
SES-L	-	Shows the provisioned number of line severely errored seconds for the QH bin and the Day bin that will cause a TCA.
UAS-L	-	Shows the provisioned number of unavailable seconds for the QH bin and the Day bin that will cause a TCA.
TCA Report	-	Shows if the automatic reporting of TCAs is enabled or disabled.
PJC	-	Shows the provisioned number of STS Pointer Justification Counts for the QH bin and Day bin that will cause a TCA.

Example 33- PERFORMANCE-Retrieve-PM Threshold-Optics

```

Delta-1 97-11-01 23:15:15 EST
M Retrieve-PM Threshold-Optics:OC48:All: COMPLD
/* OC-48 Optics TCA Autonomous Reporting Status Report
=====
Address      Bin      TCA
Report
=====
line-1e      QH      Enable
              Day      Disable
line-1w      QH      Enable
              Day      Disable
* /

```

- Address - Shows the specific optical line.
- Bin - Shows the quarter-hour (QH) and day bins.
- TCA Report - Shows if the automatic reporting of TCAs is enabled or disabled.

Example 34 - PERFORMANCE-Retrieve-PM Threshold-Section

```

NODE-0  97-11-01 13:15:15 EST
M Retrieve-PM Threshold-Section:All:  COMPLD
/* STS-48 Section Performance Monitoring Threshold Value Report
=====
                        STS-48 Section (B1) -----
Address      Bin      BER      CV-S      ES-S      SES-S      SEFS-S
=====
line-1e      QH       -9       1000       25       10        5
              Day      -9       1000        3      250       50
line-1w      QH       -9       1000       25       10        5
              Day      -9       1000        3      250       50
*/
;

/* STS-48 TCA Autonomous Reporting Status Report
=====
                        TCA      STS-48 Section (B1) -----
Address      TCA Report TCA Report TCA Report TCA Report TCA Report
              Bin  BER      CV-S      ES-S      SES-S      SEFS-S
=====
line-1e      QH  Enable  Disable  Enable  Disable  Disable
              Day Enable  Disable  Enable  Disable  Disable
line-1w      QH  Enable  Disable  Enable  Disable  Disable
              Day Enable  Disable  Enable  Disable  Disable
*/

```

The report shows the current performance-monitoring threshold crossing alert (TCA) values for the STS-48 section.

Address	-	Shows the specific OC-48 line.
Bin	-	Shows the quarter-hour (QH) and the day bins.
TCA Report	-	Shows if the automatic reporting of TCAs is enabled or disabled.
BER	-	Shows the provisioned bit error rate for the QH and day bins that will cause a TCA.
CV-S	-	Shows the provisioned number of code violations for the QH and day bins that will cause a TCA.
ES-S	-	Shows the provisioned number of errored seconds for the QH and day bins that will cause a TCA.
SES-S	-	Shows the provisioned number of severely errored seconds for the QH and day bins that will cause a TCA.
SEFS-S	-	Shows the provisioned number of section errored frame seconds for the QH and day bins that will cause a TCA.
TCA Report	-	Shows if the automatic reporting of TCAs is enabled or disabled.

Example 35 - PERFORMANCE-Retrieve-PM Threshold-STS1

(User the PERFORMANCE category.)

```

NODE-0  97-11-01 13:23:55 EST
M Retrieve-PM Threshold-STS1
/* STS-1 Path Performance Monitoring Threshold Value Report
=====
----- STS-1 Path (B3)/FEBE -----
Address      Bin  BER  CV-P/F  ES-P/F  SES-P/F  UAS-P/F
=====
sts1-1e-1-1  QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
sts1-1e-1-2  QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
sts1-1e-1-3  QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
sts1-1e-2-1  QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
sts1-1e-2-2  QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
.            .    .    .    .    .    .
sts1-1e-16-3 QH   -9   1000    25     10      10
              Day  -9   1000   250     10      10
*/
:

/* STS-1 Path TCA Autonomous Reporting Status Report
=====
TCA Report TCA Report TCA Report TCA Report TCA Report
Address      Bin  BER  CV-P/F  ES-P/F  SES-P/F  UAS-P/F
=====
sts1-1e-1-1  QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
sts1-1e-1-2  QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
sts1-1e-1-3  QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
sts1-1e-2-1  QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
sts1-1e-2-2  QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
.            .    .    .    .    .    .
sts1-1e-16-3 QH   Enable  Enable  Disable  Disable  Disable
              Day  Enable  Enable  Disable  Disable  Disable
*/

```

The report shows the current performance-monitoring threshold crossing alert (TCA) values for the STS-1 path.

Address	-	Shows the specific OC-48 line, STS-3 tributary, and STS-1 tributary for the STS-1 path.
Bin	-	Shows the quarter-hour (QH) and the day bins.
BER	-	Shows the provisioned bit error rate for the QH and day bins that will cause a TCA.
CV-P/F	-	Shows the provisioned number of code violations for the QH and day bins that will cause a TCA.
ES-P/F	-	Shows the provisioned number of errored seconds for the QH and day bins that will cause a TCA.
SES-P/F	-	Shows the provisioned number of severely errored seconds for the QH and day bins that will cause a TCA.
UAS-P/F	-	Shows the provisioned number of unavailable seconds for the QH and day bins that will cause a TCA.
TCA Report	-	Shows if the automatic reporting of TCAs is enabled or disabled.

Example 36 - PERFORMANCE-Retrieve-PM Threshold-T3

```

NODE-0 97-11-01 23:55:21 EST
M Retrieve-PM-Threshold-T3
/* DS-3 Performance Monitoring Threshold Value Report
=====
              DS3 Line  ----- DS3 Path -----
Address      Bin ES-L  BER    CV-P  ES-P  SES-P  SAS-P  UAS-P
=====
ls-1a-1      QH  5    -9    500    25    10    50    5
              Day  3    -9    500   250    10    50    3
ls-1a-2      QH  5    -9    500    25    10    50    5
              Day  3    -9    500   250    10    50    3
ls-1a-3      QH  5    -9    500    25    10    50    5
              Day  3    -9    500   250    10    50    3
ls-1b-1      QH  5    -9    500    25    10    50    5
              Day  3    -9    500   250    10    50    3
.            .    .    .    .    .    .    .    .
.            .    .    .    .    .    .    .    .
ls-8a-3      QH  5    -9    500    25    10    50    5
              Day  3    -9    500   250    10    50    3
*/
;

              TCA Rpt TCA Rpt TCA Rpt TCA Rpt TCA Rps TCA Rpt TCA Rpt
1s-1a-1      QH  Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
1s-1a-2      QH  Enable Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
1s-1a-3      QH  Enable Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
1s-1b-1      QH  Enable Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
1s-1b-2      QH  Enable Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
.            .    .    .    .    .    .    .    .
.            .    .    .    .    .    .    .    .
1s-8b-3      QH  Enable Enable Enable Enable Enable Enable Enable Enable
              Day Disable Disable Disable Disable Disable Disable Disable
*/

```

The report shows the current performance-monitoring threshold crossing alert (TCA) values for the DS3 line and path.

Address	- Shows the specific DS3 low-speed slot and port.
Bin	- Shows the quarter-hour (QH) and the day bins.
DS3 Line ES-L	- Shows the provisioned number of line errored seconds for the QH and day bins that will cause a TCA.
BER	- Shows the provisioned bit error rate for the QH and day bins that will cause a TCA.
CV-P	- Shows the provisioned number of code violations for the QH and day bins that will cause a TCA.
ES-P	- Shows the provisioned number of errored seconds for the QH and day bins that will cause a TCA.
SES-P	- Shows the provisioned number of severely errored seconds for the QH and day bins that will cause a TCA
SAS-P	- Shows the provisioned number of severely errored frame/ AIS seconds for the QH and day bins that will cause a TCA.
UAS-P	- Shows the provisioned number of unavailable seconds for the QH and day bins that will cause a TCA.
TCA Report	- Shows if the automatic reporting of TCAs is enabled or disabled.

Example 37 - CONFIGURATION-Retrieve-Protection-Line

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Protection-Line: COMPLD
/* Network Element Protection Switching Provisioning Report
=====
Parameter                               Value
=====
Operating Mode                          2 fiber ring    bi-directional
Wait To Restore                          0 (disabled)
*/

```

The first report shows the provisioned protection switching information of the FT-2000 add/drop-rings terminal.

Operating Mode	-	Shows the add/drop-rings terminal configuration and whether protection switching is unidirectional or bidirectional.
Wait To Restore	-	Shows the time (up to 12 minutes after a trouble clears) before breaking automatic high-speed, low-speed, and synchronization reference protection switches. A value of zero minutes will disable this parameter.
Provisioned Mode	-	For 1x1 end terminal only. Shows the current provisioned protection switching configuration and whether protection switching is unidirectional or bidirectional.
Restoration Protection Access	-	For 1x1 end terminal only. Shows the parameter value (either yes or no) if the FT-2000 terminal is provisioned for restoration protection access.

Example 38 - CONFIGURATION-Retrieve-Protection-Low Speed

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Protection-Low Speed:  COMPLD
/* Low Speed Protection Switching Provisioning Report
=====
Parameter                               Value
=====
Wait To Restore                         3 minutes
*/
;

```

The report shows the provisioned low-speed protection switching information of the FT-2000 network element.

Wait To Restore - Shows the time (up to 12 minutes after a trouble clears) before breaking the automatic low-speed switch. A value of zero minutes will disable this parameter.

Example 39- SECURITY-Retrieve-Security-Network Element

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-Security-Network Element:  COMPLD
/* Access Security Global Configuration Report
=====
Parameter                               Value
=====
Logins Allowed                          yes
Password Aging                         60 days
Login Aging                            60 days
*/
;

```

The above report shows global security information for the local FT-2000 network element.

- Logins Allowed - Shows if nonprivileged users are allowed to log in or not. Privileged users are always allowed to log in.
- Password Aging - Shows the lifetime interval in days before the user must select a new password. A zero interval will disable this parameter.
- Login Aging - Shows the lifetime interval in days before the user must select a new login. A zero interval will disable this parameter.

Example 40 - SECURITY-Retrieve-Security-Port

```

NODE-0 97-11-01 23:15:15 EST
M Retrieve-Security-Port: COMPLD
/* Access Port Security Configuration Report
=====
Access Port   Channel   Port Status   Port Type/   Baud Rate/   Inactive
              Status      OS Type      Calling Address  Timer
=====
dce           enabled    cit          auto         10
dte           enabled    tl1          9600         15
dcc           disabled   cit          10
=====
x25           pvc-1      memry-admin
x25           pvc-2      maintenance
=====
x25           tbl-1      cmd-resp     19089492810
x25           tbl-2      cmd-resp     12125551212
x25           tbl-3      cmd-resp     19142348217
x25           tbl-4      cmd-resp     -
x25           tbl-5      cmd-resp     -
x25           tbl-6      cmd-resp     -
*/
;

```

The above report shows the current CIT and TL1 port provisioning and who is currently logged in on each port.

Access Port	-	Shows a specific operations interface (physical port) for which the status is being displayed.
Channel	-	Shows the TL1 calling address table entry and may be a virtual channel (vc)-0, a permanent virtual channel (pvc) 1 or 2, or table entry 1 through 6. A blank (" ") is always reported for the dte and dce ports. A pvc -1 or -2 or a table entry 1 through 6 is reported for an X.25 port.
Port Status	-	Shows if the port will or will not accept nonprivileged user logins (enabled or disabled).
Port Type OS Type	-	Shows the protocol used (cit or tl1) on the port and displays the autonomous message set reported on the port as "maintenance," "memry-admin," "cmd-resp," or "other."
Baud Rate	-	Shows the provisioned baud rate as blank, auto, 9600, 4800, 2400, or 1200.
Calling Address	-	Shows the value of the X.25 address key used to associate the port type with the user.
Inactive Timer	-	Shows the inactivity timeout in minutes (0 to 999).

Example 41 - FAULT-Retrieve-State

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-State:All:  COMPLD
/* State Report

```

```

=====
Address      CP      --Port--      Switch      ----- Switch Priority -----
^            type      DSX 0C48      State      Active      Deferred
=====
DS1-in-pri          a      active      -      -
DS1-in-sec          a      standby     -      -
-----
tg-1      TG3          active      -      -
tg-2      TG3          active      -      -
-----
trmtr-1e  TRMTR          active      -      -
trmtr-1w  TRMTR          active      -      -
-----
rcvr-1e   RCVR          active      -      -
rcvr-1w   RCVR          active      -      -
-----
Continue report page-by-page?(y/n)Yes

```

The State Report shows a normal state at an FT-2000 Add/Drop-Rings Terminal, meaning that there are no active protection switches, inhibits, lockouts, or other abnormal conditions.

Address	- Shows the address by slot function, high-speed line designation, and physical slot location.
Circuit Pack	- Shows the functional name of the circuit pack.
PortState DSX OC48	- DSX and OC48 Port States show the state of the port in the direction from the DSX and the OC-48 line, respectively. The state of multiple ports (1, 2, and 3) is shown as an i for the IS state, an a for the AUTO state, an n for the NMON state, a dash ("-") for not applicable (when the slot is not equipped), and a blank for the timing packs and the high-speed interfaces. The port state is listed left to right in ascending order.
Switch State	- Shows whether the circuit pack or DS1 reference input is in an active state (by carrying traffic or by providing timing) or in a standby state (by not carrying traffic or by not providing timing). For OC3/IS3/OC12 circuit packs, the parameter indicates the state for the transmit and receive OC3/IS3/OC12 lines. This parameter also indicates whether the tributary is 'active' (available for service traffic) or 'standby' (available for protecting service traffic).
Switch Priority	- Active switch priority shows the current protection switching priority of a circuit pack or external DS1 reference. The "-ring" suffix for a high-speed switch priority means that the circuit pack is signaling a switch request for a switch at the other side of the node or at another node. An external high-speed switch request results in an "-ne" (near end) suffix at the node where the request was entered, and an "-fe" (far end) suffix at the other end of the line. If the same priority request was entered at both ends of a line, both ends show an "-ne" suffix. Any protection tributaries with a switch state of 'active' that are not designated as "-ne" or "-fe" will be designated as "-oth". Operating protection access mode values are designated as "temporary" or "permanent". A value of "unprotected" indicates that service traffic will not be protected. A dash (-) indicates that the condition causing the switch failure has been cleared. The queued or deferred switch priorities can only be a "manual-ne," "APS(SD)," "APS(SF)," and "manual" for a low-speed interface.

The following example shows how a manual switch condition is displayed at the node where the manual switch is initiated.

```
-----  
trmtr-1e  TRMTR      active  manual-ring  
trmtr-1w  TRMTR      standby  manual-ne  
-----  
rcvr-1e   RCVR       active  manual-ring  
rcvr-1w   RCVR       standby  manual-ne
```

The following example shows what is displayed at the node located at the opposite end of the line being switched.

```
-----  
trmtr-1e  TRMTR      standby  manual-fe  
trmtr-1w  TRMTR      active   manual-ring  
-----  
rcvr-1e   RCVR       standby  manual-fe  
rcvr-1w   RCVR       active   manual-ring
```

The following example shows what is displayed at the remaining node(s) on the ring network.

```
-----  
trmtr-1e  TRMTR      active  manual-ring  
trmtr-1w  TRMTR      active  manual-ring  
-----  
rcvr-1e   RCVR       active  manual-ring  
rcvr-1w   RCVR       active  manual-ring
```

Example 42 - CONFIGURATION-Retrieve-Synchronization

```

Delta-1  97-11-01 23:15:15 EST
M Retrieve-Synchronization:  COMPLD
/* Synchronization Report
=====
Parameter                                Value
=====
Provisioned Mode                         Free Running
Operational Mode (East)                  Free Running
Operational Mode (West)                  Free Running
TG1 Clock Range Status                   0%
TG2 Clock Range Status                   -2%
Primary DS1 In/Out Format                 SF
Secondary DS1 In/Out Format               SF
Primary DS1 In Line Code                  AMI
Secondary DS1 In Line Code                AMI
DS1 Out 1 Equalization                   ON
DS1 Out 2 Equalization                   ON

*/
;

```

The above report shows the provisioned synchronization parameters of the FT-2000 ring network. Additional synchronization information is contained in Section 5, "Control, Transmission, and Synchronization Interfaces."

Parameter	- <i>Provisioned Mode</i> shows the synchronization mode that was provisioned at the FT-2000 add/drop-rings terminal. - <i>Operating Mode (East/West)</i> shows the current synchronization mode being used in the FT-2000 network. - <i>TG1/TG2 Clock Range Status</i> shows the current percentage that the frequency is off of the center frequency. The lower the percentage, the closer the frequency is to the center frequency. The deviation limits in ppm are ± 100 but the allowable range is ± 110. - <i>Primary/Secondary DS1 In/Out Format</i> shows the value that was provisioned, either D4 super frame format (SF) or extended super frame (ESF). - <i>Primary/Secondary DS1 In Line Code</i> shows the provision value, either alternate mark inversion (AMI) or bipolar with 8 zeros substitution (B8ZS). - <i>DS1 Out 1/Out 2 Equalizations</i> shows the equalizer setting of the DS1 external reference output 1/output 2. The value is a percentage of the maximum cable length; for example, 100 (%) equates to a maximum of 660 feet of 600-type cable.
Value	- The values are discussed with the parameter.

Example 43 - CONFIGURATION-Retrieve-T3

```

NODE-0  97-11-01 23:15:15 EST
M Retrieve-T3:All:  COMPLD
/* T3 Port Provisioning Report
=====
Port      VMR      Alarm   Signal   --Port State--   Path
Address   Mode      Level   Degrade   from      from      RFI
          VM      MJ      Threshold DSX       OC48      Alarm
=====
ls-1a-1   VMR       MJ      -6        is        is        MN
ls-1a-2   VM        MJ      -6        auto      auto      MN
ls-1a-3   CC w/ AIS CR      -6        is        is        MN
.
.
ls-8b-3   CC w/o AIS MN      -3        is        is        MN
*/
;

```

The above report shows how the T3 (DS3) port(s) was provisioned and the port attributes. The report provides information on the violation monitor and removal mode, the severity of the alarm implied by the failure of the DS3 port, the signal degrade threshold, and the memory administrative state.

Port Address	-	Shows a specific slot, and low-speed port (1, 2, or 3) of a DS3 circuit pack.
VMR Mode	-	Shows the violation monitor removal mode of the DS3 signal, such as VMR (for monitor and removal of DS3 signal format violations), VM (for monitor only but do not remove DS3 signal format violations), and CC (for clear channel) with or without alarm indication signal (AIS). When CC w/AIS is shown, this means an AIS signal will be inserted in the DS3 signal that is going in the opposite direction of the failure.
Alarm Level	-	Shows the highest severity user panel LED that is lit, which is the alarm that is assigned to the incoming DS3 signal failure. If no LEDs are lit, then status is shown as NA (not alarmed) or NR (not reported) if provisioned as such.
Signal Degrade Threshold	-	Shows the provisioned signal degrade threshold, either -3 or -6. The example shows a -6, meaning the error rate 10u-6d.

Signal Degrade Threshold	- Shows the provisioned signal degrade threshold, either -3 or -6. The example shows a -6, meaning the error rate 10^{-6} .
Port State	- Shows the administrative state (from memory) of the port address; (from DSX or OC48) such as, is for in service, auto for automatic, and nmon for not monitored.
Path RFI Alarm	- Shows the provisioned alarm level for near-end indications of far-end path-related conditions in the drop (from OC-48) direction. The allowable values are: (CR, MJ, MN, NA, NR and NO).

Example 44 - CONFIGURATION - Retrieve-Timeslot-STS1

```

Worcester-MA 00-01-31 23:11:57
M Retrieve-Timeslot-STS1:1-2: COMPLD
/* STS-1 Tributary Map Circuit Report
=====
Ring Node
Source      Destination      Type      Source      Destination      Primary
  AID        AID              Type      TID         TID              State
=====
Worcester-MA
1w-1-2      1w-1-2            1WAY      Worcester-MA Worcester-MA
1s-1a-1     1s-1a-3           1WAY      Quabbin-MA   Worcester-MA
1e-1-2      1e-1-2           1WAY      Worcester-MA Salem-NH
1s-1b-3     1s-1b-3           1WAY      Chicopee-MA  Worcester-MA
-----
Salem-NH
1e-1-2      1w-1-2            1WAY      Chicopee-MA  *Worcester-MA
1w-1-2      1s-7a-2           1WAY      Worcester-MA Salem-NH
1s-2a-2     1e-1-2           1WAY      Salem-NH    Chicopee-MA
1s-2b-2     1e-1-2           1WAY      Salem-NH    Salem-NH      ACT
                                           STBY
-----
Concord-MA
1e-1-2      1w-1-2            1WAY      Chicopee-MA  Worcester-MA
1w-1-2      1e-1-2           1WAY      Salem-NH    Chicopee-MA
-----
Chicopee-MA
1s-4a-1     1w-1-2            1WAY      Chicopee-MA  Worcester-MA
1w-1-2      1s-4a-2           1WAY      Salem-NH    Chicopee-MA
1e-1-2      1e-1-2            1WAY      Chicopee-MA  Chicopee-MA
1e-1-2      1e-1-2            1WAY      Chicopee-MA  Chicopee-MA
-----
Holyoke-MA
1w-1-2      1w-1-2            1WAY      Holyoke-MA   Holyoke-MA
1e-1-2      1e-1-2            1WAY      Holyoke-MA   Holyoke-MA
1e-1-2      1e-1-2            1WAY      Holyoke-MA   Holyoke-MA
1e-1-2      1e-1-2            1WAY      Holyoke-MA   Holyoke-MA
-----
Quabbin-MA
1w-1-2      1w-1-2            1WAY      Quabbin-MA   Quabbin-MA
1s-6a-1     1e-1-2            1WAY      *Quabbin-MA  Quabbin-MA
1e-1-2      1e-1-2            1WAY      Quabbin-MA   Worcester-MA
1e-1-2      1e-1-2            1WAY      Quabbin-MA   Quabbin-MA
*/

```

This command retrieves a Tributary Map report, organized by node, for all nodes in a ring. The report shows all cross-connections on a single user-specified time slot throughout the entire ring, indicating parts of the ring available for new circuits.

The output parameters are:

Ring Node	- Lists the nodes in the ring. The topmost node is the node where the report request was issued. The remaining nodes in the ring are arranged in West to East sequence.
Source/ Destination TID	- TID lists the target identifiers involved in the sequelch map cross connect entries associated with the time slot specified in the RTERIEVE-TIMESLOT command.
Source/ Destination AID	- The STS-1 Tributary or Slot Address identifiers (AIDS). They are derived from local copies of the squelch maps of all nodes in the ring.
Type	- The provisioned cross-connection type being reported at that tributary.
Primary State	- A parameter used to report the status of 1WAYDRI and 1+1 protected OC-3 interface cross-connections. It accepts two values: ACT for an active DRI or OC-3 protected cross connection, STBY for one in a standby state.

For the above example, assume the ring topology to be:

West to East from Worcester-MA

West-East between Worcester and Salem-NH

West-East between Salem and Concord-MA

West-East between Concord and Chicopee-MA

West-East between Chicopee and Holyoke-MA

West-East between Chicopee and Quabbin-MA

West to East from Quabbin to Worcester-MA.



NOTE:

In mixed FT-2000/*WaveStar* rings, the "Source AID" and "Destination AID" columns in this report may appear different than is pictured. If the specified add or drop cross-connection is part of an add/drop at a *WaveStar* NE, the "AID" shown in the "Source AID" or "Destination AID" column is displayed as "WAV-LOC". A drop cross-connection at a *WaveStar* NE is represented as a single drop regardless of whether the single or multiple drops exist.

Example 45 - CONFIGURATION - Retrieve-ULSDCC-L3

```

      NODE-0 97-11-01 20:29:13
M Retrieve-ULSDCC-L3: COMPLD
/* Upper Layers DCC Report
=====
Parameter                               Value
=====
Level 2 Router                          Disabled
L3 Organization                         000000
L3 Routing Domain                       0000
L3 Area                                0000
*/
```

The above report shows the provisioning information of (a) the Area Address, and (b) Level 2 IS.

Level 2 Router	- Supports the two values (Enabled or Disabled). Identifies the NE as Level 2 Intermediate Systems (IS).
L3 Organization	- Layer 3 Organization: This field is reported in the form of 6 hexadecimal numbers.
L3 Routing Domain	- Layer 3 Routing Domain: This field is reported in the form of 4 hexadecimal numbers.
L3 Area	- Layer 3 Area: Identifies the Area that an NE belongs to when the subnetwork is partitioned into multiple Areas connected via Level 2 ISs. This field is reported in the form of 4 hexadecimal numbers.

Example 46 - CONFIGURATION - Retrieve-ULSDCC-L4

```

NODE-0 97-11-01 20:29:13
M Retrieve-ULSDCC-L4: COMPLD
/* Upper Layers DCC Report
=====
Parameter                               Value
=====
TARP Data Cache                         Enabled
*/

```

The above report shows the state (Enabled or Disabled) of the TARP data Cache.

Example 47 - CONFIGURATION-Retrieve-Crossconnection-TIRKS

```

NODE-0
M Retrieve Crossconnection-All: COMPLD
/* Cross-Connection Map Report
(..stby STS1,--act STS1,*Invalid Flag,+AUDIT set to No)
(..# Red Line Service set to Yes, & DRI Primary Node TID)
=====
Destination/Source      Cross-Connection      Source/Destination
=====
Worcester-MA 1w-1 <-----> 1e-1 Chicopee-MA
Worcester-MA 1w-2 -->2b-1 4a-1<-> 1e-2 Chicopee-MA
- 1w-3 1e-3 -
West-Ossipee-NH 1w-4 -->1a-1 1e-4 -
West-Ossipee-NH 1w-4 -->1b-1 1e-4 -
West-Ossipee-NH 1w-4 <--1a-1 1e-4 -
West-Ossipee-NH 1w-4 <..1b-1 1e-4 -
West-Ossipee-NH# 1w-5 -->1e-29 1e-5 -
West-Ossipee-NH# 1w-5 -->7a-5 5a-11<-> 1e-5 #Newburyport-MA
West-Ossipee-NH# 1w-5 <--7a-5 1e-5 -
West-Ossipee-NH# 1w-5 <..1e-29 1e-5 -
- 1w-6 1e-6 -
- 1w-7 1e-7 -
Quabbin-MA# 1w-8 <-----> 1e-8 #Lenox-MA
Quabbin-MA 1w-9 .....> 1e-9 #Lenox-MA
1w-9 2a-1--> 1e-9 #Lenox-MA
1w-9 2a-1<-- 1e-9 #Lenox-MA
Quabbin-MA# 1w-9 <-----> 1e-9 Lenox-MA
Boscawen-NH 1w-10 -->6a-2 1e-10 -
Boscawen-NH 1w-10 <--6a-1 1e-10 -
Boscawen-NH 1w-10 <..... 1e-10 Keene-NH

```

The above report shows information on the add/drop/through configuration of an FT-2000 Add/Drop-Rings Terminal. STS-1 tributaries and ports equipped with an OC-12 circuit pack are shown with TIRKS AIDs. Refer to the **RETRIEVE-Translate-Trib** and **RETRIEVE-Translate-OC12** commands for the translation between FT-2000 and TIRKS AIDs.

The output parameters are:

Source AID	-	The STS-1 Tributary or Port Address identifier.
Destination AID	-	The STS-1 Tributary or Port Address identifier.
Type	-	The type of connection.
Source TID	-	The signal entry source destination (LOCA).
Destination TID	-	The signal exit destination (LOCZ).
Primary State	-	The status of 1WAYDRI and 1+1 protected OC-3 interface cross-connections. The values are ACT (active) or STBY (standby).
Invalid Flag	-	An asterisk displays (first character of the Source/ Destination TID) if a provisioned cross-connection does not exist in the ring.
AUDIT parameter Flag	-	A "+" displays (last character of the Type field) if a provisioned cross-connection has its AUDIT parameter set to "No." If the AUDIT parameter is set to "Yes," the last character is blank.
Red Line Service	-	A "#" displays (last character of the Destination/Source field and/or first character of the Source/Destination field) if that cross-connection is tagged for Red Line Service.
DRI Primary Node TID	-	A "&" displays with the provisioned DRI Primary Node TID for all 2-way-dri-sec cross-connections in place of the Source TID. The "&" is reported as the last character of the Destination/Source (West Tributary) or as the first character of the Source/Destination (East Tributary) TID value.

Although the Source TID of the 2-way-dri-sec drop cross-connection is not shown, it will always match the Destination TID of the 2-way-dri-sec add cross-connection.

Example 48 - CONFIGURATION-Retrieve-Translate-Trib

```

NODE-0
M Retrieve-Translate-Trib: COMPLD
/* TIRKS Tributary Translation Table
=====
FT-2000    FT-2000    TIRKS      FT-2000    FT-2000    TIRKS
STS-3      STS-1      STS-1      STS-3      STS-1      STS-1
=====
1w-1 <-----> 1w-1-1 <----> 1w-1      1e-1 <-----> 1e-1-1 <----> 1e-1
      |-----> 1w-1-2 <----> 1w-2      |-----> 1e-1-2 <----> 1e-2
      |-----> 1w-1-3 <----> 1w-3      |-----> 1e-1-3 <----> 1e-3

1w-2 <-----> 1w-2-1 <----> 1w-4      1e-2 <-----> 1e-2-1 <----> 1e-4
      |-----> 1w-2-2 <----> 1w-5      |-----> 1e-2-2 <----> 1e-5
      |-----> 1w-2-3 <----> 1w-6      |-----> 1e-2-3 <----> 1e-6

1w-3 <-----> 1w-3-1 <----> 1w-7      1e-3 <-----> 1e-3-1 <----> 1e-7
      |-----> 1w-3-2 <----> 1w-8      |-----> 1e-3-2 <----> 1e-8
      |-----> 1w-3-3 <----> 1w-9      |-----> 1e-3-3 <----> 1e-9

1w-4 <-----> 1w-4-1 <----> 1w-10     1e-4 <-----> 1e-4-1 <----> 1e-10
      |-----> 1w-4-2 <----> 1w-11     |-----> 1e-4-2 <----> 1e-11
      |-----> 1w-4-3 <----> 1w-12     |-----> 1e-4-3 <----> 1e-12

1w-5 <-----> 1w-5-1 <----> 1w-13     1e-5 <-----> 1e-5-1 <----> 1e-13
      |-----> 1w-5-2 <----> 1w-14     |-----> 1e-5-2 <----> 1e-14
      |-----> 1w-5-3 <----> 1w-15     |-----> 1e-5-3 <----> 1e-15

```

The above report displays information on the FT-2000 STS-1 and STS-3 tributary AIDs and their corresponding TIRKS STS-1 tributary AIDs.

The output parameters are:

FT-2000 STS-3	-	Lists the FT-2000 STS-3 tributary AIDs. The report shows both east and west directions.
FT-2000 STS-1	-	Lists the FT-2000 STS-1 tributary AIDs. The report shows both east and west directions.
TIRKS STS-1	-	Lists the TIRKS-compatible STS-1 tributary AIDs.

Example 49- CONFIGURATION-Retrieve-Translate-OC12

```

NODE-0
M Retrieve-Translate-OC-12: COMPLD
/* TIRKS OC-12 AID Translation Table
=====
FT-2000          FT-2000          FT-2000          TIRKS
OC-12 Quad       OC-12 Slot       OC-12 Port       OC-12 Port
=====
|-----> 1a <-----> 1a-1 <-----> 1a-1
|----->          |-----> 1a-2 <-----> 1a-2
|----->          |-----> 1a-3 <-----> 1a-3
1b <-----> 1b <-----> 1b-1 <-----> 1a-4
|----->          |-----> 1b-2 <-----> 1a-5
|----->          |-----> 1b-3 <-----> 1a-6
|-----> 2a <-----> 2a-1 <-----> 1a-7
|----->          |-----> 2a-2 <-----> 1a-8
|----->          |-----> 2a-3 <-----> 1a-9
|-----> 2b <-----> 2b-1 <-----> 1a-10
|----->          |-----> 2b-2 <-----> 1a-11
|----->          |-----> 2b-3 <-----> 1a-12

|-----> 3a <-----> 3a-1 <-----> 3a-1
|----->          |-----> 3a-2 <-----> 3a-2
|----->          |-----> 3a-3 <-----> 3a-3
3b <-----> 3b <-----> 3b-1 <-----> 3a-4
|----->          |-----> 3b-2 <-----> 3a-5
|----->          |-----> 3b-3 <-----> 3a-6

```

The above report displays information on the FT-2000 OC-12 quad, slot and port AIDs and their corresponding TIRKS OC-12 port AIDs.

The output parameters are:

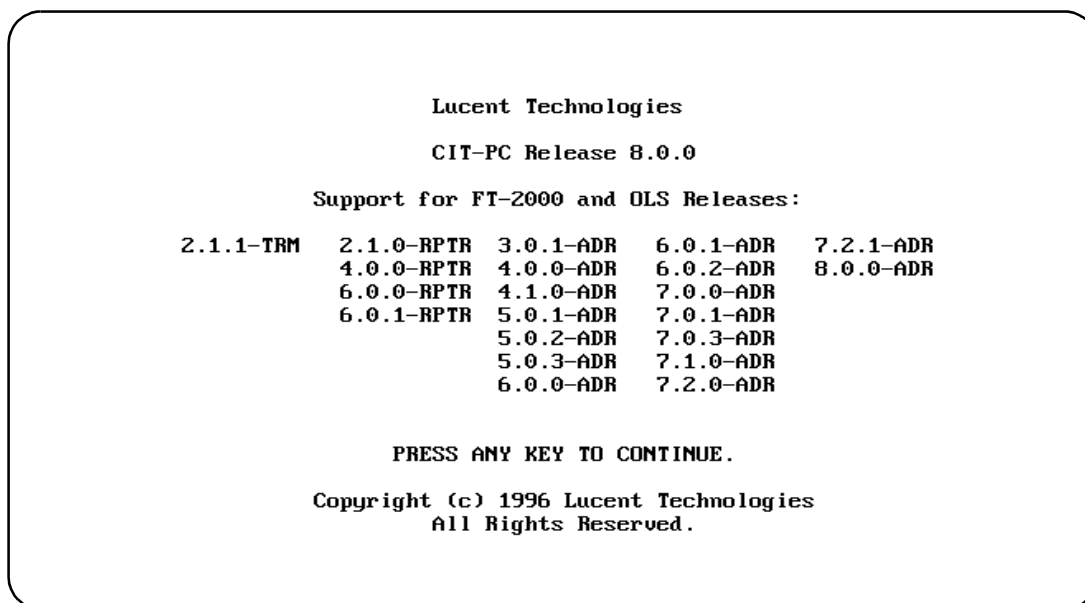
FT-2000 OC-12 Quad	-	Lists the FT-2000 OC-12 quad AIDs.
FT-2000 OC-12 Slot	-	Lists the FT-2000 OC-12 slot AIDs.
FT-2000 OC-12 Port	-	Lists the FT-2000 OC-12 port AIDs.
TIRKS OC-12 Port	-	Lists the TIRKS-compatible OC-12 port AIDs.

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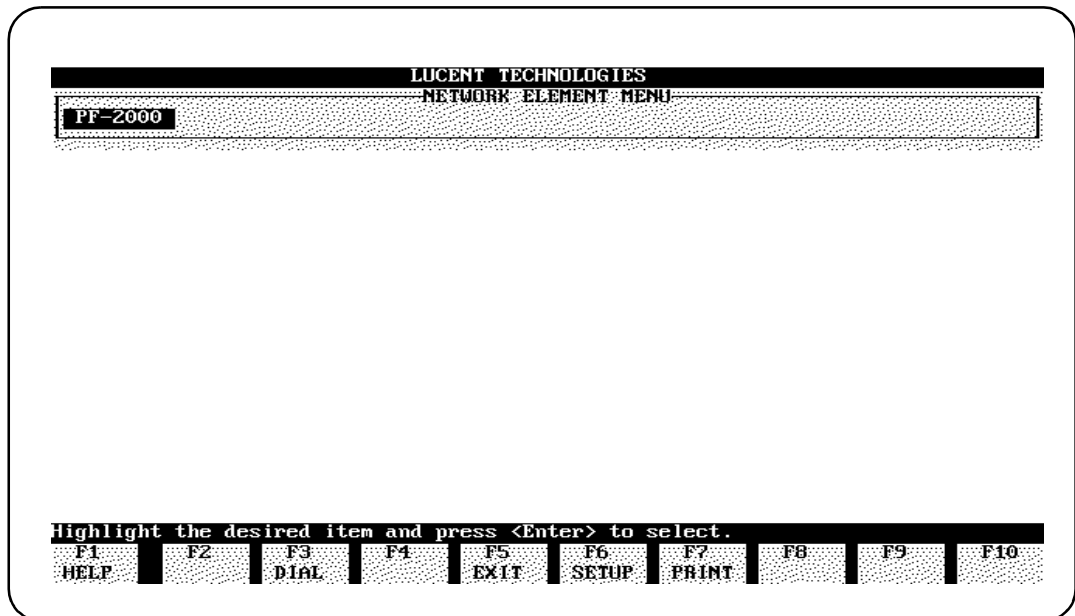
General: This tutorial illustrates, through a series of exercises, the features of the FT-2000 CIT-PC software. This software which supports the FT-2000 user interface is menu-driven and user-friendly. *It is strongly recommended that this tutorial only be used with an FT-2000 network element that is **out of service**.*

It is assumed that the craft interface terminal (CIT) is conditioned and connected to the FT-2000 network element. If it is not, refer to **DLP-501** in the Detailed Level Procedures section of this manual for assistance in getting to that point. Press **F5**, labeled EXIT, if it is shown on the screen.

1. Change directory to where the FT-2000 CIT-PC software is installed, for example "cd cit".
2. Enter "**cit**" and press . This enters the user into the standard mode and not into the expert mode.



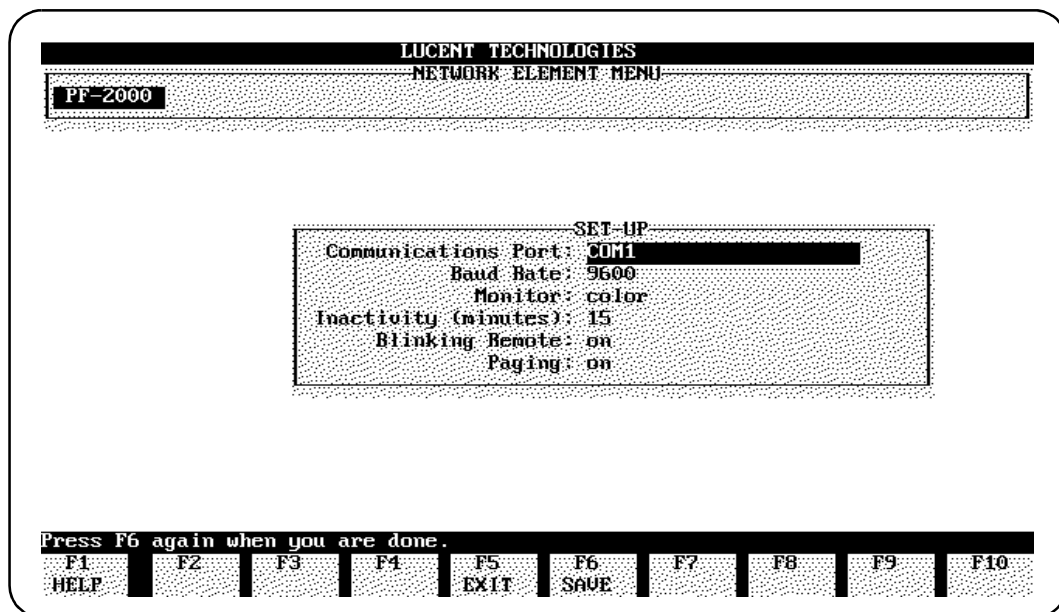
3. Press 'space bar' or any other key to display next screen.



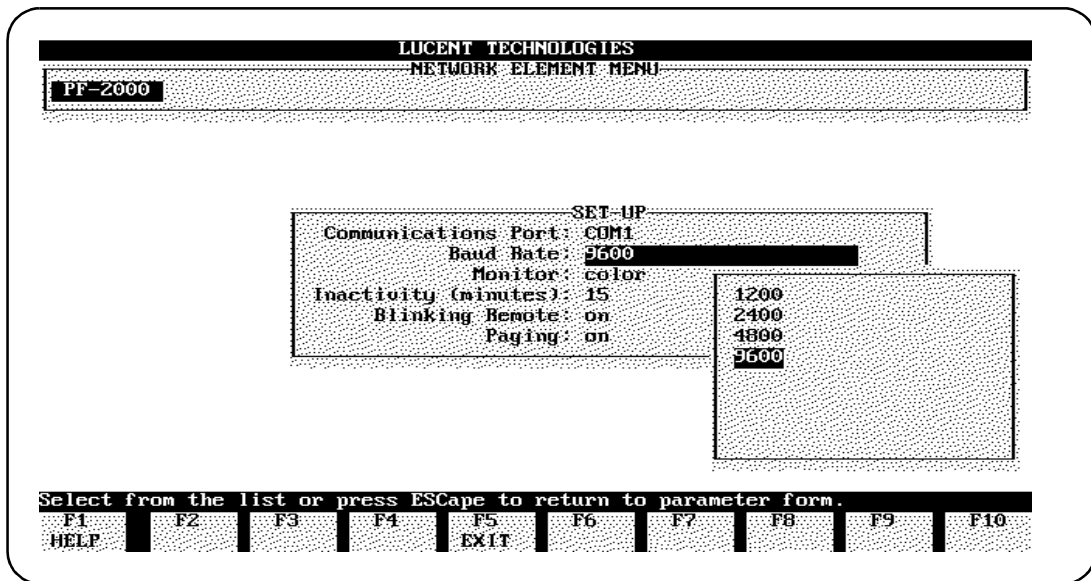
4. Press function key **F6** for **SETUP** menu.
5. Compare displayed screen with information below and note any differences:

Communications: com-1 (as appropriate)
Baud Rate: 9600
Monitor: (appropriate value for type of monitor)
Inactivity (minutes): (value between 0* and 9999)
Blinking Remote: on
Paging: on

* This value (zero) disables the inactivity timer.



6. As an exercise, the baud rate will be set to 9600, even if it is already set to 9600.
Use up (↑) and down (↓) arrow keys to move highlighted area to **Baud Rate:** parameter value.
7. Type a "?" when **Baud Rate** is highlighted.



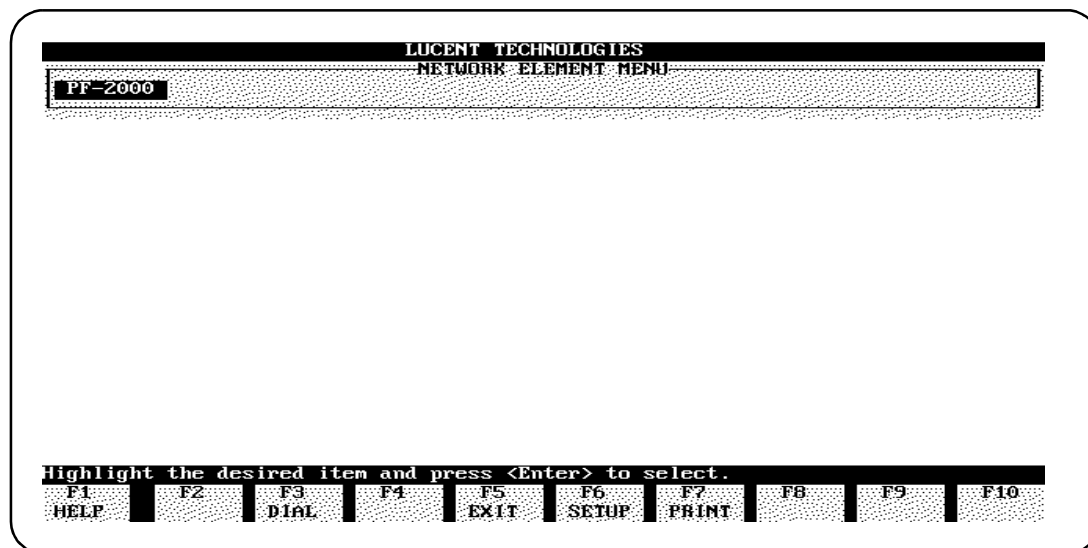
8. Use ↑ and ↓ arrow keys to select desired value "9600".
9. Press .
10. Use arrow keys and "?"; set any other parameter values (if necessary) to values given in Step 5.



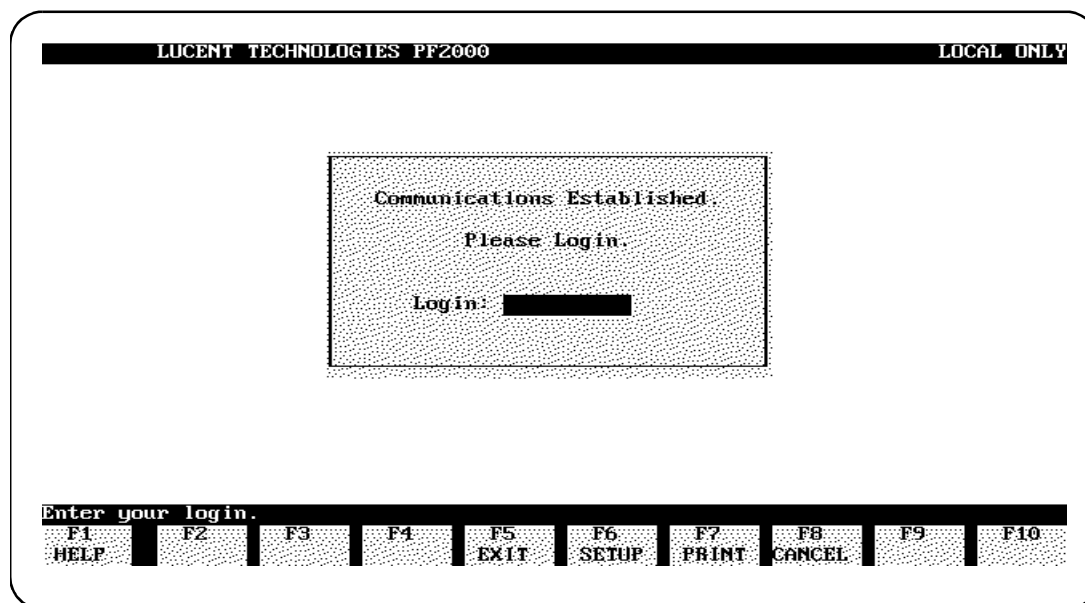
NOTE:

The **message line** immediately over the display of the function keys will always show what is to be done next. For example, it now says "Press F6 again when you are done;" PT-2000 is highlighted at this time.

11. Press again when parameters are set.



12. Press .



13. Enter a valid login (obtained from the system administrator) and press .

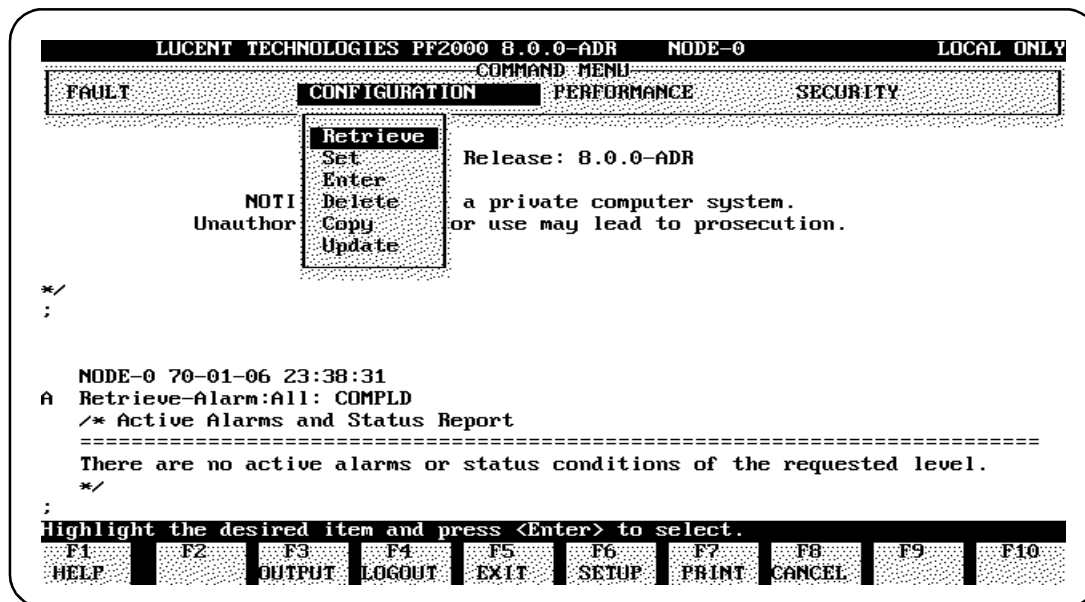
LUCENT TECHNOLOGIES PF2000					LOCAL ONLY																								
Login Failed. Please try again. Login: LUC01 Password:																													
Enter your password. <table style="width: 100%; border: none;"> <tr> <td style="border: 1px solid black; padding: 2px;">F1</td> <td style="border: 1px solid black; padding: 2px;">F2</td> <td style="border: 1px solid black; padding: 2px;">F3</td> <td style="border: 1px solid black; padding: 2px;">F4</td> <td style="border: 1px solid black; padding: 2px;">F5</td> <td style="border: 1px solid black; padding: 2px;">F6</td> <td style="border: 1px solid black; padding: 2px;">F7</td> <td style="border: 1px solid black; padding: 2px;">F8</td> <td style="border: 1px solid black; padding: 2px;">F9</td> <td style="border: 1px solid black; padding: 2px;">F10</td> </tr> <tr> <td style="border: none; padding: 2px;">HELP</td> <td style="border: none; padding: 2px;"></td> <td style="border: none; padding: 2px;"></td> <td style="border: none; padding: 2px;"></td> <td style="border: none; padding: 2px;">EXIT</td> <td style="border: none; padding: 2px;">SETUP</td> <td style="border: none; padding: 2px;">PRINT</td> <td style="border: none; padding: 2px;">CANCEL</td> <td style="border: none; padding: 2px;"></td> <td style="border: none; padding: 2px;"></td> </tr> </table>										F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	HELP				EXIT	SETUP	PRINT	CANCEL		
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10																				
HELP				EXIT	SETUP	PRINT	CANCEL																						

14. Enter the appropriate password (obtained from the system administrator) and press ENTER.

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR					NODE-0		LOCAL ONLY																						
COMMAND MENU																													
FAULT			CONFIGURATION			PERFORMANCE		SECURITY																					
FT-2000 Release: 8.0.0-ADR NOTICE: This is a private computer system. Unauthorized access or use may lead to prosecution. */ ; NODE-0 70-01-06 23:38:31 A Retrieve-Alarm:All: COMPLD /* Active Alarms and Status Report ===== There are no active alarms or status conditions of the requested level. */ ;																													
Highlight the desired item and press <Enter> to select. <table style="width: 100%; border: none;"> <tr> <td style="border: 1px solid black; padding: 2px;">F1</td> <td style="border: 1px solid black; padding: 2px;">F2</td> <td style="border: 1px solid black; padding: 2px;">F3</td> <td style="border: 1px solid black; padding: 2px;">F4</td> <td style="border: 1px solid black; padding: 2px;">F5</td> <td style="border: 1px solid black; padding: 2px;">F6</td> <td style="border: 1px solid black; padding: 2px;">F7</td> <td style="border: 1px solid black; padding: 2px;">F8</td> <td style="border: 1px solid black; padding: 2px;">F9</td> <td style="border: 1px solid black; padding: 2px;">F10</td> </tr> <tr> <td style="border: none; padding: 2px;">HELP</td> <td style="border: none; padding: 2px;">REMOTE</td> <td style="border: none; padding: 2px;">OUTPUT</td> <td style="border: none; padding: 2px;">LOGOUT</td> <td style="border: none; padding: 2px;">EXIT</td> <td style="border: none; padding: 2px;">SETUP</td> <td style="border: none; padding: 2px;">PRINT</td> <td style="border: none; padding: 2px;"></td> <td style="border: none; padding: 2px;">ALARMS</td> <td style="border: none; padding: 2px;"></td> </tr> </table>										F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	HELP	REMOTE	OUTPUT	LOGOUT	EXIT	SETUP	PRINT		ALARMS	
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10																				
HELP	REMOTE	OUTPUT	LOGOUT	EXIT	SETUP	PRINT		ALARMS																					

15. Notice that after a successful login, an Active Alarms and Status Report is displayed. An example is shown above. The top line shows the actual target identifier (TID) of the network element.

16. Use ← and → arrow keys to highlight **CONFIGURATION** but **do not press** **ENTER** **at this time**.
17. Press ↓ key once to display **CONFIGURATION** menu. The figure shows the report for an Add/Drop-Rings Terminal. The menu for other platforms may differ slightly. Also, the menu is slightly different when the user is in the expert mode.



18. Notice that the following tables list all of the inputs available under each of the four management categories (**FAULT**, **CONFIGURATION**, **PERFORMANCE**, and **SECURITY**).

Table 11-2 Release 8.0 and 8.1 Inputs (Commands) Menu for Add/Drop-Rings Terminal

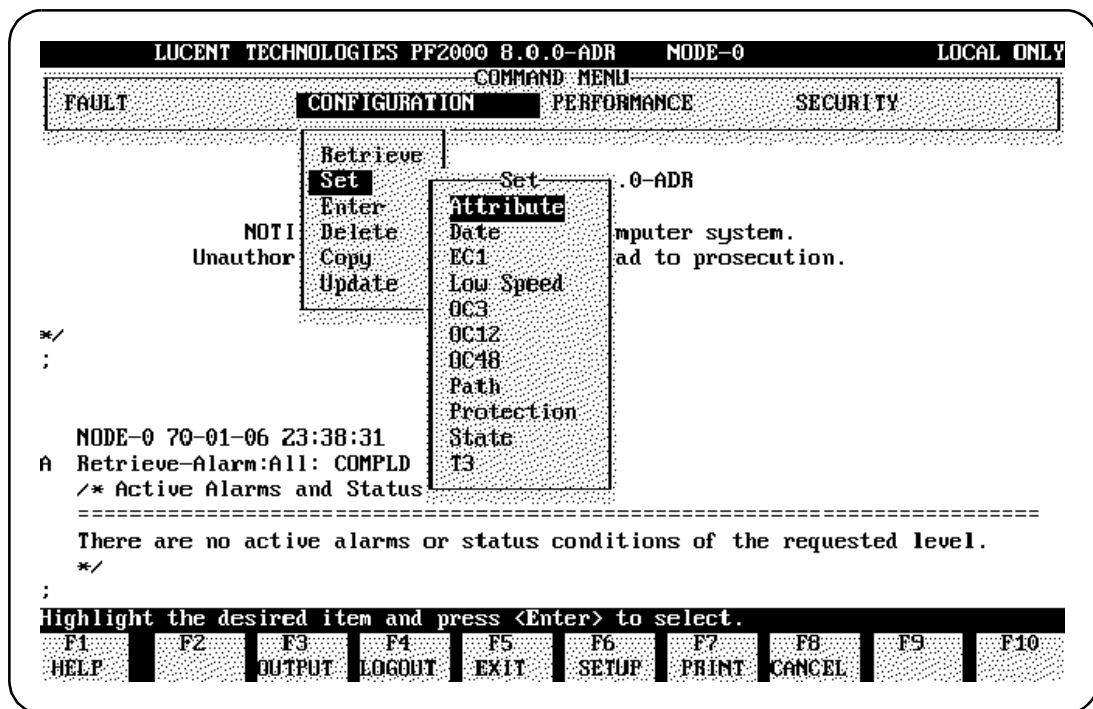
Table 11-3 [Inputs (Commands) Definitions] of this section provides a brief description of each of these inputs.



NOTE:

You are now going to use the **Set-Date** command to set the hour of the day. (After completing this tutorial, you may want to set the time back to the original value.)

19. Use the ↑ and ↓ arrow keys to highlight the verb **Set** and press **ENTER**. The figure shows the menu for an Add/Drop-Rings Terminal. The menu for other platforms may differ slightly.



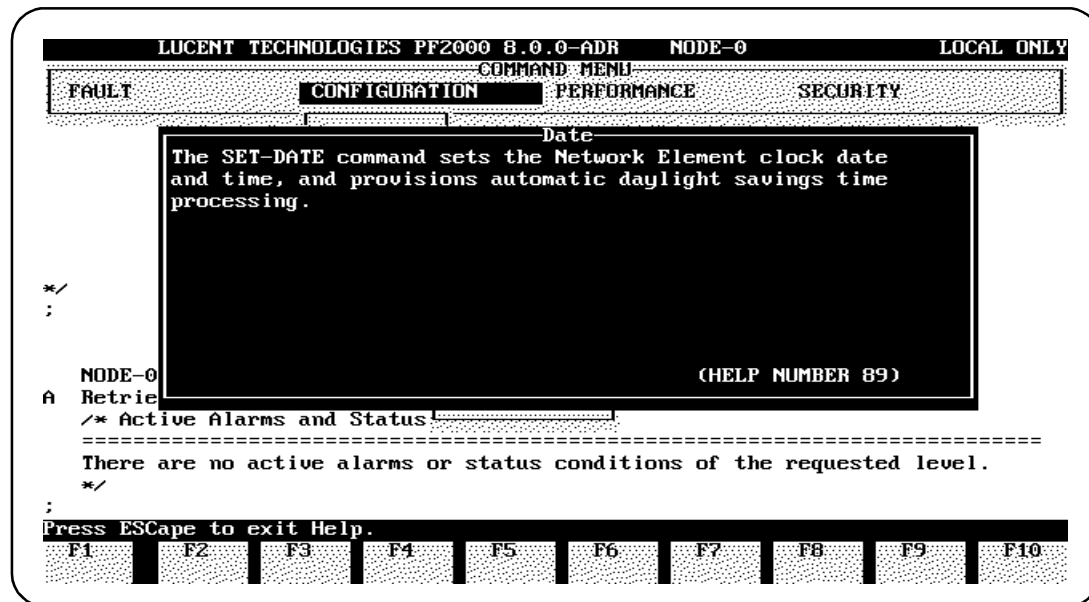
20. Use ↓ and ↑ keys to highlight **Date:** but **do not press** **at this time.**



NOTE:

When function key is labeled **HELP**, it can be pressed to obtain information about the item highlighted on the screen.

21. Press function key labeled **HELP** to display the explanation of the highlighted item.



22. After reading the information, press **ESC** (escape) key, then press **ENTER** to select **Date** (highlighted).
23. Use the **↑** and **↓** keys to highlight **Hours:** but **do not press ENTER** at this time.

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
COMMAND MENU
FAULT  CONFIGURATION  PERFORMANCE  SECURITY
-----
Set-Date
Date: 97-10-26
Hours: 14
Minutes: 09
Seconds: 44
Standard Time Zone:
Start Daylight Savings Date: 04-20
Stop Daylight Savings Date: 10-26
Daylight Savings Time Zone: EST
*/
;

N
A Retrieve-Alarm:All: COMPLD T3
/* Active Alarms and Status
=====
There are no active alarms or status conditions of the requested level.
*/
;

Enter a value or press <Enter> to accept the default or press F9 to execute.
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP OUTPUT LOGOUT EXIT CANCEL EXECUTE

```



NOTE:

You will now deliberately mistype a value.

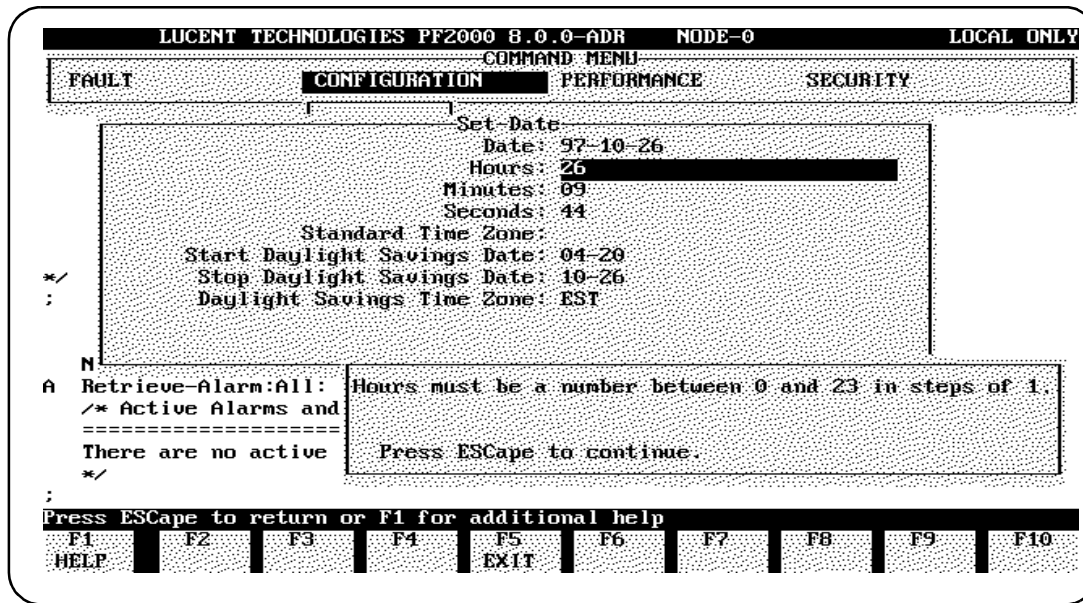
24. Enter "99" (without the quotes) for **Hours:** but **do not press the** **at this time.**
25. Use the "BACK SPACE" key to erase your entry.



NOTE:

You will now deliberately enter an invalid value.

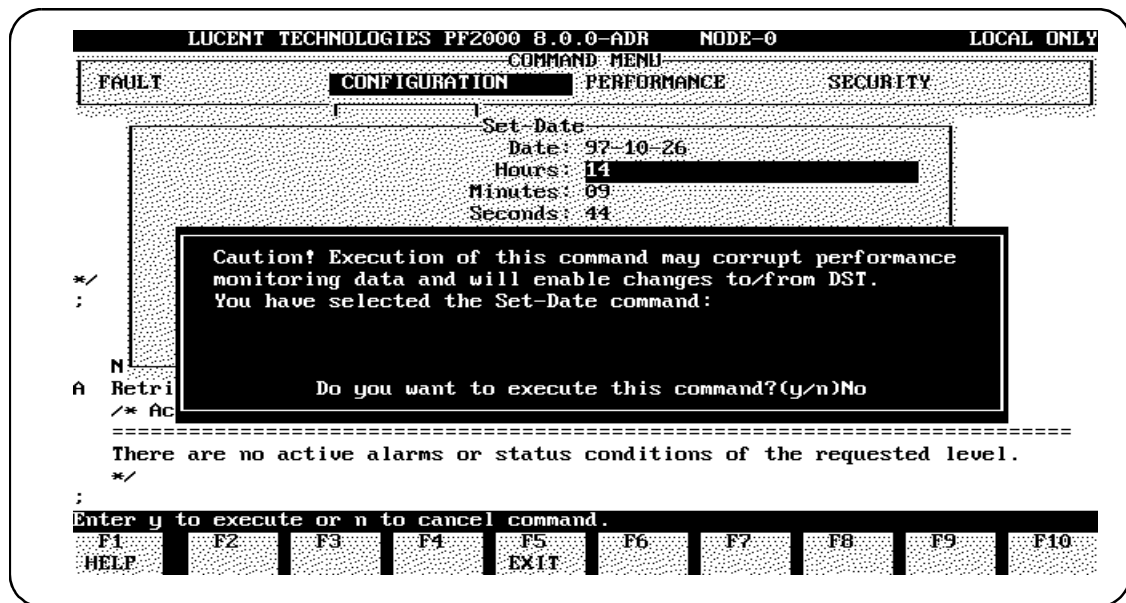
26. Enter "26" for the hour followed by .



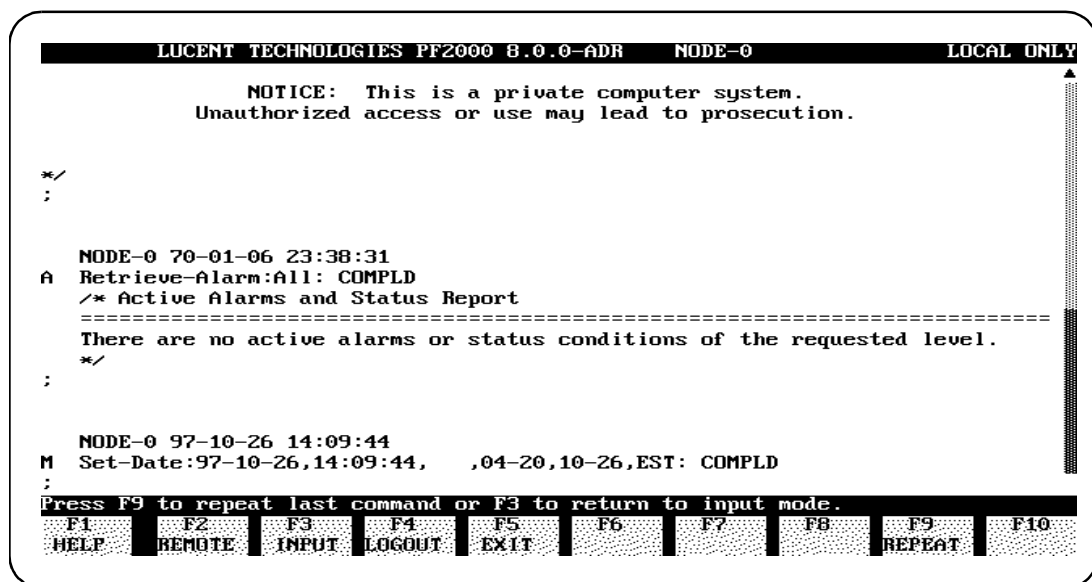
NOTE:

A screen appears and displays the allowable values for **Hours**.

27. Press the **ESC** key.
28. Enter a different or correct value (hour) than the one displayed, followed by **ENTER**.
29. Press function key **F9** to execute the input.
30. Notice that a confirmation frame appears on the screen with a Caution statement.



31. Enter y for the "yes" selection and press .



32. Notice that the **COMPLD** output echoes the command. Function key **F3** is now labeled **INPUT** because the display is now in the output mode. (**F3** toggles between **INPUT** and **OUTPUT** modes. You may experiment with the F3 key now.)
33. Notice that when the CIT is in the output mode, a **scroll bar** appears on the right side of the screen. You can scroll the screen either forward or backward depending on whether the darker-shaded portion of the bar is at top or bottom. Use the ↑ and ↓ keys to scroll the screen.



NOTE:

You just used **CONFIGURATION-Set-Date** to set the hour. You will now use **Retrieve-Date** to look at the value of that parameter.

34. Press **F3** to return to OUTPUT mode.
35. Under the **CONFIGURATION** category, select **Retrieve** and then press **ENTER**.



NOTE:

You will now deliberately make an incorrect selection of **Retrieve-Attribute** instead of **Retrieve-Date**.

36. Under **Retrieve**, highlight **Attribute** and press **ENTER**.
37. To correct, press **ESC** to back up to the preceding screen. Any time you are in the INPUT mode, you can back up one screen at a time by pressing the **ESC** key.
38. Under **Retrieve**, highlight **Date** (by using ↓ and ↑ arrow keys) and press **ENTER**.


```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
COMMAND MENU
FAULT  CONFIGURE  Retrieve  SECURITY
      Retrieve
      Set
      Enter
      Assignment
      Attribute
      Circuit
      Crossconnection
*/
;
Retrieve-Date
NODE-0 70-01-06 21
A Retrieve-Alarm:All: COMPLD
/* Active Alarms and Status
=====
There are no active alarms
*/
;
NODE-0 97-10-26 14:09:44
M Set-Date:97-10-26,14:09:44,
;
Low Speed
Map
OC3
OC12
OC48
Path
Protection
Synchronization
T3
Timeslot
ULSDCC
=====
of the requested level.
COMPLD
Press F9 to execute the command.
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP  REMOTE  INPUT  LOGOUT  EXIT  CANCEL  EXECUTE

```

39. Press function key to execute.

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
NODE-0 97-10-26 14:09:44
M Set-Date:97-10-26,14:09:44, 04-20,10-26,EST: COMPLD
;
NODE-0 97-10-26 14:13:24
M Retrieve-Date: COMPLD
/* Date and Time Report
=====
Parameter                               Value
=====
Current Date                           97-10-26
Current Time                           14:13:24
Standard Time Zone
Start Daylight Savings Time            04-20
Stop Daylight Savings Time             10-26
Daylight Savings Time Zone             EST
*/
;
Press F9 to repeat last command or F3 to return to input mode.
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP  REMOTE  INPUT  LOGOUT  EXIT  REPEAT

```

40. Refer to Table 11-7 [List of Inputs (Commands) That Generate Reports for FT-2000 Network Elements] in this section to determine the report generated by **Retrieve-Date**. Then refer to the indicated example and read the definition of the parameters.

41. Refer to the report on the CIT screen and note that the **Hours:** have been changed.
42. If appropriate, use **CONFIGURATION-Set-Date** to set the **Hours:** back to the original value. Otherwise, continue with the next step.
43. At this point in the tutorial, you must decide to either stop or continue with the CIT-PC training. If you continue, the additional training pertains to an add/drop-rings terminal in a ring network.

If **exiting the tutorial**, then continue with Step 44.

If **continuing the tutorial**, then continue with Step 45.
44. Log off of the CIT by pressing (**LOGOUT** from the FT-2000 network element) or exit the FT-2000 CIT-PC software by pressing (**EXIT**) as appropriate.

Additional Training on an FT-2000 Add/Drop-Rings Terminal



NOTE:

You are now going to use **CONFIGURATION-Set-State-T3** to set the administrative state of port 1 of slot 1A to **NMON** for a DS3 circuit pack. If an STS1E or OC-3 circuit pack is in slot 1A, then select another slot that contains a DS3 circuit pack (use this new slot reference throughout the procedure). (After completing this portion of the tutorial, you may want to set the port state to **AUTO**.)

45. Depress function key to return to the input mode and select **CONFIGURATION-Set-State-T3** by using the F3, ←, →, ↑, and ↓ arrow keys to highlight the command and press .

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
COMMAND MENU
FAULT  CONFIGURATION  PERFORMANCE  SECURITY
M Set-Date:97-10-26 Retrieve ,04-20,10-26,EST: COMPLD
;
M NODE-0 97-10-26 1
M Retrieve-Date: CO
/* Date and Time
=====
Parameter
=====
Current Date
Current Time
Standard Time Zone
Start Daylight Savings Time
Stop Daylight Savings Time
Daylight Savings Time Zone
*/

Set
Enter
Delete
Copy
Update
Attribute
Date
EC1
Low Speed
OC3
OC12
OC48
Path
Protection
State
T3
Set-State
EC1
OC3
OC12
ES
T3

Highlight the desired item and press <Enter> to select.
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
HELP OUTPUT LOGOUT EXIT SETUP PRINT CANCEL

```

46. Enter a "3a" for slot followed by . If slot 3A does not contain a DS3 circuit pack, select another slot that does contain a DS3 circuit pack.
47. Enter a "1" for port followed by .
48. Select **From DSX** for the **Direction**.

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
COMMAND MENU
FAULT  CONFIGURATION  PERFORMANCE  SECURITY
M Set
;
M NOD
M Ret
/*
=====
Parameter
=====
Current Date
Current Time
Standard Time Zone
Start Daylight Savings Time
Stop Daylight Savings Time
Daylight Savings Time Zone
*/

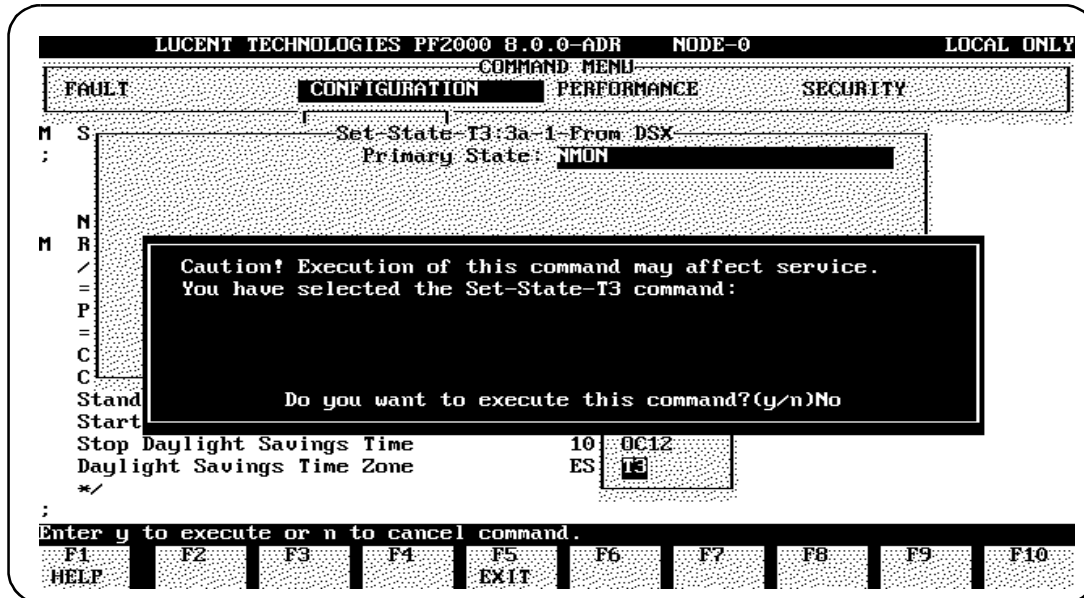
Set-State-T3
Slot: 3a
Port: 1
Direction: From DSX

OC48
Path
Protection
State
T3
Set-State
EC1
OC3
OC12
ES
T3

Enter a value or press ? to list choices.
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
HELP OUTPUT LOGOUT EXIT CANCEL

```

49. Press .
50. Enter "nmon" for the primary state followed by .
51. Press function key to execute the inputs.
52. Notice that a confirmation frame appears on the screen with a Caution statement.



53. Enter y for the "yes" selection and press .

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
;
NODE-0 97-10-31 10:36:21
M Retrieve-Map-Ring: COMPLD
/*Ring Map Report
=====
TID          Ring      NSAP
Continuity
=====
NODE-0      good  39 840f 80 000000 0000 0000 0000 08006a060102 00
NODE-1      good  39 840f 80 000000 0000 0000 0000 08006a06261f 00

NODE-1 ->(W) NODE-0 (E)-> NODE-1
*/
;

NODE-0 97-10-31 10:38:47
M Set-State-T3:All,From DSX:NMON: COMPLD
;
Press F9 to repeat last command or F3 to return to input mode.
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP REMOTE INPUT LOGOUT EXIT  REPEAT

```

**NOTE:**

You just used **CONFIGURATION-Set-State-T3** to set the administrative state of port 1 of slot 1A to **NMON**. You will now use **CONFIGURATION-Retrieve-T3** to look at the value of that parameter.

54. Press to return to the INPUT mode.
55. Select **CONFIGURATION-Retrieve-T3** and then press .
56. Enter "All" (without quotes) for **Slot:** and then press .
57. Press function key to execute.
58. Refer to the report displayed on the CIT screen and note that the port has been set to **NMON**. Only the first line of the report should match. The remaining lines may differ slightly.

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR				NODE-0		LOCAL ONLY			
NODE-0 97-10-26 14:22:50									
M	Retrieve-T3:All: COMPLD								
/* T3 Port Provisioning Report									
=====									
Port Address	UMR Mode	Alarm Level	Signal Degrade Threshold	--Port State-- from from DSX OC48					
=====									
1s-1a-1	UMR	CR	-6	auto	auto				
1s-1a-2	UMR	CR	-6	auto	auto				
1s-1a-3	UMR	CR	-6	auto	auto				
1s-1b-1	UMR	CR	-6	auto	auto				
1s-1b-2	UMR	CR	-6	auto	auto				
1s-1b-3	UMR	CR	-6	auto	auto				
1s-2a-1	UMR	CR	-6	auto	auto				
1s-2a-2	UMR	CR	-6	auto	auto				
1s-2a-3	UMR	CR	-6	auto	auto				
1s-2b-1	UMR	CR	-6	auto	auto				
1s-2b-2	UMR	CR	-6	auto	auto				
Continue report page-by-page?(y/n)Yes									
F1 HELP	F2	F3	F4	F5 EXIT	F6	F7	F8 CANCEL	F9	F10

59. Notice the message line at the bottom of the screen is waiting for a "yes" or "no" entry if **Paging:** was set to **on** during SET-UP.
60. Press the key for yes. Notice the report is scrolling one more page.
61. Press function key to cancel the remaining portion of the report.

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR						NODE-0	LOCAL ONLY
Address	Mode	Level	Threshold	DSX	OC48		
1s-2b-3	VMR	CR	-6	auto	auto		
1s-3a-1	VMR	CR	-6	nmon	auto		
1s-3a-2	VMR	CR	-6	auto	auto		
1s-3a-3	VMR	CR	-6	auto	auto		
1s-3b-1	VMR	CR	-6	auto	auto		
1s-3b-2	VMR	CR	-6	auto	auto		
1s-3b-3	VMR	CR	-6	auto	auto		
1s-4a-1	VMR	CR	-6	auto	auto		
1s-4a-2	VMR	CR	-6	auto	auto		
1s-4a-3	VMR	CR	-6	auto	auto		
1s-4b-1	VMR	CR	-6	auto	auto		
1s-4b-2	VMR	CR	-6	auto	auto		
1s-4b-3	VMR	CR	-6	auto	auto		
1s-5a-1	VMR	CR	-6	auto	auto		
1s-5a-2	VMR	CR	-6	auto	auto		
1s-5a-3	VMR	CR	-6	auto	auto		

Notice: This report was cancelled before completion by the user.

Press F9 to repeat last command or F3 to return to input mode.

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
HELP	REMOTE	INPUT	LOGOUT	EXIT				REPEAT	

62. Scrolling is now possible by using the ↑ and ↓ arrow keys.
63. If appropriate, use **CONFIGURATION-Set-State-T3** to set port 1 of slot 1A to AUTO. Otherwise, continue with the next step.

**NOTE:**

You are now going to enter and delete a cross-connection. You will retrieve a cross-connection report and select an appropriate address (unused slot and tributary). Then, you will make an add cross-connection and verify it. And finally, you will remove the cross-connection and verify its removal.

**NOTE:**

Other types of cross-connections are explained in detail in Section 8, "Administration and Provisioning."

64. Depress function key **F3** to return to the input mode and select the command **CONFIGURATION-Retrieve-Crossconnection-All**
65. Press the **ENTER** key to obtain an STS-1 Cross-Connection Map Report.

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY

NODE-0 97-10-26 14:27:10
M Retrieve-Crossconnection-All: COMPLD
/* Cross-Connection Map Report
(..stby STS1,::stby STS3,--act STS1,==act STS3,*Invalid Flag,+AUDIT set to No)
=====
Destination/Source      Cross-Connection      Source/Destination
=====
- 1w-1                  1e-1                  -
- 1w-2                  1e-2                  -
- 1w-3                  1e-3                  -
- 1w-4                  1e-4                  -
- 1w-5                  1e-5                  -
- 1w-6                  1e-6                  -
- 1w-7                  1e-7                  -
- 1w-8                  1e-8                  -
- 1w-9                  1e-9                  -
- 1w-10                 1e-10                 -
- 1w-11                 1e-11                 -
- 1w-12                 1e-12                 -
Continue report page-by-page?(y/n)Yes
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP  EXIT  CANCEL

```

66. From the report, select an unused slot (3a through 5b) and an unused tributary that is identified by a line number (1E or 1W) and a tributary number (3 through 5). An unused slot and tributary is indicated with a dash (-) in the Destination/Source columns.
67. Select **CONFIGURATION-Enter-Crossconnection-STs1** command to add (slot to tributary) cross-connection. For example, **CONFIGURATION-Enter-Crossconnection-STs1:2-way,3a,1w-5** is a 2-way add/drop from slot 5b to tributary 5 in the West direction.


```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
NODE-0 97-10-26 14:33:33
M Enter-Crossconnection-STs1: DENY
SROF
/* Status, Requested Operation Failed
This command can be executed on Network Elements equipped with
all STS-1 capable OC-48 TRMTR and RCUR circuit packs. One or more
TRMTR or RCUR circuit packs are not STS-1 capable on this node.
*/
;

NODE-0 97-10-26 14:35:23
M Enter-Crossconnection-STs3: COMPLD
/*
Type: 2-way
Source: sts3-1e-3 NODE-0
Destination: sts3-1w-3 NODE-1
Audit: Yes
*/
;

Press F9 to repeat last command or F3 to return to input mode.
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
HELP REMOTE INPUT LOGOUT EXIT REPEAT

```

68. Select **CONFIGURATION-Retrieve-Crossconnection-All** command to obtain an updated STS-1 Cross-Connection Map Report and verify the add cross-connection (slot 5b to tributary 5).

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
NODE-0 97-10-26 14:36:40
M Retrieve-Crossconnection-All: COMPLD
/* Cross-Connection Map Report
(..stby STS1,::stby STS3,--act STS1,==act STS3,*Invalid Flag,+AUDIT set to No)
=====
Destination/Source      Cross-Connection      Source/Destination
=====
- 1w-1                  1e-1                  -
- 1w-2                  1e-2                  -
NODE-1 1w-3 <=====> 1e-3 NODE-0
- 1w-4                  1e-4                  -
- 1w-5                  1e-5                  -
- 1w-6                  1e-6                  -
- 1w-7                  1e-7                  -
- 1w-8                  1e-8                  -
- 1w-9                  1e-9                  -
- 1w-10                 1e-10                 -
Continue report page-by-page?(y/n)Yes
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
HELP EXIT CANCEL

```

69. Select **CONFIGURATION-Delete-Crossconnection-ST3** command to remove the cross-connection established in Step 67. Using the same example, select **CONFIGURATION-Delete-Crossconnection-ST3: 2-way,5b,1w-5**.
70. Select **CONFIGURATION-Retrieve-Crossconnection-All** command to obtain an updated STS-1 Cross-Connection Map Report and verify the cross-connection has been removed.

```

LUCENT TECHNOLOGIES PF2000 8.0.0-ADR  NODE-0  LOCAL ONLY
NODE-0 97-10-26 14:51:39
M Retrieve-Crossconnection-All: COMPLD
/* Cross-Connection Map Report
(..stby STS1,::stby STS3,--act STS1,==act STS3,*Invalid Flag,+AUDIT set to No)
=====
Destination/Source      Cross-Connection      Source/Destination
=====
- 1w-1                  1e-1                  -
- 1w-2                  1e-2                  -
- 1w-3                  1e-3                  -
- 1w-4                  1e-4                  -
- 1w-5                  1e-5                  -
- 1w-6                  1e-6                  -
- 1w-7                  1e-7                  -
- 1w-8                  1e-8                  -
- 1w-9                  1e-9                  -
- 1w-10                 1e-10                 -
- 1w-11                 1e-11                 -
- 1w-12                 1e-12                 -
Press F9 to repeat last command or F3 to return to input mode.
F1  F2  F3  F4  F5  F6  F7  F8  F9  F10
HELP REMOTE INPUT LOGOUT EXIT

```

71. Log off of the CIT by pressing **F4** (**LOGOUT**) or exit FT-2000 CIT-PC by pressing **F5** (**EXIT**) as appropriate.
72. **STOP! YOU HAVE COMPLETED THE ADD/DROP-RINGS TERMINAL TUTORIAL.**

Overview

This section supports operation and maintenance of the FT-2000 OC-48 Lightwave System product via task oriented practices (TOP) procedures. Use of these procedures should be preceded by a general knowledge and understanding of the software for the FT-2000 network. Refer to Section 11, "Craft Interface Terminal Usage." The TOP procedures are included in the following five separate tabs:

- Acceptance — Yellow tab
- Circuit Order — Orange tab
- Operation — Green tab
- Trouble Clearing — Red tab
- Detailed Level Procedures — Blue tab.

TOP Section Organization

The **Acceptance** tab covers procedures that are used to accept the hardware AFTER installation by someone else.

The **Circuit Order** tab covers procedures that are used when adding or deleting work order items like a DS3 path, a DS3 circuit pack, or an OC-48 line, or when entering/deleting cross-connections in a ring network.

The **Operation** tab covers procedures that can be used in day-to-day operations. Such procedures are to enter/change/delete a user's login, to establish a remote login using the CIT, to establish remote access to a network element by using a

dial-up modem, etc. A complete listing is in the "Operation Task Index" (Operation: IXL-001).

The **Trouble Clearing** tab covers procedures on clearing the "condition" that caused the alarm and clearing trouble reports. These procedures are consistent with the two-tier maintenance philosophy.

The **Detailed Level Procedures (DLP)** tab contains detailed "how to" instructions, beginning with DLP-500.

Some procedures have an introductory "**Overview**" section that explains the purpose of the procedure. The other procedures are self-explanatory from the title.

How To Use This TOP Section

A tutorial is provided for you in Section 11 of this manual to familiarize yourself with the interactions of the CIT-PC software and the network element. However, *it is strongly recommended that this tutorial only be used with an FT-2000 network element that is **out of service**.*

To find the instructions for performing acceptance, circuit order, operation, or trouble-clearing tasks, proceed as follows:

1. Find your job in the Task Index under the appropriate colored tab and go to the referenced procedure; for example, **Acceptance IXL-001** (this is the index for the acceptance tasks). Or, you may use the Master Task Index (**Operation and Maintenance: IXL-001**) to find your job.
2. Go to the referenced procedure. This is a director level procedure and includes one of the following types:
 - c. Non-Trouble-Clearing Procedure (**NTP**) - a director level procedure that lists normal work items to perform other than trouble clearing.
 - d. Trouble Analysis Procedure (**TAP**) - a director level procedure that contains step-by-step trouble-clearing instructions to locate and/or fix troubles. The maintenance philosophy is contained in trouble analysis data (**TAD**)-100.
 - e. Some DLPs are director level procedures. These procedures combine the "what to do" with the "how to do" information; for example, replacing a fan filter in DLP-526.
3. All procedures are listed in numerical order but are not used in numerical order. A "Numerical List of Procedures" is provided as a **reference only** and should not be used alone in finding instructions for performing tasks.
4. Perform all the items in the director level procedure in the suggested order unless it sends you to another director level procedure. After you have completed a director level procedure, you have finished the task. Where

more detailed information is required, you will be sent to a Detailed Level Procedure **DLP-()**. Or, you may be sent to a Detailed Level Procedure by another Detailed Level Procedure.

5. **IMPORTANT:** When you complete a Detailed Level Procedure, you **MUST** return to the procedure (NTP, TAP, or DLP) that sent you there unless the DLP is a director level procedure; for example, replacing a fan filter (DLP-526).
6. **IMPORTANT:** Unless otherwise instructed, if one director level procedure sends you to another director level procedure, you should not return to the first director level procedure after you complete the second.
7. Sometimes you will be asked to verify that things have occurred. This may take the form of a formal statement of the expected response. At other times, the instructions will merely state *verify that ...*.
8. If the expected response is not observed and a specific trouble-clearing reference is not made, you should reference the "Trouble Clearing Task Index" to start trouble clearing.
9. If you need help in clearing a trouble after completing all the applicable trouble-clearing procedures in this section, contact your local or regional maintenance assistance group. Then, the group may contact the Regional Technical Assistance Center (RTAC) at **1-800-225-RTAC** in accordance with local procedures.

Faulty equipment being returned for repair should be sent to the following address:

Lucent Technologies
Network Systems
Returned Goods Dept.
Dept. 11MV287122
1600 Osgood Street
North Andover, Massachusetts 01845

Screen Display and Equipment Designation

Fonts

The procedures in this manual use a MONOSPACE font to identify text on a screen or a response displayed from the network. A **BOLD** font identifies the lettering designations on panels, shelves, and circuit packs. Also, the bold font is used throughout this manual for emphasis.

FT-2000 Installation

The 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 3 through 8.1, Installation Manual* is available for customers planning to install the equipment

themselves. To acquire this manual, refer to "How to Order Documents" in the About This Document tab.

FT-2000 Software Release Description

Different releases have different comcode numbers and/or document numbers but all documents contain information such as known problems, problems that have been fixed from an earlier release, and upgrade/download procedures. For the specific release and document, refer to the **Operation: NTP-002** or to the "Related Documentation/Training" part of the "About This Document" section at the beginning of this manual.

Safety Instructions

Admonishments

This section may contain admonishments as **DANGERS**, **WARNINGS**, and **CAUTIONS**. These admonishments have the following definitions:

DANGER shows the presence of a hazard that *will* cause death or severe personal injury if the hazard is not avoided.

WARNING shows the presence of a hazard that *can* cause death or severe personal injury if the hazard is not avoided.

CAUTION shows the presence of a hazard that *will* or *can* cause minor personal injury or property damage if the hazard is not avoided. The caution is also used for property-damage-only accidents. This includes equipment damage, loss of software, or service interruption.

Lightwave Safety

A Lucent Technologies lightwave digital transmission system and associated optical test sets use semiconductor laser transmitters. The lasers emit lightwaves, at or near infrared wavelengths, into lightguide cables. This light is at the red end of the visible spectrum. Direct exposure at close distances should be avoided.



WARNING:

Never view any unterminated optical connector with optical instruments other than indirect image-converting devices such as the FIND-R-SCOPE, since viewing optics tends to collimate the energy from an optical connector and, hence, increases the potential risk for injury.

For Warning Label and Compliance Label information, refer to the "About This Document" Section.

Electrostatic Discharge (ESD) Considerations



CAUTION:

Industry experience has shown that all integrated circuit packs can be damaged by static electricity that builds up on work surfaces and personnel. The static charges are produced by various charging effects of movement and contact with other objects. Dry air allows greater static charges to accumulate. Higher potentials are measured in areas with low relative humidity, but potentials high enough to cause damage can occur anywhere.

Observe the following precautions when handling circuit packs to prevent damage by electrostatic discharge:

- Assume all circuit packs contain solid state electronic components that can be damaged by ESD.
- When handling circuit packs (storing, inserting, removing, etc.) or when working on the backplane, always wear a grounded wrist strap or wear a heel strap and stand on a grounded, static-dissipating floor mat.
- Handle all circuit packs by the faceplate or latch and by the top and bottom outermost edges. Never touch the components, conductors, or connector pins.
- Observe warning labels on bags and cartons. Whenever possible, do not remove circuit packs from antistatic packaging until ready to insert them into slots.
- If possible, open all circuit packs at a static-safe work position, using properly grounded wrist straps and static-dissipating table mats.
- Always store and transport circuit packs in static-safe packaging. Shielding is not required unless specified.
- Keep all static-generating materials such as food wrappers, plastics, and Styrofoam containers away from all circuit packs. On removal from bay, immediately put circuit packs into static-safe packages.
- Whenever possible, maintain relative humidity above 20 percent.
- Keep the electromagnetic interference (EMI)/ESD protective front covers on the shelves at all times except during an upgrade or maintenance procedure. Once a circuit pack is replaced in the shelf, close the front cover immediately.

To reduce the possibility of ESD damage, shelves are equipped with grounding jacks to enable personnel to ground themselves using wrist straps (Figure 1) while handling circuit packs or working on a shelf. The jacks for connection of wrist straps are located at the lower right-hand corner of each user panel and filter

panel and at the rear of the bay. These jacks are labeled. The wrist straps should be checked periodically with a wrist strap tester to ensure that they are working properly.

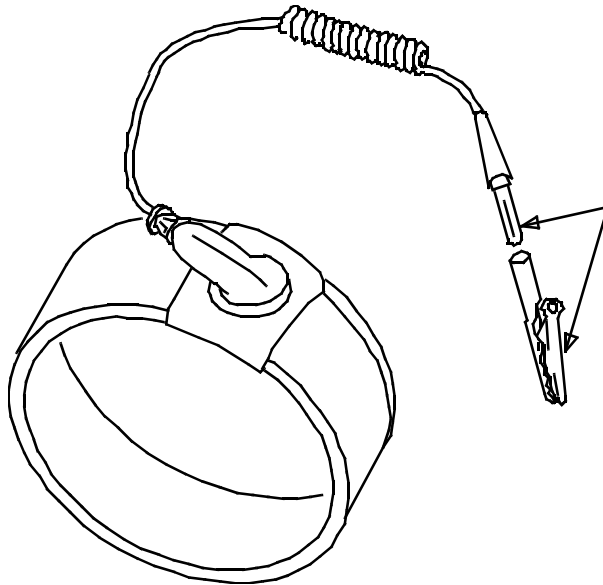


Figure 12-1. Static Control Wrist Strap

IMPORTANT SAFETY INSTRUCTIONS

READ AND UNDERSTAND ALL INSTRUCTIONS.

When using this telecommunication equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:

- Follow all warnings and instructions marked on the product.

- Slots and openings in this product and the back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered.

- Opening or removing rear covers or sheet-metal parts may present exposure to high current or electrical energy levels, or to other risks. Refer all servicing in those areas to qualified service personnel.

- Never push objects of any kind into this product through slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electrical shock. Never spill liquid of any kind on the product.

- Refer servicing to qualified service personnel.

Master Task Index

FIND YOUR JOB IN THE LIST BELOW THENGOTO

Accept Dual Ring Interworking (DRI) Connections to/from an FT-2000 Ring	Acceptance: NTP-009
Accept FT-2000 2-Fiber Ring Network	Acceptance: NTP-007
Accept FT-2000 OC-48 1x1 End Terminal	Acceptance: NTP-002
Accept FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Ring	Acceptance: NTP-006
Accept FT-2000 OC-48 Add/Drop-Rings Terminal for Operation with an FT-2000 Lightwave Booster Amplifier (FT-LBA) . .	Acceptance: NTP-011
Accept FT-2000 OC-48 Repeater Bay/Shelf	Acceptance: NTP-005
Accept FT-2000 Point-to-Point Network	Acceptance: NTP-003
Accept New and Added Electrical Low-Speed Cables to an In-Service FT-2000 Network Element	Acceptance: NTP-008
Accept New and Added Optical Low-Speed Fibers to an In-Service FT-2000 Network Element	Acceptance: NTP-010
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Provision STS-1 Path Trace	DLP-531
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NTP-005	Accept FT-2000 OC-48 Repeater Bay/Shelf
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NTP-008	Accept New and Added Electrical Low Speed Cables to an In-Service FT-2000 Network Element
NTP-009	Accept Dual Ring Interworking (DRI) Connections to/from an FT-2000 Ring
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DLP-523	Release Looped Back DS3 and/or EC1 Circuit(s)
DLP-524	Establish or Disconnect Remote Login Using CIT
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DLP-527	Replace Circuit Pack with Different Circuit Pack
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DLP-544	Enter or Change TID String of FT-2000 Network Element
DLP-545	Replace Fan Filter Every Six Months (in D-Bay)
DLP-546	Replace Defective Fan Unit in D-Bay
DLP-547	Provision OC12 Slot for 1_Way Drop Service
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Acceptance Task Index

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Accept Mixed FT-2000/ <i>WaveStar</i> 2-Fiber Ring Network	Acceptance: NTP-012
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Accept FT-2000 OC-48 Repeater Bay/Shelf	Acceptance: NTP-005
Accept FT-2000 Point-to-Point Network	Acceptance: NTP-003
Accept Added Optical Low-Speed Fibers to	
an In-Service FT-2000 Network Element	Acceptance: NTP-010
Accept Added Electrical Low-Speed Cables to	
an In-Service FT-2000 Network Element	Acceptance: NTP-008
Accept Protection Access Upgrade in	
Point-to-Point Network	Acceptance: NTP-004

Accept FT-2000 OC-48 1x1 End Terminal

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure tests an **out-of-service** FT-2000 1x1 End Terminal in a stand-alone state. Each FT-2000 end terminal in the FT-2000 point-to-point network should be tested individually.

Required Test Equipment:

Craft Interface Terminal (CIT)
Optical Loopback Jumpers with 20-dB buildout
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 end terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the FT-2000 end terminal was installed by someone else. If the installation has not been completed (including circuit pack installation), notify the installation personnel or refer to 365-575-104 to complete the installation. If you completed the installation following the procedures in 365-575-104, do not perform this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
It is assumed that installation of the FT-2000 end terminal has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the end terminal is powered and running. *If at any point in this procedure, the FT-2000 end terminal fails to respond in the indicated way, refer the trouble to installation personnel.*

⇒ **NOTE:**
Ignore the LEDs at the user panel during this test.

	Inspect the FT-2000 end terminal for obvious damage.	—
2.	At the DSX-3 cross-connect panel or equivalent, disconnect all DS3 connections to the FT-2000 end terminal.	—
3.	Loop back all high-speed OC-48 lines.	DLP-500
4.	If required, connect the Craft Interface Terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501
5.	At the CIT, select SECURITY-Set-Network Element and Site 0 with a Yes, then execute by using F9 .	—
6.	At the CIT, select CONFIGURATION-Update and execute.	—
7.	Obtain an Active Alarm and Status Report (use Retrieve-Alarm) and verify that it shows only the two conditions below (no other conditions should be listed): line-1 site provisioning conflict line-p site provisioning conflict	—
8.	Perform local automatic turnup test for all lines.	DLP-502

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

9.	Obtain an Active Alarm and Status Report (use Retrieve-Alarm) and verify that it shows only the two conditions below (no other conditions should be listed):	—
	line-1 site provisioning conflict	
	line-p site provisioning conflict	
-
10.	Perform automatic low-speed cabling test (to cross-connection) for all low-speed ports on each line.	DLP-503
-
11.	If required, perform provisioning at this time.	DLP-505
-
12.	If so equipped, test the fan assembly for proper operation.	DLP-513
-
13.	The FT-2000 end terminal has passed the acceptance tests. After all FT-2000 network elements have been tested individually, the network (system) is ready for the FT-2000 point-to-point network acceptance test.	Acceptance: NTP-003
-

Acceptance: NTP-002---+---DLP-500---+---DLP-511

```

|               |---DLP-512
|               |---DLP-510-----DLP-512
|---DLP-501-----Operation: NTP-002
|---DLP-502
|---DLP-503---+---DLP-518-----DLP-511
|               |---DLP-500---+---DLP-511
|               |---DLP-512
|---DLP-505               |---DLP-510-----DLP-512
|---DLP-513
|---Acceptance: NTP-003

```

Accept FT-2000 Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure is made on the FT-2000 point-to-point network after all FT-2000 network elements (including any repeaters) have been individually acceptance tested.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Optical Power Meter and/or Optical Time Domain Reflectometer
(OTDR) (Used in DLP-506)



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the FT-2000 point-to-point network was installed by someone else. If the installation has not been completed, notify the installation personnel or refer to 365-575-104 to complete the installation. If you completed the installation following the procedures in 365-575-104, do not perform this procedure.

Each FT-2000 network element should have been individually acceptance tested. If this has not been done, refer to **Acceptance: NTP-002** for the FT-2000 end terminal and/or refer to **Acceptance: NTP-005** for the FT-2000 repeater bay/shelf. If at any point in this procedure, an FT-2000 network element fails to respond in the indicated way, refer the trouble to the group that installed it.

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
⇒ NOTE: Ensure that all slots, including the low-speed slots, are properly equipped before initiating this test.		
	Verify the FT-2000 network elements are connected in an FT-2000 point-to-point network and are not looped back.	DLP-506
2.	At the local FT-2000 end terminal, connect and condition the craft interface terminal (CIT).	DLP-501
3.	At the CIT, select SECURITY-Retrieve-Network Element and execute to obtain a <i>Retrieve-Network Element Report</i> to determine the state of the Site 0 parameter. The site parameter is used to differentiate the network elements in a point-to-point network.	—
4.	At the DSX-3 cross-connect panel or equivalent, disconnect all DS3 inputs and outputs at the local FT-2000 end terminal.	—
5.	At the CIT, select CONFIGURATION-Update and execute.	—
6.	Establish a remote login to the remote FT-2000 end terminal and repeat Steps 3 through 5. An assistant is required when Step 4 is performed at the remote FT-2000 end terminal.	DLP-524
7.	If required, and at the CIT, set SECURITY-Site 0 parameter to Yes at one end terminal and to No at the other end terminal.	—
8.	Verify the NE ACTY and the FE ACTY LEDs are off at the local user panel.	—
9.	Perform a system automatic turnup test on all lines.	DLP-507
10.	If required, test office alarm operation.	DLP-504


```

Acceptance: NTP-003---+---DLP-506---+---DLP-511
                |               |---DLP-510-----DLP-512
                |---DLP-501-----Operation: NTP-002
                |---DLP-524-----DLP-501-----Operation: NTP-002
                |---DLP-507
                |---DLP-504
                |---DLP-508
                |---DLP-509
                |---DLP-530

```

Accept Protection Access Upgrade in Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED

FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure tests a Protection Access Upgrade in an FT-2000 point-to-point network. Circuit pack and software compatibility are described in Section 7, "Circuit Pack Descriptions."

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 end terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the FT-2000 protection access upgrade was installed by someone else. If the installation has not been completed (including circuit pack installation), notify the installation personnel or refer to 365-575-104 to complete the installation. If you completed the installation following the procedures in 365-575-104, do not perform this procedure.



NOTE:

It is assumed that installation of the FT-2000 protection access upgrade has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the new low-speed shelf is powered and running. If at any point in this procedure, the FT-2000 end terminal fails to respond in the indicated way, refer the trouble to installation personnel.

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
At the local FT-2000 network element, inspect the shelf (Low Speed Shelf - Complementary) for obvious damage.	—
2. If required at the local FT-2000 network element, connect and condition the craft interface terminal (CIT).	DLP-501
3. At the local FT-2000 network element and at the CIT, select CONFIGURATION-Retrieve-Protection-Line to obtain the Network Element Protection Switching Provisioning Report.	—
4. At the local FT-2000 network element, does the report indicate that Restoration Protection Access has been provisioned to "yes"? If YES , then continue with Step 5. If NO , then continue with Step 6.	
5. At the local FT-2000 network element and at the CIT, select CONFIGURATION-Set-Protection-Line and set Restoration Protection Access to no.	—
6. At the local FT-2000 network element, remove all DS3 inputs and outputs at the DSX-3 cross-connect panel or equivalent for the protection access shelf.	—
7. At the local FT-2000 network element and at the CIT, select CONFIGURATION-Update and execute.	—
8. At the remote FT-2000 end terminal, have someone repeat Steps 1 through 7.	—
9. At the local FT-2000 end terminal and at the CIT, select FAULT-Switch-Line for line P with priority set to Reset.	—
10. At the local FT-2000 end terminal CIT, select FAULT and perform the low-speed cabling test.	DLP-503

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
11. At the remote FT-2000 end terminal CIT, select FAULT and perform the low-speed cabling test.	DLP-503
12. At the local FT-2000 end terminal CIT, select FAULT and perform the system automatic turnup test.	DLP-507
13. At both FT-2000 end terminals, verify the NE ACTY LED at the user panel is off.	—
14. If required, perform provisioning at this time.	DLP-505
15. The Protection Access Upgrade has passed the acceptance tests and is now ready for protection or traffic.	—

Acceptance: NTP-004---+---DLP-501-----Operation: NTP-002
 |---DLP-503---+---DLP-518-----DLP-511
 | |---DLP-500---+---DLP-511
 | |---DLP-512
 | |---DLP-510-----DLP-512
 |---DLP-507
 |---DLP-505

Accept FT-2000 OC-48 Repeater Bay/Shelf

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Accept FT-2000 OC-48 Add/Drop-Rings Terminal for 2-Fiber Ring

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure tests an **out-of-service** FT-2000 OC-48 Add/Drop-Rings Terminal for a 2-fiber ring in a stand-alone state. Each FT-2000 terminal (node) in the FT-2000 ring network should be tested individually.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Optical Loopback Jumpers with 20-dB buildout



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the FT-2000 add/drop-rings terminal was installed by someone else. If the installation has not been completed (including circuit pack installation), notify the installation personnel or refer to 365-575-115 to complete the installation. **If you completed the installation following the procedures in 365-575-115, do not perform this procedure.**

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

⇒ **NOTE:**
It is assumed that installation of the FT-2000 add/drop-rings terminal has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the add/drop-rings terminal is powered and running. **If at any point in this procedure the FT-2000 add/drop-rings terminal fails to respond in the indicated way, refer the trouble to installation personnel.**

⇒ **NOTE:**
Ignore the LEDs at the user panel during this test.

Inspect the FT-2000 add/drop-rings terminal for obvious damage	—

2. ⇒ **NOTE:**
All connections to other equipment must be removed.

At the DSX-3, STSX-1, and/or LGX [®] cross-connect panel or equivalent, remove all DS3, EC1, OC3, IS3 and/or OC12 connections to the FT-2000 terminal. All electrical output ports associated with slots equipped with DS3/EC1 packs must be terminated with 75-ohms. Make a record of these disconnections so they can be replaced after the test.	—

3. Loop back all high-speed OC-48 lines (so that the OUT jack of TRMTR 1E is connected to the IN jack of RCVR 1E and the OUT jack of TRMTR 1W is connected to the IN jack of RCVR 1W).	DLP-500

4. If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501

5. Log in to the CIT by entering " cit expert ". This is required when using the CONFIGURATION-Set-Synchronization command in Steps 7 and 15.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
6. At the CIT, select SECURITY-Retrieve-Network Element to obtain the FT-2000 System Provisioning Report (example shown in Section 11) and verify that the value of the TID (Target ID) agrees with the value from the engineered configuration work order. Use the SECURITY-Set-Network Element command.	—
7. Is this FT-2000 Add/Drop Rings Terminal running Release 9.0.0 or later? If YES , then continue with Step 8. If NO , then at the CIT, select CONFIGURATION-Set-Synchronization . Record the original value for the Provisioned Mode parameter before continuing. Then, set the Provisioned Mode to Free Running . Use CONFIGURATION-Retrieve-Synchronization command to verify setting. (an example is shown in Section 11).	—
8. At the CIT, select FAULT-Reset and execute (reset takes about 5 minutes).	—
9.  NOTE: Reset disconnects the CIT from the network element. At the CIT, log out and log in again by entering "cit expert". If you log in before reset is completed, the Active Alarms and Status Report will show a reset in progress condition.	—
10. At the CIT, select CONFIGURATION-Update and execute (update takes about 1 minute).	—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO																
11.	Use FAULT-Retrieve-Alarm to obtain an Active Alarm and Status Report. Make a note of any conditions other than those listed below that appear in the report. (Your report may not include all of the conditions listed.) Report these conditions to installation personnel if any failures occur during the following test. <table><tr><td>system</td><td>ring incomplete/open</td></tr><tr><td>system</td><td>ring startup in progress</td></tr><tr><td>system</td><td>sync mode:holdover auto switch (R9.0.0 or later)</td></tr><tr><td>system</td><td>sync-messaging</td></tr><tr><td>dcc-1e</td><td>incoming DCC failure</td></tr><tr><td>dcc-1w</td><td>incoming DCC failure</td></tr><tr><td>line-1e</td><td>site provisioning conflict</td></tr><tr><td>line-1w</td><td>site provisioning conflict</td></tr></table>	system	ring incomplete/open	system	ring startup in progress	system	sync mode:holdover auto switch (R9.0.0 or later)	system	sync-messaging	dcc-1e	incoming DCC failure	dcc-1w	incoming DCC failure	line-1e	site provisioning conflict	line-1w	site provisioning conflict	
system	ring incomplete/open																	
system	ring startup in progress																	
system	sync mode:holdover auto switch (R9.0.0 or later)																	
system	sync-messaging																	
dcc-1e	incoming DCC failure																	
dcc-1w	incoming DCC failure																	
line-1e	site provisioning conflict																	
line-1w	site provisioning conflict																	
	 NOTE: This test may be denied if the terminal is exhibiting conditions or alarms other than those listed here. The disallowed condition must be cleared before continuing.																	
12.	Perform local automatic turnup test for all lines.	DLP-502																
13.	Use FAULT-Retrieve-Alarm to obtain an Active Alarm and Status Report. Make a note of any conditions, other than those listed in Step 11, that appear in the report. (Your report may not include all of the conditions listed.) Report these conditions to installation personnel if any failures occur during the following test.	—																
14.	 NOTE: Only 2-way cables (input and output) can be tested. Perform automatic low-speed cabling test (to cross-connect panel) for all low-speed ports.	DLP-503																

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
15. Is this FT-2000 Add/Drop Rings Terminal running Release 9.0.0 or later? If YES, then continue with Step 16. If NO, then at the CIT, select CONFIGURATION-Set-Synchronization and set Provisioned Mode back to the original parameter value recorded in Step 7.	—
16. Reconnect all OC-48 lines (removed in Step 3).	—
17. Reconnect all DS3, EC1, OC3, IS3 and/or OC12 connections (recorded and removed in Step 2) at the DSX-3, STSX-1, and/or LGX cross-connect panel or equivalent.	—
18. If required, perform additional provisioning at this time (date, time, etc.). Helpful provisioning sources for the experienced technician are 365-575-122, <i>FT-2000 OC-48 Add/Drop-Rings Terminal Provisioning Job Aid (Releases 3, 4, 5, 6, 7, 7.1, 7.2, 8.0 and 8.1)</i>, and 365-575-123, <i>FT-2000 Threshold-Crossing Alert (TCA) Parameters Provisioning Job Aid (Release 4 and later)</i>.	DLP-505
19. The FT-2000 terminal has passed the acceptance tests. After testing all of the FT-2000 terminals individually, the FT-2000 ring network will be ready for the acceptance test.	Acceptance: NTP-007

Acceptance: NTP-006---+---TAD-100

|---DLP-500
|---DLP-501
|---DLP-502
|---DLP-503
|---DLP-505
|---Job Aid 365-575-122
|---Job Aid 365-575-123
|---Acceptance: NTP-007

Accept FT-2000 2-Fiber Ring Network

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure for the FT-2000 2-fiber ring network can be performed from any FT-2000 add/drop-rings terminal in the network. This acceptance procedure is performed after all of the FT-2000 add/drop-rings terminals and FT-2000 repeater bay/shelves or FT-Lightwave Booster Amplifiers (FT-LBA) in the network have been individually acceptance tested. If the ring is a mixed FT-2000/*WaveStar* ring, refer to the following installation manuals to test any *WaveStar* nodes in the ring: 365-370-100 (BandWidth Manager), 365-371-106 (2.5G), or 10G (365-371-306).

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **NOTE:**
This procedure is only used if the FT-2000 2-fiber ring network was installed by someone else. If the installation has not been completed, notify the installation personnel or refer to 365-575-115 to complete the installation. ***If you completed the installation following the procedures in 365-575-115, do not perform this procedure.***

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

⇒ **NOTE:**
Each FT-2000 network element should have been individually acceptance tested. If this has not been done, refer to **Acceptance: NTP-006** for the FT-2000 add/drop-rings terminal, or **Acceptance: NTP-011** for the FT-2000 add/drop-rings terminal for operation with an FT-LBA, and/or to **Acceptance: NTP-005** for the FT-2000 repeater bay/shelf. ***If at any point in this procedure any FT-2000 network element fails to respond in the indicated way, refer the trouble to installation personnel.***

⇒ **NOTE:**
If the ring network is equipped with FT-LBAs, it is **required** that they be in place (connected in the ring) during ring acceptance testing. The FT-LBAs should be transparent during ring acceptance.

Verify the FT-2000 network elements are connected in an FT-2000 2-fiber bidirectional ring.	DLP-506

2.	Verify the NE ACTY and the FE ACTY LEDs are off at the user panel on the local FT-2000 add/drop-rings terminal.	—

3.	If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501

4.	At the CIT, select CONFIGURATION-Retrieve-Map-Ring and execute to obtain a Ring Map Report for the local node.	—

5.	⇒ NOTE: The Ring Map Report lists the ring nodes from west to east starting at the local node. If the nodes are incorrectly connected, the order of the nodes in the report will also be incorrect.	

Verify that the Ring Map Report agrees with the engineered data, particularly the TID (target identifier). Also verify that DCC Status and Ring Continuity are "good". Section 11 shows an example of the report.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
6. At the CIT, select SECURITY-Retrieve-Network Element and execute to obtain an FT-2000 System Provisioning Report for the local FT-2000 add/drop-rings terminal.	—
7. Verify the report agrees with the engineered data. Section 11 shows example of report.	—
8. At the CIT, select CONFIGURATION-Retrieve-Synchronization and execute to obtain a Synchronization Report for the local node.	—
9. Verify the report agrees with the engineered data, particularly the Provisioned Mode. Section 11 shows example of report.	—
10.  NOTE: If you are remotely logged in, you will require assistance at the distant node in order to perform this step.	—
If required, test office alarm operation.	DLP-504
11.  NOTE: An FT-LBA provides four miscellaneous discrete (environmental) inputs to the FT-2000 terminal. If the network is so equipped, these inputs are tested separately in Acceptance: NTP-011 .	—
 NOTE: If you are remotely logged in, you will require assistance at the distant node in order to perform this step.	—
If required, check the miscellaneous discrete telemetry.	DLP-530
12. Establish a remote login to one of the other FT-2000 add/drop-rings terminals on the FT-2000 ring network.	DLP-524
13. Repeat Steps 6 through 11 for that FT-2000 add/drop-rings terminal.	—
14. Discontinue the remote login.	DLP-524

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
15. Repeat Steps 12 through 14 for each of the remaining FT-2000 add/drop-rings terminals in the FT-2000 ring network.	—
16. Are both the NE ACTY and the FE ACTY LEDs off at the local FT-2000 add/drop-rings terminal? If YES , then continue with Step 17. If NO , then the trouble must be referred to the group that installed it.	—
17. If required, notify personnel at the remote maintenance site (OS center) that the FT-2000 ring network is ready for any operational tests they wish to perform using the X.25 link.	—
18. The FT-2000 ring network has passed this acceptance test and is now ready to provide service.	—

Acceptance: NTP-007---+---TAD-100
|---DLP-501
|---DLP-504
|---DLP-506
|---DLP-509
|---DLP-524
|---DLP-530

Accept Added Electrical Low-Speed Cables to an In-Service FT-2000 Network Element

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure is used to test added electrical low-speed cables between an in-service FT-2000 network element and the corresponding cross-connect panel or other terminating equipment.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the added electrical low-speed cables were installed by someone else. If the installation has not been completed (including associated circuit pack installation), notify the installation personnel, or refer to the installation manual 365-575-115, to complete the installation. If you completed the installation following the procedures in the installation manual, do not perform this procedure.



NOTE:

It is assumed that installation of the added electrical low-speed cables has been completed (including associated circuit pack installation) for the engineered configuration and that the FT-2000 network element is in service. If at any point in this procedure the FT-2000 add/drop-rings terminal fails to respond in the indicated way, refer the trouble to installation personnel.

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.		DLP-501
2. At the CIT, select CONFIGURATION-Retrieve-Alarm to obtain the Active Alarm and Status Report and verify that there are no active alarms or status conditions. Section 11 shows example of report.		—
3.  CAUTION: <i>If the automatic low-speed cabling test is accidentally performed on an in-service low-speed cable, service will be interrupted.</i>		
 NOTE: Only 2-way cables (input and output) can be tested.		
Perform automatic low-speed cabling test for all added electrical low-speed cables.		DLP-503
4. At the CIT, select CONFIGURATION-Retrieve-Alarm to obtain the Active Alarm and Status Report and verify that there are no active alarms or status conditions. Section 11 shows example of report.		
5. The added electrical low-speed cables have passed the acceptance tests and are ready for service.		—

Acceptance: NTP-008---+---TAD-100
|---DLP-501
|---DLP-503

Accept Dual Ring Interworking (DRI) Connections to/from an FT-2000 Ring

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure verifies path integrity as the path enters and/or leaves the local FT-2000 ring. Figures 1 through 5 show different path possibilities for the local FT-2000 ring. Every external network may be different in the way it protects path integrity; therefore, it is imperative that the active path and standby path(s) be known.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Microwave Logic's ST-112 SONETest Transmission Analyzer, or
Tektronix CTS-710 SONET Transmission Analyzer, or
Tberd 310 SONET Transmission Analyzer, or
Cerjac 156 SONET Transmission Analyzer, or equivalent.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 add/drop-rings terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is used to test an individual path through a local FT-2000 ring, but keep in mind that a typical FT-2000 ring will have many more paths and DRI cross-connections than what is shown in Figures 1 through 5.

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

⇒ NOTE:
These tests pertain to a single path through a local FT-2000 ring that can have up to 16 nodes. The path being tested can encounter either one or two DRI cross-connections as it enters and/or leaves a ring per the examples in Figures 1 through 5.

⇒ NOTE:
Assistance is required at the remote source/destination access points in the external network or at the test sets when connected directly to the local FT-2000 ring.

⇒ NOTE:
Path testing should be accomplished by using an end-to-end arrangement as shown in Figure 6. However, due to equipment availability, another possibility includes a loopback arrangement (Figure 7).

⇒ NOTE:
It is assumed that acceptance testing of the local FT-2000 ring has passed. ***If at any point in this procedure the local FT-2000 ring fails to respond in the indicated way, refer the trouble to installation personnel.***

Referring to Figures 1 through 5, which figure —
most closely represents your configuration?

If **Figure 1**, then continue with Step 2.

If **Figure 2**, then continue with Step 11.

If **Figure 3**, then continue with Step 20.

If **Figure 4**, then continue with Step 33.

If **Figure 5**, then continue with Step 47.

2. ⇒ NOTE:
The local FT-2000 ring has one DRI cross-connection to the outside. Both DRI cross-connections and local source/destination cross-connections terminate directly to test sets.

Verify that there are no alarm or status conditions in —
the ring (Figure 1).

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
3. At the transmit test set, insert a verifiable signal for each path being tested.	—
4. At the receive test set, verify the detection of the inserted signal on each path being tested.	—
5. To test path integrity for 2-way paths, repeat Steps 3 and 4 from opposite ends of each path.	—
6. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
7. Repeat Steps 3 through 5 for each path being tested.	—
8. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Reset command for the appropriate line(s) and tributary(s).	—
9. Verify that there are no alarm or status conditions in the ring.	—
10. This completes testing path integrity (Figure 1).	—
11.  NOTE: The local FT-2000 ring has one DRI cross-connection to the outside. The DRI cross-connections terminate on an external network and the local source/destination cross-connections terminate directly to a test set.	
Verify that there are no alarm or status conditions in either ring/network (Figure 2).	—
12. At the transmit end in the external network, insert a verifiable signal into each path being tested.	—
13. At the receive test set, verify the detection of the inserted signal on each path being tested.	—
14. To test path integrity for 2-way paths, repeat Steps 12 and 13 from opposite ends of each path.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
15. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
16. Repeat Steps 12 through 14 for each path being tested.	—
17. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Reset command for the appropriate line(s) and tributary(s).	—
18. Verify that there are no alarm or status conditions in the ring.	—
19. This completes testing path integrity (Figure 2) in the local FT-2000 ring. If the external network is non-Lucent (another vendor), refer to local maintenance procedures to test path integrity in that network. If the network is a DDM-2000 ring, refer to the appropriate manual as follows: 363-206-285 for DDM-2000 OC3 for Release 13 and Higher 363-206-295 for DDM-2000 OC12/OC12 Regenerator for Releases 7 and higher	—
20.  NOTE: The local FT-2000 ring has two DRI cross-connections to the outside. Both DRI cross-connections terminate directly to test sets. Verify that there are no alarm or status conditions in the ring (Figure 3).	—
21. At the transmit test set, insert a verifiable signal for each path being tested.	—
22. At the receive test set, verify the detection of the inserted signal on each path being tested.	—
23. To test path integrity for 2-way paths, repeat Steps 21 and 22 from opposite ends of each path.	—

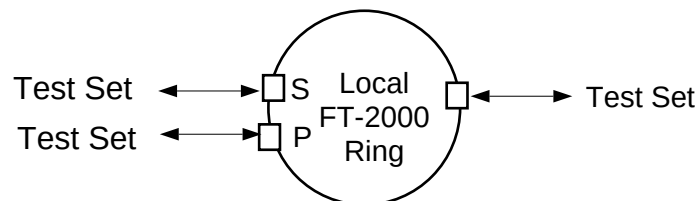
DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
24. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1) -Manual command for the appropriate line(s) and tributary(s).	—
25. Repeat Steps 21 through 23 for each path being tested.	—
26. DO NOT RESET the DRI switch at node P at this time. At FT-2000 primary node P' (P prime), execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1) -Manual command for the appropriate line(s) and tributary(s).	—
27. Repeat Steps 21 through 23 for each path being tested.	—
28. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1) -Reset command for the appropriate line(s) and tributary(s).	—
29. Repeat Steps 21 through 23 for each path being tested.	—
30. At the FT-2000 primary node P', reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1) -Reset command for the appropriate line(s) and tributary(s).	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
31. Verify that there are no alarm or status conditions in the ring.	—
32. This completes testing path integrity (Figure 3).	—
33.  NOTE: The local FT-2000 ring has two DRI cross-connections to the outside. One DRI cross-connection terminates in an external network and the other DRI cross-connection terminates directly to test sets.	
Verify that there are no alarm or status conditions in the ring (Figure 4).	—
34. At the transmit end in the external network, insert a verifiable signal into each path being tested.	—
35. At the receive test set, verify the detection of the inserted signal on each path being tested.	—
36. To test path integrity for 2-way paths, repeat Steps 34 and 35 from opposite ends of each path.	—
37. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
38. Repeat Steps 34 through 36 for each path being tested.	—
39. DO NOT RESET the DRI switch at node P at this time. At FT-2000 primary node P' (P prime), execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
40. Repeat Steps 34 through 36 for each path being tested.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
41. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3-Reset command for the appropriate line(s) and tributary(s).	—
42. Repeat Steps 34 through 36 for each path being tested.	—
43. At the FT-2000 primary node P', reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3-Reset command for the appropriate line(s) and tributary(s).	—
44. Verify that there are no alarm or status conditions in the ring.	—
45. This completes testing path integrity (Figure 4).	—
46. This completes testing path integrity (Figure 4) in the local FT-2000 ring. If the external network is non-Lucent (another vendor), refer to local maintenance procedures to test path integrity in that ring. If the network is a DDM-2000 ring, refer to the appropriate manual as follows: 363-206-285 for DDM-2000 OC3 for Release 13 and Higher 363-206-295 for DDM-2000 OC12/OC12 Regenerator for Releases 7 and higher	—
47.  NOTE: The local FT-2000 ring has two DRI cross-connections to the outside. Both DRI cross-connections terminate to external networks. Verify that there are no alarm or status conditions in either ring (Figure 5).	—
48. At the transmit end in the external network (left side), insert a verifiable signal into each path being tested.	—
49. At the receive end in the external network (right side), verify the detection of the inserted signal on each path being tested.	—

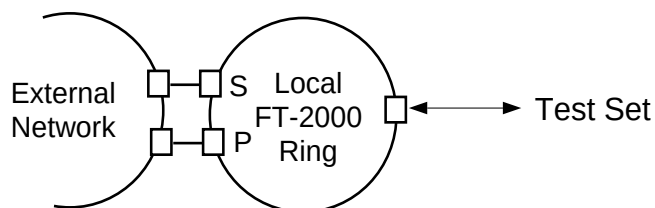
DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
50. To test path integrity for 2-way paths, repeat Steps 48 and 49 from opposite ends of each path.	—
51. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
52. Repeat Steps 48 through 51 for each path being tested.	—
53. DO NOT RESET the DRI switch at node P at this time. At FT-2000 primary node P' (P prime), execute a manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Manual command for the appropriate line(s) and tributary(s).	—
54. Repeat Steps 48 through 50 for each path being tested.	—
55. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Reset command for the appropriate line(s) and tributary(s).	—
56. Repeat Steps 48 through 50 for each path being tested.	—
57. At the FT-2000 primary node P'(P prime), reset the manual DRI switch for each path being tested. Use the FAULT-Switch-Path-STS3(or STS1)-Reset command for the appropriate line(s) and tributary(s).	—
58. Verify that there are no alarm or status conditions in the ring.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
59. This completes testing path integrity (Figure 5).	—
60. This completes testing path integrity (Figure 5) in the local FT-2000 ring. If one of the external networks is non-Lucent (another vendor), refer to local maintenance procedures to test path integrity in that network. If an external network is a DDM-2000 ring, refer to the appropriate manual as follows: 363-206-285 for DDM-2000 OC3 for Release 13 and higher 363-206-295 for DDM-2000 OC12/OC12 Regenerator for Releases 7 and higher	—



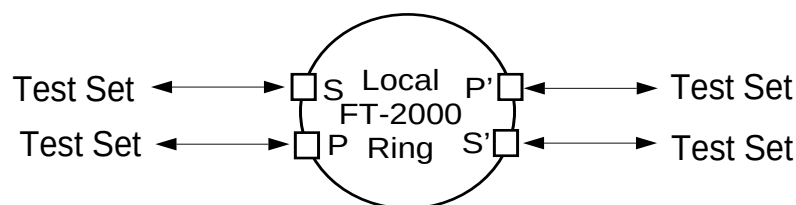
Note: One DRI cross-connection to the outside. Both DRI cross-connections and local source/destination cross-connections terminate directly to test sets.

Figure 1 – Testing Local FT-2000 Ring (Three Nodes)



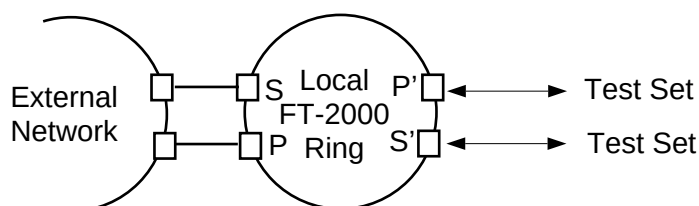
Note: One DRI cross-connection to the outside. The DRI cross-connections terminate on an external network and the local source/destination cross-connections terminate directly to a test set.

Figure 2 – Testing Local FT-2000 Ring (Three Nodes) and External Network



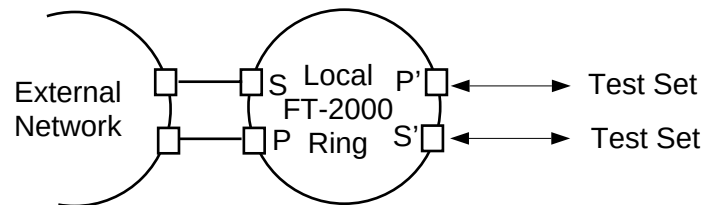
Note: Two DRI cross-connections to the outside. Both DRI cross-connections terminate directly to test sets.

Figure 3 – Testing Local FT-2000 Ring (Four Nodes)



Note: Two DRI cross-connections to the outside. One DRI cross-connection terminates in an external network and the other DRI cross-connection terminates directly to test sets.

Figure 4 – Testing Local FT-2000 Ring (Four Nodes) and External Network



Note: Two DRI cross-connections to the outside. One DRI cross-connection terminates in an external network and the other DRI cross-connection terminates directly to test sets.

Figure 5 – Testing Local FT-2000 Ring (Four Nodes) and Two External Network

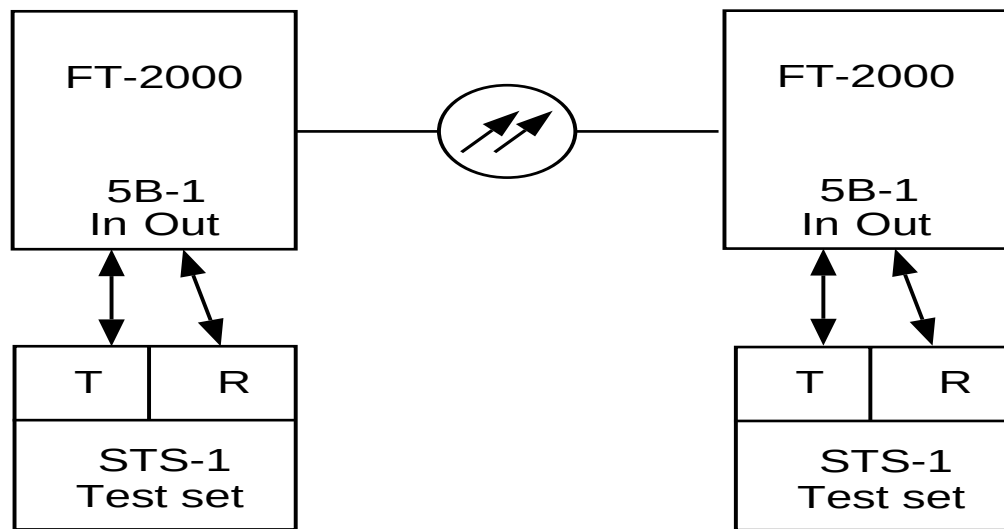


Figure 6 – End-to-End Test Arrangement (for Slot 5B)

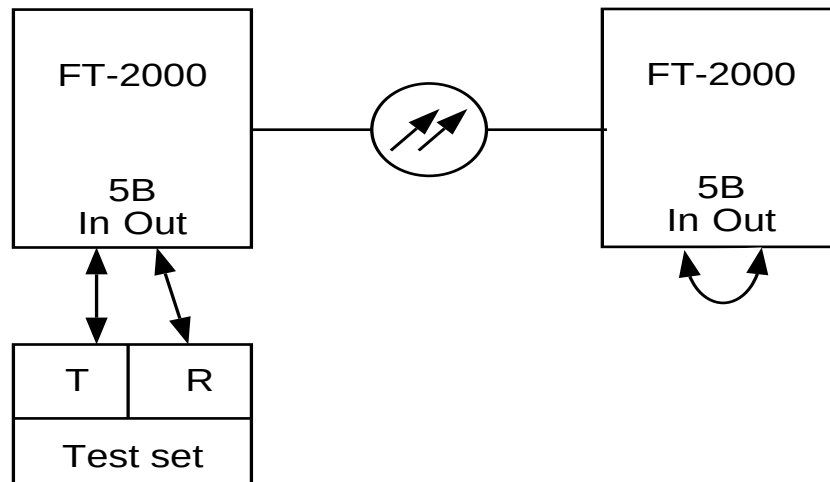


Figure 7 – Loopback Test Arrangement (for Slot 5B/Port 1)

Accept Added Optical Low-Speed Fibers to an In-Service FT-2000 Network Element

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure is used to test new optical low-speed fibers between an **in-service FT-2000 network element** and the corresponding lightguide cross-connect panel or other terminating equipment.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

This procedure is only used if the new optical low-speed fibers were installed by someone else. If the installation has not been completed (including associated circuit pack installation), notify the installation personnel or refer to 365-575-115 to complete the installation. ***If you completed the installation following the procedures in the installation manual, do not perform this procedure.***

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ NOTE:
It is assumed that installation of the new optical low-speed fibers has been completed (including associated circuit pack installation) for the engineered configuration and that the FT-2000 network element is in service. ***If at any point in this procedure the FT-2000 add/drop-rings terminal fails to respond in the indicated way, refer the trouble to installation personnel.***

If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it. **DLP-501**

2. At the CIT, select **FAULT-Retrieve-Alarm** to obtain the Active Alarm and Status Report (example is shown in Section 11) and verify that there are no active alarms or status conditions. —

3. **⚠ CAUTION:**
If the automatic low-speed cabling (fiber) test is accidentally performed on an in-service low-speed fiber, service will be interrupted.

⇒ NOTE:
Only 2-way fibers (input and output) can be tested.

Perform automatic low-speed cabling (fiber) test for all new optical low-speed fibers. **DLP-503**

4. At the CIT, select **FAULT-Retrieve-Alarm** to obtain the Active Alarm and Status Report (example is shown in Section 11) and verify that there are no active alarms or status conditions. —

5. The new optical low-speed fibers have passed the acceptance tests and are ready for service. —

Acceptance: NTP-010---+---TAD-100
|---DLP-501
|---DLP-503

Accept FT-2000 OC-48 Add/Drop-Rings Terminal for Operation with a FT-2000 Lightwave Booster Amplifier (FT-LBA)

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This acceptance procedure tests the four miscellaneous discrete telemetry connections from an FT-Lightwave Booster Amplifier (FT-LBA) to the FT-2000 terminal. It also verifies that the appropriate text strings have been provisioned for these inputs at the FT-2000 terminal. Additional descriptive information is in Section 6, "User-Settable Miscellaneous Discrete Interface."

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
This procedure is only used if the FT-2000 add/drop-rings terminal operating with an FT-LBA was installed by someone else. If the installation has not been completed (including circuit pack installation), notify the installation personnel or refer to 365-575-115 and/or 365-565-500 to complete the installation. If you completed the terminal installation and/or the FT-LBA installation following the procedures in 365-575-115 or 365-565-500, respectively, do not perform this procedure.

⇒ **NOTE:**
It is assumed that installation of the FT-2000 add/drop-rings terminal operating with an FT-LBA has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the add/drop-rings terminal and the FT-LBA are powered and running. If at any point in this procedure the FT-2000 add/drop-rings terminal or the FT-LBA fails to respond in the indicated way, refer the trouble to installation personnel.

⇒ **NOTE:**
It is assumed that all of the FT-LBAs were in place (connected in the ring) during the ring acceptance procedure (**Acceptance: NTP-007**).

Inspect the FT-2000 add/drop-rings terminal and the FT-LBA for obvious damage.	—
2. Do you wish to test the FT-LBA environmental discretes (inputs to the FT-2000 add/drop-rings terminal) for proper operation? If YES , then continue with Step 3. If NO , then continue with Step 9.	—
3. If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501
4. Log in to the CIT by entering "cit".	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

5.	 NOTE: Additional test information on the FT-LBA is contained in 365-565-500. At the FT-LBA, remove the 10A fuse from the -48A fuse socket on the user panel.	—
6.	At the CIT, select FAULT-Retrieve-Alarm command to obtain an Active Alarm and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.	—
7.	From the report, verify the correct condition is listed in the Description column of the report. (Your report may include only one condition at a time.) If the condition does not appear, notify the installation group of the problem. FT-LBA fuse/power failure FT-LBA 1WE failure FT-LBA 1EW failure FT-LBA fan failure	—
8.	Repeat Steps 5 through 7 for each of the miscellaneous discretes listed below. Remove the 10A fuse from the -48B fuse socket at the FT-LBA, Disconnect the 1EW fiber at the FT-LBA, Disconnect the 1WE fiber at the FT-LBA.	—
9.	STOP! YOU HAVE COMPLETED THIS PROCEDURE.	—
-

Circuit Order Task Index

FIND YOUR JOB IN THE LIST BELOW	THEN GO TO
Add a Node to an In-Service 2-Fiber Ring Network	Circuit Order: NTP-008
Add a <i>WaveStar</i> Node to an In-Service 2-Fiber Ring Network	Circuit Order: NTP-019
Add DS3 and/or EC1 Low Speed Port(s)	Circuit Order: NTP-002
Add OC3/IS3 Low Speed Slot(s)	Circuit Order: NTP-010
Add OC12 Low Speed Slot(s)	Circuit Order: NTP-012
Add OC-48 Protection Line to Point-to-Point Network	Circuit Order: NTP-005
Change an OC-3/IS-3 Link From 0x1 to 1+1 Protection Mode	Circuit Order: NTP-014
Change an OC-12 Link From 0+1 to 0x1 Protection Mode	Circuit Order: NTP-015
Change an OC-3/IS-3 Link From 1+1 to 0x1 Protection Mode	Circuit Order: NTP-016
Change an OC-12 Link From 1+1 to 0x1 Protection Mode	Circuit Order: NTP-017
Delete DS3 and/or EC1 Low Speed Port(s)	Circuit Order: NTP-003
Delete OC3/IS3 Low Speed Slot(s)	Circuit Order: NTP-011
Delete OC12 Low Speed Slot(s)	Circuit Order: NTP-013
Delete a Node from an In-Service 2-Fiber Ring Network	Circuit Order: NTP-009
Delete a <i>WaveStar</i> Node from an In-Service Mixed FT-2000/ <i>WaveStar</i> 2-Fiber Ring Network	Circuit Order: NTP-020
Delete OC-48 Protection Line from Point-to-Point Network	Circuit Order: NTP-004
Discontinue Restoration Protection Access from Point-to-Point Network	Circuit Order: NTP-006
Establish Cross-Connection Between FT-2000 OC-3/OC-12 Inter- face and DDM-2000 OC-3/OC-12 Interface	Circuit Order: NTP-018

FIND YOUR JOB IN THE LIST BELOW

THEN GO TO

Establish Restoration Protection Access in

Point-to-Point Network

Circuit Order: NTP-007

Add DS3 and/or EC1 Low Speed Port(s)

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This procedure is used to add a low-speed port to a network element and not to make cross-connections. Refer to **DLP-536** for cross-connect information for an FT-2000 OC-48 Add/Drop-Rings Terminal.

Required Test Equipment: Craft Interface Terminal (CIT) Wrist Strap

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **NOTE:**
Shelves are keyed to prevent circuit packs from being accidentally installed into the wrong slots.

 **NOTE:**
This procedure may be performed after all installation wiring and testing of the Low Speed Shelf - System Controller and/or the Low Speed Shelf - Complementary have been completed or on an in-service basis. Additional installation information is contained in 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 6.0 and later, Installation Manual*.

 **NOTE:**
A DS3 (LAA2) or STS1E (LAA4) circuit pack has three ports.

Obtain the circuit order instructions to add a DS3 or
EC1 port(s) and note the assigned address. A
point-to-point network address requires a line, slot,
and port(s) assignment. A ring network address
requires a slot and port(s) assignment.

-
2. If required, connect and condition the craft interface terminal (CIT).
-

DLP-501

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
3. At the CIT, select CONFIGURATION-Retrieve-Equipment , then LS INTFC and execute to obtain an Equipage and Version Report. Section 11 shows an example of the report.	—
4. Determine from the report if the DS3 or STS1E circuit pack is already present in each slot associated with a DS3 or EC1 port to be added. A circuit pack is in the slot if the type of circuit pack is indicated in the Circuit Pack column of the report. If circuit pack(s) is present in the slot(s) , then continue with Step 10. If circuit pack(s) is not present in the slot(s) , then continue with Step 5.	
5. Remove the appropriate low-speed shelf cover.	DLP-511
6. If necessary, remove the apparatus (circuit pack) blank(s) from the slot(s) requiring new circuit pack(s).	DLP-533
7. For circuit pack and software compatibility, refer to Table 7-1 in Section 7, "Circuit Pack Description."	
A protection circuit pack of the same type (DS3 or STS1E) as a new service electrical low-speed circuit pack must be installed in one of the protection slots(P1 or P2) if low-speed protection is desired. Install DS3 or STS1E circuit pack(s) into the specified slot(s) of the low-speed shelf per the circuit order.	DLP-514
8. Verify the FAULT LED on each DS3 or STS1E circuit pack(s) goes off within 1 minute after the circuit pack is installed.	—
9. Replace the shelf cover.	DLP-511
10. Make the appropriate external cross-connections at the DSX-3 or equivalent.	—
11.  NOTE: Signal degrade provisioning for the STS1E circuit pack is done for all three ports at the same time. For the DS3 circuit pack, it is done for one port at a time.	

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
If required, provision the DS3 or EC1 port parameters.	DLP-517
12. Verify that none of the low-speed ports being added were inadvertently left in the NMON state.	DLP-534
13. The DS3 or EC1 low-speed port(s) is now ready for service.	—

Circuit Order: NTP-002---+---DLP-536

|---TAD-100
|---DLP-501
|---DLP-511
|---DLP-533
|---DLP-514
|---DLP-517
|---DLP-534

Delete DS3 and/or EC1 Low Speed Port(s)

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

A DS3 (LAA2) or STS1E (LAA4) circuit pack has three ports.

Obtain the circuit order instructions to delete a —
DS3 or EC1 port(s) and note the assigned
address. A point-to-point network address
requires a line, slot, and port(s) assignment. A
ring network address requires a slot and port(s)
assignment.

2.	If required, connect and condition the craft interface terminal (CIT).	DLP-501

3.	If required by local operating procedures, disconnect incoming signals and properly terminate outgoing DS3 or EC1 signals at the digital cross-connect bay, DACS III-2000, etc., for the port(s) being deleted.	DLP-520

4. **NOTE:**
If the receive end is equipped with DS3 circuit pack, deleting a port(s) at the transmit end of an STS-1 path will cause an **NE ACTY** condition at the receive end of the STS-1 path. If both ends are equipped with STS1E circuit packs, no **NE ACTY** condition will be observed

At the CIT, select **CONFIGURATION - Update** —
command and execute.

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
5.	Does the circuit order indicate that the circuit pack is to be removed from the shelf slot? If YES , then continue with Step 6. If NO , then continue with Step 11.	
6.	Verify that all three ports associated with a particular DS3 or STS1E circuit pack are to be removed or that the office records show the ports are not carrying traffic.	—
7.	Remove the shelf cover from the low-speed shelf that contains the DS3 or STS1E circuit pack(s).	DLP-511
8.	Remove the circuit pack(s) from the shelf.	DLP-514
9.	Replace the shelf cover.	DLP-511
10.	At the CIT, select CONFIGURATION - Update and execute.	—
11.	The software release in use can be determined by using the CONFIGURATION - Retrieve - Equipment : SY SCTL command.	
12.	At the other end of the STS-1 path and at the CIT, select CONFIGURATION - Update and enter. (To establish and discontinue a remote login, refer to DLP-524 .)	—
13.	The DS3 or EC1 port(s) has been deleted for an STS-1 path and completes this procedure.	—

Circuit Order: NTP-003---+---TAD-100

|---DLP-501
|---DLP-520
|---DLP-511
|---DLP-514
|---DLP-524

Delete OC-48 Protection Line from Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Required Test Equipment:**

Craft Interface Terminal (CIT)
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the circuit order instructions and
note which OC-48 line will be deleted.

—

2.	If required, connect the Craft Interface Terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501

3.	Remove the appropriate high-speed shelf cover.	DLP-511

4. Are you at an FT-2000 end terminal or FT-2000 repeater bay/shelf?

If **FT-2000 end terminal**, then continue with Step 5.

If **FT-2000 repeater bay/shelf**, then continue with Step 20.

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
5.	Verify that the LNCTL circuit pack for the OC-48 line being deleted is installed and that its FAULT LED is off. If the LNCTL circuit pack was just installed, wait about 5 minutes for the FAULT to go off. Refer to Figure 1 for the High Speed Shelf or to Figure 2 for the Enhanced High Speed Shelf.	—
6.	Remove both the TRMTR and the RCVR circuit packs for the protection OC-48 line being deleted.	DLP-514
7.	At the CIT, select CONFIGURATION - Update and execute.	—
8.	Wait until the NE ACTY goes off (approximately 5 minutes).	—
9.	Remove the LNCTL circuit pack for the protection OC-48 line being deleted.	DLP-514
10.	Replace the high-speed shelf cover.	DLP-511
11.	At the CIT, select CONFIGURATION - Update and execute.	—
12.	Wait until the NE ACTY goes off (approximately 1 minute).	—
13.	Is FT-2000 end terminal equipped for protection line access? If YES , then continue with Step 14. If NO , then continue with Step 20.	—
14.	Remove the appropriate low-speed shelf cover.	DLP-511
15.	Remove all circuit packs in the low-speed shelf.	DLP-514
16.	Replace the low-speed shelf cover.	DLP-511

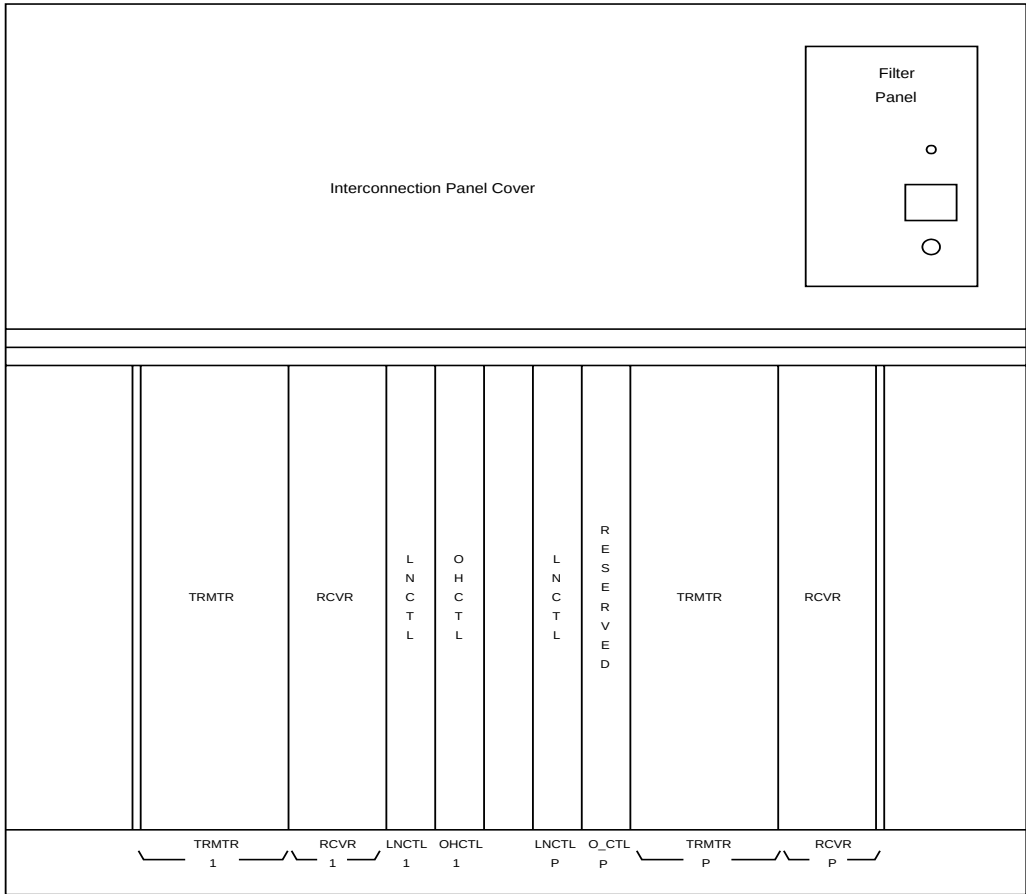


Figure 1 – High Speed Shelf (Cover Removed)

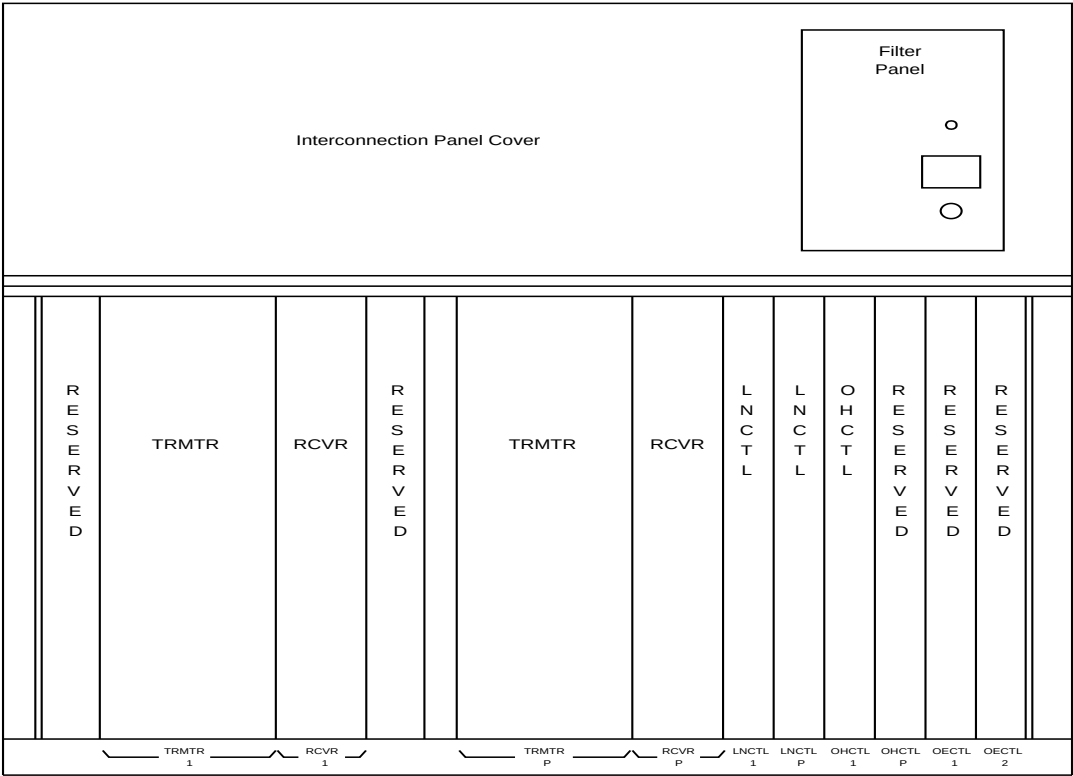
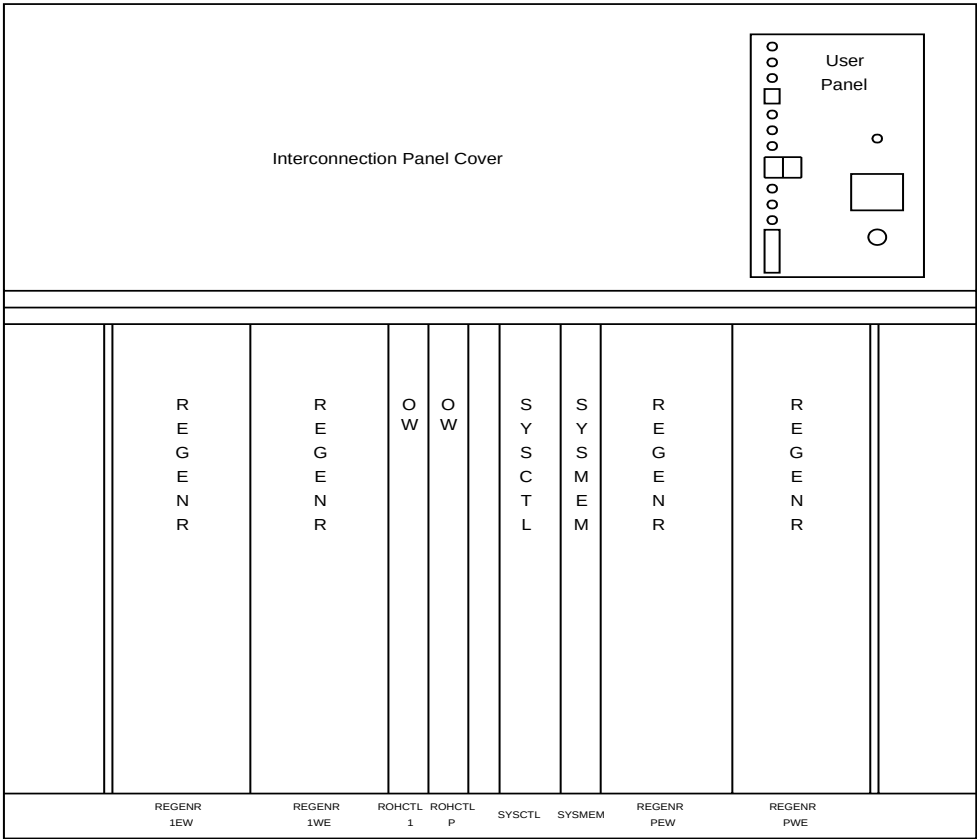


Figure 2 – Enhanced High Speed Shelf (Cover Removed)



tpa 814212/01

Figure 3- FT-2000 Repeater Bay/Shelf (Cover Removed)

Add OC-48 Protection Line to Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Required Test Equipment:**
Craft Interface Terminal (CIT)
Wrist Strap

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the circuit order instructions and note
which OC-48 protection line will be added.

—

-
2. If required, connect and condition the craft interface terminal (CIT).	DLP-501
3. Remove the high-speed shelf cover.	DLP-511
4. Install the TRMTR, RCVR, and LNCTL circuit packs and make the appropriate optical connections.	DLP-514
5. Replace the high-speed shelf cover.	DLP-511
-

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
6.	Repeat Steps 1 through 5 at the remote FT-2000 network element.	—
7.	Wait until the NE ACTY LED goes off at both FT-2000 end terminals (approximately 5 minutes).	—
8.	If required to add DS3 port(s) to this OC-48 line at this time, then refer to circuit order procedure.	Circuit Order: NTP-002

Circuit Order: NTP-005---+---DLP-501-----Operation: NTP-002
|---DLP-511
|---DLP-514---+---DLP-512
| |---DLP-510-----DLP-512
|---Circuit Order: NTP-002

Discontinue Restoration Protection Access from Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Required Test Equipment:**
Craft Interface Terminal (CIT)
Wrist Strap



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

At the local FT-2000 end terminal, obtain the circuit order instructions to discontinue restoration protection access. Both FT-2000 end terminals must be provisioned.

—

-
2. If required, connect the Craft Interface Terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501
-

3. At the local FT-2000 end terminal, under the CIT **FAULT** category, select **Switch-Line-Protection** and **Priority** set to **Reset**.

—

-
4. To verify the provisioning, retrieve a report by selecting **CONFIGURATION-Retrieve-Protection-Line**.

At the CIT, select **CONFIGURATION-Set-Protection-Line** and **Restoration Protection Access** set to **no**.

—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
5.	At the remote FT-2000 network element, repeat Step 4. This can be accomplished by establishing a remote login.	DLP-524
6.	At both FT-2000 network elements, verify the NE ACTY LED is off. An assistant is required at the remote FT-2000 end terminal.	—
7.	Restoration protection access has been discontinued.	—

Circuit Order: NTP-006---+---DLP-501-----Operation: NTP-002
|---DLP-524-----DLP-501-----Operation: NTP-002

Establish Restoration Protection Access in Point-to-Point Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Required Test Equipment:**
Craft Interface Terminal (CIT)
Wrist Strap



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

At the local FT-2000 end terminal, obtain the circuit order instructions to establish restoration protection access. Both FT-2000 end terminals must be provisioned.

—

-
2. At the local FT-2000 end terminal (if required), connect and condition the craft interface terminal (CIT).

DLP-501

-
3. To verify the provisioning, obtain a report by selecting **CONFIGURATION-Retrieve-Protection-Line**.

At the local FT-2000 end terminal, at the CIT, select

CONFIGURATION-Set-Protection-Line
and **Restoration Protection Access**
set to **Yes**.

—

-
4. At the remote FT-2000 network element, repeat Steps 1 through 3. This can be accomplished by establishing a remote login.

DLP-524

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
5.	At the local FT-2000 end terminal and at the CIT, select FAULT-Switch-Line-Protection and Priority set to preemptible.	—
6.	At both FT-2000 network elements, verify the NE ACTY LED is off. An assistant is required at the remote FT-2000 end terminal.	—
7.	Restoration protection access has been established.	—

Circuit Order: NTP-007---+---DLP-501-----Operation: NTP-002
|---DLP-524-----DLP-501-----Operation: NTP-002

Add a Node to an In-Service 2-Fiber Ring Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to add a "new node" to an existing and **in-service** 2-fiber ring network. The "new node" is an add/drop-rings terminal with/without an FT-2000 Lightwave Booster Amplifier (FT-LBA). This procedure is written from the "new node" perspective although action is required at two other nodes. The "new node" will be connected between two operational nodes (called the West node and East node). If adding a "new node" to an out-of-service 2-fiber ring network, refer to Acceptance: NTP-006 or to Acceptance: NTP-011 (node operating with FT-LBA).

Required Test Equipment and Personnel:

Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical LBOs
Technical assistance at two other nodes.

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **NOTE:**
Major alarms will be active at different times during this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
Only use this procedure to add a new FT-2000 add/drop-rings terminal to an **in-service** 2-fiber ring network. If the installation of the new terminal has not been completed (including circuit pack installation), notify the installation personnel or refer to 365-575-115 and/or to 365-565-500 (FT-LBA) to complete the installation.

⚠ **CAUTION:**
If the ring already has NPPA provisioned—then the new node must be equipped with STS-1 capable circuit packs. Otherwise, a service outage may result.

⚠ **CAUTION:**
Incorrect setting of the timing option could result in a service interruption in certain applications. Be certain that the timing option for the new bay is set to be consistent with the rest of the ring and to be consistent with the intended application. The bay defaults to “free running mode” when it is initially turned up. Provisionable timing options are discussed in Section 5 of this User/Service Manual.

⇒ **NOTE:**
It is assumed that installation of the new FT-2000 add/drop-rings terminal with/without FT-LBA has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the new add/drop-rings terminal with/without FT-LBA is powered and running and that the new fibers have been tested.

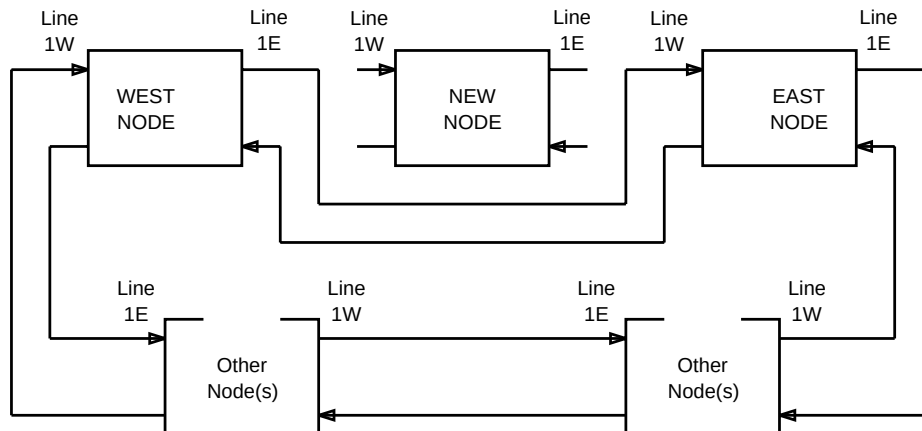
⇒ **NOTE:**
The TID of the "new node" must be unique. The TIDs cannot be the same as any others in the ring.

⇒ **NOTE:**
Refer to Figure 1 and notice that the node to be connected to line 1W of the "new node" is referred to, in this procedure, as the West node and that the node to be connected to line 1E of the "new node" is referred to, in this procedure, as the East node.

From office records, determine which nodes
in the ring network will be called the West
node and the East node for this procedure.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



tpa 832675/01

Figure 1 – Identify the East Node and the West Node

-
2. **CAUTION:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.

At the "new node", make any necessary tributary-to-tributary (through) cross-connections and verify that there are no unnecessary cross-connections.

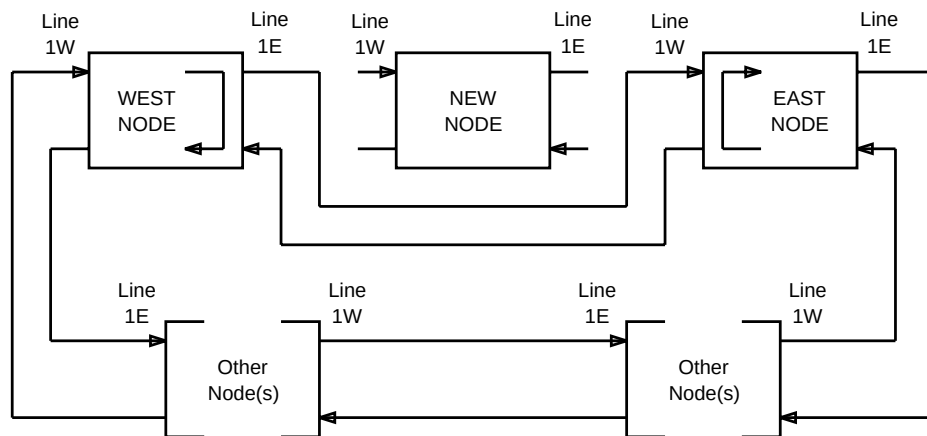
DLP-536

-
3. **CAUTION:**
A line forced switch will preempt extra traffic, if any, on the protection tributaries.

NOTE:
For this step and Step 4, refer to Figure 2. The service tributaries to be connected (add/drop/through) to the "new node" will now be looped back in the opposite direction at the West node and at the East node.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Instruct the technician at the West node (or travel to that location) to enter the
FAULT-Switch-Line:1E:Forced command
at the CIT for line 1E. This makes a forced switch
on line 1E and may cause traffic hits.



tpa 832676/01

Figure 2 – Forced Switched Lines at the East Node and the West Node

-
4. **CAUTION:**
A line forced switch will preempt extra traffic, if any, on the protection tributaries.

Instruct the technician at the East node (or travel to that location) to enter the
FAULT-Switch-Line:1W:Forced command
at the CIT for line 1W. This makes a forced switch
on line 1W and may cause traffic hits.

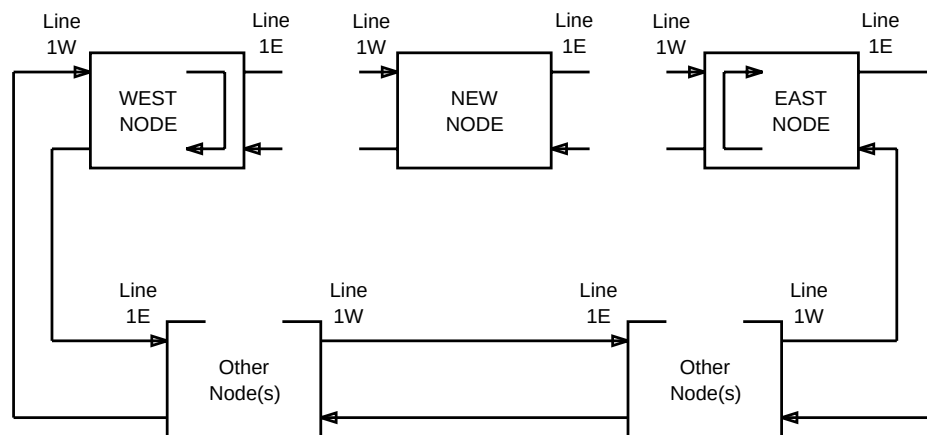
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

5. Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed from the West node (fibers connected to East node).

Instruct the technician at the West node to remove the OC-48 optical fibers (line 1E) connected to the East node.

-
6. **⇒ NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed from the East node (fibers connected to West node).

Instruct the technician at the East node to remove the OC-48 optical fibers (line 1W) connected to the West node.



tpa 832677/01

Figure 3 – Optical Fibers Removed

-
7. **⇒ NOTE:**
Refer to Figure 4 and notice the new optical connections can now be made to the "new node".
-

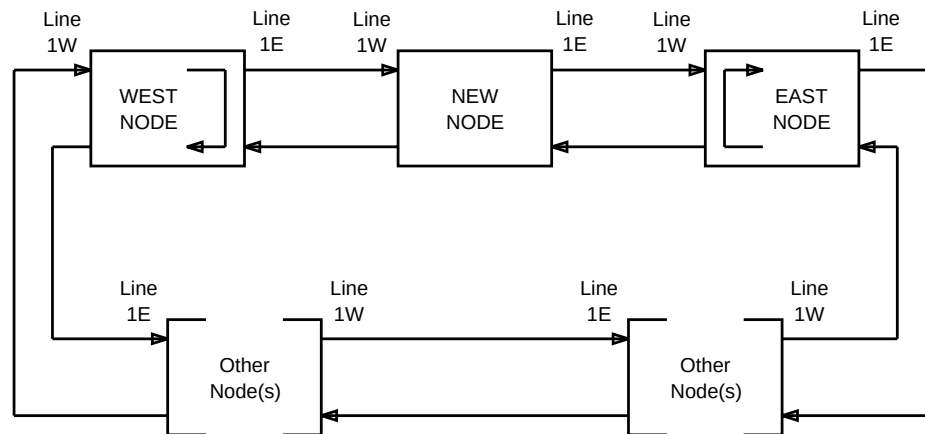
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
A transient node ID conflict condition will be observed after the ring is reconnected.

⇒ **NOTE:**
Lightguide buildouts (if required) are installed on the receive fibers of the "new node".

Select one of the receive fibers (change the lightguide buildout as necessary) and connect to the appropriate RCVR circuit pack. For example, select line 1E of the West node to be connected to line 1W of the "new node".

DLP-512



tpa 832678/01

Figure 4 – Optical Fibers Connected to New Node

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
8.	At the CIT, select FAULT-Retrieve-Alarm command to obtain an Active Alarms and Status Report and verify an incoming OC-48 LOS condition does not exist for either the 1E or 1W receiver (that is, whichever receive fiber that was connected to the RCVR circuit pack in Step 7) at the "new node".	—
9.	Select the other receive fiber (change the 0-db lightguide buildout as necessary) and connect to the appropriate RCVR circuit pack. For example, select line 1W of the East node to be connected to line 1E of the "new node".	DLP-512
10.	At the CIT, select FAULT-Retrieve-Alarm command to obtain an Active Alarms and Status Report and verify an incoming OC-48 LOS condition does not exist for either the 1E or 1W receiver at the "new node".	—
11.	Connect the transmit fibers (change the lightguide buildout as necessary) to the appropriate TRMTR circuit pack. For example, line 1W at the "new node" (to be connected to the West node) and line 1E (to be connected to the East node).	DLP-512
12.	Instruct the technician at the West node to: a. Change the lightguide buildout as necessary on the 1E receive fiber. b. Connect it to 1E RCVR circuit pack. c. Verify the RCVR (line 1E) does not show an incoming OC-48 LOS condition by obtaining an Active Alarms and Status Report at the CIT located at the West node.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

13. Instruct the technician at the East node to: —
- a. Change the lightguide buildout as necessary on the 1W receive fiber.
 - b. Connect it to 1W RCVR circuit pack.
 - c. Verify the RCVR (line 1W) does not show an incoming OC-48 LOS condition by obtaining an Active Alarms and Status Report at the CIT located at the East node.

-
14. At the CIT, select —
CONFIGURATION-Retrieve-Map-Ring
command to obtain a Ring Map Report and verify that the "new node" has been added to the ring as intended. (**DCC Stat** should indicate **good**.)

 **CAUTION:**
Incorrect setting of the timing option could result in a service interruption in certain applications. Be certain that the timing option for the new bay is set to be consistent with the rest of the ring and to be consistent with the intended application. The bay defaults to "free running mode" when it is initially turned up. Provisionable timing options are discussed in Section 5 of this User/Service Manual.

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

15. Verify that the Synchronization has been provisioned for this “new node”, and that it is correct and consistent for this FT-2000 ring.	

16.  NOTE: Refer to Figure 5. The forced switch at the West node can now be reset.	

Instruct the technician at the West node to enter **FAULT-Switch-Line:1E:Reset** to reset the forced switch on line 1E. An alternative method is to remotely log in to the West node and execute the command. The line switch may cause traffic hits.

Reference: **DLP-524**

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

17. Refer to Figure 5. The forced switch at the East node can now be reset.

Instruct the technician at the East node to enter
FAULT-Switch-Line:1E:Reset to reset the
forced switch on line 1W. An alternative method is
to remotely log in to the East node and execute the
command. The line switch may cause traffic hits.

Reference: **DLP-524**

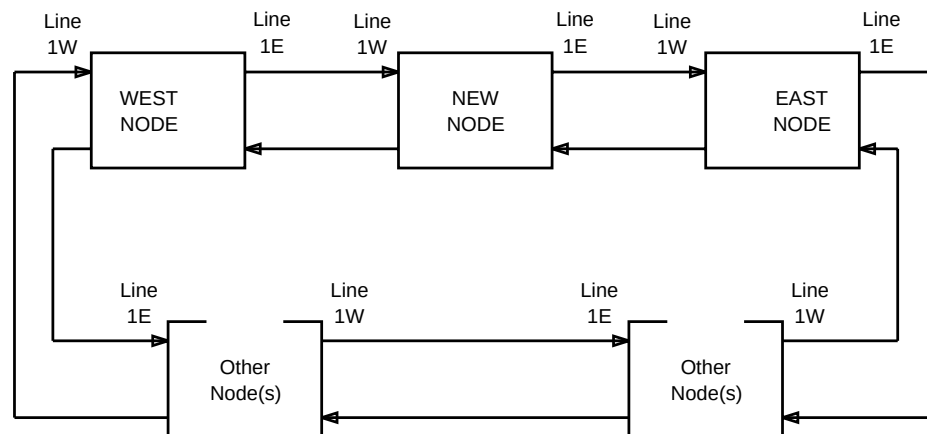


Figure 5 – Ring Network With New Node

18. **NOTE:**
The "new node" has NOW been added to the ring network.

Verify that the NE ACTY LED is off at the "new
node" by (1) looking at the LED at the user
panel or (2) using the CIT, login to the new
node and select **FAULT-Retrieve-Alarms**
command to verify that there are NOT any
active alarms.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

-
19.	Instruct the technician at the West node to verify that the NE ACTY LED is off at the user panel. An alternative method is to log in to the "West node" and execute the FAULT-Retrieve-Alarms command to verify that there are NOT any active alarms.	—
-
20.	Instruct the technician at the East node to verify that the NE ACTY LED is off at the user panel. An alternative method is to log in to the "East node" and execute the FAULT-Retrieve-Alarms command to verify that there are NOT any active alarms.	—
-
21.	 NOTE: <i>Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.</i>	
	If required, enter any tributary-to-slot (drop) and/or slot-to-tributary (add) cross-connections at the "new node".	DLP-536
-

Circuit Order: NTP-008---+---Acceptance: NTP-006
|---Acceptance: NTP-011
|---TAD-100
|---DLP-536
|---DLP-512
|---DLP-524

Delete a Node from an In-Service 2-Fiber Ring Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to delete an FT-2000 OC-48 Add/Drop-Rings Terminal (Node To Be Deleted) from an existing and **in-service** 2-fiber ring network. The Node To Be Deleted may be an add/drop-rings terminal with or without an FT-2000 Lightwave Booster Amplifier (FT-LBA). The procedure is written from the Node To Be Deleted perspective although action is required at two other nodes. The Node To Be Deleted is located between two operational nodes (called the West Node and East Node).

Required Test Equipment and Personnel:

Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical LBOs
Technical assistance at two other nodes.

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **CAUTION:**
First, it must be verified that no traffic terminates at the Node To Be Deleted (Steps 1 through 4). Through traffic will be unaffected by this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ NOTE:
Major alarms will be active at different times during this procedure.

At the Node To Be Deleted, verify that the —
NE ACTY and **FE ACTY** LEDs are off.

2. At the CIT, select —
**CONFIGURATION-Retrieve-Crossconnect
ion-STs1** to obtain an STS1 Cross-Connection
Map Report).

3. Refer to the STS1 Cross-Connection Map —
Report obtained in Step 2 and verify that there
are no tributary-to-slot (drop) or slot-to-tributary
(add) cross-connections. These
cross-connections could be carrying traffic, so
follow local operating procedures to reroute or
terminate the traffic.

4. ⇒ NOTE:
Refer to Figure 1 and note that the node connected to line 1W of the
Node To Be Deleted is referred to, in this procedure, as the West Node
and that the node connected to line 1E of the Node To Be Deleted is
referred to, in this procedure, as the East Node.

At the CIT, select **CONFIGURA-** —
TION-Retrieve-Map-Ring and execute
to obtain a Ring Map Report for the Node
To Be Deleted.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

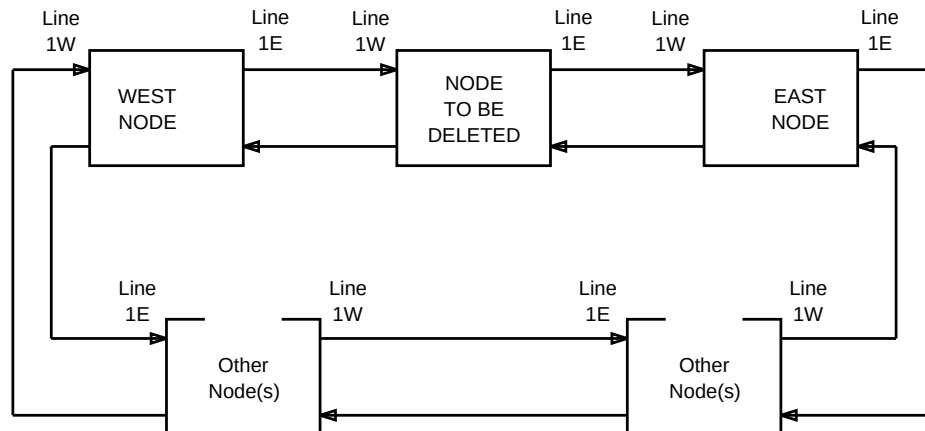
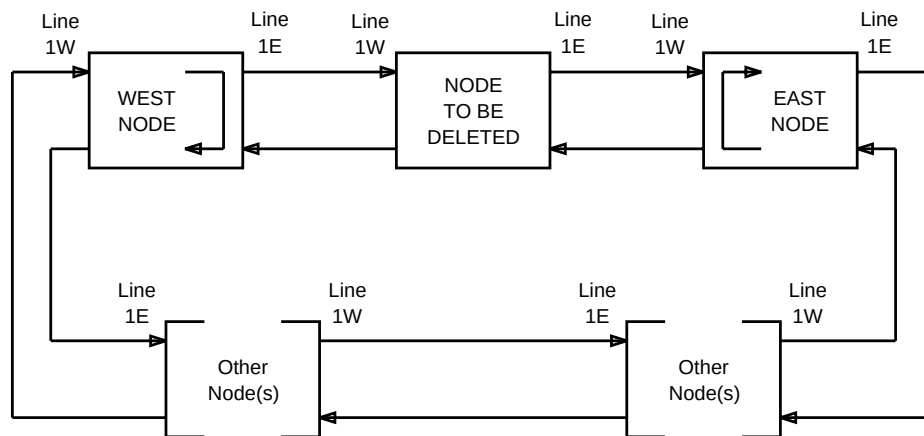


Figure 1 – Identify the East Node and the West Node

-
5. Determine from the Ring Map Report which node represents the West Node and which node represents the East Node for this procedure. The topmost entry in the report is the Node To Be Deleted. The East Node is second on the list and the West Node is last on the list. (The nodes are listed in a West-to-East sequence.)
-
6. **CAUTION:**
The line forced switches will preempt extra traffic, if any, on the protection tributaries.
 - NOTE:**
Refer to Figure 2. The service tributaries connected to the Node To Be Deleted will now be looped back in the opposite direction with OC-48 line forced switches at the West Node and at the East Node.
 - NOTE:**
The next two steps will cause the **ABN** and **NE ACTY** LEDs to light, but there will be no alarm even though the Node To Be Deleted is being disconnected from the rest of the ring.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Instruct the technician at the West Node (or travel to that location) to enter the **FAULT-Switch-Line:1E:Forced** command at the CIT. This makes a forced switch on line 1E and may cause traffic hits.



tpa 832681/01

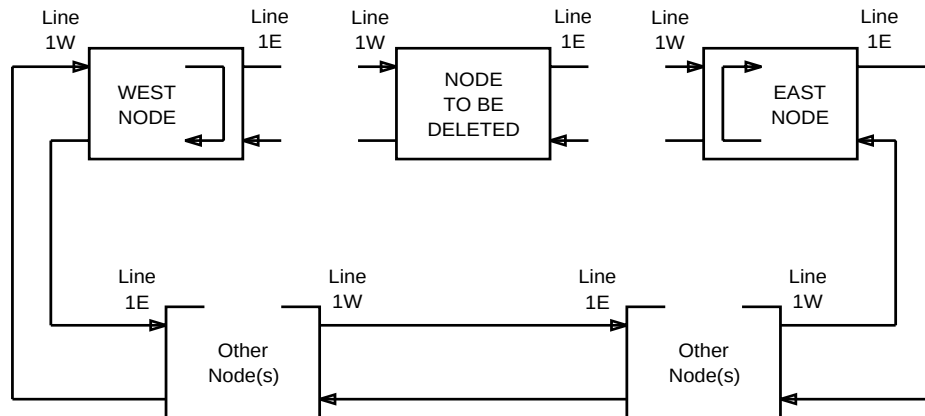
Figure 2 – Forced Switched Lines at the East Node and the West Node

-
7. Instruct the technician at the East Node (or travel to that location) to enter the **FAULT-Switch-Line:1W:Forced** command at the CIT. This makes a forced switch on line 1W and may cause traffic hits.
-

8.  **NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed at the Node To Be Deleted (fibers connected to the West Node).

Remove the OC-48 optical fibers at the Node To Be Deleted (line 1W) that connected to the West Node.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



tpa 832682/01

Figure 3 – Optical Fiber Removed

-
9.  **NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed at the Node To Be Deleted (fibers connected to the East Node).

Remove the OC-48 optical fibers at the Node To Be Deleted (line 1E) that connects to the East Node. The node is now completely isolated from the ring. However, the adjacent nodes (East and West Nodes) get a **sync mode auto switch** condition if they are "through timed" (Provisioned Mode).

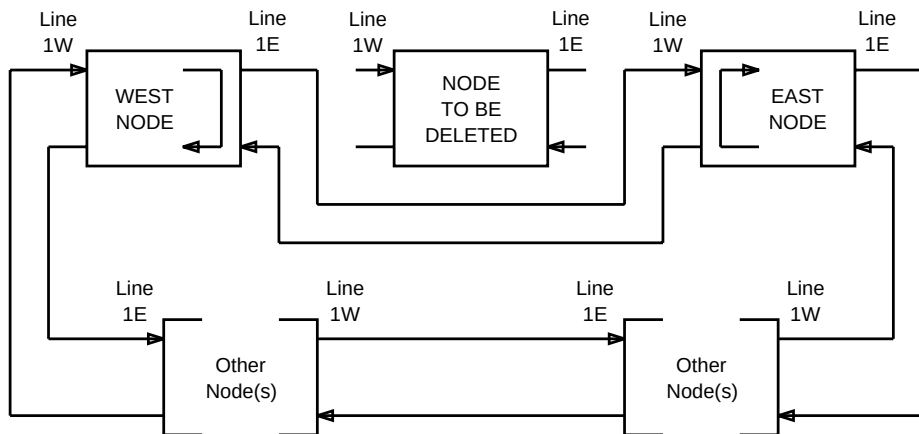
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

10. ➡ **NOTE:**
Refer to Figure 4 and notice that new optical connections can now be made at the West Node and at the East Node (bypass the Node To Be Deleted).

- ➡ **NOTE:**
Lightguide buildouts (if required) are installed only on the receive fibers at the East and West Nodes.

Instruct the technician at the West Node to change the lightguide buildout as necessary and reconfigure the fibers to connect line 1E of the West Node to line 1W of the East Node.

DLP-512



tpa 832683/01

Figure 4 – Optical Fibers Connected to East Node and West Node

-
11. Instruct the technician at the East Node to change the lightguide buildout as necessary and reconfigure the fibers to connect line 1W of the East Node to line 1E of the West Node.
-

DLP-512

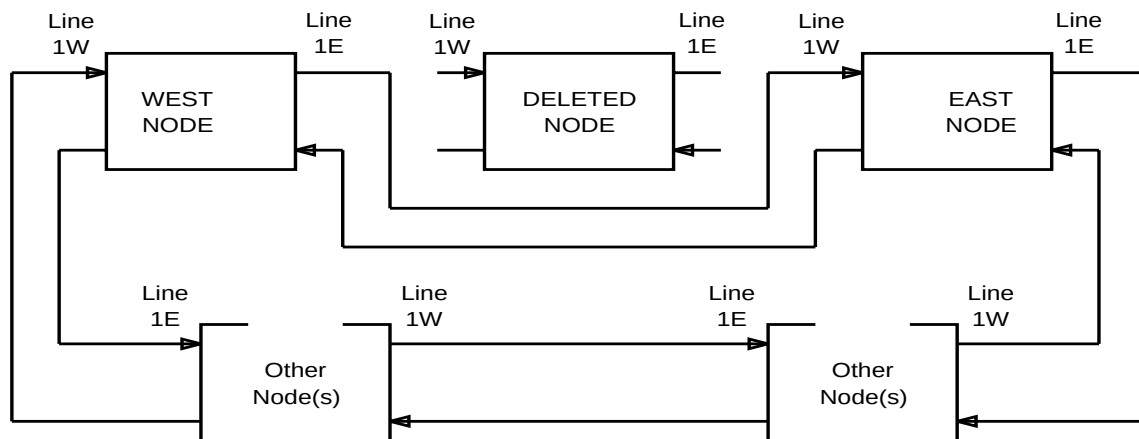
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

12. Instruct the technicians, at both the West Node and East Node, to wait one minute for the LEDs on each node's receiver circuit pack to stop flashing. If they do not stop flashing after about a minute, refer to TAP-110.

13. Whenever the receiver's LEDs stop blinking--the ring is then re-connected and a transient **node ID conflict** condition will exist. Depending on how many nodes are in the ring it may take from several minutes to a few hours for this condition to clear. —

14. ➡ **NOTE:**
Refer to Figure 5. The forced switch at the West Node can now be reset.

Instruct the technician at the West Node to enter **FAULT-Switch-Line:1E:Reset** command at the CIT. The line switch may cause traffic hits. —



tpa 832684/01

Figure 5 – Forced Switched Lines at the East Node and the West Node

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

15.  **NOTE:**
Refer to Figure 5. The forced switch at the East Node can now be reset.

Instruct the technician at the East Node to enter **FAULT-Switch-Line:1W:Reset** command at the CIT. The line switch may cause traffic hits. —

16. This step is optional. If it is desired to clear the Node ID conflict condition promptly, then a ring RESET should be performed. From either the East or West node and at a CIT, select **CONFIGURATION-Retrieve-Map-Ring** command to obtain a Ring Map Report. (The deleted node will still appear in the list even though it has been removed.) —

Start with the node shown at the top of the list, remote login to each node and select and execute the command **FAULT-Reset**. The reset will disconnect you from that node. Repeat this sequence from all nodes in the order listed, except for the node that was deleted from the ring.

17.  **NOTE:**
The Node To Be Deleted has been deleted from the ring network.

Instruct the technician at the West Node to verify that the NE ACTY LED is off at the user panel. —

18. Instruct the technician at the East Node to verify that the NE ACTY LED is off at the user panel. —
-

Add OC-3/IS-3 Low Speed Circuit Pack(s)

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to add a low-speed OC-3/IS-3 service by adding an OC-3/IS-3 circuit pack to a network element.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical Lightguide buildouts (LBO)

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to the beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **NOTE:**
Shelves are keyed to prevent circuit packs from being accidentally installed into the wrong slots.

 **NOTE:**
This procedure may be performed after all installation wiring (fiber) and testing of the Low Speed Shelf - System Controller and/or the Low Speed Shelf - Complementary have been completed or on an in-service basis. Additional installation information is contained in 365-575-115, *FT-2000 OC-48 Lightwave System, Installation Manual*.

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
Obtain the circuit order instructions to add OC-3 (LAA10 or LAA10B)/IS-3 (LAA5) circuit pack(s) and note the assigned address(es). The address requires a slot assignment.	—
2. If required, connect and condition the craft interface terminal (CIT).	DLP-501
3.  WARNING: <i>Traffic on "B" slot could be dropped. Note that restoring the original value of the OC-3/IS-3 Protection Mode parameter will change 1+1 slot pairs to 0x1 slot pairs. This will, in turn, cause all cross-connections associated with such a 1+1 slot pair to be associated with the "A" slot only. If such a transition takes place at the tail end and the "B" slot was the active slot at that time, an interruption of less than 60 msec will be observed. And, if such a transition takes place at the head end of a 1+1 protected optical line while the tail end is active on the "B" slot, the traffic will be dropped with no alarms being raised.</i>  WARNING: <i>When a pair of slots ("A" and "B" slots) changes from 0x1 to 1+1 operation, all cross-connections added from those slots will initially select the "A" slot. This will cause a brief service hit if the original add cross-connection was from the "B" slot.</i>  NOTE: OC-3/IS-3 circuit pack provisioning is done on a slot basis.  NOTE: For Releases 5, 6, and 7.0 only, the alarm level parameter must be provisioned to NO if the desire is to suppress alarms when there is no optical input signal present. For releases 7.1 and later, there will be no alarm with the absence of an optical input signal unless the port has already been in-service and the input signal subsequently removed.	
If required, provision the OC-3/IS-3 slot parameter(s).	DLP-517

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Supplemental Information: If an **incoming** OC3/IS-3 LOS condition exists prior to setting the Alarm Level to NO, this condition **will not disappear** after the Alarm Level is set to NO. Only subsequent conditions will be subdued (not reported). The user may clear the condition by temporarily providing a good input signal until the condition clears or by reseating the OC3/IS-3 circuit pack. Only reseat the circuit pack if you are sure there is no live traffic on the outgoing fiber, otherwise service interruption will occur.

4. At the CIT, select **CONFIGURATION-Retrieve-Equipment**, then **LS INTFC** and execute to obtain an Equipage and Version Report. —

5. Determine from the report if the OC-3 circuit pack is already present in the slot associated with an OC-3 circuit pack to be added. A circuit pack is in the slot **if** OC3 is indicated in the Circuit Pack column of the report.

If a **OC3 circuit pack(s)** is present in the **slot(s)**, then continue with Step 11.
If there is **no circuit pack(s)** present in the **slot(s)**, then continue with Step 6.
If any **circuit pack(s)** other than **OC3** is present in the **slot(s)**, remove the circuit pack(s), perform a **CONFIGURATION-Update** command and continue with Step 6.

6. Remove the appropriate low-speed shelf cover. **DLP-511**

7. If necessary, remove the apparatus (circuit pack) blank(s) from the slot(s) requiring new circuit pack(s). **DLP-533**

8. Install OC-3/IS-3 circuit pack(s) into the specified slot(s) of the low-speed shelf [with the appropriate receive lightguide buildouts (LBOs)] and then connect the optical fibers per the circuit order. **DLP-514**

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
9.	Verify the FAULT LED on each OC-3/IS-3 circuit pack(s) goes off within 1 minute after the circuit pack is installed.	—
10.	Replace the shelf cover.	DLP-511
11.	Make the appropriate external cross-connections at the lightguide cross-connect panel or equivalent.	—
12.	 CAUTION: <i>If the purpose of this slot/circuit pack is to provide service for an OC-3c signal—then care must be exercised to complete all three STS-1 cross-connections (in each NE of the signal's path) before applying the OC-3c signal. Otherwise, the incoming (from OC3) STS LOP alarm will be produced.</i>	DLP-536
At the CIT, enter all appropriate cross-connections for the newly equipped low-speed slot(s) to the OC48 line.		
13.	 NOTE: This step is optional. One of eight DCC channels can be assigned to a slot or pair of slots that will be equipped with OC-3/IS-3 circuit packs. The orientation of the OC-3/IS-3 circuit packs is provisioned "network" at one end and "user" at the other end. Both ends of the OC-3/IS-3 line cannot be the same and it makes no difference which end is "network."	
	 NOTE: If you are establishing DCC connectivity for the first time, you may have additional alarms. All alarms should clear after the DCC stabilizes; but if they do not, refer to the trouble clearing tab of this manual.	
	At the CIT, select CONFIGURATION-Enter-Assignment-DCC command to assign a DCC channel to a slot or pair of slots.	DLP-542
14.	The OC-3/IS-3 circuit pack(s) is now ready for service.	—

Circuit Order: NTP-010---+---DLP-536
|---TAD-100
|---DLP-501
|---DLP-517
|---DLP-511
|---DLP-533
|---DLP-514
|---DLP-542

Remove OC-3/IS-3 Low Speed Circuit Pack(s) From the Shelf

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Required Test Equipment:**

Craft Interface Terminal (CIT)
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the circuit order instructions to
delete an OC-3/IS-3 slot(s) and note the
assigned address. The address requires a
slot assignment.

—

-
2. If required, connect and condition the craft
interface terminal (CIT).

DLP-501

-
3. At the CIT, select the
CONFIGURATION-Retrieve-CKT-STS3
command (or the
CONFIGURATION-Retrieve-CKT-STS1
command) for the slot address indicated in Step
1 and obtain an STS-3 (or STS-1) Circuit Map
Report.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

4.  **CAUTION:**
*If the application of this slot/circuit pack was to provide service for an OC-3c signal—then care must be exercised to delete all three STS-1 cross-connections (in each NE of the signal's path) after **first** removing the OC-3c signal. Otherwise, the **incoming (from OC3) STS LOP** alarm will be produced.*

While looking at the report, determine whether or not the slot being deleted **appear** in the West or East Cross-Connect columns. If a cross-connection is shown, then traffic is possible at this slot.

Does the slot being deleted still have cross-connections assigned?

If **YES**, then continue with Step 5.
If **NO**, then continue with Step 6.

 **NOTE:**
If you have any doubt about deleting this slot, please confer with your supervisor.

-
5.	Delete the cross-connections for the slot that is being deleted.	DLP-536
-

6.	Does the circuit order indicate that the circuit pack is to be removed from the shelf slot?	
	If YES , then continue with Step 8.	
	If NO , then continue with Step 16.	
-

7.	Remove the shelf cover from the low-speed shelf that contains the OC-3/IS-3 circuit pack(s).	DLP-511
-

8.	Remove the optical fibers from the OC-3/IS-3 circuit pack(s).	—
-

9.	Remove the circuit pack(s) from the shelf.	DLP-514
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
10. Replace the shelf cover.	DLP-511
11. At the CIT, select CONFIGURATION - Update and execute.	—
12.  NOTE: Steps 12 through 14 are optional. You may delete the DCC assignment or leave it in place without causing any interference or harm to other channels. At the CIT, select CONFIGURATION - Retrieve - Assignment - DCC to obtain a DCC Assignment Report.	—
13. From the report, does the DCC assignment exist for the slot of the circuit pack being removed? If YES , then continue with Step 14. If NO , then continue with Step 15.	—
14. At the CIT, select CONFIGURATION - Delete - Assignment - DCC to remove the DCC assignment; and repeat the CONFIGURATION - Delete - Assignment - DCC command for each DCC channel to be removed.	DLP-542
15. The OC-3/IS-3 circuit pack(s) has been deleted.	—

Circuit Order: NTP-011---+---TAD-100
 |---DLP-501
 |---DLP-511
 |---DLP-514
 |---DLP-536
 |---DLP-542

Add OC-12 Low Speed Circuit Pack(s)

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to add low-speed OC-12 service by adding an OC-12 circuit pack to a network element.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical Lightguide buildouts (LBO)

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **NOTE:**
Unlike for other circuit packs, the low speed shelf is not keyed to prevent the OC-12 from being accidentally installed into the wrong slots. Each OC-12 occupies four consecutive slots and must only be installed into slot locations (1A-1B-2A-2B, 3A-3B-4A-4B, 5A-5B-6A-6B, or 7A-7B-8A-8B).

 **NOTE:**
This procedure may be performed after all installation wiring (fiber) and testing of the Low Speed Shelf - System Controller have been completed or on an in-service basis. Additional installation information is contained in 365-575-115, *FT-2000 OC-48 Lightwave System, Installation Manual*.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Obtain the circuit order instructions to add OC-12 (T939A) circuit pack(s) and note the assigned address(es). The address requires a slot assignment.

—

-
2. If required, connect and condition the craft interface terminal (CIT).

DLP-501

-
3.  **NOTE:**
For releases 7.1 and later, there will be no alarm with the absence of an optical input signal unless the port has already been in-service and the input signal subsequently removed.

If required, provision the OC-12 slot parameter(s).

DLP-517

Supplemental Information: If an **incoming OC-12 LOS** condition exists prior to setting the Alarm Level to NO, this condition **will not disappear** after the Alarm Level is set to NO. Only subsequent conditions will be subdued (not reported). The user may clear the condition by temporarily providing a good input signal until the condition clears or by reseating the OC-12 circuit pack. Only reseat the circuit pack if you are sure there is no live traffic on the outgoing fiber, otherwise service interruption will occur.

-
4. At the CIT, select **CONFIGURATION-Retrieve-Equipment**, then **LS INTFC** and execute to obtain an Equipage and Version Report.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO		
5.	Determine from the report if the OC-12 circuit pack is already present in the slot associated with an OC-12 circuit pack to be added. A circuit pack is in the slot if OC -12 is indicated in the Circuit Pack column of the report. If OC12 circuit pack(s) is present in the slot(s), then continue with Step 11. If no circuit pack(s) is present in the slot(s), then continue with Step 6. If any circuit pack(s) other than OC12 is present in the slot(s), remove the circuit pack(s), perform a CONFIGURATION-Update command, and continue with Step 6.	
6.	Remove the appropriate low-speed shelf cover.	DLP-511
7.	If necessary, remove the apparatus (circuit pack) blank(s) from the slot(s) requiring new circuit pack(s).	DLP-533
8.	 NOTE: OC-12 circuit pack requires Release 7.1 or later software. Install OC-12 circuit pack(s) into the specified slot(s) of the low-speed shelf [with the appropriate receive lightguide buildouts (LBOs)] and then connect the optical fibers per the circuit order.	DLP-514
9.	Verify the FAULT LED on each OC-12 circuit pack(s) goes off within 1 minute after the circuit pack is installed.	—
10.	Replace the shelf cover.	DLP-511
11.	Make the appropriate external cross-connections at the lightguide cross-connect panel or equivalent.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

12.  **CAUTION:** **DLP-536**

*If the purpose of this circuit pack is to provide service for an OC-12c signal—then care must be exercised to complete all twelve STS-1 cross-connections (in each NE of the signal's path) before applying the OC-12c signal. Otherwise, the **incoming (from OC12) STS LOP** alarm will be produced.*

At the CIT, enter all appropriate cross-connections for the newly equipped low-speed slot(s) to the OC48 line.

-
13.  **NOTE:**
This step is optional. One of eight DCC channels can be assigned to a slot (0x1 unprotected links only) that is equipped with an OC-12 circuit pack. The orientation of the OC-12 circuit packs is provisioned "network" at one end and "user" at the other end. Both ends of the OC-12 line cannot be the same and it makes no difference which end is "network."

 **NOTE:**
If you are establishing DCC connectivity for the first time, you may have additional alarms. All alarms should clear after the DCC stabilizes; but if they do not, refer to the trouble clearing tab of this manual.

At the CIT, select
CONFIGURATION-Enter-Assignment-DCC
command to assign a DCC channel to a single slot.

DLP-542

-
14. The OC-12 circuit pack(s) is now ready for service. —
-

Circuit Order: NTP-012---+---DLP-536
|---TAD-100
|---DLP-501
|---DLP-517
|---DLP-511
|---DLP-533

|---DLP-514
|---DLP-511
|---DLP-536
|---DLP-542

Remove OC-12 Circuit Pack(s) From the Shelf

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Required Test Equipment:**
Craft Interface Terminal (CIT)
Wrist Strap

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the circuit order instructions to
remove an OC-12 circuit pack(s) and note
the assigned address. The address
requires a slot assignment.

-
2. If required, connect and condition the craft interface terminal (CIT). **DLP-501**
-

3. At the CIT, select the
CONFIGURATION-Retrieve-CKT-STs3
command (or the
CONFIGURATION-Retrieve-CKT-STs1
command) for the slot address indicated in Step
1 and obtain an STS-3 (or STS-1) Circuit Map
Report.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

4.  **CAUTION:**
*If the application of this slot/circuit pack was to provide service for an OC-12c signal—then care must be exercised to delete all twelve STS-1 cross-connections (in each NE of the signal's path) after **first** removing the OC-12c signal. Otherwise, the **incoming (from OC12) STS LOP** alarm will be produced.*

Looking at the report, verify the slot being deleted **does not appear** in the West or East Cross-Connect columns. If a cross-connection is shown, then traffic is possible at this slot.

Does the slot being deleted still have cross-connections assigned?

If **YES**, then continue with Step 4.
If **No**, then continue with Step 5.

 **NOTE:**
If you have any doubt about deleting this slot, please confer with your supervisor.

-
5. Delete the cross-connections for the slot that is being deleted. **DLP-536**

 **NOTE:**
When deleting Cross-Connections for an OC-12c signal, the first (lowest number) tributary must be deleted first, then the remaining STS-1 tributaries can be deleted in any order.

-
6. Does the circuit order indicate that the circuit pack is to be removed from the shelf slot?
- If **YES**, then continue with Step 7.
If **NO**, then continue with Step 15.

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
7.	Remove the shelf cover from the low-speed shelf that contains the OC-12 circuit pack(s).	DLP-511
8.	Remove the optical fibers from the OC-12 circuit pack(s).	—
9.	Remove the circuit pack(s) from the shelf.	DLP-514
10.	Replace the shelf cover.	DLP-511
11.	At the CIT, select CONFIGURATION-Update and execute.	—
12.	 NOTE: Steps 12 through 14 are optional. You may delete the DCC assignment or leave it in place without causing any interference or harm to other channels. At the CIT, select CONFIGURATION-Retrieve-Assignment-DCC to obtain a DCC Assignment Report.	—
13.	From the report, does the DCC assignment exist (the channel to be removed)? If YES , then continue with Step 14. If NO , then continue with Step 15.	—
14.	At the CIT, select CONFIGURATION-Delete-Assignment-DCC to remove the DCC assignment; and repeat the CONFIGURATION-Delete-Assignment-DCC command for each DCC channel to be removed.	DLP-542
15.	The OC-12 circuit pack(s) has been removed.	—

Circuit Order: NTP-011---+---TAD-100
|---DLP-501
|---DLP-511
|---DLP-514
|---DLP-511
|---DLP-542

Change an OC-3/IS-3 Link From 0x1 to 1+1 Protection Mode

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure enables you to change a Low Speed optical link from 0x1 protection mode to 1+1 protection mode without causing a service impairment.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical Lightguide buildouts (LBO)

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the Circuit Order work instructions and identify the slot that is specified for use as the "Protection Link".

 **NOTE:**
The "Service slot" has an _a (e.g., 1a, 2a, 3a, etc) slot address. While, the "Protection slot" has an _b (e.g., 1b, 2b, 3b, etc) slot address.

 **NOTE:**
This procedure assumes that the Service slot is already equipped with an OC-3/IS-3 circuit pack.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
2.	Determine whether the identified Protection slot is already equipped. At the CIT, select CONFIGURATION-Retrieve-Equipment and execute to obtain a report depicting how the shelf is currently equipped. —
3.	From the report, is the required protection slot equipped with an existing circuit pack? If NO , then go to Step 12. If YES , then continue with Step 4. —
4.	Is the slot already equipped with an optical circuit pack? If NO , then go to Step 8. If YES , then continue with Step 5. —
5.	Are fibers already terminated on the OC-3/IS-3 circuit pack? If NO , then it is available, go to Step 12. If YES , then continue with Step 6. —
6.	Determine whether the slot already has cross-connects defined. At the CIT, select the CONFIGURATION-Retrieve-Crossconnect-all command for this slot. —

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

7. Look at the report, verify that the required slot does not appear in the cross-connect column. If a cross-connection is shown, then traffic is possible at the slot. —

Is there a cross-connection shown for the required protection slot?

If **YES**, then consult with your supervisor and make certain that the slot specified in the work order is correct, is to be used as the protection link, and that the slot is not currently supporting traffic. If the slot is supporting traffic, then – either a different slot must be selected or the traffic must be moved. **STOP! You cannot re-start this procedure until this issue is resolved.**

If **NO**, then go to Step 14.

-
8.  **NOTE:** —
At this point you have determined that the slot is already equipped with an electrical circuit pack (either a DS3 or STS-1E). You must still determine whether, or not, the circuit pack is supporting traffic.

Are coaxial cables already connected to the DS3/EC-1 circuit pack?

If **NO**, then it is available, go to Step 11.

If **YES**, then continue with Step 9.

-
9. Determine whether the slot already has cross-connects defined. At the CIT, select the **CONFIGURATION-Retrieve-Crossconnect -All** command for this slot. —
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

10.	Look at the report, verify that the required slot does not appear in the cross-connect column. If a cross-connection is shown, then traffic is possible at the slot. Is there a cross-connection shown for the required slot? If YES , then consult with your supervisor and make certain that the slot specified in the work order is correct, is to be used as the protection link, and that the slot is not currently supporting traffic. If the slot is supporting traffic, then – either a different slot must be selected or the traffic must be moved. STOP! You cannot re-start this procedure until this issue is resolved. If NO , then continue with Step 11.	—
11.	Delete the DS3/STS-1E Low Speed ports and remove the circuit pack.	Circuit Order: NTP-003
12.	Delete all existing cross-connection(s) for the required slot (new protection link), if not already performed.	DLP-536
13.	Add an OC-3/IS-3 Low Speed Slot.	Circuit Order: NTP-010
14.	Verify that the correct fibers are attached to the circuit pack.	—
15.	Change the protection slot's "Protection Mode" from 0x1 to 1+1.	DLP-517

 **NOTE:**
As a result of changing the protection slot's "Protection Mode" the OC-3 Mode Conflict Alarm will be raised.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

16.	Change the service slot's "Protection Mode" from 0x1 to 1+1.	DLP-517

⇒ **NOTE:**
As a result of changing the service slot's "Protection Mode" the OC-3 Mode Conflict Alarm will be cleared.

-
17.	At the CIT, select the CONFIGURATION-Update-All command.	—
-

18.	Enter the appropriate cross-connection(s) for the required slot.	DLP-536
-

19. Verify that the operating mode is 1+1 for the slot pair. At the CIT select, **CONFIGURATION-Retrieve-OC3:All** and execute to obtain a report that lists the actual "Operating Mode" of the OC-3/IS-3 circuit packs.

⇒ **NOTE:**
It is important to understand that the slot pair could be provisioned for 1+1 protection mode, but yet the operating mode still be 0x1.

⇒ **NOTE:**
Look at the report and for the slot pair identified in the work order, verify that the "Operating Mode" is actually 1+1.

⇒ **NOTE:**
The _b address, of the slot pair, is the Protection slot while the _a address is the Service slot.

20. For the subject slot pair (_a and _b), is the "Operating Mode" indicating 1+1?

If **YES**, then **STOP**.

If **NO**, then contact next level of support.

Circuit Order: NTP-014----+----Circuit Order : NTP-003

Circuit Order: NTP-010

Circuit Order: NTP-013---+---DLP-517

|---DLP-536

Change an OC-12 Link From 0x1 to 1+1 Protection Mode

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure enables you to change an OC-12 Low Speed optical link from 0x1 protection mode to 1+1 protection mode without causing a service impairment.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the Circuit Order work instructions and
identify the quad that is specified for use as the
"Protection Link".



NOTE:

The Service and Protection quad pairs are (1b and 3b) or (5b and 7b). The "Service quad" has either 1b or 5b as its quad address. The "Protection quad" has either 3b or 7b as its quad address.



NOTE:

This procedure assumes that the Service quad is already equipped with an OC-12 circuit pack.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
2.	Determine whether the identified "Protection quad" is already equipped. At the CIT, select CONFIGURATION-Retrieve-Equipment and execute to obtain a report showing how the shelf is currently equipped. —
3.	From the report, is the protection quad equipped with an existing circuit pack? —
⇒ NOTE: If the report indicates a circuit pack is present but no circuit pack is installed, perform CONFIGURATION-Update command. If NO, then go to Step 13. If YES, then continue with Step 4.	
4.	Are the protection quad's slot/slots already equipped with an optical pack? —
If NO, then go to Step 9. If YES, then continue with Step 5.	
5.	Is the quad already equipped with an OC-12 circuit pack? —
If NO, then go to Step 15. If YES, then continue with Step 6.	
6.	Are fibers already terminated on the OC-12 circuit pack? —
If NO, then it is available, go to Step 13. If YES, then continue with Step 7.	
7.	Determine whether the quad already has cross-connects defined. At the CIT, select the CONFIGURATION-Retrieve-Crossconnect ion-All command for this slot. —

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

8. Look at the report, verify that the protection quad slots to be used do not appear in the cross-connect column. If a cross-connection is shown, then traffic is possible at the quad. —

Is there a cross-connection shown for any of the four required protection slots?

If **YES**, then consult with your supervisor and make certain that the quad specified in the work order is correct, is to be used as the protection link, and that the quad is not currently supporting traffic. If the quad is supporting traffic, then – either a different quad must be selected or the traffic must be moved. **STOP! You cannot re-start this procedure until this issue is resolved.**

If **NO**, then go to Step 20.

-
9.  **NOTE:** —
At this point you have determined that the protection quad slots to be used are already equipped with an electrical circuit pack (either a DS3 or STS-1E). You must still determine whether, or not, the circuit pack is supporting traffic.

Are coaxial cables already connected to the DS3/STS-1E circuit pack via the DSX cross-connect panel associated with this shelf and slot?

If **NO**, then it is available, go to Step 12.

If **YES**, then continue with Step 10.

-
10. Determine whether the quad already has cross-connects defined. At the CIT, select the **CONFIGURATION-Retrieve-Crossconnect ion-All** command for this slot. —
-

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
11.	Look at the report, verify that the protection quad slots do not appear in the cross-connect column. If a cross-connection is shown, then traffic is possible at the quad. Is there a cross-connection shown for any of the four required protection slots? If YES , then consult with your supervisor and make certain that the quad specified in the work order is correct, is to be used as the protection link, and that the quad is not currently supporting traffic. If the quad is supporting traffic, then – either a different quad must be selected or the traffic must be moved. STOP! You cannot re-start this procedure until this issue is resolved. If NO , then continue with Step 12.	—
12.	Delete the DS3/STS-1E Low Speed Ports and remove the circuit pack(s).	Circuit Order: NTP-003
13.	Delete all existing cross-connection(s) for the new protection quad slots, if not already performed.	DLP-536
14.	Continue with Step 19.	
15.	Are fibers already terminated on the OC-3/IS-3 circuit pack? If NO , then it is available, go to Step 18. If YES , then continue with Step 16.	—
16.	Determine whether the quad already has cross-connects defined. At the CIT, select the CONFIGURATION-Retrieve-Crossconnection-All command for this slot.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

17. Look at the report, verify that the protection quad slots do not appear in the cross-connect column. If a cross-connection is shown, then traffic is possible at the quad. —

Is there a cross-connection shown for any of the four required protection slots?

If **YES**, then consult with your supervisor and make certain that the quad specified in the work order is correct, is to be used as the protection link, and that the quad is not currently supporting traffic. If the quad is supporting traffic, then – either a different quad must be selected or the traffic must be moved. **STOP! You cannot re-start this procedure until this issue is resolved.**

If **NO**, then continue with Step 18.

-
18. Remove OC-3/IS-3 Low Speed circuit pack(s) from the shelf.	Circuit Order: NTP-011
-

19. Add an OC-12 Low Speed Slot (actually four slots).	Circuit Order: NTP-012
-

20. Verify that correct optical fibers and LBOs are attached to the circuit pack.	DLP-512
-

21. Change the protection quad's "Protection Mode" from 0x1 to 1+1 in both the "from OC12" and "from OC48" direction.	DLP-517
-

⇒ NOTE:
Changing the protection quad's "Protection Mode" raises the OC-12 Mode Conflict Alarm.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

22. Change the service quad's "Protection Mode" from 0x1 to 1+1 in both the "from OC12" and "from OC48" direction. **DLP-517**

 **NOTE:**
Changing the service quad's "Protection Mode" clears the OC12 Mode Conflict Alarm.

-
23. Enter the appropriate cross-connection(s) for the protection quad. **DLP-536**
-

24. Use **CONFIGURATION-Retrieve-OC12** command to verify that the operating mode is 1+1 for the quad pair.

If **Operating Mode is 1+1**, then STOP! You Have Completed This Procedure.

If **Operating Mode is NOT 1+1**, then contact your next level of Technical Support.

Circuit Order: NTP-015-----+-----Circuit Order : NTP-003

Circuit Order: NTP-010

Circuit Order: NTP-013---+----DLP-517

|---DLP-536

Change an OC-3/IS-3 Link From 1+1 to 0x1 Protection Mode

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** The steps in this procedure enable you to change an OC-3/IS-3 Low Speed optical link from 1+1 protection mode to 0x1 protection mode without causing a service impairment. This procedure involves performing a sequence of tasks on two separate NEs.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Obtain the Circuit Order work instructions and identify the slot that is currently being used for the "Service Link" and its companion slot that is currently being used for the "Protection Link".



NOTE:

The "Service slot" has an **_a** (e.g., 1a, 2a, 3a, etc) slot address. The "Protection slot" has an **_b** (e.g., 1b, 2b, 3b, etc) slot address.

-
2. If required, connect and condition the craft interface terminal (CIT).
-

DLP-501

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

3. At the CIT, use **FAULT-Retrieve-State** command to obtain a report that lists the current actual protection Switch State. —

If **Service Slot _a** Switch State is active (**rx:act**), go to Step 7.

If **Service Slot _a** Switch State is standby (**rx:stby**), then continue with Step 4.

-
- 4.. At the CIT, select **FAULT-Switch-OC3:Manual** to switch service from the Protection slot **_b** to the Service slot **_a**.

 **NOTE:**
Service will be switched unless there is an existing *switch* request active.

-
5. Did the command in Step 4 execute?
If **YES**, then go to Step 7.
If **NO**, then continue with Step 6.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

6. Use the **FAULT-Retrieve-Alarm** command to check for system alarms. Clear any alarms present, then repeat this procedure from Step 4. You must determine why the **SWITCH** command in Step 4 did not execute before continuing this procedure.

-
7. Change the "Protection Mode" from 1+1 to 0x1 for the **_b** slot address. **DLP-517**

 **NOTE:**
As a result of changing the Protection Mode from 1+1 to 0x1, the cross-connections associated with the protection slot **_b** are deleted.

-
8. Change the "Protection Mode" from 1+1 to 0x1 for the **_a** slot address. **DLP-517**
-

DLP-501
DLP-517

Change an OC-12 Link From 1+1 to 0x1 Protection Mode

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** The steps in this procedure enable you to change an OC-12 Low Speed optical link from 1+1 protection mode to 0x1 protection mode without causing a service impairment. Tasks are performed on two separate NEs (for example; Node A, an FT-2000, and Node B). Node B can be another FT-2000, DDM-2000, or other vendor equipment. The process is as follows:

1. At Node A, switch traffic from Protection quad to Service quad.
2. At Node B, switch traffic from Protection quad/slot to Service quad/slot.
3. At Node B, change Protection mode from 1+1 to 0x1.
4. At Node A, change Protection mode from 1+1 to 0x1.

 **NOTE:**
The FT-2000 OC-12 “Service and Protection” quad pairs are (**1b** and **3b**) or (**5b** and **7b**). The “Service quad” has a **1b** or **5b** quad address. The “Protection quad” has a **3b** or **7b** quad address.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

From the instructions (work order), identify the quad pair addresses of the "Service and Protection Links" (**1b** and **3b**), or (**5b** and **7b**).

-
2.	If required, connect and condition the craft interface terminal (CIT).	DLP-501
-
3.	At near-end Node A, use FAULT-Retrieve-State command to obtain a report that lists the current actual protection Switch State. If Service Quad (1b or 5b) Switch State is active (rx:act), go to Step 7. If Service Quad (1b or 5b) Switch State is standby (rx:stby), then continue with Step 4.	—
-
4.	At the CIT, select CONFIGURATION-Switch-OC12:Lockout to: (1) switch service from the Protection quad (3b or 7b) to the Service quad (1b or 5b) for this near-end NE, and (2) prevent further selection of the Protection quad by this near-end NE.	
-
	NOTE: Service will be switched unless there is an existing <i>inhibit</i> request active.	
-
5.	Did the command in Step 4 execute? If YES , then go to Step 7. If NO , then continue with Step 6.	
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

6. Use the **FAULT-Retrieve-Alarm** command to check for system alarms. Clear any alarms present, then repeat this procedure from Step 4. You must determine why the **SWITCH** command in Step 4 did not execute before continuing this procedure.

-
7.  **NOTE:**
Steps 7 through 13 assume that the far-end node B NE is an FT-2000. If this is not the case, then the equivalent sequence of commands, which are appropriate for the particular product, must be performed.

At CIT, remotely Login to far-end node B. Use **FAULT-Retrieve-State** command to obtain a report that lists the actual protection Switch State of the OC-12 circuit packs.

If **Service Quad (1b or 5b)** Switch State is active (**rx:act**), go to Step 11.

If **Service Quad (1b or 5b)** Switch State is standby (**rx:stby**), then continue with Step 8.

-
8. While still logged into far-end node B, use **CONFIGURATION-Switch-OC12:Lockout** command to: (1) switch service from the Protection quad (**3b** or **7b**)/slot to the Service quad (**1b** or **5b**)/slot for this far-end NE, and (2) prevent further selection of the Protection quad/slot by this far-end NE.

 **NOTE:**
Service will be switched unless there is an existing *inhibit* request active.

-
9. Did the command in Step 8 execute?
If **YES**, then go to Step 11.
If **NO**, then continue with Step 10.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

10. Use the **FAULT-Retrieve-Alarm** command to check for system alarms. Clear any alarms present, then repeat this procedure from Step 8. You must determine why the **SWITCH** command in Step 8 did not execute before continuing this procedure.

-
11. While still logged into far-end node B, use **CONFIGURATION-Set-OC12** command to change the "Protection Mode" from 1+1 to 0x1 for the protection quad (**3b** or **7b**)/slot address. **DLP-517**

 **NOTE:**
As a result of changing the Protection Mode from 1+1 to 0x1, the cross-connections associated with the protection quad/slot are deleted.

-
12. While still logged into far-end node B, use **CONFIGURATION-Set-OC12** command to change the "Protection Mode" from 1+1 to 0x1 for the service quad (**1b** or **3b**)/slot address. **DLP-517**

-
13. At the CIT, execute the **CONFIGURATION-Update-All** command. —
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

14.	At the CIT, login to near-end node A. Use CONFIGURATION-Set-OC12 command to change the "Protection Mode" from 1+1 to 0x1 for the protection quad (3b or 7b) address.	DLP-517

⇒ NOTE:
As a result of changing the Protection
Mode from 1+1 to 0x1, the
cross-connections associated with the
protection quad are deleted.

-
15.	While still logged into near-end node A, use CONFIGURATION-Set-OC12 command to change the "Protection Mode" from 1+1 to 0x1 for the service quad (1b or 5b) address.	DLP-517
-

16.	At the CIT, execute the CONFIGURATION-Update-All command. STOP! You Have Completed This Procedure.	—
-

DLP-501
DLP-517

Establish Cross-Connection Between FT-2000 1+1 OC-3/OC-12 Interface and DDM-2000 OC-3/OC-12 Ring Interface

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure uses special provisioning to provision an FT-2000 OC-3/OC-12 low-speed interface (See Figure 1, Node 3.) for 1+1 protection and connect it to a DDM-2000 OC-3, OC-12, or FiberReach system **ring** interface. This procedure is useful when a DDM-2000 ring release is needed for feature or compatibility reasons but interconnection with a 1+1 interface is also required. The FT-2000 can be any release that provides an OC-3/OC-12 low-speed interface. However, DCC connectivity requires compatible DDM-2000 and FT-2000 software releases. DDM-2000 OC-3 Release 15.0, or later, will provide interconnection of its main ring interface to a 1+1 OC-3/OC-12 interface without special provisioning of the FT-2000 low-speed interface.

Required Test Equipment:

Craft Interface Terminal (CIT)



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to the beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

If **OC-3 interface**, use the
CONFIGURATION-Set -OC3 command to set
one of the service slots (1A, 2A, 3A, 4A, 5A, 6A,
7A, or 8A) for **1 + 1** protection in the “from OC3”
direction and **0 x 1** protection in the “from OC48”
direction.

⇒ **NOTE:**
The FT-2000 ADR Terminal does not
support mixed LAA10/LAA10B operation in
a **1+1** configuration. To configure a OC-3
low speed interface for **1+1** configuration,
any two adjacent low speed slots (for
example, 2A and 2B) **MUST** be equipped
with the same type OC3 (1.3 STD) circuit
pack, and not a mix of the two.

If **OC-12 interface**, use the
CONFIGURATION-Set -OC12 command to set
one of the service quads (1B or 5B) for **1 + 1**
protection in the “from OC12” direction and **0 x 1**
protection in the “from OC48” direction.

-
2. ⇒ **NOTE:**
Steps 2 and 3 reference the same tributary.

Use the
CONFIGURATION-Enter-Crossconnection
command to provision an add (or 1-way DRI)
cross-connection from the service slot/quad.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

3. Use the CONFIGURATION-Enter-Crossconnection command to provision a drop cross-connection to the service slot/quad and a drop cross-connection to the corresponding protection slot/quad.	—
4. At the CIT, select the CONFIGURATION-Enter-Assignment-DCC command to assign a DCC channel, if required, to the service slot/quad and to the corresponding protection slot/quad, and set the orientation of the channels.	—
5. Cross-connections and DCC assignments have been established between the FT-2000 OC-3/OC-12 low speed interface and the DDM-2000 OC-3/OC-12 ring interface.	—
-

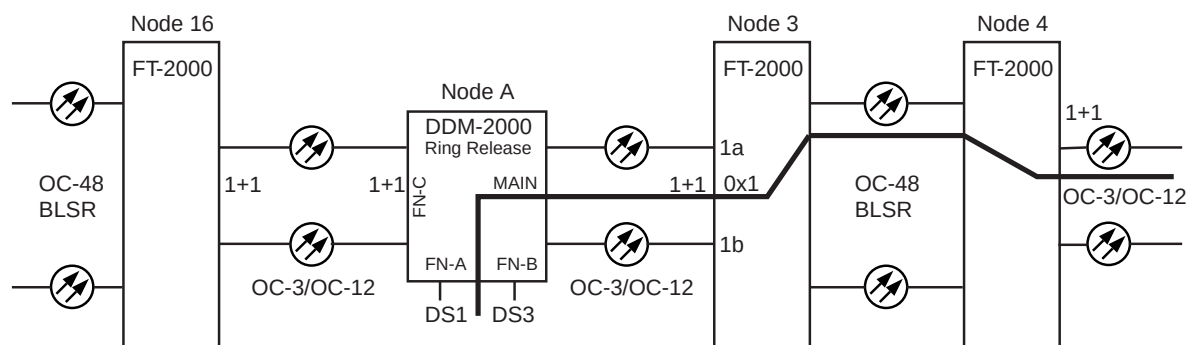


Figure 1 – DDM-2000 OC-3/OC-12 Ring to FT-2000 1+1 OC-3/OC-12 Interface

Add a *WaveStar* Node to an In-Service FT-2000 2-Fiber Ring Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to add a "new *WaveStar* node" to an existing and **in-service** FT-2000 2-fiber ring network. The "new *WaveStar* node" is a BandWidth Manager, 2.5G or 10G system. This procedure is written from the "new *WaveStar* node" perspective, although action is required at two other FT-2000 nodes. The "new *WaveStar* node" will be connected between two operational FT-2000 nodes (called the West node and East node). If adding a "new *WaveStar* node" to an **out-of-service** 2-fiber ring network, refer to the appropriate user/service manual for acceptance testing of individual *WaveStar* nodes.



NOTE:

All references to *WaveStar* information in this procedure are based on the documentation listed below (except where noted). These manuals all have the same basic structure and content, so any reference to a procedure or chapter is the same for all three documents. However, you must refer to the appropriate manual, based on the type of *WaveStar* system you are adding (BWM, 2.5G or 10G). *WaveStar* references appear in ***bold italic***. FT-2000 references appear in **bold**.

- *WaveStar* BandWidth Manager User/Service Manual, 365-370-102, Release 2.0
- *WaveStar* TDM 2.5G User/Service Manual, 365-371-102, Release 3.0
- *WaveStar* TDM 10G User/Service Manual, 365-373-102, Release 1.0.



CAUTION:

*You **MUST** read and completely understand this entire procedure **BEFORE** you add a *WaveStar* node to an in-service FT-2000 2-fiber ring network. You **MUST** have the appropriate manual, listed above, on-hand at all times during this procedure. You should also have on-hand the latest issue of the Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide, 824-102-144.*

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



CAUTION:

Before you add a WaveStar node to an in-service FT-2000 2-fiber ring network, both the WaveStar node(s) and FT-2000 node(s) must be pre-conditioned for the following provisioning and synchronization guidelines. Failure to do so could lead to service interruption. Some of the restrictions listed throughout this procedure may be removed in later releases of WaveStar products.

For WaveStar BandWidth Manager, 2.5G and 10G nodes:

- OC48 Section DCC — DCC must be enabled and provisioned “User” for the East line and “Network” for the West line. **Task 305**
- Provisioning — Establish ports and E/W direction. Provision protection group.
- Provisioning — Provision pass-through cross-connections. **Task 303**
- Synchronization — Synchronization mode must be “externally timed” or “free running.” **Task 300**
- Performance Monitoring (PM) — Do not enable Far End Performance Monitoring on all WaveStar nodes. REI-L indicators will not be accurate if Far End PM is “enabled”. Far End PM is “disabled” by default. **Task 318**

For FT-2000 nodes:

- Software — FT-2000 ring must be running R9.1.0-ADR or later software. Releases prior to R9.1 do not support mixed FT-2000/WaveStar rings.
- Guidelines — Review guidelines for mixed FT-2000/WaveStar rings located in Chapter Two, “Applications”, and provision system accordingly. Most of these guidelines are covered in this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Required Test Equipment and Personnel:

FT-2000 Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical LBOs
Technical assistance at two other nodes
WaveStar Craft Interface Terminal (CIT)



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 or WaveStar terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

Major alarms will be active at different times during this procedure.



NOTE:

Only use this procedure to add a new WaveStar node to an **in-service** FT-2000 2-fiber ring network. If the installation of the new terminal has not been completed (including circuit pack installation), notify the installation personnel or refer to the following installation manuals: 365-370-100 (BWM), 365-371-106 (2.5G), or 10G (365-371-306).



CAUTION:

If the ring has NPPA provisioned—then NPPA in the existing FT-2000 nodes in the ring must be disabled by changing the protection access value to “preemptible”. WaveStar nodes do not support NPPA.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

 **CAUTION:**
*Incorrect setting of the timing option could result in a service interruption in certain applications. Be certain that the timing option for the new bay is set to be consistent with the rest of the ring and to be consistent with the intended application. The FT-2000 bay defaults to “externally timed mode” when it is initially turned up. WaveStar nodes added to an existing FT-2000 ring, and the FT-2000 nodes on either side of the WaveStar nodes, **should** be provisioned “externally timed.” Provisionable timing options for FT-2000 are discussed in Section 5 of this User/Service Manual. Provisionable timing options for WaveStar are discussed in Chapter 6 of their respective user/service manuals.*

 **NOTE:**
It is assumed that installation of the new *WaveStar* node has been completed (including circuit pack installation) for the engineered configuration. It is further assumed that the new *WaveStar* node is powered and running and that the new fibers have been tested.

 **NOTE:**
Do not install FT-2000 Repeater Bays on lines between *WaveStar* and FT-2000 nodes, or on lines between *WaveStar* nodes. Do not install *WaveStar* nodes on lines adjacent to FT-2000 Repeater Bays. Transmission is supported with this configuration, but alarm management is not. Therefore, this configuration is not recommended. F-byte processing is used by FT-2000 terminals to fault locate FT-2000 Repeaters. However, it is not supported by *WaveStar* products and must be disabled at all FT-2000 nodes with lines connecting to *WaveStar* nodes. To disable F-byte processing, at the FT-2000 CIT, select the **CONFIGURATION-Set-0C48:1E/1W:F Byte Processing:disabled** command.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ NOTE:
The TID of the "new *WaveStar* node", as well as all other nodes in the ring, must be unique. The TIDs cannot be the same as any others in the ring. FT-2000 nodes that have TIDs containing percent (%) or pound (#) characters will not appear as an icon on the *WaveStar* CIT screen. The user must manually type in the TID of the FT-2000 node for the TL1 cut-through mode. For *WaveStar* TID syntax rules, refer to Chapter 7 of the appropriate user/service manual.

⇒ NOTE:
Refer to Figure 1 and notice that the node to be connected to line 1W of the "new *WaveStar* node" is referred to, in this procedure, as the West node and that the node to be connected to line 1E of the "new *WaveStar* node" is referred to, in this procedure, as the East node. In mixed *WaveStar*/FT-2000 rings, the East line **MUST** be cabled to the West line, and the West line **MUST** be cabled to the East line. The user/network side of the "new *WaveStar* node" must be provisioned as "user" for the East line and "network" for the West line for the OC48 Section DCC.

From office records, determine which nodes
in the ring network will be called the West
node and the East node for this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

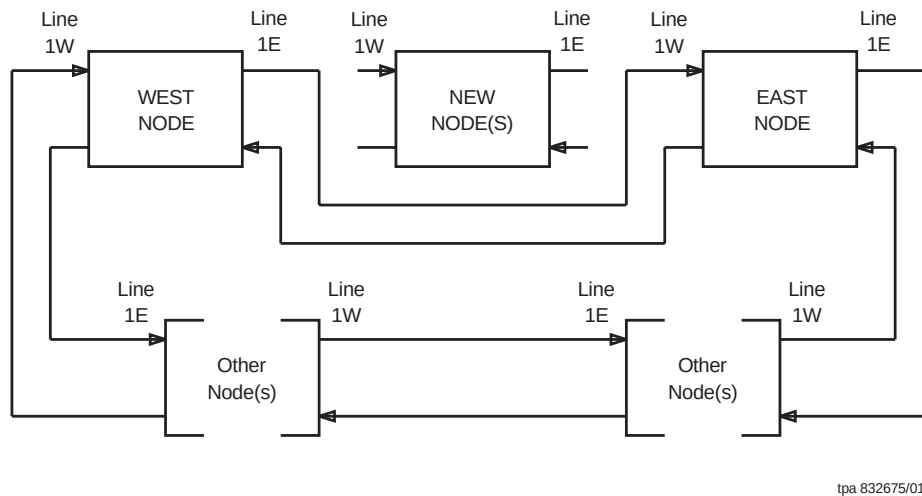


Figure 1 – Identify the East Node and the West Node

2. **CAUTION:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.

At the "new WaveStar node", make any necessary tributary-to-tributary (through) cross-connections and verify that there are no unnecessary cross-connections.

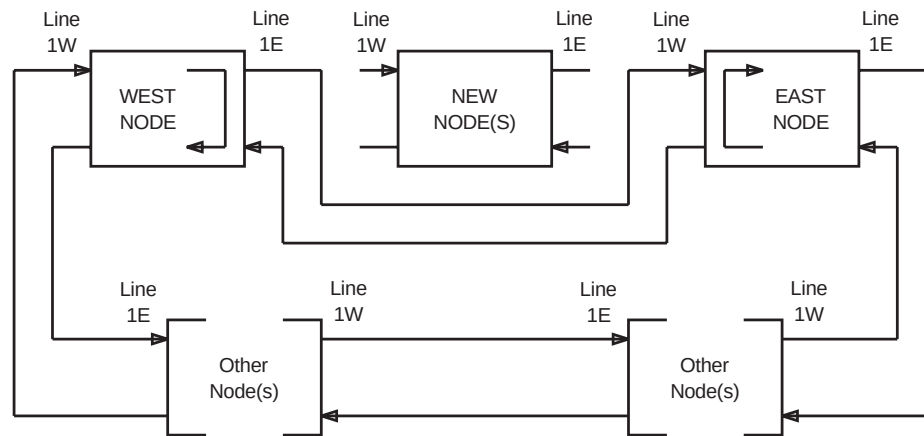
Task 303

3. **CAUTION:**
A line forced switch will preempt extra traffic, if any, on the protection tributaries.

NOTE:
For this step and Step 4, refer to Figure 2. The service tributaries to be connected (add/drop/through) to the "new WaveStar node" will now be looped back in the opposite direction at the West node and at the East node.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Instruct the technician at the West node (or travel to that location) to enter the
FAULT-Switch-Line:1E:Forced command at the CIT for line 1E. This makes a forced switch on line 1E and may cause traffic hits.



tpa 832676/01

Figure 2 – Forced Switched Lines at the East Node and the West Node

4. **CAUTION:**
A line forced switch will preempt extra traffic, if any, on the protection tributaries.

Instruct the technician at the East node (or travel to that location) to enter the
FAULT-Switch-Line:1W:Forced command at the CIT for line 1W. This makes a forced switch on line 1W and may cause traffic hits.

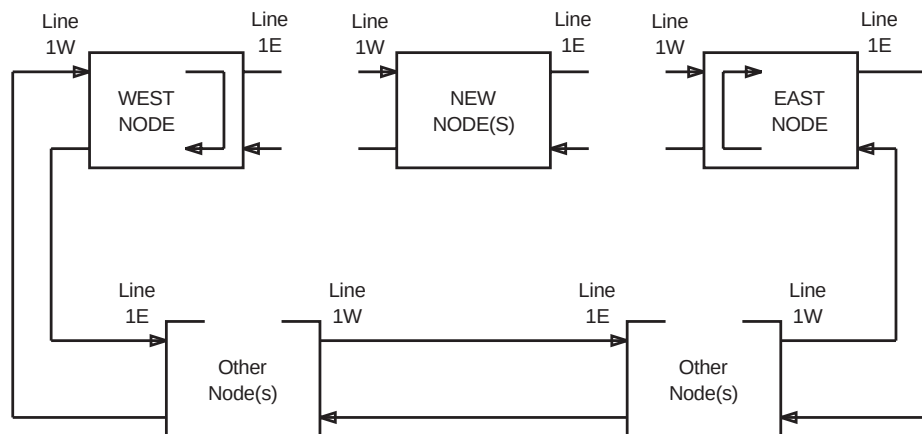
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

5. Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed from the West node (fibers connected to East node).

Instruct the technician at the West node to remove the OC-48 optical fibers (line 1E) connected to the East node.

6. **NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed from the East node (fibers connected to West node).

Instruct the technician at the East node to remove the OC-48 optical fibers (line 1W) connected to the West node.



tpa 832677/01

Figure 3 – Optical Fibers Removed

7. **NOTE:**
Refer to Figure 4 and notice that new optical connections can now be made to the "new WaveStar node".

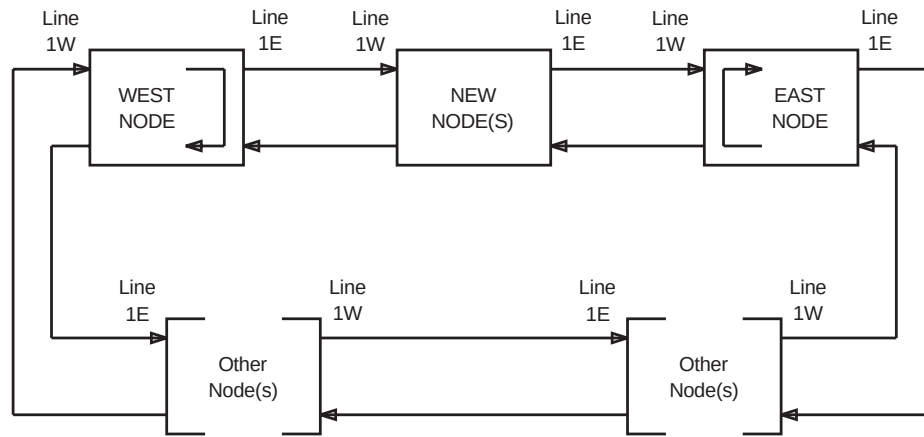
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
A transient node ID conflict condition will be observed after the ring is reconnected. Depending on how many nodes are in the ring, it may take from several minutes to a few hours for this condition to clear.

⇒ **NOTE:**
Lightguide buildouts (if required) are installed on the receive fibers of the "new *WaveStar* node".

Select one of the receive fibers (change the lightguide buildout as necessary) and connect to the appropriate RCVR circuit pack. For example, select line 1E of the West node to be connected to line 1W of the "new *WaveStar* node".

Task 707



tpa 832678/01

Figure 4 – Optical Fibers Connected to New Node

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

8. At the *WaveStar* CIT System View screen, left-click on the "Alarm List" button to obtain an Active Alarms and Status Report and verify an incoming OC-48 LOS condition has cleared for either the 1E or 1W receiver (that is, whichever receive fiber that was connected to the RCVR circuit pack in Step 7) at the "new *WaveStar* node". —

9. Select the other receive fiber (change the 0-db lightguide buildout as necessary) and connect to the appropriate RCVR circuit pack. For example, select line 1W of the East node to be connected to line 1E of the "new *WaveStar* node". **Task 707**

10. At the *WaveStar* CIT System View screen, left-click on the "Alarm List" button to obtain an Active Alarms and Status Report and verify an incoming OC-48 LOS condition has cleared for either the 1E or 1W receiver at the "new *WaveStar* node". —

11. Connect the transmit fibers (change the lightguide buildout as necessary) to the appropriate TRMTR circuit pack. For example, line 1W at the "new *WaveStar* node" (to be connected to the West node) and line 1E (to be connected to the East node). **Task 707**

12. Instruct the technician at the West node to: —

- a. Change the lightguide buildout as necessary on the 1E receive fiber.
- b. Connect it to 1E RCVR circuit pack.
- c. Verify the RCVR (line 1E) does not show an incoming OC-48 LOS condition by obtaining an Active Alarms and Status Report at the CIT located at the West node.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

13. Instruct the technician at the East node to: —
- a. Change the lightguide buildout as necessary on the 1W receive fiber.
 - b. Connect it to 1W RCVR circuit pack.
 - c. Verify the RCVR (line 1W) does not show an incoming OC-48 LOS condition by obtaining an Active Alarms and Status Report at the CIT located at the East node.

-
14. At the FT-2000 CIT, select —
CONFIGURATION-Retrieve-Map-Ring
command to obtain a Ring Map Report and verify that the "new WaveStar node" has been added to the ring as intended. (**DCC Stat** should indicate **good**.)

 **CAUTION:**
*Incorrect setting of the timing option could result in a service interruption in certain applications. Be certain that the timing option for the new bay is set to be consistent with the rest of the ring and to be consistent with the intended application. The FT-2000 bay defaults to "externally timed mode" when it is initially turned up. The WaveStar node, and the FT-2000 nodes on either side of the WaveStar nodes, **should** be provisioned "externally timed" in all mixed rings. Provisionable timing options for FT-2000 are discussed in Section 5 of this User/Service Manual. For information on provisionable timing options for WaveStar products, refer to Chapter 6 of the appropriate user/service manual.*

-
15. Verify that the Synchronization has been provisioned "externally timed" for this "new WaveStar node", and that it is correct and consistent for this mixed FT-2000/WaveStar ring.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

16. Verify that Synchronization at the FT-2000 nodes on either side of the *WaveStar* node is also “externally timed.”
-

17.  **NOTE:**
Refer to Figure 5. The forced switch at the West node can now be reset.

Instruct the technician at the West node to enter **FAULT-Switch-Line:1E:Reset** to reset the forced switch on line 1E. An alternative method in an FT-2000 ring is to remotely log in to the West node and execute the command. However, remote login from a *WaveStar* CIT to an FT-2000 network element (or vice versa) is not possible in a mixed FT-2000/*WaveStar* ring. It is possible to use TL1 cut-through from the *WaveStar* CIT to login to the FT-2000 NE and enter TL1 commands.

Reference: **DLP-524**

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

18. Refer to Figure 5. The forced switch at the East node can now be reset.

Instruct the technician at the East node to enter **FAULT-Switch-Line:1W:Reset** to reset the forced switch on line 1W. An alternative method in an FT-2000 ring is to remotely log in to the East node and execute the command. However, remote login from an *WaveStar* CIT to an FT-2000 network element (or vice versa) is not possible in a mixed FT-2000/*WaveStar* ring. It is possible to use TL1 cut-through from the *WaveStar* CIT to login to the FT-2000 NE and enter TL1 commands.

Reference: **DLP-524**

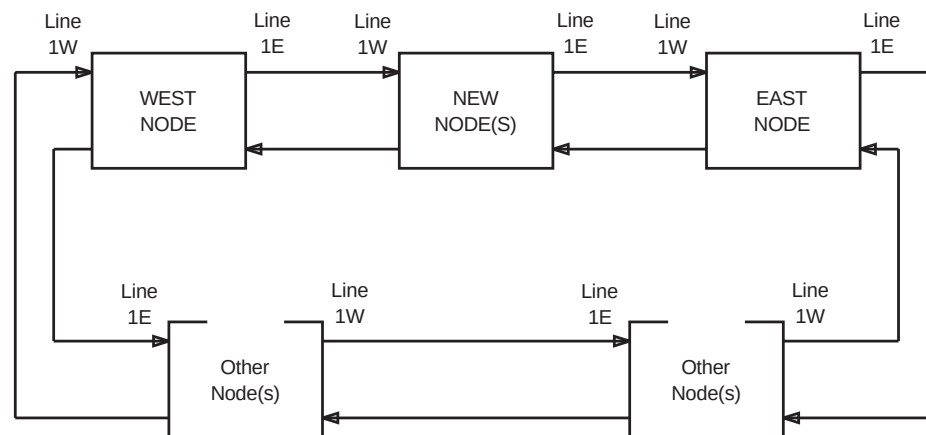


Figure 5 – Ring Network With New Node

19. **NOTE:**
The "new *WaveStar* node" has NOW been added to the ring network.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Verify that the NE ACTY LED is off at the "new WaveStar node" by (1) looking at the LED at the user panel or (2) using the WaveStar CIT, login to the new node and left-click on the "Alarm List" button on the System View screen to verify that there are NOT any active alarms.

—

20. Instruct the technician at the West node to verify that the **NE ACTY** LED is off at the user panel. An alternative method is to log in to the "West node" and execute the **FAULT-Retrieve-Alarms** command to verify that there are NOT any active alarms.

—

21. Instruct the technician at the East node to verify that the **NE ACTY** LED is off at the user panel. An alternative method is to log in to the "East node" and execute the **FAULT-Retrieve-Alarms** command to verify that there are NOT any active alarms.

—

22.  **NOTE:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions. Incorrectly provisioned TIDs will not be alarmed in cross-connects where the circuit drops at a WaveStar node.

 **CAUTION:**
DRI-P cross-connections cannot be provisioned at WaveStar nodes in mixed FT-2000/WaveStar rings. DRI-P cross-connections can still be provisioned at FT-2000 nodes in the mixed ring. DRI cross-connections are not supported in BandWidth Manager Release 2.0.

If required, enter any tributary-to-slot (drop) and/or slot-to-tributary (add) cross-connections at the "new WaveStar node".

Task 303

Circuit Order: NTP-019---+---Acceptance: NTP-006

|---Acceptance: NTP-011

|---TAD-100

|---DLP-524

|---Task 300

|---Task 303

|---Task 305

|---Task 318

|---Task 707

Delete a *WaveStar* Node from an In-Service FT-2000 2-Fiber Ring Network

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to delete a *WaveStar* BandWidth Manager, 2.5G or 10G node (Node To Be Deleted) from an existing and **in-service** FT-2000 2-fiber ring network. The procedure is written from the Node To Be Deleted perspective although action is required at two other nodes. The Node To Be Deleted is located between two operational nodes (called the West Node and East Node).



NOTE:

All references to *WaveStar* information in this procedure are based on the documentation listed below (except where noted). These manuals all have the same basic structure and content, so any reference to a procedure or chapter is the same for all three documents. However, you must refer to the appropriate manual, based on the type of *WaveStar* system you are deleting (BWM, 2.5G or 10G). *WaveStar* references appear in ***bold italic***. FT-2000 references appear in **bold**.

- *WaveStar* BandWidth Manager User/Service Manual, 365-370-102, Release 2.0
- *WaveStar* TDM 2.5G User/Service Manual, 365-371-102, Release 3.0
- *WaveStar* TDM 10G User/Service Manual, 365-373-102, Release 1.0.



CAUTION:

*You **MUST** read and completely understand this entire procedure **BEFORE** you add a *WaveStar* node to an in-service FT-2000 2-fiber ring network. You **MUST** have the appropriate manual, listed above, on-hand at all times during this procedure. You should also have on-hand the latest issue of the Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide, 824-102-144.*

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Required Test Equipment and Personnel:

FT-2000 Craft Interface Terminal (CIT)
Wrist Strap
Appropriate Optical LBOs
Technical assistance at two other nodes
WaveStar Craft Interface Terminal (CIT)

 **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

 **CAUTION:**
First, it must be verified that no traffic terminates at the Node To Be Deleted (Steps 1 through 4). Through traffic will be affected by this procedure for the duration of the ring switch (<50 milliseconds).

 **NOTE:**
Major alarms will be active at different times during this procedure.

At the Node To Be Deleted, verify that the **Task 508**
NE ACTY and **FE ACTY** LEDs are off.

-
2. At the *WaveStar* CIT, select **View-Cross-Connections** to obtain an STS1 Cross-Connection Map Report. —

-
3. Refer to the STS1 Cross-Connection Map Report obtained in Step 2 and verify that there are no tributary-to-slot (drop) or slot-to-tributary (add) cross-connections. These cross-connections could be carrying traffic, so follow local operating procedures to reroute or terminate the traffic.

Task 303

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

4.  **NOTE:**
Refer to Figure 1 and note that the node connected to line 1W of the Node To Be Deleted is referred to, in this procedure, as the West Node and that the node connected to line 1E of the Node To Be Deleted is referred to, in this procedure, as the East Node.

At the *WaveStar* CIT, select
View-Rings-Ring Map and execute to obtain a Ring Map Report for the Node To Be Deleted.

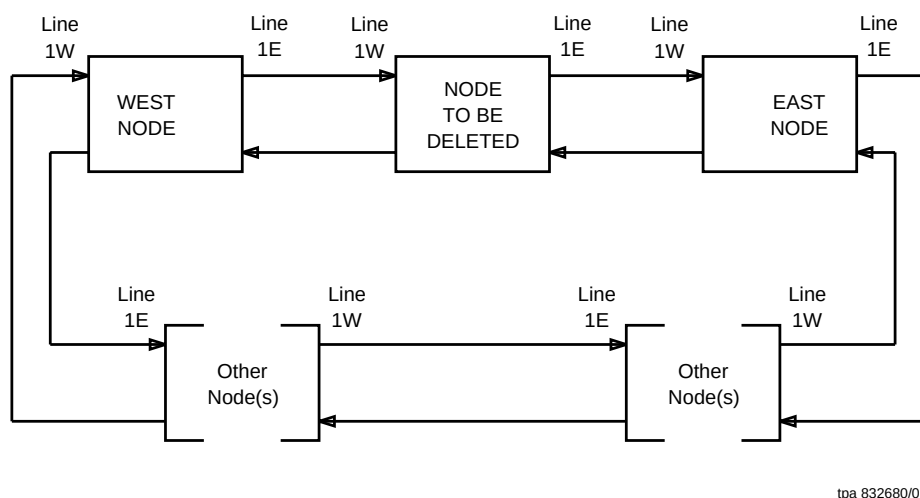


Figure 1 – Identify the East Node and the West Node

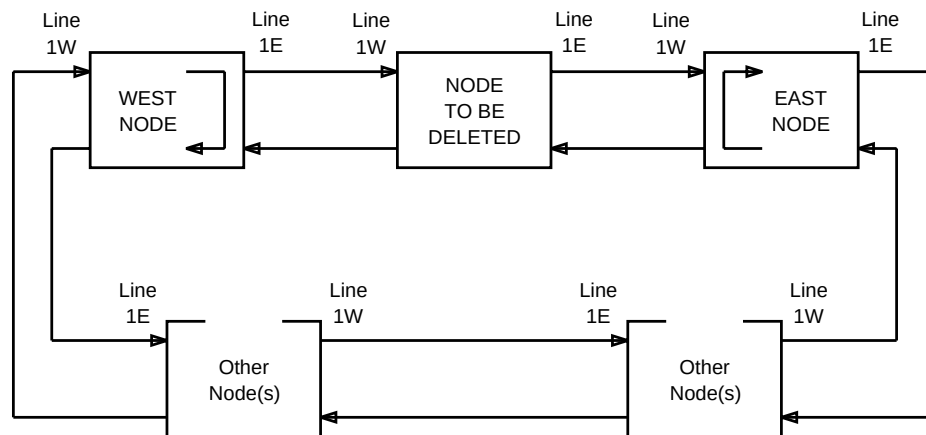
5. Determine from the Ring Map Report which node represents the West Node and which node represents the East Node for this procedure. The first entry in the report is the node with the lowest Node ID. The nodes are displayed in an East-to-West sequence.
-
6.  **CAUTION:**
The line forced switches will preempt extra traffic, if any, on the protection tributaries.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

⇒ **NOTE:**
Refer to Figure 2. The service tributaries connected to the Node To Be Deleted will now be looped back in the opposite direction with OC-48 line forced switches at the West Node and at the East Node.

⇒ **NOTE:**
The next two steps will cause the **ABN** and **NE ACTY** LEDs to light, but there will be no alarm even though the Node To Be Deleted is being disconnected from the rest of the ring.

Instruct the technician at the West Node (or travel to that location) to enter the **FAULT-Switch-Line:1E:Forced** command at the FT-2000 CIT. This makes a forced switch on line 1E and may cause traffic hits. An alternative method is to use TL1 cut-through from the *WaveStar* CIT to login to the FT-2000 NE and enter TL1 commands.



tpa 832681/01

Figure 2 – Forced Switched Lines at the East Node and the West Node

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

7. Instruct the technician at the East Node (or travel to that location) to enter the **FAULT-Switch-Line:1W:Forced** command at the FT-2000 CIT. This makes a forced switch on line 1W and may cause traffic hits. An alternative method is to use TL1 cut-through from the *WaveStar* CIT to login to the FT-2000 NE and enter TL1 commands.

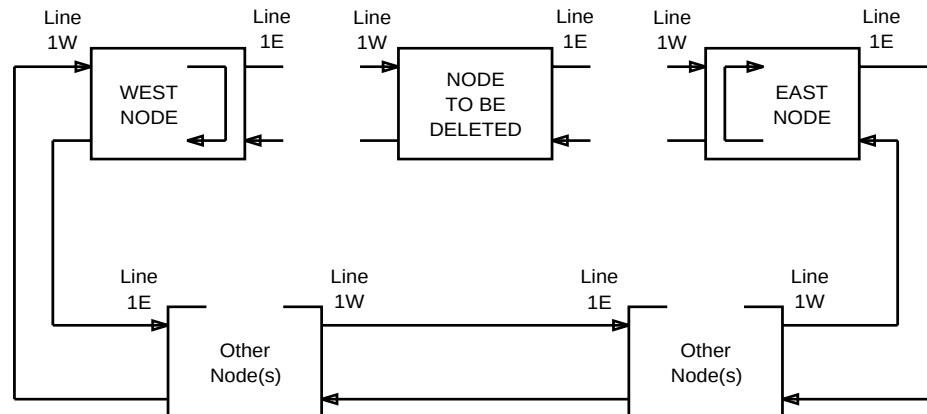
—

8.  **NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed at the Node To Be Deleted (fibers connected to the West Node).

Remove the OC-48 optical fibers at the Node To Be Deleted (line 1W) that connected to the West Node.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



tpa 832682/01

Figure 3 – Optical Fiber Removed

9.  **NOTE:**
Refer to Figure 3 to help locate the OC-48 optical fibers that can now be removed at the Node To Be Deleted (fibers connected to the East Node).

Remove the OC-48 optical fibers at the Node To Be Deleted (line 1E) that connects to the East Node. The node is now completely isolated from the ring. The adjacent nodes (East and West Nodes) get a **sync mode auto switch** condition if they are "through timed" (Provisioned Mode). However, this is not likely because the *WaveStar* node being deleted must be "externally timed", and the adjacent FT-2000 nodes should be "externally timed" as well.

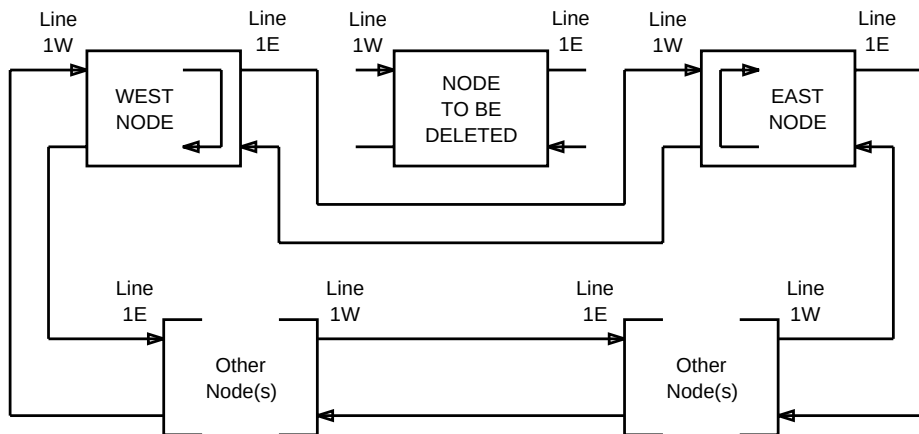
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

10. **⇒ NOTE:**
Refer to Figure 4 and notice that new optical connections can now be made at the West Node and at the East Node (bypass the Node To Be Deleted).

- ⇒ NOTE:**
Lightguide buildouts (if required) are installed only on the receive fibers at the East and West Nodes.

Instruct the technician at the West Node to change the lightguide buildout as necessary and reconfigure the fibers to connect line 1E of the West Node to line 1W of the East Node.

DLP-512



tpa 832683/01

Figure 4 – Optical Fibers Connected to East Node and West Node

11. Instruct the technician at the East Node to change the lightguide buildout as necessary and reconfigure the fibers to connect line 1W of the East Node to line 1E of the West Node.

DLP-512

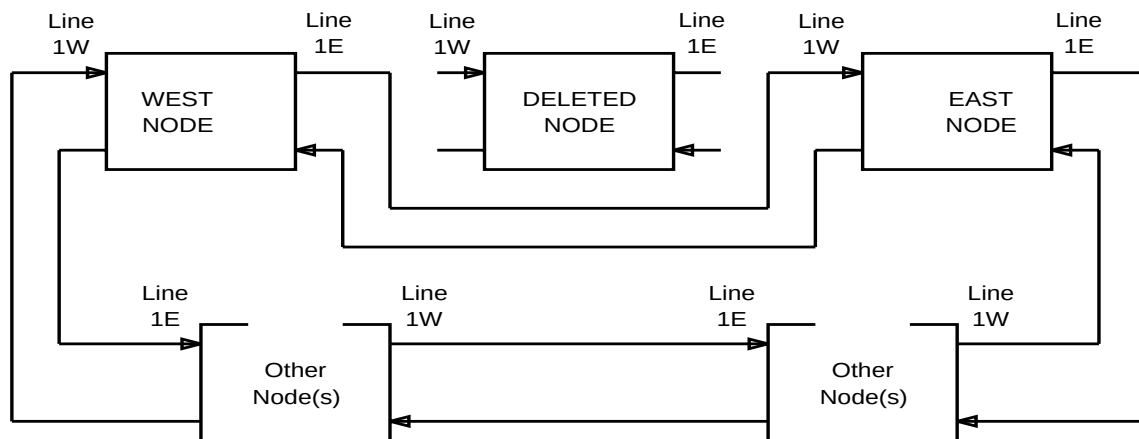
DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

12. Instruct the technicians, at both the West Node and East Node, to wait one minute for the LEDs on each node's receiver circuit pack to stop flashing. If they do not stop flashing after about a minute, refer to TAP-110.

13. Whenever the receiver's LEDs stop blinking--the ring is then re-connected and a transient **node ID conflict** condition will exist. Depending on how many nodes are in the ring it may take from several minutes to a few hours for this condition to clear.

14.  **NOTE:**
Refer to Figure 5. The forced switch at the West Node can now be reset.

Instruct the technician at the West Node to enter **FAULT-Switch-Line:1E:Reset** command at the FT-2000 CIT. The line switch may cause traffic hits.



tpa 832684/01

Figure 5 – Forced Switched Lines at the East Node and the West Node

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

15.  **NOTE:**
Refer to Figure 5. The forced switch at the East Node can now be reset.

Instruct the technician at the East Node to
enter **FAULT-Switch-Line:1W:Reset**
command at the FT-2000 CIT. The line
switch may cause traffic hits.

—

-
16.  **NOTE:**
The following step should only be performed if the node being deleted is a *WaveStar* node and all other nodes in the ring are FT-2000 nodes. If this is not the case, skip Step 16.

This step is optional. If it is desired to clear the Node ID conflict condition promptly, then a ring RESET should be performed. From either the East or West node and at a FT-2000 CIT, select **CONFIGURATION-Retrieve-Map-Ring** command to obtain a Ring Map Report. (The deleted node will still appear in the list even though it has been removed.)

Start with the node shown at the top of the list, remote login to each node and select and execute the command **FAULT-Reset**. The reset will disconnect you from that node. Repeat this sequence from all nodes in the order listed, except for the node that was deleted from the ring.

-
17.  **NOTE:**
The Node To Be Deleted has been deleted from the ring network.

Instruct the technician at the West Node to
verify that the NE ACTY LED is off at the
user panel.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

18. Instruct the technician at the East Node to verify
that the NE ACTY LED is off at the user panel.

19. Enable F-Byte Processing on line 1E of the
West node and line 1W of the East node. To
enable F-Byte processing, at the FT-2000 CIT
select **CONFIGURATION-Set-OC48:1E/1W:**
F Byte Processing: enabled.

20. If desired, Synchronization at the East and West
nodes may be changed. Once the *WaveStar*
node has been deleted, Synchronization does
not depend on the capabilities of the *WaveStar*
node.

Circuit Order: NTP-020---+---TAD-100
|---DLP-5I2
|---Task 303
|---Task 508

Operation Task Index

FIND YOUR JOB IN THE LIST BELOW	THEN GO TO
Connect Two FT-2000 Rings via a Low-Speed Optical Link.	Operation: NTP-011
Change, Delete, or Enter a User's Login	DLP-522
Copy Software from One Network Element to	
Another Network Element	Operation: NTP-005
Disconnect Dual Ring Interworking (DRI) Connections.....	Operation: NTP-004
Enter/Delete/Edit Cross-Connections at Network Elements	
for 2-Fiber Ring Network	DLP-536
Enter or Change TID String for FT-2000 Network Element	DLP-544
Establish Dual Ring Interworking (DRI) Connections.....	Operation: NTP-003
Establish Modem or <i>Datakit</i> [®] Network Access	DLP-521
Establish or Disconnect Remote Login Using CIT.....	DLP-524
Identify Primary/Secondary and	
Source/Destination Nodes	Operation: NTP-006
Install Software (Initial Installation/Upgrade/Change)	
into CIT and FT-2000 Network Element	Operation: NTP-002
Introduction to the PC	DLP-529
Loop Back DS3 and/or EC1 Circuit(s) for Testing	DLP-525
Loop Back OC-3 Line(s) for Testing.....	DLP-538
Merge Two OC-48 Rings.....	Operation: NTP-009
Optical Upgrade From STS-3 to STS-1 Granularity	Operation: NTP-010

Operation Task Index (Contd)

FIND YOUR JOB IN THE LIST BELOW	THEN GO TO
Provision 1-Way-DRI Video Distribution Circuit for Entire Ring	Operation: NTP-007
Provision OC3 Slot for 1-Way Drop Service	DLP-540
Provision STS-1 Path Trace.....	DLP-531
Provision STS-1/STS3 Non-Preemptible Protection Access (NPPA)	Operation: NTP-008
Release Looped Back DS3 and/or EC1 Circuit(s).....	DLP-523
Release Looped Back OC-3 Line(s)	DLP-539
Replace Fan Filter (in E-Bay)	DLP-526
Replace Fan Filter Every Six Months (in D-Bay)	DLP-545
Verify STS-1 Path Trace.....	DLP-532
Provision STS-1/TS-3 Level Non-Preemptible Protection Access.....	Operation: NTP-008

Install Software (Initial Installation/Upgrade/Change) into CIT and FT-2000 Network Element

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Required Test Equipment:**

Craft Interface Terminal (CIT)

Wrist Strap

 **CAUTION:**
When installing software, the CIT-PC software must be the same release or a higher release than the software currently running in the FT-2000 network element.

 **CAUTION:**
All network elements within a particular network must be running the same software release. The CIT-PC software must be the same release as the network elements or a higher release.

 **NOTE:**
Software is available on 3 1/2" floppy disks. For Release 9.0.0 and later, software is also available on programmed Digital Audio Tape (DAT).

 **NOTE:**
For a general description on using a personal computer in the following procedures, refer to **DLP-529**.

Verify the software disks consist of INSTALL DISK,
CIT-PC DISK, GENERIC and DATA numbered disks,
and the appropriate documentation as follows:

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

FT-2000 Add/Drop-Rings Terminal

FT-2000 OC-48 Lightwave System

Software Release Description

Release 8.1.1-ADR

Comcode 108400748

FT-2000 OC-48 Lighthwave System

Software Release Description

Release 9.0.0-ADR (Floppies)

Comcode 108361437

Release 9.0.0-ADR (DAT tape)

Comcode 108399973

⇒ **NOTE:**
DAT tape is required to download and distribute software via the ITM-SNC (Release 5 or later).

⇒ **NOTE:**
The feature "Sync Messaging" (R7.2 or later) has a default state of **Enabled**. The B2 optical transmitters do not support the Sync Messaging feature. Therefore, if a node contains B2 transmitters and is being upgraded with Release 7.2, or later, generic software, an alarm will be raised for each B2 transmitter. This Major Alarm is defined as "Sync Mode Equipment Conflict". Refer to TAP-102 for details on how to clear this alarm.

⇒ **NOTE:**
If the ring contains B2-optics at any node, then "Sync Messaging" should be **Disabled** at every node within the ring.

-
2. Refer to and perform the appropriate software download procedure (initial installation/ upgrade/change) per the software release description for your particular release.
-

Establish Dual Ring Interworking (DRI) STS-3 (or STS-1) Cross-Connections

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This operations procedure is used to establish the necessary cross-connections at the primary and secondary nodes of an FT-2000 2-fiber ring network. These cross-connections are necessary to support dual ring interworking operation with a second SONET ring network. This procedure can be performed from any node in the FT-2000 2-fiber ring network.

 **CAUTION:**
Cross-connections made to the wrong points can cause service interruptions.

 **NOTE:**
An electrical low-speed interface circuit pack (DS3 and/or STS1E) has three low-speed ports. All three ports associated with the slot will be affected by a slot-to-tributary or a tributary-to-slot cross-connection.

 **NOTE:**
An optical low-speed interface circuit pack (OC-3) operates on a slot basis and is affected by a slot-to-tributary or a tributary-to-slot cross-connection.

Obtain the operation instructions (work order) —
that indicates the required cross-connections.

-
2.  **NOTE:**
The primary node normally carries traffic via a DRI cross-connection.

From the operation instructions, identify and —
record the target identifier (TID) of the primary
node.

3.	NOTE: The secondary node carries traffic only if the primary node is unable to carry traffic. From the operation instructions, identify and record the cross-connections to be made at the secondary node.	—
4.	If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501
5.	Establish a login to the secondary node. (To remotely establish a login, refer to DLP-524.)	—
6.	NOTE: The normal cross-connection at the secondary node is a 2-way cross-connection, however, a 1-way cross-connection is used for half-duplex transmission. At the CIT, select CONFIGURATION-Retrieve-Crossconnection-All and execute to obtain a Cross-Connection Map Report. Section 11 shows examples of reports.	—
7.	Compare the report with the operation instructions and record any cross-connections to be added and/or deleted at the secondary node.	—
8.	CAUTION: <i>The cross-connections to be deleted MUST NOT be carrying traffic; otherwise, service interruptions will occur.</i> Delete any unnecessary cross-connections associated with the tributary(ies) and/or the slot(s) to be cross-connected. Use the CONFIGURATION-Delete-Crossconnection-STS3 (or STS1) command to delete a cross-connection.	DLP-536

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

9.  **CAUTION:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.

Enter the required cross-connection(s) as necessary. Use the **DLP-536**
CONFIGURATION-Enter-Crossconnection
-STS3 (or STS1) command to make a cross-connection.

10.  **NOTE:**
This step is optional. If the cross-connection just made was to a slot containing an OC-3/OC-12 circuit pack, you may want to provision a DCC assignment to establish DCC connectivity with the NE at the other end of the OC-3/OC-12 line.

You may enter/change a DCC assignment on an **DLP-542**
OC-3/OC-12 line.

11. At the CIT, select **—**
CONFIGURATION-Retrieve-Crossconnection-All and execute to obtain a Cross-Connection Map Report. Section 11 shows examples of reports.
-

12. Verify that the cross-connections in the report match those in the operation instructions. **—**
-

13.  **NOTE:**
This step is optional. If the cross-connection just deleted was to a slot containing an OC-3/OC-12 circuit pack, you may want to provision a DCC assignment to remove DCC connectivity with the network element at the other end of the OC-3/OC-12 line.

You may delete a DCC assignment on an **DLP-542**
OC-3/OC-12 line.

14. Discontinue the login at the secondary node. (To discontinue a remote login, refer to **DLP-524.**) **—**
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

15. Establish a login to the primary node identified in Step 2. (To establish a remote login, refer to **DLP-524.**) —
-

16.  **NOTE:**
The normal cross-connections needed at the primary node are a 1-way-dri cross-connection and a drop-and-continue cross-connection (bridged tributary-to-slot and same tributary-to-tributary).

At the CIT, select —
**CONFIGURATION-Retrieve-Crossconnect
ion-All** and execute to obtain a
Cross-Connection Map Report. Section 11
shows examples of reports.

17. Compare the report with the operation instructions and record any cross-connections to be added and/or deleted at the primary node. —
-

18.  **CAUTION:**
The cross-connections to be deleted MUST NOT be carrying traffic; otherwise, service interruptions will occur.

 **NOTE:**
If the slot-to-tributary (add) cross-connection of the required 1-way-dri cross-connection already exists, do not delete it.

Delete any unnecessary cross-connections associated with the tributary(ies) and/or the slot(s) to be cross-connected. Use the **DLP-536**
**CONFIGURATION-Delete-Crossconnectio
n-STS3 (or STS1)** command to delete a
cross-connection.

19.  **CAUTION:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Enter the required 1-way-dri cross-connection(s), 2-Way-DRI-Pri cross-connection(s) or 2-Way-DRI-Sec cross-connection(s) using one of these commands. Use the **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command to make a cross-connection, or if the slot-to-tributary (add) component of the desired 1-way-dri cross-connection already exists, use the **CONFIGURATION-Enter-Roll-STS3 (or STS1)** command to change it to a 1-way-dri cross-connection.

DLP-536

-
20.  **NOTE:**
This step is optional. If the cross-connection just made was to a slot containing an OC-3 circuit pack, you may want to provision a DCC assignment to establish DCC connectivity with the network element at the other end of the OC-3 line.

You may enter/change a DCC assignment on an OC-3 line.

DLP-542

-
21.  **NOTE:**
This step is optional, but it is recommended. The primary node has a 1-way-dri cross-connection. An incoming low-speed signal failure on the associated port or slot will be protected by a DRI protection switch so service will not be affected. You may wish to change the alarm level associated with an incoming low-speed signal failure from the original value of CR (critical) to MN (minor).

At the CIT, select the appropriate command, **CONFIGURATION-Set-T3**, **CONFIGURATION-Set-EC1**, **CONFIGURATION-Set-OC3**, or **CONFIGURATION-Set-OC12** to provision the Alarm Level to MN (minor).

—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
22.	At the CIT, select CONFIGURATION-Retrieve-Crossconnect ion-All and execute to obtain a Cross-Connection Map Report. Section 11 shows examples of reports.	—
23.	Verify that the cross-connections in the report match those in the operation instructions.	—
24.	 NOTE: This step is optional. If the cross-connection just deleted was to a slot containing an OC-3/OC-12 circuit pack, you may want to provision the DCC assignment to remove DCC connectivity with the network element at the other end of the OC-3/OC-12 line. You may delete a DCC assignment on an OC-3/OC-12 line.	DLP-542
25.	 NOTE: This step is optional and only applies if there are no low-speed connections to an external network(s). Test DRI cross-connections for path integ- rity.	DLP-541
26.	Discontinue the login at the primary node. (To discontinue a remote login, refer to DLP-524 .)	—
27.	The necessary cross-connections have been made in the primary and secondary nodes, and they are ready to support dual ring interworking (DRI) operation with the second SONET ring network.	—
28.	Refer to DLP-536 to make any other necessary cross-connections at other nodes in the FT-2000 2-fiber ring network.	—

|---DLP-542
|---DLP-541

Disconnect Dual Ring Interworking (DRI) STS-3 (or STS-1) Cross-Connections

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This operations procedure is used to disconnect the cross-connections at the primary and secondary nodes of an FT-2000 2-fiber ring network. These cross-connections were necessary to support dual ring interworking operation with a second SONET ring network. This procedure can be performed from any node in the FT-2000 2-fiber ring network.

 **CAUTION:**
Cross-connections deleted at the wrong points can cause service interruptions.

 **NOTE:**
An electrical low-speed interface circuit pack has three low-speed ports. All three ports associated with the slot will be affected by a slot-to-tributary or a tributary-to-slot cross-connect deletion.

 **NOTE:**
An optical low-speed interface circuit pack (OC-3) operates on a slot basis and is affected by a slot-to-tributary or a tributary-to-slot cross-connection deletion.

Obtain the operation instructions (work order) that indicate which cross-connections are to be deleted.

-
2.  **NOTE:**
The primary node normally carries traffic via a DRI cross-connection.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO		
	From the operation instructions, identify and record the target identifier (TID) of the primary node.	—
3.	 NOTE: The secondary node carries traffic only if the primary node is unable to carry traffic. From the operation instructions, identify and record the cross-connections to be deleted at the secondary node.	—
4.	If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.	DLP-501
5.	Establish a login to the secondary node. (To remotely establish a login, refer to DLP-524 .)	—
6.	 NOTE: The cross-connection to be deleted at the secondary node is a 1-way slot-to-tributary (add) cross-connection. At the CIT, select CONFIGURATION-Retrieve-Crossconnect ion-All and execute to obtain a Cross-Connection Map Report. Examples of these reports with a description of the output parameters are provided in Section 11 of this manual.	—
7.	Compare the report with the operation instructions and record any slot-to-tributary (add) cross-connections to be deleted at the secondary node.	—
8.	Delete any unnecessary slot-to-tributary (add) cross-connections identified in Step 7. Use the CONFIGURATION-Delete-Crossconnection-STS3 (or STS1) command to delete a cross-connection.	DLP-536

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

9.  **NOTE:**
This step is optional. If the cross-connection just deleted was to a slot containing an OC-3 circuit pack, you may want to provision a DCC assignment to remove DCC connectivity with the network element at the other end of the OC-3 line.

You may delete a DCC assignment on an OC-3 line. **DLP-542**

-
10. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-All** and execute to obtain a Cross-Connection Map Report. Section 11 shows examples of reports.

—

-
11. Verify that the cross-connection(s) in the report matches those in the operation instructions.

—

-
12. Discontinue the login at the secondary node. (To discontinue a remote login, refer to **DLP-524**.)

—

-
13. Establish a login to the primary node identified in Step 2. (To establish a remote login, refer to **DLP-524**.)

—

-
14.  **NOTE:**
The cross-connection(s) to be deleted and/or replaced at the primary node is a 1-way-dri cross-connection(s).

At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-All** and execute to obtain a Cross-Connection Map Report.

—

-
15. Compare the report with the operation instructions and record any cross-connections to be deleted and/or replaced at the primary node.

—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO		
16.	Are any existing 1-way-dri cross-connections to be deleted rather than replaced? If YES , then continue with Step 17. If NO , then continue with Step 18.	—
17.	Delete any unnecessary 1-way-dri cross-connections identified in Step 15. Use the CONFIGURATION-Delete-Crossconnection-STS3 (or STS1) command to delete a cross-connection.	DLP-536
18.	 NOTE: This step is optional. If the cross-connection just deleted was to a slot containing an OC-3 circuit pack, you may want to provision a DCC assignment to remove DCC connectivity with the network element at the other end of the OC-3 line. You may delete a DCC assignment on an OC-3 line.	DLP-542
19.	Roll any unnecessary 1-way-dri cross-connection(s) to 1-way cross-connection(s). Use the CONFIGURATION-Enter-Roll-STS3 (or STS1) command to modify a cross-connection.	—
20.	 NOTE: This step is optional. If the cross-connection just rolled was to a slot containing an OC-3 circuit pack, you may want to provision a DCC assignment to remove DCC connectivity with the network element at the other end of the OC-3 line. You may delete a DCC assignment on an OC-3 line.	DLP-542

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

21.	Establish a login to all downstream nodes (destination node and every intermediate node) and update the STS-3 (or STS-1) cross-connection map with the "new" source node using the CONFIGURATION-Enter-Crossconnection -STS3 (or STS1) command. (The secondary node was the source node for the 1-way-dri cross-connection.) (To remotely establish a login, refer to DLP-524 .)	—
22.	At the CIT, select CONFIGURATION-Retrieve-Crossconnect ion-All and execute to obtain a Cross-Connection Map Report. Section 11 shows examples of reports.	—
23.	Verify that the cross-connections in the report match those in the operation instructions.	—
24.	Discontinue the login at the primary node. (To discontinue a remote login, refer to DLP-524 .)	—
25.	The necessary cross-connections have been disconnected in this FT-2000 2-fiber ring network. It no longer supports DRI operation with the second SONET ring network.	—
-

Operation: NTP-004---+---DLP-501
 |---DLP-524
 |---DLP-536

Copy Software from One Network Element to Another Network Element

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** This procedure is used to copy the software in one FT-2000 network element to another FT-2000 network element through the data communications channel (DCC) residing in an OC-3 or OC-48 signal. This procedure can be accomplished while the FT-2000 ring is **in service**.



NOTE:

Software can be copied and/or installed via the ITM SNC with an FT-2000 Add/Drop-Rings Terminal, Release 9.0 or later, and an ITM-SNC Release 5.0 or later. This will be especially useful when upgrading to future releases of the FT-2000 ADR Terminal.

Required Test Equipment:

Craft Interface Terminal (CIT)
Wrist Strap



NOTE:

Software may be copied over either the OC-3, OC-12, or OC-48 lines.



NOTE:

For a general description on using a personal computer in the following procedure, refer to **DLP-529**.

If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.

DLP-501

-
- 2.



NOTE:

The CIT user must have a "privileged" security level.

Log in to the CIT using the expert mode by entering **cit expert**.

—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
3.	Verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before starting this procedure.	—
4.	At the CIT, select CONFIGURATION-Retrieve-Map-Network command to obtain the Network Map Report or select CONFIGURATION-Retrieve-Map Ring command to obtain the Ring Map Report. An example of these reports with a description of the output parameters is provided in Section 11 of this manual.	—
5.	 NOTE: The software in the network will be updated by starting with the topmost FT-2000 network element (TID) in the report and moving down the list of TIDs (nodes) one at a time. This approach updates the network software in an East direction on a section-by-section basis. Refer to the appropriate software release description for your particular release and perform the Remote (DCC) Download procedure. The software release descriptions are listed in "Operation: NTP-002".	—

Identify Primary/Secondary and Source/Destination Nodes

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This procedure is used to identify the primary, secondary, source, and destination nodes of a circuit provisioned for dual ring interworking (DRI). (For an understanding of these terms, refer to the Glossary and Chapters 8 and 9 of this manual.) This procedure can be performed from any node in an FT-2000 2-fiber ring network.

⇒ **NOTE:**
The terms **source** and **destination** are used for slots, tributaries, lines, and nodes when making cross-connections. However, this procedure will only use **source** and **destination** in reference to nodes that describe a 1-way circuit (one direction of transmission).

If required, connect the craft interface terminal (CIT) to the FT-2000 network element and condition it.	DLP-501

-
2. Establish a login to a node. (To remotely establish a login, refer to DLP-524 .)	—
-
3. From the operation instructions, determine the tributary to be used in identifying the primary, secondary, source, and destination nodes of that circuit. Each tributary could have different nodes.	—
-
4. At the CIT, select CONFIGURATION-Retrieve-Timeslot-STs3 (or STS1) command and execute to obtain an STS-3 (or STS1) Tributary Map Report.	—
-

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
5.	From the STS-3 (or STS1) Tributary Map Report, identify the source, destination, primary, and secondary nodes by referring to Figure 1 and to Exhibit 1 for STS3 or to Exhibit 2 for STS1. The exhibits contain an explanation to Figure 1. Figure 1 and Exhibit 1 or Exhibit 2 use tributary 1 and slot 1a for examples and that Worcester-MA is the location requesting the report.	—
6.	Discontinue the login to the node. (To discontinue a remote login, refer to DLP-524 .)	—
7.	This completes the procedure to identify the primary, secondary, source, and destinations nodes of a DRI circuit.	—

Operation: NTP-006---+---DLP-501
+---DLP-524

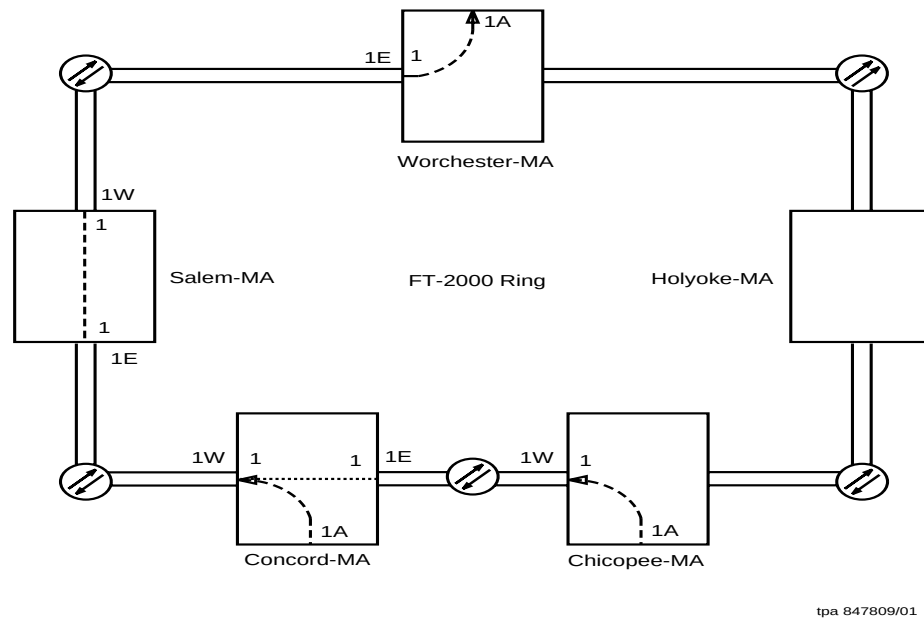


Figure 1 – Five Node Ring with DRI Cross-Connections

This report shows the primary, secondary, source and destination nodes. Observe the following from the report (no DRI switch means traffic is coming from the primary node):

- Scan the report in the **Cross-connection** column and locate a 1-way DRI. A 1-way DRI is a 1-way add cross-connection and a 1-way through cross-connection sharing the same outgoing tributary. Note that one of these cross-connections will be active (dashed line) while the other will be standby (dotted line). In this report, the **At Node** column indicates Concord-MA is provisioned with a 1-way DRI cross-connection.
- The **primary node** is a node at which a 1-way DRI cross-connection has been provisioned. In this report, Concord-MA is the primary node. Concord-MA is also the **active source node** because the add cross-connection is dashed and not dotted.
- The **secondary node** is given in the TID column associated with the incoming tributary of the 1-way DRI. In this report, the secondary node is to the right (East) of the 1-way DRI, Chicopee-MA. Chicopee-MA is also the **standby source node** because the through cross-connect is dotted.
- The **destination node** is given in the TID column associated with the outgoing

tributary of the 1-way DRI. In this report, the **destination node** is to the left (West) of the 1-way DRI, Worcester-MA.

- Note: If a DRI switch occurs and the secondary node becomes the active source node, the through cross-connection will be dashed and the add cross-connection will be dotted.

Additional information on this type of report is described in Chapter 11 of this manual.

Example 1. STS3 Explanation to Figure 1

```

/*          STS-1 Tributary Map Circuit Report
=====
Ring Node   Source   Source   Destination   Destination   Primary
  TID       AID      AID      TID          State
=====
Worcester-MA
Worcester-MA      ls-1a-1      1e-1-2      Salem-MA
-----
Salem-NH
Concord-MA        1e-1-2      1w-1-2      Worcester-MA
-----
Concord-MA
Concord-MA        ls-1a-2      1w-1-2      Worcester-MA      ACT
Chicopee-MA       le-1-2      1w-1a-      Worcester-MA      STBY
-----
Chicopee-MA
Worcester-MA      1w-1-2      ls-1a-2      Chicopee-MA
-----
Holyoke-MA
-----
*/

```

This report shows the primary, secondary, source and destination nodes. Observe the following from the report (no DRI switch means traffic is coming from the primary node):

- Scan the report in the **Primary State** column and locate a 1-way DRI. A 1-way DRI is a 1-way add cross-connection and a 1-way through cross-connection sharing the same outgoing line and tributary. Note that one of these cross-connections will be active (ACT) while the other will be standby (STBY). In this report, the **Ring Node** column indicates Concord-MA is provisioned with a 1-way DRI cross-connection.

- The **primary node** is a node at which a 1-way DRI cross-connection has been provisioned. In this report, Concord-MA is the primary node. Concord-MA is also the **active source node** because the add cross-connection is indicated by ACT in the **Primary State** column.
- The **secondary node** is given in the **Source TID** column associated with the incoming tributary of the 1-way DRI. In this report, the secondary node is to the right (East) of the 1-way DRI, Chicopee-MA. Chicopee-MA is also the **standby source node** because the through cross-connect at Concord-MA is indicated by STBY in the **Primary State** column.
- The **destination node** is given in the **Destination TID** column associated with the outgoing tributary of the 1-way DRI. In this report, the **destination node** is to the left (West) of the 1-way DRI, Worcester-MA.
- Note: If a DRI switch occurs and the secondary node becomes the active source node, the through cross-connection will become **ACT** and the add cross-connection will become **STBY**.

Additional information on this type of report is described in Chapter 11 of this manual.

Exhibit 2. STS1 Explanation to Figure 1

Provision 1-Way-DRI Video Distribution Circuit for Entire Ring

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

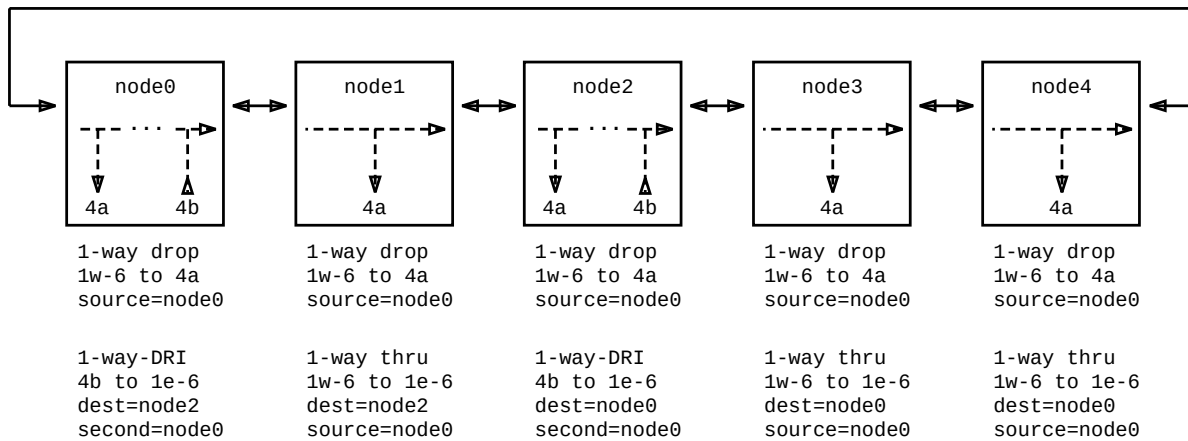
1. **Overview:** This procedure is used to provision all FT-2000 nodes throughout an entire ring that uses a 1-way-DRI (dual ring interworking) circuit for video distribution. Examples are used to illustrate target identifier (TID) provisioning rules to prevent alarm conditions under normal operations. This procedure can be performed from any node in an FT-2000 2-fiber ring network. Additional information may be found in Chapter 2, "Applications," and in Chapter 8, "Administration and Provisioning."

 **NOTE:**
The terms **source** and **destination** are used for slots, tributaries, lines, and nodes when making cross-connections. However, this procedure will only use **source** and **destination** in reference to nodes that describe a 1-way circuit (one direction of transmission).

If required, connect the craft interface terminal (CIT) to the FT-2000 network element and condition it. **DLP-501**

-
2.	Establish a login to a node. (To remotely establish a login, refer to DLP-524 .)	—
-
3.	From the operation instructions, determine the same tributary to be used at all nodes for the video circuit.	—
-
4.	At the CIT, select CONFIGURATION-Retrieve-Timeslot-STS3 command and execute to obtain an STS-3 Tributary Map Report for the tributary.	—
-

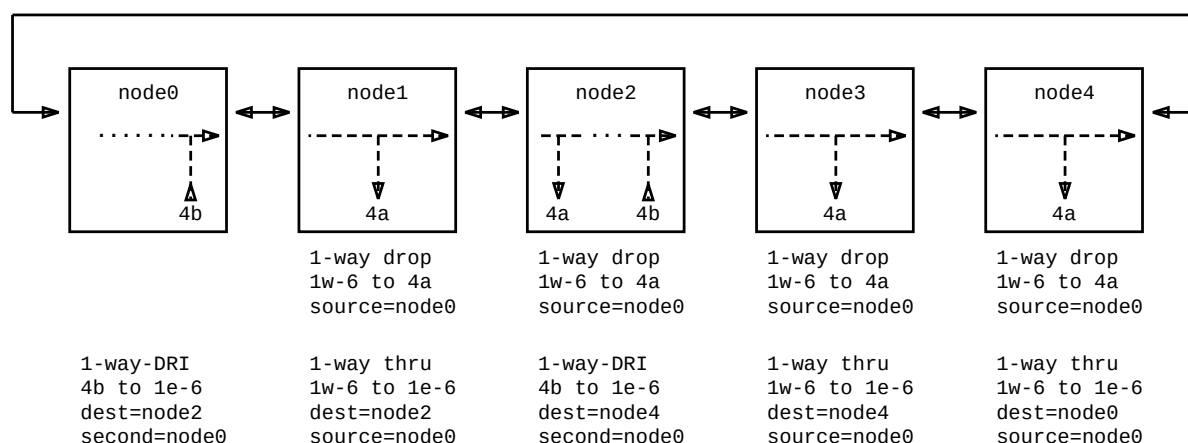
DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
5. From the STS-3 Tributary Map Report, identify the source, destination, primary, secondary, and intermediate nodes and provision those nodes by referring to the examples in Figures 1, 2, and 3. The following TID rules should be observed when specifying the source node TID, secondary node TID, and destination node TID. A. The source node TID (1-way cross-connections) and the secondary node TID (1-way-DRI cross-connections) must be the <i>same</i> at all nodes. Which TID is chosen is arbitrary but is normally one of the nodes having a 1-way-DRI cross-connection. B. The destination node TID depends on exactly what cross-connections are present. To determine the destination node TID from the local node, assign the following: 1. X is the TID of the local node. 2. Y is the TID of the next downstream node (transmit direction) with a 1-way-DRI cross-connection. X and Y will never be the same node. 3. Z is the TID of the last node with a 1-way drop cross-connection when following the circuit from node X to node Y. Z can be node X or Y, some other node between X and Y, or null if there are no 1-way drop cross-connections between X and Y. 4. If Z is X or null, use the TID of node Y as the destination node TID. 5. Otherwise, use the TID of node Z as the destination node TID.	—
6. Discontinue the login to the node. (To discontinue a remote login, refer to DLP-524.)	—
7. This completes the procedure to provision a 1-way-DRI circuit for video distribution.	—



tpa 849524/01

Figure 1 – Five Node Ring (Two Nodes with DRI Cross-Connections and Five Drops)

In Figure 1, the topology is a five node ring with two DRIs protecting each other at node 0 and at node 2. Each node has a drop cross-connection from the West direction on time slot 6. In addition, node 1, node 3, and node 4 have a through (continue) cross-connection. TID rule A applies to all source nodes and secondary nodes. TID rule B applies to all destination nodes.



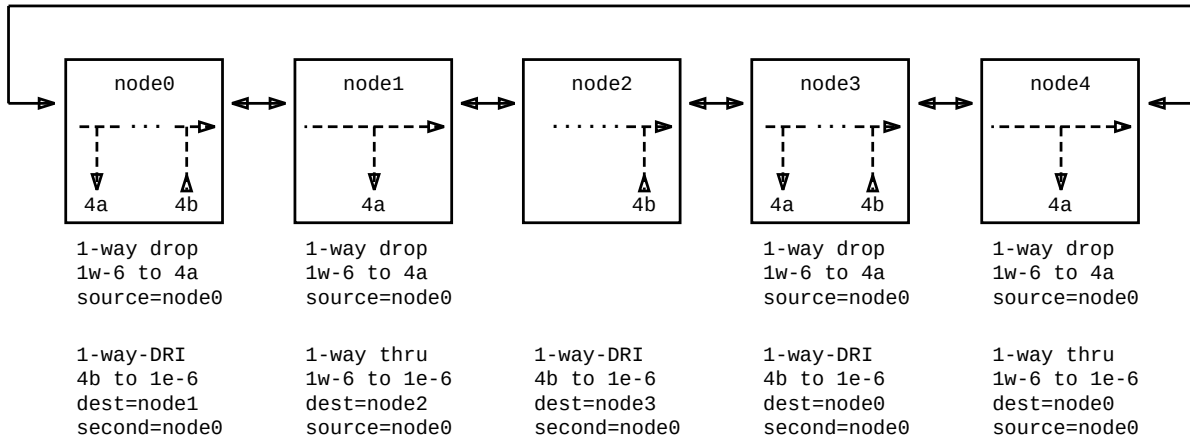
tpa 849525/01

Figure 2 – Five Node Ring (Two Nodes with DRI Cross-Connections and Four Drops)

In Figure 2, the topology is the same as in Figure 1 but node 0 does not have a 1-way drop cross-connection. Applying TID rule A to all source nodes and secondary nodes implies using the same TID as node 0 (or, equivalently, the TID of node 2) for all cross-connections at all nodes. Application of TID rule B gives different results since there is no longer a drop cross-connection at node 0. For example,

At node 4,
TID rule B.4 applies (X = node 4, Y = node 1 and Z = node 4),
so the destinations TID of the 1-way through is set to node 0.

At node 2,
TID rule B.5 applies (X = node 2, Y = node 0 and Z = node 4),
so the destination node TID is set to the same as the TID for node 4.
TID rule B.5 also applies to node 3.



tpa 849526/01

Figure 3 – Five Node Ring (Three Nodes with DRI Cross-Connections and Four Drops)

In Figure 3, the topology is the same as in Figure 1 but node 2 does not have a 1-way drop cross-connection. Applying TID rule A to all source nodes and secondary nodes implies using the same TID as node 0 (or, equivalently, the TID of node 2) for all cross-connections at all nodes. Application of TID rule B gives different results since there is no longer a drop cross-connection at node 2. For example,

At node 0:

X=node 0, Y=node 2, and Z=node 1 where TID rule B.5 implies Z=node 1 be used.

At node 1:

X=node 1, Y=node 2, Z= node 1 where TID rule B.4 implies Y=node 2 be used.

At node 2:

X=node 2, Y=node 3, and Z = node 3 where TID rule B.5 implies Z=node 3 be used.

At node 3:

X = node 3, Y = node 0, and Z = node 0 where TID rule B.5 implies Z = node 0 be used.

At node 4:

X = node 4, Y = node 0, and Z = node 0 where TID rule B.5 implies Z = node 0 be used.

Provision STS-1/STS-3 Non-Preemptible Protection Access (NPPA)

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** Normally, this feature will be provisioned via TIRKS. However, it can also be provisioned from the CIT. This NTP describes the steps that must be performed in order to add/delete/change NPPA traffic.

 **CAUTION:**
Each add/delete/change will affect the same timeslot in every node of the FT-2000 ring. An add/delete/change need only be entered at a single node. To delete or change an NPPA assignment--you should make all changes at the node where that assignment was first made.

 **CAUTION:**
When a protection tributary is selected for non-preemptible protection access, the corresponding STS-3 tributary of service capacity at every node of the ring becomes unprotected.

 **NOTE:**
Release 7.2 provides NPPA at both STS-3 and STS-1 levels (there is no restriction on optics).

If required, connect the craft interface terminal (CIT) to the FT-2000 network element and condition it.

DLP-501

-
2.	Establish a login to a node. (To remotely establish a login, refer to DLP-524 .)	—
-
3.	At the CIT, select the CONFIGURATION-Retrieve-Protection STS3 or (STS1) command and execute to retrieve current values of the local protection access state variables for each tributary.	—
-

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO



NOTE:

This report lists the state variables of each STS3 tributary for both the East and West fiber-links. There are three possible state variables. They are as follows:

- a. Preemptible (where a signal fail or signal degrade condition on the service STS-3 tributaries causes traffic to be automatically switched to the protection STS-3 tributaries, preempting extra traffic).
- b. Permanent (where the protection capacity is used, on a permanent basis, to carry extra traffic; for example, video transport).
- c. Temporary (where service traffic is temporarily made unprotected and the non-preemptible protection capacity is used for DACS-based network restoration purposes).

4.	At the CIT, select the CONFIGURATION-Enter-Protection-STS3 or (STS1) command and execute to add/delete/change the state variable for the desired tributary.	—
5.	Verify that the state variable, for the specified tributary, has actually been changed per the previous (Step 4) command. At the CIT, select the CONFIGURATION-Retrieve-Protection STS3 or (STS1) command and execute to retrieve the (new) current values.	—
6.	Are there additional NPPA changes to be made? If YES , then continue with Step 2. If NO , then continue with Step 7.	—
7.	The NPPA add/delete/change operation has been performed. This completes the procedure.	—

Merge Two OC-48 Rings

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** The steps in this procedure detail how to merge (combine) two small OC-48 rings into a single larger OC-48 ring.

⇒ **NOTE:**
For discussion purposes, the two rings are referred to as ring-1 and ring-2. Figure 1 is an example that serves to illustrate ring-1 and ring-2. Both rings must be accessible via a CIT (either dial-up or direct connection). It is assumed that there are enough fibers and that all new fibers have already been tested and installed.

Required Test Equipment:

CIT
Wrist Strap

Required Personnel:

Have installation/maintenance personnel at all four nodes (two nodes of ring-1 and two nodes of ring-2) where fibers are to be physically moved (originals disconnected/new connected).

-
2.	If required, connect the CIT to the local FT-2000 network element and condition it.	DLP-501
-

3. ⇒ **NOTE:**
The CIT user(s) must have a "privileged" security level.

Log in to the CIT (on both ring-1 and ring-2) using the expert mode by entering **cit expert**.

—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
4.	For ring-1, verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure.	TAP-102
5.	For ring-2, verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure. Refer to TAP-102 as appropriate.	—
6.	Verify that each node, of both ring-1 and ring-2, is running the same release of software.	—
 NOTE: If it is determined that the software on one or more NEs must be upgraded—then follow the procedures specified in the software release description associated with the particular software release.		
7.	Verify that each node, for both ring-1 and ring-2, has a unique TID. At the CIT connected to any NE within ring-1, select CONFIGURATION-Retrieve-Map-Network command to obtain the Network Map Report. An example of these reports with a description of the output parameters is provided in Section 11 of this manual.	—
8.	At the CIT connected to any NE within ring-2, select CONFIGURATION-Retrieve-Map-Network command to obtain the Network Map Report.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Provision Through Cross-Connections

9.  **WARNING:**
All traffic that is presently routed directly between the nodes adjacent to where the rings will be opened requires new through cross-connections provisioned in the nodes of the other ring. This must be done prior to merging the rings. Otherwise, service will be dropped when the merge is completed.

 **NOTE:**
In order to establish the through cross connections it may be necessary to roll some of the existing cross connections in either or both rings.

At the CIT connected to ring-1, select —
CONFIGURATION-Retrieve-Crossconnect
-STS..... command to obtain the
cross-connect map report.

10. From the ring-1 cross-connect map report, —
identify all traffic that must have a "through"
cross-connection defined for one or more NEs of
ring-2. At the CIT connected to ring-2, select
CONFIGURATION-Enter-Crossconnection
-STS..... command, at each NE as
appropriate, to define the "through"
cross-connections. Refer to Figure 2.

 **NOTE:**
This will cause non-service affecting
system alarms until the procedure is
completed.

11. At the CIT connected to ring-2 select —
CONFIGURATION-Retrieve-Crossconnect
-STS1 command to obtain the cross-connect
map report.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

12. From the ring-2 cross-connect map report, identify all traffic that must have a "through" cross-connection defined for one or more NEs of ring-1. At the CIT connected to ring-1, select **CONFIGURATION-Enter-Crossconnection-STS**. command, at each NE as appropriate, to define the "through" cross-connections. Refer to Figure 2.

 **NOTE:**
This will cause non-service affecting system alarms until the procedure is completed.

Remove traffic from fibers that are to be disconnected

13. Perform a Protection Switch on each of the four nodes involved in the merge. **Make sure that the Forced Switch is performed on the proper direction (E or W) at the respective four nodes.**

From the CIT, access the NE's to be Protection Switched and select **FAULT-Switch-Line-1W/1E** command. Refer to the example provided in Figure 3 and enter the respective switches.

Switching hits will occur on service carried through the fibers that were "Force Switched". Also, using Figure 3 as our point of discussion, you should observe the following typical alarms:

Node A: ABN line-1E line forced switch at near end
Node C: ABN line-1W line forced switch at near end
Node 2: ABN line-1W line forced switch at near end
Node 3: ABN line-1E line forced switch at near end

There may be other alarms at the various nodes during this procedure.

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

Prepare to Disconnect Existing Fibers

14.	Instruct the installation/maintenance personnel, at node A to disconnect the East transmit fiber (point AET) and also verify that the West receiver (point CWR) has an incoming OC-48 LOS alarm and its FAULT LED is flashing. Refer to the example provided in Figure 4.	—
15.	Instruct the installation/maintenance personnel, at node C, to disconnect the West receive fiber (point CWR).	—
16.	Instruct the installation/maintenance personnel, at node C, to disconnect the West transmit fiber (point CWT) and also verify that the East receiver (point AER) has an incoming OC-48 LOS alarm and its FAULT LED is flashing. Refer to the example provided in Figure 4.	—
17.	Instruct the installation/maintenance personnel, at node A, to disconnect the East receive fiber (point AER).	—
18.	Instruct the installation/maintenance personnel, at node 2, to disconnect the West transmit fiber (point 2WT) and also verify that the East receiver (point 3ER) has an incoming OC-48 LOS alarm and its FAULT LED is flashing. Refer to the example in Figure 4.	—
19.	Instruct the installation maintenance personnel, at node 3, to disconnect the East receive fiber (point 3ER).	—
20.	Instruct the installation maintenance personnel, at node 3, to disconnect the East transmit fiber (point 3ET) and also verify that the West receiver (point 2WR) has an incoming OC-48 LOS alarm and its FAULT LED is flashing. Refer to the example in Figure 4.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
21. Instruct the installation maintenance personnel, at node 2, to disconnect the West receive fiber (point 2WR).	—
Prepare to Connect New Fibers	
22. Instruct the installation/maintenance personnel, at node 2, to connect the new West transmit fiber (point 2WT). Refer to the example in Figure 5.	—
23. Instruct the installation/maintenance personnel, at node A, to measure the received optical power level at the new East receive fiber (point AER). Select and install the correct optical LBO—then connect the fiber to the receiver. Verify that the incoming OC-48 alarm and flashing FAULT LED clear after about 1 minute.	—
24. Instruct the installation/maintenance personnel, at node A, to connect the new East transmit fiber (point AET). Refer to the example in Figure 5.	—
25. Instruct the installation/maintenance personnel, at node 2, to measure the received optical power level at the new West receive fiber (point 2WR). Select and install the correct optical LBO—then connect the fiber to the receiver. Verify that the incoming OC-48 alarm and flashing FAULT LED clear after about 1 minute.	—
26. Instruct the installation/maintenance personnel, at node 3, to connect the new East transmit fiber (point 3ET). Refer to the example in Figure 5.	—

DO ITEMS BELOW IN ORDER LISTED		FOR DETAILS, GO TO
27.	Instruct the installation/maintenance personnel, at node C, to measure the received optical power level at the new West receive fiber (point CWR). Select and install the correct optical LBO—then connect the fiber to the receiver. Verify that the incoming OC-48 alarm and flashing FAULT LED clear after about 1 minute.	—
28.	Instruct the installation/maintenance personnel, at node C, to connect the new West transmit fiber (point CWT). Refer to the example in Figure 5.	—
29.	Instruct the installation/maintenance personnel, at node 3, to measure the received optical power level at the new East receive fiber (point 3ER). Select and install the correct optical LBO—then connect the fiber to the receiver. Verify that the incoming OC-48 alarm and flashing FAULT LED clear after about 1 minute.	—
30.	Allow 5 to 10 minutes for the new ring to settle. From the CIT access each of the four nodes where fibers were changed and select CONFIGURATION-Retrieve-Map-Network command to obtain the Network Map Report or select CONFIGURATION-Retrieve-Map Ring command to obtain the Ring Map Report. Verify that the new map contains all the expected nodes.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

**Remove the Forced Switch—MERGE the
Two Rings**

31. From the CIT access each of the four nodes where fibers were changed and select **FAULT-Switch-Line:1W/1E:Reset** command to reset each node. Figure 6 is an example of what the ring should look like after the Protection Switch has been removed. —

 **NOTE:**
Switching hits will occur on service traffic carried through the fibers to be reset.

-
32. This completes the "Merge Two OC-48 Rings" procedure. Additional new services can now be added between all nodes on this new ring. —
-

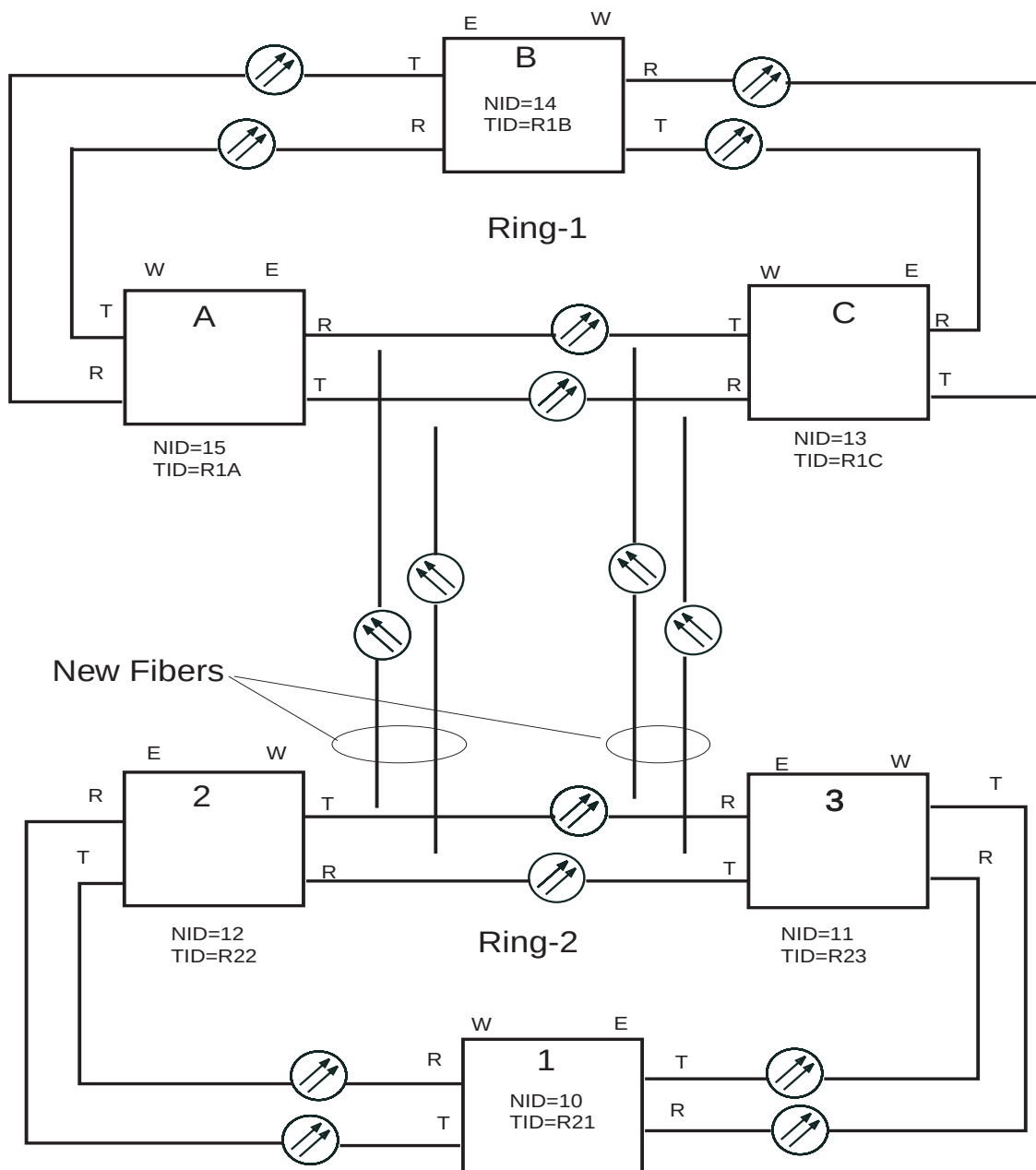


Figure 1 – Example of Two Small Rings—Before Beginning of Merge

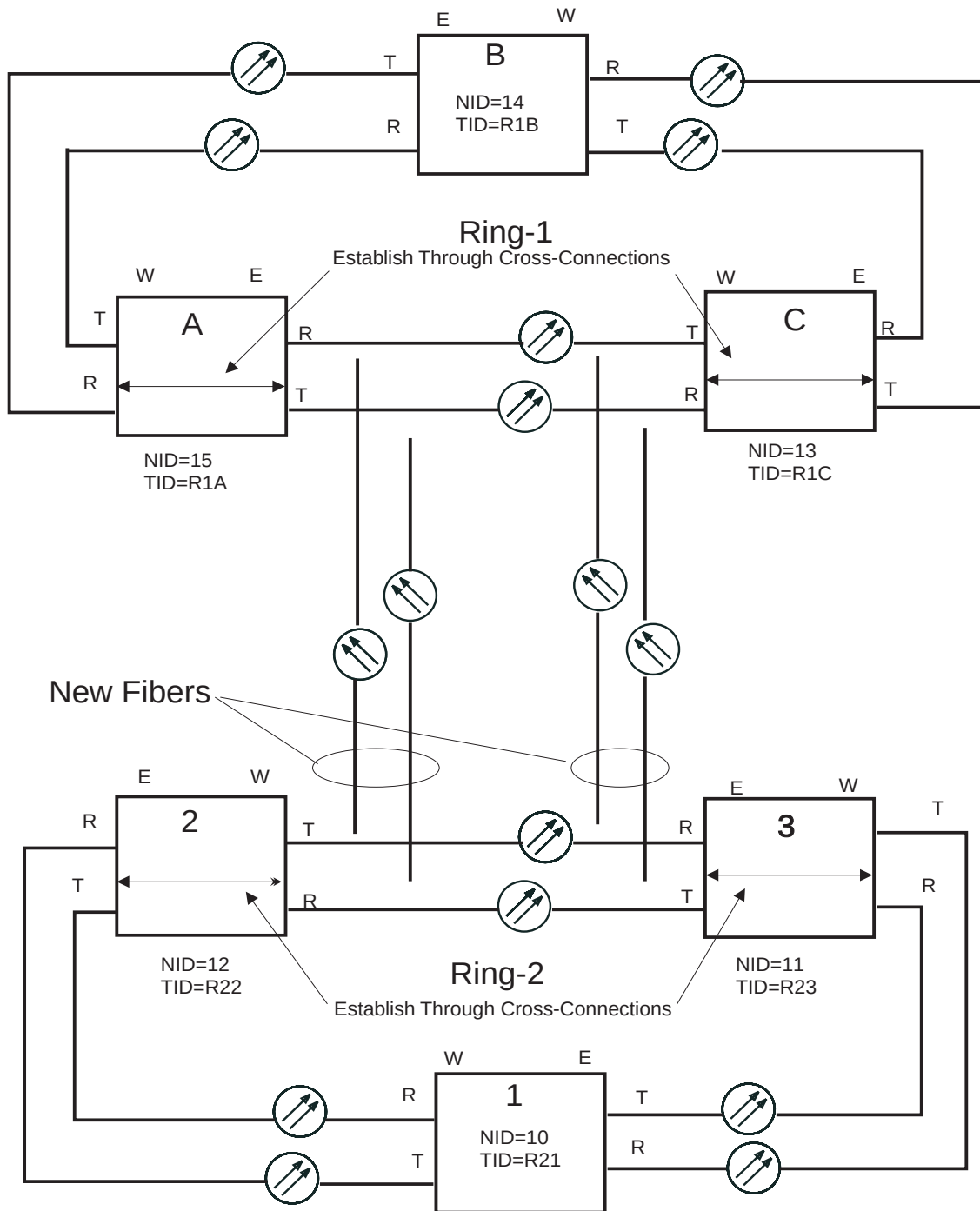


Figure 2 – Example With Through Cross-Connections Provisioned

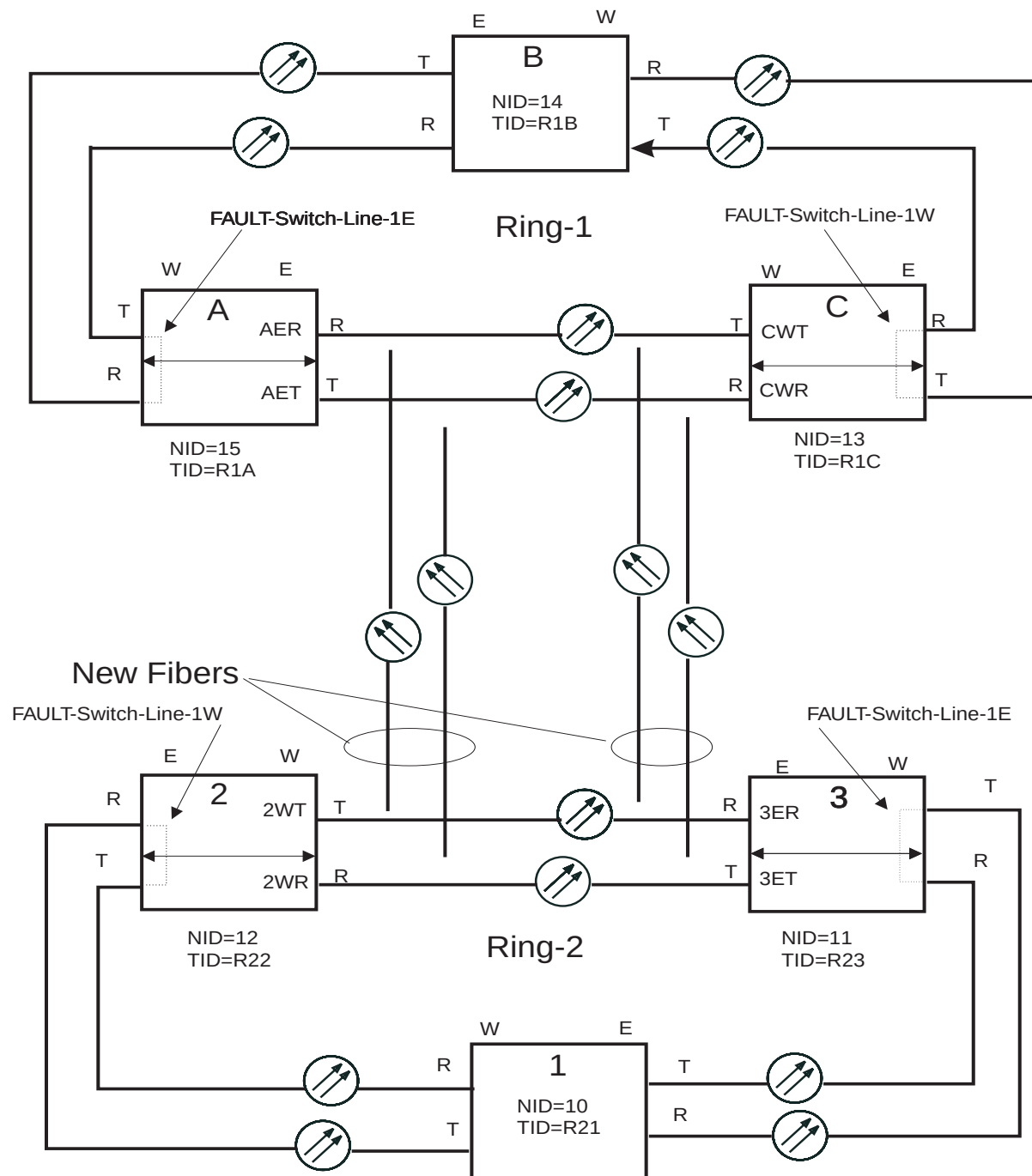


Figure 3 – Example Depicting Four Nodes With Forced Protection Switch

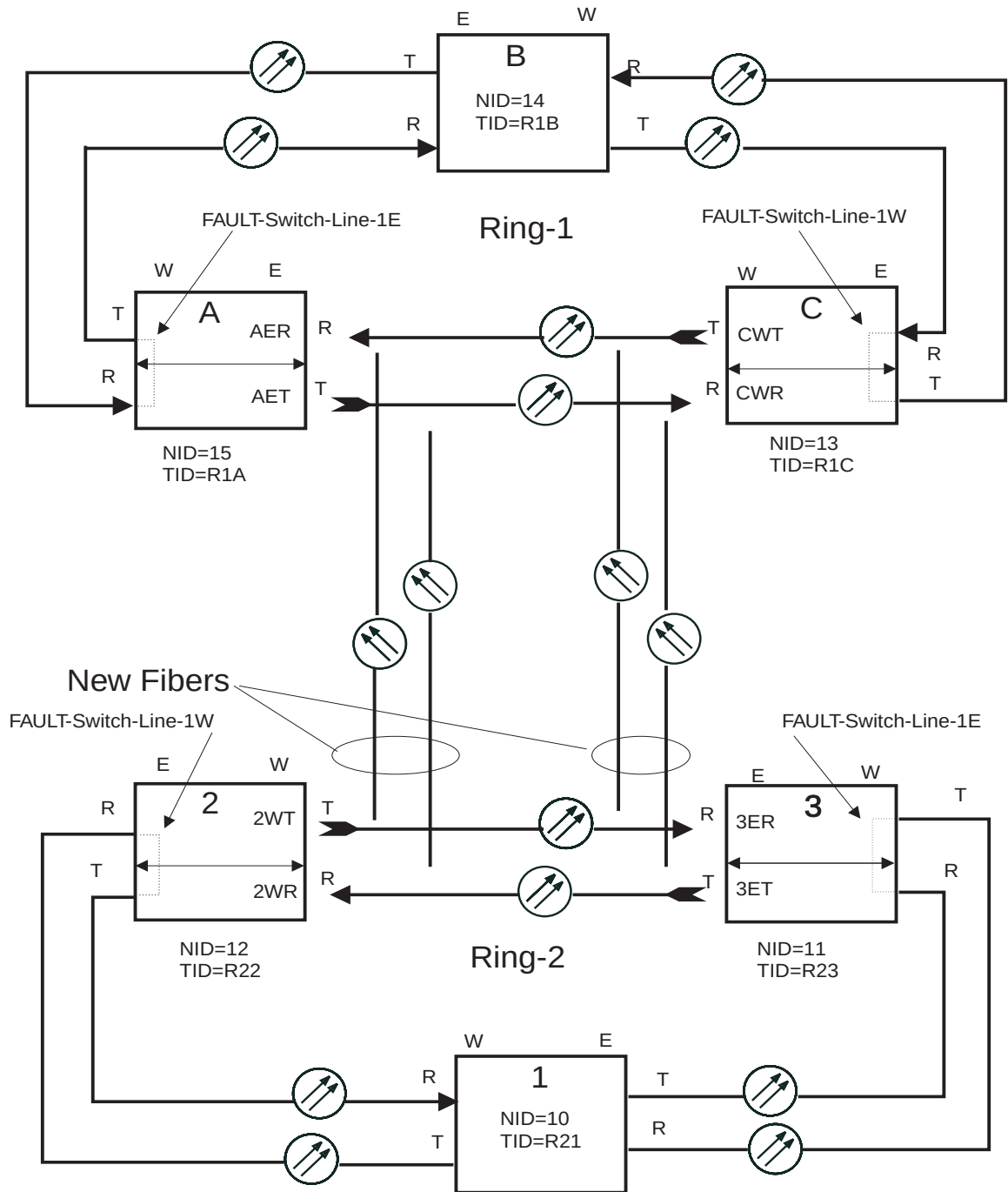


Figure 4 – Example Depicting Rings With Existing Fibers Disconnected

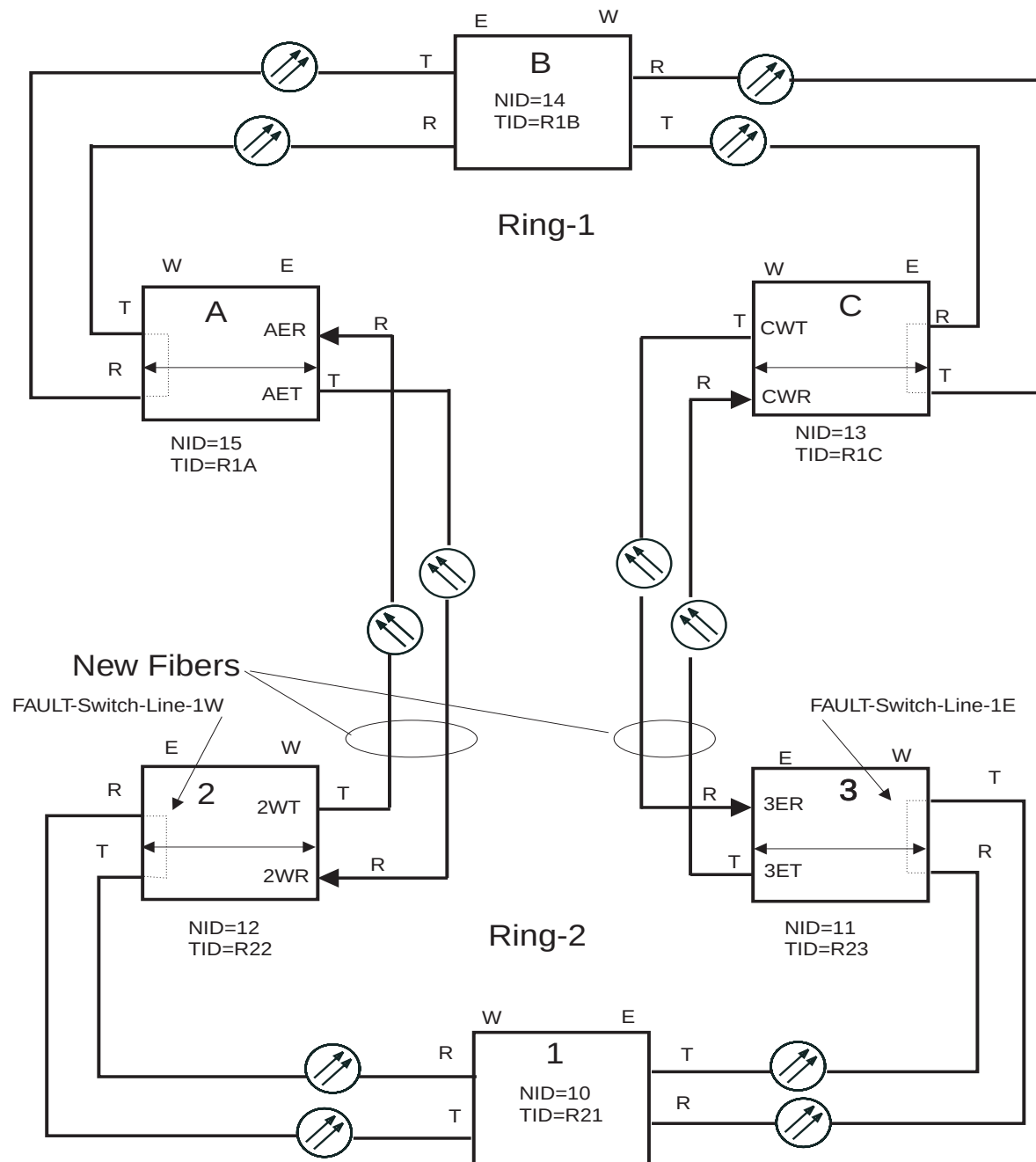


Figure 5 – Example Depicting Ring With New Fibers Connected

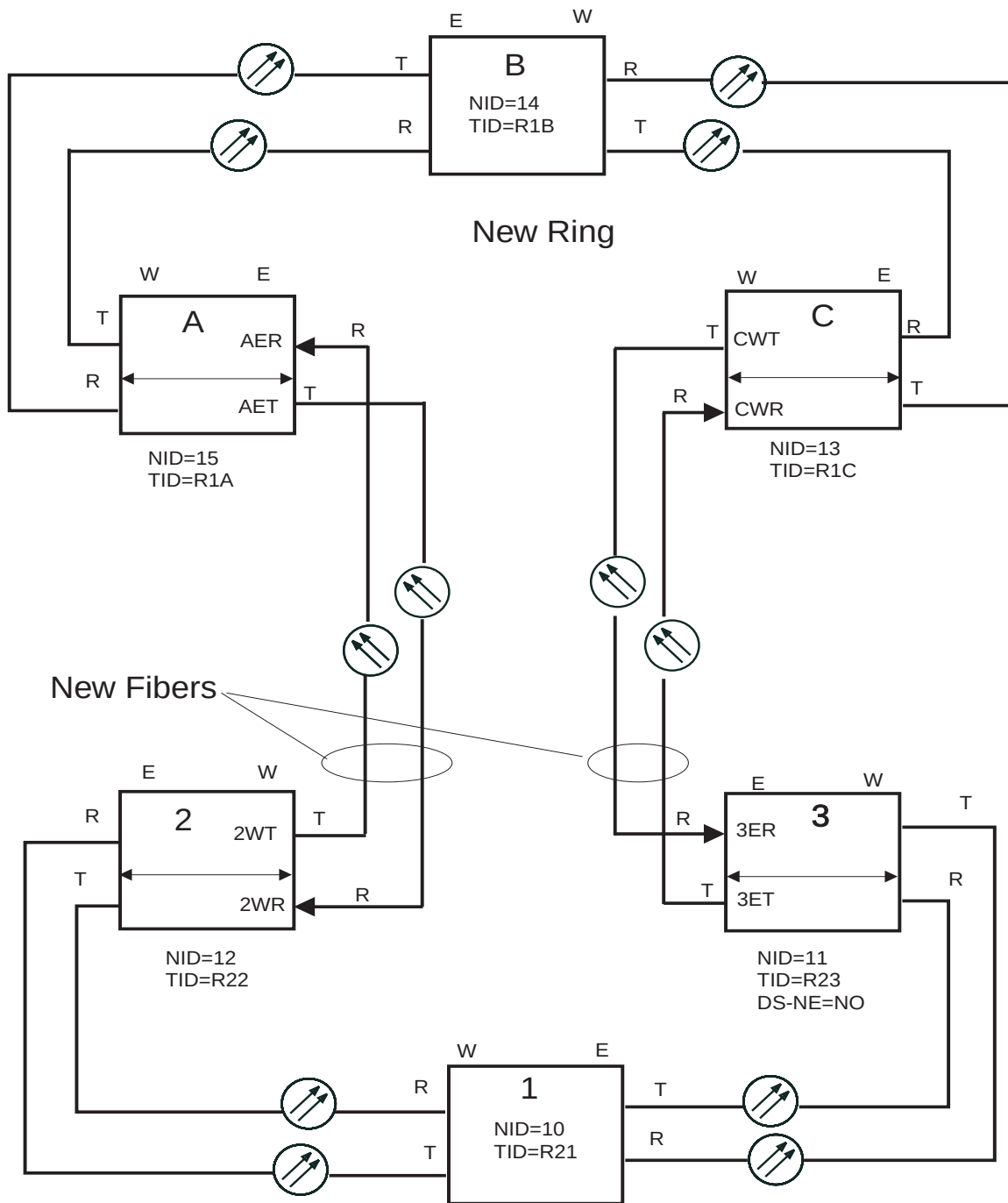


Figure 6 – Example Depicting Ring With Protection Switch Removed

Optical Upgrade From STS-3 to STS-1 Granularity

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO

1. **Overview:** This procedure is used for upgrading an FT-2000 OC-48 ADR ring from STS-3 granular optical packs to STS-1 granular optical packs.

⇒ **NOTE:**
The STS-3 optical packs to be upgraded (replaced) are generally referred to as "2-type". More specifically, these packs contain one of the following designations ___B2, ___C2, or ___J2. The STS-1 optical packs are referred to as "5-type". Similarly, these packs contain **one** of the following designations ___B5, ___C5, or ___J5. Generally, it will be desirable to only replace a B2 with a B5, a C2 with a C5, etc.,.

⇒ **NOTE:**
In order to protect all service, only two nodes in the ring can have their optical circuit packs upgraded at any one time.

⇒ **NOTE:**
The two nodes being upgraded must have their common span "Protection Switched". This will cause a hit on services being carried on the span that is switched. Figure 1 depicts a three node segment of an FT-2000 ADR ring. For reference purposes, this figure is used to support the steps within this procedure.

Required Test Equipment:
Craft Interface Terminal (CIT)
Wrist Strap

3. If required, connect the CIT to the local FT-2000 NE and condition it.	DLP-501
4. Log in to the CIT.	

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
5. In order to take advantage of the STS-1 related features the NE must be loaded with R7.0.1 or later software. If it is necessary to load (upgrade) the software of the ring, the recommendation is to upgrade the software at all NEs within the ring before beginning to upgrade any of the NE's optical packs. As necessary, refer to the "Software Release Description" that accompanies the particular software and to "Operation: NTP-005 " for steps on how to copy software from one NE to another NE.	NTP-005
6. After the software upgrade is completed and the ring is running R7.x or later software, verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9. Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure.	TAP-102
7. Identify the two nodes to be upgraded and assign personnel to be at those two nodes (node A and node B).	—
8. Make sure that the Forced Switch is performed on the proper direction (E or W) at the respective two nodes. From the CIT, access the NEs to be Protection Switched. For node "A" select the FAULT-Switch-Line-1E:Forced command.	—
9. For node "B" select the FAULT-Switch-Line-1W:Forced command.	—

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

- ⇒ **NOTE:**
Switching hits will occur on service carried through the fibers that were "Forced Switched". Also, using Figure 1 as our point of discussion, you should observe the following typical alarms:
 A:ABN line-1E line forced switch at near end
 B:ABN line-1W line forced switch at near end

There may be other alarms at the various nodes during this procedure.

10.	Instruct the personnel at node "_" (e.g., A) to replace the 1E transmitter and 1E receiver with the new "5"-type optical packs.	—
11	Instruct the personnel at node "_" (e.g., B) to replace the 1W transmitter and 1W receiver with the new "5"-type optical packs.	—
11.	Instruct the personnel, at the two subject nodes, to install any optical attenuators that may be required. As necessary, clean and then reconnect the fibers.	—
12.	At the two subject nodes and from the CIT, enter the command CONFIGURATION-Update .	—
13.	Verify that the FAIL LEDs on the receivers at the two subject nodes stop flashing within about one minute after reconnecting the fibers.	—
14.	At node "_" (e.g., A) and from the CIT, enter the command FAULT-Switch-Line:1E:Reset to reset the Forced Switch.	—
15.	At node "_" (e.g., B) and from the CIT, enter the command FAULT-Switch-Line:1W:Reset to reset the Forced Switch.	—

DO ITEMS BELOW IN ORDER LISTED	FOR DETAILS, GO TO
16. Verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure.	TAP-102
17. Are there additional nodes to be upgraded? If NO , then go to Step 19. If YES , then continue.	—
17. As necessary, assign personnel to the next two nodes to be upgraded (e.g., B and C).	—
18. Repeat steps 7 through 17, replacing site A with B and B with C, etc. Repeat these steps until all pairs of nodes around the ring have been completed.	—
19. Now, STS-1 granular add and drop cross-connections can be established to nodes in the ring where STS-1 granular optical packs are installed. This completes the procedure.	—

Operation: NTP-010---+---TAP-102
+---DLP-501

Connect Two FT-2000 Rings via an Optical Link

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO

1. **Overview:** The steps in this procedure detail how to connect two separate FT-Rings via an OC-3/IS-3/OC-12 link.

⇒ NOTE:
For discussion purposes, the two rings are referred to as ring-1 and ring-2. Figure 1 is an example that serves to illustrate ring-1 and ring-2. Both rings must be accessible via a CIT (either dial-up or direct connection). It is assumed that there are enough fibers and that all new fibers have already been tested and installed. Furthermore, it is also assumed that the Low Speed shelf in both rings already has an OC-3/IS-3/OC-12 installed. Should this assumption be incorrect—then refer to Circuit Order NTP-010 and Circuit Order NTP-012.

Engineering Considerations:

- a. It is not necessary that the two separate FT-rings be running the same release of software.
- b. However, in order for DCC communication to functions between the two FT-rings, both rings must be running compatible OSI stack releases. Specifically, both rings must be running R6.0 to R7.2 releases, OR, both rings must be running R8.1 or later releases.
- c. If transport between the two separate rings is all that is desired (and no DCC communication for this OC-3 link is desired)—then there is no restriction that both rings be running compatible OSI stack releases.
- d. Additionally, in order for DCC communication to function between the two FT-rings, it will be necessary to administer one ring as “User” side and the other ring as “Network” side.

Required Test Equipment:

CIT
Wrist Strap

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
Required Personnel: Have installation/maintenance personnel at both (two) nodes where new fibers are to be connected.	
2.	If required, connect the CIT to the local FT-2000 network element and condition it. DLP-501
3.	 NOTE: The CIT user(s) must have a “privileged” security level. Log in to the CIT (on both ring-1 and ring-2) using the expert mode by entering cit expert . —
4.	For ring-1, verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure. TAP-102
5.	For ring-2, verify that there are no active alarms or status conditions by selecting the FAULT-Retrieve-Alarms (and Status):All or by pressing function key F9 . Review the Active Alarms and Status Report and clear any conditions before continuing with this procedure. TAP-102
Connect New Fibers DLP-503	
6.	Instruct the installation/maintenance personnel, at ring-2 and node-2, to connect the new transmit fiber. Refer to the example in Figure 2. —

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
7. Instruct the installation/maintenance personnel, at ring-1 and node A, to measure the received optical power level. Select and install the correct optical LBO on the receiver input—then connect the fiber to the LBO. Verify that the incoming OC-3/IS-3/OC-12 alarm and flashing FAULT LED clear after about 1 minute.	DLP-512
8. Instruct the installation/maintenance personnel, at ring-1 and node A, to connect the new transmit fiber. Refer to the example in Figure 3.	—
9. Instruct the installation/maintenance personnel, at ring-2 and node 2, to measure the received optical power level at the new receive fiber. Select and install the correct optical LBO on the receiver—then connect the fiber to the LBO. Verify that the incoming OC-3/IS-3/OC-12 alarm and flashing FAULT LED clear after about 1 minute.	—
 NOTE: This completes the physical connections. Figure 4 depicts what the network should now look like.	
10. Repeat Steps 2 through 9 for any additional low-speed links that are to be connected.	—
11. Use the CIT and log into ring-1 and node-A using the expert mode by entering cit expert .	
12. From the work order, identify what cross-connections are required for that particular node—and enter those cross-connections.	DLP-536
13. From the work order, determine whether a DCC assignment is required for that particular node. If so, then and enter the assignment.	DLP-542

DO ITEMS BELOW IN ORDER LISTED FOR DETAILS, GO TO	
14. Use the CIT and log into ring-2 and node-2 using the expert mode by entering cit expert .	—
15. From the work order, identify what cross-connections are required for that particular node. If so, then enter the cross-connections.	DLP-536
16. From the work order, determine whether a DCC assignment is required for that particular node. If so, then enter the assignment.	DLP-542
17. This completes the procedure to connect two FT-rings via OC-3 links.	—

Operation: NTP-011---+---DLP-501

|---TAP-102
|---DLP-503
|---DLP-512
|---DLP-536
|---DLP-542

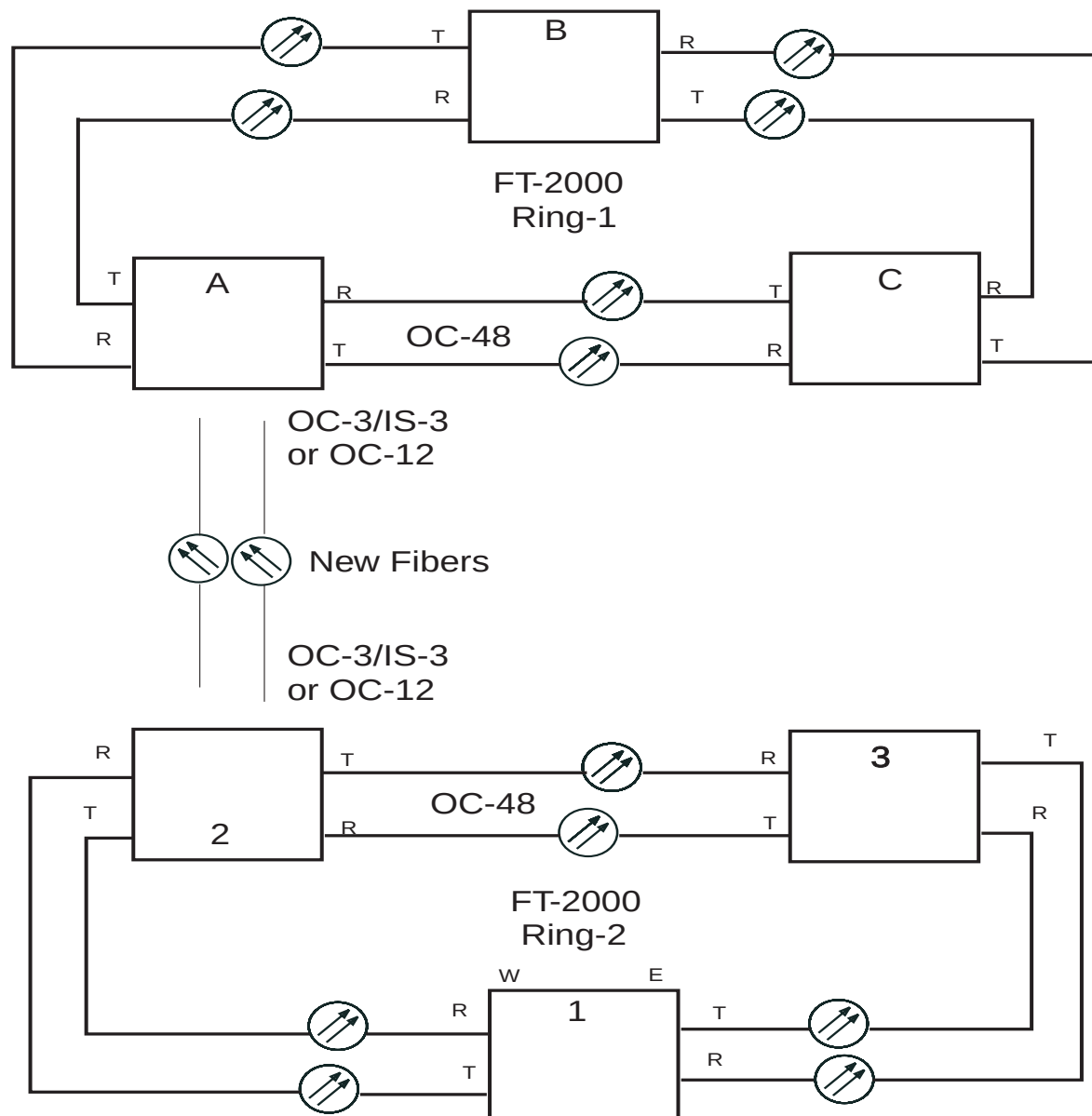


Figure 1 – Example of Two FT-Rings—That are to be Connected via a Low-Speed Optical Link

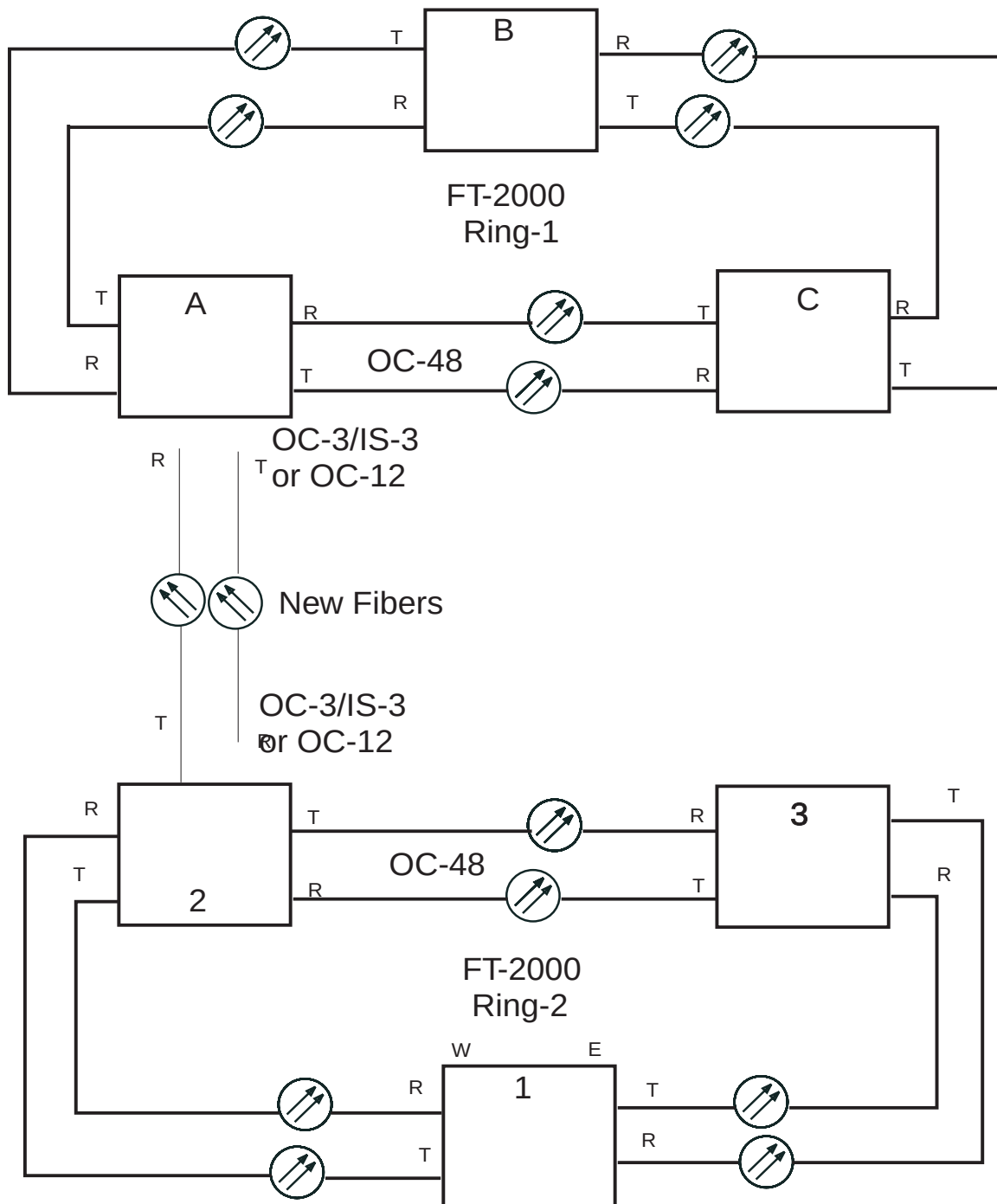


Figure 2 – Example of Connecting First Fiber for LBO Measurement

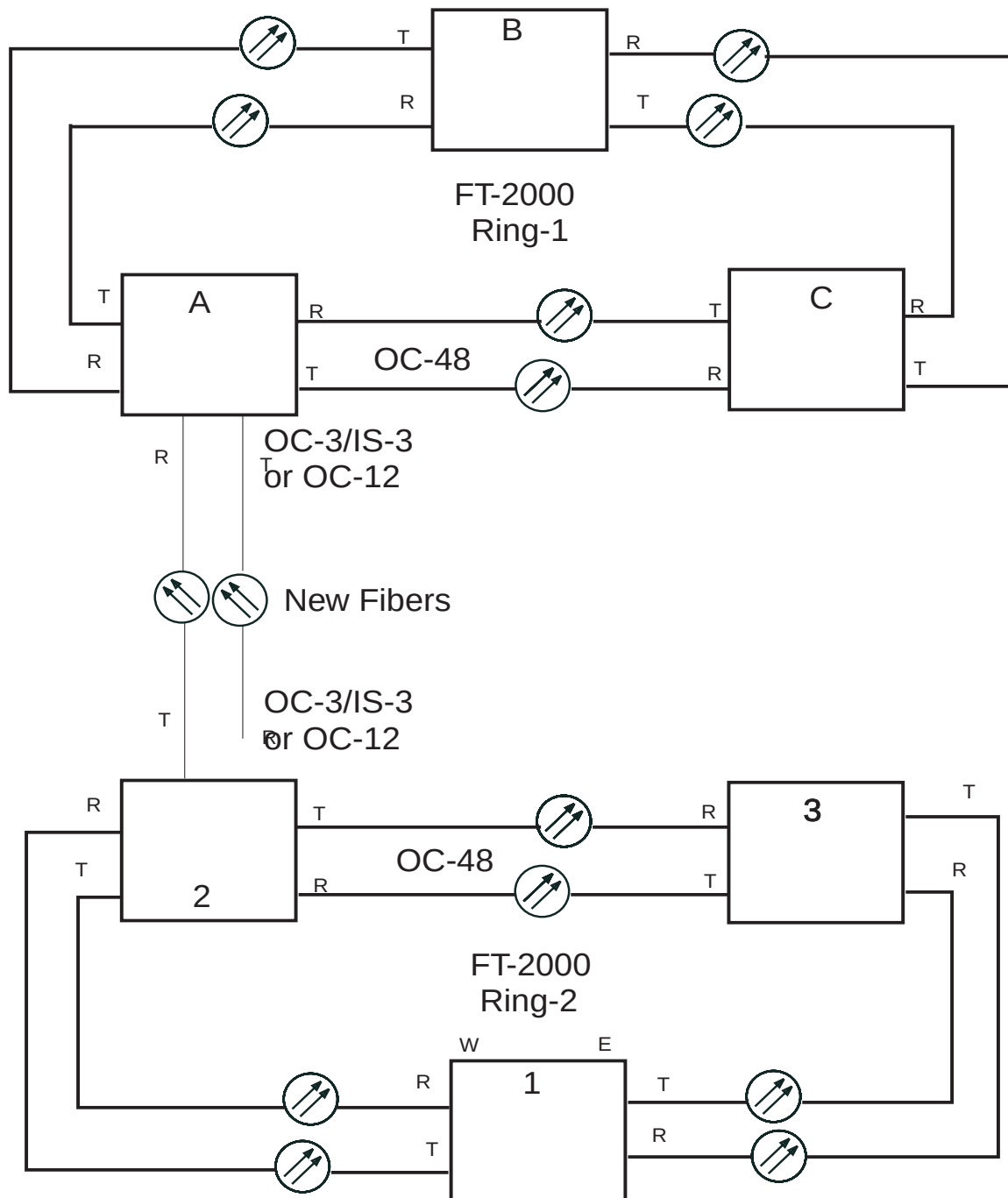


Figure 3 – Example of Connecting Second Fiber for LBO Measurement

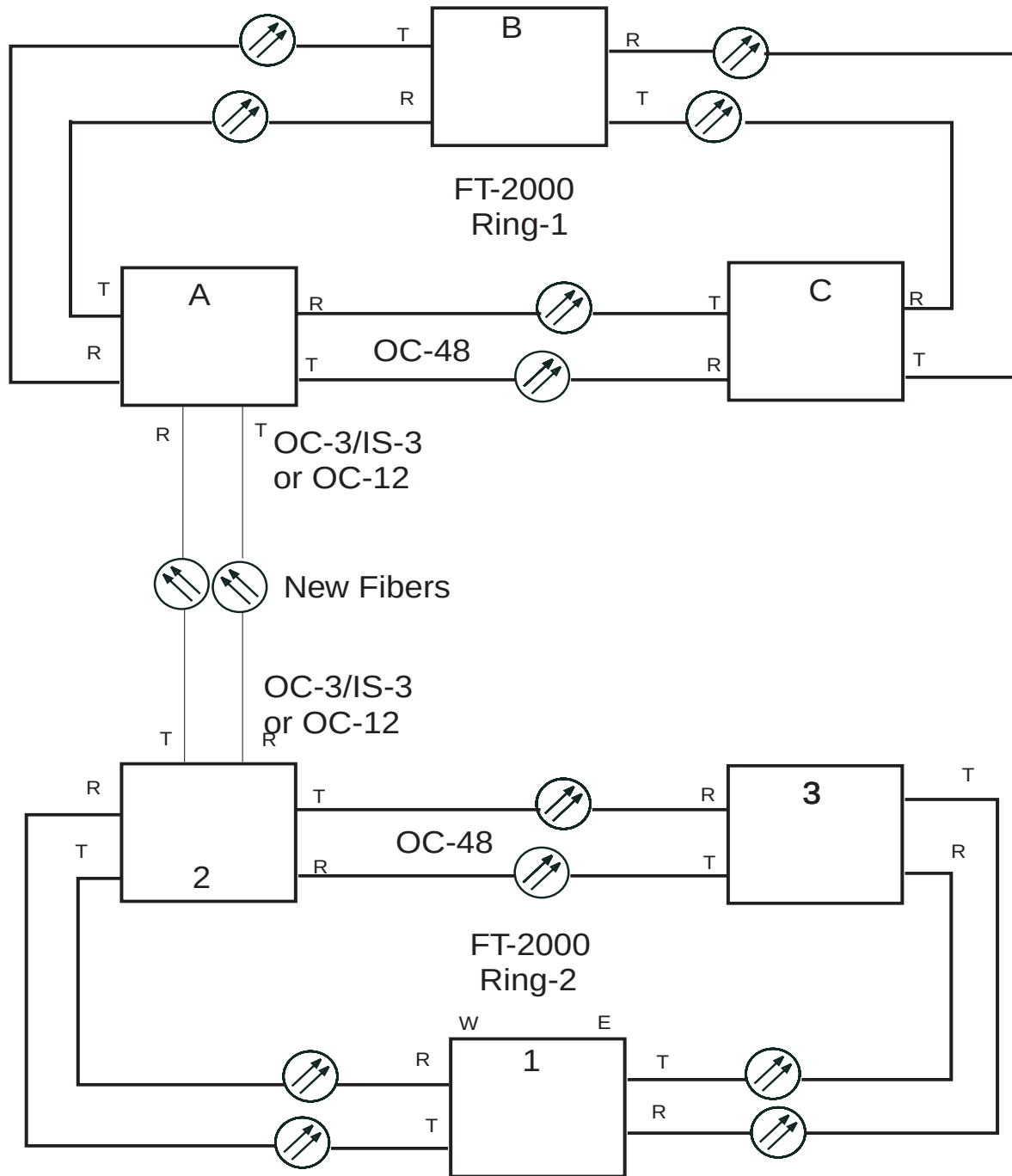


Figure 4 – Example Depicting Two FT-Rings Fully Connected via a Low-Speed Optical Link

Trouble Clearing Task Index

FIND YOUR JOB IN THE LIST BELOW THEN GO TO	
Clear Local Office Alarm When NE ACTY and FE ACTY LEDs Are Off.	TAP-136
Clear NE ACTY and/or FE ACTY (Regardless of Alarm Level)	TAP-103
Clear Suspected Failure in FT-2000 Network Via Remote Modem (or <i>Datakit</i> [®] Network) Connection	TAP-155
Clear Trouble in CIT (CIT Does Not Respond to Commands).....	TAP-128
Clear Trouble Report (of Bad Outgoing Signals From Local Network Element)	TAP-104
Maintenance Philosophy.....	TAD-100
Restore Network Element Operation After Power Loss.....	TAP-171

Maintenance Philosophy

Overview: The maintenance philosophy is built on gathering FT-2000 OC-48 Lightwave System information at two levels. The first maintenance level is a local visual inspection of the user panel (and the circuit pack LEDs when the cover is removed.) Most internal hardware problems can be detected and corrected at this level. The second maintenance level requires a craft interface terminal (CIT) to obtain detailed information on the FT-2000 network elements. The CIT retrieves detailed reports about performance monitoring, alarms and status, and configurations for the local and remote FT-2000 network elements. Performance monitoring is not accessible at the FT-2000 repeater bay/shelf.

Trouble Analysis Procedures

The trouble analysis procedures in this document involve replacing faulty circuit packs and obtaining performance reports and/or alarm and status reports for analysis to determine the status of the FT-2000 System. If a trouble cannot be corrected, the procedures direct the technician to obtain help. This means that the trouble is of a nature that requires local maintenance engineering or a higher level technical assistance.

RTAC Assistance

The technician must make the decision regarding trouble analysis, corrective action, and obtaining assistance. The technician and the local technical support staff may choose to continue trouble analysis based on their knowledge or experience on the FT-2000 System, or they may elect to obtain assistance by calling the Regional Technical Assistance Center **1-800-225-RTAC** in accordance with local procedures.

COACH Assistance

Various customer computer-support tools are on-line and available via COACH. A login identification and password must be obtained to gain access to the COACH tools. The tools consist of a diagnostic dictionary, compatibility data, news and bulletin, and a COACH user's guide. Only the first three tools are mentioned here. Contact your regional account executive for information on obtaining a COACH login.

Diagnostic Dictionary

The Diagnostic Dictionary tool gives the user access to previously detected symptoms, problems, temporary fixes, cautions, and solutions. These may be usable in diagnosing, correcting, or avoiding an FT-2000 System problem.

Compatibility Data

The Compatibility Data tool gives the user access to hardware configuration data that is compatible to a user-specified software generic.

News and Bulletin

The News and Bulletin tool allows the user to process News and Bulletin information. News consists of messages that may be of general interest to the user. Bulletins contain information of a more urgent nature.

Circuit Pack Failures

Circuit pack failures are identified by LEDs and reported by FT-2000 network alarms and reports.

Circuit packs are replaced in a specified sequence, but only one circuit pack is replaced at a time. If trouble is not cleared after replacing a circuit pack, the original circuit pack should be reinstalled. This reduces the chances of returning nondefective circuit packs for repair.

Electrostatic Discharge (ESD) Considerations

Any integrated circuit on a circuit pack can be damaged by static electricity that builds up within a work area, particularly in areas with low relative humidity. This static buildup on work surfaces and on personnel and their clothing is produced by the various charging effects of even simple movements and by contact between various objects.

As a rule, the greatest potential for electrostatic damage occurs in areas with the lowest relative humidity. But, because such damage can occur anywhere, all personnel handling circuit packs should take the following precautions:

1. Since materials such as food wrappers, plastics, and Styrofoam containers tend to generate static electricity, keep them away from all circuit packs.
2. Be sure to read all warning labels on bags and cartons before opening any packaging.

3. If possible, open all circuit packs at a static-safe work position using properly grounded wrist straps and table mats that can dissipate static electricity.
4. Whenever possible, wait to remove circuit packs from their protective antistatic packaging until it is time to insert them into a shelf.
5. Never touch a circuit pack's components, conductors, or connector pins. Handle all circuit packs only by the faceplate or latch or by the top and bottom outermost edges.
6. When handling circuit packs (storing, installing, removing, etc.) or when working on backplanes, always wear a grounded wrist strap or wear a heel strap and stand on a grounded, static-dissipating floor mat.
7. Always store and transport circuit packs in static-safe packages. (Shielding is not required unless specified.)
8. When removing a circuit pack from the shelf, immediately put it into a static-safe package.
9. Try to keep relative humidity above 20 percent.
10. FT-2000 network elements are equipped with grounding jacks for connecting the static ground wrist strap. The jacks are located on the user panel and on the filter panel.
11. Keep the electromagnetic interference (EMI)/ESD protective front shelf covers closed at all times. Close the cover immediately after a maintenance procedure such as replacing a circuit pack.

Clear Local Trouble When 'USE CIT' LED Is Off

Overview: This procedure is used to replace a circuit pack with a lighted **FAULT** LED at the local FT-2000 network element. Alternatively, the craft interface terminal (CIT) may be used in clearing the trouble.



CAUTION:

*Do not remove the SYSCTL circuit pack even if its **FAULT** LED is lighted because the provisioning data (current values) could be lost. Current values were provisioned with the **Set** command.*

1. Are you using the CIT to clear trouble?
If **NO**, then continue with Step 2.
If **YES**, then go to **TAP-102**.
2. Momentarily depress and release the **ACO/LOCTR** push-button on the user panel to silence any audible alarms.
3. Does the **LINE LOCTR** display in the user panel show a line (**1** or **P**) or a shelf (**H** or **L**)?
If **LINE (1 or P)**, then continue with Step 4.
If **SHELF (H or L)**, then continue with Step 5.
4. Depress and hold the **ACO/LOCTR** push-button. The **LINE LOCTR** display will indicate the shelf with the failed circuit pack. The shelf is associated with an OC-48 line and its direction is visually indicated by a lighted **E** (East) or **W** (West) LED.



NOTE:

An **H** indicates a High Speed Shelf or Enhanced High Speed Shelf at the bottom of the bay. An **L** indicates a Low Speed Shelf - System Controller or Low Speed Shelf - Complementary in the middle of the bay.

5. Remove the cover on the shelf just identified.
Reference: **DLP-511**
6. Is one and only one **FAULT** LED continuously lighted?
If **YES**, then continue with Step 7.
If **NO**, then go to **TAP-108**.

7. Is the **FAULT** LED lighted on either the SYSCTL or SYSMEM circuit pack?

If **YES**, then go to **TAP-102**.

If **NO**, then continue with Step 8.



NOTE:

A series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.

8. Obtain a replacement circuit pack with the same or a higher series number and install it in place of the circuit pack with the lighted **FAULT** LED. As required, make the appropriate optical connections on the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit pack(s).

Reference: **DLP-514**

9. Wait for the time indicated in Table A.

Table A - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted due to software provisioning.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes.

10. Is the **FAULT** LED off on the circuit pack just replaced?

If **YES**, then continue with Step 11.

If **NO**, then go to **TAP-116**.

11. Replace the shelf cover.

Reference: **DLP-511**

12. Are all LEDs off at the user panel except the **PWR ON** LED?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

If **NO**, then go to **Trouble Clearing: IXL-001**.

Clear Local Trouble When 'USE CIT' LED Is Lighted

Overview: This procedure is used to clear the conditions listed in the Active Alarms and Status Report in the order listed, from top to bottom, regardless of the indicated alarm severity, date, or time. The craft interface terminal (CIT) is required for this procedure.

1. Is the CIT conditioned and connected to the FT-2000 network element?
If **YES**, then continue with Step 2.
If **NO**, then complete **DLP-501** and return to this procedure.
2. At the CIT, select **FAULT-Retrieve-Alarm (and Status):All** to obtain an Active Alarms and Status Report.

➡ **NOTE:**
The report shown below is an example that shows several entries. There may be only one entry in the actual report.

3. Record the information in the Source Address and the Description columns for the topmost entry in the Active Alarms and Status Report.

```
Lucent Technologies FT-2000 97-11-01 23:15:15 EST
M Retrieve-Alarm:All: COMPLD
/* Active Alarms and Status Report
=====
Alarm      Source      Date   Time   Srv    Description
Level      Address      Detected
=====
CR         ls-1-1a      05-19  23:15:41SA  DS3 INTFC removed
-----
ABN        tg-1-2       05-19  23:15:42nsa  sync reference manual switch
ABN        tg-1-2       05-19  23:15:42nsa  sync reference lockout
-----
NE ACTY    line-1       05-19  23:15:42nsa  line auto switch
NE ACTY    line-1-p1    05-19  23:15:42nsa  path AIS
*/
```

4. Was "env - (1-16)", the Source Address recorded in Step 3?

If **YES**, then go to **TAP-107**.

If **NO**, then continue with Step 5.

5. Find the Description information that was recorded in Step 3 in Table A and go to the referenced TAP.

Table A - Trouble Conditions

Description	Go To TAP
APS channel failure	TAP-105
APS provisioning conflict	TAP-150
circuit audit suspended	TAP-161
circuit provisioning error	TAP-162
CKP Serial EPROM corrupted	TAP-177
clock out of range	TAP-134
CP reset in progress	TAP-151
CP (unknown type) failure	TAP-123
CP (unknown type) removed	TAP-148
CPYPGM:IP tid	TAP-159
Cross-connect equipment conflict	TAP-176
DCC start-up in progress	TAP-129
DRI auto switch	TAP-149
DRI manual switch	TAP-149
DS3 INTFC failure	TAP-111
DS3 INTFC removed	TAP-112
DS3 loopback	TAP-114
DS3 path unequipped	TAP-156
duplicate node id defined	TAP-138
duplicate TID defined	TAP-138
EC1 loopback	TAP-114
excessive holdover	TAP-117
extra traffic preempted	TAP-143
fan failure	TAP-118

Table A - Trouble Conditions (Contd)

Description	Go To TAP
FT-LBA fan failure	TAP-157
FT-LBA fuse/power failure	TAP-157
FT-LBA 1EW failure	TAP-157
FT-LBA 1WE failure	TAP-157
fuse/power failure (A,B)	TAP-119
inc. (from DS1) sync ref fail	TAP-110
inc. (from OC3) DCC failure	TAP-169
inc. (from OC12) DCC failure	TAP-169
inc. (from OC48) DCC failure	TAP-120
inc. (from OC48) path RFI/yellow	TAP-122
inc. (from OC48) sync ref fail	TAP-152
inc. (from STSX) line RFI/yellow	TAP-122
incoming DCC failure	TAP-120
incoming (from DSX) DS3 LOS	TAP-110
incoming (from DSX) DS3 SD	TAP-110
incoming (from OC3) STS LOP	TAP-110
incoming (from OC12) STS LOP	TAP-110
incoming OC3 AIS	TAP-110
incoming OC12 AIS	TAP-110
incoming OC3 APS byte fail	TAP-160
incoming OC12 APS byte fail	TAP-160
incoming OC3 LOF	TAP-110
incoming OC3 LOS	TAP-110
incoming OC3 SD	TAP-110
incoming OC3 SF	TAP-110
incoming OC3 line RFI/yellow	TAP-122

Continued on next page

Table A - Trouble Conditions (Contd)

Description	Go To TAP
incoming OC12 LOS	TAP-110
incoming (from OC-48) DS3 AIS	TAP-109
incoming (from OC-48) DS3 LOF	TAP-122
incoming (from OC48) path AIS	TAP-110
incoming (from OC48) STS LOP	TAP-174
incoming (from STSX1) EC1 LOF	TAP-110
incoming (from STSX1) EC1 LOP	TAP-110
incoming (from STSX1) EC1 LOS	TAP-110
incoming (from STSX1) EC1 SD	TAP-110
incoming (from STSX1) line AIS	TAP-110
incoming OC-48 AIS	TAP-110
incoming OC-48 APS byte fail	TAP-132
incoming OC-48 APS default byte	TAP-168
incoming OC48 B1 parity error	TAP-147
incoming OC-48 invalid F byte	TAP-145
incoming OC-48 line RFI/yellow	TAP-121
incoming OC-48 LOF	TAP-110
incoming OC-48 LOS	TAP-110
incoming OC-48 LOS/LOF	TAP-147
incoming OC-48 SD	TAP-110
incoming OC-48 SF	TAP-110
incoming sync ref failure	TAP-110
inhibit alarms-office alarms	TAP-114
inhibit alarms-X.25	TAP-114
laser bias current-out-of-range	TAP-135

Continued on next page

Table A - Trouble Conditions (Contd)

Description	Go To TAP
LCLAN failure	TAP-175
line auto switch	TAP-115
line FERF	TAP-121
line forced switch	TAP-114
line forced switch at far end	TAP-114
line forced switch at near end	TAP-114
line lockout	TAP-114
line lockout at far end	TAP-114
line lockout at near end	TAP-114
line manual switch	TAP-114
line manual switch at far end	TAP-114
line manual switch at near end	TAP-114
line switch inhibit	TAP-114
line switch inhibit - far end	TAP-114
line switch inhibit - near end	TAP-114
line TCA	TAP-144
LNCTL failure	TAP-111
LNCTL removed	TAP-112
logins inhibited	TAP-114
LS auto switch	TAP-115
LS forced switch	TAP-114
LS lockout	TAP-114
LS loopback	TAP-114
LS manual switch	TAP-114
LSSW failure	TAP-111
LSSW removed	TAP-112

Continued on next page

Table A - Trouble Conditions (Contd)

Description	Go To TAP
NE status comm failure	TAP-172
node ID conflict	TAP-140
non-preemptible protn access	TAP-114
OC3 auto switch at far end	TAP-115
OC3 auto switch at near end	TAP-115
OC3 forced switch at far end	TAP-114
OC3 forced switch at near end	TAP-114
OC3 INTFC failure	TAP-111
OC3 INTFC removed	TAP-112
OC3 inhibit at near end	TAP-114
OC3 lockout at far end	TAP-114
OC3 lockout at near end	TAP-114
OC3 loopback (from OC3)	TAP-114
OC3 loopback (from OC48)	TAP-114
OC3 mode conflict (equipment)	TAP-158
OC3 mode conflict (slot pair)	TAP-158
OC3 mode conflict (x-connect)	TAP-158
OC12 auto switch at far end	TAP-115
OC12 auto switch at near end	TAP-115
OC12 forced switch at far end	TAP-114
OC12 forced switch at near end	TAP-114
OC12 INTFC failure	TAP-111
OC12 INTFC removed	TAP-112
OC12 inhibit at near end	TAP-114
OC12 lockout at far end	TAP-114
OC12 lockout at near end	TAP-114
OC12 loopback (from OC48)	TAP-114
OC12 mode conflict (equipment)	TAP-158
OC12 mode conflict (quad pair)	TAP-158
OC12 mode conflict (x-connect)	TAP-158

Continued on next page

Table A - Trouble Conditions (Contd)

Description	Go To TAP
OHCTL failure	TAP-111
OHCTL removed	TAP-112
optical parameter out-of-range	TAP-135
path AIS	TAP-122
path integrity failure	TAP-163
path TCA	TAP-144
path unequipped	TAP-122
path yellow	TAP-122
preemptible protn access	TAP-114
RCVR failure	TAP-111
RCVR removed	TAP-112
receiver parametr-out-of-range	TAP-135
REGENR failure	TAP-111
REGENR removed	TAP-112
repeater bay environment input	TAP-147
repeater bay equipment failure	TAP-147
reset in progress	TAP-124
ring incomplete/open	TAP-141
ring start-up in progress	TAP-142
section TCA	TAP-144
site provisioning conflict	TAP-130
software download in progress	TAP-131
STS1E INTFC failure	TAP-111
STS1E INTFC removed	TAP-112

Continued on next page

Table A - Trouble Conditions (Contd)

Description	Go To TAP
STS1 squelch map conflict	TAP-164
STS3 squelch map conflict	TAP-154
STS1 squelch map inconsistent	TAP-165
STS3 squelch map inconsistent	TAP-165
squelch map conflict	TAP-153
sync mode auto switch	TAP-115
sync mode equipment conflict	TAP-114
sync mode forced switch	TAP-114
sync reference auto switch	TAP-115
sync reference forced switch	TAP-114
sync reference lockout	TAP-114
sync reference manual switch	TAP-114
SYSCTL failure	TAP-113
SYSMEM failure	TAP-113
SYSMEM removed	TAP-133
SYSMEM/SYSCTL code mismatch	TAP-126
SYSMEM unrecognizable code	TAP-125
test alarm in progress	TAP-114
test auto turnup in progress	TAP-114
TG auto switch	TAP-115
TG manual switch	TAP-114
TG warming up	TAP-154
TG3 failure	TAP-111
TG3 removed	TAP-112
TID address map full	TAP-170
TL-1 link failure	TAP-106
TOHCTL failure	TAP-111
TOHCTL removed	TAP-112
traffic squelched	TAP-146
transmit parametr-out-of-range	TAP-135
TRMTR failure	TAP-111

Table A - Trouble Conditions (Contd)

Description	Go To TAP
TRMTR removed	TAP-112
unexpected CP type	TAP-127
x-conn provisioned but not est	TAP-173

Clear NE ACTY and/or FE ACTY (Regardless of Alarm Level)



NOTE:

With Release 8.1 and later releases, alarm status information is NOT passed around the ring nor through the subnetwork—like it was with previous releases. More specifically, a particular NE only knows its own status. For example, if a particular NE has a low-speed facility alarm—it would not cause any **FE ACTY** in the subnetwork. However, the occurrence of a high speed protection switch or line lockout in the ring will cause an associated **FE ACTY** at all NEs in the ring. When using a CIT, it will be necessary to login to each NE in order to determine whether there exists an **NE ACTY** or **FE ACTY**. As a contrast, when using TL1 OS reporting to a centralized maintenance center, the maintenance center can direct local craft to the source of the problem (e.g., the NEs reporting **NE ACTY**).

Overview: This procedure is used to clear one or more conditions indicated by a lighted **NE ACTY** and/or **FE ACTY** LED(s) on the local user panel. (These conditions may or may not be accompanied by an alarm.)

1. This procedure starts with the assumption that you are already either physically located at an NE that displays the NE ACTY/FE ACTY or are already remotely (with the CIT) logged into an NE with an NE ACTY/FE ACTY condition.
2. Are you responsible for maintaining the remote FT-2000 or DDM-2000 network element (NE) as well as the local FT-2000 NE?
If **YES**, then continue with Step 3.
If **NO**, then continue with Step 21.
3. Is the **FE ACTY** LED lighted on the local user panel?
If **YES**, then continue with Step 4.
If **NO**, then continue with Step 19.
4. At the CIT, select **FAULT-Retrieve-Alarms-All** to obtain an Active Alarms and Status Report for that particular NE.
5. Are there any entries in the Active Alarms and Status Report?
If **YES**, then go to **TAP-102** to clear the indicated condition(s).

If **NO**, then continue with Step 6.

⇒ **NOTE:**
There are no active alarm or status conditions in this NE.

6. Either consult office records to determine the TID of other NEs in the ring; or, select **CONFIGURATION-Retrieve-Map-Ring** to identify all NEs in the ring along with each NEs communication status.

⇒ **NOTE:**
It is not possible to login to a Repeater Bay/Shelf.

7. At the CIT, establish a remote login to any one of the other NEs identified from Step 4. Press the CIT function key **F2**, labeled **REMOTE**, and log in to the other FT-2000 NE with the TID identified in Step 4.

⇒ **NOTE:**
You may require assistance at the remote FT-2000 or DDM-2000 NE to replace a circuit pack(s) or to observe LEDs.

8. Were you able to log into the NE?

If **YES**, then continue with Step 9.

If **NO**, then continue with Step 17.

9. At the CIT, select **FAULT-Retrieve-Alarms-All** to obtain the Active Alarms and Status Report for that particular NE.

10. Are there any entries in the Active Alarms and Status Report?

If **YES**, then go to **TAP-102** to clear the indicated condition(s).

If **NO**, then continue with Step 11.

11. Repeat Steps 7 through 10 for each of the remaining NEs identified in Step 7.

12. At this point any problem(s) associated with any/all NEs, except repeaters, will have already been corrected. Does the ring contain a Repeater Bay/Shelf?

If **YES**, and if locally determined necessary, you should issue a Trouble Report about the FT-2000 Repeater Bay/Shelf location with the indicated *Source Address*. If not necessary continue with Step 13.

If **NO**, continue with Step 13.

13. Does the FT-2000 ring support a DDM-2000 subnetwork?

If **Yes**, continue with Step 14.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

14. Obtain the appropriate reference DDM-2000 User/Service Manual as follows:

363-206-285 for DDM-2000 OC3 for Release 13 and Higher

363-206-295 for DDM-2000 OC12 for Release 7 and Higher

15. Locate the appropriate task to be cleared from the trouble clearing index (IXL) of the User/Service Manual based on the alarm level obtained from the report in Step 5.

Nice to Know: The IXL lists tasks according to alarm level as follows:

System Alarm	DDM-2000 OC3	DDM-2000 OC12/OC12 Regenerator
CR	Tap-101	Tap-101
MJ	Tap-102	Tap-102
MN	Tap-112	Tap-112

16. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

17. You should issue a Trouble Report to the remote FT-2000.

18. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

19. Is the **NE ACTY** LED lighted on the user panel?

If **YES**, then continue with Step 20.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

20. The trouble to be cleared is at the **local FT-2000 NE**. Is the **USE CIT** LED lighted on the local user panel?

If **YES**, then go to **TAP-102**.

If **NO**, then go to **TAP-101**.

21. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear Trouble Report

Overview: This procedure is used to clear a trouble report that was received from a remote location. The remote location is receiving a bad signal or other condition from this local FT-2000 network element.

1. Is the **NE ACTY** LED lighted on the user panel?

If **YES**, then continue with Step 2.

If **NO**, then continue with Step 3.

2. Is the **USE CIT** LED lighted?

If **NO**, then go to **TAP-101**.

If **YES**, then go to **TAP-102**.

3. Is a local CIT available for use?

If **YES**, then continue with Step 4.

If **NO**, then continue with Step 13



NOTE:

An outgoing OC3 DCC failure can be caused by a DCC assignment to an LS INTFC slot that does not contain a good OC3 circuit pack.

4. At the CIT, select **CONFIGURATION-Retrieve-Assignment-DCC** command to determine the LS INTFC slot associated with each existing DCC assignment.
5. At the CIT, select **CONFIGURATION-Retrieve-Equipment** command to determine whether or not each LS INTFC slot identified in Step 4 contains a good OC3 circuit pack.
6. Does any LS INTFC slot(s) with an existing DCC assignment **NOT** contain a good OC3 circuit pack.

If **YES**, then continue with Step 7.
If **NO**, then continue with Step 9.

7. **Either** install an OC3 circuit pack in the slot(s) identified in Step 6 or use the **CONFIGURATION-Delete-Assignment-DCC** command to delete the DCC assignment(s) to that slot(s).
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
9. Test the LEDs at the local user panel as follows: At the CIT, select **FAULT-Test-LED** and **User Panel**, then execute.
10. Did all the LEDs on the user panel light?
If **YES**, then continue with Step 11.
If **NO**, then go to **TAP-108**.
11. Obtain an Active Alarms and Status Report as follows: At the CIT, select **FAULT-Retrieve-Alarm**, then **ALL** for alarm levels.
12. Are any alarm or status conditions indicated on the report?
If **YES**, then go to **TAP-102**.
If **NO**, then continue with Step 13.
13. Make a visual inspection of the outgoing cable(s) and connection(s) and correct any problem(s) found.
Reference: **DLP-528**
14. Was any problem(s) found with the outgoing cable(s) or connection(s).
If **YES**, then continue with Step 15.
If **NO**, then return a NO TROUBLE FOUND conclusion to the report (no active local alarms or visual problems).

⇒ **NOTE:**
OC-48 and/or OC-3 optical lines can be tested by using optical line meters and/or optical time domain reflectometers (OTDR) to help locate a fiber bend or cut. Refer to local operating procedures for further guidance in addressing this condition.

15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `APS Channel Failure'

Overview: An `APS channel failure' cannot be cleared by itself. It is always associated with one or more other failures at the local FT-2000 network element or at a remote FT-2000 network element. This procedure provides instructions to identify and clear the associated failure or failures.

1. Look for the associated failure or failures in the near end Active Alarm and Status Report. The only possibilities are:
 - Incoming protection line failure such as:
 - incoming OC-48/OC-12/OC-3 AIS
 - incoming OC-48/OC-12/OC-3 LOF
 - incoming OC-48/OC-12/OC-3 LOS
 - incoming OC-48/OC-12/OC-3 SF
 - incoming OC-48/OC-12/OC-3 SD.
 - RCVR failure or RCVR removed
 - TRMTR failure or TRMTR removed
 - Controller failure or controller removed such as:
 - OHCTL failure
 - OHCTL removed
 - LNCTL failure
 - LNCTL removed.
2. Did you find **only one**, **more than one**, or **none** of the associated failures listed in Step 1 in the report?
 - If **more than one**, then continue with Step 3.
 - If **only one**, then continue with Step 5.
 - If **none**, then the trouble is not in the local FT-2000 network element but may be the OC-48/OC-12/OC-3 optical line. Initiate a Trouble Report to the remote FT-2000 network element.

3. Referring only to the topmost failure from the Active Alarm and Status Report identified in Step 1, find this failure in Table A of **TAP-102** and go to the referenced TAP.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
5. Find the identified failure from Step 1, then locate this condition in Table A of **TAP-102** and go to the referenced TAP.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address 'TL-1 Link Failure'

1. Does the Active Alarms and Status Report show a controller failure (LNCTL, OHCTL, or SYSCTL circuit pack)?
 If **YES**, then go to **TAP-102**.
 If **NO**, then continue with Step 2.
2. Initiate a Trouble Report to the responsible Operations System stating an incoming TL1 link failure has been detected on this network.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address Environmental Input Condition

1. Does the **Description(s)** associated with the "**env-(1-16)**" **Source Address** begin with the string **FT-LBA**?
 - If **YES**, then refer to the LBA maintenance documentation to clear the trouble condition.
 - If **NO**, then continue with Step 2.
2. Consult and follow the local maintenance procedures to clear the indicated environmental condition. This condition may be cleared by something as simple as closing a door and completing a contact closure or the resetting of a relay switch, thus clearing the condition. The environmental condition is external to the FT-2000 network element.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address Missing or Incorrect Response

Overview: You were sent here from another procedure because the FT-2000 Network Element responded in an unexpected manner. This unexpected response was a missing or incorrect LED indication or CIT message.

⇒ **NOTE:**
If duplicate Site/NE numbers are provisioned on DDM-2000 systems, an FT-2000 in the same network may reset continuously if DCC is enabled. Be sure each DDM-2000 in the network is assigned a unique Site/NE number.

1. Review, and keep in mind, the unexpected response that sent you to this TAP.
2. Was the unexpected response from an LED or from the CIT?
If from an **LED**, then continue with Step 3.
If from the **CIT**, then continue with Step 9.
3. At the CIT, select **FAULT - Test - LED** and execute.
Response: All LEDs are lighted for 10 seconds, off for 10 seconds, then they return to their normal condition.
4. Did the LED(s) of interest operate as indicated above?
If **YES**, then continue with Step 5.
If **NO**, then continue with Step 14.

⇒ **NOTE:**
The LED operation appears to be normal.

⇒ **NOTE:**
If an Active Alarms and Status Report (use **FAULT - Retrieve - Alarms**) shows **OHCTL failure** for both 1E and 1W **and** if neither LED is lighted at the OHCTL circuit packs (1E and 1W), **then** the problem appears to be the TOHCTL circuit pack.

5. Replace the TOHCTL circuit pack.
Reference: **DLP-514**

6. Is the same unexpected response still observed?

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then continue with Step 7.

7. Return to the procedure that sent you here. If the same unexpected response is observed again, contact the appropriate maintenance support organization for further technical assistance.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
9. At the CIT, select **FAULT-Retrieve-Alarms** and execute. Resolve any other alarms or conditions (abnormal conditions included) present before continuing.



NOTE:

Performing a reset in the presence of certain other alarms and conditions may compound the problem and make resolution of the problem more difficult.

10. At the CIT, select **FAULT-Reset** and execute.
11. Wait 15 minutes for the Reset to complete. During this time the lighting of LEDs and clicking of relays will be observed.
12. Return to the procedure that sent you here. If the same unexpected response is observed again, contact the appropriate maintenance support organization for further technical assistance.
13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
14. Replace the circuit pack, user panel, or filter panel containing the LED(s) that did not operate as indicated in Step 4.
- Reference: For Circuit Packs: DLP-514
For Panels: Drawing ED-6G994-30 (E-Bay)
For Panels: Drawing ED-7G001-33 (D-Bay)
15. Return to the procedure that sent you here. If the same unexpected response is observed again, contact the appropriate maintenance support organization for further technical assistance.
16. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address `Incoming (from OC-48) DS3 AIS'

1. Consult and follow the local maintenance procedures for addressing an incoming (from OC-48) DS3 Alarm Indication Signal (AIS) condition.
2. If required by local maintenance procedures, initiate a Trouble Report to the remote FT-2000 network element stating that an incoming (from OC-48) DS3 AIS condition has been detected on an incoming OC-48 optical line. The referenced DLP will help you locate or identify the source of the **incoming (from OC-48) DS3 AIS** condition.

Reference: **DLP-535**

3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address Incoming Signal Failure

1. One of the following incoming signal failures was detected:

- Incoming (from DSX) LOS (loss of signal)
- Incoming (from DSX) SD (signal degrade)
- Incoming (from OC3) path PDI(payload defect indicator)
- Incoming (from OC3) STS LOP (loss of pointer)
- Incoming (from OC12) path PDI(payload defect indicator)
- Incoming (from OC12) STS LOP (loss of pointer)
- Incoming (from OC-48) path AIS (alarm indication signal)
- Incoming (from STSX) EC1 line AIS (alarm indication signal)
- Incoming (from STSX) EC1 LOF (loss of frame)
- Incoming (from STSX) EC1 LOP (loss of pointer)
- Incoming (from STSX) EC1 LOS (loss of signal)
- Incoming (from STSX) EC1 SD (signal degrade)
- Incoming (from STSX) path PDI (payload defect indicator)
- Incoming OC3 AIS (alarm indication signal)
- Incoming OC12 AIS (alarm indication signal)
- Incoming OC3 LOF (loss of frame)
- Incoming OC12 LOF (loss of frame)
- Incoming OC3 LOS (loss of signal)
- Incoming OC12 LOS (loss of signal)
- Incoming OC3 SD (signal degrade)
- Incoming OC12 SD (signal degrade)
- Incoming OC3 SF (signal failure)
- Incoming OC12 SF (signal failure)
- Incoming OC12 APS byte fail
- Incoming (from OC12) DCC failure
- Incoming (from OC12) STS LOP (loss of pointer)
- Incoming OC12 line RFI/yellow
- Incoming OC-48 AIS (alarm indication signal)
- Incoming OC-48 LOF (loss of frame)
- Incoming OC-48 LOS (loss of signal)
- Incoming OC-48 SD (signal degrade)
- Incoming OC-48 SF (signal failure)
- Incoming sync ref failure.

2.



NOTE:

If the provisioning is not completed properly (ALL appropriate Cross-Connections provisioned in each NE of a signal's path) before an OC-3c or OC-12c service/signal is applied—then the **incoming (from OC3) STS LOP**, or **incoming (from OC12) STS LOP** will be produced. As a contrast, before deleting any of the Cross-Connections in an OC-3c or OC-12c signal's path, the signal must have been previously removed.

Refer to the Active Alarms and Status Report (**FAULT-Retrieve-Alarm**) and determine the type of incoming signal failure.

Is the incoming signal failure an **incoming (from OC3) STS LOP**, or **incoming (from OC12) STS LOP**?

If **NO**, then go to Step 3.

If **YES**, then initiate a Trouble Report to the source of the failed incoming signal indicating the type of failure. And, ask that they verify that all Cross-Connections for the signal path have been provisioned correctly.

If the source of the failed incoming signal returns a Trouble Report indicating "no trouble found," then follow the prescribed operating procedures to fault isolate the cable/fiber carrying the failed incoming signal.

Reference: DLP-535

3.



CAUTION:

*If an **incoming OC3 LOS** or **incoming OC12 LOS** condition exists prior to setting the Alarm Level to NO, this condition **will not disappear** after the Alarm Level is set to NO. Only subsequent conditions will be subdued (not reported). The user may clear the condition by temporarily providing a good input signal until the condition clears or by reseating the OC3 or OC12 circuit pack. Only reseal the circuit pack if you are sure there is no live traffic on the outgoing fiber, otherwise service interruption will occur.*

Is the incoming signal failure an **incoming (from DSX) LOS**, **incoming (from STSX) EC1 LOS**, **incoming OC3 LOS**, **incoming OC12 LOS**, **incoming OC-48 LOS**, or **incoming sync ref failure**?

If **YES**, then continue with Step 4.

If **NO**, then continue with Step 8.

4. Make a visual inspection of the incoming signal cable(s) and connection(s) and correct any problems found.

Reference: **DLP-528**

If a visual inspection does not reveal any problems, you may consider making an optical or electrical measurement per local operating instructions.

Suggestion 1: OC-3/OC-12/OC-48 optical lines can be tested by using an optical line meter and/or an optical time domain reflectometer (OTDR) to help locate a fiber bend or cut.

Suggestion 2: Low-speed signals (DS3/EC-1/OC-3/OC-12) can be tested by using a transmitter/receiver test set.

Suggestion 3: Sync reference cables can be tested by using a DS1 error rate test set (ERTS) to verify the DS1 signal.

5. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.
6. Referring to the report obtained in Step 5, is the same incoming signal failure still listed?

If **YES**, then replace the receive circuit pack indicated in the **FAULT-Retrieve-Alarms (and Status)** report from Step 5.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

7. Did the same incoming signal failure clear?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, remove the replacement circuit pack and return the original circuit pack to the slot, then continue with Step 10.

8. Is the incoming signal failure an **incoming (from OC3) path PDI, incoming (from OC12) path PDI, or incoming (from STSX) path PDI**?

If **YES**, then continue with Step 9.

If **NO**, then continue with Step 10.

9.



NOTE:

The PDI is sent when the STS termination sources a good STS path level signal containing a defective payload, for example: one or more bad VTs or bad DS3 tributary in the STS. The detected PDI will cause the FT-2000 to switch to the alternate STS at the "Drop and Continue" interface, if switching is enabled.

Use the **CONFIGURATION-Retrive-Path-Trace** command to display the status of the mapped signals in the STS payload. Use local procedures to determine the source of the payload defects and initiate a Trouble Report to the source indicating the type of failure.

10.



NOTE:

At this point, it appears that the local terminal is operating correctly. The trouble is in the line or in the far-end terminal.

Initiate a Trouble Report to the source of the failed incoming signal indicating the type of failure. If the source of the failed incoming signal returns a Trouble Report indicating "no trouble found," then follow the prescribed operating procedures to fault isolate the cable/fiber carrying the failed incoming signal.

Reference: **DLP-535**

11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Circuit Pack Failure'

Overview: This procedure is used to replace a circuit pack with a lighted **FAULT** LED in response to one of these indicated failures:

DS3 INTFC failure
LNCTL failure
LSSW failure
OC3 INTFC failure
OC12 INTFC failure
OHCTL failure
RCVR failure

REGENR failure
STS1E INTFC failure
TG3 failure
IS3 INTFC failure
TOHCTL failure
TRMTR failure.



CAUTION:

When running valid software releases 3.0.1 ADR through 5.0.2 ADR and 6.0.1 through 6.0.2, a potential service interruption (OUT OF SERVICE condition) can be avoided when replacing DS3, STS1E, OC3, TRMTR, or RCVR circuit packs by following this instruction. After a replacement circuit pack has been inserted, the FAULT LED should go out within 30 seconds. If the FAULT LED remains lighted after the 30 seconds, immediately remove the replacement circuit pack before 110 seconds elapses. If a circuit pack does not boot up within the 110 second time period, the FT-2000 ADR node can become isolated from the ring interrupting all add/drop connections at that node. Software releases 5.0.3 ADR and all R7 ADR and later releases prevent node isolation under this condition.

1. From a failure condition above, identify the appropriate shelf using Table A.

Table A – Shelf and Associated Circuit Packs

Failed Circuit Pack	Shelf
DS3 LSSW OC3 STS1E IS3 OC12 TG3 TOHCTL	Low Speed Shelf
LNCTL OHCTL RCVR TRMTR	High Speed Shelf
REGENR	Repeater Bay/Shelf

2. Is the circuit pack being replaced a high-speed interface (LAA21, LAA22, LAA28, 739B2, 739B4, 739B5, 739C2, 739C5, 739E[1-8], 739G[1-8], 739H[1-16], 739J2, 739J3, 739J4, 739J5, 739P5, 739R2, 739R5, 739S2, 739S5, 839B2, 839B4B, 839B5, 839E5) circuit pack?

If **YES**, then continue with Step 3.
If **NO**, then continue with Step 6.
3. At the CIT, select **CONFIGURATION-Retrieve-Equipment:TRMTR** command to obtain an Equipment Report on the circuit pack being replaced.
4. From the report, determine if an alternate slot (i.e., a slot other than the one containing the circuit pack being replaced) is reporting a failure. Is there an alternate slot reporting a failure?

If **YES**, then continue with Step 5.
If **NO**, then continue with Step 6.

5. The alternate slot indicated in the report may have caused the high-speed circuit pack failure. Continue with Step 7 to replace the high-speed circuit pack. If trouble persists after replacing the high-speed circuit pack, continue with Step 1 to replace the alternate circuit pack indicated in the report.

6. Remove the appropriate shelf cover.

Reference: **DLP-511**

7. Is the **FAULT** LED lighted on the circuit pack identified in the **Source Address** column (Active Alarms and Status Report)?

If **YES**, then continue with Step 4.

If **NO**, then go to **TAP-108**.

8. Is the circuit pack a low speed interface (DS3 or STS1E)?

If **YES**, then continue with Step 5.

If **NO**, then continue with Step 9.



NOTE:

For DS3 and STS1E circuit packs only: A verification of either an automatic or a CIT provisioned protection switch is made before removing the low speed circuit pack from the shelf.

9. At the CIT, select **FAULT-Retrieve-State:LS INTFC** command and obtain a State Report on the circuit pack being replaced.
 10. From the report, is the low speed slot (circuit pack to be removed) in a standby state?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 7.
 11. At the CIT, select **FAULT-Switch-Low Speed:Slot** command for the circuit pack being removed and execute. Use the **FAULT-Retrieve-State:LS INTFC** command to verify, if desired.
 12. Verify that all outputs of a DS3 or STS1E circuit pack are properly terminated.
Reference: **DLP-520**
 13. Is the circuit pack a TG3 circuit pack?
If **YES**, then continue with Step 10.
If **NO**, then continue with Step 13.
-  **NOTE:**
For TG3 circuit packs only: A verification of a CIT provisioned protection switch is made before removing the TG3 circuit pack from the shelf.
14. At the CIT, select **FAULT-Retrieve-State:TG** command and obtain a State Report on the circuit pack being replaced.
 15. From the report, is the TG3 circuit pack to be removed in a standby state with a manual switch?
If **YES**, then continue with Step 13.
If **NO**, then continue with Step 12.
 16. At the CIT, select **FAULT-Switch-Synchronization-Hardware** command for the circuit pack being removed and execute a manual switch. Use the **FAULT-Retrieve-State:TG** command to verify, if desired.

17. See NOTES. Obtain a replacement circuit pack with the same or a higher series number and install it in place of the circuit pack with the lighted **FAULT** LED. As required, make the appropriate optical connections on the OC3, IS3, OC12, RCVR, TRMTR, or REGENR circuit pack(s).

Reference: **DLP-514**

- ⇒ **NOTE:**
The FT-2000 ADR Terminal Release 9.0 does not support mixed LAA10/LAA10B operation in a **1+1** configuration. Before obtaining a replacement OC-3 circuit pack for a network element configured for 1+1 protection, note whether the circuit pack is an LAA10 or LAA10B, and place a new OC-3 circuit pack of the same type into the slot.
- ⇒ **NOTE:**
Before replacing an OC-3 circuit pack, try removing and then reconnecting the input optical fiber on each failed OC-3 circuit pack. If the failure does not clear, replace the circuit pack. An OC-3 circuit pack failure indication can occur if a TG circuit pack is replaced without performing a manual switch as in Step 12.
- ⇒ **NOTE:**
A series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.
- ⇒ **NOTE:**
Power to each shelf must be applied before replacing any circuit packs. For example, a loss of power to a high speed shelf could show a failure of the RCVRs in the shelf as the alarm.
- ⇒ **NOTE:**
An IS-3 circuit pack requires multimode fiber for proper performance monitoring operation.

18. Wait for the time indicated in Table B.

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	30 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

19. Was the circuit pack just replaced a TG3 circuit pack?
If **YES**, then continue with Step 16.
If **NO**, then continue with Step 22.
20. At the CIT, select **FAULT-Switch-Synchronization-Hardware** command for the circuit pack just replaced and execute a switch reset. Use the **FAULT-Retrieve-State:TG** command to verify, if desired.
21. Is the **FAULT** LED lighted on the replacement circuit pack?
If **YES**, then continue with Step 18.
If **NO**, then continue with Step 20.
22. At the CIT, select **CONFIGURATION-Retrieve-Synchronization** and obtain a Synchronization Report.
23. From the report, is the associated TG3-1/TG3-2 Clock Range Status at or near +110 percent or -110 percent.
If **YES**, then issue a trouble report stating an out-of-range external timing reference.
If **NO**, then go to **TAP-116**.
24. Replace the shelf cover.
Reference: **DLP-511**
25. Is the **NE ACTY** LED lighted at the user panel.
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

26. Is the **FAULT** LED lighted on the replacement circuit pack?

If **YES**, then go to **TAP-116**.

If **NO**, then continue with Step 23.

27. Replace the shelf cover.

Reference: **DLP-511**

28. Is the **NE ACTY** LED lighted at the user panel.

If **YES**, then go to **Trouble Clearing: IXL-001**.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Circuit Pack Removed'

Overview: This procedure is used to clear one of the conditions below by (1) installing the missing circuit pack or (2) updating the SYSMEM circuit pack to reflect the current equipage:

DS3 INTFC removed
LNCTL removed
LSSW removed
OC3 INTFC removed
OC12 INTFC removed
TRMTR removed

REGENR removed
STS1E INTFC removed
TG3 removed
TOHCTL removed
OHCTL removed
RCVR removed.

1. Identify the appropriate shelf associated with the removed circuit pack, using Table A.

Table A - Shelf and Associated Circuit Packs

Removed Circuit Pack	Shelf
DS3	Low Speed Shelf - Complementary or Low Speed Shelf - System Controller
LSSW	
OC3	
STS1E	
OC12	
TG3	
TOHCTL	
LNCTL	High Speed Shelf or Enhanced High Speed Shelf
OHCTL	
RCVR	
TRMTR	
REGENR	Repeater Bay/Shelf

2. Remove the appropriate shelf cover.

Reference: **DLP-511**

3. Is the indicated slot empty?
If **YES**, then continue with Step 4.
If **NO**, then go to **TAP-108**.
4. Do the office records show that the slot should contain a circuit pack?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 5.
5. At the CIT, select **CONFIGURATION-Update** (records the current hardware arrangement in SYSMEM circuit pack).
6. Replace the shelf cover.
Reference: **DLP-511**
7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
8. Obtain the missing circuit pack and install it into the appropriate slot. As required, make the appropriate optical connections on the OC3, RCVR, TRMTR, or REGENR circuit pack(s).
Reference: **DLP-514**



NOTE:

The FT-2000 ADR Terminal does not support mixed OC-3 LAA10/LAA10B operation in a **1+1** protected configuration. If the missing circuit pack is an OC-3 and the network element is configured for **1+1** protection, be sure to check which particular OC3 circuit pack (LAA10 or LAA10B) is installed in the adjacent low-speed interface slot before installing the new OC3 circuit pack. For example, if there is a OC3 circuit pack missing in slot 2B, and there is an OC3 LAA10B circuit pack installed in slot 2A, you **MUST** install an OC3 LAA10B circuit pack into slot 2B **IF** the low speed interface is configured for **1+1** protection.

9. Wait for the time indicated in Table B.

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	1 minute

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

10. Is the **FAULT** LED lighted on the replacement circuit pack?

If **YES**, then replace shelf cover and go to **Trouble Clearing: IXL-001**.

If **NO**, then continue with Step 11.

11. Replace shelf cover.

Reference: **DLP-511**

12. Is the **NE ACTY** LED lighted at the user panel?

If **YES**, then go to **Trouble Clearing: IXL-001**.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Clear 'SYSMEM Failure,' or 'SYSCTL Failure'



CAUTION:

*Do not remove the SYSCTL circuit pack unless instructed to do so by this procedure. If removed, provisioning data (current values) could be lost. Current values were provisioned with the **Set** commands.*



NOTE:

This procedure begins with the replacement of the SYSMEM circuit pack even though the SYSCTL circuit pack **FAULT** LED may be lighted.

1. If the bay is in service, then remove the LNCTL circuit pack.
2. Remove the SYSMEM circuit pack and install a replacement circuit pack having the same or a higher series number. For example, an LAA25 with series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.

Reference: **DLP-514**
3. Wait 10 minutes or until the **MJ** LED is off at the user panel, whichever comes first.
4. At the CIT, select **CONFIGURATION-Retrieve-Equipment** and **SYSCTL** to obtain an Equipage and Version Report.
5. Refer to the Equipage and Version Report and compare the software release stored in SYSMEM [shown under **sysmem-()** entry in report] with the software release running in the FT-2000 [shown under **sysctl-** entry in report].
6. Are software releases identical?

 If **YES**, then go to Step 8.
 If **NO**, then continue with Step 7.
7. Install identical software into the SYSMEM circuit pack that is running in the FT-2000.

Reference: **Operation: NTP-002**
8. At the CIT, select **FAULT-Reset** and execute.

9. Wait 10 minutes or until the **MJ** LED is off at the user panel, whichever comes first. Reset takes approximately 10 minutes but some user panel LEDs flash and relays click in about a minute indicating that reset has started.
10. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarm and Status Report.
11. Does the **SYSCTL failure** or **SYSTEM failure** appear under the **Description** column of the report?
If **YES**, then continue with Step 12.
If **NO**, then go to Step 17.
12. Reinstall the SYSMEM circuit pack that was removed in Step 2.



NOTE:

For circuit pack and software compatibility, refer to Table 7-1 in Section 7, "Circuit Pack Description."

13. Remove the SYSCTL circuit pack and install a replacement circuit pack having the same or a higher series number. For example, an LAA23 with series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.
Reference: **DLP-514**
14. Wait 10 minutes or until the **MJ** LED is off at the user panel, whichever comes first.
15. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarm and Status Report.
16. Does a **SYSCTL failure** or **SYSTEM failure** appear under the **Description** column of the report?
If **YES**, then go to **TAP-108**.
If **NO**, then continue with Step 17.
17. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection**. Verify that all crossconnections are present and correct.
If the cross-connections are **correct**, then go to Step 19.
If the cross-connections are **corrupted**, then continue with Step 18.

18. Cross-connections must be reentered using an out-of-service spare bay. Follow the procedures listed in this step to restore cross-connections using an out-of-service spare bay.



NOTE:

If cross-connections are corrupted, they cannot be reentered with the LNCTL circuit pack removed from the bay. And, if the LNCTL is reinserted, the corrupted cross-connect data will overwrite the actual cross-connections in the High Speed Optical circuit packs.

1. Remove all circuit packs from the out-of-service spare bay.
 2. Remove the good SYSMEM circuit pack from the in-service bay and insert it into the spare bay.
 3. Remove the good SYSCTL circuit pack from the in-service bay and insert it into the spare bay.
 4. Insert a LNCTL in the spare bay.
 5. Insert an OHCTL in the **OHCTL 1** (1W) slot in the spare bay.
 6. Login to the spare bay and enter crossconnections and TID.
 7. Remove the SYSMEM circuit pack and reinstall it into the in-service bay.
 8. Remove the SYSCTL circuit pack and reinstall it into the in-service bay.
 9. Login to the in-service bay and repeat this procedure from Step 17.
19. Reinsert the LNCTL circuit pack that was removed in Step 1.
 20. At the CIT, select **FAULT -Reset** and execute.
 21. Is the **NE ACTY** LED off at the user panel?
If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **NO**, then go to **Trouble Clearing: IXL-001.**

Clear Trouble When 'ABN' LED Is Lighted

Overview: This procedure is used to clear one of the following conditions:

DS3 loopback	LS loopback
EC1 loopback	LS manual switch
inhibit alarms-office alarms	non-preemptible protn access
	OC3 forced switch at far end
inhibit alarms-X.25	OC3 forced switch at near end
line forced switch	OC3 inhibit switch at near end
line forced switch at far end	OC3 lockout at far end
line forced switch at near end	OC3 lockout at near end
line lockout	OC3 loopback (from OC3)
line lockout at far end	OC3 loopback (from OC48)
	OC3 sync mode/equipment conflict
line lockout at near end	preemptible protection access
line manual switch	sync mode equipment conflict
line manual switch at far end	sync mode forced switch
line manual switch at near end	sync reference forced switch
line switch inhibit	sync reference lockout
line switch inhibit - far end	sync reference manual switch
line switch inhibit - near end	TG manual switch
logins inhibited	test alarm in progress
LS forced switch test	auto turnup in progress
LS lockout	
OC12 forced switch at far end	OC12 forced switch at near end
OC12 lockout at far end	OC12 inhibit at near end
OC12 loopback (from OC48)	OC12 lockout inhibit at near end.



NOTE:

The indicated condition was initiated by a user command. You must determine, by consulting with the appropriate maintenance personnel, whether the need for the user-initiated condition still exists before proceeding.

1. Does the need for the user initiated condition still exist?

If **YES**, then continue with Step 2.

If **NO**, then continue with Step 3.

2. Referring to the Active Alarms and Status Report on the CIT screen, are any other conditions indicated?

 If **YES**, then go to **TAP-102** to clear the remaining condition(s), ignoring the condition that sent you here.
 If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
3. Use the CIT to clear the indicated condition by performing the function listed in Table A.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Table A - Determine Command for Condition

Condition To Be Cleared	Perform Function
inhibit alarms-office alarms inhibit alarms-X.25	FAULT-Allow-Alarm-All
line forced switch line forced switch at far end line forced switch at near end line lockout line lockout at far end line lockout at near end line manual switch line manual switch at far end line manual switch at near end line switch inhibit line switch inhibit - far end line switch inhibit - near end non-preemptible protn access preemptible protn access	FAULT-Switch-Line-All-Reset

Table A - Determine Command for Condition

Condition To Be Cleared	Perform Function
OC3 forced switch at far end OC3 forced switch at near end OC12 forced switch at far end OC12 forced switch at near end OC3 inhibit at near end OC12 inhibit at near end OC3 lockout at far end OC3 lockout at near end OC12 lockout at far end OC12 lockout at near end	FAULT-Switch-<LS type>-All-Reset
logins inhibited	SECURITY-Set-Security-Network Element-Logins Allowed:Yes
LS forced switch LS lockout LS manual switch	FAULT-Switch-Low Speed-All-Reset
DS3 loopback EC1 loopback LS loopback OC3 loopback (from OC3) OC12 loopback (from OC48) OC3 loopback (from OC48)	FAULT-Release-Loopback-<LS type>-All
OC3 sync mode/equipment conflict	CONFIGURATION-Set-OC3-Sync Messages-Disabled or Enabled
sync mode equipment conflict	CONFIGURATION-Set-OC48-Sync Messages-Disabled
sync mode forced switch sync reference forced switch sync reference lockout sync reference manual switch TG manual switch	FAULT-Switch-Synchronization-<type of switch>-Reset
test alarm in progress test auto turnup in progress test telemetry in progress	Wait for the test to complete.

Clear Automatic Switch Condition

Overview: This procedure is used to clear one of the following automatic protection switch conditions:

line auto switch	sync mode auto switch
LS auto switch	sync reference auto switch
OC3 auto switch at far end	TG auto switch.
OC3 auto switch at near end	OC12 auto switch at far end
OC12 auto switch at near end	

1. Which switch is to be cleared?

- If **TG auto switch**, then continue with Step 2.
- If **LS auto switch**, then continue with Step 8.
- If **sync mode auto switch**, then continue with Step 14.
- If **sync reference auto switch**, then continue with Step 14.
- If **line auto switch**, then continue with Step 17.
- If **OC3 auto switch at near end**, then continue with Step 29.
- If **OC3 auto switch at far end**, then continue with Step 29.
- If **OC12 auto switch at near end**, then continue with Step 29.
- If **OC12 auto switch at far end**, then continue with Step 29.

TG Auto Switch Condition



NOTE:

Conditions are shown in the **Description** column of the Active Alarms and Status Report.

2. Is there one or more other conditions with the same TG **Source Address** in the report?
 - If **YES**, then continue with Step 3.
 - If **NO**, then continue with Step 5.
3. Identify the topmost other condition in the report with the same TG **Source Address**. Find this condition in Table A of **TAP-102** and go to the referenced TAP.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in this state by using the **FAULT-Retrieve-State** command for the TG slot.

5. Wait 5 minutes or until the **NE ACTY** LED goes off, whichever comes first.

6. Is the **NE ACTY** LED off?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then consult the appropriate maintenance support organization for further technical assistance.

7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

LS Auto Switch Condition

⇒ **NOTE:**
Conditions are shown in the **Description** column of the Active Alarms and Status Report.

8. Is there one or more other condition with the **same** low-speed interface **Source Address** in the report?

If **YES**, then continue with Step 9.

If **NO**, then continue with Step 11.

9. Identify the topmost other condition in the report with the same TG **Source Address**. Find this condition in Table A of **TAP-102** and go to the referenced TAP.

10. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
An LS auto switch will remain in effect for a provisioned interval (the Wait To Restore interval) after the cause of the switch is cleared. You can use the **CONFIGURATION-Retrieve-Protection-Line** command to determine the provisioned value of the Wait To Restore interval.

11. Wait for the provisioned Wait To Restore interval to expire or until the **NE ACTY** LED goes off, whichever comes first.

12. Is the **NE ACTY** LED off?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then consult the appropriate maintenance support organization for further technical assistance.

13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Sync Mode Auto Switch or Sync Reference Auto Switch Conditions



NOTE:

Conditions are shown in the **Description** column of the Active Alarm and Status Report.

14. Is there one or more other conditions with the same **Source Address** in the report?

If **YES**, then continue with Step 15.

If **NO**, then consult the appropriate maintenance support organization for further technical assistance.

15. Identify the topmost other condition in the report with the **same Source Address**. Find this condition in Table A of **TAP-102** and go to the referenced TAP.

16. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Line Auto Switch Condition



NOTE:

The failure to be cleared is a **line auto switch** condition.



NOTE:

Conditions are shown in the **Description** column of the Active Alarms and Status Report.

17. Is there one or more other conditions with the **same line Source Address** in the report?

If **YES**, then continue with Step 18.

If **NO**, then continue with Step 20.

⇒ **NOTE:**
While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **line auto switch** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **line auto switch**, the answer is NO.

⇒ **NOTE:**
After clearing the condition identified in Step 17, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **line auto switch** condition.

18. Find the condition identified in Step 17 in Table A of **TAP-102** and go to the indicated TAP to clear that condition (ignoring the **line auto switch** condition throughout the remainder of the trouble clearing procedure).

19. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
The **line auto switch** may be associated with a condition at the first FT-2000 Add/Drop-Rings Terminal in the indicated direction in a ring network or at the other FT-2000 End Terminal in a point-to-point network.

20. From office records, determine which network element is at the other end of the switched line.

⇒ **NOTE:**
You may not be able to login to the other network element. If you cannot login to that network element, you will need assistance there to continue with this procedure.

21. At the network element identified in Step 20, use a CIT to obtain an Active Alarms and Status Report.

⇒ **NOTE:**
It is possible that a **line auto switch** will also be observed at this network element. If so, you **MUST** ignore the **line auto switch** condition in the Active Alarms and Status Report.

22. Referring to the report obtained in Step 21, are there any conditions other than "**line auto switch**" listed?

If **YES**, then continue with Step 23.
If **NO**, then continue with Step 26.

23. Referring to the report obtained in Step 21, identify the topmost condition other than **line auto switch** condition.

⇒ **NOTE:**
While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **line auto switch** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **line auto switch**, the answer is NO.

⇒ **NOTE:**
After clearing the condition identified in Step 22, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **line auto switch** condition.

24. Find the condition identified in Step 22 in Table A of **TAP-102** and go to the indicated TAP to clear that condition (ignoring the **line auto switch** condition throughout the remainder of the trouble clearing procedure).

25. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
A line switch will remain in effect for a provisioned interval (the Wait To Restore interval) after the cause of the switch is cleared. You can use the **CONFIGURATION-Retrieve-Protection-Line** command to determine the provisioned value of the Wait To Restore interval.

26. Wait for the provisioned Wait To Restore interval to expire or until the **NE ACTY** LED goes off, whichever comes first.

27. Is the **NE ACTY** LED off?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then consult the appropriate maintenance support organization for further technical assistance.

28. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

OC3/OC12 Auto Switch at Near End or at Far End Condition

⇒ **NOTE:**
The failure to be cleared is an **OC3/OC12 auto switch at near end** or an **OC3/OC12 auto switch at far end** condition and will remain in effect for a provisioned interval (Wait To Restore interval) after the cause of the switch is

cleared. You can use the **CONFIGURATION-Retrieve-Protection-Low Speed** command to determine the provisioned value of the Wait To Restore interval.

⇒ **NOTE:**
The **OC3/OC12 auto switch at near end** or the **OC3/OC12 auto switch at far end** may be associated with a condition on the OC-3/OC12 line or at the distant network element located at the other end of the OC-3/OC12 line (FT-2000 or DDM-2000).

⇒ **NOTE:**
Conditions are shown in the **Description** column of the Active Alarms and Status Report.

29. Is there one or more other conditions with the **same slot Source Address** in the report?

If **YES**, then continue with Step 30.

If **NO**, then continue with Step 32.

⇒ **NOTE:**
While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end**, the answer is NO.

⇒ **NOTE:**
After clearing the other condition identified in Step 29, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition.

30. Find the condition identified in Step 29 in Table A of **TAP-102** and go to the indicated TAP to clear that condition (ignoring the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition throughout the remainder of the trouble clearing procedure).

31. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

32. Do you have maintenance responsibilities for the network element at the other end of the OC-3/OC12 line?

If **YES**, then continue with Step 34.

If **NO**, then issue a Trouble Report to the network element stating the error condition you are receiving.

33. STOP! YOU HAVE COMPLETED THIS PROCEDURE.

34. From office records, determine the type of network element at the other end of the OC-3/OC12 auto switched line.

35. Is the remote network element an FT-2000 add/drop-rings terminal?

If **YES**, then continue with Step 36.

If **NO**, then refer to the proper trouble clearing documentation for the type of network element. For example, DDM-2000 OC-3 Multiplexer, User/Service Manual, 363-206-280.



NOTE:

You will need to travel to the remote network element or ask for assistance to continue with this procedure.

36. At the network element identified in Step 32, use a CIT to obtain an Active Alarms and Status Report.



NOTE:

It is possible that an **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** will also be observed at this network element. If so, you **MUST** ignore the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition in the Active Alarms and Status Report.

37. Referring to the report obtained in Step 36, are there any conditions other than **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** listed?

If **YES**, then continue with Step 38.

If **NO**, then continue with Step 41.

38. Referring to the report obtained in Step 36, identify the topmost condition other than **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition.

⇒ **NOTE:**
While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end**, the answer is NO.

⇒ **NOTE:**
After clearing the condition identified in Step 36, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition.

39. Find the condition identified in Step 36 in Table A of **TAP-102** and go to the indicated TAP to clear that condition (ignoring the **OC3/OC12 auto switch at near end** and/or **OC3/OC12 auto switch at far end** condition throughout the remainder of the trouble clearing procedure).

40. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
An OC3/OC12 auto switch will remain in effect for a provisioned interval (the Wait To Restore interval) after the cause of the switch is cleared. You can use the **CONFIGURATION-Retrieve-Protection-Low Speed** command to determine the provisioned value of the Wait To Restore interval.

41. Wait for the provisioned Wait To Restore interval to expire or until the **NE ACTY** LED goes off, whichever comes first.

42. Is the **NE ACTY** LED off?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then follow local maintenance procedures to clear what appears to be trouble with the OC-3/OC-12 line. You may consult the appropriate maintenance support organization for further technical assistance.

43. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear Unsuccessful Circuit Pack Replacement

Overview: Only use this procedure in the unlikely event that you were sent here by another procedure (for example, **TAP-111**) because a circuit pack replacement did not clear the associated failure indicator(s). This procedure is used to replace other circuit packs that could possibly cause such a failure indication(s).



CAUTION:

*A potential service interruption can be avoided for DS3, STS1E, OC3, OC12, TRMTR, or RCVR circuit packs by following this instruction. After a replacement circuit pack has been inserted, the **FAULT** LED should go out within 35 seconds (optical packs may still FLASH if no signal is present). If the **FAULT** LED remains lighted after the 35 seconds, immediately remove the replacement circuit pack before 110 seconds elapses. In addition, and if the system crashes (all LEDs lighted), remove the pack that caused the crash and wait for the bay to recover. Then, install a different version of the replacement circuit pack and then reseat the LNCTL circuit pack. Do not reinstall the pack that caused the crash into an in-service system. Return it for repair.*



NOTE:

A series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.



NOTE:

In this procedure, the circuit pack that first indicated "failed" is called the original circuit pack. The replacement circuit pack that did not clear the failure is called the original replacement circuit pack (same type of circuit pack). If the failure still exists, then one or more circuit packs which are called alternative replacement circuit packs are substituted.

1. What software version is running in the network element? (The software version is displayed at the top of the CIT screen).

If **Version 3.0.0 or lower**, then continue with Step 6.

If **Version 4.0.0 or higher**, then continue with Step 2.



NOTE:

The Equipage and Version Report generated by the **Retrieve-Equipment** command indicates an **alternative CP** to be replaced if replacing the circuit

⇒ **NOTE:**
 pack identified in the Alarm and Status Report failed to clear the trouble indication.

2. At the CIT, select **Retrieve-Equipment** to obtain an Equipage and Version Report.
3. Referring to the entry in the Equipage and Version Report for the circuit pack just replaced, note the type and slot address of the alternative replacement circuit pack (shown as **alternative CP** in the report).
4. Obtain a circuit pack of the type identified in Step 3 and install it in the slot address identified in Step 3 (replacing an apparently good circuit pack).

Reference: **DLP-514**

5. Is the **FAULT** LED lighted on the *original replacement circuit pack*?

If **YES**, then go **TAP-108**.

If **NO**, then continue with Step 14.

6. Find the original circuit pack in the first column of Table A.

Table A - Circuit Pack Replacements

Original Circuit Pack	Alternative Replacement Circuit Pack Order						
	1	2	3	4	5	6	7
DS3*	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	DS3	—
LAA14 OW	LAA14 OW	—	—	—	—	—	—
LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	TG3	DS3/STS1E	LSSW
LSSW	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	DS3/STS1E	—
OC3	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	TOHCTL	OC3
OC12	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	TOHCTL	OC12
OHCTL	SYSCTL	SYSTEM	TRMTR	RCVR	DS3/STS1E	—	—
RCVR	LNCTL	SYSCTL	SYSTEM	TG3	DS3/STS1E/OC3	—	—
REGENR	REGENR	SYSCTL	SYSTEM	—	—	—	—
STS1E*	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	STS1E	—
SYSCTL	SYSTEM	—	—	—	—	—	—
SYSTEM	SYSCTL	—	—	—	—	—	—
TG3	LNCTL	SYSCTL	SYSTEM	TRMTR	RCVR	DS3/STS1E	—
TOHCTL	SYSCTL	SYSTEM	TRMTR	RCVR	OC3	—	—
TRMTR	LNCTL	SYSCTL	SYSTEM	TG3	DS3/STS1E/OC3	—	—

* Remember to replace the protection circuit packs.

⇒ **NOTE:**
All of the following circuit pack replacements, except for the SYSCTL and the SYSMEM, apply only to the line containing the original circuit pack.

7. Identify the first alternative replacement circuit pack (shown in the column labeled **1**).
8. Replace only one circuit pack identified as the first alternative replacement circuit pack.

Reference: **DLP-514**

9. Is the **FAULT** LED still lighted on the original replacement circuit pack?
If **YES**, then continue with Step 10.
If **NO**, then continue with Step 14.
10. Reinstall the circuit pack replaced in Step 8.
11. Repeat Steps 8 through 10 for any additional circuit packs of the same type identified in Step 6.
12. Repeat Steps 6 through 11 for each remaining alternative replacement circuit pack type until either (1) the **FAULT** LED on the original replacement circuit pack is off or (2) all the alternative replacement circuit pack types have been tried. Then, continue with Step 13.
13. Is the **FAULT** LED lighted on the original replacement circuit pack?
If **YES**, then go to **TAP-108**.
If **NO**, then continue with Step 14.

⇒ **NOTE:**
The remaining steps help prevent returning nondefective circuit packs for repair.

14. Is the NE running Release 5.0.3, R7.0.1, or a later release?
If **NO**, then continue with Step 18.
If **YES**, then reinstall the original circuit pack.
15. Is the **FAULT** LED lighted on the original circuit pack?
If **YES**, then continue with Step 16.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
16. Reinstall the *original replacement circuit pack*.
17. Verify the **FAULT** LED is off on the *original replacement circuit pack*.

18. STOP! YOU HAVE COMPLETED THIS PROCEDURE.

Clear 'Excessive Holdover'



NOTE:

Another condition is affecting the synchronization of the FT-2000. This condition is causing the FT-2000 to operate in a synchronization holdover mode for an excessive amount of time.

1. Refer to the **Description** column of an Active Alarms and Status Report and find another condition (not **excessive holdover**) affecting synchronization in the FT-2000.
2. Find this second condition (identified in Step 1) in Table A of **TAP-102** and go to the referenced TAP.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Fan Failure'

Overview: This procedure is used to clear a fan failure condition caused by a tripped circuit breaker or a defective fan assembly.

1. Is the **POWER ON** LED lighted on the fan assembly?
If **YES**, then continue with Step 5.
If **NO**, then continue with Step 2.
2. Is either circuit breaker, labeled **POWER RESET A** and **POWER RESET B**, on fan assembly tripped?
If **YES**, then continue with Step 3.
If **NO**, then continue with Step 9.



NOTE:

If circuit breaker(s) continues to trip after repeated attempts to reset, then continue with Step 9.

3. Reset the tripped circuit breaker(s).
4. Is the **POWER ON** LED lighted on the fan assembly?
If **YES**, then continue with Step 5.
If **NO**, then continue with Step 9.
5. Is the **ALM** LED lighted on the fan assembly?
If **YES**, then continue with Step 9.
If **NO**, then continue with Step 6.
6. Press and hold in the **ALM TST** pushbutton switch for 20 seconds (checks the control board and the LEDs).
7. Release the **ALM TST** pushbutton switch.
8. Is the **ALM** LED off (within 20 seconds)?
If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **NO**, then continue with Step 9.

9. For (E-Bay), remove the fan assembly ED-6G992-30 and replace it with a new fan assembly (see 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 3, 4, 5, 6, 7, and 8, Installation Manual*).

For (D-Bay), refer to DLP-546 "Replace Defective Fan Unit in D-Bay."

10. Test the new fan assembly.

Reference: **DLP-513**

11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Fuse/Power Failure'

Overview: This procedure is used to clear a fuse/power failure by replacing a blown fuse (lighted) or isolating the power failure to a shelf.



CAUTION:

*Carefully follow the steps in this TAP-119 to clear any fuse/power failure conditions. However, fuse/power failure detection circuitry is contained within the TG1 and TG2 timing circuit packs. This circuitry has a "fail safe" design, such that if the detection circuitry itself fails (is no longer able to detect a fuse/power failure) the fuse/power failure alarm is raised as a precaution to prevent a silent failure of the fuse/power. If the fuse/power failure condition can not be cleared by following the steps in this TAP-119, the reported condition may be the result of the timing pack fail safe design. Refer to **TAP-111** for information on clearing failed timing packs. (Note that the fuse/power detection circuitry is not connected in any way to the circuitry which provides timing to the shelf. Correct timing to the shelf is still provided even if the fuse/power detection circuitry fails.) Additionally, the fuse/power failure can be reported from either the TG1 or TG2 timing circuit pack. There is no way to predetermine which pack is reporting the failure. The circuit pack reporting the alarm could be either timing pack. When a reporting timing pack is removed, its report of the fuse/power failure alarm clears. The alarm will be correctly updated when a fully-functioning timing pack is reinserted into the same slot. Does the system announce a "cleared alarm?"*

1. Is a fuse lighted (blown) at the top of the bay or at the repeater shelf?
If **YES**, then continue with Step 2.
If **NO**, then continue with Step 4.
2. Replace the lighted fuse with a new fuse.
Reference: **DLP-515**
3. Did the fuse blow (light) again?
If **YES**, then continue with Step 4.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
4. Obtain the appropriate drawing for the bay/shelf part to be replaced (see the "Related Documentation/Training" part in the "About This Document" section). For example, the E-Bay user panel (ED-6G994-30, G1) is found on drawing

ED-6G999-30. Another helpful source is 365-575-115, *FT-2000 OC-48 Light-wave System, Releases 3, 4, 5, 6, 7, 8, and 9 Installation Manual*.

Shelf Trouble-Clearing Suggestions

- If the shelf has power but the **PWR ON** LED is off, then replace the user panel or filter panel.

Reference: **Drawing ED-6G994-30** (E-Bay)

Reference: **Drawing ED-7G001-33** (D-Bay)

- If the user panel **PWR ON** LED or any other LEDs are defective, replace the user panel.
- If the shelf has no power, check the 1186A power filter boards (or equivalent) or replace the user panel.

5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Incoming DCC Failure' or 'Inc. (From OC48) DCC Failure'



CAUTION:

Do not reset the FT-2000 NEs while trying to clear this problem! This will result in a "Ring Incomplete/Open" that will seriously complicate repair of the problem.



NOTE:

Failure of the incoming data communications channel (DCC) is usually associated with hardware failure(s) at the source of the incoming OC-48 signal or with other troubles involving the incoming OC-48 signal from that source.



NOTE:

The **inc. (from OC48) DCC failure** condition applies to Release 6 and later whereas the **incoming DCC failure** condition applies to Release 5 and earlier.

1. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.
2. Referring to the report obtained in Step 1, are there any conditions other than **inc. (from OC48) DCC failure** or **incoming DCC failure** listed?
If **YES**, then continue with Step 3.
If **NO**, then continue with Step 6.
3. Referring to the report obtained in Step 1, identify the topmost condition other than the **inc. (from OC48) DCC failure** or **incoming DCC failure** condition.
- 4.



NOTE:

While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **inc.**

(from OC48) DCC failure or the incoming DCC failure, the answer is NO.



NOTE:

After clearing the condition identified in Step 3, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition.

Find the condition identified in Step 3 in Table A of **TAP-102** and go to the indicated TAP to clear that condition [ignoring the **inc. (from OC48) DCC failure** or **incoming DCC failure** condition throughout the remainder of the trouble clearing procedure].

5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

6. Is the ring a mixed FT-2000/*WaveStar* ring?

If **YES**, then continue with Step 7.

If **NO**, then continue with Step 21.

7. At the *WaveStar* CIT System View screen, left-click on the “Alarm List” button to obtain an Active Alarms and Status Report.

8. Referring to the report, is an **E/W Cable Error** indicated?

If **YES**, then continue with Step 9.

If **NO**, then continue with Step 14.

9. An **E/W Cable Error** indicates that the OC-48 cabling from the *WaveStar* node to the FT-2000 node is not in an E/W configuration (i.e., E/E or W/W). To correct this problem, all lines between FT-2000 and *WaveStar* nodes must be cabled E/W or W/E.

Reference: Task 707 of the appropriate *WaveStar* user/service manual (365-370-102 for BWM, 365-371-102 for 2.5G, or 365-373-102 for 10G)

10. At the *WaveStar* CIT System View screen, left-click on the “Alarm List” button to obtain an Active Alarms and Status Report and verify that the **E/W Cable Error** condition has cleared.

11. Referring to the report, has the **E/W Cable Error** condition cleared?

 If **YES**, then continue with Step 12.
 If **NO**, then report the trouble to the appropriate maintenance personnel.
12. At the FT-2000 CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.
13. Referring to the report, has the **inc. (from OC48) DCC failure** condition cleared?

 If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
 If **NO**, then continue with Step 14.
14. At the *WaveStar* CIT System View screen, left-click on the “Alarm List” button to obtain an Active Alarms and Status Report.
15. Referring to the report, is a **User-Network Side Sect Failure** condition indicated?

 If **YES**, then continue with Step 16.
 If **NO**, then continue with Step 21.
16. A **User-Network Side Sect Failure** condition indicates that the user-network side is provisioned incorrectly. To clear this condition, OC-48 Section DCC must be enabled and provisioned “User” for the East line and “Network” for the West line.

 Reference: Task 305 of the appropriate *WaveStar* user/service manual (365-370-102 for BWM, 365-371-102 for 2.5G, or 365-373-102 for 10G)
17. At the *WaveStar* CIT System View screen, left-click on the “Alarm List” button to obtain an Active Alarms and Status Report and verify that the **User-Network Side Sect Failure** condition has cleared.
18. Referring to the report, has the **User-Network Side Sect Failure** condition cleared?

 If **YES**, then continue with Step 19.
 If **NO**, then report the trouble to the appropriate maintenance personnel.
19. At the FT-2000 CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.

20. Referring to the report, has the **inc. (from 0C48) DCC failure** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then continue with Step 21.

21.



NOTE:

The source of the failed DCC input is the other FT-2000 End Terminal in a point-to-point network, or the first (adjacent) FT-2000 Add/Drop-Rings Terminal in the indicated direction.

From office records, determine which network element is the source of the failed DCC input.

22.



NOTE:

You may not be able to log in to the network element sending the failed DCC input. If you cannot log in to that network element, you will need assistance there to continue with this procedure.

At the source of the failed DCC input, use the CIT to obtain an Active Alarms and Status Report.

23.



NOTE:

It is possible that an **inc. (from 0C48) DCC failure** or an **incoming DCC failure** will also be observed at this network element. If so, you **MUST** ignore the **inc. (from 0C48) DCC failure** or the **incoming DCC failure** condition in the Active Alarms and Status Report.

Referring to the report obtained in Step 22, are there any conditions other than **inc. (from 0C48) DCC failure** or **incoming DCC failure** listed?

If **YES**, then continue with Step 24.

If **NO**, then continue with Step 27.

24. Referring to the report obtained in Step 22, identify the topmost condition other than the **inc. (from 0C48) DCC failure** or the **incoming DCC failure** condition.

25.

⇒ NOTE:
While following the instructions in the procedure(s) to which you will now be sent, you **MUST** ignore the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition in the Active Alarms and Status Report. For example, if you are asked whether there are any alarm or status conditions listed and the only condition shown in the report is **inc. (from OC48) DCC failure** or **incoming DCC failure**, the answer is NO.

⇒ NOTE:
After clearing the condition identified in Step 24, continue the trouble clearing procedure using TAP-102 at the network element that initially reported the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition.

Find the condition identified in Step 24 in Table A of TAP-102 and go to the indicated TAP to clear that condition [ignoring the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition throughout the remainder of the trouble clearing procedure].

26. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

27.

⇒ NOTE:
The **inc. (from OC48) DCC failure** or the **incoming DCC failure** is possibly due to a "silent" failure of the OHCTL circuit pack at the network element sending the failed DCC input or at the network element detecting it.

At the network element identified in Step 21, replace the OHCTL circuit pack for the line associated with the failed DCC output.

Reference: DLP-514

28. Wait 5 minutes for the OHCTL circuit pack to reboot.

29. Is the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition still reported at the network element where it was initially detected?

If **YES**, then continue with Step 30.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

30. At the network element that originally reported the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition, replace the OHCTL circuit pack for the line associated with the failed DCC output.

31. Wait 5 minutes for the circuit pack to reboot.

32. Is the **inc. (from OC48) DCC failure** or the **incoming DCC failure** condition still reported at the network element where it was initially detected?

If **YES**, then continue with Step 33.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

33.



NOTE:

The **inc. (from OC48) DCC failure** or the **inc. DCC failure** is possibly due to a "silent" failure of the optical transmission circuit pack at the network element sending the failed DCC input or a failure of the optical receiver pack at the NE detecting it.

At the NE identified in Step 21, replace the optical transmitter circuit pack for the line associated with the failed DCC output.

Reference: DLP-514

34. Wait 5 minutes for the optical transmitter circuit pack to reboot.

35. Is the **inc. (from OC48) DCC failure** or the **inc. DCC failure** condition still reported at the NE where it was initially detected?

If **YES**, then continue with Step 36.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

36. At the NE that originally reported the **inc. (from OC48) DCC failure** or the **inc. DCC failure** condition, replace the optical receiver circuit pack for the line associated with the failed DCC output.

Reference: DLP-514

37. Wait 5 minutes for the optical transmitter circuit pack to reboot.

38. Is the **inc. (from OC48) DCC failure** or the **inc. DCC failure** condition still reported at the NE where it was initially detected?

If **YES**, then continue with Step 39.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

39. Replacing the hardware has not corrected this problem. It is possible that an optical fiber in the span is defective. Replace the fibers with spares or trouble shoot the fibers with an optical Time Domain Reflectometer.
40. Is the **inc. (from OC48) DCC failure** or the **inc. DCC failure** condition still reported at the NE where it was initially detected?

I If **YES**, then continue with Step 41.

 If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

41. Consult the appropriate maintenance support organization for further technical assistance.
42. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address 'Line FERF' or 'Incoming OC-48 Line RFI/Yellow'



NOTE:

A remote FT-2000 network element has detected a bad OC-48 signal from this network element. The "line FERF" or "incoming OC-48 line RFI/yellow" condition indicates that the trouble is in the local FT-2000 network element or in the OC-48 optical line. The condition is normally cleared by correcting an associated condition(s).

1. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** and execute to obtain the Active Alarms and Status Report.



NOTE:

An **incoming DCC failure, line auto switch** and/or **extra traffic preempted** condition(s) may also accompany the **line FERF** or **incoming OC-48 line RFI/yellow** condition.

2. Referring to the report obtained in Step 1, are there any conditions other than **line FERF, incoming OC-48 line RFI/yellow, incoming DCC failure, extra traffic preempted**, and/or **line auto switch** listed?

If **YES**, then continue with Step 3.
If **NO**, then continue with Step 5.
3. Referring to the report obtained in Step 1, identify the topmost condition other than the **line FERF** or **incoming OC-48 line RFI/yellow** condition.
4. Find the condition identified in Step 3 in Table A of **TAP-102** and go to the indicated TAP to clear that condition.
5. Make a visual inspection of the outgoing OC-48 optical cable(s) and connection(s) and correct any problem(s) found.

Reference: **DLP-528**

6. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** and execute to obtain a new Active Alarms and Status Report.

7. Referring to the report obtained in Step 6, is the **line FERF** or **incoming OC-48 line RFI/yellow** condition still listed?

If **YES**, then initiate a Trouble Report to the remote FT-2000 network element (the source of the **line FERF** condition) indicating the **line FERF** condition.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**Address `Path AIS', `Path unequipped', `Path Yellow',
`Incoming (from OC-48) DS3 LOF',
`Inc (from STSX) Line RFI/Yellow',
`Inc (from OC48) Path RFI/Yellow',
`Incoming OC3 Line RFI/Yellow', and
`Incoming OC12 Line RFI/Yellow'**

1. Consult and follow the local maintenance procedures regarding how to address the low-speed or the high-speed condition(s) shown below. The condition (trouble) is not in the local FT-2000 network element.

path AIS
path unequipped
path yellow
incoming (from OC3) STS LOP
incoming (from OC12) STS LOP
incoming (from OC-48) DS3 LOF
inc (from STSX) line RFI/yellow
inc (from OC48) path RFI/yellow
incoming OC3 line RFI/yellow
incoming OC12 line RFI/yellow
incoming OC12 LOF
incoming OC12 SF
incoming OC12 SD
incoming OC12 AIS
incoming OC12 APS byte fail

2. Obtain an Active Alarms and Status Report and determine if other conditions are to be cleared.

If **YES**, then find the topmost **other** condition in Table A of **TAP-102** and go to the referenced TAP.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'CP (Unknown Type) Failure'

1. If the affected circuit pack was just installed, wait for the time indicated in Table A to allow the software in the affected circuit pack to start up.

Table A - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

⇒ **NOTE:**
The circuit pack in the indicated slot has failed, but its type is unknown to the software. The type or code appears on the circuit pack faceplate.

⇒ **NOTE:**
Section 3, "Platform Descriptions," lists the circuit pack codes that are supported by the slot for a particular shelf. Also listed is the compatible software for the particular circuit pack code.

2. Consult office records to determine the type of circuit pack to be installed in the slot.
3. Obtain and install a replacement circuit pack determined in Step 2. As required, make the appropriate optical connections on the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit pack(s).

Reference: **DLP-514**

4. Wait for the time indicated in Table A for the download of software.

5. Did the **FAULT** LED on the replacement circuit pack go off?
If **YES**, then continue with Step 6.
If **NO**, then go to **TAP-116**.
6. Is the **NE ACTY** LED lighted?
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Address 'Reset in Progress'

⇒ **NOTE:**
A software reset is in progress. This involves downloading software from SYSMEM to SYSCTL, to LNCTLs, and to OHCTLs and to board controllers on all other circuit packs. This can take as long as 10 minutes. During this time, the miscellaneous discrete control points are deactivated.

⇒ **NOTE:**
If duplicate Site/NE numbers are provisioned on DDM-2000 systems, an FT-2000 in the same network may reset continuously if DCC is enabled. Be sure each DDM-2000 in the network is assigned a unique Site/NE number.

1. Is the **MJ** LED lighted?
If **YES**, then wait 10 minutes before proceeding with Step 2.
If **NO**, then continue with Step 5.
2. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an updated Active Alarm and Status Report.
3. Is **reset in progress** still reported?
If **YES**, then continue with Step 4.
If **NO**, then continue with Step 7.
4. Wait 10 minutes or until the **MJ** LED is off at the user panel.
5. At the CIT, select **FAULT-Retrieve-Alarm** to obtain updated Active Alarm and Status Report.
6. Is **reset in progress** still reported?
If **YES**, then go to **TAP-108**.
If **NO**, then continue with Step 7.
7. Is the **NE ACTY** LED lighted?
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Clear 'SYSMEM Unrecognizable Code'

Overview: The software code stored in the nonvolatile memory of the SYSMEM circuit pack is corrupted or its version is not recognized by the SYSCTL circuit pack. The recommended way to clear this condition is to download new software code from the CIT to the SYSMEM circuit pack. Another way to clear this condition is to install a replacement SYSMEM circuit pack loaded with the correct code.

1. At the CIT, select **CONFIGURATION-Retrieve-Equipment** and **sysctl** to obtain an Equipage and Version Report.
2. Refer to the report and record the software release information from the line immediately under the **sysctl** entry. For example, **FT-2000 RELEASE 8.0**. This software release is now running in the SYSCTL circuit pack.
3. Do you want to download new software or replace the SYSMEM circuit pack?

To **download new software**, go to **OPERATION: NTP-002**.

To **replace the SYSMEM circuit pack**, continue with Step 4.

4. Remove the shelf cover from the Low Speed Shelf - System Controller or from the FT-2000 repeater bay/shelf.
5. Is the **FAULT** LED flashing at the SYSMEM circuit pack?
If **YES**, then continue with Step 6.
If **NO**, then go to **TAP-108**.
6. Obtain a replacement SYSMEM circuit pack containing an exact copy of the software identified in Step 2.
7. Remove the SYSMEM circuit pack and install the replacement SYSMEM circuit pack.

Reference: **DLP-514**

8. Wait several minutes for the FT-2000 to stabilize (indicated by the **FAULT** LED on the SYSMEM circuit pack being continuously lighted, flashing, then off.)

9. Is the **FAULT** LED continuously lighted on the SYSMEM circuit pack?
If **YES**, then continue with Step 10.
If **NO**, then continue with Step 12.
10. Is a second replacement SYSMEM circuit pack available?
If **YES**, then continue with Step 11.
If **NO**, then continue with Step 13.
11. Replace the SYSMEM circuit pack with the second replacement SYSMEM circuit pack (loaded with an exact copy of the software identified in Step 2).
Reference: **DLP-514**
12. Is the **FAULT** LED flashing on the SYSMEM circuit pack?
If **YES**, then go to **TAP-102**.
If **NO**, then continue with Step 15.
13. Reinstall the original SYSMEM circuit pack.
Reference: **DLP-514**
14. Install new software (same release as currently running in the SYSCTL circuit pack.)
Reference: **Operation: NTP-002**.
15. Replace the shelf cover.
Reference: **DLP-511**
16. Is the **NE ACTY** LED lighted at the user panel?
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Clear `SYSMEM/SYSCTL Code Mismatch'

Overview: The software code stored in the nonvolatile memory of the SYSMEM circuit pack is different from the code running in the FT-2000 network element. The `SYSMEM/SYSCTL code mismatch' condition can be cleared by (1) executing Reset that causes the SYSMEM circuit pack to download code to the FT-2000 network element or (2) by downloading a copy from the CIT to the SYSMEM circuit pack.



NOTE:

During the duration of the code mismatch, several other indications exist [**MJ** at control panel and **FAULT** LEDs on LNCTL and OHCTL (1W and 1E) circuit packs]. Ignore these indications until the code mismatch condition has been cleared, then clear any remaining trouble conditions.

1. At the CIT, select **CONFIGURATION-Retrieve-Equipment** and **sysctl** to obtain an Equipage and Version Report.
2. Refer to the report and record the software release information from the line immediately under the **sysctl** entry, for example, **FT-2000 RELEASE 8.0**. This software release is now running in the SYSCTL circuit pack.
3. Refer to the report and record the software release information from the line immediately under the **sysmem** entry, for example, **FT-2000 RELEASE 8.0**. This software release is stored in the nonvolatile memory of the SYSMEM circuit pack.
4. Are the software releases recorded in Steps 2 and 3 different from each other?
If **YES**, then continue with Step 5.
If **NO**, then go to **TAP-108**.
5. Determine which of the two software releases is supposed to be running in the FT-2000 network element.
6. Is the software release running in the FT-2000 network element (software release recorded in Step 2) supposed to be running in the FT-2000 network element?
If **YES**, then continue with Step 7.
If **NO**, then continue with Step 9.

7. Go to the **OPERATION: NTP-002** to install the same software release in the SYSMEM circuit pack that is running in the FT-2000 network element.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
9. At the CIT, select **FAULT -Reset** and execute. During the reset time, the miscellaneous discrete control points will be deactivated.
10. Wait 10 minutes or until the **MJ** LED is off at the user panel.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Unexpected CP Type'

Overview: Circuit pack keying prevents different circuit packs from being installed into other type slots.



NOTE:

The unexpected CP type condition is issued whenever the FT-2000 software detects a difference between what it expects in a circuit pack (CP) slot and which CP is actually in the slot. This condition is normally cleared by correcting the difference (wrong CP type or incomplete records).

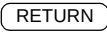
1. At the CIT, select **CONFIGURATION-Retrieve-Equipment:All** to obtain the Equipment Report.
2. Determine from office records the correct CP type for the slot in question.
3. Compare the Equipment Report with the office records and determine which indicates the correct CP type.
4. Is the correct CP type actually plugged into the slot?
If **YES**, then continue with Step 5.
If **NO**, then continue with Step 7.
5. At the CIT, select **CONFIGURATION-Update** to update the network element.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
7. Obtain the correct CP type according to the correct CP source.
8. If required, remove the shelf cover.
Reference: **DLP-511**
9. Remove the incorrect CP type from the slot and insert the correct CP type.
Reference: **DLP-514**
10. Replace the shelf cover.
Reference: **DLP-511**
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear Trouble In CIT (CIT Does Not Respond to Commands)

Overview: This procedure is used to clear trouble within the Craft Interface Terminal (CIT) such as a software hang-up or a malfunction.

1. Was a notice frame (warning message) displayed on the CIT?
If **YES**, then follow the instructions displayed on the screen and/or ask for technical assistance from your FT-2000 administrator.
If **NO**, then continue with Step 2.

 **NOTE:**
Some keys on the keyboard may be locked up (inoperative).

2. Press function key **F5**, labeled **EXIT**.
3. Wait 1 minute or until the PC prompt (typically **C:>**) is displayed.
4. Are the keys on the keyboard operative?
If **YES**, then continue with Step 7.
If **NO**, then continue with Step 5.
5. Perform a hard boot on the PC by pressing the "RESET" switch or by turning the power switch off and then back on.
6. Did the PC reboot (**C:>** is displayed)?
If **YES**, then continue with Step 7.
If **NO**, then replace the PC.
7. Start the CIT software (change to directory where software is located, enter **cit**, and press ).
8. Is the FT-2000 CIT-PC software running?
If **YES**, then go to Step 9.
If **NO**, then verify that you are in the correct directory and/or ask for assistance from your FT-2000 technical support.

9. Does the FT-2000 respond to an attempt to login to the CIT(DCE) port on the front of the bay?
 - If **YES**, then go to STEP 12.
 - If **NO**, then continue.
10. The CIT(DCE) port may be configured for TL1 messages, rather than CIT commands. This can be verified by any one of the following three options:
 - a. Connect the CIT-PC to the CIT(DTE) port labeled P158A on the interconnect panel of the low speed and attempting to login. A null modem (which is described in co.ntp002) is required between this port and the CIT-PC.
 - b. Have someone remote login to the bay and verify the CIT port settings with the command **SECURITY-Retrieve-Security-Port**. For front access using the CIT(DCE) port, the port must be "enabled" and the port type must be "CIT".
 - c. From the CIT program connected to the CIT(DCE) port, use the F3 (dial) key and try to access the bay using TL1 commands.
11. Does the problem still exist?
 - If **YES**, then contact your FT-2000 technical support organization and ask for assistance.
 - If **NO**, then continue.
12. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'DCC Startup In Progress'



NOTE:

The data communication channel (DCC) is starting up. This interaction between the FT-2000 network elements takes from 5 to 7 minutes.

1. Wait 7 minutes or until the **NE ACTY** LED goes off.
2. Did the "DCC startup in progress" condition clear?
If **YES**, then continue with Step 3.
If **NO**, then go to **TAP-108**.
3. Is the **NE ACTY** LED lighted?
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Clear 'Site Provisioning Conflict'

1. Is this a point-to-point network or a ring network?

If **point-to-point network**, then continue with Step 2.

If **ring network**, then continue with Step 6.



NOTE:

In an FT-2000 point-to-point network, one and only one of the two FT-2000 end terminals must be provisioned to be "Site 0."

2. Determine from office records which FT-2000 end terminal is to be "Site 0."
3. At each FT-2000 end terminal, obtain a report as follows: at the CIT, select **SECURITY-Retrieve-Network Element** and execute. Determine the value (either yes or no) of the **Site 0** parameter.
4. At the incorrectly provisioned FT-2000 end terminal and at the CIT, select **SECURITY-Set-Network Element** and execute to change the **Site 0** parameter to the correct value.
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
6. Is the node connected to the alarmed OC-48 line a *WaveStar* node?

If **YES**, then continue with Step 7.
If **NO**, then continue with Step 13.
7. At the CIT, select **RTRV-OC48** and determine if the F Byte Processing parameter is disabled for the alarmed OC-48 line.
8. Is F Byte Processing disabled for the alarmed OC-48 line?

If **YES**, then continue with Step 13.
If **NO**, then continue with Step 9.
9. At the CIT, disable F Byte Processing for the alarmed OC-48 line by selecting the **CONFIGURATION-Set-OC48** command.
10. At the CIT, select **FAULT-Reset** and wait five minutes for the reset to finish.

11. At the FT-2000 CIT, select **FAULT-Retrieve-Alarm (and Status)** to obtain an Active Alarms and Status Report.

12. Has the **site provisioning conflict** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE!**

If **NO**, then continue with Step 13.

13. Check the OC-48 optical connections to the adjacent nodes in both directions to verify that the East (West) TRMTR here is connected to the West (East) RCVR there and that the East (West) RCVR here is connected to the West (East) TRMTR there. Rearrange any incorrect connections.



NOTE:

A likely cause of a **site provisioning conflict** condition is that the East (West) TRMTR at one node is connected to the East (West) RCVR at the next node.

14. At the CIT, select **FAULT-Retrieve-Alarm (and Status)** to obtain another Active Alarms and Status Report.

15. Does the **site provisioning conflict** condition still appear in the report?

If **YES**, then continue with Step 16.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

16. Consult the appropriate maintenance support organization for further technical assistance.

17. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Software Download in Progress'



NOTE:

A software download can take as long as 2 hours at 9600 baud (less time at the higher baud rate of 19,200 or 38,400).

1. Wait for the download to be completed.
2. Did the **software download in progress** condition clear?
 - If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
 - If **NO**, then refer the trouble to the people doing the software download.

Clear 'Incoming OC-48 APS Byte Fail'



NOTE:

This condition is associated with a signal degrade (SD) or an automatic protection switch (APS) channel failure on the protection line.

1. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarms and Status Report.
2. Is the **incoming OC-48 SD** condition shown on the report for the protection line?
 - If **YES**, then go to **TAP-110**.
 - If **NO**, then continue with Step 3.
3. Is the **APS channel failure** condition shown on the report for the protection line?
 - If **YES**, then go to **TAP-105**.
 - If **NO**, then go to **TAP-108**.

Clear 'SYSMEM Removed'



CAUTION:

*Do not remove the SYSCTL circuit pack. If removed, provisioning data (current values) will be lost. Current values were provisioned with the **Set** command. Obtain a replacement SYSMEM circuit pack having the same or a higher series number.*

1. Install the replacement SYSMEM circuit pack.

Reference: **DLP-514**

2. Wait 10 minutes or until the **MJ** LED goes off.
3. Is the **NE ACTY** LED off?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then go to **TAP-103**.

Clear 'Clock Out of Range'

⇒ **NOTE:**
This condition indicates that the operating frequency of one or both of the TG3 circuit packs supplying synchronization to the TRMTR circuit packs has gone out of the recommended range.

1. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarms and Status Report.
2. Is one or more of the conditions listed in Table A indicated in the report?
If **YES**, then find this second associated condition (identified below) in Table A of **TAP-102** and go to the referenced TAP.
If **NO**, then continue with Step 3.

Table A - Possible Associated Conditions

incoming sync ref failure
TG3 failure
TG3 removed

3. At the CIT, select **CONFIGURATION-Retrieve-Synchronization** to obtain a report.
4. From the Synchronization Report (Step 3), record the values of the **TG1 Clock Range Status** and **TG2 Clock Range Status** parameters.

⇒ **NOTE:**
This condition, by itself, does not indicate a failure with the FT-2000 network element.

5. Refer to local operating procedures for further guidance in addressing this condition.

Clear (Optical Parameter) 'Out-Of-Range'

⇒ **NOTE:**
This condition indicates that one or more of the operating parameters of a RCVR, TRMTR, or REGENR circuit pack has exceeded the recommended range.

1. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarms and Status Report.
2. Is one or more of the conditions listed in Table A indicated in the report?
If **YES**, then find this second associated condition (identified below) in Table A of **TAP-102** and go to the referenced TAP.
If **NO**, then continue with Step 3.

Table A - Possible Associated Conditions

incoming OC-48 LOS
RCVR failure
TRMTR failure
REGENR failure
line FERF

⇒ **NOTE:**
This condition, by itself, does not indicate a failure with the FT-2000 network element.

⇒ **NOTE:**
At an FT-2000 end terminal and at the CIT, select **PERFORMANCE-Retrieve-PM-Optics** to obtain a report that shows the transmit power, receive power, and the laser bias current with respect to time.

⇒ **NOTE:**
OC-48 optical lines can be tested by using optical line meters and/or optical time domain reflectometers (OTDR) to help locate a fiber bend or cut.

3. Refer to local operating procedures for further guidance in addressing this condition.

Clear Alarm When `NE ACTY' and `FE ACTY' LEDs Are Off or You Cannot Login to a Network Element

Overview: This procedure is used to clear an active office alarm originating at an FT-2000 network element when both the **NE ACTY** and the **FE ACTY** LED on the user panel are off. This procedure is also used when a login cannot be established via any port to a Network Element.

1. Is the green **POWER ON** LED on the user panel lighted?
If **YES**, then continue with Step 2.
If **NO**, then go to **TAP-119**.
2. Is the CIT conditioned and connected to the FT-2000 network element?
If **YES**, then continue with Step 3.
If **NO**, then complete **DLP-501** and return to this procedure.

⇒ **NOTE:**
It is unlikely that the CIT will be unable to communicate with the network element under these conditions.

3. At the CIT, select **FAULT-Retrieve-Alarm** to try to obtain an Active Alarms and Status Report.
4. Are you able to communicate with the network element (obtained an Active Alarms and Status Report)?
If **YES**, then continue with Step 5.
If **NO**, then continue with Step 6.
5. Make a note that the office alarm outputs and/or the **NE ACTY** and **FE ACTY** LEDs on the user panel are not operating properly and go to **TAP-108**.

⇒ **NOTE:**
The SYSCTL and/or the SYSMEM circuit pack is either failed or removed.

6. Remove the shelf cover from the Low Speed Shelf - System Controller.

7. Are SYSCTL and SYSMEM circuit packs installed?

If **YES**, then continue with Step 8.

If **NO**, then continue with Step 16.

8. If the bay is still in service, remove the LNCTL circuit pack.

9. Remove the SYSMEM circuit pack and install a replacement circuit pack having the same or a higher series number. For example, a series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.

Reference: **DLP-514**

10. Wait 10 minutes. (If an Active Alarms and Status Report is obtained during this time and the Description Column shows a **reset in progress** condition, don't worry because this is a normal software download operation).

11. Does one or both of the following conditions exist?

a. The **NE ACTY** and/or **FE ACTY** LED are lighted.

b. The office alarm(s) is off.

If **YES**, then continue with Step 19.

If **NO**, then continue with Step 12.

12. Reinstall the original SYSMEM circuit pack removed in Step 9.

Reference: **DLP-514**

13. Remove the SYSCTL circuit pack and install a replacement circuit pack having the same or a higher series number. For example, a series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.

Reference: **DLP-514**

14. Wait 10 minutes.

15. Does one or both of the following conditions exist?

a. The **NE ACTY** and/or **FE ACTY** LED are lighted.

b. The office alarm(s) is off.

If **YES**, then continue with Step 19.

If **NO**, then contact your local maintenance support group for a higher level of technical assistance.

16. Install a replacement SYSMEM and/or SYSCTL circuit pack in the appropriate slot(s).

Reference: **DLP-514**

17. Wait 10 minutes, or until the **NE ACTY** or **FE ACTY** LED is on, or until the office alarm(s) is off, whichever comes first.

18. Does one or both of the following conditions exist?

- a. The **NE ACTY** and/or **FE ACTY** LED is lighted.
- b. The office alarm(s) is off.

If **YES**, then continue with Step 19.

If **NO**, then contact your local maintenance support group for a higher level of technical assistance.

19. Log in to the network element as directed by the instructions on the CIT screen.
20. At the CIT, select **CONFIGURATION-Retrieve-Equipment** and **SYSCTL** to obtain an Equipage and Version Report.
21. Refer to the Equipage and Version Report and compare the software version stored in the SYSMEM (shown under the **sysmem** entry in the report) and the software version running in the network element (shown under the **sysctl** entry in the report) with office records. If office records are not available, log in remotely to another network element and obtain a report to determine what software version is running in the network.
22. Is the correct software version stored in the SYSMEM and running in the network element?

If **YES**, then continue with Step 29.

If **NO**, then continue with Step 23.

23. Install the appropriate software into the SYSMEM circuit pack.

Reference: **Operation: NTP-002**

24. At the CIT, select **FAULT-Reset** and execute.

25. Wait 10 minutes or until the **MJ** LED is off at the user panel, whichever comes first. Reset takes approximately 10 minutes, but some user panel LEDs flash and relays click in about a minute, indicating that reset has started.
26. Login to the network element as directed by the instructions on the CIT screen.
27. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection**. Verify that all cross-connections are present and correct.

If the cross-connections are correct, then go to Step 28.

If the cross-connections are corrupt, they must be corrected.

Reference: DLP-536

28. Insert the LNCTL circuit pack. This will cause a reset of the OHCTL packs, the TOHCTL pack, and then all transmission packs.
29. Is the **NE ACTY** LED off?
 - If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
 - If **NO**, then go to the **Trouble Clearing: IXL-001**

Clear `DS-NE Not Reachable'

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Clear 'Duplicate Node ID Defined' or 'Duplicate TID Defined'



NOTE:

A recently entered target identifier (TID) value is a duplicate of another network element in the ring network.

1. Determine from office records the correct TID for the network elements showing the duplicate values.
2. Log in to the network element that is in error. If a remote login is required and you need additional help, refer to **DLP-524**.
3. At the CIT, select **SECURITY-Set -Network Element** and enter the correct TID for that network element.
4. Log off of the network element, as required.
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `Multiple DS-NEs Defined'

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Clear 'Node ID Conflict'



NOTE:

This condition is normally a transient condition.

1. Wait 5 minutes or until the **NE ACTY** LED on the user panel goes off.
2. At the CIT, select **FAULT-Retrieve-Alarms** to obtain an Active Alarms and Status Report.
3. Has the **node ID conflict** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then continue with Step 4.



NOTE:

The **node ID conflict** alarm may have occurred during node addition/deletion if the procedure in this manual was not followed properly, or it may have occurred after an isolated node was restored.

4. Try removing and reconnecting the OC-48 fibers associated with the line direction shown in the CIT Active Alarms and Status Report.
5. Has the **node ID conflict** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then go to **TAP-108** to clear the unexpected response.

Clear `Ring Incomplete/Open'

⇒ **NOTE:**
This condition indicates that the subject network element is unable to create a complete ring map because of a controller or transmission failure in the ring network.

⇒ **NOTE:**
You cannot obtain a valid Ring Map Report while this condition exists.

1. Consult office records to determine the Target Identifiers (TIDs) of the other nodes in the ring.
2. Establish a remote login to any one of the other network elements identified from the the office records in Step 1. If you need help with the remote login, refer to **DLP-524**.
3. At the CIT, select **FAULT-Retrieve-Alarms** to obtain an Active Alarms and Status Report for that network element.
4. Does a controller circuit pack (SYSCTL, SYSMEM, LNCTL, or OHCTL) condition or an incoming OC-48 condition appear in the Active Alarms and Status Reports?
 If **YES**, then go to **TAP-102** to clear the indicated condition(s).
 If **NO**, then continue with Step 5.
5. Repeat Steps 2 through 4 for each of the remaining network elements identified in Step 1.
6. At the CIT, select **CONFIGURATION-Retrieve-Map-Ring** to obtain the current ring topology and communication status of each node. Is the **ring incomplete/open** condition still active at the original network element?
 If **YES**, then continue with Step 7.
 If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.
7. Consult the appropriate maintenance support organization for further technical assistance.

8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Ring Startup In Progress'



NOTE:

This condition is normally a transient condition.

1. Wait 5 minutes or until the **NE ACTY** LED on the user panel goes off.
2. At the CIT, select **FAULT-Retrieve-Alarms** to obtain an Active Alarms and Status Report.
3. Has the **ring startup in progress** condition cleared?
If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **NO**, then go to **TAP-108** to clear the unexpected response.

Address 'Extra Traffic Preempted'



NOTE:

This condition indicates that the extra traffic routed over the protection tributaries (9 through 16) has been preempted by a line protection switch. This condition (**extra traffic preempted**) is normally cleared by correcting the associated condition(s) that caused the automatic line protection switch.

1. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.
2. Referring to the report obtained in Step 1, are there any conditions other than **extra traffic preempted** listed?
 - If **YES**, then continue with Step 3.
 - If **NO**, then initiate a Trouble Report to the remote FT-2000 network element (or source of failure) stating the **extra traffic preempted** condition.
3. Is the **line auto switch** condition reported?
 - If **YES**, then go to **TAP-115** to clear this condition that was caused by an automatic line switch.
 - If **NO**, then continue with Step 4.
4. Referring to the report obtained in Step 1, identify the topmost condition other than the **extra traffic preempted** and **line auto switch** conditions.
5. Find the condition identified in Step 4 in Table A of **TAP-102** and go to the indicated TAP to clear that condition.

Clear `Path TCA', `Section TCA', or `Line TCA'

1. This condition indicates that a threshold-crossing alert (TCA) has been issued. The alert means that the signal degrade threshold has been exceeded.



NOTE:

At the CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.

2. Referring to the report obtained in Step 1, are there any conditions other than **path TCA, section TCA, or line TCA** listed?
If **YES**, then continue with Step 3.
If **NO**, then consult and follow local operating procedures for further guidance in addressing this condition.
3. Referring to the report obtained in Step 1, identify the topmost condition other than the **path TCA, section TCA, or line TCA** conditions.
4. Find the condition identified in Step 3 in Table A of **TAP-102** and go to the indicated TAP to clear that condition.

Clear 'Incoming OC-48 Invalid F Byte'

1. Referring to the Active Alarms and Status Report on the CIT screen, is the Source Address for the "incoming OC-48 invalid F byte" condition that of an FT-2000 Repeater Bay/Shelf or of an OC-48 line?

If **FT-2000 Repeater Bay/Shelf**, then continue with Step 2.
If **OC-48 Line**, then continue with Step 4.



NOTE:

The condition to be cleared is at a remote FT-2000 Repeater Bay/Shelf.

2. Go to **TAP-147** to address the "incoming OC-48 invalid F byte" condition.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
4. Wait 5 minutes for the condition to clear.



NOTE:

The **incoming OC-48 invalid F byte** condition is issued whenever slot provisioning occurs at a repeater. This condition is normal during this automatic slot provisioning. This condition is normally cleared by correcting the associated condition(s) that caused the **incoming OC-48 invalid F byte** condition.

5. Is the node connected to the alarmed OC-48 line a *WaveStar* node?

If **YES**, then continue with Step 6.
If **NO**, then continue with Step 11.
6. At the CIT, select **RTRV - OC48** and determine if the F Byte Processing parameter is disabled for the alarmed OC-48 line.
7. Is F Byte Processing disabled for the alarmed OC-48 line?

If **YES**, continue with Step 11.
If **NO**, continue with Step 8.
8. At the CIT, disable F Byte Processing for the alarmed OC-48 line by selecting the **SET - OC48** command.

9. At the CIT, select **FAULT-Reset** and wait five minutes for the reset to finish.
10. At the CIT, select **FAULT-Retrieve-Alarms-All** to obtain the Active Alarms and Status Report.
11. Referring to the report obtained in Step 10, are there any conditions other than **incoming OC-48 invalid F byte** listed?

If **YES**, then continue with Step 13.

If **NO**, then continue with Step 12.

12. Has the **incoming OC-48 invalid F byte** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then continue with Step 16.

13. Referring to the report obtained in Step 10, identify the topmost condition other than the **incoming OC-48 invalid F byte** condition.

14. Find the condition identified in Step 13, then refer to Table A of **TAP-102** and go to the indicated TAP to clear that condition.

15. Has the **incoming OC-48 invalid F byte** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then go back to Step 10.

16. Are you responsible for maintaining the remote FT-2000 network element(s) as well as the local FT-2000 network element?

If **YES**, then continue with Step 17.

If **NO**, then initiate a Trouble Report to the remote FT-2000 network element (or source of failure) stating the **incoming OC-48 invalid F byte** condition.

17. At the CIT, and as necessary, select **FAULT-Retrieve-Map-Ring** to obtain the current ring topology and communication status to each node.

18. Have you already checked the adjacent NE in the East bound direction?

If **NO**, then continue with Step 19.

If **YES**, then continue with Step 21.

19. At the CIT, establish a remote login to the adjacent NE in the East bound direction. Press the CIT function key **F2**, labeled **REMOTE**, and log in to the other FT-2000 NE with the TID identified in Step 17. If you need additional help,

refer to **DLP-524**.

| 20. Repeat Steps 10 through 21.

21. At the CIT, establish a remote login to the adjacent NE in the West bound direction. Press the CIT function key **F2**, labeled **REMOTE**, and log in to the other FT-2000 NE with the TID identified in Step 11. If you need additional help, refer to **DLP-524**.

| 22. Repeat Steps 11 through 21.

23. Has the **incoming 0C-48 invalid F byte** condition cleared?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then go to **TAP-108** to clear the unexpected response.

Address 'Traffic Squelched'



NOTE:

The **traffic squelched** condition indicates that multiple failures have occurred in the ring network and have resulted in the traffic being squelched (stopped) to eliminate any possibility of it being misrouted. A **traffic squelched** condition is normally cleared by correcting the associated condition(s) that caused the **traffic squelched** condition.

1. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** to obtain the Active Alarms and Status Report.
2. Referring to the report obtained in Step 1, are there any conditions other than **traffic squelched** listed?
 - If **YES**, then continue with Step 3.
 - If **NO**, then initiate a Trouble Report to the remote FT-2000 network element (or source of failure) stating the **traffic squelched** condition.
3. Referring to the report obtained in Step 1, identify the topmost condition other than the **traffic squelched** condition.
4. Find the condition identified in Step 3 in Table A of **TAP-102** and go to the indicated TAP to clear that condition.

Address Condition at Remote Repeater Bay/Shelf

Overview: This procedure is used to address a condition at a remote FT-2000 Repeater Bay/Shelf in response to one of these indicated conditions:

Incoming OC48 B1 parity error	optical parameter out-of-range
Incoming OC48 invalid F byte	repeater bay environment input
Incoming OC48 LOS/LOF	repeater bay equipment failure



NOTE:

The condition to be cleared is at a remote FT-2000 Repeater Bay/Shelf.

1. Referring to the Active Alarms and Status Report on the CIT screen, note and record the Source Address for the condition that sent you to this procedure (the topmost condition in the report).
2. Issue a Trouble Report to the FT-2000 Repeater Bay/Shelf location with the indicated Source Address. The Trouble Report should include the text from the Description field of the report.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'CP (Unknown Type) Removed'



NOTE:

The **Source Address** of the removed circuit pack is shown in the Active Alarms and Status Report.

1. Identify the appropriate shelf associated with the removed circuit pack as indicated in Table A.

Table A - Source Addresses and Associated Shelves

Source Address	Associated Shelf
ls-()	Low Speed Shelf - Complementary or Low Speed Shelf - System Controller
lssw-()	
tg-()	
trmtr-()	High Speed Shelf or Enhanced High Speed Shelf
rcvr-()	
lnctl-()	
ohctl-()	
regenr-()	Repeater Bay/Shelf

2. Remove the appropriate shelf cover.
Reference: **DLP-511**
3. Is the indicated slot empty?
If **YES**, then continue with Step 4.
If **NO**, then go to **TAP-108**.
4. Do office records show that the slot should contain a circuit pack?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 5.
5. At the CIT, select **CONFIGURATION-Update** (records the current hardware arrangement in SYSMEM circuit pack).

6. Replace the shelf cover.

Reference: **DLP-511**

7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

8. Obtain the type of circuit pack determined from office records and install it in the appropriate slot. As required, make the appropriate optical connections on the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit pack(s).

Reference: **DLP-514**

9. Wait for the time indicated in Table B.

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

10. Is the **FAULT** LED lighted on the replacement circuit pack?

If **YES**, then replace shelf cover and go to **Trouble Clearing: IXL-001**.

If **NO**, then continue with Step 11.

11. Replace shelf cover.

Reference: **DLP-511**

12. Is the **NE ACTY** LED lighted at the user panel.

If **YES**, then go to **Trouble Clearing: IXL-001**.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear DRI Switch

Overview: This procedure is used to clear one of the following conditions:

DRI auto switch
DRI manual switch

1. Which switch condition is to be cleared?
If **DRI auto switch**, then continue with Step 2.
If **DRI manual switch**, then continue with Step 8.

⇒ **NOTE:**
Conditions are shown in the "**Description**" column of the Active Alarms and Status Report.

2. Is there one or more other conditions with the same STS3 (or STS1) tributary **Source Address** in the report?
If **YES**, then continue with Step 3.
If **NO**, then continue with Step 5.
3. Identify the topmost other conditions in the report with the same STS3 (or STS1) tributary **Source Address**. Find this condition in Table A of **TAP-102** and go to the referenced TAP.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
5. At the CIT, select the **FAULT-Switch-Path-STS3 (or STS1)** command with a priority of RESET to reset the switch.
6. The automatic DRI switch may have been caused by loss of signal (LOS), loss of Frame (LOF), and, with SONET interfaces by Alarm Indication Signal (AIS-P). It will automatically revert to normal upon restoral of the signal.
7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
8. Does the need for the DRI manual switch still exist?
If **YES**, then continue with Step 9.
If **NO**, then continue with Step 10.



NOTE:

Was the DRI manual switch initiated by a user command. You must determine, by consulting with the appropriate maintenance personnel, whether the need for the DRI manual switch still exists before proceeding.

9. Referring to the Active Alarms and Status Report on the CIT screen, are any conditions indicated other than the DRI manual switch?

If **YES**, then go to **TAP-102** to clear the remaining condition(s) ignoring the DRI manual switch condition.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

10. At the CIT, select the **FAULT-Switch-Path-STS3 (or STS1)** command with a priority of RESET to reset the switch.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'APS Provisioning Conflict'

⇒ **NOTE:**
An "APS provisioning conflict" condition means that the line protection switching configuration (1xN or 1+1) or directionality (unidirectional or bidirectional) is provisioned differently at the two ends of the line.

1. Referring to the topmost entry in the Active Alarms and Status Report on the CIT screen, is the **Source Address** of the line with an "APS provisioning conflict" condition that of an OC-48, OC-3, or an OC-12 line?

If **OC-48**, then continue with Step 2.

If **OC-3**, then continue with Step 7.

If **OC-12**, then continue with Step 7.

2. At the CIT, select the **CONFIGURATION-Retrieve-Protection-Line** command to obtain a Network Element Protection Switching Provisioning Report and note the entries in the report for "Configuration" and "Directional."
3. Do the values of "Configuration" and "Directional" recorded in Step 2 match those from the office records?

If **YES**, then continue with Step 7.

If **NO**, then continue with Step 4.

4. At the CIT, select the **CONFIGURATION-Set-Protection-Line** command to provision the correct values for "Configuration" and/or "Directional."
5. At the CIT, select the **FAULT-Retrieve-Alarm** command to obtain another Active Alarms and Status Report.
6. Does the "APS provisioning conflict" condition still appear in the report?

If **YES**, then continue with Step 7.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
The FT-2000 OC-3 interface is always provisioned for 1+1 unidirectional protection switching or it is unprotected (0x1).

7. Issue a Trouble Report to the network element at the other end of the line indicating the "APS provisioning conflict" condition and the provisioned "Configuration" and "Directional" values recorded at this end of the line.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address 'CP Reset In Progress'

⇒ **NOTE:**
When a circuit pack is installed, it is downloaded with the necessary software.
While this is occurring, the **CP reset in progress** condition will be active.

1. Find the circuit pack with the **CP reset in progress** condition in Table A and wait for the indicated time.

Table A - Circuit Pack Reset Time

Circuit Pack	Time
SYSCTL	10 minutes
SYSMEM	10 minutes
LNCTL	10 minutes
OHCTL	5 minutes
TOHCTL	5 minutes
All Others	35 seconds

2. At the CIT, select the **FAULT-Retrieve-Alarm** and execute to obtain another Active Alarms and Status Report.
3. Is the **CP reset in progress** condition still indicated for the same circuit pack?
If **YES**, then go to **TAP-108**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Clear 'Inc. (from OC48) Sync Ref Fail'



NOTE:

An "**inc. (from OC48) sync ref fail**" condition is associated with another condition that prevents the TG circuit pack from receiving a good synchronization reference signal from the associated RCVR circuit pack.

1. Does an "incoming OC-48 LOS," "RCVR failure," or "RVCR removed" condition also appear in the Active Alarms and Status Report on the CIT screen?

If **YES**, then find that condition in Table A of **TAP-102** and go to the indicated Trouble Clearing procedure.

If **NO**, then go to **TAP-108**.
2. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `STS3 Squelch Map Conflict', `STS1 Squelch Map Conflict', or `Squelch Map Conflict'

⇒ **NOTE:**
An **STS3 (or STS1) squelch map conflict** condition is most likely caused by the controller circuits being unable to associate any network element's target identifier (TID) with the value supplied for a source or destination node of a cross-connection.

⇒ **NOTE:**
The Destination/Source(s) with an **STS3 (or STS1) squelch map conflict** or **squelch map conflict** condition are indicated by an asterisk (*) appearing immediately before the TID in the report.

⇒ **NOTE:**
The following are possible causes of the **STS3 (or STS1) squelch map conflict** or the **squelch map conflict** condition:

- A possible cause is the user entered a nonexistent TID while executing the **CONFIGURATION-Enter-Crossconnect-STS3 (or STS1)** or the **CONFIGURATION-Enter-Roll-STS3 (or STS1)** command.
- A node was deleted from the ring but not the cross-connections to that node from the remaining nodes in the ring.
- A possible cause of this condition is that the wrong TID has been entered when executing the **SECURITY-Set-Network Element** command.

1. At the CIT, select the **CONFIGURATION-Retrieve-Crossconnection-STS3 (or STS1)** command and execute to obtain an STS-3 (or STS-1) Cross-Connection Map Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
2. Find the cross-connection with the invalid flag (invalid flag is specified with TID).
3. Consult office records to determine the proper TID for the Source/Destination of the troublesome cross-connection (TID).

4. Is the TID from the report (Step 2) the same as that specified in the office records (Step 3).
 If **YES**, then continue with Step 5.
 If **NO**, then continue with Step 8.
5. Log in to the node with the incorrect TID. If a remote login is required and you need additional help, refer to **DLP-524**.
6. At the CIT, select the **SECURITY-Set-Network Element** command and execute to correct the TID.
7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
8. Is the Source/Destination node of the troublesome cross-connection from a node that has been deleted?
 If **YES**, then continue with Step 9.
 If **NO**, then continue with Step 13.
9. Consult office records and verify that the cross-connection is no longer needed.
10. Identify the nodes with the incorrect cross-connections and log in to the nodes one at a time.
11. At the CIT, select the **CONFIGURATION-Delete-Crossconnection-STS3 (or STS1)** command and execute to delete the cross-connections for the deleted node.
12. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
13. Consult office records to determine the correct TID for the Source/Destination of the troublesome cross-connection (TID).
14. At the CIT, select the **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command and correct the Source/Destination for each of the cross-connections with an asterisk in the STS-3 (or STS-1) Cross-Connection Map Report.
15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address `TG Warming Up'

⇒ **NOTE:**
When a TG circuit pack is installed (or if it fails and recovers while still inserted), it must be allowed to reach a stable operating temperature before it is switched into service. This warming up process takes as long as 5 minutes.

1. Wait 5 minutes or until the **NE ACTY** LED on the local FT-2000 user panel goes off, whichever comes first.
2. At the CIT, select **FAULT-Retrieve-Alarm** and execute to obtain another Active Alarms and Status Report.
3. Is the "**TG warming up**" condition still active for the same circuit pack?
If **YES**, then go to **TAP-108**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear Suspected Failure in FT-2000 Network Element(s) Via Remote Modem (or Datakit[®] Network) Connection

Overview: This procedure is used to clear a suspected failure in one or more FT-2000 network elements when you are **not** physically located at any of the network elements in the network. If you are located at one of the network elements, go to Trouble Clearing: IXL-001 and select the procedure, from among the others listed, that most closely matches the actual situation.

⇒ **NOTE:**
Throughout this procedure, the FT-2000 network element to which you are now connected will be called the "local" network element.

⇒ **NOTE:**
From this point on, this procedure is written to support troubleshooting performed by someone physically located at the FT-2000 network element in question. For example, the procedure assumes that you can see the LEDs on the equipment, and obviously, you can not see them. The procedure also assumes that you can perform visual inspections and replace circuit packs, and you can not do these things either. At some point in this procedure, you will likely require assistance at the FT-2000 network element in question.

⇒ **NOTE:**
When the procedure asks if the **NE ACTY** LED is lighted, you can use the CIT to select **FAULT-Retrieve-Alarm-All** to obtain an Active Alarms and Status Report. If there are one or more entries in the report, you can assume that **NE ACTY** is lighted.

⇒ **NOTE:**
When the procedure asks if the **FAULT** LED is lighted on a particular circuit pack, you can use the CIT to select **FAULT-Retrieve-Alarm-All** to obtain an Active Alarms and Status Report. If the circuit pack in question is shown as failed in the report, you can assume that its **FAULT** LED is lighted.

1. Is the CIT conditioned and a remote login established, via modem or *Datakit* network, to an FT-2000 network element in the network?

If **YES**, then continue with Step 4.

If **NO**, then complete **DLP-501** and **DLP-521** and return to this procedure.

2. Either consult office records to determine the TID of other NEs in the ring; or, select **CONFIGURATION-Retrieve-Map-Ring** to identify all NEs in the ring along with each NEs communication status.



NOTE:

It is not possible to login to a Repeater Bay/Shelf.

3. At the CIT, establish a remote login to any one of the other NEs identified from Step 2. Press the CIT function key **F2**, labeled **REMOTE**, and log in to the other FT-2000 network element with the TID identified in Step 2. If you need help with the remote login, refer to DLP-524.

4. At the CIT, select **FAULT-Retrieve-Alarms-All** to obtain an Active Alarms and Status Report for that particular NE.

5. Are there any entries in the Active Alarms and Status Report?

If **YES**, then go to **TAP-102** to clear the indicated condition(s).

If **NO**, then continue with Step 6.



NOTE:

There are no active alarm or status conditions in this NE.

6. Repeat Steps 2 through 5 for each of the remaining NEs identified in Step 2.

7. At this point any problem(s) associated with any/all NEs, except repeaters, will have already been corrected. Does the ring contain a Repeater Bay/Shelf?

If **YES**, and if locally determined necessary, you should issue a Trouble Report about the FT-2000 Repeater Bay/Shelf location with the indicated *Source Address*. If not necessary continue with Step 8.

If **No**, continue with Step 8.

8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'DS3 Path Unequipped'

Overview: The DS3 path unequipped condition means that a DS3 drop-direction port in the network element lacks a continuous path back to a DS3 source. This procedure is used to locate the missing cross-connection(s) and/or circuit pack(s) in that path.

1. Referring to the Active Alarms and Status Report on the CIT screen, note and record the **Source Address** of the DS3 port reporting the **DS3 path unequipped** condition.
2. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-STS1** to obtain an STS-1 Cross-Connection Map Report.
3. Referring to the STS-1 Cross-Connection Map Report, note and record the tributary (1-48 for STS1) and line (1E or 1W) to which the affected DS3 port is cross-connected.
4. At the CIT, select **CONFIGURATION-Retrieve-Map-Ring** to obtain a Ring Map Report.
5. Referring to the Ring Map Report, note and record the TID of the next network element in the affected path. (The network element terminating line 1E is the second entry in the report. The network element terminating line 1W is the bottom entry in the report.)

⇒ **NOTE:**
If you are already remotely connected to a network element, you must **LOGOUT** (use **F4** key) before you can remotely log in to another network element.

6. At the CIT, press the function key **F2**, labeled **REMOTE**, and log in to the network element identified in Step 5.

⇒ **NOTE:**
The next two steps will determine whether a cross-connection exists at this network element for the path being traced. If the path left the previous network element on line 1E, it will arrive at this network element on line 1W and vice versa

7. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-STS1** to obtain an STS-1 Cross-Connection Map Report.
8. Referring to the STS-1 Cross-Connection Map Report, is a through cross-connection, an add cross-connection, or no cross-connection shown for the appropriate tributary (1-48 for STS1) and line (1E or 1W)?

If a **through cross-connection**, then go back to Step 4.

If an **add cross-connection**, then continue with Step 9.

If **no cross-connection**, then continue with Step 18.

9. Referring to the STS-3 (or STS-1) Cross-Connection Map Report, note and record the LS INTFC slot associated with the add cross-connection.
10. At the CIT, select **CONFIGURATION-Retrieve-Equipment: All** to obtain an Equipage and Version Report.
11. Referring to the Equipage and Version Report, is a DS3 circuit pack (CP), an STS1E or OC3 CP, or no CP shown for the LS INTFC slot identified in Step 10?

If a **DS3 CP**, then continue with Step 12.

If an **STS1E or OC3 CP**, then continue with Step 14.

If **no CP**, then continue with Step 16.

⇒ **NOTE:**
There is no apparent reason for the **DS3 path unequipped** condition.

12. Go to TAP-108 to clear the incorrect response.

13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
The DS3 path does not originate within the FT-2000 ring network.

14. Issue a Trouble Report to the source of the path associated with the LS INTFC slot identified in Step 9.

15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

⇒ **NOTE:**
The **DS3 path unequipped** condition is due to the path's not having a DS3 source. The condition can be cleared by installing a DS3 CP or by deleting all of the cross-connections associated with the path at all of the associated nodes.

16. Install a DS3 circuit pack in the LS INTFC slot identified in Step 9 (**DLP-514**) or delete all of the cross-connections associated with the path at all of the associated nodes (**DLP-536**).

17. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



CAUTION:

Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.



NOTE:

The **DS3 path unequipped** condition is due to one or more missing cross-connections, including one at this network element. The condition can be cleared by entering the missing cross-connection(s) or by deleting all of the cross-connections associated with the path at all of the associated nodes.

18. Referring to office records, enter the missing cross-connection(s) or delete all of the cross-connections associated with the path at all of the associated nodes (**DLP-536**).
19. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'FT-LBA (Condition)'

Overview: This procedure is used to clear a condition at an FT-2000 Lightwave Booster Amplifier (FT-LBA) in response to one of these indicated conditions at the FT-2000 network element:

FT-LBA fan failure	FT-LBA fuse/power failure
FT-LBA 1EW failure	FT-LBA 1WE failure

1. Are you responsible for maintaining the FT-LBA?
If **YES**, then continue with Step 2.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
2. Clear the FT-LBA trouble condition(s) by using the FT-LBA user documentation (365-565-500).
3. To verify that the trouble condition has been cleared, select **FAULT-Retrieve-Alarm** at the CIT to obtain an Active Alarms and Status Report from the FT-2000 network element and verify the condition is not shown.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `OC3/OC12 Mode Conflict (Equipment, Slot Pair, X-Connect)'



NOTE:

An OC3/OC12 mode conflict () means that the addressed slot has a Provisioned Mode of "1+1" and an Operating Mode of "0x1."

1. What is the condition to be cleared?

If **OC3 mode conflict (equipment)**, then continue with Step 2.

If **OC12 mode conflict (equipment)**, then continue with Step 2.

If **OC3 mode conflict (slot pair)**, then continue with Step 6.

If **OC12 mode conflict (slot pair)**, then continue with Step 6.

If **OC3 mode conflict (x-connect)**, then continue with Step 10.

If **OC12 mode conflict (x-connect)**, then continue with Step 10.



NOTE:

For an LS INTFC slot to have an Operating Mode of "1+1," both the A slot and the B slot of the slot pair must be equipped with OC3/OC12 circuit packs.

2. At the CIT, select **CONFIGURATION-Retrieve-Equipment:LS INTFC** to obtain an Equipage and Version Report.
3. Use the first and second columns in the report to locate the slot with no circuit pack installed or the wrong type of circuit pack (DS3 or STS-1E) installed.
4. Install an OC3/OC12 circuit pack or replace the wrong type circuit pack with an OC3/OC12 circuit pack.
Reference: **DLP-514**
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
6. For an LS INTFC slot to have an Operating Mode of "1+1," both the A slot and the B slot of the slot pair must have a Provisioned Mode of "1+1." At the CIT, select **CONFIGURATION-Retrieve-OC3(or OC12):All** to obtain an OC3/OC12 Provisioning Report.

7. Use the **Provisioned** and **Operating** columns in the report to identify the slot pair that is not provisioned correctly (mismatched).
8. At the CIT, select **CONFIGURATION-Set-OC3(or OC12)** command to correctly provision the slot (must match).
Reference: **DLP-517**
9. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
10. For an LS INTFC slot to have an Operating Mode of "1+1," the two slots (A and B) cannot be cross-connected to different tributaries in the applicable direction of transmission. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-STS1** to obtain an STS-3 (or STS-1) Cross-Connection Map Report.
11. Use the **Cross-Connection** column in the report to locate the invalid cross-connection(s).
12. At the CIT, select **CONFIGURATION-Delete-Crossconnection** command to correct the invalid cross-connection(s).
13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `CPYPGM:IP (tid)'

⇒ **NOTE:**
This condition means that software is being copied from this FT-2000 network element to the FT-2000 network element whose target identification (TID) appears in the message.

⇒ **NOTE:**
The software download is performed in the background (approximately 1 hour) and is from one SYSMEM circuit pack to another SYSMEM circuit pack. Up to 15 downloads can occur simultaneously. See the Software Release Description Known Problems section for limitations on simultaneous downloads with some software releases.

⇒ **NOTE:**
You **cannot cancel** the background download **once it is initiated**.

1. If desired, you may perform other CIT-PC activities during this time, for example, checking the status of the download [use the **CONFIGURATION-Retrieve-Alarm (and Status)** command].

If an error message appears on the screen during the background download, reinitiate the software download per **Operation: NTP-005**.

2. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Incoming OC3 APS Byte Fail' or 'Incoming OC12 APS Byte Fail'

⇒ **NOTE:**
This condition means a hardware and/or software failure at this FT-2000 network element or at the network element at the opposite end of the indicated OC-3/OC-12 line (could be a DDM-2000 network element or an FT-2000 network element).

1. At the CIT, select **FAULT-Retrieve-Alarms (and Status)** command to obtain an Active Alarms and Status Report.

⇒ **NOTE:**
The specific condition is found in the **Description** column of the report.

2. Is there one or more other conditions in the report?
If **YES**, then continue with Step 3.
If **NO**, then issue a Trouble Report to the opposite end of the OC-3 line stating that you are receiving an **incoming OC3 APS byte fail** or **incoming OC12 APS byte fail** condition.
3. Identify the topmost condition other than the **incoming OC3 APS byte fail** or **incoming OC12 APS byte fail** condition in the report. Find this condition in Table A of **TAP-102** and go to the referenced TAP.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Circuit Audit Suspended'

⇒ **NOTE:**
This condition means that the background circuit audit has stopped running possibly caused by a data communication channel (DCC) failure somewhere in the network.

⇒ **NOTE:**
On startup, an incomplete ring, will cause a "circuit audit suspended" alarm. And, while the ring remains incomplete, the "circuit audit suspended" alarm will not clear.

⇒ **NOTE:**
This condition may be caused due to ULSDCC provisioning errors. If the problem remains after exhausting other ideas first—then the ULSDCC provisioning parameters should be checked.

1. Did you just remove and reseal the LNCTL circuit pack in another procedure?

If **YES**, then reset the network element (use the **FAULT-Reset** command). **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then continue with Step 2.

2. Are you performing an auto turnup test (toward the DSX, STSX1, or LGX)?

If **YES**, then reset the network element (use the **FAULT-Reset** command). **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then continue with Step 3.

3. At the CIT, select the **CONFIGURATION-Retrieve-Map-Ring** command to obtain a Ring Map Report.

⇒ **NOTE:**
It may take up to 5 minutes from the time that the cause of **circuit audit suspended** is corrected until the actual alarm disappears.

4. Does a **FAIL** indication appear in the **DCC Status** column of the report?
If **YES**, then continue with Step 5.
If **NO**, then wait for 5 minutes, if the **circuit audit suspended** condition still exists, then contact your next level of technical support.
5. Determine from the report the target identification (TID) associated with the **FAIL** indication in the **DCC Status** column.
6. Use the TID identified in Step 5 to locate the FT-2000 network element. You must dispatch to that location or ask for assistance from that location.
7. At the CIT, select **CONFIGURATION-Retrieve-Alarms (and Status)** command to obtain an Active Alarms and Status Report.
8. Does the **incoming DCC failure** condition appear in the **Description** column of the report?
If **YES**, then go to **TAP-120** (referenced from **TAP-102**).
If **NO**, then go to **TAP-102** to clear any other condition(s) in the report except for the **circuit audit suspended** condition.
9. All nodes within the FT-2000 ring must either (1) be enabled as Level 2 Routers, or (2) have the same Area Address. Login to each NE around the ring and select **CONFIGURATION-Retrieve-ULSDCC** and execute. Verify that correct parameters have been provisioned. Refer to the "Operations Interworking Guide" 824-102-144, for additional details. Use the **CONFIGURATION-Set-ULSDCC** command to make corrections to the provisionable parameters as necessary.
10. If all previous steps have failed to clear the **circuit audit suspended** condition, at the CIT, select **FAULT-Reset** and execute. During the reset time, the miscellaneous discrete control points will be deactivated.
11. Wait 10 minutes or until the **MJ** LED is off at the user panel.
12. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Circuit Provisioning Error'

⇒ **NOTE:**
This condition means an internal audit function found a circuit with incorrectly provisioned source or destination.

⇒ **NOTE:**
The most likely causes of this condition are (1) the provisioned add/drop source/destination TID for the selected drop slot does not match the actual source/destination TIDs or (2) a secondary source cross-connection is missing for a DRI circuit.

1. At the CIT, select **CONFIGURATION-Retrieve-Circuit-STS3 (or STS1)** command for the slot with the **circuit provisioning error** condition and execute to obtain an STS-3 (or STS-1) Circuit Map Report. The report lists all the cross-connections that make up this circuit. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
2. From the report obtained in Step 1, identify the tributary of the circuit. For 2-way DRI-Pri and 2-way DRI-Sec cross-connections, identify both service and protection tributaries.
3. At the CIT, select **CONFIGURATION-Retrieve-Timeslot-STS3 (or STS1)** command for the tributary identified in Step 2 and execute to obtain an STS-3 (or STS-1) Tributary Map Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
4. From the report obtained in Step 3, identify the actual source and destination nodes in the report.

Hint 1: For a 1-way cross-connection, the actual source TID is the TID (listed in the **At Node** column) of the node where the add cross-connection exists. The actual destination TID is the TID (listed in the **At Node** column) of the node where the drop cross-connection exists.

Hint 2: For a DRI cross-connection, the actual source is the TID (listed in the **At Node** column) of the secondary node.

Hint 3: For a drop-and-continue cross-connection, the actual destination is the TID (listed in the **At Node** column) of the node where the last drop in the circuit

is shown.

Hint4: For a 2-Way-DRI cross-connection, when provisioning the secondary node (2-Way-DRI secondary cross-connection), the actual TID supplied must be that for the primary node where the corresponding 2-Way-DRI-primary cross-connection is provisioned. If an incorrect TID is supplied – then the CPE alarm will be raised.

5. From the report obtained in Step 3, identify the provisioned source TID (listed in the **TID** column on the left side of the report) and the destination TID (listed in the **TID** column on the right side).
6. Compare the actual TID obtained in Step 3 with the provisioned TID obtained in Step 5 and identify any inconsistencies between the actual and provisioned node TIDs.
7. Do the actual TIDs match the provisioned TIDs?
 If **NO**, then continue with Step 8.
 If **YES**, then continue with Step 12.
8. Log in to the node with the TID inconsistency. If a remote login is required and you need additional help, refer to **DLP-524**.
9. At the CIT, select **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command to correct the problem (invalid source/destination provisioning).
10. If remotely logged in to the node (network element), log out.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
12. Log in to the node with the missing cross-connection. If a remote login is required and you need additional help, refer to **DLP-524**.
13. At the CIT, select **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command to correct a missing secondary source cross-connection for DRI circuit.
14. If remotely logged in to the node (network element), log out.
15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Path Integrity Failure'

⇒ **NOTE:**
The **path integrity failure** condition may appear as a transient condition.

1. Wait 5 minutes before continuing with this procedure if you haven't already done so.

⇒ **NOTE:**
This condition means a complete circuit from a drop cross-connection back to an add cross-connection does not exist. The circuit path is open.

⇒ **NOTE:**
The most likely cause of this condition is one or more missing through and/or add cross-connection(s).

2. At the CIT, select **CONFIGURATION-Retrieve-Circuit-STS3 (or STS1)** command to obtain an STS-3 (or STS-1) Circuit Map Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
3. Compare this report with office records to locate the node with the missing cross-connection(s). A missing cross-connection is indicated in the report by a question mark (?) in the **Cross-Connect** column.
4. Log in to the node with the missing cross-connection(s). If a remote login is required and you need additional help, refer to **DLP-524**.
5. At the CIT, select **CONFIGURATION-Enter-Crossconnection-STS3** command to correct the problem [missing cross-connection(s)].
6. If remotely logged in to the node (network element), log out.
7. If necessary, repeat Steps 4, 5, and 6 at other nodes missing a cross-connection(s).
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `STS1 Squelch Map Conflict'

⇒ **NOTE:**
This condition means an error was made in provisioning an STS1 squelch map.

⇒ **NOTE:**
The most likely cause of this condition is that one or more target identifiers (TIDs) is unknown to the STS-1 level squelch map function. The unknown TID could be the source node, through node, and/or the destination node TID.

1. At the CIT, select **CONFIGURATION-Retrieve-Squelch Map-STs1** command to obtain an STS-1 Squelch Map Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
2. Determine from the report the unknown or invalid TID. An invalid TID is shown in the report by a ? ***<tid>** in the **NID** and **Destination/Source (<tid>)** columns.
3. Consult office records to determine the correct TID for the Source or Destination of the troublesome squelch map.
4. At the CIT, select **CONFIGURATION-Enter-Squelch Map-STs1** command to correct the problem (unknown or invalid TID provisioning).
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear `STS1 Squelch Map Inconsistent'



NOTE:

An **STS1 squelch map inconsistent** condition is most likely caused by the provisioned target identifier (TID) for the Source and/or Destination Node(s) at an intermediate node is not the actual TID for the Source and/or Destination Node(s).

1. Does an **STS1 squelch map conflict** condition exists along with an **STS1 squelch map inconsistent** condition?

If **YES**, then go to **TAP-102** and clear the **STS1 squelch map conflict** condition before using this procedure.

If **NO**, then continue with Step 2.
2. At the CIT, select **CONFIGURATION-Retrieve-Circuit-STS1** command for the slot with the **STS1 squelch map inconsistent** condition and execute to obtain an STS-1 Circuit Map Report. The report lists all the cross-connections that make up this circuit. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
3. From the report obtained in Step 2, identify the tributary of the circuit.
4. At the CIT, select **CONFIGURATION-Retrieve-Timeslot-STS1** command for the tributary identified in Step 3 and execute to obtain an STS-1 Tributary Map Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
5. From the report obtained in Step 4, identify the actual source and destination nodes in the report.

Hint 1: For a 1-way cross-connection, the actual source TID is the TID (listed in the **At Node** column) of the node where the add cross-connection exists. The actual destination TID is the TID (listed in the **At Node** column) of the node where the drop cross-connection exists.

Hint 2: For a DRI cross-connection, the actual source is the TID (listed in the **At Node** column) of the secondary node.

Hint 3: For a drop-and-continue cross-connection, the actual destination is the TID (listed in the **At Node** column) of the node where the last drop in the circuit is shown.

6. From the report obtained in Step 4, identify the provisioned source TID (listed in the **TID** column on the left side of the report) and the destination TID (listed in the **TID** column on the right side).
7. Compare the actual TID obtained in Step 4 with the provisioned TID obtained in Step 6 and identify any inconsistencies between the actual and provisioned node TIDs.
8. Log in to the node with the TID inconsistency. If a remote login is required and you need additional help, refer to **DLP-524**.
9. At the CIT, select **CONFIGURATION-Enter-Crossconnection-STS1** command to correct the problem (invalid source/destination provisioning).
10. Log out of the network element at the intermediate node.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address an Unexplained Loss of Service



CAUTION:

This condition can be caused by an incorrectly provisioned source and/or destination node TID and can result in a service outage under certain multiple failure conditions.

1. At the CIT, select the **CONFIGURATION-Retrieve-Map-Ring** command to obtain a Ring Map Report.
2. Compare the actual node TIDs listed on the report with the work order (instructions).
3. Do the node TIDs match (report and work order)?
 - If **NO**, then continue with Step 4.
 - If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
4. Make the appropriate correction (node TID, cross-connection, etc.).
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear Potential Loss of Service Due to Double Failure

Overview: This procedure is used to clear an obscure double failure state which can, under some conditions, result in a potential loss of service. This procedure must not be used unless one of the specific double failure conditions identified in Steps 2 through 5 is present. Because a wide variety of specific failure messages could be associated with this double failure condition, this procedure is written in more general terms than some other trouble clearing procedures.

1. Is Release 5 or later software running in the network element?
If **YES**, then continue with Step 2.
If **NO**, then continue with Step 6.
2. Was there a loss of -48 V power to either the high-speed shelf or to the entire bay followed by a line failure on one of the spans terminated by this network element?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 3.
3. Was there a line failure on one of the spans terminated by this network element followed by a loss of -48 V power to either the high-speed shelf or to the entire bay, followed, in turn, by a clearing of the loss of -48 V power?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 4.
4. Was there a line failure on one of the spans terminated by this network element, followed by a reset of an OHCTL circuit pack for any reason, followed, in turn, by a hardware reset of an east-facing TRMTR, RCVR or an LS INTFC cross-connected to an east-facing tributary?
If **YES**, then continue with Step 8.
If **NO**, then continue with Step 5.
5. Was an LS INTFC, TRMTR, or RCVR reset or changed out while the ADR terminal was isolated from the rest of the ring or when the OC-48 signals were optically looped back?
If **YES**, then continue with Step 8.

If **NO**, then continue with Step 6.



NOTE:

The double failure condition addressed by this procedure is not present.

6. Go to **TAP-102** and clear all individual trouble conditions at this network element.
7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
8. Delete and reenter all cross-connections involving east-facing tributaries by using the **CONFIGURATION-Delete-Crossconnection:STS3 (or STS1)** command. Use the **CONFIGURATION-Enter-Crossconnection:STS3 (or STS1)** command to reenter the cross-connections.
9. At each of the nodes adjacent to the affected node, lock out high-speed protection switching by using the **FAULT-Switch-Line:All:Lockout** command. This prevents a line switch to protection anywhere in the ring and drops any active switch already in the ring.
10. Once the line failure at the affected node is cleared, reset the high-speed protection lockout at both adjacent nodes by using the **FAULT-Switch-Line:All:Reset** command. This drops the lockouts and terminates any Wait to Restore interval in progress.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'Incoming OC48 APS Default Byte'



NOTE:

This condition is normally a transient condition caused by a Reset in progress at an upstream OC-48 source.

1. Wait 5 minutes or until the **NE ACTY** LED on the user panel goes off.
2. At the CIT, select **FAULT-Retrieve-Alarms (and Status):All** command and execute to obtain an Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
3. Has the **incoming OC48 APS default byte** condition cleared?
If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **NO**, then continue with Step 4.
4. Issue a Trouble Report to the source of the incoming OC-48 signal stating the **incoming OC48 APS default byte** condition.
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address 'Inc. (from OC3) DCC Failure' or 'Inc. (from OC12) DCC Failure'

⇒ **NOTE:**
This condition means the Data Communications Channel (DCC) on the indicated OC-3/OC-12 port has failed. The failure is most likely caused by a hardware failure at the source of the incoming OC-3/OC-12 signal.

⇒ **NOTE:**
This condition will most likely prevent a remote login to the source of the incoming OC-3/OC-12 signal.

1. Issue a Trouble Report to the source of the incoming OC-3/OC-12 signal stating that you are receiving an **inc. (from OC3) DCC failure**, or **inc. (from OC12) DCC failure** condition and that they are to assume there is no trouble at this (local) network element.
2. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Address 'TID Address Map Full'

⇒ **NOTE:**
This condition means the network accessible to the local network element via its Data Communications Channel (DCC) connections has grown beyond the limit of 32.

⇒ **NOTE:**
This condition prevents the completion of the **CONFIGURATION-Retrieve-Map-Network** command to obtain a Network Map Report which normally lists the network elements in the network.

⇒ **NOTE:**
This condition can only be cleared locally and by removing the provisionable DCC connections at either the OC-3 lines, or the OC-12 lines.

1. Determine from office records if any DCC connections are engineered for the local network element.
2. At the CIT, select **CONFIGURATION-Retrieve-Assignment-DCC** command and execute to obtain a DCC Assignment Report.
3. Does the DCC information from the office records and the DCC Assignment Report agree?
If **NO**, then continue with Step 4.
If **YES**, then continue with Step 7.

⇒ **NOTE:**
The extra DCC connection(s) that appears on the report must be removed.

4. At the CIT, select **CONFIGURATION-Delete-Assignment-DCC** command and execute to remove the extra DCC connection(s).
5. At the CIT, select **FAULT-Retrieve-Alarm (and Status)** command and execute to obtain an Active Alarms and Status Report.
6. Is the **TID address map full** condition still present?
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then continue with Step 7.



NOTE:

This step is performed only if there is no extra DCC connection(s).

7. Notify the network administrator of the continued **TID address map full** condition after all extra DCC connections have been removed. Nothing else can be done locally to clear the trouble.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Restore Network Element Operation After Power Loss

⇒ **NOTE:**
The network element has had its power restored and one or more circuit packs have an "unexpected" or "unrecognized" failure.

1. Is the green **POWER ON** LED on the user panel lighted?

If **NO**, then go to **TAP-119**.

If **YES**, then continue with Step 2.

⇒ **NOTE:**
If the low-speed and/or the high-speed shelf cover is removed, you will see one or more **FAULT** LEDs lighted.

2. Wait for the time indicated in Table A.

Table A - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes
TG3 †	5 minutes
TOHCTL	5 minutes
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

3. If the low-speed and/or the high-speed shelf cover is removed, you will see one or more **FAULT** LEDs lighted. At the CIT, select **FAULT-Retrieve-Alarm (and status):All** command and execute to obtain an Active Alarms and Status Report.

4. Are any conditions listed in the **Descriptive** column of the report?
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **YES**, then continue with Step 5.
5. At the CIT, select **CONFIGURATION-Reset** command and execute to reset the network element.
6. Wait for the time indicated in Table A.



NOTE:

If the low-speed and/or the high-speed shelf cover is removed, you will see one or more **FAULT** LEDs lighted.

7. At the CIT, select **FAULT-Retrieve-Alarm (and status):All** command and execute to obtain an Active Alarms and Status Report.
8. Are any conditions listed in the **Descriptive** column of the report?
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
If **YES**, then go to **TAP-102.**
9. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'NE Status Comm Failure'

Overview: This condition could arise from situations such as one or more nodes are not reachable because of a DCC failure (condition will timeout after 4 hours if a node was intentionally removed from the subnetwork). Remember, that for this procedure, a network element (NE) and a node are interchangeable

1.



NOTE:

This procedure assumes that you are logged into the NE with the **NE status comm failure** condition.



NOTE:

This condition is complicated because it may be caused by other trouble conditions, therefore, these other conditions must be cleared first. If you have previously obtain any reports, one or all may currently be inaccurate (not up to date).

At the CIT, select **FAULT-Retrieve-Alarms** command and execute to obtain an Active Alarms and Status Report.

2. Is the **NE status comm failure** condition still shown?

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then continue with Step 3.

3. At the CIT, select **CONFIGURATION-Retrieve-Map-Network** command and execute to obtain a Network Map Report.

4. Is an **inc. (0C3) DCC failure** or **inc. (0C12) DCC failure** condition shown on the report?

If **NO**, then continue with Step 7.

If **YES**, then clear this condition first (refer to **TAP-169**) and return to this procedure.

5. Wait 5 minutes after clearing the condition.

6. Obtain another Active Alarms and Status Report. Is the **NE status comm**

failure condition still shown?

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then continue with Step 7.

7. Is an **inc. (0C48) DCC failure** condition shown on the report?

If **NO**, then continue with Step 9.

If **YES**, then clear this condition first (refer to **TAP-120**) and return to this procedure.

8. Wait 5 minutes after clearing the condition.

9. Obtain another Active Alarms and Status Report. Is the **NE status comm failure** condition still shown?

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then continue with Step 10.

10. Is a trouble condition listed in the **Descriptive** column of the report?

If **NO**, then go to **IXL-001** to start trouble clearing.

If **YES**, then go to **TAP-102**.

11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'X-Conn Provisioned But Not Est'

Overview: This condition arises from situations when hardware is not available, such as a low-speed circuit pack not being physically inserted into a slot.

1. At the CIT, select **FAULT-Retrieve-Alarms** command and execute to obtain an Active Alarms and Status Report.
2. From the report, determine the slot and/or tributary address of the cross-connection.
3. If necessary, remove the low-speed shelf cover.
4. Verify that the circuit pack is inserted into the shelf per office records.
5. Obtain another Active Alarms and Status Report.
6. Is the **x-conn provisioned but not est** condition still shown in the report?

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **YES**, then contact your next level of technical support.

Clear 'Incoming (From OC-48) STS LOP'

Overview: An **incoming (from OC-48) STS LOP** condition may occur from any of four different specific circuit pack failure. These circuit pack failures should be diagnosed in the following prioritized order:

- a. Local NE TRMTR
- b. Local NE RCVR
- c. Upstream NE TRMTR
- d. Local NE, one or more Low speed interfaces (only if the tributary is drop connected).

⇒ **NOTE:**
If no attempt to clear any solid circuit pack failures has been made prior to now, this should be done before clearing the LOP condition.

1. Does a 'circuit pack failure' condition appear in the Active Alarms and Status Report (also indicated by a lighted **FAULT LED**)?

If **NO**, then continue with Step 2.

If **YES**, then go to **TAP-111**.

⇒ **NOTE:**
Pointer processor devices (which detect STS-3 LOP) are located on the local low-speed interface circuit packs and on the local high-speed TRMTR circuit packs.

⇒ **NOTE:**
STS-3 Pointers are monitored for all tributaries, those with and those without cross-connections. However, a protection switch is made only for tributaries that have cross-connections.



NOTE:

You may need to travel to the node with the incoming condition or ask for assistance at that node.

2. Log in to the node with the incoming (from OC-48) STS LOP condition (called the local node.) If a remote login is required and you need additional help, refer to **DLP-524**.
3. From the Active Alarms and Status Report, identify and record the Source Address (AID) associated with the STS LOP condition and note the East or West line direction of the tributary (sts-1e-# or sts-1w-# where # is the tributary number [value 1 through 16]).
4. At the CIT, select FAULT-Retrieve-History command and execute to obtain a Maintenance History Report.
5. Determine from the report (in Step 4) if a repeating pattern is occurring between the East and West TRMTR circuit packs. For example (Figure 1), a repeating pattern is occurring between line-1e with TRMTR failure and TRMTR failure-cleared **and** line-1w with TRMTR failure and TRMTR failure-cleared.

If **NO**, then continue with Step 6.

If **YES**, then continue with Step 10.

```

/* Maintenance History Report
=====
Date Time      System Source      Event
of Event      Alarm Address      Description
=====
04-26 13:45:31 MN      sts-3-1w-6 incoming (from OC48) STS LOP-cleared
04-26 13:30:11 MN      line-1w      line auto switch
04-26 13:29:52 CR      trmtr-1w     TRMTR failure-cleared
04-26 13:29:51 CR      trmtr-1w     TRMTR failure
04-26 13:28:11 NE ACTY line-1e      incoming OC-48 line RFI/yellow
04-26 13:28:21 CR      trmtr-1e     TRMTR failure-cleared
04-26 13:28:20 CR      trmtr-1e     TRMTR failure
          .      .      .      .
          .      .      .      .
          .      .      .      .
04-26 13:27:31 CR      sts-3-1w-6 incoming (from OC48) STS LOP
*/

```

Figure 1 – Example Showing Repeating "TRMTR Failure/Cleared" Pattern

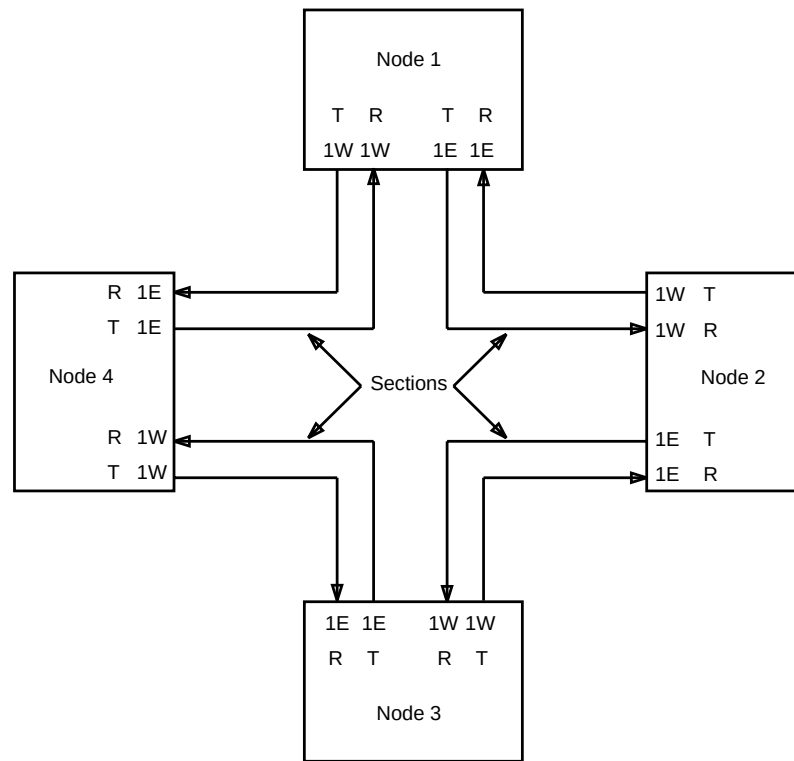


CAUTION:

It is advisable to contact your next level of technical support before replacing the opposite side TRMTR circuit pack. Service may be lost when the TRMTR circuit pack is replaced due to a double failure occurring at the local node.

6. Replace the **opposite side** TRMTR circuit pack at the local node as indicated by the Source Address from Step 3 (Figure 2). For example, if Node 2 is reporting an incoming (from OC-48) STS LOP condition on sts-1w-6, then replace the 1e transmitter at Node 2 (local node).

Reference: **DLP-514**



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Figure 2 – Four-Node Ring Network Example

7. After the new TRMTR boots, obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or **F9** key).
8. Does the **incoming (from OC-48) STS LOP** condition still appear in the

Active Alarm and Status Report?

If **NO**, then go to Step 35.

If **YES**, then continue.

9. Replace the TRMTR circuit pack just installed in Step 6 with the original TRMTR circuit pack because the trouble still exists.

Reference: **DLP-514**



CAUTION:

Any traffic on tributaries 9 through 16 of the opposite line side (line that's not receiving the LOP) will be preempted while the high speed protection switch is active.



CAUTION:

It is advisable to contact your next level of technical support before making the high speed protection switch. Service may be lost if the switch is made to failed circuit packs (double failure).

10. At the local node, select **FAULT-Switch-Line:Forced** command and execute for the **line identified in Step 3** (protection line now active).
11. At the local node and using the source address and line recorded in Step 3, replace the RCVR circuit pack that's receiving the incoming LOP failure.

Reference: **DLP-514**

12. Obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or **F9** key).
13. Does the incoming (from OC-48) STS LOP condition still appear in the Active Alarm and Status Report?

If **NO**, then go to Step 34.

If **YES**, then continue.

14. Replace the (NEW) RCVR circuit pack just installed in Step 12 with the original (OLD) RCVR circuit pack because the trouble still exists.

Reference: **DLP-514**



CAUTION:

It is advisable to contact your next level of technical support before replacing the same line side TRMTR circuit pack (same line that's receiving the LOP condition). Service may be lost when the TRMTR circuit pack is replaced due to a double failure occurring at the local node.

15. Replace the **same side** TRMTR circuit pack at the local node as indicated by the Source Address from Step 3 (Figure 2). For example, if Node 2 is reporting an incoming (from OC-48) STS LOP condition on sts-1w-6, then replace the 1w transmitter at Node 2 (local node).

Reference: **DLP-514**

16. Obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or **F9** key).
17. Does the incoming (from OC-48) STS LOP condition still appear in the Active Alarm and Status Report?
If **NO**, then go to Step 34.
If **YES**, then continue.
18. Replace the same side TRMTR circuit pack (just installed in Step 15) with the original TRMTR circuit pack because the trouble still exists.

Reference: **DLP-514**



NOTE:

Assistance is required at the adjacent upstream node to replace a circuit pack in the high-speed shelf.

19. Notify personnel to replace the appropriate TRMTR circuit pack at the upstream node (Figure 2). For example, if Node 2 is reporting an incoming (from OC-48) STS LOP condition on sts-1W-6, then the 1E transmitter at Node 1 may be the cause of the failure condition.
- Reference: **DLP-514**
20. After the new TRMTR boots, obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or F9 key).
 21. Does the incoming (from OC-48) STS LOP condition still appear in the Active Alarm and Status Report?
If **NO**, then go to Step 34.
If **YES**, then continue.
 22. Notify personnel to replace the TRMTR circuit pack (just installed in Step 19 at the upstream node) with the original TRMTR circuit pack because the trouble still exists.

Reference: **DLP-514**

23. At the CIT, select **FAULT-Switched-Line:Reset** command and execute to retire the OC-48 Forced Switch.
24. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection-All** command and execute to obtain the Cross-Connection Map Report for the tributary identified in Step 3.
25. Identify and record the low-speed interface circuit pack used (if any) to **drop the STS signal** indicated by the Source Address in Step 3.



CAUTION:

Removing low-speed interface circuit pack (DS3 or STS1E) may result in loss of traffic if protection circuit pack is not available (slots P1 and P2).



CAUTION:

Removing an OC-3 circuit pack may result in loss of traffic if a protection circuit pack is not available (slot #B).



CAUTION:

Removing an OC-12 circuit pack will result in loss of traffic if a protection circuit pack is not available (slot 3B or slot 7B).



NOTE:

Low-speed interface protection switching will be required in the next few steps.

26. From the list of low speed interface circuit packs (Step 25), disengage one of the circuit packs just enough to cause a low-speed protection switch.
27. Obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or **F9** key).
28. Does the incoming (from OC-48) STS LOP condition still appear in the Active Alarm and Status Report?

If **NO**, then go to Step 31.

If **YES**, then continue.
29. Reengage the low-speed interface circuit pack, and wait for the system to revert from protection to normal operation. Optionally, the **FAULT-Switch-Low Speed:Reset** command may be used.)
30. Contact your next level of technical support for assistance.
31. Replace the low-speed interface circuit pack.

Reference: **DLP-514**

32. Obtain another Active Alarm and Status Report (use **FAULT-Retrieve-Alarms** command or **F9** key).
33. Does the incoming (from OC-48) STS LOP condition still appear in the Active Alarm and Status Report?
If **YES**, then go to Step 30.
If **NO**, then continue with Step 35.
34. At the local node, select **FAULT-Switch-Line:Reset** command and execute to normalize the line identified in Step 3 (original line now active.)
35. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'LCLAN Failure'

⇒ **NOTE:**
The LCLAN failure alarm is an indication of a particular hardware failure directly related to the SYSCTL circuit pack.

⚠ **CAUTION:**
*Do not remove the SYSCTL circuit pack unless instructed to do so by this procedure. If removed, provisioning data (current values) could be lost. Current values were provisioned with the **Set** commands.*

1. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarm and Status Report.
2. Do other alarms, in addition to **LCLAN failure**, appear under the Description column of the report?

If **YES**, then go to **TAP-102**.

If **NO**, then continue with Step 3.

⇒ **NOTE:**
It is necessary to clear any/all additional alarms before continuing with this procedure.

3. Remove the SYSCTL circuit pack and install a replacement circuit pack having the same or a higher series number. For example, an LAA23B with series number **S1:2** is the same series number as **S1:4**. The 2 and 4 refer to minor changes within series 1.

Reference: **DLP-514**

⇒ **NOTE:**
For circuit pack and software compatibility, refer to Table 7-1 in Section 7, "Circuit Pack Description."

4. Wait 10 minutes or until the **MJ** LED is off at the user panel, whichever comes first.
5. At the CIT, select **FAULT-Retrieve-Alarm** to obtain an Active Alarm and Status Report.

6. Does a **LCLAN failure** appear under the **Description** column of the report?

If **YES**, then go to **TAP-116**.

If **NO**, then continue with Step 7.

7. Is the **NE ACTY** LED off at the user panel?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then go to **Trouble Clearing: IXL-001**.

Clear 'X-CONN/EQUIPMENT CONFLICT'



NOTE:

This condition is caused by one of the following in Release 9.0: (1) An existing LAA10B OC3 circuit pack, which was provisioned for bi-directional drops, has been replaced by a LAA10 OC3 circuit pack; or (2) An OC3 circuit pack other than a LAA10B has been inserted into an OC3 slot that has been pre-provisioned for bi-directional drops.

1. Identify the Source Address in the Active Alarms and Status Report.
2. If the OC3 slot is in service or is going to be put in service with bi-directional STS1 drops, remove the LAA10 OC3 circuit pack and replace it with a LAA10B OC3 circuit pack.

If the OC3 slot is **not** going to support bi-directional drops and is to be equipped with a LAA10 OC3 circuit pack, then reprovision the slot with the proper cross connections.

3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Clear 'CKP Serial EPROM corrupted'

1. If the affected circuit pack was just installed, wait for the time indicated in Table A to allow the software in the affected circuit pack to start up.

Table A - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
TG3 †	5 minutes
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete. During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the **FAULT-Retrieve-State** command for the TG slot.

⇒ **NOTE:**
The circuit pack in the indicated slot has corrupt data in its memory. Failure to replace the circuit pack could result in loss of service.

⇒ **NOTE:**
Section 3, "Platform Descriptions," lists the circuit pack codes that are supported by the slot for a particular shelf. Also listed is the compatible software for the particular circuit pack code.

2. Consult office records to determine the type of circuit pack to be installed in the slot.
3. Obtain and install a replacement circuit pack determined in Step 2. As required, make the appropriate optical connections on the OC-3, IS-3, OC-12, RCVR, or TRMTR circuit pack(s).

Reference: **DLP-514**

4. Wait for the time indicated in Table A for the download of software.

5. Did the **FAULT** LED on the replacement circuit pack go off?
If **YES**, then continue with Step 6.
If **NO**, then go to **TAP-116**.
6. Is the **NE ACTY** LED lighted?
If **YES**, then go to **Trouble Clearing: IXL-001**.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE**.

Make Manual Optical Loopback at FT-2000 Network Element

Overview: This procedure requires the FT-2000 network element to be **out of service**.

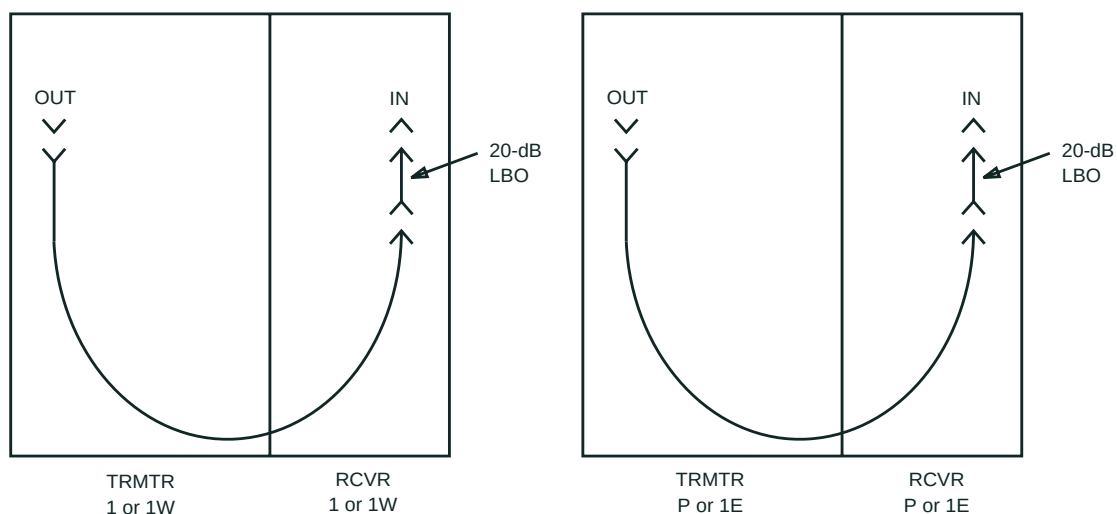
⚠ CAUTION:

Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.

1. Remove the shelf cover from one high-speed shelf.

Reference: **DLP-511**

2. For each OC-48 line to be looped back, obtain a lightguide jumper (package label FS1E-E-02) and a 20-dB loss lightguide buildout, or equivalents. (It is possible to connect another LBO to an existing LBO to obtain a total of 20-dB provided the LBOs do not physically interfere with the shelf cover when closed.) Table A shows additional buildouts that are available. Table B shows the buildout types that are compatible with different codes of the TRMTR and RCVR circuit packs. Figure 1 shows optical line loopback connections.



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Figure 1 – LoopBack Connectors

Table A - Lightguide Buildout Values

dB Loss	Letter Code
0	None
5 ±1	B
10 ±1	D
15 ±2	F
20 ±2	H

Table B - Lightguide Buildouts and Circuit Pack Compatibility

Buildout Type (Code)	Circuit Pack
ST® (A3010*), FC(A3030*)	TRMTR 739B1 TRMTR 739C1 RCVR 839B1
ST(A3070*),FC(A3080*), or SC (A3060*)	TRMTR 739B2/B5 TRMTR 739C2/C5 TRMTR 739J2/J5 TRMTR 739J3 TRMTR 739P5 TRMTR 739R2/R5 TRMTR 739S2/S5 TRMTR 739E_ TRMTR 739G_ RCVR 839B2/B4/B5

* See Table A for letter code.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if a beam is viewed directly or with improper optical instruments. Avoid direct exposure to the beam



CAUTION:

A wrong connection can be avoided by marking or recording all disconnections in Steps 3, 4, and 5.

- Remove the optical OC-48 line connection from the **OUT** connector of the TRMTR circuit pack and slide the protector cap (if available) over the end of the fiber.
- Remove the optical OC-48 line connection to the **IN** connector of the RCVR circuit pack and slide the protector cap (if available) over the end of the fiber.
- Remove the lightguide buildout from the **IN** connector of the RCVR circuit pack, if equipped.

Reference: **DLP-512**

- Remove the protector caps (if equipped) from the ends of the lightguide jumper (loopback cable).
- Clean the optical buildouts, fiber, and connectors with canned air or a non-toxic gas.

Reference: **DLP-510**

8. Install the 20-dB loss buildout into the **IN** connector of the RCVR circuit pack.
Reference: **DLP-512**
9. Connect the lightguide jumper between the buildout (on RCVR) and the **OUT** connector on the TRMTR circuit pack for the same line.
10. Repeat Steps 3 through 9 for the adjacent high-speed line in the same shelf to be looped back.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Connect and Condition Craft Interface Terminal (CIT)

Overview: This procedure provides instructions to verify the CIT [a personal computer (PC) running FT-2000 CIT-PC software] is properly connected, powered, and has software installed. If you are unfamiliar with the PC, an "Introduction to the PC" is provided in DLP-529.



NOTE:

The PC must meet the minimum requirements as stated in the "Craft Interface Terminal" part of Section 6, "Operations Interfaces."

1. Verify the PC is safely positioned on the PC tray (bay shelf) or safely secured on a cart or table.
2. Verify the cable connections at the PC.

Reference: 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 3, 4, 5, 6, 7, and 8, Installation Manual*. To summarize, check the following:

- The appropriate 9-pin or 25-pin cable or equivalent interface cable is connected between the **CIT (DCE)** female connector on the user panel and a serial male connector on the PC.
- If required, a printer with the appropriate printer cable is connected to the CIT per the instructions provided with the printer.
- If required, a modem (internal or external) is connected per the instructions provided with the modem. Many modem configurations exist and operate over the public switched network or a data communications network (*Datakit*[®]d network).

Reference: **DLP-521** (Establish modem or *Datakit* network access.)

3. Turn the PC power switch to "on."
4. Verify the PC prompt is displayed (typically C:>).

Reference: **DLP-529**

5. Is the FT-2000 CIT-PC software loaded on the PC?

If **YES**, then continue with Step 9.

If **NO**, then go to **Operation: NTP-002**.

If **DON'T KNOW**, then continue with Step 6.

6. If necessary, change your current directory to the directory where the CIT-PC software should be installed.
7. Enter "dir" and press the key.
8. Was the "CIT EXE" file displayed (also known as CIT.EXE)?

If **YES**, then continue with Step 10.

If **NO**, then go to **Operation: NTP-002** (software is not loaded).

9. If necessary, change your current directory to the directory where the CIT-PC software is installed.
10. Execute the FT-2000 CIT-PC software by entering **cit** or **cit expert** (as your security level allows) and pressing the key. Then, follow the instructions displayed on the screen to log in to the network element. If you encounter difficulty in logging in or the connection attempt fails, the wrong COM port may have been specified in the SET-UP menu. A CIT tutorial is available in Section 11, "Craft Interface Terminal Usage."

Nice to Know: Memory-resident programs (also called TSRs) run in the background and may compete for the same random access memory (RAM) as the CIT-PC program. If this is the situation, disable all memory resident programs currently running in the PC unless modified to run with the CIT-PC program. The easiest way to do this is to replace the AUTOEXEC.BAT and CONFIG.SYS files, with the sample files provided in the directory where the CIT-PC program is loaded. For help, contact your next level of technical support or refer to the appropriate software release description as listed in Operation: NTP-002.

11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Perform Local Automatic Turnup Test

Overview: This acceptance procedure is used to verify the internal transmission health of an **out-of-service** FT-2000 network element that was installed by someone else. The FT-2000 network element must be equipped (circuit packs installed) per the engineered configuration.



CAUTION:

Do not remove any circuit packs during testing because erroneous indications can result.

1. At the CIT, select FAULT-Test-Auto Turnup-Local. If Auto Turnup does not appear as a menu item, log out of the CIT by pressing **F5** key and answer "yes" to the confirmation message. You must log into the CIT in the expert mode by entering cit expert at the DOS prompt. This test can take up to 10 minutes.

Response: Execution in progress (one dot appears about every 2 seconds).



NOTE:

A "g" is for good or successful test. A "-" is for not equipped, therefore not tested. An "F" is for failed or unsuccessful test.

2. Does the report indicate "g" for good or "-" for not tested for each entry? See Figure 1 for an FT-2000 add/drop-rings terminal example with a fiber sharing service and protection.

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then refer the problem to the group that installed the equipment.

Response: Execution in progress (one dot appears about every 2 seconds).

```
NODE-0 97-11-07 08:30:45 EST
M Test-Auto:All: COMPLD
/* Test Auto Turnup Report - Local Test
=====
--TRMTR-- --RCVR-- ---TG--- --LSSW-- --OHCTL--
1W      1E      1W      1E      1      2      IN      OUT      1W      1E      LNCTL
g        g        g        g        g        g        g        g        g        g        g

                        ----- LS INTFC-----
                        1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 P P
                        A B A B A B A B A B A B A B A B 1 2
                        g g g g g g g g g g g g g g g g -

*/
;
```

Figure 1 – Add/Drop-Rings Terminal Example (1W and 1E Lines)

Perform Automatic Low Speed Cabling (Fiber) Test

Overview: This acceptance procedure is used to verify continuity of the low-speed cabling (fiber) between the low-speed cross-connect bay or lightguide cross-connect panel and an FT-2000 network element that was installed by someone else. The particular low-speed cables (fibers) being tested must be **out-of-service**.

⇒ **NOTE:**
Generally, it is strongly recommended that all cables (fibers) be installed (initially) and tested up front in both directions. This would be in lieu of the steps defined within this DLP.

⚠ **CAUTION:**
Do not remove any circuit packs during testing because erroneous indications can result.

⇒ **NOTE:**
The circuit being tested may be used for 1-way drop or 1-way add services, in which case there may be an output cable and not an input cable or an input cable and not an output cable.

1. Is the circuit to be tested a 1-way only?

If **YES**, then continue with Step 2.

If **NO**, then continue with Step 3.

2. To test a 1-way only circuit, a temporary cable can be installed to provide a return path during the loopback test. After the temporary cable has been installed (see reference), continue with Step 3 as if a 2-way cable.

Reference: **365-575-115**

3. Is this test part of the initial acceptance (**Acceptance: NTP-002** or **NTP-006**) or part of the protection access upgrade (**Acceptance: NTP-004**), or part of an added electrical low-speed cable acceptance (**Acceptance: NTP-008**), or part of an added optical low-speed fibers acceptance (**Acceptance: NTP-010**)?

If **initial acceptance** of network element, then continue with Step 4.

If an upgrade to add **protection access**, then continue with Step 14.

If acceptance of **new and added electrical low-speed cables**, then continue with Step 21.

If acceptance of **new and added optical low-speed fibers**, then continue with Step 28.

Initial Acceptance

- Temporarily remove any high-speed optical loopbacks on all lines.

Reference: **DLP-518**



CAUTION:

FT-2000 low-speed outputs toward the cross-connect panel or other transmission equipment must be properly terminated. If unterminated, false indications of failures may result.

- At the low-speed cross-connect bay (that is, DSX-3, STSX-1, LGX, DACS III-2000, etc.), loop back each low-speed circuit to be tested. Do **not** use the **FAULT-Operate-Loopback** command at the FT-2000 network element.
- At the CIT, select **FAULT-Retrieve-Alarm** to obtain Active Alarms and Status Report.
- Referring to the report just obtained, make a note of any conditions other than those listed below that appear in the report. (Your report may not include all of the conditions listed.) If acceptance testing, report these conditions to installation personnel if any failures occur during the following test. If circuit order testing, refer to TAP-102 to clear the trouble condition.

FT-2000 Point-to-Point Network

Source Address	Description
line-1	incoming OC-48 LOS
line-p	incoming OC-48 LOS
system	APS channel failure
system	incoming DCC failure (only if enabled)
line-1	site provisioning conflict
line-p	site provisioning conflict
rcvr-1	receiver parameter-out-of-range
rcvr-p	receiver parameter-out-of-range

FT-2000 Ring Network

Source Address	Description
line-1e	incoming OC-48 LOS
line-1w	incoming OC-48 LOS
system	ring incomplete/open
line-1e	incoming DCC failure
line-1w	incoming DCC failure

⇒ **NOTE:**
Any alarms, other than those shown in the list, may prohibit continuing with the test until they are cleared.

8. At the CIT, select the appropriate command as follows:

FT-2000 End Terminal: select **FAULT-Test-Auto Turnup** with **All** for **Line** and **DSX** for **Mode**.

FT-2000 Add/Drop-Rings Terminal: select **FAULT-Test-Auto Turnup-DSX** with **All** for **Slot**.

Response: **Execution in progress** (one dot appears about every 2 seconds).

⇒ **NOTE:**
A "g" is for good or successful test. A "-" is for not tested. An "F" is for failed or unsuccessful test.

9. Does report indicate "g" for good or "-" for not tested for each entry?
(See Figure 1 for a service line only in a point-to-point network.)
(See Figure 2 for a service line and a protection line in a point-to-point network.)
(See Figure 3 for a shared service/protection line in a ring network.)

If **YES**, then continue with Step 10.

If **NO**, then refer problem to the group that installed the equipment.

10. Remove cross-connect loopback(s) established in Step 5.

11. Replace optical loopbacks removed in Step 4.

Reference: **DLP-500**

12. At the CIT, select **CONFIGURATION-Update** and execute. This update is needed because of possible incoming signal failures, error conditions, etc., from the previous loopbacks.

13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

```

NODE-0 97-11-07 08:30:45 EST
M Test-Auto:All: COMPLD
/* Test Auto Turnup Report - Cross-Connect Wiring Test

=====
Line 1:      -----LS INTFC-----
              1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port  A B A B A B A B A B A B A B A B
      1  g g g - F - g g F g g g g g - g
      2  g g g - - - g g F g g g g g - g
      3  g g g - F - g g g g g g g g - g

*/
;

```

Figure 1 - Example of Test Auto Turnup Report - Cross-Connect Wiring Test (Service Line Only in a Point-to-Point Network)

```

NODE-0 97-11-07 08:30:45 EST
M Test-Auto:All: COMPLD
/* Test Auto Turnup Report - Cross-Connect Wiring Test

=====
Line 1:      -----LS INTFC-----
              1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port  A B A B A B A B A B A B A B A B
      1  g g g g - F g g F g g g g g - g
      2  g g g g - F g g g g g g g g - g
      3  g g g g - F g g g g g g g g - g

-----
Line P:      -----LS INTFC-----
              1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port  A B A B A B A B A B A B A B A B
      1  g g g g - g g F g F g g g g - g
      2  g g g g - g g F g g g g g g - g
      3  g g g g - g g F g g g g g g - g

```

Figure 2 - Example of Test Auto Turnup Report - Cross-Connect Wiring Test (Service and Protection Lines in a Point-to-Point Network)

```

NODE-0 97-11-07 08:30:45 EST
M Test-Auto:All: COMPLD
/* Test Auto Turnup Report - Cross-Connect Wiring Test

=====
                        -----LS INTFC-----
                        1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port  A B A B A B A B A B A B A B A B
    1  g g g - F - g g F g g g g g - g
    2  g g g - F - g g - g g g g g - g
    3  g g g - F - g g - g g g g g - g

*/
;

```

Figure 3 - Example of Test Auto Turnup Report - Cross-Connect Wiring Test (Shared Service/Protection Line in a Ring Network)

Protection Access Upgrade



CAUTION:

Care must be used at the cross-connect bay because traffic is being carried on the DSs from the low speed shelf - system controller. At this time, traffic is not on the protection access shelf.

14. At the low-speed cross-connect bay (that is, DSX-3, STSX-1, DACS III-2000, etc.), loop back only the low-speed circuits that are associated with protection access. Do **not** use the **FAULT-Operate-Loopback** command at the FT-2000 network element. Loopback is toward the FT-2000 network element.
15. Is the **NE ACTY** LED lighted?
 - If **YES**, then refer to **Trouble Clearing: IXL-001**.
 - If **NO**, then continue with Step 16.
16. At the CIT, select **FAULT-Test-Auto Turnup** with **Mode: DSX** and **P** for the line. This test can take up to 5 minutes.

Response: The **ABN** and **NE ACTY** LEDs are lighted.



NOTE:

A "g" is for good or successful test. A "-" is for not tested. An "F" is for failed or unsuccessful test.

17. Does report indicate "g" for good or "-" for not tested for each entry?
(See Figure 4 for protection line only in a point-to-point network.)

If **YES**, then continue with Step 18.

If **NO**, then refer problem to the group that installed the equipment.

18. Remove cross-connect loopback(s) established in Step 14.
19. At the CIT, select **CONFIGURATION-Update**.
20. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

```

NODE-0 97-11-07 08:30:45 EST
M Test-Auto:P: COMPLD
/* Test Auto Turnup Report - Cross-Connect Wiring Test

=====
Line P:          -----LS INTFC-----
                  1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port            A B A B A B A B A B A B A B A B
1               g g g g g F g g F g g g g g g g
2               g g g g g F g g - g g g g g g g
3               g g g g g F g g - g g g g g g g

*/
;

```

Figure 4 - Example of Test Auto Turnup Report - Cross-Connect Wiring Test
(Protection Line Only in a Point-to-Point Network)

Electrical Low Speed Cables



CAUTION:

Care must be used at the cross-connect bay because traffic is being carried on the other low-speed cables that are not being tested.

21. At the low-speed cross-connect bay (that is, DSX-3, STSX-1, DACS III-2000, etc.), loop back only the low-speed signals being tested. Do **not** use the **FAULT-Operate-Loopback** command at the FT-2000 network element.

22. Is the **NE ACTY** LED lighted?

If **YES**, then refer to **Trouble Clearing: IXL-001**.

If **NO**, then continue with Step 23.

23. At the CIT, select the appropriate command as follows: Do not select "ALL" on an in-service bay"

FT-2000 End Terminal: Select **FAULT-Test-Auto Turnup** with Mode: **DSX** and for the particular low-speed ports associated with the cables being tested.

FT-2000 Add/Drop-Rings Terminal: Select **FAULT-Test-Auto Turnup-DSX** for the particular low-speed ports associated with the cables being tested.



NOTE:

A "g" is for good or successful test. A "-" is for not tested. An "F" is for failed or unsuccessful test.

24. Does report indicate "g" for good or "-" for not tested for each entry?

(See Figure 1 for a service line only in a point-to-point network.)

(See Figure 2 for a service line and a protection line in a point-to-point network.)

(See Figure 3 for a shared service/protection line in a ring network.)

If **YES**, then continue with Step 25.

If **NO**, then refer problem to the group that installed the equipment.

25. Remove cross-connect loopback(s) established in Step 21.

26. At the CIT, select **CONFIGURATION-Update** and execute. This update is needed because of possible incoming signal failures, error conditions, etc., from the previous loopbacks.

27. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Optical Low Speed Fibers



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

Care must be used at the lightguide cross-connect panel because traffic is being carried on the other low-speed fibers that are not being tested.

28. At the lightguide cross-connect panel, manually loop back only the low-speed optical signals (OC3/IS3/OC12) being tested. **Do not use** the **FAULT-Operate-Loopback-OC3** or **FAULT-Operate-Loopback-OC12** command at the FT-2000 network element.
29. Is the **NE ACTY** LED lighted?
If **YES**, then refer to **Trouble Clearing: IXL-001**.
If **NO**, then continue with Step 30.
30. Log in to the CIT by entering **cit expert** for expert mode.
31. At the CIT, select **FAULT - Test - Auto Turnup - DSX** for the particular low-speed slots associated with the fibers being tested.

⇒ **NOTE:**
A "g" is for good or successful test. A "-" is for not tested. An "F" is for failed or unsuccessful test.

⇒ **NOTE:**
Only one entry will appear for a slot with an OC3/IS3 circuit pack. See report (Figure 5) for OC3/IS3 circuit packs in slots 1A-2B example.

⇒ **NOTE:**
Only one entry will appear for a slot with an OC12 circuit pack.

32. Does report indicate "g" for good or "-" for not tested for each OC3 slot/fiber tested?
If **YES**, then continue with Step 33.
If **NO**, then refer problem to the group that installed the equipment.

33. Remove cross-connect loopback(s) established in Step 28.

It is recommended that the loopback remain in place for any OC3/IS3/OC12 circuit pack not scheduled to immediately carry traffic. If the loopback is removed and the OC3/IS3/OC12 circuit pack is not carrying traffic, an **incoming OC3 LOS** or **incoming OC12 LOS** condition will occur for that slot.

34. At the CIT, select **CONFIGURATION - Update** and execute. This update is needed because of possible incoming signal failures, error conditions, etc., from the previous loopbacks.

35. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

```
NODE-0 97-11-17 08:30:45 EST
M Test-Auto Turnup:DSX:ALL: COMPLD
/* Test Auto Turnup Report - Cross-Connect Wiring Test

=====
Line 1:          -----LS INTFC-----
                  1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8
port            A B A B A B A B A B A B A B A B
1              g g g g g F g g F g g g g g g g
2              g F g g - g g g g g g g
3              g F g g - g g g g g g g

*/
;
```

Figure 5 - Example of Test Auto Turnup Report - Cross-Connect Wiring Test (Slots 1A-2B Equipped with OC3 Circuit Packs and Remaining Slots Equipped with DS3/STS1E Circuit Packs)

Test Office Alarm Operation

1. At the CIT, select **FAULT-Test-Alarm** and **Mode: All** with **Repeat: 1**.
2. Verify the **CR**, **MJ**, and **MN** visual LEDs are sequentially *lighted* for 4 seconds and then remain *off* per the sequence chart below. Also, the office audible alarms should be activated during this test.

Step*	Alarm LEDs at User Panel		
	CR	MJ	MN
1	off	off	off
2	on	off	off
3	off	on	off
4	off	off	on
5	off	off	off

* Each step has a 4-second duration.

3. Did the office alarms operate as described?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then refer problem to the group that installed the equipment.

Perform Provisioning

⇒ **NOTE:**
The FT-2000 does not have any manual or switch-settable options on its circuit packs.

⇒ **NOTE:**
Information about FT-2000 provisioning is provided in Section 8, "Administration and Provisioning," of this manual. Other helpful information is the CIT tutorial and commands tables (by release), which are located in Section 11 of this manual, and the job aids on provisioning as follows:

365-575-172, *FT-2000 OC-48 Add/Drop-Rings Terminal Provisioning Job Aid (Release 8.0 and Later)*
365-575-123, *Threshold-Crossing Alert (TCA) Parameters Provisioning Job Aid (Release 4 and Later)*
365-575-123, *FT-2000 Cross-Connections Job Aid (Release 8.0 and Later)*

1. At the CIT, select **CONFIGURATION**, **PERFORMANCE**, **FAULT**, or **SECURITY** category and the appropriate inputs [verb and modifier(s)].

⇒ **NOTE:**
Table 11-9 lists the reports and how to obtain them. For example, the System Alarm Attributes Report is obtained by using **CONFIGURATION-Retrieve-Attribute-Alarm**. Another example is the Synchronization Report that is obtained by using **CONFIGURATION-Retrieve-Synchronization**.

2. Did the appropriate report show that provisioning has been done?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then (1) refer the problem to the group that did the original provisioning, and/or (2) compare the report with the original work order and correct the provisioning discrepancy. Provisioning job aids are available; see Step 1 for the specific equipment references.

Verify FT-2000 Network Element Is Connected

Overview: This procedure is used to verify that all the network elements are connected in an FT-2000 network.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.

1. You are located at which FT-2000 network element?
If at **FT-2000 add/drop-rings terminal**, then continue with Step 2.
If at **FT-2000 repeater bay/shelf**, then continue with Step 25.

FT-2000 OC-48 Add/Drop-Rings Terminal (Figure 1)

2. Remove the front cover from the high-speed shelf.
Reference: **DLP-511**
3. Is there a lightguide jumper equipped with an optical buildout (20 dB for loopback testing) or equivalent connected between the **OUT** connector of the TRMTR circuit pack and the **IN** connector of RCVR circuit pack for line 1W?
If **NO**, then continue with Step 7.
If **YES**, then continue with Step 4.
4. Remove the loopback lightguide jumper between the optical connectors of the TRMTR and RCVR circuit packs for line 1W.
5. Remove the 20-dB buildout (or equivalent) from the RCVR circuit pack but not the 0-dB buildout from the TRMTR circuit pack.
6. Install protector caps (if available) over the fiber ends of the lightguide jumper that was used in the loopback.

7. Are the transmit and receive lightguide cables connected to the **OUT** connector of the TRMTR circuit pack and to the **IN** connector on the RCVR circuit pack, respectively for line 1W?

If **YES**, then continue with Step 21.

If **NO**, then continue with Step 8.

8. Locate the transmit fiber for line 1W.
9. Remove the protector cap (if equipped) from the end of the transmit fiber.
10. Clean the transmit optical fiber and the 0-dB buildout with canned air or non-toxic gas and install the buildout in the **OUT** connector of the TRMTR circuit pack.

Reference: **DLP-510, DLP-512, and DLP-519**

11. Connect the transmit fiber to the 0-dB buildout (installed in the **OUT** connector on the TRMTR circuit pack).
12. Has the received dB value of the lightguide buildout already been determined?
If **YES**, then continue with Step 15.
If **NO**, then continue with Step 13.



NOTE:

Assistance at the remote end of the OC-48 line may be required.

13. Measure the power level on the receive fiber using an optical level meter and/or an optical time domain reflectometer (OTDR) or equivalents per local procedures.

14. Using Table A and the measured received power, determine the correct build-out value.

Table A - Optical Line Buildout Values (Notes 1 and 2)

Measured Received Power in dBm	Use Optical Buildout
–2.0 to –4.9	15 dB
–5.0 to –9.9	10 dB
–10.0 to –14.9	5 db
–15.0 to –25.5	0 dB
–25.5 dBm or less	Optical loss out of range. Contact line engineering.

Notes:

1. A 20 dB optical line buildout is typically used for optical loopback testing.
2. The fiber must also meet the outside plant loss as specified in the optical line loss budget of Section 10 of this manual.

15. Clean the lightguide buildout and the **IN** connector of the RCVR circuit pack with canned air or nontoxic gas.

Reference: **DLP-510**

16. Install the buildout to the **IN** connector on the RCVR circuit pack.

Reference: **DLP-512** and **DLP-519**

17. Locate the receive fiber for line 1W.

18. Remove the protector cap (if equipped) from the end of the receive fiber.

19. Clean the receive optical fiber and the buildout with canned air or nontoxic gas (buildout is installed at the **IN** connector on the RCVR circuit pack).

Reference: **DLP-510**

20. Connect the receive fiber to the buildout (inserted at the **IN** connector on the RCVR circuit pack).

21. Repeat Steps 3 through 20 for line 1E.

⇒ **NOTE:**
At this point, the TRMTR and RCVR circuit packs should be connected to their respective lines.

⇒ **NOTE:**
A flashing **FAULT** LED on the RCVR circuit pack indicates a loss of signal from the other end.

22. Verify all connectors are secure for the OC-48 lines and the fibers are dressed into their slots.
23. Replace the front shelf cover to the high-speed shelf.

Reference: **DLP-511**

24. Return to Step 1 for any remaining network elements in the FT-2000 network.

FT-2000 Repeater Bay/Shelf (Figure 2)

25. Perform Steps 2 through 24 for each repeater in the FT-2000 network, but substitute the REGENR circuit pack in place of the TRMTR and RCVR circuit packs. The REGENR **OUT** connector represents the TRMTR and the **IN** connector represents the RCVR. Also, the OC-48 optical lines use 1 for service and P for protection along with east and west for direction. For example, 1WE means the service line has optical transmission in a west to east direction.
26. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

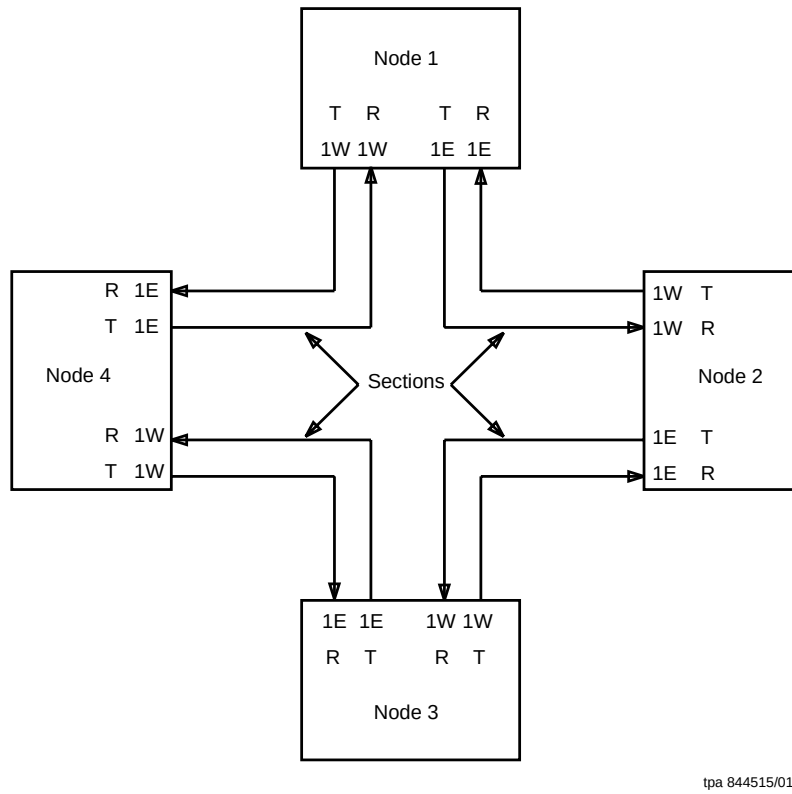


Figure 1 – Four-Node Ring Network

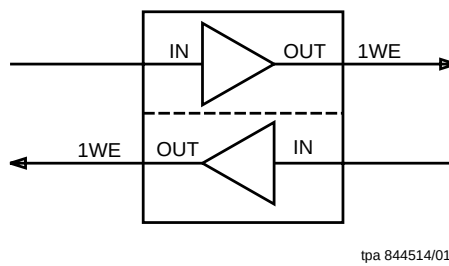


Figure 2 – Regenerator

Turnup Test—Point-to-Point System

Overview: This procedure is used to verify end-to-end transmission for an FT-2000 point-to-point network. If you are unable to complete the procedure or the test fails, contact the group who did the installation.

1. Is this test part of the initial acceptance or part of the Protection Access Upgrade?
If **initial acceptance** of network element, then continue with Step 2.
If an upgrade to add **Protection Access**, then continue with Step 4.
2. At the local CIT, select **FAULT-Test-Auto Turnup** for **All** lines in the System mode.

3.  **NOTE:**
"g" is for good or successful test. "-" is for not tested. "F" is for failed or unsuccessful test. Test takes 1 minute.

Did the report indicate "g" or "-" for each entry? See Figure 1 for an example.

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then refer the problem (failed system test) to the group that installed the equipment.

NODE-0 97-11-17 08:30:45 EST		
M Test-Auto:All: COMPLD		
/* Test-Auto Turnup Report - System Test		
=====		
Line 1:	Transmit	Receive
	Direction	Direction
	g	g

Line P:	Transmit	Receive
	Direction	Direction
	g	g

Figure 1 – Example of Test Auto Turnup Report - System Test (Service Line and Protection Line)

Protection Access Upgrade



CAUTION:

If this test is performed on a line other than the protection line, then service will be interrupted.



NOTE:

This test can take up to 5 minutes.

- At the local CIT, select **FAULT-Test-Auto Turnup and Line: P** with **Mode: System**.

Response: The **ABN** and **NE ACTY** LEDs are lighted.



NOTE:

"g" is for good or successful test. "-" is for not tested. "F" is for failed or unsuccessful test.

- Did the report indicate "g" or "-" for each entry?
See Figure 2 for an example.

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then refer to the Installation Manual or contact the group that did the upgrade installation.

```

NODE-0 97-11-17 08:30:45 EST
M Test-Auto:P: COMPLD
/* Test-Auto Turnup Report - System Test

=====
Line P:                Transmit    Receive
                        Direction    Direction
                        g            g
*/
;
```

Figure 2 – Example of Test Auto Turnup Report - System Test (Protection Line Only)

Test Parallel Telemetry

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Test Serial Telemetry

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Clean Optical Fibers and Connectors

1.  **WARNING:**
Disconnected or separated optical connectors may emit invisible laser radiation. Do not view the lightwave beam with an optical instrument. Avoid direct exposure to the beam.

 **NOTE:**
All optical fiber connectors (ST[®], FC/PC, and SC types), lightguide buildouts, and buildout blocks or equivalents should be cleaned before making initial connections or reconnections per the following instructions. Only the components being assembled at this particular time should be cleaned.

Keep all dust caps and plugs in place until time to make connections.

Disassemble

2. Remove (if necessary) lightguide connector from buildout.
3. Remove (if necessary) lightguide buildout from buildout block by unlocking tab and pushing in and turning in counterclockwise direction.

Reference: **DLP-512**

Clean

4. Clean the end and the sides of the connectors, buildouts, and blocks with a lint-free, optical quality tissue dampened with isopropyl alcohol.
5. Carefully wipe the connector, buildouts, and blocks again with a clean, dry, lint-free optical quality tissue.
6. Blow any lint or dust from the connectors, buildouts, and blocks using canned air or a nontoxic gas held 3 inches away.
7. Clean the inside of the block (and 0-dB buildout only) using a pipe cleaner moistened with isopropyl alcohol.
8.  **CAUTION:**
Do not use pipe cleaner on attenuated buildouts (5, 10, 15, and 20 dB) as the lens can be damaged.

Blow any lint or dust from inside the block, using canned air or a nontoxic gas held 3 inches away.

Assemble

9. Assemble by inserting the buildout into the block by aligning the buildout with the slot in the block. Push in the buildout and rotate it clockwise until locked into position. Slide the connector onto the buildout and rotate it clockwise until locked into position.

Reference: **DLP-512**

10. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Remove/Replace Shelf Cover

1.  **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Locate the circuit pack shelf cover or interconnection panel cover to be removed or replaced.

- Circuit pack shelf cover dimensions are 13 inches x 21.3 inches.
 - Interconnection panel cover dimensions are 7 inches x 21.3 inches.
2. Is the cover being removed or replaced?
If **Removed**, then continue with Step 3.
If **Replaced**, then continue with Step 11.

Remove Cover

3. At the top of each cover, locate the two-turn fasteners.
4. Use the appropriate size slotted screwdriver (or a dime) to rotate the turn fasteners counterclockwise 90 degrees so slots are positioned vertically (unlocked position).
5. Which cover is being removed?
If **Circuit Pack Shelf Cover**, then continue with Step 6.
If **Interconnection Panel Cover**, then continue with Step 9.
6. Put a finger in each wire loop and pull the cover forward until it is horizontal (rotated 90 degrees from closed position).
7. Lift the pivot pins located at the bottom of the cover, push back, and lift up on the pins again to remove the cover from the shelf, then lift cover up until it is free from shelf framing.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
9. Put a finger in each wire loop and pull the shelf cover forward nearly 3 inches

and lift cover up to free it from the shelf framing.

10. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Replace Cover

11. Which cover is being replaced?

If **Circuit Pack Shelf Cover**, then continue with Step 12.

If **Interconnection Panel Cover**, then continue with Step 13.

12. Position the pivot pins located at the bottom of the cover under the flange on the shelf framing, then continue with Step 14.

13. Place bottom of cover over side pivot pins.

14. Close the cover and rotate the two turn fasteners 90 degrees clockwise using the screwdriver (or dime) until the fastener slots are horizontal (locked position).

15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Install/Remove Lightguide Buildout

Description

This procedure is used to select the proper value of Line Build Out (LBO) to be used on the circuit pack's faceplate jacks. High Speed links may require an attenuating LBO on the RCVR (IN) jack, and a zero-dB (0dB) LBO on the TRMTR (OUT) jack. As a contrast, Low-Speed links may require an attenuating LBO on the TRMTR (OUT) jack, and a zero-dB (0dB) LBO on the RCVR (IN) jack. In rare instances LBOs can be placed in the LGX, but this is NOT recommended. Typically, although there is not any requirement, the span fibers will connect to an LGX. And, "Fiber Jumpers" are used to connect the LGX's span fibers to the circuit pack faceplate LBOs.

This procedure covers the selection of both single-mode (SM) and multi-mode (MM) LBOs, span fibers, and associated fiber jumpers. In order to determine the correct type of connection devices (SM or MM) you will need to know the type of circuit pack being used and its application. The information contained within Table A should help in this selection.

Table A – (Some) Optical Link Configurations and Span Component Requirements

Type of Circuit Pack	Circuit Pack Transmitter Device	Type LBO	Span Fiber	Jumper	Type RCVR	Circuit Pack RCVR Device
OC-48	Laser (SM)	SM	SM	SM	OC-48	Diode (MM)
OC-12 (T939A)*	Laser (MLM)	SM	SM	SM	OC-12 [†]	Diode (MM)
OC-3 (LAA10) [‡]	Laser (MLM)	SM	SM	SM	OC-3*	Diode (MM)
OC-3	Laser (MLM)	MM	MM	MM	IS-3*	Diode (MM)
OC-3	Laser (MLM)	SM [§]	SM	SM	IS-3*	Diode (MM)
IS-3 (LAA5) [¶]	LED (MM)	MM	MM	MM	OC-3*	Diode (MM)
IS-3	LED (MM)	MM	MM	MM	IS-3*	Diode (MM)

* T939A circuit packs are shipped from the factory with 0dB LBOs on both the IN and OUT jacks.

† If the attenuation LBO is installed at the transmit (OUT) jack—then normally only a 0dB LBO is required at the receive (IN) jack. If an attenuation LBO must be used at the input (IN) jack on the LAA10 or T939A, then a MM LBO must be used.

‡ LAA10 circuit packs are shipped from the factory with a 0dB LBO on the IN jack and a 7.1dB SM LBO on the OUT jack.

§ This option uses more expensive components than the previous (above) option.

¶ LAA5 circuit packs are shipped from the factory with 0dB LBOs on both the IN and OUT jacks.

1.  **WARNING:**
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

-  **CAUTION:**
Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.

Is the buildout being installed or removed (see Figure 1)?

If **Installed on a High Speed fiber**, then continue with Step 2.

If **Installed on a Low Speed fiber**, then continue with Step 16.

If **Removed**, then continue with Step 35.

High Speed Fiber Installation via an LGX

2. While considering the application (Table A), and as appropriate, select the correct jumper from Table B.

-  **NOTE:**
When connecting to an LGX, you will need one jumper for the transmit fiber and an identical jumper for the receive fiber.

Table B – Single-mode Lightwave Jumpers for low speed and high speed fiber connection

Code	Comcode	Length	Description
FS1E-E-02	105 357 727	2 ft.	ST-ST
FS1E-E-10	105 357 768	10 ft.	ST-ST
FS1E-E-25	105 357 800	25 ft.	ST-ST
FS1E-E-50	105 357 859	50 ft.	ST-ST
FS1E-E-100	105 357 875	100 ft.	ST-ST
LS1K-E-10	105 713 150	10 ft.	Biconic-ST
LS1K-E-25	105 712 939	25 ft.	Biconic-ST
LS1K-E-50	105 712 988	50 ft.	Biconic-ST
LS1K-E-100	105 712 947	100 ft.	Biconic-ST
LS1FP-FP	106 470 446	As Req'd.	FC/PC-FC/PC

3. Install/connect the selected jumpers at the LGX.
4. Label the jumpers. Indicate the line (West or East) and direction (TRMTR or

RCVR).

5. Route the jumpers from the LGX to the FT-2000 ADR terminal. Jumpers (1 Transmit and 1 Receive) for the West line must be routed down the left side of the bay in the fiber protection channel, jumpers (1 Transmit and 1 Receive) for the East line must be routed down the right side of the bay in the fiber protection channel. Refer to the following Figure 2.
6. The fiber jumpers should hang without any obstructions in the fiber protection channel. The jumpers should be routed out of the side of the protection channel near the bottom so that they can be properly dressed in the Enhanced High Speed Shelf. Make sure the bend radius of the fiber is not exceeded when dressing the fiber. Fibers should never be directly laced in place or cable tied. If secure dressing is not achieved with the steps above then place the fibers in protective tubing and lace the tubing to the protective channel.
7. Fibers enter the Enhanced High Speed Shelf near the bottom front of the shelf and should be routed up to the optical packs through the notches along the bottom edge of the shelf. Do not crimp the fiber and maintain bend radius greater than the minimum.
8. Optical fibers should be left with enough slack next to the TRMTR and RCVR circuit packs slots for later connection. Be sure to tuck fibers into the trough so that attaching and closing the shelf cover does not crimp the fiber.
9. The protective channel will be covered when the stile strips are installed.
10. Remove the protector caps and plugs (if equipped) from the buildout and build-out block and store them in a clean container.

 **NOTE:**
Only 0dB, non-attenuating, LBOs are used in most of the TRMTRs. The 739E1 through 739E8 TRMTRs use a non-zero dB attenuator that is installed at the factory. Do not change this attenuator. It is selected to work properly with an Optical Line System (OLS).

11. Connect the transmit fiber jumper to the TRMTR circuit pack.

LBO Selection

12. If necessary, measure, and record for office records, the received optical power.



NOTE:

Be sure to (a) connect the RCVR fiber to the power meter, (b) set the optical power meter for the wavelength of the light to be measured, e.g., 1300nm.

13. While considering the application (Table A), and the measured receive power level from Step 12, choose the appropriate LBO from Table C.

Table C – Optical Line Buildouts

Description	Connection	Loss (dB)	Comcode
A3070 ST 0 dB buildout	SM-SM & MM-MM	0	106795354
A2060B ST 5 dB buildout	MM-MM	5	106795313
A3070B1 ST 5 dB buildout	SM-SM	5	107406183
A3070X1 ST 7.1 dB buildout	SM-SM	7.1	107107740
A2070D ST 10dB buildout	MM-MM	10	106795321
A3070D1 ST 10 dB buildout	SM-SM	10	107406191
A2070F ST 15 dB buildout	MM-MM	15	106795339
A3070F1 ST 15 dB buildout	SM-SM	15	107406209
A3070H ST 20 dB buildout	SM-SM	20	106795396

14. Align the buildout with the slot in the buildout block, push in, and rotate clockwise until locked into position. Refer to the appropriate Figures (3, 4, or 5) for the specific buildout type.
15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Low Speed Fiber Installation

- 16.



NOTE:

This procedure is used to select the proper value of LBO to be used on the faceplate of the LAA5/LAA10/T939A (OUT) jack.

The LAA5 supports span lengths up to 2000 feet, when using MM fiber. The LAA10 supports span lengths from 0 to 51 km, when using SM fiber. Also, the T939A supports span lengths from 0 to 51 km, when using SM fiber.

Low speed fibers connect (either directly or through an intermediate LGX) to circuit packs within the Low Speed Shelf. Connectors are located on the faceplate of the LAA5, LAA10, or T939A circuit packs. Connection is made to

a removable Optical Line Build-Out (LBO). Only 0dB LBOs are used in the RCV (IN) port, and attenuating LBOs must be used in the TRMT (OUT) port.

Table D lists some of the available multi-mode jumpers for use when connecting a low speed span through an LGX.

Table D – Multi-mode fiber jumpers

Code	Comcode	length (feet)
FL1E-E-2	105351795	2
FL1E-E-10	105351837	10
FL1E-E-25	105351860	25
FL1E-E-50	105351910	50
FL1E-E-100	105351936	100

Span Lengths



NOTE:

Single-mode fiber is loss limited, so only the received power needs to be measured. Multi-mode fiber is dispersion limited, not loss limited, thus requiring this additional consideration for the span length. The receive end power must still be measured to ensure that the power level to the receiver is not too high nor too low, however, it can not be assumed that because the power level is within range, that the signal quality is adequate. At the receive end there may be sufficient power, but the signal shape may not be adequate. The length of fiber that is allowed must be determined by the type and manufacturer of the multi-mode fiber.

Table E shows the approximate maximum distances allowable for different fiber bandwidth specifications.

Table E – Multimode Operation Span Length

Fiber Bandwidth Specification	Maximum Span Length (km)	Maximum Span Length (miles)
1000 MHz-km	6.5 km	4.1 miles
800 MHz-km	5.1 km	3.2 miles
500MHz-km	3.1 km	1.9 miles
300 MHz-km	1.8 km	1.1 miles



NOTE:

For more detailed information about maximum span lengths for particular fibers, refer to the manufacturers specifications.

While considering the application (Table A), and as appropriate, select the cor-

rect jumper from Table B or Table D.

17. If appropriate, install/connect the selected jumpers at the LGX. If keyed biconics are used, align arrows properly.
18. Label the jumpers.
19. Route the optical fibers from the LGX to the protective channels located on each side of the bay. If the fibers are to be connected to OC-3/OC-12 circuit packs located in slots 1A through 4B then route the fibers down the left side of the bay. If the fibers are to be connected to OC-3/OC-12 circuit packs located in slots 5A through 8B then route the fibers down the right side of the bay. Refer to Figure 6.
20. The fiber jumpers should hang without any obstructions in the fiber protection channel. The jumpers should be routed out of the side of the protection channel near the middle so that they can be properly dressed in the Low Speed System Controller Shelf. Make sure the bend radius of the fiber is not exceeded when dressing the fiber. Fibers should never be directly laced in place or cable tied. If secure dressing is not achieved with the steps above then place the fibers in protective tubing and lace the tubing to the protective channel.
21. Fibers enter the Low Speed Shelf near the middle front of the shelf and should be routed up to the optical packs through the notches along the bottom edge of the shelf. Do not crimp the fiber and maintain bend radius greater than the minimum.
22. Optical fibers should be left with enough slack next to other circuit packs slots for later connection. Be sure to tuck fibers into the trough so that attaching and closing the shelf cover does not crimp the fiber.
23. The protective channel will be covered when the stile strips are installed.

LBO Selection

24. Does this Low Speed application use LAA10 or T939A Circuit packs?
If **NO**, then continue with Step 28.
If **YES**, then continue with Step 25.
25. Measure, and record for office records, the received optical power. Be sure to set the optical power meter for the wavelength of the light to be measured, 1300nm.

⇒ **NOTE:**
Table F shows the appropriate LBO value to select when the measured received power is within ranges specified.

OC-3/OC-12 LBO Selection

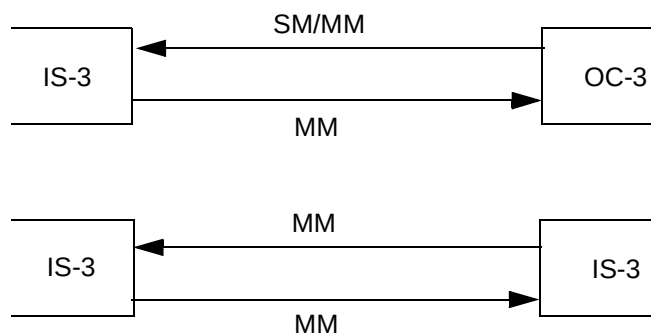
Table F – LBO Selection for LAA10/T939A (MM or SM fibers)

Measured Received Power in dBm at FT-2000	Use Optical LBO Value at Transmit
0 to -20.0 dBm	7.1 dB
-20.1 to -34.0 dBm	0 dB

26. Choose the appropriate LBO from Table C.
27. Align the buildout with the slot in the buildout block, push in, and rotate clockwise until locked into position. Refer to the appropriate Figures (3, 4, or 5) for the specific buildout type.
- 28.

IS-3 LBO Selection

⇒ **NOTE:**
For interconnection between an IS-3 (LAA5 or 21D/21D-U/22D-U) and an OC-3 or circuit pack, multi-mode fiber must be used on the IS-3 transmit, and multi-mode or single-mode can be used on the OC-3 transmit as follows:



29. The IS-3 circuit pack uses multi-mode fiber only with a 2000 foot maximum distance. Zero-dB multi-mode attenuators should always be used when connecting IS-3 circuit packs.

30. Measure, and record for office records, the received optical power. Be sure to set the optical power meter for the wavelength of the light to be measured, e.g., 1300nm.
31. Table G shows the appropriate LBO value to select when the measured received power is within ranges specified.

Table G – LBO Selection for FT-2000 LAA5 (transmit: multi-mode fiber)

Measured Received Power in dBm at FT-2000	Use Optical LBO Value at Transmit
0 to -14.0 dBm	15dB
-14.0 to -30.8 dBm	0 dB

32. Choose the appropriate LBO from Table C.
33. Align the buildout with the slot in the buildout block, push in, and rotate clockwise until locked into position. Refer to the appropriate Figures (3, 4, or 5) for the specific buildout type.
34. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
- 35.

Remove Buildout



CAUTION:

Locking beam must only be pushed along a line perpendicular to buildout body in direction towards the buildout in order to avoid damage to the locking beam.

Depress the locking beam on the buildout, rotate counterclockwise, and separate from the buildout block by sliding apart. Refer to the appropriate Figures (3, 4, or 5) for the specific buildout type.

36. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

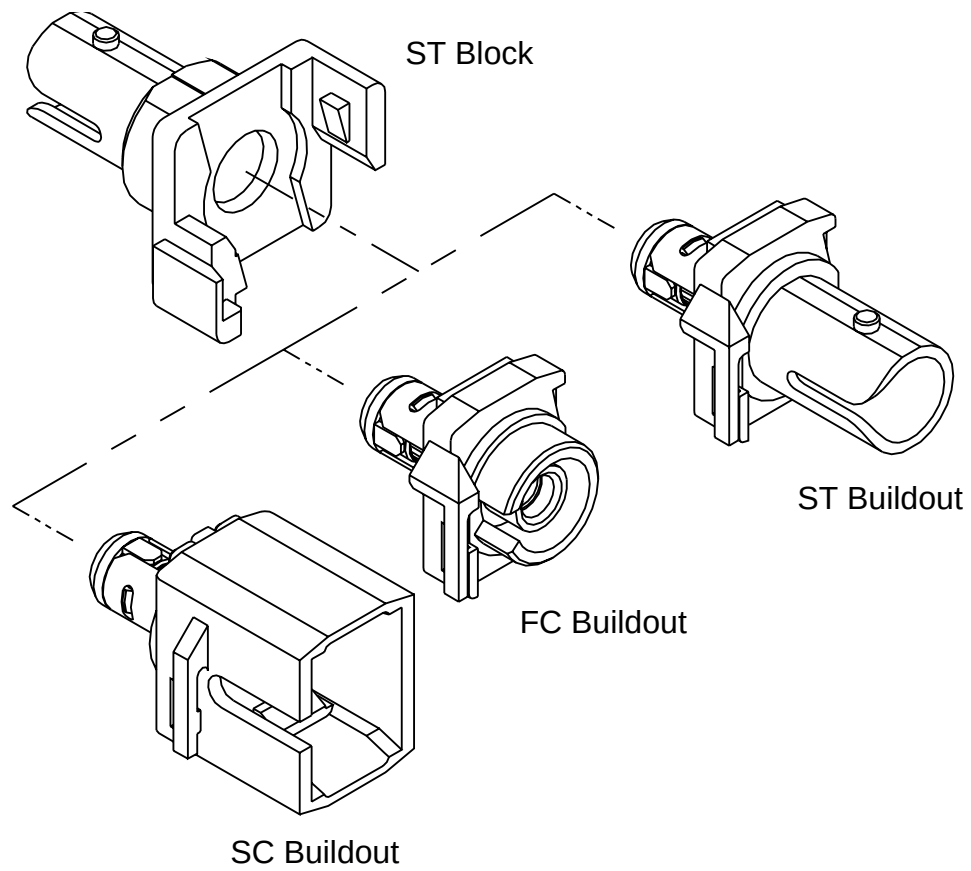


Figure 1 – ST[®] Block and Buildouts

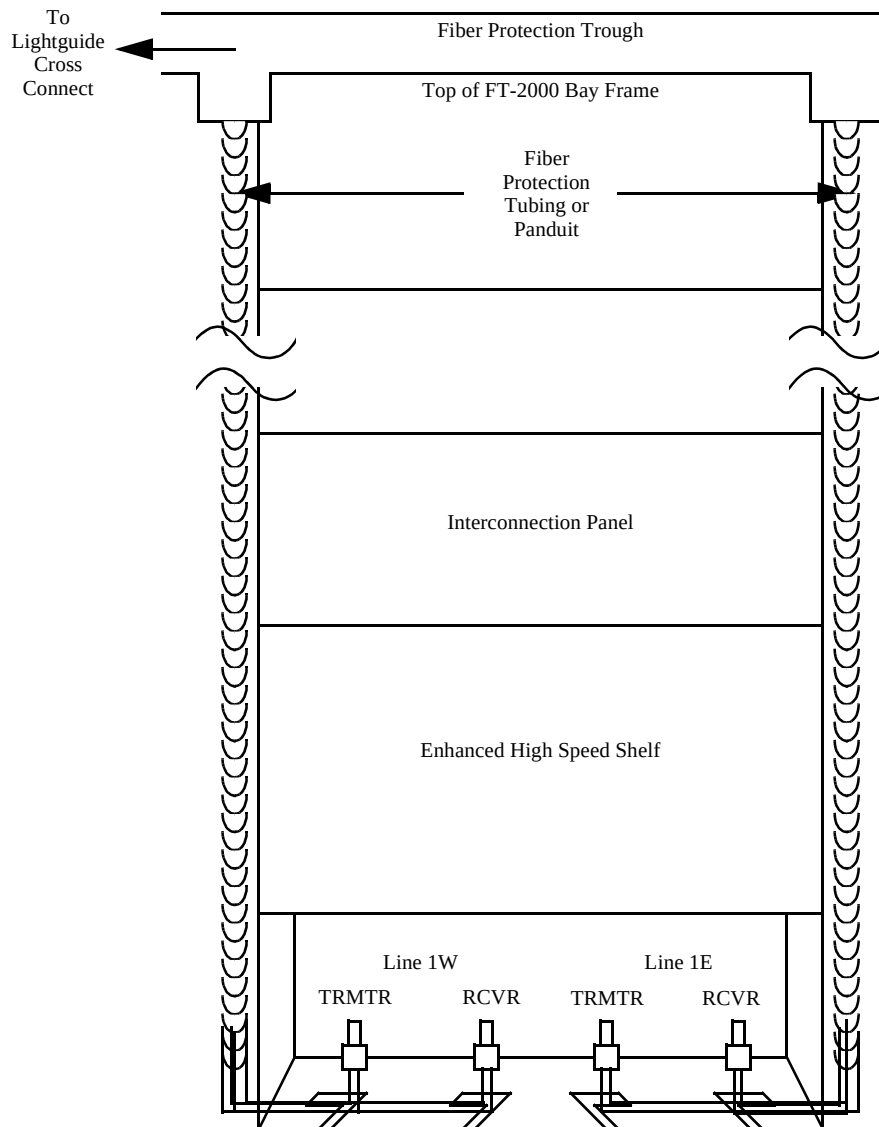


Figure 2 – FT-2000 OC-48 ADR High Speed Fiber Routing

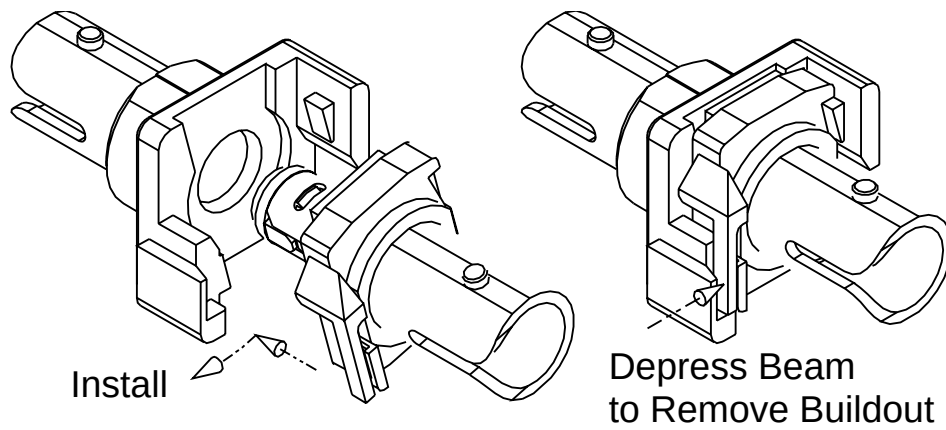


Figure 3 – ST[®] Block and ST Buildout

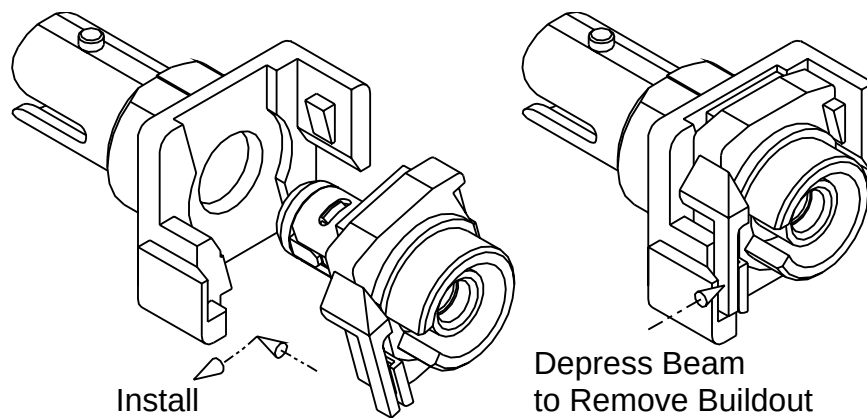


Figure 4 – ST[®] Block and FC Buildout

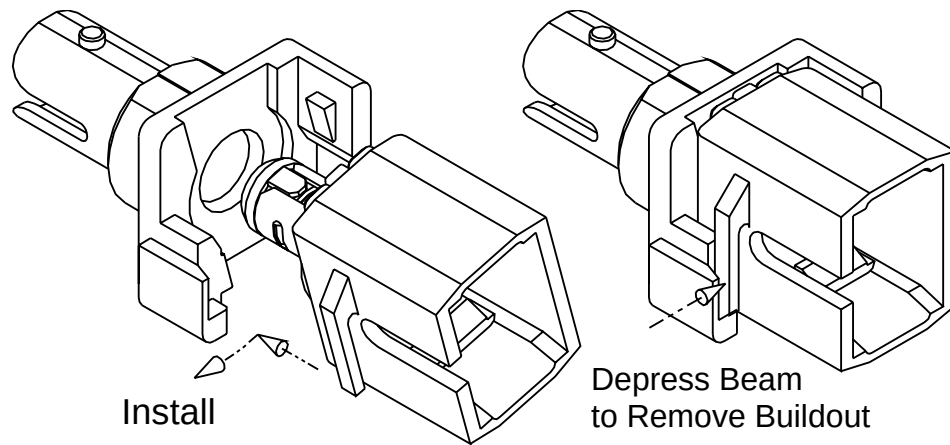


Figure 5 – ST[®] Block and SC Buildout

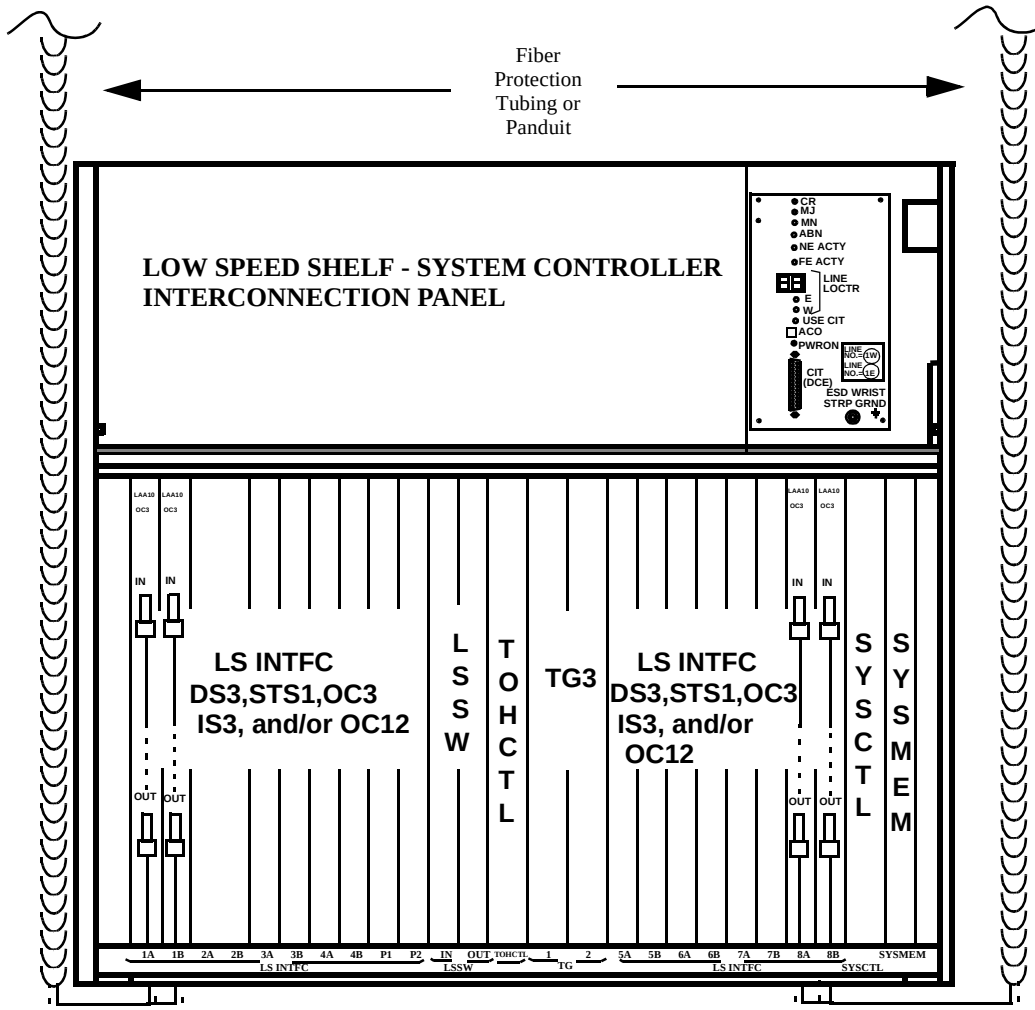


Figure 6 – Low Speed Shelf Fiber Routing (without Cover)

Test Fan Assembly (ED-6G992-30)

1. Observe that the **POWER ON** LED is lighted and the **ALM** LED is off at the fan assembly. If another condition exists, notify the group that installed the fan assembly.
2. Press and hold in the **ALM TEST** pushbutton for 20 seconds or until the fan speed slows down sufficiently to cause the control board to activate the fan alarm.

Response: **POWER ON** and **ALM** LEDs should be lighted while **ALM TEST** pushbutton is depressed.

3. Release **ALM TEST** pushbutton.

Response: **POWER ON** LED should be lighted and **ALM** LED should be off.

4. At the CIT, select **FAULT-Retrieve-History** to obtain a Maintenance History Report.
5. Are "fan failure" and "fan failure - cleared" conditions listed for the time the fan assembly was tested?

If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

If **NO**, then refer the provisioning discrepancy to the group that did installation of the fan assembly.

Reference: The **CONFIGURATION-Set-Attribute-Environment** command in **Chapter 8** provides information on provisioning the miscellaneous discrete input points #16 as "fan failure."

Remove and/or Install Circuit Pack

1.



CAUTION:

*A potential service interruption can be avoided for DS3, STS1E, OC3, IS3, OC12, TRMTR, RCVR, or TG3 circuit packs by following this instruction. After a replacement circuit pack has been inserted, the **FAULT** should go out within 35 seconds (optical packs may still FLASH if no signal is present). If the **FAULT** LED remains lighted after the 35 seconds, immediately remove the replacement circuit pack before 110 seconds elapses.*



CAUTION:

Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.



CAUTION:

Do not remove the SYSCTL circuit pack unless instructed to by the procedure that sent you here. If the SYSCTL circuit pack is removed, provisioning data could be lost.

Are you to remove or install a circuit pack?

If to **remove**, then continue with Step 2.

If to **install**, then continue with Step 17.

2. Is the circuit pack an OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR?

If **YES**, then continue with Step 3.

If **NO**, then continue with Step 6.

3.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to the beam.

Disconnect the optical fiber(s) from the lightguide buildouts (LBOs) and/or optical connector(s) at the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit

pack.

4. Remove the optical fiber from the slot guide on the shelf. This is to prevent damage to the fiber when the circuit pack is removed.
5. If required, remove the LBOs from the connector(s) on the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit pack.

Reference: **DLP-512**

6. Is the circuit pack a low speed interface (DS3 or STS1E)?

If **YES**, then continue with Step 7.

If **NO**, then continue with Step 10.

7. **NOTE:**

For DS3 and STS1E circuit packs only: A verification of either an automatic or a CIT provisioned protection switch is made before removing the low speed circuit pack from the shelf.

At the CIT, select **FAULT-Retrieve-State:LS INTFC** command and obtain a State Report on the circuit pack being replaced.

8. From the report, is the low speed slot (circuit pack to be removed) in a standby state?

If **YES**, then continue with Step 14.

If **NO**, then continue with Step 9.

9. At the CIT, select **FAULT-Switch-Low Speed:Slot** command for the circuit pack being removed and execute. Use the **FAULT-Retrieve-State:LS INTFC** command to verify, if desired.

10. Is the circuit pack a TG3 circuit pack?

If **YES**, then continue with Step 11.

If **NO**, then continue with Step 14.

11. **NOTE:**

For TG3 circuit packs only: A verification of a CIT provisioned (manual) protection switch is made before removing the TG3 circuit pack from the shelf.

At the CIT, select **FAULT-Retrieve-State:TG** command and obtain a State Report on the circuit pack being replaced.

12. From the report, is the TG3 circuit pack to be removed in a standby state with a manual switch?

If **YES**, then continue with Step 14.

If **NO**, then continue with Step 13.

13. At the CIT, select **FAULT-Switch-Synchronization-Hardware** command for the circuit pack being removed and execute a manual switch. Use the **FAULT-Retrieve-State:TG** command to verify, if desired.

14. Remove the circuit pack from the shelf as follows:

- Push up on the bottom and down on the top metal locking clips to unlock the circuit pack latches.
- Unseat the circuit pack by carefully and continuously pulling out equally on the top and bottom latches.
- Carefully slide the circuit pack out of the slot guides to remove it from the shelf. **DO NOT ROCK THE CIRCUIT PACK BACK AND FORTH.**

15. Are you to install another circuit pack in this slot.

If **YES**, then continue with Step 18.

If **NO**, then continue with Step 16.

16. At the CIT, select **CONFIGURATION-Update** command to update the hardware configuration. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

17. If required, remove the apparatus (circuit pack) blank from the slot.

Reference: : **DLP-533**

18. Obtain a **known good** replacement circuit pack with the same or higher series number.



NOTE:

The FT-2000 ADR Terminal does not support mixed OC3 LAA10/LAA10B operation in a **1+1** protected configuration. When replacing an OC3 circuit pack in a low speed interface configured for **1+1** protection, you **MUST** check the adjacent low speed interface slot to see which type of OC3 (LAA10/LAA10B) circuit pack is installed. For example, if there is an OC3 LAA10B circuit pack in

slot 2A and the circuit pack to be replaced is located in slot 2B, then you **MUST** install a OC3 LAA10B circuit pack into slot 2B.

19. Install the circuit pack as follows:
 - a. If necessary, close both latches on the circuit pack.
 - b. Place the circuit pack into the slot guides and slowly slide it into the shelf until the latches touch the shelf. **DO NOT ROCK THE CIRCUIT PACK BACK AND FORTH.**
 - c. Open the latches and push the circuit pack until it engages the connector pins.
 - d. With a thumb on each latch, continue sliding the circuit pack with one firm, continuous motion until the latches are fully engaged (the metal clips are in the locked position).
20. Is the circuit pack just installed an OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR?

If **YES**, then continue with Step 21.
If **NO**, then continue with Step 26.
21. If required, install the LBO to the appropriate **IN** or **OUT** jack for the OC-3, IS-3, OC-12, RCVR, or REGENR circuit pack.

Reference: **DLP-512**
22. Clean the optical fiber(s) and connector(s) with canned air or nontoxic gas.

Reference: **DLP-510**
23. Connect the optical fiber(s) to the lightguide buildouts (LBOs) and/or optical connector(s) on the OC-3, IS-3, OC-12, RCVR, TRMTR, or REGENR circuit pack. See table below.

Receive fiber ==>	RCVR
	REGENR (IN Connector)
	OC-3 (IN Connector)
	OC-12 (IN Connector)
	IS-3 (IN Connector)

Transmit fiber ==>	TRMTR
	REGENR (OUT Connector)
	OC-3 (OUT Connector)
	OC-12 (OUT Connector)
	IS-3 (OUT Connector)

24. At the CIT, execute the **CONFIGURATION-Retrieve-OC3** or **CONFIGURATION-Retrieve-OC12** command to verify that the input state has transitioned to an **IS** (in-service) condition on all packs with the fibers connected. If the state of a connected input is not **IS**, clear the problem before placing the circuits in service.
25. Place the optical fiber(s) in the shelf guide to prevent damaging it when replacing the shelf cover.
26. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
27. Is the circuit pack just installed a TG3?
If **YES**, then continue with Step 27.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
28. At the CIT, select **FAULT-Switch-Synchronization-Hardware** command for the circuit pack just installed and execute a switch reset. Use the **FAULT-Retrieve-State:TG** command to verify, if desired.
29. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Replace Fuse in Power Distribution and Fuse Panel or User Panel

Overview: This procedure is used to replace a blown 10A fuse (red lamp is lighted) in the power distribution and fuse panel or in the user panel.

1. Obtain a replacement 10A fuse.
2. Unsnap and lift the latch (from bottom to top) that is around the red lens cap.
3. Push in and down at the top of the red lens cap. Release slowly because the lens cap/fuse should spring forward.
4. Remove the lens cap/fuse from the fuse socket.
5. Remove the blown 10A fuse from the lens cap/fuse and replace with the replacement 10A fuse.
6. Install the lens cap/fuse into the fuse socket by pushing in and up at the bottom of the lens cap.
7. Lower the latch (from top to bottom) around the red lens cap and snap into place.
8. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Obtain State Report

Overview: This procedure supports obtaining the appropriate report after the provisioning of a DS3, EC1, OC-3, or OC-12 slot or port.

1. At the CIT, select **CONFIGURATION-Retrieve** and the appropriate modifiers as shown in Table A to obtain a State Report based on the previous parameter selections (provisioning).

Table A - Parameter

If Slot and Port Parameter Selections Were	Select These Inputs (Commands) to Obtain Report
CONFIGURATION-Set-Low Speed	CONFIGURATION-Retrieve-Low Speed:All
CONFIGURATION-Set-T3	CONFIGURATION-Retrieve-T3:All
CONFIGURATION-Set-State-T3	CONFIGURATION-Retrieve-T3:All
CONFIGURATION-Set-EC1	CONFIGURATION-Retrieve-EC1:All
CONFIGURATION-Set-State-EC1	CONFIGURATION-Retrieve-EC1:All
CONFIGURATION-Set-OC3	CONFIGURATION-Retrieve-OC3:All
CONFIGURATION-Set-State-OC3	CONFIGURATION-Retrieve-OC3:All
CONFIGURATION-Set-OC12	CONFIGURATION-Retrieve-OC12:All
CONFIGURATION-Set-state-OC12	CONFIGURATION-Retrieve-OC12:All

2. Press function key **F9** to execute and to display the report.
3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Provision Low Speed Slot and Port Parameters

1. **NOTE:**

Provisioning information is described in Section 8 of this manual. A Job Aid is also available for the FT-2000 add/drop-rings terminal (365-575-125).

Find the slot parameter in Table A to be provisioned or the port parameter in Table B to be provisioned and use the indicated CIT command(s) to provision the desired parameter(s).

Table A - Slot Parameter

Slot for	Parameter	Input (Command)
DS-3 and/or EC-1	Protection Switching Priority	CONFIGURATION-Set -Low Speed
OC-3	Protection Mode (From OC3)	CONFIGURATION-Set -OC3
	Protection Mode (From OC48)	
	Alarm Level	
	Signal Degrade Threshold	
	Output AU4 Mapping	
	Sync Messages (R7.1 or later)	
	OC3 Timing Direction (R9)	
	DCC Assignment	CONFIGURATION-Enter -Assignment -DCC
OC-12	Protection Mode (From OC12)	CONFIGURATION-Set -OC12
	Protection Mode (From OC48)	
	Alarm Level (Near End)	
	Alarm Level (Far End)	
	Signal Degrade Threshold	
	Output AU4 Mapping	
	OC12 Timing Direction	
	Sync Messages	
	DCC Assignment	CONFIGURATION-Enter -Assignment -DCC

Table B - DS-3 and EC-1 Port Parameters

Parameter	DS-3 Input (Command)	EC-1 Input (Command)
Violation Monitor/Removal Mode	CONFIGURATION-Set - T3	None
Alarm Attribute	CONFIGURATION-Set - T3	CONFIGURATION-Set - EC1
Signal Degrade Threshold	CONFIGURATION-Set - T3	CONFIGURATION-Set - EC1
Primary State	CONFIGURATION-Set - State - T3	CONFIGURATION-Set - State - EC1

2. Repeat Step 1 for the next parameter to be provisioned.
3. If desired, verify the parameter (just provisioned) by obtaining a State Report.
Reference: **DLP-516**
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Temporarily Remove High Speed Optical Loopback(s) at FT-2000 Network Element

Overview: This procedure is used to temporarily remove the high-speed optical loopback(s) during a low-speed cross-connect wiring test.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if the beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.

1. Remove the lightguide jumper from the **OUT** connector of the TRMTR circuit pack and the **IN** connector of the RCVR circuit pack. Slide a protector cap (if available) over the ends of the lightguide jumper.
2. Repeat Step 1 for an adjacent high-speed line in the same shelf.
3. Repeat Steps 1 and 2 for any remaining high-speed shelves.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Install and/or Remove Optical Loopback at OC48 REGENR Circuit Pack

Overview: This procedure optically loops each REGENR circuit pack on itself with a fixed line buildout (15 or 20 dB) for testing.

1. **⚠ CAUTION:**
Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 repeater bay/shelf to prevent electrostatic discharge damage to sensitive components.

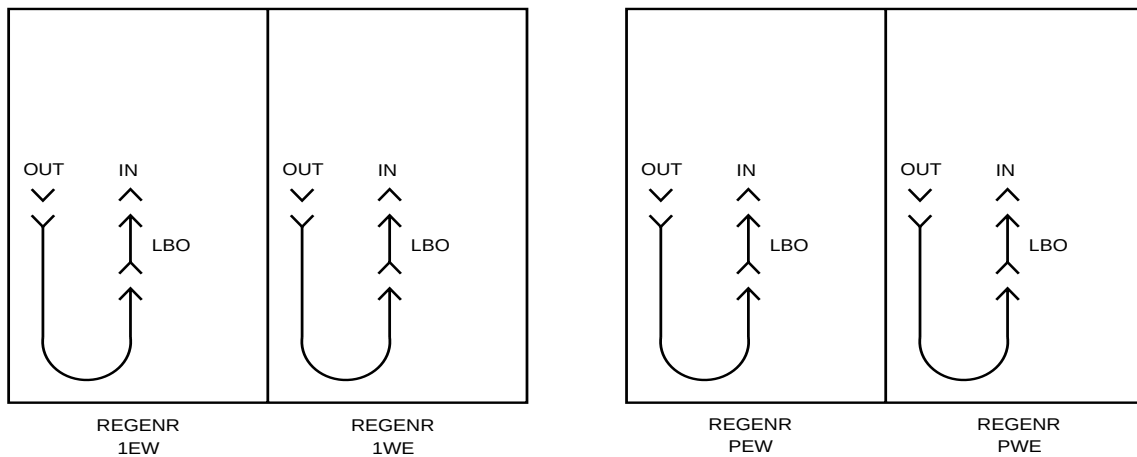
1. Remove the shelf cover from the FT-2000 repeater bay/shelf.

Reference: **DLP-511**

2. Is the OC-48 line loopback (Figure 1) being installed or removed?

To **install loopback**, continue with Step 3.

To **remove loopback**, continue with Step 13.



tpa 821267/01

Figure 1 – Optical Loopbacks at Repeater

Install Loopback

3. For each OC-48 line to be manually looped back, obtain a lightguide jumper (package label FS1E-E-02) and a 20-dB loss lightguide buildout, or equivalents. (It is possible to connect another LBO to an existing LBO to obtain a total of 20-dB provided the LBOs do not physically interfere with the shelf cover when closed.) Table A shows additional buildouts that are available. Table B shows the buildout types that are compatible with different codes of the REGENR circuit pack.

**Table A - Lightguide
Buildout Values**

dB Loss	Letter Code
0	None
5 $\pm$ 1	B
15 $\pm$ 2	F
20 $\pm$ 2	H

**Table B - Lightguide Buildouts and
Circuit Pack Compatibility**

Buildout Type (Code)	Circuit Pack
<i>ST</i> [®] (A3010*), FC (A3030*)	REGENR 39B1 REGENR 39C1
<i>ST</i> (A3070*), FC (A3080*), or SC (A3060*)	REGENR 39B2 REGENR 39C2 REGENR 39J2 REGENR 39P2 REGENR 39R2 REGENR 39S2

* See Table A for letter code.



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

4. Remove the OC-48 line optical connection from the **OUT** connector of the OC48 REGENR circuit pack and slide the protector cap (if available) over the end of the fiber.

5. Remove the OC-48 line optical connection to the **IN** connector of the OC48 REGENR circuit pack and slide the protector cap (if available) over the end of the fiber.
6. If equipped, remove the lightguide buildout from the **IN** connector of the OC48 REGENR circuit pack.

Reference: **DLP-512**

7. Remove the protector caps (if equipped) from the ends of the optical loopback cable and store the caps in a clean area (plastic box).
8. Clean the optical buildout, cable fiber ends, and connectors with canned air or nontoxic gas.

Reference: **DLP-510**

9. Install a 20-dB buildout into the **IN** connector of the OC48 REGENR circuit pack.

Reference: **DLP-512**

10. Connect the lightguide jumper between the buildout (at **IN** connector) and the **OUT** connector on the same OC48 REGENR circuit pack (same line.)
11. Repeat Steps 3 through 10 for the adjacent OC48 REGENR circuit pack(s) in the same shelf to be looped back.
12. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Remove Loopback

WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

NOTE:

Remember that the OC48 REGENR circuit packs are used in the service and protection lines and in both the east and west directions.

13. Remove the lightguide jumper connected between the **OUT** and **IN** connectors of an OC48 REGENR circuit pack and slide protector caps (if available) over the jumper ends.

14. If equipped, remove the 20-dB buildout (for testing) from the **IN** connector of an OC48 REGENR circuit pack.

Reference: **DLP-512**

15. If equipped, clean the buildout (engineered for that line) that was removed in Step 6 and reinstall it in the **IN** connector of the OC48 REGENR circuit pack.

Reference: **DLP-510**

16. Select the transmit fiber, remove the protector cap (if equipped), and store the cap in a clean area (plastic box).

17. Clean the connector on the transmit fiber and the **OUT** connector of the OC48 REGENR circuit pack with canned air or nontoxic gas.

Reference: **DLP-510**

18. Connect the transmit fiber to the **OUT** connector of the OC48 REGENR circuit pack.

19. Select the receive fiber, remove the protector cap (if equipped), and store the cap.

20. Clean the connector on the receive fiber and the buildout (if equipped) or the **IN** connector of the OC48 REGENR circuit pack, using canned air or nontoxic gas.

Reference: **DLP-510**

21. Connect the receive fiber to the line engineered buildout (if equipped) or the **IN** connector of the OC48 REGENR circuit pack.

22. Repeat Steps 13 through 21 for the next OC48 REGENR circuit pack to have the optical loopback removed.

23. Replace the shelf cover.

Reference: **DLP-511**

24. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Properly Terminate DS3 and/or EC1 Outputs

Overview: This procedure is used to properly terminate the DS3 and/or EC1 outputs from the FT-2000 network element. Descriptive information is contained in Section 5 of this manual.



CAUTION:

Do not inadvertently unterminate any DS3 or EC1 outputs that were previously terminated.



CAUTION:

DS3 and EC1 outputs should always be terminated by one of the following methods to prevent false DS3 or EC1 failure indications.

1. Are the DS3 and/or EC1 output connected to a cross-connect panel or connected directly to other transmission equipment?

 If to **cross-connect panel**, then continue with Step 2.

 If to **other transmission equipment**, then continue with Step 5.
2. Does the DSX-3 (STSX-1) cross-connect panel provide internal terminations for nonconnected circuits? (cross-connect panels meet this requirement.)

 If **YES**, then continue with Step 4.

 If **NO**, then continue with Step 3.
3. At the DSX-3 (STSX-1) cross-connect panel, install a 75-ohm termination on each nonconnected DS3 and/or EC1 output.
4. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
5. Verify the DS3 and/or EC1 outputs (low-speed cable) are connected directly to other working transmission equipment, such as a DACS III-2000, DDM-2000, etc., to provide good low-speed terminations.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Establish Modem or Datakit[®] Network Access

Overview: This procedure is used to access a distant FT-2000 network element (NE) from a local craft interface terminal (CIT). Some of the more common CIT access configurations are shown in Figures 1 through 4. Other configurations exist with access gained through local company procedures. Once access is gained, the FT-2000 network element responds to any CIT selections just as if you were physically connected to it.

1. Are you using the public switched network (via modem) or the *Datakit* network?

If **public switched network**, then continue with Step 2.

If **Datakit network**, then continue with Step 25.

Quick Check for Compatible Modems (Both Locations)



NOTE:

Modems at the CIT and FT-2000 NE locations must be compatible. Quick check/setup of the modem parameters and connections are given in this procedure for the FT-2000 NE location first, then for the CIT location.



NOTE:

The manufacturer's manuals may be referred to for specific instructions on setting the modem parameters. For example, when using a *Penril*¹ modem, the speed conversion parameter must be set to off.



NOTE:

Additional information on using a modem for remote access is available in Section 6, "Operations Interface." Also, refer to 365-575-115, *FT-2000 OC-48 Lightwave System, Releases 3, 4, 5, 6, 7, and 8 Installation Manual*.

1. Registered trademark of Penril Corporation

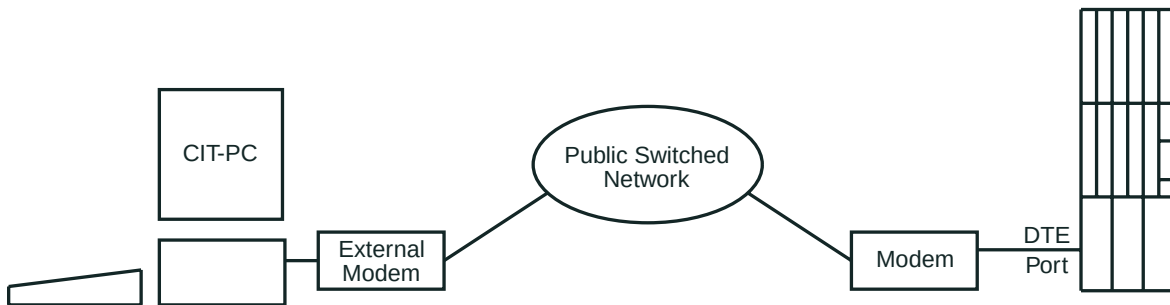


Figure 1 - External Modem Configuration

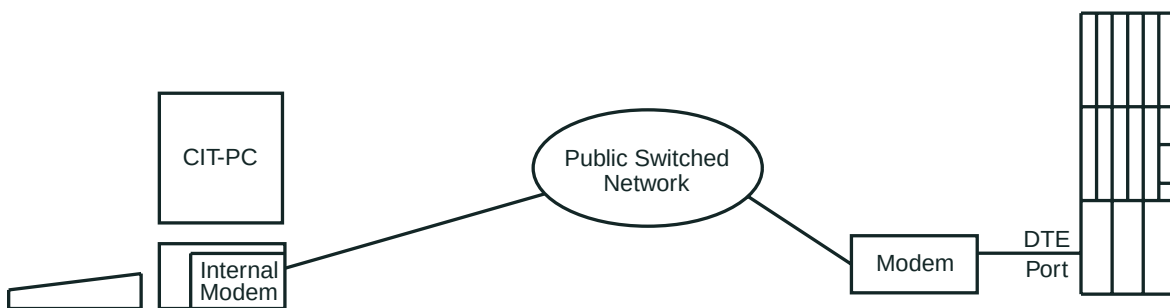


Figure 2 - Internal Modem Configuration

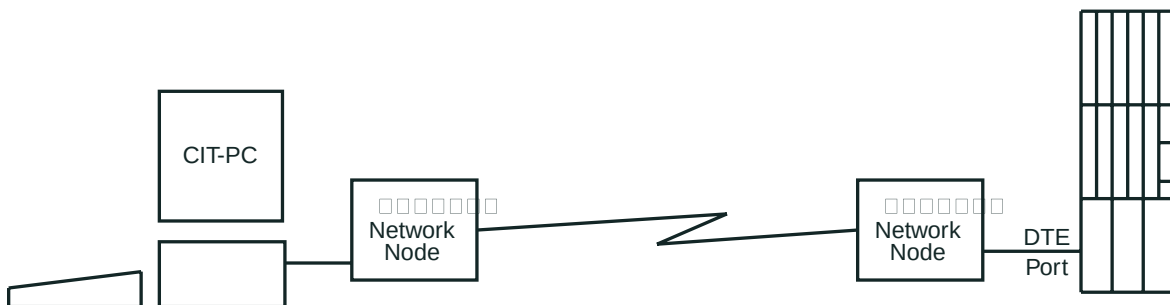


Figure 3 - Network Configuration

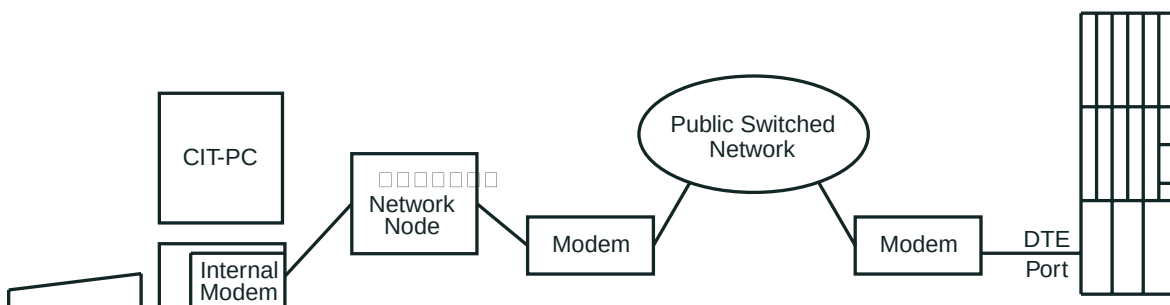


Figure 4 - Hybrid Network Configuration

Figure 1 – Figure 1 - CIT/FT-2000 Network Element Configurations

2. Verify the generic parameters of the modem are set to the following:
 - Modem baud rate (AT&T 4024 or AT&T 2224 CEO modems at 2400, AT&T 2292 modem at 9600) for CIT (DCE) port. This port and the CIT automatically select the highest usable baud rate up to 9600.
 - Full duplex
 - 8 data bits
 - No parity bits
 - 1 start bit
 - 1 stop bit
 - No flow control.

FT-2000 Network Element Location



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge Considerations" in **Trouble Clearing: TAD-100**.*

3. Set the modem to answer incoming calls. For example, if you are using an AT&T 2224 CEO modem, do the following to program the modem:



NOTE:

It is assumed the PC and modem ("AT" command compatible) are powered and the PC is loaded with communications software.

- a. Set all front panel switches to DOWN (factory default) for AT command mode.
- b. Connect PC serial port to the modem RS-232C port using modem cable (Table A) or using a null-modem adapter (Figure 5).



NOTE:

Black Box model # ME-200 provides these null-modem connections and female-to-female connectors.

- c. Establish communications between the PC and modem using the communications software set for the generic parameters in Step 2.
- d. At the prompt, enter the following "AT" commands.

PC	Response	Comment
ATH	OK	#hang-up (on-hook)
AT&F	OK	#resets to factory defaults
AT&C1	OK	#data carrier is present when on
ATS0=2	OK	answer on 2 rings
AT&W	OK	wait for second dial tone

- e. Remove the connector at the PC serial port and plug into the CIT (DTE) connector at the interconnection panel (Low Speed Shelf - System Controller) of the FT-2000 network element. Dial-up access to the network element via a 2400 baud modem is now ready.
4. Verify the telephone line is plugged into the modem.
5. This completes the quick check/setup for the modem at the FT-2000 NE location. Continue with the next step (modem at CIT location).

CIT Location

6. Is the modem installed internally (card) or a stand-alone (external).
If **internal modem**, then continue with Step 7.
If **external modem**, then continue with Step 8.
7. Verify the telephone line is plugged into the modem. Continue by going to Step 11.
8. Verify the modem is connected to the CIT, using the appropriate modem cable. Tables B and C list the pins for the DB-25 connector and DB-9 connector, respectively.
9. Verify the modem is powered.
10. This completes the quick check/setup for the modem at the CIT location. Continue with the next step (CIT operation).

Using CIT DIAL Feature

11. Do you want to use the DIAL feature (function key **F3**) in the FT-2000 CIT-PC software?

If **YES**, then continue with Step 15.

If **NO**, then continue with Step 12.

12. Dial the remote FT-2000 network element by entering the telephone number. A personal computer communications software package is very helpful in accessing the remote FT-2000 network element. Many packages exist, so use the one you are familiar with which may be *ProComm Plus*¹, CTRM, QMO-DEM, SimTerm, *Terranova*[®], etc.
13. After the remote modem answers, press the key or space bar until communication between the two is established. Some locations may use a server switch at the FT-2000 network element which requires entering an additional login, password, and a port assignment in order to connect to the FT-2000 network element.²
14. Once communication has been established to the remote FT-2000 network element, escape to *MS-DOS*² (at the CIT), enter "cit", and press the key. The FT-2000 CIT-PC software should start and display the logo/copyright screen. Continue with Step 22.
15. At the CIT with an *MS-DOS* prompt, change directory to where the CIT-PC software is installed and enter "cit" without the quotes and press To clear the Network Systems screen, press .
16. Press the **F6** key for the CIT *terminal* SETUP. Select the desired communication port, baud rate to match the modem, and monitor and press **F6**.
17. Press the **F3** key, labeled **DIAL**.
18. This step is optional and is only used if you wish to change the previous *modem* parameter settings. You may change the parameters by pressing the **F6** key, labeled **SETUP**, then select the desired PORT and BAUD rate and press the key twice (to SAVE and EXIT).
19. For an external modem, press the key several times until the dial response appears on the screen. For an internal modem, enter the dial string "atdt xxx-xxxxx" (phone number of the FT-2000 network element) and press the key.
20. Type the desired telephone number and press the key.

1. Registered trademark of Datastrom Technologies, Inc.

2. Registered trademark of Microsoft Corporation.

21. After the connection is confirmed, press function key **F9**, labeled **CONT** (to continue).
22. Press the key to select **FT-2000**, then type your login and password.
23. After completing your work, log out of the FT-2000 network element by pressing function key **F4**, labeled **LOGOUT**, or exit the software by pressing function key **F5**, labeled **EXIT**. At this time, you may press **F3** again to establish a new connection to a different FT-2000 network element.
24. **STOP. YOU HAVE COMPLETED THIS PROCEDURE.**

Quick Check for Typical Datakit Network

⇒ **NOTE:**
The *Datakit* network supports many configuration parameters. Some parameters are changeable by the user; others are set by the network administrator. The user should consult local procedures in determining how to configure their network. The manufacturer's manuals may be referred to for specific instructions on setting the parameters.

⇒ **NOTE:**
The provisioned state (parameter settings) of the *Datakit* port to which the user is connected may interfere with the successful interaction of the CIT PC and the FT-2000 NE. This procedure allows the connection to be made independently of the provisioned state of the *Datakit* port.

25. Press the key and momentarily wait for the response **DESTINATION:.**
26. Did you get the **DESTINATION:** prompt?
 - If **YES**, then continue with Step 34.
 - If **NO**, then continue with Step 27.

⇒ **NOTE:**
The *Datakit* port (to which the PC is connected) is NOT supporting the *Datakit* command mode. Perform the following steps to allow the connection to be made independently of the provisioned state of the *Datakit* port. This allows a method to connect to the CIT (DTE) port of an FT-2000 NE via a *Datakit* network.

27. Put the PC into a terminal emulation mode and send the "attention sequence" which is usually provisioned to be two BREAK characters. [Check with the

Datakit network administrator for the local attention sequence character(s).]

28. Did the *Datakit* port respond with **Command:**?

If **YES**, then continue with Step 31.

If **NO**, then continue with Step 29.



NOTE:

Assistance is required from your *Datakit* network administrator. The administrator must verify or provision the following parameters for the *Datakit* port you're using.

29. Verify the generic parameters of the *Datakit* network port are set to the following:

- Full duplex, asynchronous
- 8 data bits per serial data byte with 1 start bit and 1 stop bit
- No parity bits
- Attention sequence is 2 breaks initially; however, zero breaks may be required for proper operation
- No flow control by the network and no flow control by the device.

30. After verifying or provisioning the parameters, continue with Step 34.

31. At the **Command:** prompt, type SET ATTN NONE and press the **ENTER** key.

32. Type CONT and press the **ENTER** key. (The **Destination:** prompt should appear on the screen.)

33. This completes the provisioning state of the *Datakit* port. Continue with the next step.

Using Datakit Network

34. Type the desired *Datakit* network number and press the **ENTER** key.

35. Press the **F4** key, labeled **CHECK**, to verify connectivity between the CIT and the network element. A notice frame appears on the screen.

36. What does the notice frame indicate?

If the **NE is communicating**, then continue with Step 37.

If the **NE is not responding**, then you may wish to (a) double check the

Datakit port parameters (Step 29) and (b) seek the next level of *Datakit* network help.

37. Press the **ESC** key to clear the notice frame.
38. Press the **F9** key, labeled **CONT**, to continue the CIT-PC software program.
39. Press the **ENTER** key to select FT-2000, then type your login and password.
40. After completing your work, log out of the FT-2000 network element by pressing function key **F4**, labeled **LOGOUT**, or exit the software by pressing function key **F5**, labeled **EXIT**. At this time, you may press **F3** again to establish a new connection to a different FT-2000 network element.
41. **STOP. YOU HAVE COMPLETED THIS PROCEDURE.**

Table A. Pin Connections at CIT (DTE) Connector

CIT (DTE) Connector (Note)	FT-2000 Network Element
Pin 1 - Protective Ground	Protective frame ground.
Pin 2 - Transmit Data	Transmits data to the modem.
Pin 3 - Receive Data	Receives data from the modem.
Pin 4 - Request to Send	FT-2000 network element notifies the modem that it is ready to send data.
Pin 5 - Clear to Send	Modem notifies the FT-2000 network element that it is clear to send its data
Pin 6 - Data Set Ready	Modem notifies the FT-2000 network element that the modem is connected and ready to receive data.
Pin 7 - Signal Ground	Signal ground.
Pin 8 - Receive Line Signal Detected	This modem has detected carrier from the remote modem.
Pin 20 - Data Terminal Ready	FT-2000 network element notifies the modem that it is connected.

Note: All remaining pins are not connected.

Table B. Pin Connections for Modem Using DB-25 Cable

PC DB-25 Connector (Note)	CIT
Pin 1 - Protective Ground	Protective frame ground.
Pin 2 - Transmit Data	Transmits data to the modem
Pin 3 - Receive Data	Receives data from modem
Pin 4 - Request to Send	CIT is requesting clearance from the modem so it can send data.
Pin 5 - Clear to Send	Modem notifies the CIT that it is clear to send data.
Pin 6 - Data Set Ready	Modem notifies the CIT that the modem is connected.
Pin 7 - Signal Ground	Signal ground
Pin 8 - Carrier Detect	This modem detects carrier from the remote modem.
Pin 20 - Data Terminal Ready	CIT notifies the modem that it is connected.

Note: All remaining pins are not connected.

Table C. Pin Connections for Modem Using DB-9 Cable

PC DB-9 Connector	CIT
Pin 1 - Carrier Detect	This modem detects carrier from the remote modem.
Pin 2 - Receive Data	Receives data from modem
Pin 3 - Transmit Data	Transmits data to the modem
Pin 4 - Data Terminal Ready	CIT notifies the modem that it is connected
Pin 5 - Signal ground	Signal ground
Pin 6 - Data Set Ready	Modem notifies the CIT that the modem is connected and ready to receive data
Pin 7 - Request to Send	CIT is requesting clearance from the modem so it can send data.
Pin 8 - Clear to Send	Modem notifies the CIT that it is clear to send.
Pin 9 - Ring indicator	Modem notifies the CIT that ring signal is present when the modem is in an auto-answer mode.

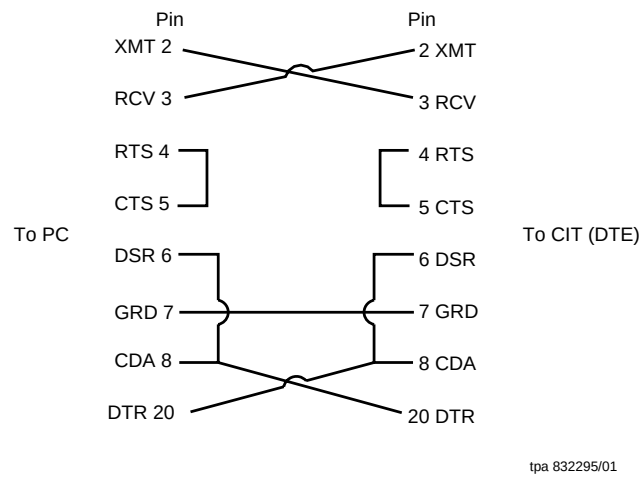


Figure 2 – Figure 5 - Null-Modem Internal Wiring Connections

Change, Delete, or Enter a User's Login

Overview: This procedure covers login aging and password aging in addition to changing, deleting, or entering a user's login.



CAUTION:

These tasks can only be performed by one of two privileged users. Privileged users cannot change their own login.



CAUTION:

Additional information about security and aging is provided in Section 8, "Administration and Provisioning."

1. If required, connect and condition the craft interface terminal (CIT).

Reference: **DLP-501**

2. What do you want to do to a user's login?

If to **change a user's login**, continue with Step 3.

If to **delete a user's login**, continue with Step 7.

If to **enter a new user's login**, continue with Step 10.

If to **enable/disable login aging**, continue with Step 16.

If to **enable/disable password aging**, continue with Step 16.

Change Login

3. At the CIT, select **SECURITY-Set -Login-Change:** for the specified user's login to be changed.
4. Select the appropriate input parameter (new login, password, verify password, user privilege, and status), make the change, and press function key **F9** to execute the change(s).
5. At the CIT, select **SECURITY-Retrieve-Login:** to obtain the Login Provisioning Report and verify that the user's login has been changed.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Delete Login

7. At the CIT, select **SECURITY-Set -Login-Delete:** for the specified user's login to be deleted and press function key **F9** to execute the deletion.
8. At the CIT, select **SECURITY-Retrieve-Login:** to obtain the Login Provisioning Report and verify that the user's login has been deleted.
9. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Enter Login

 **NOTE:**
Each FT-2000 network element may have up to 98 nonprivileged users.

10. At the CIT, select **SECURITY-Set -Login-Enter** and enter the new user login (up to 10 alphanumeric characters) and an initial password (from 6 to 10 characters with 1 number and with 1 symbolic character except the @, #, and =).
11. When prompted, reenter the initial password to verify your intended password. Passwords are not displayed.
12. Assign either security level (Reports Only or General) to the user's login and press function key **F9** to execute the assignment.
13. At the CIT, select **SECURITY-Retrieve-Login:** to obtain the Login Provisioning Report and verify that the user's login has been entered.
14. The login and initial password may be given to the person working on the FT-2000 network element.
15. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Enable/Disable Login Aging and/or Password Aging

16. At the CIT, select the **SECURITY-Set -Security-Network Element:** command to gain access to the global security parameters for the system.
17. Select the appropriate input parameter, enter a value, and press function key **F9**.
Logins Allowed= <Yes, No> If No, all nonPrivileged users will be immediately disconnected.
Password Aging= <0, 7 through 999> A 0 (zero) will disable.

Login Aging= <0, 7 through 999> A 0 (zero) will disable.

18. At the CIT, select **SECURITY-Retrieve-Security-Network Element:** to obtain the Access Security Global Configuration Report and verify the correct parameter value(s).
19. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Release Looped Back DS3 and/or EC1 Circuit(s)



CAUTION:

Traffic and service interruption can occur to other DS3 or EC1 circuits if they are accidentally looped back. Recheck the address of the port(s) being released from loopback. Release of loopback occurs at the DS-3/EC-1 level.



NOTE:

A DS3 (LAA2) or STS1E (LAA4) circuit pack has three ports.

1. Obtain the operation instructions to release the looped back DS3 or EC1 port(s) and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).
Reference: **DLP-501**
3. At the CIT, select **FAULT-Release-Loopback-T3** (for DS3 circuits) or **FAULT-Release-Loopback-EC1** (for EC1 circuits) for the first of the specified port(s).
4. Repeat Step 3 for any remaining port(s).
5. The port(s) is released from the looped back condition. If you wish to verify, select **FAULT-Retrieve-Alarm** for an updated Active Alarms and Status Report. Section 11 contains an example of this report.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Establish or Disconnect Remote Login Using CIT

Overview: This procedure is used to gain access to a remote FT-2000 or DDM-2000 network element (NE) over the data communications channel (DCC) but not to an FT-2000 repeater bay/shelf.

1. Are you to establish remote login or disconnect from remote login?

To **establish**, then continue with Step 2.

To **disconnect**, then continue with Step 8.

Establish Remote Login

2. If required, connect and condition the craft interface terminal (CIT).

Reference: **DLP-501**



NOTE:

The CIT connection state is indicated in the upper right-hand corner of the FT-2000 screen only as **LOCAL ONLY**, **REMOTE**, or **LOCAL**.

LOCAL ONLY - CIT is only connected to local network element.

REMOTE - CIT is connected to remote network element from local network element.

LOCAL - CIT is connected to remote network element but it is toggled back to local network element.

3. Press the **F2** function key labeled **REMOTE** followed by the enter or return key to display the **Destination:** prompt window.



NOTE:

Typing a question mark (?) in response to the TID prompt will display a pick list of available addresses in the network(s).

4. Enter the target identification (TID) obtained from the office records (or report) for the remote FT-2000 or DDM-2000 NE.

⇒ **NOTE:**
For FT-2000 only. If your login on the local network is also a valid login on the remote network element, you will be logged in automatically. Otherwise, you must log in at this time.

⇒ **NOTE:**
For DDM-2000 only. A small box will be displayed on your terminal monitor after a successful login. Please note the software version listed in the box for possible use at a later time.

5. If necessary, enter the login and password for the remote FT-2000 or DDM-2000 NE. If unable to log in to the network element, check your login and password with the office records and/or supervisor.

⇒ **NOTE:**
If remotely logged in to an FT-2000, **REMOTE** is now displayed in the upper right-hand corner.

⇒ **NOTE:**
The remote FT-2000 or DDM-2000 NE will now respond to any inputs from the CIT just as if you were physically connected to it.

⇒ **NOTE:**
If you have remotely logged in to an **FT-2000**, then **F2** is now labeled **LOCAL** and acts as a toggle back to the local FT-2000. If you have remotely logged in to a **DDM-2000**, then **<control> T** allows you to toggle back to the local network element and **F2** on the FT-2000 screen allows you to toggle back to the DDM-2000.

6. Perform any required work such as obtaining reports or provisioning.

7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Disconnect Remote Login

8. Is **LOCAL** or **REMOTE** displayed in the upper right-hand corner of the CIT screen or are you currently displaying DDM-2000 screen?

If **LOCAL**, then continue with Step 9.

If **REMOTE**, then continue with Step 10.

If **DDM-2000**, then continue with Step 13.

9. You should be logged in to the remote network element. If the remote is an FT-2000, **REMOTE** will be displayed in the upper right-hand corner.



NOTE:

If **LOGOUT** is selected while connected to the remote FT-2000, the remote connection is dropped, but the CIT continues to operate with the local FT-2000 NE. If **LOGOUT** is selected at the local FT-2000 NE, both the remote and local connections are dropped.

Are you now remotely logged in to an FT-2000 NE or a DDM-2000 NE?

If **FT - 2000**, then continue with Step 11.

If **DDM - 2000**, then continue with Step 13.

10. Press **F4** function key, labeled **LOGOUT**, to log out of the remote FT-2000. The CIT is still logged into the local FT-2000 NE.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
12. Enter lo; at the DDM-2000 prompt. This will log you out of the DDM-2000 NE and return you to **LOCAL ONLY** mode on the FT-2000 NE.
13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Loop Back DS3 and/or EC1 Circuit(s) for Testing



CAUTION:

Traffic and service interruption can occur to the other DS3 or EC1 circuits if they are accidentally looped back. Recheck the address of the port(s) being looped back. Loopback occurs at the DS3 or EC1 level towards the OC-48 line(s).



NOTE:

A logical loopback will be completed and indicated whether or not a compatible circuit pack is present. A physical loopback will occur only when a compatible circuit pack is present. For example, if an **Operate-Loopback-T3** command is executed to an address of a slot containing an STS1E circuit pack, the logical loopback will be "COMPLD" but no physical loopback will occur.



NOTE:

A DS3 or STS1E circuit pack has three ports.

1. Obtain the operation instructions to loop back the DS3 or EC1 circuit(s) for testing and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).

Reference: **DLP-501**



NOTE:

A single port may be looped back towards the OC-48 line(s) and will remain looped until deactivated by the **Release-Loopback-T3** or **Release-Loopback-EC1** selections.

3. At the CIT, select **FAULT-Operate-Loopback-T3** (for DS3 circuits) or **FAULT-Operate-Loopback-EC1** (for EC1 circuits) for the first of the specified port(s).
4. Repeat Step 3 for any remaining port(s).
5. Verify the **ABN**, **NE ACTY**, **USE CIT**, and **PWR ON** LEDs are lighted at the user panel.

6. The port(s) is looped back toward the OC-48 line(s). If you wish to verify, select **Retrieve-Alarm** for an updated Active Alarms and Status Report. Section 11 contains an example of this report.
7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Replace Fan Filter (in E-Bay)

Overview: This procedure disconnects the DC power to the fan assembly before the air filter is replaced to prevent dust contamination to the FT-2000 network element. This procedure should be completed without any interruptions.

 **CAUTION:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*

Locate the Power Distribution and Fuse Panel at the top of the bay.

1. Remove the front cover of the panel by using a 7mm or adjustable wrench to loosen (about three turns) the two hex-head screws (one located on each side of the cover). If the cover is secured with slotted pan-head screws, these must be removed completely by using a slotted screwdriver (straight shaft or offset).
2. Locate the two **FAN** power connectors/plugs, labeled **FAN, -48A** and **FAN, -48B** at the upper left of the connectorized panel.

 **CAUTION:**
Do not pull on the power cables to remove the plugs from the connectors. Remove the two FAN power plugs from the connectors (squeeze on the sides of the plug and pull it straight out from the connector).

Response: The **POWER ON** LED at the fan assembly is off.

 **NOTE:**
Filters may be ordered as sub List 200 from either the FT-2000 J68974AK-1 or J68974EK-1 (circuit packs, miscellaneous hardware, and spare parts shipped separately from the equipment) drawing.

3. Obtain a replacement (disposable) air filter.
4. About 32 inches from the floor, locate two 1/4-turn fasteners on the PC tray screen. See Figure 1.
5. Use a slotted screwdriver (or a dime) to rotate the 1/4-turn fasteners counter-clockwise 90 degrees.

6. Put a finger in each wire loop and pull to open the screen.
7. Remove the dirty air filter located right above the PC tray by sliding it toward you.



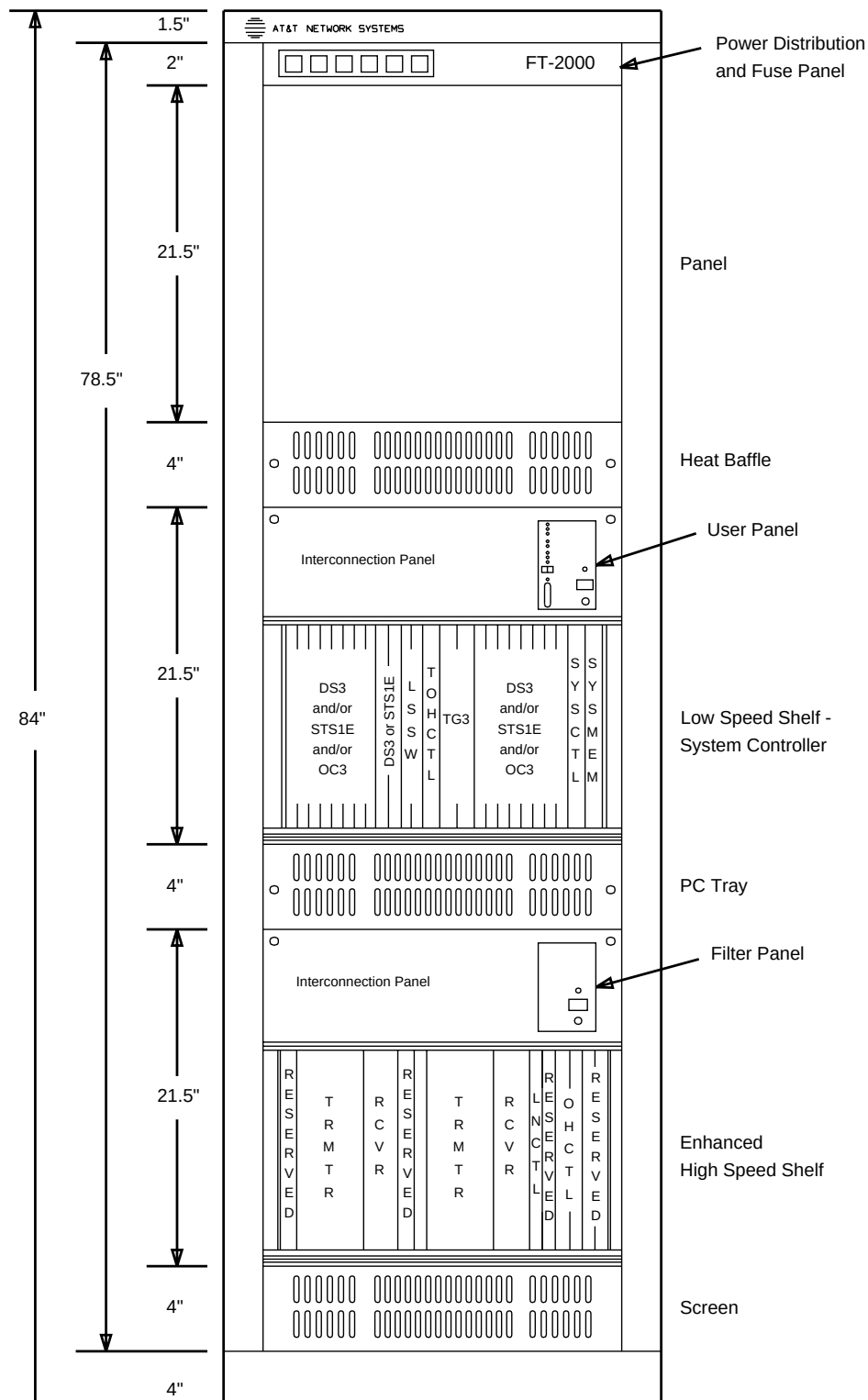
NOTE:

Air flow in the bay is from bottom to top (up).

8. Install the replacement filter by sliding it into the bay within the filter guides, with the arrows on the filter pointing up.
9. Dispose of the dirty air filter per the local operating instructions.
10. After the filter replacement has been completed, close the screen and rotate the 1/4-turn fasteners 90 degrees clockwise until each screw slot is horizontal.
11. Insert the two **FAN** power plugs into their respective connectors ("A" plug has red/black wires and "B" plug has slate with black strip/slate wires). The two **FAN** power plugs are keyed and when connected properly, the "A" plug has a red wire on the left and the "B" plug has a slate wire with a black strip on the left.

Response: The **POWER ON** LED at the fan assembly is lighted.

12. Reposition the front cover of the Power Distribution and Fuse Panel and secure it using the two screws.
13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



Replace Circuit Pack with Different Circuit Pack Code

Overview: This procedure is used to replace an existing circuit pack with one of a different code type or version; for example, replacing circuit pack LAA17 with circuit pack LAA18, or 739B2 with 739B5.

⚠ WARNING:
Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.

⚠ CAUTION:
Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 network element to prevent electrostatic discharge damage to sensitive components.

⚠ CAUTION:
Do not remove the SYSCTL circuit pack unless instructed to by a procedure that sent you here. If the SYSCTL circuit pack is removed, provisioning data could be lost.

1. Identify the appropriate shelf, using Table A.

Table A - Shelf and Associated Circuit Packs

Circuit Pack	Shelf
DS3 LSSW OC3 IS3 OC12 STS1E TG3 TOHCTL	Low Speed Shelf - Complementary or Low Speed Shelf - System Controller
LNCTL OHCTL	High Speed Shelf, Enhanced High Speed Shelf

Table A - Shelf and Associated Circuit Packs

Circuit Pack	Shelf
RCVR	or
TRMTR	Condensed High Speed Shelf
REGENR	Repeater Bay/Shelf

2. Remove the appropriate shelf cover.

Reference: **DLP-511**

- 3.



CAUTION:

*Before replacing a circuit pack, the corresponding low-speed slot **MUST** be taken out of service to prevent a service outage.*



NOTE:

If the circuit pack being removed is an electrical DS-3 or STS-1E pack, then a low speed switch will automatically occur (condition that one does not already currently exist) when the circuit pack is removed from the shelf, and will retire when the Update command is executed.



NOTE:

To replace a circuit pack with a different code, you must verify that the software running in the bay is compatible with the new circuit pack codes. Refer to Table 7-1 in Section 7, "Circuit Pack descriptions."

Is the current circuit pack, that is to be replaced, a DS3 or STS1E low speed interface?

If **YES**, then continue with Step 4.

If **NO**, then continue with Step 10.

DS3/STS1E

- 4.



NOTE:

For DS3 and STS1E circuit packs only: Verify that an automatic switch condition does not already exist or that a CIT provisioned protection switch has been made before removing the circuit pack from the shelf.

At the CIT, select **FAULT-Retrieve-State:LS INTFC** command and obtain a State Report on the (slot) circuit pack being replaced.

5. From the report, is the low speed slot for the circuit pack that is to be removed

in a standby state?

If **YES**, then go to Step 7.

If **NO**, then continue with Step 6.

6. At the CIT, select **FAULT-Switch-Low Speed:Slot** command for the circuit pack being removed and execute. Use the **FAULT-Retrieve-State:LS INTFC** command to verify, if desired.
7. Remove the existing DS3/STS1E circuit pack from the slot.
8. Install the replacement low speed circuit pack. As appropriate, connect any low speed cables or optical fibers and provision the slot as required for the application.
9. At the CIT, select **CONFIGURATION-Update** and execute. Go to Step 35.

Low Speed Optical

10. Is the current circuit pack, that is to be replaced, a low speed optical interface?

If **NO**, then go to Step 21.

If **YES**, then continue with Step 11.

11. At the CIT, select **CONFIGURATION-Retrieve-OC3/12:All** command to determine the operating mode of the slot.
12. Is the slot operating in 1+1 mode?
 - If **YES**, then go to Step 14.
 - If **NO**, then continue with Step 13.
13. The circuit pack is operating in 0x1 mode. In order to prevent a service outage it will be necessary to remove service from the slot before replacing the circuit pack. Continue with Step 17.
14. At the CIT, select **FAULT-Retrieve-State:LS INTFC** command and obtain a State Report on the (slot) circuit pack being replaced.
15. From the report, is the low speed slot for the circuit pack that is to be removed in a standby state?
 - If **YES**, then go to Step 17.
 - If **NO**, then continue with Step 16.
16. At the CIT, select **FAULT-Switch-Low Speed:Slot** command for the circuit pack being removed and execute. Use the **FAULT-Retrieve-State:LS**

INTFC command to verify, if desired.

17. Disconnect the optical fibers from the existing optical circuit pack and subsequently remove the circuit pack from the slot.
18. Install the replacement low speed circuit pack. As appropriate, connect any optical fibers and provision the slot as required for the application.
19. At the CIT, select **CONFIGURATION-Update** and execute.
20. Is there a need to replace another low speed optical circuit pack?
If **YES**, then continue with Step 11.
If **NO**, then go to Step 35.

High Speed Optical

21. Before removing the optical fibers or removing the circuit packs, determine if you want the automatic protection switch to make the switch or if you want to make a manual switch.
If auto switch, go to Step 24.
If manual switch then continue with Step 22.
22. At the CIT, select **FAULT-Retrieve-State:TRMTR or RCVR** command and obtain a State Report on the (slot) circuit pack being replaced
23. From the report, is the slot for the appropriate circuit pack, that is to be removed, in a standby state?
If **YES**, then go to Step 25.
If **NO**, then continue with Step 24.
24. At the CIT, select **FAULT-Switch-Line:TRMTR or RCVR** command for the circuit pack being removed and execute. Use the **FAULT-Retrieve-State:TRMTR or RCVR** command to verify, if desired.
25. Remove the OC48 optical fibers on the appropriate TRMTR and/or RCVR.
 **WARNING:**
Only remove the fibers on the 1E side OR the 1W side at a time. Removing fibers on both sides will isolate the node and will result in lost service for all adds and drops at the local node.
26. Install the new TRMTR and/or the RCVR. Clean and reconnect the OC48 optical fibers.

27. At the CIT, select **CONFIGURATION-Update** and execute.
28. Wait for the OC48 automatic protection switch to retire. At the CIT select, **FAULT-Retrieve-Alarms** command to verify that the automatic protection switch has cleared.
29. Is there a need to replace another high speed optical circuit pack?
If **YES**, then continue with Step 21.
If **NO**, then go to Step 35.

Repeater REGENR

30. Determine, from the work order, which REGENR is to be replaced first. Disconnect the OC48 optical fibers on the appropriate identified REGENR.
 **WARNING:**
Only remove the fibers on one REGENR at a time.
 **WARNING:**
Install the new REGENR. Clean and reconnect the OC48 optical fibers.
31. Is there a need to replace another REGENR circuit pack?
If **YES**, then continue with Step 30.
If **NO**, then go to Step 35.

All Other Types

32. Identify the slot for the subject circuit pack. Remove the existing circuit pack from the slot.
33. Install the replacement circuit pack.
34. At the CIT, select **CONFIGURATION-Update** and execute.
35. Wait the minimum time, indicated in Table B, for the circuit pack to reset.

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
LNCTL *	10 minutes
OHCTL	5 minutes
TG3 †	5 minutes
TOHCTL	5 minutes

Table B - Mini Reset Waiting Times

CP Inserted	Waiting Time
All Others	35 seconds

* Inserting an LNCTL circuit pack starts a mini reset that can take up to 10 minutes to complete.

During this time, LEDs on other circuit packs will be lighted.

† When a TG3 circuit pack is first inserted, it will be switched out of service until it warms up. This can take as long as 5 minutes. You can confirm that it is in the standby state by using the FAULT-Retrieve-State command for the TG slot.

36. Is the **NE ACTY** LED lighted at the user panel?

If **YES**, then go to **Trouble Clearing: TAP-103**.

If **NO**, then continue with Step 22.

37. Replace the shelf cover.

Reference: **DLP-511**

38. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Inspect (Repair) Optical and/or Electrical Cable(s)

Overview: You were sent here from a trouble clearing procedure. This procedure is used to correct an input or output cable problem such as a damaged or disconnected cable. This procedure uses cable in a general sense to refer to either the electrical coax cable or to the optical fibers, as appropriate.



CAUTION:

A prolonged and significant disruption in the flow of ventilation air within the D-Bay can result in the buildup of excessive heat. Therefore, if it becomes necessary to remove one of the front covers or open one of the sliding doors, care should be exercised to limit this time and quickly close the opening.

1. Remove the appropriate cover as follows:
 - High speed shelf cover for OC-48 cables
 - Interconnection panel cover for low-speed (DS3 or EC1), sync reference cables, or OS cables.
 - Low speed shelf cover for OC-3 cables
 - Low speed shelf cover for IS-3 cables
 - Low speed shelf cover for OC-12 cables.
2. Verify that the cable(s) are properly connected.
3. Visually inspect the cable, starting at the connector on the local network element and going as far as practical (usually to an interconnection bay or to a cross-connect panel).
4. Correct any problems with the cable, following local procedures.
5. Replace the cover that was removed in Step 1.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Introduction to the PC

Overview: This DLP provides a brief introduction to the PC. It includes proper handling and storage of diskettes and some of the important procedures you should follow when working with your PC. This DLP is a brief review of PC concepts. Refer to your PC user's guide for a complete description.

Parts of a PC

PCs vary in physical appearance and size. Most *IBM*¹ compatible PCs consist of three basic parts — a main unit, a monitor, and a keyboard. Note that some PCs, particularly portables, integrate the keyboard, monitor, and main unit into a briefcase-size package. The FT-2000 generic program may be installed with either a desktop PC or a portable PC. The diskettes may be either 3-1/2 inch floppy disks or 5-1/4 inch floppy disks.

Main Unit

The main unit of the PC contains the central processing unit (CPU), disk drive(s), and memory, among other things. All main units have some common features which include:

- **ON/OFF Switch** — This switch is used to switch the PC **ON** or **OFF**. Newer PCs have the switch located on the front. In older models, the switch is located on the back of the PC, near where the AC power cord plugs in to the PC.
- **Serial Port** — A port which the PC uses to communicate with the customer equipment. When using the PC to install a new generic program, either COM1 or COM2 port must be used. Some PCs have both COM ports. Refer to your PC documentation to determine which port is being used. There are two types of serial port connectors:
 - 25-pin RS-232 connector (male)
 - 9-pin connector (male).

If your PC has the 9-pin connector, you will need a serial port adapter which converts the 9-pin connector to a 25-pin connector. This is a cable which has a 9-pin connector on one end and a 25-pin male connector on the other end.

- **Parallel Port** — This port is used to connect to some printers.

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- Disk Drives — PCs come in several basic types, such as:
 - Single floppy disk, no hard disk — This type PC is the most basic configuration. The PC has a single floppy disk drive, with no hard (fixed) disk. The floppy drive is referred to as drive **A:**.
 - Dual floppy disk, no hard disk — This type PC is identified by the two floppy disk drives installed. One floppy drive is referred to as drive **A:**. The second is referred to as drive **B:**.
 - Single floppy disk with hard disk — This type PC has a single floppy disk drive and a hard disk, which can typically store 10 or more megabytes of data. The single floppy disk drive is referred to as drive **A:**, and the hard disk is usually referred to as drive **C:**.

Other combinations of floppy and hard drives are possible, but all that is required is a single floppy drive as a minimum. The procedures in this manual for installing a new generic program indicate using drive **A**.

Monitor

The monitor, sometimes called a display screen, may be either monochrome or color. The higher the resolution, the better the monitor.

Keyboard

The keyboard is used to enter commands. This section reviews some of the features of the keyboard and points out some of the special keys.

The keyboard is divided into three different sections:

- *Typewriter section* — This area has the alphanumeric keys that resemble the layout of a typewriter. In particular, you should locate the **ENTER** key (sometimes referred to as **RETURN**). This key is located on the right side of the typewriter section. It may have the word **ENTER** or **RETURN** printed on the key or a bent arrow. When you are asked to select **<ENTER>**, you should momentarily depress that key, or equivalent.
- *Function Keys* — The keyboard normally has 10 or 12 function keys. These keys can be set up (programmed) to perform different functions. Refer to your PC documentation to determine how to setup these keys.
- *Special Keys* — The keyboard has many special keys which are interpreted differently by various software packages. Locate the **CANCEL** or **DELETE** key.

Rebooting the PC

Occasionally, you may have to reboot the PC. There are three ways to accomplish this:

- Power **ON/OFF** switch ####V-EM-V#### If the PC is **OFF**, you should set the **ON/OFF** switch to the **ON** position. If the PC is already **ON**, it is preferable to reset it using one of the following two methods:
- **RESET** button ####V-EM-V#### Not all PCs have a **RESET** button, but if yours does, it provides an easy way to reset the PC (also known as a hard reset). Alternatively, the following method may work.
- Hold down the **CTRL**, **ALT**, and **DELETE** keys all at the same time (also known as a soft reset).

If **RESET** or **CTRL**, **ALT**, and **DEL** keys are not effective, turn **OFF** the PC, wait a few seconds, and turn it back **ON**. Rebooting the PC clears all data you had in random access memory. If the time of day clock is not indicating the current time and date, set the time of day clock.

Diskettes — Care and Handling

Diskettes are sometimes called floppy disks, or floppies for short. Diskettes are similar to cassette tapes—magnetically encoded information is stored on the diskette for later retrieval. By adhering to the following guidelines you will increase the useful life of your diskettes:

DO:

- Keep the diskette in a protective envelope when not in use.
- Keep the diskette in a dry place.
- Keep the diskettes away from magnetic fields or objects (for example, magnetic screwdriver.)

DO NOT:

- Touch any of the exposed surfaces of the diskette itself; handle it by the edge of the jacket. Very tiny scratches, fingerprints, or dust can ruin a diskette.
- Bend a diskette.
- Write on a diskette label with a ball point pen or pencil. Use a felt-tipped pen instead. Write the label before applying it to the diskette if possible.
- Erase the diskette label with a pencil eraser. The dust may destroy the diskette. Instead, place a new label over the old one.

Inserting Diskettes

You should never remove or insert a diskette while the disk drive indicator light is on. (The computer turns the indicator light on to let you know that it is reading or writing from the disk.) Always wait for the indicator light to go off before opening the disk drive door. Failure to do this may result in damaging the diskette or loss of data on the diskette. Insert a diskette into a disk drive as follows:

1. Open the diskette drive door.
2. Gently insert the diskette with the label facing up and the notch to the left, if provided.



CAUTION:

Do not attempt to force the diskette into the drive.

3. Slide the diskette in as far as it will go, but do not force it. You may hear a click when the diskette is all the way in.

If resistance is felt or it does not slide in easily, remove the diskette and insert it again.

4. Close (latch) the disk drive door.

When you are instructed to insert a diskette into a drive, it is implied that you should open the door, slide the diskette in all the way, and close (latch) the door.

Removing Diskettes

Wait for the indicator light on the disk drive to go off. Open the disk drive door. The diskette may pop out for easy removal. (Opening up a disk drive door is similar to ejecting a cassette from a cassette recorder.) After the diskette has been removed, place it into its protective envelope or storage facility.

Test Miscellaneous Discrete Telemetry

Overview: This procedure tests the user settable miscellaneous discrete environmental (input) points and control (output) points.

1. Contact the remote operations center and request their help to observe the environmental points and to activate the control points during this test.
2. At the remote operations center, disable, if desired, the alarm threshold level for the points being tested.



NOTE:

When an external device connected to the FT-2000 network element causes a contact closure to appear as an environmental input to the network element, a corresponding environmental point is activated at the remote operations center.

3. Operate the first external device connected to the FT-2000 network element in such a way as to cause a closed contact to appear at the network element environmental input.
4. Was the corresponding environmental point activated at the remote operations center?
If **YES**, then continue with Step 5.
If **NO**, then report the trouble to the installation personnel.
5. Operate the first external device connected to the FT-2000 network element in such a way as to cause an open contact to appear at the network element environmental input.
6. Was the corresponding environmental point deactivated at the remote operations center?
If **YES**, then continue with Step 7.
If **NO**, then report the trouble to the installation personnel.
7. Repeat Steps 3 through 6 for any remaining environmental points to be tested.



NOTE:

When a control point is activated at the remote operations center, it results in a contact closure at the corresponding control output of the FT-2000 network element which, in turn, can operate an external device connected to the network element.

8. Ask the personnel at the remote operations center to activate the first control point being tested.
9. Was the corresponding external device connected to the network element operated correctly? (For example, was it turned on?)
 - If **YES**, then continue with Step 10.
 - If **NO**, then report the trouble to the installation personnel.
10. Ask the personnel at the remote operations center to deactivate the first control point being tested.
11. Was the corresponding external device connected to the network element operated correctly? (For example, was it shut off?)
 - If **YES**, then continue with Step 12.
 - If **NO**, then report the trouble to the installation personnel.
12. Repeat Steps 8 through 11 for any remaining control points to be tested.
13. At the remote operations center, enable the alarm threshold level for the points being tested, if disabled in Step 2.
14. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Provision STS-1 Path Trace

Overview: This procedure is used to provision the transmit and receive path trace fields of one or more 1 way STS-1 signals. Path trace is only applicable to a DS3 circuit pack because it is an STS-1 terminating device, whereas an STS-1E circuit pack is not an STS-1 terminating device. This procedure can be performed from any network element in an FT-2000 network.

1. If required, condition the craft interface terminal (CIT) and connect it to the local FT-2000 network element.

Reference: **DLP-501**

2. From office records, determine which FT-2000 network elements are the source network element and the destination network element for the STS-1 path(s) to be provisioned.
3. From office records, determine the path trace character string for each STS-1 path to be provisioned (path is between the source and destination network elements).
4. Establish a login to the **source** network element for the first 1 way STS-1 path to be provisioned. (To establish a remote login, refer to **DLP-524**.)



NOTE:

The path trace string may be up to 64-characters long. The transmit and receive strings should be different. Additional information is in Section 8, "Administration and Provisioning" or by pressing ? (help).

5. At the CIT, select **CONFIGURATION-Set-Path-Trace** command to set the transmit path trace (Xmit Path Trace) for all STS-1 paths to be provisioned that originate at this network element. (For example, the Xmit Path Trace could be "transmitting from node 3 at Boston.")
6. Repeat Step 5 for any additional STS-1 paths to be provisioned.
7. Discontinue the login at the source network element. (To discontinue a remote login, refer to **DLP-524**.)
8. Establish a login to the **destination** network element for the first STS-1 path to be provisioned. (To establish a remote login, refer to **DLP-524**.)



NOTE:

The path trace string may be up to 64-characters long. Additional information is in Section 8, "Administration and Provisioning" or by pressing ? (help).

9. At the CIT, select **CONFIGURATION-Set-Path-Trace** command to set the expected Rcv Path Trace for all STS-1 paths to be provisioned that terminate at this network element. (To continue with the same example as in Step 5, the Rcv Path Trace must be "transmitting from node 3 at Boston.")
10. Repeat Step 9 for any additional STS-1 paths to be provisioned.
11. Discontinue the login at the destination network element. (To discontinue a remote login, refer to **DLP-524**.)
12. Verify the provisioning just done by using the **CONFIGURATION-Retrieve-Path-Trace** command.
Reference: **DLP-532**
13. This step is optional. If you desire to clear the path trace fields (fields set to all nulls), enter spaces (nothing else) in place of the characters in the **PrvTx** and the **PrvRx** fields.
14. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Verify STS-1 Path Trace

Overview: This procedure is used to verify the provisioned values of the transmit and receive path trace fields for one or more 1 way STS-1 signals of a DS3 circuit pack. It is also used to verify that the actual receive path trace agrees with the provisioned receive path trace. This procedure can be performed from any network element in an FT-2000 network. For non-DS3 signals, a monitoring arrangement is described in **DLP-543**.

1. If required, condition the craft interface terminal (CIT) and connect it to the local FT-2000 network element.

Reference: **DLP-501**

2. Do you wish to verify the provisioned values of the transmit and receive path trace fields for one or more STS-1 signals?

If **YES**, then continue with Step 3.

If **NO**, then continue with Step 17.

Verify Provisioned Values

3. From office records, determine which FT-2000 network elements are the source network element and the destination network element for the STS-1 path(s) to be verified.
4. From office records, determine the path trace character string to be observed for each 1 way STS-1 path to be verified. (Path is between the source and destination network elements.)
5. Establish a login to the **source network element** for the first STS-1 path to be verified. (To establish a remote login, refer to **DLP-524**.)
6. At the CIT, select **CONFIGURATION-Retrieve-Path-Trace** command and execute to obtain a Path Trace Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual. This report shows the STS-1 path(s) that originates at this network element.
7. Compare the provisioned transmit (PrvTx) character string(s) in the Path Trace Report with the values determined from office records (Step 4) and make a note of any differences. (To continue with the same example as in DLP-531,

- the PrvRx and the PrvTx strings should match with "transmitting from node 3 at Boston.")
8. If required to correct any discrepancies, use the **CONFIGURATION-Set-Path-Trace** command.
Reference: **DLP-531**
 9. Repeat Steps 6 through 8 for any additional STS-1 paths to be verified.
 10. Discontinue the login at the source network element. (To discontinue a remote login, refer to **DLP-524**.)
 11. Establish a login to the **destination network element** for the first STS-1 path to be verified. (To establish a remote login, refer to **DLP-524**.)
 12. At the CIT, select **CONFIGURATION-Retrieve-Path-Trace** command and execute to obtain a Path Trace Report. Section 11 shows example of report. This report shows the STS-1 paths that originate or terminate at this network element.
-  **NOTE:**
A path trace mismatch will not cause an alarm or status condition. A mismatch could be caused by missing cross-connections.
13. Compare the provisioned receive (PrvRx) character string(s) in the Path Trace Report with the values determined from office records (Step 4) and make a note of any differences. (To continue with the same example as in DLP-531, the PrvRx and the PrvTx strings should match with "transmitting from node 3 at Boston.")
 14. If required to correct any discrepancies, use the **CONFIGURATION-Set-Path-Trace** command.
Reference: **DLP-531**
 15. Repeat Steps 12 through 14 for any additional STS-1 paths to be verified.
 16. Discontinue the login at the destination network element. (To discontinue a remote login, refer to **DLP-524**.)

Verify Actual Receive Path Trace

17. Do you wish to verify that the actual receive path trace agrees with the provisioned receive path trace for one or more STS-1 signals?

If **YES**, then continue with Step 18.

If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

18. From office records, determine which FT-2000 network element is the destination network element for the STS-1 path(s) to be verified.
19. Establish a login to the destination network element for the first STS-1 path to be verified. (To establish a remote login, refer to **DLP-524.**)
20. At the CIT, select **CONFIGURATION-Retrieve-Path-Trace** command and execute to obtain a Path Trace Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual. This report shows the STS-1 path(s) that originates or terminates at this network element.



NOTE:

The Status field in the report for each STS-1 path to be verified will show one of the following values:

good means the actual receive path trace is the same as the provisioned Rcv Path Trace.

MISMATCH means that the actual receive path trace is different from the provisioned Rcv Path Trace and is only detectable by using the **CONFIGURATION-Retrieve-Path Trace** command.

NOT APPLICABLE means that the addressed slot is not provisioned for DS3 operation.

UNAVAILABLE means that an incoming signal failure, a hardware failure, or a missing cross-connection is preventing the observation of the actual receive path trace.

21. Does the Status field for each STS-1 path to be verified show the value "good"?

If **YES**, then continue with Step 25.

If **NO**, then continue with Step 22.

22. Make a note of the value in the Status field for each STS-1 path with a Status other than "good". Also, record the actual receive path trace (ActRx) and the provisioned receive path trace (PrvRx) for each STS-1 path showing a Status of "MISMATCH."



NOTE:

At this time you must determine from office records whether the mismatch is due to an incorrect actual receive path trace or to an incorrect provisioned receive path trace.

23. Is the incorrect path trace the actual receive path trace or the provisioned receive path trace?

If **provisioned receive path trace**, then continue with Step 24.

If **actual receive path trace**, then continue with Step 26.

24. Provision the correct provisioned receive path trace using the **CONFIGURATION-Set-Path-Trace** command or be sure cross-connections are correct in the network.

Reference: **DLP-531**

25. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



NOTE:

There is a remote possibility that the actual receive path trace is NOT the same as the provisioned transmit path trace at the source of the DS3 path.

26. Determine via a remote login, or by contacting the personnel at the source of the DS3 path, if the actual receive path trace you are seeing is the **same** as the provisioned transmit path trace at the source of the DS3 path?

If **the same**, then continue with Step 27.

If **different**, then continue with Step 29.

27. At the source of the DS3 path, provision the correct provisioned transmit path trace using the **CONFIGURATION-Set-Path-Trace** command or be sure cross-connections are correct in the network.

Reference: **DLP-531**

28. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

29. What software release is running at the source of the DS3 path?

If **Release 4.0 or earlier**, then continue with Step 30.

If **Release 4.1 or later**, then continue with Step 34.



CAUTION:

Service interruption may occur if the protections DS3 circuit pack is not ready.

30. At the source of the DS3 path, unseat, and then reseal, the DS3 circuit pack that terminates the path.
31. Is the path trace mismatch still observed at the original network element?
If **YES**, then continue with Step 32.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
32. Consult the appropriate maintenance support organization for further technical assistance.
33. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
34. At the source of the DS3 path, use the CIT's **CONFIGURATION-Switch-Low Speed** command to make and then reset a low-speed protection switch of the DS3 circuit pack that terminates the DS3 path.
35. Is the path trace mismatch still observed at the original network element?
If **YES**, then continue with Step 36.
If **NO**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
36. Consult the appropriate maintenance support organization for further technical assistance.
37. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Install/Remove Apparatus (Circuit Pack) Blank



CAUTION:

A prolonged and significant disruption in the flow of ventilation air within the D-Bay can result in the buildup of excessive heat. Therefore, if it becomes necessary to remove one of the front covers or open one of the sliding doors, care should be exercised to limit this time and quickly close the opening.

1. Is an apparatus blank to be installed or removed?

If the blank is to be **installed**, then continue with Step 2.

If the blank is to be **removed**, then continue with Step 7.

2. Position the apparatus blank vertically with its white painted surface towards you and its two extended protrusions away from you and on the right side.
3. Insert the apparatus blank bottom extended protrusion into the bottom of the circuit pack slot and snap its spring-clip notch over the bottom shelf cross-support channel.
4. Carefully bend the apparatus blank so that it is slightly bowed towards you in the middle, insert its top protrusion into the top of the circuit pack slot, and snap its spring-clip notch over the top shelf cross-support channel.
5. Push the center of the apparatus blank inwards to fully seat it and to eliminate any residual bowing.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
7. Is there a vacant slot adjacent to the apparatus blank to be removed?

If **YES**, then continue with Step 8.

If **NO**, then continue with Step 12.

8. Carefully bend the apparatus blank so that it is slightly bowed towards you in the middle, unsnap its spring-clip notch from the top shelf cross-support channel, and remove its top protrusion from the top of the circuit pack slot.

9. Unsnap the apparatus blank spring-clip notch from the bottom shelf cross-support channel and remove its bottom extended protrusion from the bottom of the circuit pack slot.
10. Lift the apparatus blank from the slot.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
12. Use a flat-bladed screwdriver against the bottom shelf cross-support channel to pry the apparatus blank bottom edge upward and forward.
13. Lift the apparatus blank from the slot.
14. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Verify That Low-Speed Ports Are Not NMON

Overview: This procedure is used to verify that one or more low speed ports are not in the NMON state and to set them to the AUTO state, if necessary.

1. At the CIT, select **FAULT-Retrieve-State** to obtain a State Report for the **LS INTFC** slot(s) associated with the electrical low-speed ports to be verified.
2. Referring to the Port State column for the **LS INTFC** slot(s) associated with the electrical and optical low-speed ports to be verified, are any of the ports in the NMON state as indicated by the letter "n"?

If **YES**, then continue with Step 3.

If **NO**, then continue with Step 5.

3. At the CIT, select **CONFIGURATION-Set-State-T3** (for DS3 ports) or **CONFIGURATION-Set-State-EC1** (for EC1 ports) or **CONFIGURATION-Set-State-OC3** or **CONFIGURATION-Set-State-OC12** with a Primary State of AUTO for the ports identified in Step 2.



NOTE:

Some of the ports just CIT provisioned to the AUTO state may have been immediately auto-provisioned to the IS state.

4. You can use the **FAULT-Retrieve-State** command again (for the State Report) to verify that none of the affected low-speed ports are in the NMON state. All of the affected ports should be shown with an "a" (indicating the AUTO state) or an "i" (indicating the IS state).
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Identify Source of Incoming Signal

Overview: You were sent to this procedure to identify the signal source associated with an incoming signal condition so that you can issue a Trouble Report to the personnel at that location.

1. Find the condition to be reported in the table below and continue with the indicated step.

For This Condition	Go To
incoming DCC failure	Step 2
inc. (from DS1) sync ref fail	Step 4
inc (from OC48) path RFI/yellow	Step 12
inc (from OC-48) sync ref fail	Step 2
inc (from STSX) line RFI/yellow	Step 12
incoming (from DSX) DS3 LOS	Step 12
incoming (from DSX) DS3 SD	Step 12
incoming (from OC-3) STS LOP	Step 16
incoming (from OC-12) STS LOP	Step 16
incoming (from OC-48) DS3 AIS	Step 12
incoming (from OC-48) DS3 LOF	Step 10
incoming (from OC-48) path AIS	Step 14
incoming (from OC-48) STS LOP	Step 10
incoming (from STSX) EC1 LOF	Step 12
incoming (from STSX) EC1 LOP	Step 12
incoming (from STSX) EC1 LOS	Step 12
incoming (from STSX) EC1 SD	Step 12
incoming (from STSX) line AIS	Step 12
incoming OC-3 AIS	Step 18
incoming OC-12 AIS	Step 18
incoming OC-48 AIS	Step 8
incoming OC-3 APS byte fail	Step 18

For This Condition	Go To
incoming OC-12 APS byte fail	Step 18
incoming OC-48 APS byte fail	Step 2
incoming OC48 B1 parity error	Step 6
incoming OC-48 invalid F byte	Step 8
incoming OC-3 line RFI/yellow	Step 6
incoming OC-12 line RFI/yellow	Step 6
incoming OC-48 line RFI/yellow	Step 6
incoming OC-3 LOF	Step 6
incoming OC-12 LOF	Step 6
incoming OC-48 LOF	Step 6
incoming OC-3 LOS	Step 6
incoming OC-12 LOS	Step 6
incoming OC-48 LOS	Step 6
incoming OC-48 LOS/LOF	Step 6
incoming OC-3 SD	Step 6
incoming OC-12 SD	Step 6
incoming OC-48 SD	Step 6
incoming OC-3 SF	Step 6
incoming OC-12 SF	Step 6
incoming OC-48 SF	Step 6
incoming sync ref failure	Step 4
incoming OC-48 LOS	Step 6
incoming OC-48 LOS/LOF	Step 6
incoming OC-3 SD	Step 6
incoming OC-12 SD	Step 6
incoming OC-48 SD	Step 6
incoming OC-3 SF	Step 6
incoming OC-12 SF	Step 6
incoming OC-48 SF	Step 6
incoming sync ref failure	Step 4

2.

⇒ **NOTE:**
The source of the incoming signal condition is the next ring node in the direction of the incoming signal (or the other end terminal if this is a point-to-point network).

From office records, determine the location of the next ring node and send a Trouble Report to the personnel responsible for maintaining that site.

3. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

4.

⇒ **NOTE:**
The source of the incoming signal condition is the external synchronization reference source.

From office records, determine the location of the synchronization reference source and send a Trouble Report to the personnel responsible for maintaining that site.

5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

6.

⇒ **NOTE:**
The source of the incoming signal condition is the next network element in the direction of the incoming signal.

From office records, determine the location of the next network element and send a Trouble Report to the personnel responsible for maintaining that site.

7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

8.

⇒ **NOTE:**
The source of the incoming signal condition is the next Regenerator Bay/Shelf in the direction of the incoming signal.

From office records, determine the location of the next Regenerator Bay/Shelf and send a Trouble Report to the personnel responsible for maintaining that site.

9. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

10.



NOTE:

The source of the incoming signal condition is the location where the DS3 signal enters the FT-2000 NE. This is either a DS3 circuit pack in an FT-2000 NE or a non-FT-2000 NE external to the FT-2000 network.



NOTE:

Another possible cause of the incoming signal condition is that the signal originates at a non-DS3 circuit pack in an FT-2000 NE at the source location.

From office records, determine the location where the DS3 signal enters (or is supposed to enter) the FT-2000 NE and send a Trouble Report to the personnel responsible for maintaining that site.

11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

12.



NOTE:

The source of the incoming signal condition is the location where the DS3 or EC1 signal enters the FT-2000 NE. For a DS3 signal, this is either a DS3 circuit pack in an FT-2000 NE or a non-FT-2000 NE external to the FT-2000 network.

From office records, determine the location where the DS3 or EC1 signal enters the FT-2000 NE and send a Trouble Report to the personnel responsible for maintaining that site.

13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

14.



NOTE:

Path AIS can be inserted into the OC-48 signal at any of a number of locations. The best approach is to clear all other reported conditions at all other FT-2000 network elements in the network. In all likelihood that will also clear the incoming (from OC-48) path AIS condition.

If there are no other active conditions at any other network elements in the SDH network, then refer the trouble to the next level of technical support.

15. STOP! YOU HAVE COMPLETED THIS PROCEDURE.

16.



NOTE:

The source of the incoming signal condition is the location where the OC-3/OC-12 signal enters the FT-2000 NE.

From office records, determine the location where the OC-3/OC-12 signal enters the FT-2000 NE and send a Trouble Report to the personnel responsible for maintaining that site.

17. STOP! YOU HAVE COMPLETED THIS PROCEDURE.

18.



NOTE:

The source of the incoming signal condition is the next network element in the direction of the incoming signal.

From office records, determine the location of the next network element and send a Trouble Report to the personnel responsible for maintaining that site.

19. STOP! YOU HAVE COMPLETED THIS PROCEDURE.

Enter/Delete/Edit STS-3 (or STS-1) Cross-Connections at Network Elements for 2-Fiber Ring Network

Overview: This procedure for the FT-2000 2-fiber ring network can be performed on an **in-service** or **out-of-service** basis. Cross-connections are made at one network element or node in the ring. Then, a remote login may be established to the other nodes in the ring to make cross connections for a complete circuit.



CAUTION:

Cross-connections made to the wrong points can cause service interruptions. Care must be exercised to closely follow the "Cross-Connect Rules" — which are specified in section 8.



CAUTION:

STS-1 traffic may be interrupted if making STS-3 cross-connections for the same slot.



NOTE:

A DS3 (LAA2) or STS1E (LAA4) circuit pack has three ports. For STS-3 cross-connections, all three ports associated with the slot will be affected by a slot-to-tributary or a tributary-to-slot cross-connection. This is also true for an OC3 (LAA10) circuit pack which has three STS1s. An OC12 (T939A) circuit pack has 12 ports which are arranged as four groups of three ports each. For STS-1 cross-connections, each of the 12 ports can be cross-connected to any tributary. For STS-12c cross-connections, all 12 ports must be cross-connected to four consecutive slots.



NOTE:

A 1-way cross-connection means that the connection is made in **either** the transmit or the receive direction. A 2-way cross-connection means that the connection is made in **both** the transmit and receive directions.



NOTE:

This procedure requires that an LNCTL circuit pack be installed and operating (not removed or failed).

1. Obtain the instructions (work order) that contain the cross-connect information. Form 1 (at the end of this procedure) may be used to track the cross-connections.
2. If required, connect the craft interface terminal (CIT) to the local FT-2000 network element and condition it.

Reference: **DLP-501**

3. At the CIT (local network element), select **CONFIGURATION-Retrieve-Crossconnection-All** and execute to obtain a Cross-Connection Map Report. Examples of a Cross-Connection Map Report with a description of the output parameters are provided in Section 11 of this manual.



CAUTION:

Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.



NOTE:

To edit a cross-connection simply means to change the Source Node TID and/or Destination Node TID associated with an existing cross-connection. This is done by re-entering the same cross-connection right on top of the existing one but with the new TID(s). The source node TID is the TID of the node where the signal is added, whereas, the destination node TID is the TID of the node where the signal is dropped. See Examples 1 and 2.

4. Compare the report with the instructions (work order). Are any cross-connections to be added, edited, and/or deleted at the local network element?

If **YES**, then continue with Step 5.

If **NO**, then continue with Step 14.



NOTE:

Assistance in selecting the appropriate parameters for the **CONFIGURATION-Delete-Crossconnection-STS3 (or STS1)** command is provided by the **F1** help key function.



NOTE:

Descriptive information and examples on cross-connections are given in Section 8, "Administration and Provisioning."

5. Determine from the instructions (work order) if any existing cross-connections are to be deleted and delete only those cross-connections. If you have any doubt about the instruction, please verify with your supervisor. Use the **CON-**

FIGURATION-Delete-Crossconnection-STS3 (or STS1) command to delete a cross-connection.

⇒ **NOTE:**
If the cross-connection just deleted were to all ports of an OC-3/OC-12 circuit pack, they may have had DCC assignments that should also be deleted now.

6. You may delete a DCC assignment on an OC-3/OC-12 line.

Reference: **DLP-542**

7. At the CIT (local network element), select **CONFIGURATION-Retrieve-Crossconnection-All** and execute to obtain a Cross-Connection Map Report (examples are shown in Section 11).

⚠ **CAUTION:**
Incorrectly provisioned source node TID and/or destination node TID can result in a service outage under certain multiple failure conditions.

⇒ **NOTE:**
Assistance in selecting the appropriate parameters for the **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command is provided by the **F1** help key function.

⇒ **NOTE:**
If a tributary-to-slot (drop) cross-connection is made for a DS3 circuit pack, a **DS3 path unequipped** condition may exist until all cross-connections for the entire circuit have been made and if one of the low-speed ports is in the IS state.

⇒ **NOTE:**
A drop cross-connection is always looking for its source. If it does not find a source, a **path integrity failure** condition is generated at the node that has the drop. This condition will remain until the entire path in the ring is cross-connected.

8. Compare the report with the instructions. Add and/or edit the cross-connections per the instructions. This can be a slot-to-tributary, tributary-to-slot, or a tributary-to-tributary cross-connection. Use the **CONFIGURATION-Enter-Crossconnection-STS3 (or STS1)** command to add a cross-connection. The source node TID is the TID of the node where the signal is added, whereas, the destination node TID is the TID of the node where the signal is dropped. See Examples 1 and 2.

⇒ **NOTE:**
If the cross-connection just made was to a port(s) of an OC-3/OC-12 circuit pack, you may want to provision a DCC assignment to establish DCC connectivity with the network element at the other end of the OC-3/OC-12 line.

9. You may enter a DCC assignment on an OC-3/OC-12 line.

Reference: **DLP-542**

10. At the CIT (local network element), select **CONFIGURATION-Retrieve-Crossconnection-All** and execute to obtain a Cross-Connection Map Report (examples are shown in Section 11).
11. Verify that the cross-connections in the report match the instructions.
12. Steps 12 through 16 are used to verify that the source and destination node TID provisioning has been done correctly.

Wait 2 minutes and verify that a **site provisioning conflict** IS NOT reported at either of the two end NEs or any of the intermediate NE(s). It will be necessary to individually check each NE, that is involved in the crossconnection. At the CIT, use the **FAULT-Retrieve-Alarms** command.

⇒ **NOTE:**
Every possible combination of DRI manual switches in the path being established should be checked. See Example 2 where a DRI manual switch at node B would result in a new path coming from node C.

13. Make the first possible DRI manual switch in the path by using the **FAULT-Switch-Path** command.
14. Wait 2 minutes and verify that a **site provisioning conflict** IS NOT reported at either of the two end NEs or any of the intermediate NE(s). It will be necessary to individually check each NE, that is involved in the crossconnection. At the CIT, use the **FAULT-Retrieve-Alarms** command.
15. Repeat Steps 12 through 14 for each different remaining path.
16. Reset all DRI manual switches using the **FAULT-Switch-Path:Reset** command.

17. Do you have instructions pertaining to cross-connections at other network elements?

If **YES**, then continue with Step 18.

If **NO**, then continue with Step 22.

18. Establish a remote login to one of the other network elements in the FT-2000 ring network.

Reference: **DLP-524**

19. Repeat Steps 3 through 22 for the appropriate cross-connections. Do not forget that the remote node has now become the local node.

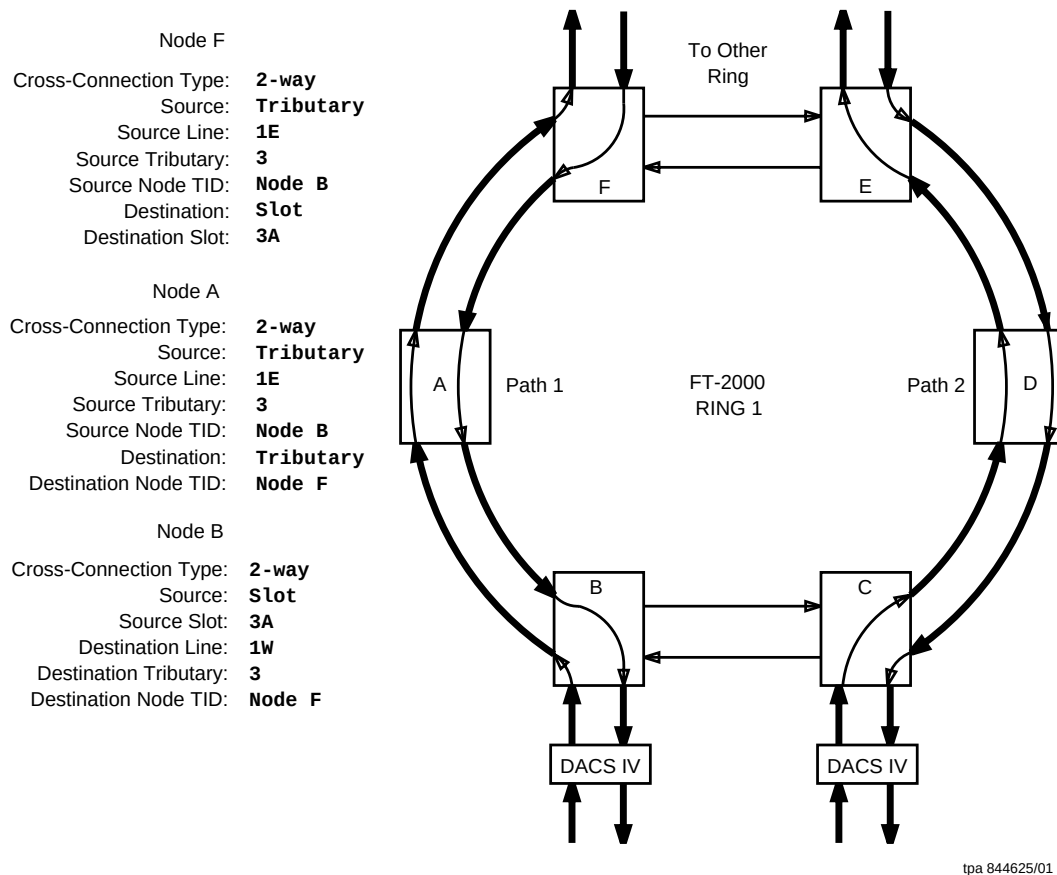
20. Discontinue the remote login.

Reference: **DLP-524**

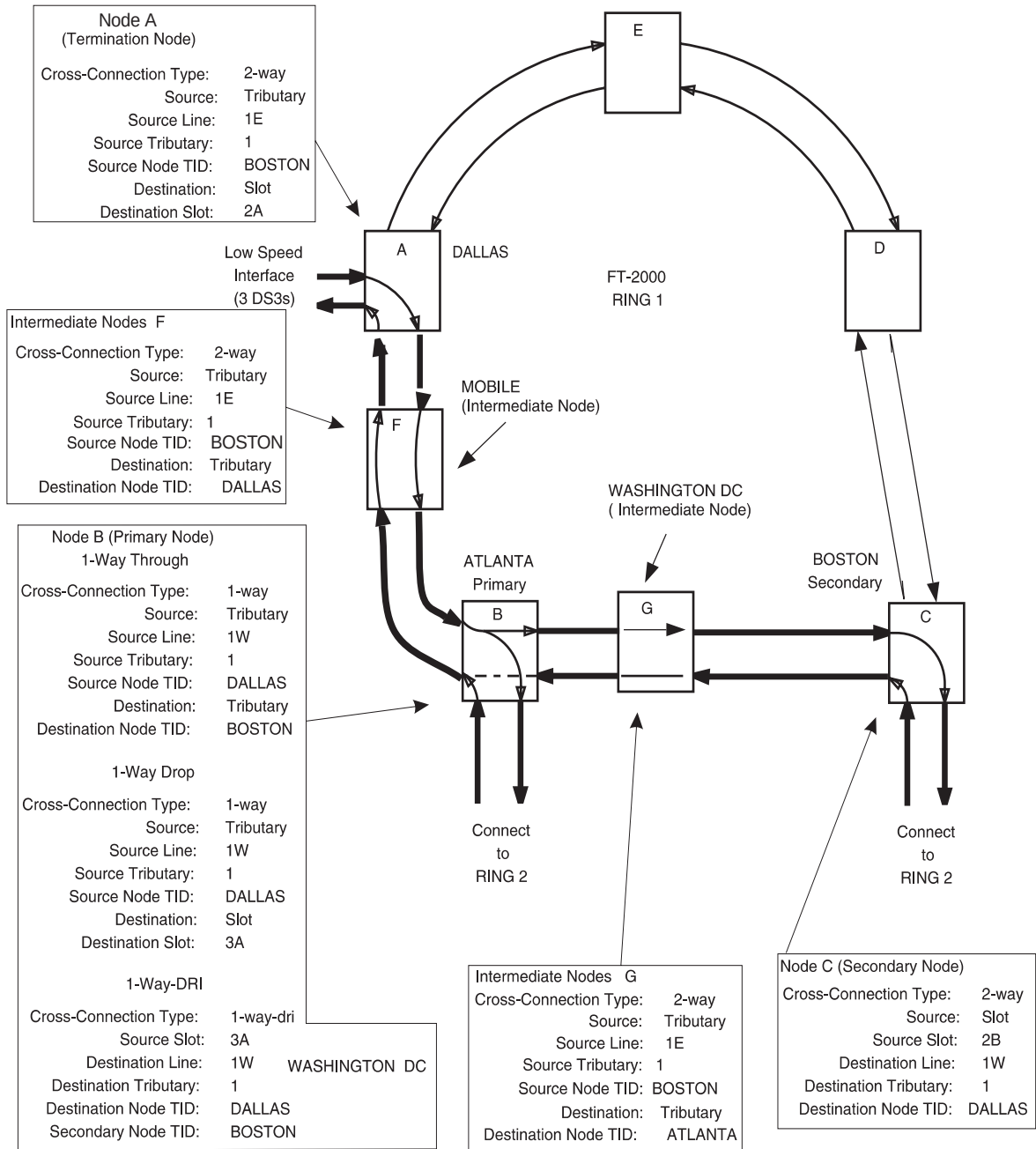
21. Repeat Steps 18 through 20 for each of the remaining network elements in the ring network that requires cross-connections per the instructions.

22. All cross-connections have been made and the FT-2000 ring network is now ready for traffic and/or testing.

23. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



Example 1 - Cross-Connections (Dual Wire Center)



Dri-cross-conn

Example 2 - Cross-Connections (DRI Ring)

	W	E		W	E		W	E		W	E		W	E
1	1 2 3	1 2 3	1	1 2 3	1 2 3	1	1 2 3	1 2 3	1	1 2 3	1 2 3	1	1 2 3	1 2 3
2	1 2 3	1 2 3	2	1 2 3	1 2 3	2	1 2 3	1 2 3	2	1 2 3	1 2 3	2	1 2 3	1 2 3
3	1 2 3	1 2 3	3	1 2 3	1 2 3	3	1 2 3	1 2 3	3	1 2 3	1 2 3	3	1 2 3	1 2 3
4	1 2 3	1 2 3	4	1 2 3	1 2 3	4	1 2 3	1 2 3	4	1 2 3	1 2 3	4	1 2 3	1 2 3
5	1 2 3	1 2 3	5	1 2 3	1 2 3	5	1 2 3	1 2 3	5	1 2 3	1 2 3	5	1 2 3	1 2 3
6	1 2 3	1 2 3	6	1 2 3	1 2 3	6	1 2 3	1 2 3	6	1 2 3	1 2 3	6	1 2 3	1 2 3
7	1 2 3	1 2 3	7	1 2 3	1 2 3	7	1 2 3	1 2 3	7	1 2 3	1 2 3	7	1 2 3	1 2 3
8	1 2 3	1 2 3	8	1 2 3	1 2 3	8	1 2 3	1 2 3	8	1 2 3	1 2 3	8	1 2 3	1 2 3
9	1 2 3	1 2 3	9	1 2 3	1 2 3	9	1 2 3	1 2 3	9	1 2 3	1 2 3	9	1 2 3	1 2 3
10	1 2 3	1 2 3	10	1 2 3	1 2 3	10	1 2 3	1 2 3	10	1 2 3	1 2 3	10	1 2 3	1 2 3
11	1 2 3	1 2 3	11	1 2 3	1 2 3	11	1 2 3	1 2 3	11	1 2 3	1 2 3	11	1 2 3	1 2 3
12	1 2 3	1 2 3	12	1 2 3	1 2 3	12	1 2 3	1 2 3	12	1 2 3	1 2 3	12	1 2 3	1 2 3
13	1 2 3	1 2 3	13	1 2 3	1 2 3	13	1 2 3	1 2 3	13	1 2 3	1 2 3	13	1 2 3	1 2 3
14	1 2 3	1 2 3	14	1 2 3	1 2 3	14	1 2 3	1 2 3	14	1 2 3	1 2 3	14	1 2 3	1 2 3
15	1 2 3	1 2 3	15	1 2 3	1 2 3	15	1 2 3	1 2 3	15	1 2 3	1 2 3	15	1 2 3	1 2 3
16	1 2 3	1 2 3	16	1 2 3	1 2 3	16	1 2 3	1 2 3	16	1 2 3	1 2 3	16	1 2 3	1 2 3

Form 1 - Worksheet for Cross-Connections

Enter/Delete/Edit Limited Granularity STS-1 Cross-Connections and Network Elements for 2-Fiber Ring Network

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Loop Back OC-3 Line(s) for Testing



CAUTION:

Traffic and service interruption can occur to other OC3 lines if they are accidentally looped back. Recheck the address of the line(s) being looped back.



NOTE:

Loopback occurs at the OC3 slot in either the multiplex direction (towards the OC-48 line) or the demultiplex direction (towards the lightguide cross-connect panel). Simultaneous loopbacks in both directions are not possible.



NOTE:

All three STS-1 signals in an OC3 equipped slot must be cross-connected to a tributary for a valid loopback.

1. Obtain the operation instructions to loop back the OC3 line(s) for testing and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).

Reference: **DLP-501**



NOTE:

A loopback will remain in effect until deactivated by the **Release - Loopback - OC3** command.

3. At the CIT, select **FAULT - Operate - Loopback - OC3** for the first specified slot(s) and the direction (either **From OC48** or **From OC3**).
4. Repeat Step 3 for any remaining slot(s).
5. Verify the **ABN**, **NE ACTY**, **USE CIT**, and **PWR ON** LEDs are lighted at the user panel.
6. The slot(s) is now looped back in the direction specified in Step 3. If you wish to verify, select **Retrieve-Alarm** for an updated Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.

- 7. STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Release Looped Back OC-3 Line(s)



CAUTION:

Traffic and service interruption can occur to other OC3 lines if they are accidentally looped back. Recheck the address of the slot(s) being released from loopback.



NOTE:

Loopback occurred at the OC3 slot in either the multiplex direction (towards the OC-48 line) or the demultiplex direction (towards the lightguide cross-connect panel). Simultaneous loopbacks in both directions were not possible.

1. Obtain the operation instructions to release the looped back OC3 slot(s) and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).
Reference: **DLP-501**
3. At the CIT, select **FAULT - Release - Loopback - OC3** for the first specified slot and the direction (either **From OC48** or **From OC3**).
4. Repeat Step 3 for any remaining slot(s).
5. The slot(s) is released from the looped back condition. If you wish to verify, select **FAULT - Retrieve - Alarm** for an updated Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Provision OC3 Slot for 1-Way Drop Service

This procedure number is not used in FT-2000 Release 8.1 and later generics.

Test DRI Cross-Connections for Path Integrity in FT-2000 Ring

Overview: This procedure is used to test path integrity through the DRI cross-connections of an FT-2000 ring (Figures 1 and 2) using external test sets.

1. **Required Test Equipment:**

Craft Interface Terminal (CIT)

Wrist Strap

Microwave Logic's ST-112 SONETest Transmission Analyzer or equivalent



WARNING:

Unterminated optical connectors may emit invisible laser radiation. Eye damage may occur if beam is viewed directly or with improper optical instruments. Avoid direct exposure to beam.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 add/drop-rings terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**.*



NOTE:

Assistance is required at the source and destination test sets.



NOTE:

Path testing should be accomplished by using an end-to-end arrangement as shown in Figure 3. However, due to equipment availability, another possibility includes a loopback arrangement (Figure 4).

Referring to Figure 1 and Figure 2, which figure most closely represents your configuration?

If **Figure 1**, then continue with Step 2.

If **Figure 2**, then continue with Step 12.



NOTE:

The local FT-2000 ring has one DRI cross-connection to the outside. Both DRI cross-connections and local source/destination cross-connections terminate directly to test sets.

2. Verify that there are no alarm or status conditions in the ring.
3. At the transmit test set, insert a verifiable signal for each path being tested.
4. At the receive test set, verify the detection of the inserted signal on each path being tested.
5. To test path integrity for 2-way paths, repeat Steps 2 and 3 from the opposite end for each path.
6. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Manual** command for the appropriate line(s) and tributary(s).
7. Repeat Steps 2 through 4 for each path being tested through the secondary node S.
8. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Reset** command for the appropriate line(s) and tributary(s).
9. Verify that there are no alarm or status conditions in the ring.
10. This completes testing path integrity.
11. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

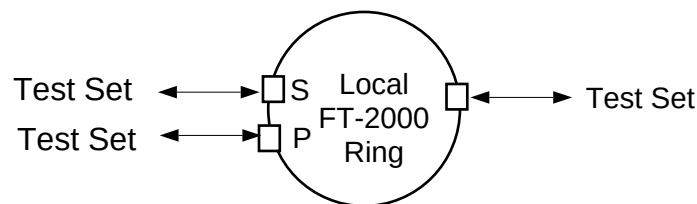


NOTE:

The local FT-2000 ring has two DRI cross-connections to the outside. Both DRI cross-connections terminate directly to test sets.

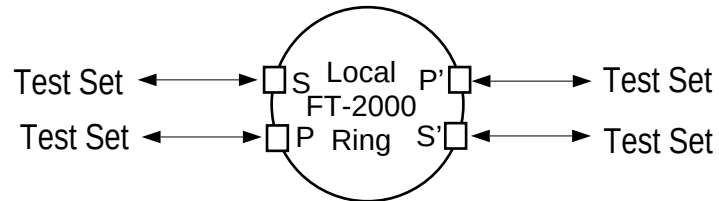
12. Verify that there are no alarm or status conditions in the ring (Figure 2).
13. At the transmit test set, insert a verifiable signal for each path being tested.
14. At the receive test set, verify the detection of the inserted signal on each path being tested.
15. To test path integrity for 2-way paths, repeat Steps 13 and 14 from the opposite end for each path.

16. At the FT-2000 primary node P, execute a manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Manual** command for the appropriate line(s) and tributary(s).
17. Repeat Steps 13 through 15 for each path being tested.
18. DO NOT RESET the DRI switch at node P at this time. At FT-2000 primary node P' (P prime), execute a manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Manual** command for the appropriate line(s) and tributary(s).
19. Repeat Steps 13 through 15 for each path being tested.
20. At the FT-2000 primary node P, reset the manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Reset** command for the appropriate line(s) and tributary(s).
21. Repeat Steps 13 through 15 for each path being tested.
22. At the FT-2000 primary node P', reset the manual DRI switch for each path being tested. Use the **FAULT-Switch-Path-STS3-Reset** command for the appropriate line(s) and tributary(s).
23. Verify that there are no alarm or status conditions in the ring.
24. This completes testing path integrity (Figure 2).



Note: One DRI cross-connection to the outside. Both DRI cross-connections and local source/destination cross-connections terminate directly to test sets.

Figure 1 – Testing Local FT-2000 Ring (Three Nodes)



Note: Two DRI cross-connections to the outside. Both DRI cross-connections terminate directly to test sets.

Figure 2 – Testing Local FT-2000 Ring (Four Nodes)

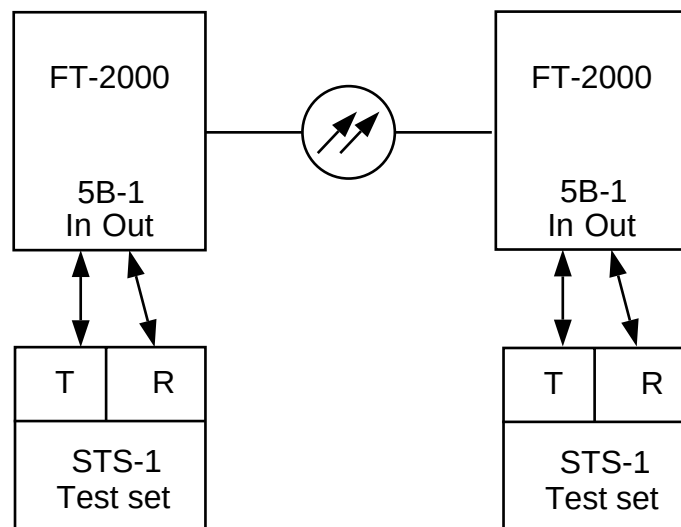


Figure 3 – End-to-End Test Arrangement (for Slot 5B)

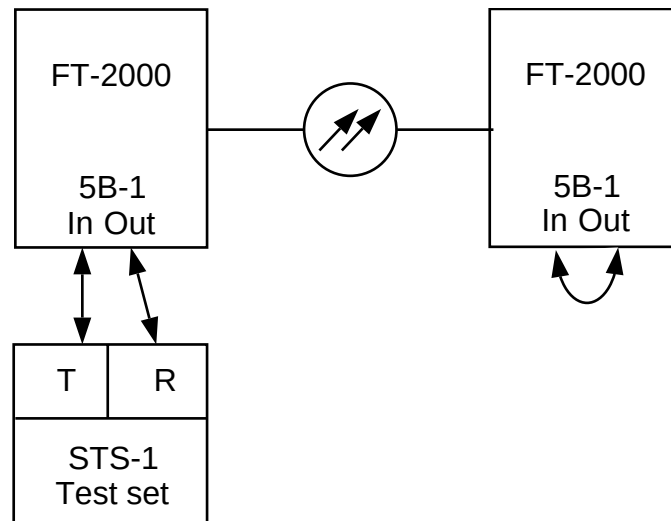


Figure 4 – Loopback Test Arrangement (for Slot 5B)

Enter/Delete DCC Assignment on OC-3/OC-12 Line

Overview: This procedure is used to enter, delete, or change the assignment of one of eight Data Communications Channels (DCC) to a particular LS INTFC slot or pair of slots. Also at this time, the orientation of the DCC may be provisioned to "User" or "Network".

1. Do you want to **enter, delete, or change** a DCC assignment?

If you want to **enter new DCC assignment**, then continue with Step 2.

If you want to **delete DCC assignment**, then continue with Step 7.

If you want to **change an existing DCC assignment/orientation**, then continue with Step 11.

Enter DCC Assignment

2. Determine from office records the DCC assignment (1-8) and the orientation (network/user).



NOTE:

A DCC assignment should not be made to an LS INTFC slot that does not already contain a good OC3/OC-12 circuit pack.

3. At the CIT, select **CONFIGURATION-Retrieve-Equipment** command to verify the slot contains an OC3/OC-12 circuit pack.



NOTE:

The orientation of the OC-3/OC-12 circuit pack is provisioned "network" at one end and "user" at the other end. Both ends of the OC-3/OC-12 line cannot be the same, and it makes no difference which end is "network."



NOTE:

If you are establishing DCC connectivity for the first time, you may have additional alarms. All alarms should clear after the DCC stabilizes, but if they do not, refer to the trouble clearing tab of this manual.

4. At the CIT, select **CONFIGURATION-Enter-Assignment-DCC** to make the DCC assignment and set the orientation.

5. This step is optional. At the CIT, select **CONFIGURATION-Retrieve-Assignment-DCC** command and verify the entries are correct.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Delete DCC Assignment

7. Determine from office records the DCC assignment (1-8) to be deleted.
8. At the CIT, select **CONFIGURATION-Delete-Assignment-DCC** to delete the DCC assignment.
9. This step is optional. At the CIT, select **CONFIGURATION-Retrieve-Assignment-DCC** command and verify the entry is correct.
10. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Change DCC Assignment/Orientation

11. Determine from office records the required orientation (network/user) of the existing DCC assignment.

⇒ **NOTE:**
The orientation of the OC-3/OC-12 circuit pack is provisioned "network" at one end and "user" at the other end. Both ends of the OC-3/OC-12 line cannot be the same, and it makes no difference which end is "network."

⇒ **NOTE:**
If you are establishing DCC connectivity for the first time, you may have additional alarms. All alarms should clear after the DCC stabilizes, but if they do not, refer to the trouble clearing tab of this manual.

12. At the CIT, select **CONFIGURATION-Enter-Assignment-DCC** to make the same DCC assignment but with a different orientation.
13. This step is optional. At the CIT, select **CONFIGURATION-Retrieve-Assignment-DCC** command and verify the entries are correct.
14. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

STS3 (or STS1) Path Trace Monitor for Non-DS3 Signals

Overview: This procedure is used to monitor non-DS3 signals at the destination node and at any intermediate node(s). [The path trace is a "tag" on a path in the network.] The non-DS3 signals could be an STS1, OC3, OC3c, OC12, OC12c, STS-12, STS-12c, or any other SONET signal. The monitor arrangement accesses the path trace byte (J1) of the SONET signal. The SONET signal is provisioned at its source (network element) and may be either inside an FT-2000 ring or outside an FT-2000 ring. This procedure can be performed from any network element in an FT-2000 network.

1. Do you wish to verify the path trace byte for a DS3 or non-DS3 signal?

If a **DS3 signal**, then go to **DLP-532**.

If a **non-DS3 signal**, then continue with Step 2.

2. If required, condition the craft interface terminal (CIT) and connect it to the local FT-2000 network element.

Reference: **DLP-501**

3. From office records or work instructions, determine the path(s) to be monitored.



NOTE:

A "tag" or path trace may be verified at one or at all of the intermediate network elements and/or at the destination network element.

4. Establish a login to the network element, if required, for the first path to be verified. (To establish a remote login, refer to **DLP-524**.)
5. From office records, identify a DS3 circuit pack that is ready for service BUT IS NOT carrying service (AUTO state). This slot (STS3) or port (STS1) and circuit pack will be used as an STS3 (or STS1) path trace monitor. To verify the slot or port state, you can use the **FAULT-Retrieve-State-LS** command.
6. At the CIT, select **CONFIGURATION-Enter-Crossconnection-STs3 (or STS1)** command and enter a drop cross-connection (tributary-to-slot). The drop must be from the incoming tributary of the 1-way circuit. Another DS3 cir-

cuit pack would be required if monitoring a 2-way circuit.

⇒ **NOTE:**
When monitoring an OC3 or three STS1 signals, the report shows the path trace status for all three ports of the DS3 circuit pack.

⇒ **NOTE:**
When monitoring an OC3c signal, the report shows the path trace status for only port 1 of the DS3 circuit pack.

⇒ **NOTE:**
Optional and only if the signal has been provisioned at its source. You can provision the PrvRx field using the **CONFIGURATION-Set-Path-Trace** command to match what was provisioned at its source. If the PrvRx field matches the ActRx field, then the report shows the path trace status as "good" at the DS3 circuit pack.

7. At the CIT, select **CONFIGURATION-Retrieve-Path-Trace** command and execute to obtain a Path Trace Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.

⇒ **NOTE:**
The STS1E and the OC3 circuit packs do not create new signals, they simply pass the existing SONET signal on through at the intermediate node(s).

8. Verify the expected or embedded path trace byte or "tag" of the SONET signal for this path.
9. Repeat Steps 3 through 8 for any additional path(s) to be monitored at this network element.
10. Discontinue the login to this network element. (To discontinue a remote login, refer to **DLP-524**.)
11. Repeat Steps 3 through 10 for any additional path(s) to be monitored at the next network element, if required.
12. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Enter or Change TID String of FT-2000 Network Element

Overview: This procedure is used to enter or change the Target IDentifier (TID) string of an FT-2000 network element. A TID change is the same as entering a TID. Additional information on the SECURITY-Set-Network Element command is in Chapter 8 of this manual.

1. At the CIT, select **CONFIGURATION-Retrieve-Map Ring** command and execute to obtain a Ring Map Report.
2. Verify that the DCC Status of the ring is **good**. If the DCC Status column indicates a **FAIL**, this must be cleared before continuing with this procedure.
3. Determine from office records the unique TID string (up to 20 characters).
- 4.



WARNING:

In FT-2000 Release 8.1 and later releases, a duplicate TID condition will not generate an alarm and could result in a service-affecting outage. Therefore, it is imperative when entering/changing a TID to verify that it is unique both to the ring and in each partitioned subnetwork.

Verify that the new TID is unique by manually comparing it against all existing TIDs in the ring and subnetworks. At the CIT, select **CONFIGURATION-Retrieve-Map-Network** command and enter. Repeat this command (and verification process) once for each area in a partitioned subnetwork.

5. Any identified conflict between the office records/work order and the manual verification process (Step 4), should be resolved before continuing.
- 6.



NOTE:

Changing the value of the local TID will result in all incoming remote TL1 sessions being disconnected. This means the local network element will terminate all login sessions that were requested from a TL1 gateway network element.

At the CIT, select **SECURITY-Set -Network Element** command and enter or change the TID string, but DO NOT press the ENTER key at this time.

7. Wait at least 2 minutes for the TID to be mapped into all nodes on the ring.
8. This step is optional. At the CIT, select **CONFIGURATION-Retrieve-Map Ring** command and verify all entries are consistent with the work instructions.
9. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Replace Fan Filter Every Six Months (in D-Bay)

Overview: The equipment manufacturer (Lucent Technologies) suggests that the fan filter be changed every six-months. Due to the amount of heat generated within the D-Bay it is necessary that the fan remain powered and continuously circulate air even while the filter is being changed. Please note, this is a different procedure than required for the E-Bay. Once the old fan filter has been removed the new fan filter should be inserted without an interruption.

⇒ **NOTE:**
*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100.***

1. The filter is accessible from the front of the bay without opening any doors or removing any covers. It is located approximately 5-inches up from the floor. There are two plastic loops (one on the right side and one on the left side) available to pull the filter out of the bay.
2. Place one finger in both plastic loops and pull the old filter from the bay.

⇒ **NOTE:**
Air flow in the bay is from bottom to top (up).

3. Obtain the new (replacement) filter and make sure that the arrows, which are located on the front edge of the filter, are pointing up. Apply equal pressure to both sides of the filter and gently slide it, within the filter guides, until it is flush with the front of the bay.
4. Dispose of the dirty air filter per the local operating instructions.
5. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Replace Defective Fan Unit in D-Bay

Overview: Replacing a defective fan unit is a simple procedure which can, and once started, must be completed in a brief time interval. A fan unit alarm is typically the first and only sign indicating a problem with the fan unit. Within the fan unit there are two conditions that may raise an alarm. These are:

- a. Loss of power to the fan unit.
- b. Lack of sufficient air flow (e.g., one of the fans has stopped turning). The fan unit alarm LED, which is normally not lit, is red in color. The power LED, which is normally lit, is green in color.



CAUTION:

*Use a static ground wrist strap whenever handling circuit packs or working on an FT-2000 terminal to prevent electrostatic discharge damage to sensitive components. See "Electrostatic Discharge (ESD) Considerations" in **Trouble Clearing: TAD-100**. Due to the amount of heat generated within the D-Bay it is necessary to minimize the time interval wherein air is not being circulated.*

1. Unpack the new fan unit and place near the D-Bay for easy and quick access.
2. At the D-Bay, locate and disconnect the fan unit alarm leads. This is the squeeze type connector on the left side of the fan unit.
3. At the D-bay, locate and disconnect the fan unit power leads. This is the squeeze type connector on the right side of the fan unit.
4. There are two screws (one on the left front and the other on the right front) that hold the fan unit to the D-Bay frame. Obtain a screw-driver and remove both screws.
5. **CAUTION:**
Verify that the fan blades are not spinning. Then, pull the defective fan unit forward and out of the front of the D-Bay frame.
6. Place the defective fan unit aside and carefully, but quickly, insert the new fan unit.
7. Insert both left and right screws and tighten each securely.

8. Obtain the fan unit power lead and connect it to the fan unit.
9. Visually, verify that the fan unit "power" LED, which is located on the fan unit, is lit and that each fan is turning.
10. Obtain the fan unit alarm lead and connect to the alarm receptacle on the fan unit.
11. Visually, verify that the fan unit "alarm" LED, which is located on the fan unit, is not lit.



NOTE:

Once the new fan unit is installed the Red alarm LED should not be lit. Generally, this alone will be sufficient indication that the problem has been corrected. However, if this is an unstaffed site it is recommended that a check be made, via the CIT, to determine for certain that the "remote" alarm has been cleared.

12. If you wish to verify that the remote alarm has been cleared, at the CIT select **Retrieve-Alarm** for an updated Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
13. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Provision OC12 Slot for 1-Way Drop Service

Overview:

1. Determine the OC12 slot address from the work order (engineering instructions).
2. At the CIT, select **CONFIGURATION-Retrieve-Crossconnection** command and determine what type of cross-connection(s) (if any) is already at that slot.
3. Is the OC12 slot cross-connected for a 1-way drop?
If **NO**, then continue with Step 4.
If **YES**, then **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**
4. At the CIT, select **CONFIGURATION-Set -OC12** command and provision the Alarm Level to NO to prevent the reporting or alarming of any future condition.
5. At the CIT, select **CONFIGURATION-Retrieve-OC12** command and verify the **Alarm Level** is provisioned correctly.

Supplemental Information: If an **incoming OC12 LOS** condition exists prior to setting the Alarm Level to NO, this condition **will not disappear** after the Alarm Level is set to NO. Only subsequent conditions will be subdued (not reported). The user may clear the condition by temporarily providing a good input signal until the condition clears or by reseating the OC12 circuit pack. Only reseal the circuit pack if you are sure there is no live traffic on the outgoing fiber, otherwise service interruption will occur.

6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Release Looped Back OC-12 Line(s)



CAUTION:

Traffic and service interruption can occur to other OC12 lines if they are accidentally looped back. Recheck the address of the slot(s) being released from loopback.



NOTE:

Loopback occurred at the OC12 slot in either the multiplex direction (towards the OC-48 line) or the demultiplex direction (towards the lightguide cross-connect panel). Simultaneous loopbacks in both directions were not possible.

1. Obtain the operation instructions to release the looped back OC12 slot(s) and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).
Reference: **DLP-501**
3. At the CIT, select **FAULT - Release - Loopback - OC12** for the first specified slot and the direction (either **From OC48** or **From OC12**).
4. Repeat Step 3 for any remaining slot(s).
5. The slot(s) is released from the looped back condition. If you wish to verify, select **FAULT - Retrieve - Alarm** for an updated Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.
6. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

Loop Back OC-12 Line(s) for Testing



CAUTION:

Traffic and service interruption can occur to other OC12 lines if they are accidentally looped back. Recheck the address of the line(s) being looped back.



NOTE:

Loopback occurs at the OC12 slot in either the multiplex direction (towards the OC-48 line) or the demultiplex direction (towards the lightguide cross-connect panel). Simultaneous loopbacks in both directions are not possible.



NOTE:

The OC12 slot must be cross-connected to a tributary for a valid loopback.

1. Obtain the operation instructions to loop back the OC12 line(s) for testing and note the assigned address.
2. If required, connect and condition the craft interface terminal (CIT).

Reference: **DLP-501**



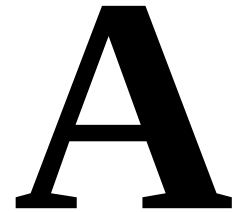
NOTE:

A loopback will remain in effect until deactivated by the **Release-Loopback-OC12** command.

3. At the CIT, select **FAULT-Operate-Loopback-OC12** for the first specified slot(s) and the direction (either **From OC48** or **From OC12**).
4. Repeat Step 3 for any remaining slot(s).
5. Verify the **ABN**, **NE ACTY**, **USE CIT**, and **PWR ON** LEDs are lighted at the user panel.
6. The slot(s) is now looped back in the direction specified in Step 3. If you wish to verify, select **Retrieve-Alarm** for an updated Active Alarms and Status Report. An example of this report with a description of the output parameters is provided in Section 11 of this manual.

7. **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

A SONET Overview



Overview

This section briefly describes the Synchronous Optical Network (SONET).

History

In the early 1980s, *ANSI*^{*} recognized the need for an optical signal standard for future broadband transmission. The *ANSI* T1X1 subcommittee began working on optical signal and interface standards in 1984. In 1985, Bellcore proposed a network approach to fiber system standardization to T1X1. The proposal suggested a hierarchical family of signals whose rates would be **integer multiples** of a basic modular signal. The proposal further suggested a synchronous multiplexing technique, leading to the coining of the term *Synchronous Optical NETWORK* (SONET).

The International Telephone and Telegraph Consultative Committee (CCITT) first showed interest in 1986. Conferences held through 1987 and 1988 resulted in coordinated specifications for both the American National Standard (SONET) and the CCITT-International Standard, Synchronous Digital Hierarchy (SDH). Approval of both sets of standards occurred in late 1988. The CCITT has been renamed the International Telecommunications Union — Telecommunications Standards Section (ITU-TSS).

*

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Basic Purpose

The basic purpose of SONET is to provide a standard synchronous optical hierarchy with sufficient flexibility to accommodate digital signals that currently exist in today's network as well as those planned for the future.

SONET currently defines standard rates and formats and optical interfaces. These and other related issues continue to evolve through the *ANSI* committees. SONET ultimately will permit an optical midspan meet in a multivendor environment.

The American National Standard defines the following:

- Optical parameters (*ANSI T1.106-1988*)
- Electrical parameters (*ANSI T1.102-1993 Draft*)
- Multiplexing schemes to map existing digital signals (for example, DS1, DS2, and DS3) into SONET payload signals (*ANSI T1.105-1991*)
- Criteria for optical line automatic protection switch (APS) (*ANSI T1.105-1991*)
- Overhead channels to support standard operation, administration, maintenance, and provisioning (OAM&P) functions (*ANSI T1.105-1991*).

Technical Overview

SONET Signal Hierarchy

The SONET signal hierarchy is based on a basic "building block" frame called the synchronous transport signal - level 1 (STS-1), as shown in Figure A-1 on the following page. The STS-1 frame has a reoccurring rate of 8000 frames per second. Each frame is 125 microseconds.

The STS-1 frame consists of:

- 90 columns (each column is an 8-bit byte)
- 9 rows.

The STS-1 frame is transmitted serially starting from the left with row 1 column 1 on through column 90, then row 2 column 1 through 90, continuing on, row-by-row, until all 810 bytes (9 X 90) of the STS-1 frame have been transmitted.

Since each STS-1 frame consists of 810 bytes and each byte has 8 bits, the frame contains 6480 bits a frame. There are 8000 STS-1 frames per second, at the STS-1 signal rate of 51,840,000 (6480 X 8000) bits a second.

The first three columns in each of the nine rows carry the SECTION and LINE overhead bytes. Collectively, these 27 bytes are referred to as transport overhead.

The remainder of the frame, columns 4 through 90, is reserved for payload signals (for example, DS1, DS3, and path overhead) and is referred to as the STS-1 synchronous payload envelope (STS-1 SPE). The optical counterpart of the STS-1 is the optical carrier level 1 signal (OC-1), which is the result of a direct optical conversion. The electrical counterpart of the STS-1 is the electrical carrier level 1 signal (EC-1).

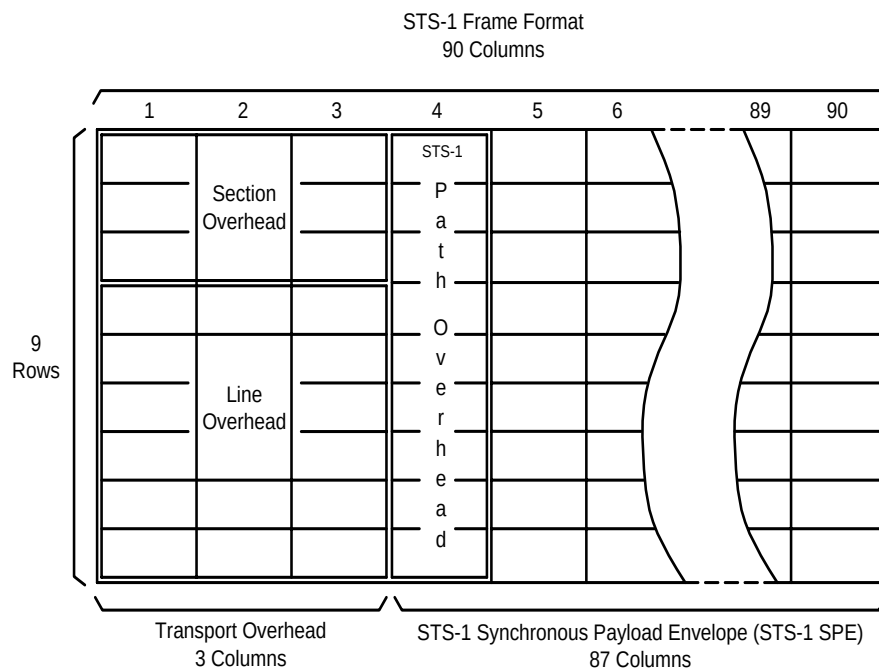


Figure A-1. SONET STS-1 Frame — Simplified Version

SONET Layers

SONET divides its processing functions into three layers. These three layers are associated with equipment that reflects the natural divisions in network spans. Figure A-2 shows these defined layers in a signal path. They include:

- **SECTION** and **Section Terminating Equipment** - the transmission spans between lightwave terminating equipment and the regenerators. The spans between the regenerators are also considered sections. Section

terminating equipment provides regenerator functions and terminates the section overhead to provide single-ended operations and section performance monitoring.

- **LINE and Line Terminating Equipment** - the transmission span between terminating equipment (STS-1 cross-connections) that provides line performance monitoring. If there are no intervening repeaters, the line terminating equipment also functions as section terminating equipment.
- **STS-1 and VT Path and Path Terminating Equipment** - the transmission span for an end-to-end tributary (DS1 or DS3) signal that provides functions including signal labeling and path performance monitoring for signals as they are transported through a SONET network. STS-1 path terminating equipment can also provide cross-connections for lower rate (that is, DS1) signals. A virtual tributary (VT) is a sub-DS3 payload and is described later in more detail.

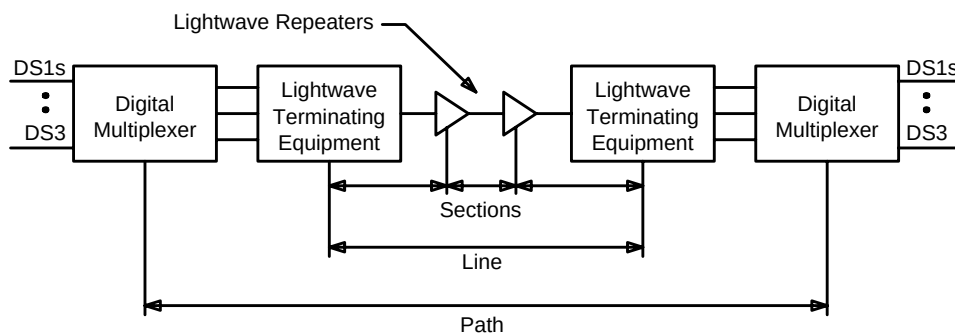


Figure A-2. Section, Line, and Path Definitions

Each SONET layer has a set of overhead bytes as shown in Figure A-3. These bytes carry information used by various network elements.

- **Section Layer Overhead** contains information that is used by all SONET equipment including repeaters.
- **Line Overhead** is used by all SONET equipment except repeaters.
- **Path Overhead** is carried within the payload envelope.
 - **STS-1 path overhead** remains with the STS-1 SPE until its asynchronous signal is extracted (for example, DS-3) or until its individual VT1.5 signals are demultiplexed.
 - **VTN (N= 1.5, 2, 3, or 6) path overhead** remains with the VTN until its asynchronous signal is extracted.

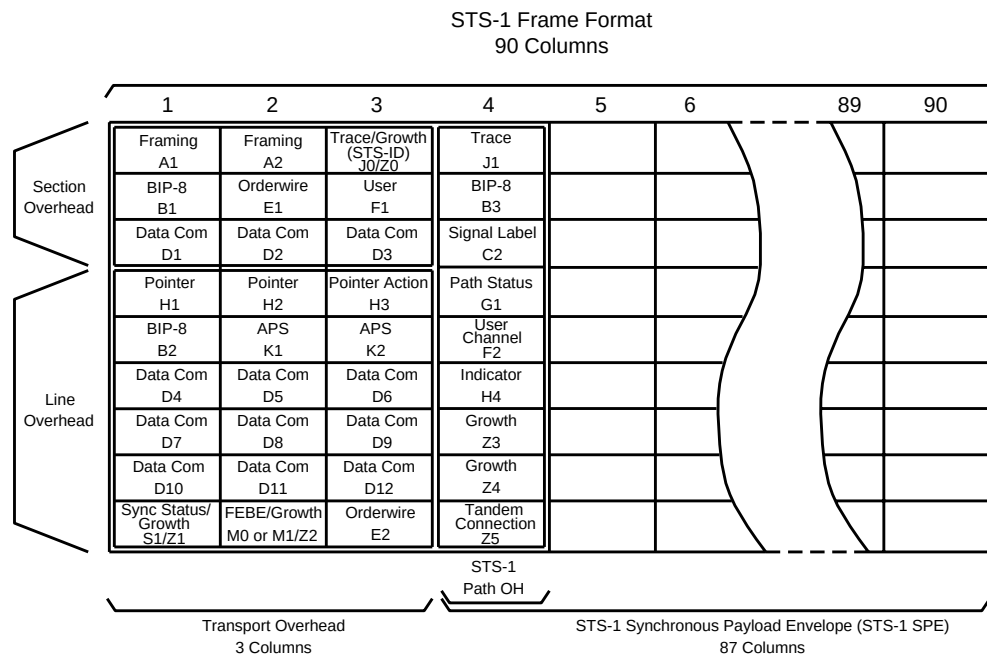


Figure A-3. SONET Frame Format

SONET Frame Structure

The following pages provide more detailed information on the function of various overhead bytes for each SONET layer.

Section Overhead

- Framing (A1, A2)
 - Provides framing for each STS-1.
 - Trace/Growth (J0/Z0)
 - The Section Trace and Section Growth bytes replace STS-1 ID (C1).
 - J0/Z0 are for future use.
 - The J0 byte is located in the first STS-1 of an STS-N.
 - The Z0 byte is located in the second through Nth STS-1 of the STS-N.
- Section Bit-Interleaved Parity (BIP-8) (B1)

- Provides SECTION performance monitoring and is calculated over all bits of the previous STS-*N* frame. Defined only for STS-1 #1 of an STS-*N* signal.
- Section Orderwire (E1)
 - Provides a local orderwire for voice communication channel between section terminating network elements, such as repeaters. Defined only for STS-1 #1 of an STS-*N* signal.
- Section User Channel (F1)
 - Set aside for the user's purpose. Defined only for STS-1 #1 of an STS-*N* signal.
- Section Data Communications Channel (D1, D2, D3)
 - Is a 192 kb/s message-based channel. Used for alarms, maintenance, control, monitoring, and other communication needs between section terminating equipment. Defined only for STS-1 #1 of an STS-*N* signal.

Line Overhead

- Line Pointer (H1, H2)
 - Two bytes indicate the offset in bytes between the pointer action byte (H3) and the first byte (J1) of the STS-1 synchronous payload envelope (SPE).
- Pointer Action (H3)
 - One byte is allocated for frequency justification.
- Line Bit-Interleaved Parity (BIP-8) (B2)
 - This byte is for line performance monitoring. This byte is provided in all STS-1 signals within an STS-*N* signal.
- Line Automatic Protection Switching (APS) (K1, K2)
 - Two bytes used for APS signaling between line level entities. In addition, bits 6, 7, and 8 of K2 are used for line alarm indication signal (AIS) and line far-end receive failure (FERF). Defined only for STS-1 #1 of an STS-*N* signal.
- Line Data Communications Channel (D4 - D12)
 - Is a 576 kb/s message-based channel.
- Sync Status/Growth (S1/Z1)
 - One byte is used to convey the synchronization status of the Network Element.
- FEBE/Growth (MO or M1/Z2)
 - The Z2 byte is relabeled M0 for STS-1 line far end block error (FEBE), and only bits 5 through 8 are used.

- Bits 1 through 4 are labeled M1. Normally, and per the standard, these are all zeros. However, the FT-2000 M1-byte deviates from the SONET standard in terms that, under normal conditions, it is all ones.
- Line Orderwire (E2). Defined only for STS-1 #1 of an STS-*N* signal.
 - One byte is allocated to be used as an express orderwire between line terminating equipment.

Path Overhead

There are two types of path overheads:

- STS-1 path overhead
- VT path overhead.

STS-1 Path Overhead

The STS-1 path overhead is assigned to and remains with the STS-1 SPE until the payload is extracted and is used for functions that are necessary to transport all synchronous payload envelopes.

- STS-1 Path Trace (J1)
 - Repetitively transmits a 64 byte, fixed length, string so that an STS-1 path receiving terminal can verify its continued connection to the intended transmitter.
- STS-1 Path Bit-Interleaved Parity (BIP-8) (B3)
 - Provides each STS-1 path performance monitoring. This byte is calculated over all bits of the previous STS-1 SPE before scrambling.
- STS-1 Path Signal Labels (C2)
 - Indicates the construction of the STS-1 SPE. Table A-1 shows the values used by the FT-2000 OC-48 Lightwave System.

Table A-1. STS-1 Signal Path Label Values

Hexidecimal Code	STS-1 Signal Path Label
00	Unequipped
01	Equipped-nonspecific payload
02	VT-Structured STS-1 SPE
04	Asynchronous mapping for DS3

Table A-1. STS-1 Signal Path Label Values—Contd

Hexidecimal Code	STS-1 Signal Path Label
12	DS4NA Asynchronous mapping
13	Mapping for ATM
14	Mapping for DQDB
15	Asynchronous mapping FDDI

- STS-1 Path Status (G1)
 - Conveys the STS-1 path terminating status, far end block errors (FEBE), and yellow alarm signal conditions back to an originating STS-1 path terminating equipment.
- STS-1 Path User Channel (F2)
 - Reserved for user communication.
- Indicator (H4)
 - Provides a general multiframe indicator for VT-structured payloads.
- Growth (Z3 - Z4)
 - Reserved for future functions.
- Tandem Connection (Z5)
 - Z5 is allocated for tandem connection maintenance and the path data channel.
 - The tandem connection information is specified by *ANSI T1.105.05*.

VT Path Overhead

There is one byte of VT path overhead called V5. It occurs on every fourth frame; that is, 2000 times a second.

This byte provides for VT paths the same functions that B3, C2, and G1 provide for STS paths, namely:

- Error checking
- Signal label
- Path status.

The bit assignments of the VT path overhead are specified in the following list and are illustrated in Figure A-4:

- Bits 1 and 2 are used for error performance monitoring (BIP-2).
- Bit 3 is a VT path far-end-block-error (FEBE) indication that is sent back toward an originating VT PTE when errors are detected by the BIP-2.

- Bit 4 and Bit 8 are used for remote defect indication (RDI)
- Bits 5 through 7 provide a VT signal label.



VT Path Signal Label Coding:

0 0 0	Unequipped
0 0 1	Equipped-Nonspecific

Figure A-4. VT Path Overhead Byte

SONET Multiplexing Procedure

SONET has provisions for multiplexing asynchronous DS1s, synchronous DS1s, and asynchronous DS3s. Refer to Figure A-5 and Figure A-6.

The first stage in multiplexing is mapping the input DS1 or DS3 tributary. In the case of DS1 inputs, three time slots (DS0s) are added to the incoming signal thus becoming a VT1.5. An asynchronous DS1 that fully meets the specified rate is mapped into the VT1.5 SPE as clear channel input since no framing is needed.

- Each VT1.5 carries a single DS1 payload.
- Four VT1.5s are bundled into a VT group (VT-G).
- Seven VT-Gs are byte-interleaved into an STS-1 frame.

The VT-G to-STS-1 multiplex is a simple byte-interleaving process, so individual VT signals are easily observable within the STS-1. Thus, cross-connections and add/drop can be accomplished without the back-to-back multiplexing/multiplexing steps required by asynchronous signal formats. The structured VTs are now multiplexed into the STS-1 SPE, and the path, line, and section overhead are added. The final multiplexing, as shown in Figure A-5, provides the scrambled STS-*N* signal to the optical conversion stage.

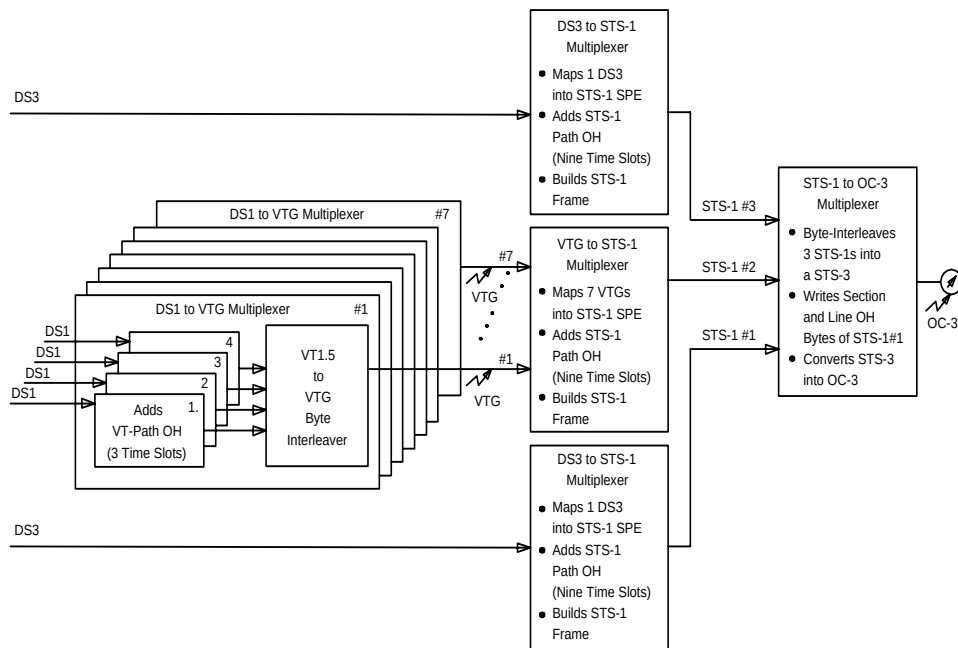


Figure A-5. SONET Multiplexing Procedure

SONET Demultiplexing Procedure

As shown in Figure A-6, demultiplexing is the inverse of multiplexing. The unscrambled STS-1 signal from the optical conversion stages is processed to extract the section and line overhead and accurately locate the SPE. The next stage processes the path overhead and demultiplexes the VTs. A standard DS3 signal will be provided to the asynchronous network after path overhead processing. For DS1 signals, the individual DS1 VTs are then processed to extract VT overhead and, via the VT pointer, accurately locate the DS1 SPE. Finally, desynchronization of the DS1 SPE provides a standard DS1 signal to the asynchronous network.

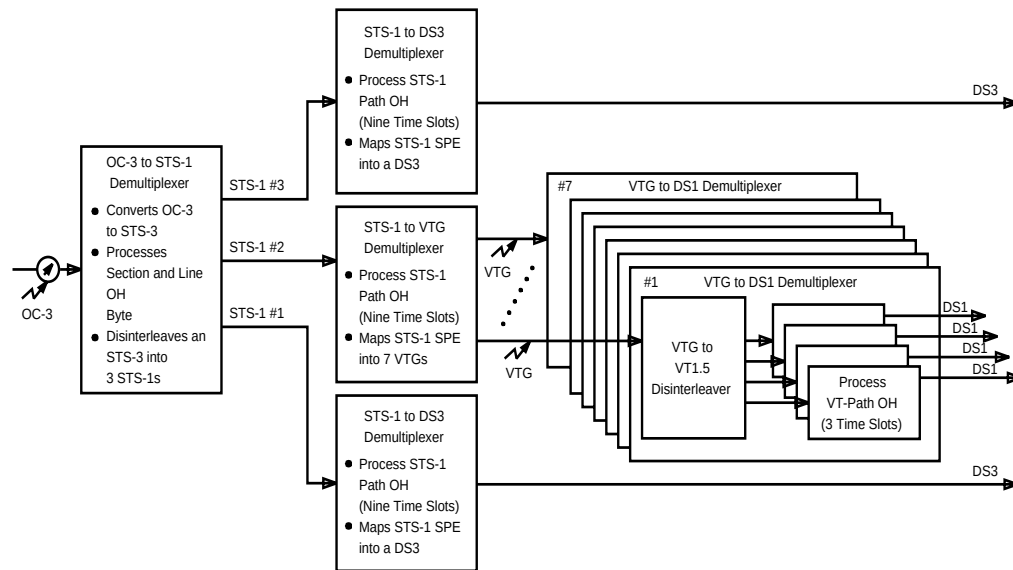


Figure A-6. SONET Demultiplexing Procedure

Two key points should be noted at this time. First, the SONET frame is a fixed time (125 μ s) and no bit-stuffing is used. Second, as shown in Figure A-7, the synchronous payload envelope can *float* within the frame using byte-stuffing. This is to permit compensation for small variations in frequency between the clocks of the two systems that may occur if the systems are independently timed (plesiochronous timing). The SPE can also drift across the 125- μ s frame boundary. SONET STS pointers are used to locate the SPE relative to the transport overhead.

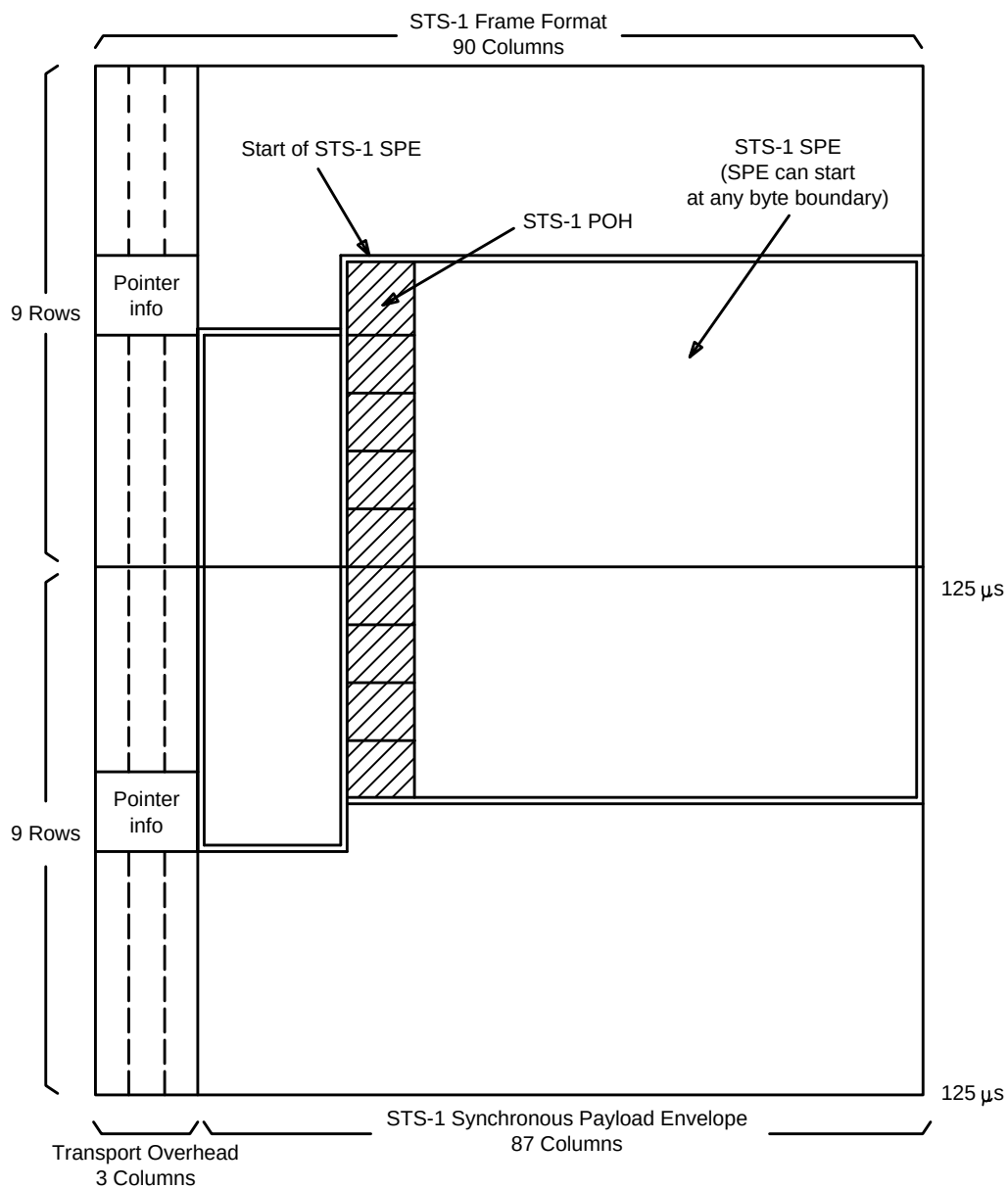


Figure A-7. STS-1 Synchronous Payload Envelope in Interior of STS-1 Frame

SONET Digital Multiplexing Schemes

Asynchronous Multiplexing

Currently, fiber optic facilities are primarily used to carry DS3 signals. The DS3 signal consists of a combination of the following payload signals:

- 28 DS1s
- 14 DS1Cs
- 7 DS2s.

Typically, 28 DS1 signals are multiplexed into a DS3 signal, using an M13 format. Refer to Figure A-8. M13 format is a process that includes bit-interleaving four DS1 into a DS2 signal and then bit-interleaving seven DS2 signals into a DS3. The DS3 rate is not a direct multiple of the DS1 or the DS2 rates due to the bit-stuffing synchronization technique used in asynchronous multiplexing.

Identification of DS0s contained in any DS-N signal, except DS1, is complex and DS0s cannot be directly extracted. Thus, an asynchronous DS3 signal must be demultiplexed down to the DS1 level to access and cross-connect DS0 and DS1 signals.

Another disadvantage of the M13 format is there is no end-to-end overhead channel for use by OAM&P groups.

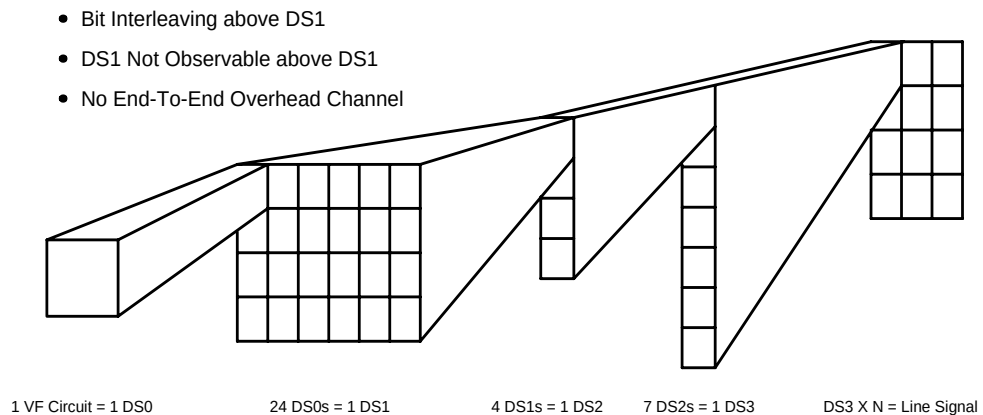


Figure A-8. Asynchronous Multiplexing

Synchronous Multiplexing

SONET's method of *byte-interleaving* DS1s to a higher signal rate permits economical extraction of a single DS1 without the need to demultiplex the entire STS-1 SPE. In addition, SONET provides overhead channels for use by OAM&P groups.

In SONET, a single asynchronous DS3 signal is mapped into an STS-1 SPE (Figure A-9).

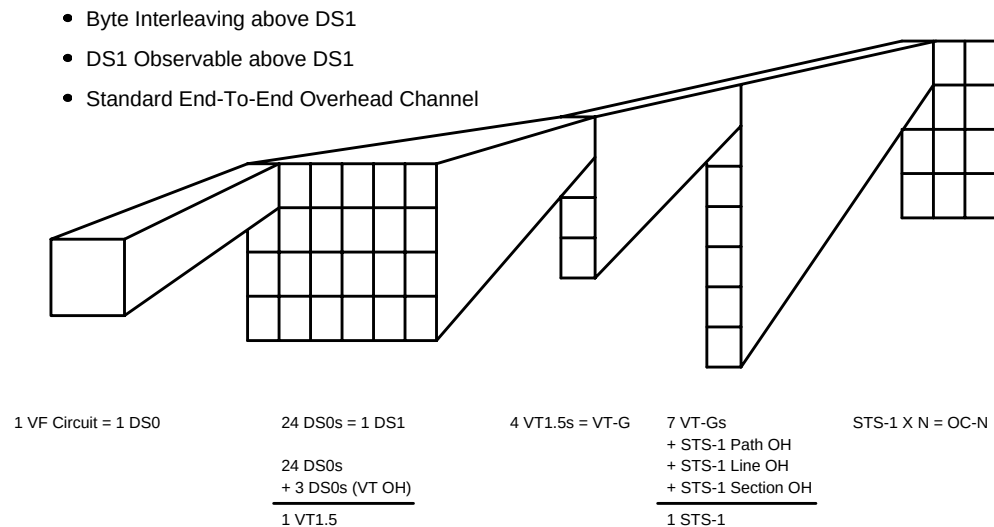


Figure A-9. Synchronous Multiplexing

Virtual Tributary Signals

Sub-DS3 asynchronous signals (DS1, DS1C, DS2 and E1) are *byte-interleaved* into a digital signal called a virtual tributary (VT). The VT is a structure designed for the transport and switching of sub-DS3 payloads. Like the STS-1 signal, the VT signal has a floating pointer that allows each VT SPE to move within the VT structure. There are four sizes of virtual tributaries (VT1.5, VT2, VT3, and VT6). Higher rate payloads are transported as one or more concatenated STS-1 signals.

Concatenated Mode

For services requiring multiples of the STS-1 rate, STS-1 path payloads may be shared to create a single broadband payload called a concatenated STS- N_c (OC- N_c). STS-1 signals are mapped into an STS- N_c SPE and transported as a concatenated STS- N_c signal. This STS- N_c signal can be carried by an STS- N or OC- N (or higher level) line signal.

The STS- N signal is multiplexed, switched, and transported through the network as a single entity. A concatenation indicator, used to show that the STS-1s of the STS- N_c signal are linked together, is contained in the STS-1 payload pointer of all but the first STS-1. The line and section overhead is sent on the first STS-1 and the payload pointer for the first STS-1 is applied to all STS-1 signals in the concatenated signal.

Figure A-10 shows the STS- N_c SPE. It consists of $N \times 87$ columns and 9 rows of bytes. The order of transmission is row by row, from left to right.

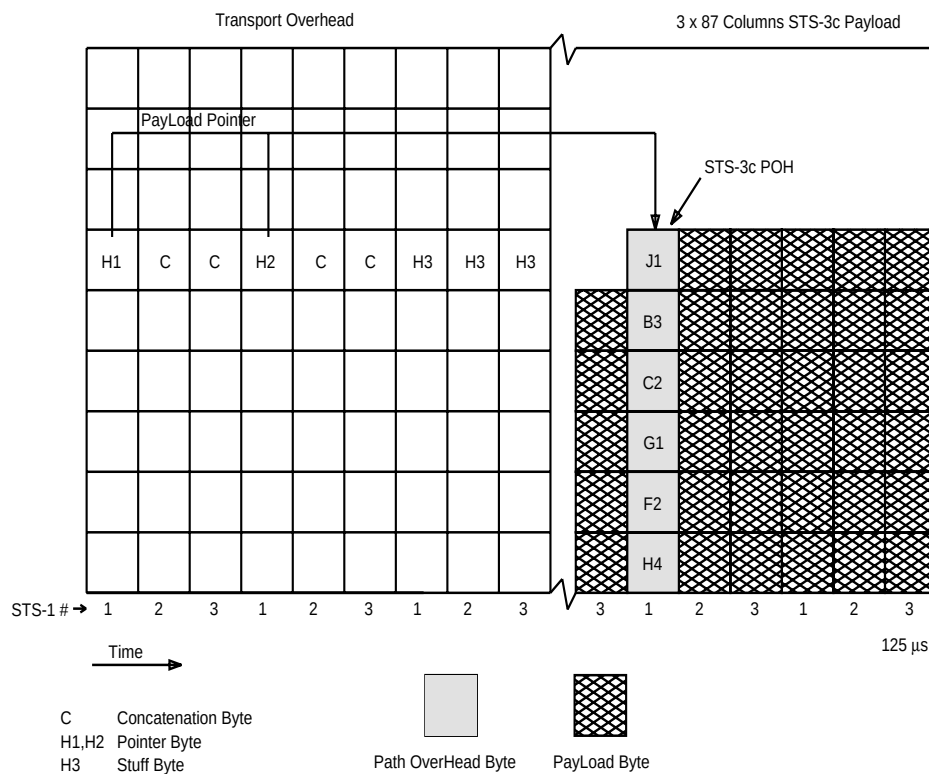


Figure A-10. STS- N_c Concatenated Payload

SONET Interface

The SONET interface (Figure A-11) provides the optical midspan meet between SONET network elements. A SONET network element is the hardware and software that processes one or more layers of the SONET signal.

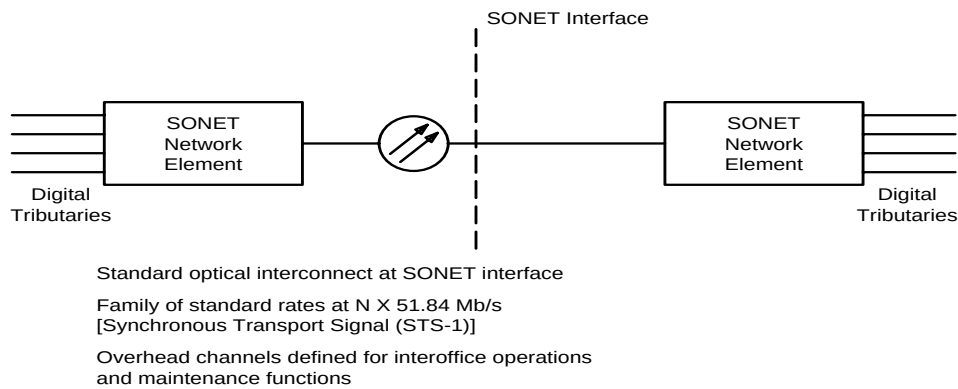


Figure A-11. SONET Interface

SONET Payloads

Table A-2 shows the digital signals that can be transported as SONET payloads.

Table A-2. SONET Payloads

Input Tributary	Equivalent		SONET	
	Channels	Rate	Signal	Rate
DS1	24 DS0s	1.544 Mb/s	VT1.5	1.728 Mb/s
E1 (CEPT)	32 DS0s	2.048 Mb/s	VT2	2.304 Mb/s
DS1C	48 DS0s	3.152 Mb/s	VT3	3.456 Mb/s
DS2	96 DS0s	6.312 Mb/s	VT6	6.912 Mb/s
DS3	672 DS0s	44.736 Mb/s	STS-1	51.840 Mb/s
DS4NA	2016 DS0s	139.624 Mb/s	STS-3c	150.336 Mb/s
ATM	2016 DS0s	149.76 Mb/s	STS-3c	150.336 Mb/s
FDDI	2016 DS0s	125.00 Mb/s	STS-3c	150.336 Mb/s
Future payloads		up to 150 Mb/s		
Future broadband payloads		Greater than 150 Mb/s		

DS1 and DS3 signals are the most important of these signals in the current network. Broadband payloads, such as asynchronous transfer mode (ATM) and fiber distributed data interface (FDDI), with rates of 150 Mb/s and higher, are also important. Other payloads may be defined for specific applications.

Higher Rate Transport

Higher rate SONET signals are created by byte-interleaving N STS-1 to form an STS- N signal. The STS- N is then scrambled and converted to an optical carrier-level N (OC- N) signal. The OC- N has a line rate of exactly N times the OC-1 signal (see Table A-3).

Table A-3. SONET Transport Rates

OC Level	Line Rate (Mb/s)	Capacity
OC-1	51.84	28 DS1s or 1 DS3
OC-3	155.52	84 DS1s or 3 DS3s
OC-9	466.56	252 DS1s or 9 DS3s
OC-12	622.08	336 DS1s or 12 DS3s
OC-18	933.122	504 DS1s or 18 DS3s
OC-24	1244.16	672 DS1s or 24 DS3s
OC-36	1866.24	1008 DS1s or 36 DS3s
OC-48	2488.32	1344 DS1s or 48 DS3s

Conclusion

The intent of this section is to present a short overview of SONET. More detailed expositions can be found in various literature. An excellent description of SONET can be found in Reference 3.

REFERENCES

1. *ANSI T1.106-1988*—American National Standard for Telecommunications - Digital Hierarchy Optical Interface Specifications, Single Mode,— and *ANSI T1.105-1991* —American National Standard for Telecommunications - Digital Hierarchy Optical Rates and Formats Specification.
2. CCITT Recommendations G.707, G.708, G.709.
3. R. Ballert and Y. C. Ching, —SONET: Now It's the Standard Optical Network—*IEEE Communications Magazine*, Vol. 27, No. 3 (March 1989): 8-15.
4. *ANSI T1.102-1993 Draft*—American National Standard for Telecommunications - Digital Hierarchy Electrical Interface Specifications.

Glossary

Numerics

0x1 Line Operation

A 0x1 protection system has one service line and no protection line.

1+1 Line Protection

A 1+1 protection system has two bidirectional lines. The transmitting terminal transmits the same signal on two lines. The receiving terminal monitors two lines independently and chooses one line as the active line and the other line as the standby line. When a protection switch occurs, the receiving terminal selects the signal from the standby line which causes the standby line to be the new active line. The original active line becomes the standby line. This status remains the same (nonrevertive) after the fault clears.

1x1 Line Protection

A 1x1 protection system has two OC-48 high speed lines. One line is designated as the service line, and the other line is designated as the protection line. The service line normally carries traffic. When a protection switch occurs, the protection line is selected to carry traffic. When the fault clears, the original service line is selected (revertive). Also see Revertive Switching.

1xM Electrical Low Speed Interface Protection

1xM electrical low speed interface protection refers to a system with one protection electrical low speed interface circuit pack (DS3 or STS1E) and up to 16 service electrical low speed interface circuit packs (DS3 or STS1E). When a low speed protection switch occurs, the electrical low speed signals are routed from the service low speed interface circuit pack to the protection low speed interface circuit pack. When the fault clears, the low speed signals are routed back to the service low speed interface circuit pack (revertive). Also see Revertive Switching.

A

ABN

Abnormal — An LED on the user panel that is lighted when a temporary condition potentially affecting transmission exists; for example, a CIT-initiated protection switch or lockout, or loopback.

AITs

Acknowledged Information Transfer Service — The required OSI Data Link Layer 2 protocol.

ACO

Alarm Cutoff — A push-button switch on the user panel that can be used to retire the active audible office alarm. If another alarmable condition occurs while the ACO is active, the highest level audible alarm is activated. The alarm cutoff function is also available from the CIT and from an operations system.

Active

Active refers to a 1+1 protected OC-3 line that is currently selected by the receiving terminal at either end as the payload carrying signal. (Also refer to Standby.)

ADM

Add/Drop Multiplexer

Add/Drop-Rings Terminal Platform

The SONET standards that are implemented in the FT-2000 OC-48 Lightwave System. More specifically, it is where one or more low speed shelves are interconnected to either one Enhanced high speed shelf (2-fiber ring) or two Enhanced high speed shelves (4-fiber ring). And, where any slot on the low speed shelf may be provisioned to have its traffic added/dropped from either the East or West OC-48 high speed links.

AID

Access Identifier — A unique identifier used to address circuit pack slots, ports, and tributaries.

AIS

Alarm Indication Signal — A maintenance signal transmitted downstream in a digital network that shows that an upstream failure has been detected and alarmed by some upstream equipment, if the upstream alarm has not been suppressed.

AITs

Alarm Information Transfer Service

Alarm

A contact closure to the office alarm grid.

AMI

Alternate Mark Inversion — A line code that employs a ternary signal to convey binary digits, in which successive binary ones are represented by signal elements that are normally of alternating, positive, and negative polarity but equal in amplitude, and in which binary zeros are represented by signal elements that have zero amplitude.

ANSI

American National Standards Institute — An organization consisting of producer, consumer, and general interest groups that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States.

APD

Avalanche Photodiode — A highly sensitive optical detector.

APS

Automatic Protection Switch — a protection switch that occurs in response to an automatically detected trouble condition.

AS&C

Alarm, Status, and Control.

ASCII

American Standard Code for Information Interchange — A standard 8-bit code used for exchanging information among data processing systems and associated equipment.

ASN.1

Abstract Syntax Notation 1.

Asynchronous

Refers to network elements that are not timed from references traceable to a single timing source.

ATM

Asynchronous Transfer Mode — A new technology based on a simple, fixed-length packet (or cell) format that allows integrated networking of voice, data, and video traffic. The packet length is set at

53 bytes. The first 5 bytes are reserved for address and control fields, and the remaining 48 bytes carry data.

AUTO

Automatic — One possible state of a low speed port or slot. When a port is in the automatic state and the presence of a good signal is detected, the port is automatically placed in the IS (in service) state. When a slot is in the automatic state and the presence of a circuit pack is detected, the slot is automatically placed in the EQ (equipped) state.

Autonomous Indicators

Autonomous indicators are those indicators that are subject to incoming signal alarm delay. These include office alarm outputs, parallel telemetry outputs, TL1 autonomous messages, the alarm LEDs (CR, MJ, and MN) on the user panel, and the network element status field in the upper left-hand corner of the CIT.

B**B3ZS**

Bipolar 3-Zero Substitution — A line coding method that replaces a string of three zeros with a sequence of symbols having some special characteristic.

B8ZS

Bipolar 8-Zero Substitution — A line coding method that replaces a string of eight zeros with a sequence of symbols having some special characteristic.

BCLAN

Board Controller Local Area Network — The internal local area network that provides communications between the Line Controller circuit pack (terminals only) and board controllers on the circuit packs associated with an OC-48 high speed line. In the ^FT-2000 OC-48 Repeater Bay, the BCLAN provides communications between the System Controller circuit pack and board controllers on the circuit packs.

BDFB

Battery Distribution and Fuse Bay.

BER

Bit Error Rate — The ratio of bits received in error to bits sent.

BIP

Bit Interleaved Parity — A method of error monitoring over a specified number of bits (BIP-3 or BIP-8).

BIP-N

Bit Interleaved Parity - N — A method of error monitoring. With even parity, an N-bit code is generated by the transmitting equipment over a specified portion of the signal in such a way that the first bit of the code provides even parity over the first bit of all N-bit sequences in the covered portion of the signal. The second bit provides even parity over the second bits of all the N-bit sequences within the specified portion, etc. Even parity is generated by setting the BIP-N bits so that there are an even number of ones in each of all the N-bit sequences including the BIP-N.

BITS

Building Integrated Timing Supply — A single clock that provides all the DS1 and DS0 synchronization references required by clocks in a building.

BOC

Bell Operating Company.

Broadband Communications

Voice, data, and/or video communications at rates greater than DS1 rates (1.544 Mb/s).

Broadband Service Transport

STS-3c and/or STS-12c transport over FT-2000 OC-48 links for ATM applications.

BRT

Business Remote Terminal.

C

CC w/AIS

Clear Channel with Alarm Indication Signal Insertion — A provisionable mode for the DS3 output in which the outgoing DS3 signals are passed through without any violation monitoring. If an incoming loss of signal is detected, a DS3 AIS is inserted.

CC w/oAIS

Clear Channel without Alarm Indication Signal Insertion — A provisionable mode for the DS3 output in which the outgoing DS3 signals are passed through without any violation monitoring. If an incoming loss of signal is detected, no DS3 AIS is inserted.

CEV

Controlled Environment Vault.

CIT

Craft Interface Terminal — A personal computer that meets FT-2000 minimum requirements loaded with the FT-2000 CIT-PC software or SNC-2000 CPro software (Release 5 and later). In Release 5 and later releases, an ASCII-based (dumb) terminal that meets FT-2000 minimum requirements can also be used as a craft interface terminal.

CCITT

International Telephone and Telegraph Consultative Committee — An international advisory committee under United Nations sponsorship that has composed and recommended for adoption worldwide standards for international communications. Recently changed to the International Telecommunications Union (ITU) Telecommunication Standardization Sector (TSS).

CMISE

Common Management Information Service Element —

CO

Central Office — A telephone company building where switching and/or transmission system equipment is located.

Concatenated Switching

Concatenated switching provides protection for simultaneous failures in adjacent sections of the same service line or different service lines. In concatenated switching the protection line is divided into sections. Each section of the protection line can be used to protect any service line in the section. Consequently, simultaneous failures in more than one section can be protected.

Condition

Conditions persist in time and indicate that there is something not normal about the system. Conditions appear in the Retrieve-Alarm Report.

CR

Critical (alarm).

Cross-Connection

A reconfigurable transmission path interconnection.

Cross Connection Map

The cross-connection map for each FT-2000 ring node contains information about how signals are connected between the high speed time slots and low speed interface packs. (See also Squelch Map).

CTS

Customer Technical Support — A Lucent Technologies organization that helps customers maintain installed systems (formerly known as the Technical Support Organization).

Current Value

The value currently assigned to a provisionable parameter.

CV

Coding Violation — A performance-monitoring parameter. The coding violations are monitored for the OC-48 line, OC-3 line, STS-48 section, STS-3 section, STS-1 path, EC-1 line, and DS3 path.

D

DACS

Digital Access and Cross-Connect System.

DACS III-2000

One of Lucent Technologies SONET-compatible Digital Access and Cross-Connect Systems.

DACS IV-2000

One of Lucent Technologies SONET-compatible Digital Access and Cross-Connect Systems.

Data

A collection of system parameters and their associated values.

DCC

Data Communications Channel — The embedded overhead communications channel in the SONET line. This is used for end-to-end communications and maintenance. It carries alarm, control, and status information between network elements in a SONET network.

DCC Link

Data Communications Channel Link — A bidirectional point-to-point fiber connection at the OC-3/OC-12 or OC-48 rate that has the DCC bytes terminated at both ends.

DCE

Data Circuit Equipment — The equipment that provides the signal conversion and coding between the data terminating equipment and the line. The DCE may be separate equipment or a part of the data terminating equipment.

DCMS

Design Change Management System — The Design Change Management System is used to issue product change notifications (PCNs) to customers.

DDM-2000

Lucent Technologies SONET-ready network multiplexer that can function as a lightwave terminal. It is designed primarily for loop feeder and interoffice applications that will work in existing asynchronous as well as the emerging SONET networks.

DDM-FiberReach

The DDM-2000 FiberReach Multiplexer is an OC-1 low density access product offering DS0 and DS1 services for business carrier access, fiber-in-the-loop, or private network applications. DDM-2000 FiberReach is hosted by the DDM-2000 OC-3 or OC-12 Multiplexer or the *SLC-2000* Access System with a single- or dual-homed ring or star topology.

DWDM

Dense Wave Division Multiplexing — Transmitting multiple OC-48 optical signals (simultaneously) over a single fiber. The DWDM signal is interface compatible with the OLS product.

Demultiplexing

A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

Destination Node

The destination node is the node in a ring where the low speed signals on an STS-3 tributary terminate. If an STS-3 tributary is bridged at one or more nodes in a ring, the last node where the low speed signals are terminated is the destination node. The destination node and source node of an STS-3 tributary are always in the same ring (also see Source Node).

DFB

Distributed Feedback.

DM

Degraded Minutes — A performance-monitoring parameter.

DMA

Direct Memory Access — A data transfer technique that uses a control circuit to move data between a device and memory.

DPLL

Digital Phase-Locked Loop.

DRAM

Dynamic Random Access Memory — Semiconductor random-access memory that requires short interval refreshing to retain its contents.

DS3

Digital Signal Level 3 (44.736 M/bs).

DS3 Interface Circuit Pack

The FT-2000 OC-48 Lightwave System DS3 Interface circuit pack interfaces with up to three bidirectional DS3 signals.

DS-NE

Directory Service Network Element — The single reference point in a ring network. The Directory Service Network Element stores the IDs of the other network elements in the ring and updates the other network elements after configuration changes.

DSX

Digital Cross-Connect Panel — A panel designed to interconnect equipment that operates at a designated rate. For example, a DSX-3 interconnects equipment operating at the DS3 rate.

DTE

Data Terminating Equipment — The equipment that originates data for transmission and accepts transmitted data.

Dual Ring Interworking

Dual Ring Interworking (DRI) is a configuration of two ring networks that share two common nodes. DRI allows a circuit with one termination in one ring and one termination in another ring to survive a loss-of-signal failure of the shared node that is currently carrying service for the circuit.

E

EC, EC-n

Electrical Carrier — The basic logical building block signal with a rate of 51.840 Mb/s for an EC-1 signal and a rate of n times 51.840 Mb/s for an EC-n signal.

EC-1

An STS-1 signal that has been shaped and encoded for transmission over electrical media. This refers to the actual physical representation of an electrical signal with an EC-1 format at a manual or electronic cross-connect interface. This signal is typically carried by coaxial cables from one equipment location to another. The term EC-1 not only refers to the organization and data rate of a signal but also to the voltage template the signal must conform to and the impedances for which the voltage template is valid.

ECI

Equipment Catalog Item

EEPROM

Electrically Erasable Programmable Read-Only Memory — Readable memory that is nonvolatile in nature, erased electrically, and programmed externally from the processor that uses it.

EIA

Electronic Industries Association — A trade association of the electronics industry that establishes electrical and functional standards.

Electrical Line Buildout

An equalizer network between the FT-2000 OC-48 Add/Drop-Rings Terminal and the DSX or STSX1 panel (or equivalent). It guarantees the proper signal level and shape at the DSX panel (or equivalent).

EMC

Electromagnetic Compatibility.

EMI

Electromagnetic Interference — High-energy, electrically induced magnetic fields that cause data corruption in cables passing through the fields.

EPROM

Erasable Programmable Read-Only Memory — Readable memory that is nonvolatile in nature, erased by exposure to intense ultraviolet light, and programmed externally from the processor that uses it.

EQ

Equipped — A memory administrative state for slots. EQ refers to a slot that is fully monitored and alarmed.

Equal Level Cross-Connect

A cross-connect panel where the signal strength (power) is the same for all the inputs and outputs so that any output can be connected to any input. The DSX-3 is an example of an equal level cross-connect panel.

ES

Errored Seconds — A second in which one or more coding violations are detected. Errored seconds are monitored for the OC-48 line, OC-3 line, STS-48 section, STS-3 section, STS-1 path, EC-1 line, and the DS3 path/line.

ESD

Electrostatic Discharge — The discharge of static electricity into equipment that potentially causes component damage and logic errors.

ESF

Extended Super Frame — A DS1 format option.

Event

Events happen at a particular time (do not persist in time) and appear in the Retrieve-History Report.

Executable Code

The "program" that controls the operation of the system.

Externally Timed

An operating condition of a network element in which it is locked to an external reference. (Also referred to as Phase Locked in releases prior to Release 5.)

Extra Traffic

Extra traffic is a capability of the FT-2000 OC-48 Add/Drop-Rings terminal that allows access to the protection STS-3 tributaries and STS-1 tributaries (Release 7 and later) of an OC-48 high speed line for low priority traffic or for restoration purposes.

F

FDA

Food and Drug Administration.

FDDI

Fiber Distributed Data Interface.

FE ACTY

Far-End Activity — An LED on the user panel that is lighted when an alarm or status condition exists at a remote FT-2000 OC-48 Repeater Bay or FT-2000 OC-48 Add/Drop-Rings Terminal.

FEBE

Far-End-Block Error — An indication returned to the transmitting terminal that an errored block has been detected at the receiving terminal. A block is a specified grouping of bits.

FERF

Far-End-Receive Failure — An indication returned to a transmitting terminal that the receiving terminal has detected an incoming failure. Also refer to the line remote defect indicator (RDI-L) signal.

FIT

Failures in Time — Circuit pack failure rates per 10⁴ hours as calculated using the method described in TR-TSY-000332, Issue 3, "*Reliability Prediction Procedure for Electronic Equipment (RPP)*".

Flash EPROM

A new technology that combines the nonvolatility of EPROM with the in-circuit reprogrammability of EEPROM (electrically-erasable PROM).

FLS

Frame Loss Seconds.

Folded Rings

Folded (collapsed) rings are ring networks without fiber diversity. The terminology derives from the image of folding a ring into a linear segment.

Free Running

An operating condition of a network element in which its local oscillator is not locked to any synchronization reference and is using no storage techniques to sustain its accuracy.

FT-LBA

FT-Lightwave Booster Amplifier

FT-RDS

FT-Ring Diversity Switch

G

Gb/s

Gigabits (10⁹ bits) per Second.

GCNS-2000

Lucent Technologies' Gigabit Cell Network Switch.

GR

Bellcore General Requirements

GR-253

Bellcore GR-253 Compliant 7-layer OSI Stack — The Bellcore standard for Multi-Vendor Interoperability

GNE

Gateway Network Element — A network element that serves as a single interface to the local X.25 message-based operations system for all the FT-2000 OC-48 Add/Drop-Rings Terminals in a ring network or all the network elements in a SONET subnetwork (for example, DDM-2000 Multiplexer).

Grooming

The rearrangement of STS-1 tributaries within an STS-3 tributary. DS3 and EC-1 signals may be rearranged within an STS-3 tributary using time slot assignment with STS-1 granularity.

H

Hardware Ready

The shelf, connector, and backplane have been designed to accept hardware (circuit packs) that is not available yet. Additional cables may be required.

Headend

Refers to the transmitting end where a signal originates.

Holdover

An operating condition of a network element in which its local oscillator is not locked to any synchronization reference but is using storage techniques to maintain its accuracy with respect to the last known frequency comparison with a synchronization reference.

I

IMTV

Interactive Multimedia Television.

I/O

Input/Output.

IR

Intermediate Reach.

IS

In Service — A memory administrative state for ports. IS refers to a port that is fully monitored and alarmed.

IS-3 Interface Circuit Pack

The FT-2000 OC-48 low-cost low speed (STS-3 rate) intraoffice optical interface.

ITM SNC

Integrated Transport Management Sub-Network Controller — A Lucent PF-2000 network management OS.

ITU

International Telecommunications Union — An international advisory committee under United Nations sponsorship that has composed and recommended for adoption worldwide standards for international communications (also refer to CCITT).

J

Jitter

Timing jitter is defined as short-term variations of the significant instants of a digital signal from their ideal positions in time.

L

LAN

Local Area Network.

LBA

Lightwave Booster Amplifier.

LBO

Line Buildout — An equalizer network that guarantees the proper signal level. Also see electrical line buildout and optical line buildout.

LCLAN

Line Controller Local Area Network — The internal local area network that provides communications between the System Controller circuit pack and the Line Controller circuit packs.

LDS

Lucent Directory Services

LED

Light-Emitting Diode.

Line

A bidirectional optical transmission line. In T1/Bellcore terminology, "line" refers to a transmission medium, together with the associated high speed equipment, required to provide the means of transporting information between two consecutive Network Elements, one of which originates the line signal and the other terminates the line signal.

LNCTL

The FT-2000 OC-48 Lightwave System Line Controller circuit pack performs line specific computations.

LOF

Loss of Frame — A failure to synchronize to an incoming signal.

LOHCTL

The FT-2000 OC-48 Lightwave System Overhead Controller - LAN circuit pack provides user access to the LAN SONET overhead channels.

LOP

Loss of Pointer — A failure to extract a good pointer from an STS-1 signal.

LOS

Loss of Signal — The absence of an adequate incoming signal.

LSSW

The FT-2000 OC-48 Lightwave System Low Speed Switch circuit pack performs low speed interface protection switching.

M

μm

Micrometer — 10^{-6} meters

Menu

A set of possible values for a parameter.

Midspan Meet

The capability to interface between two lightwave terminals of different vendors. This applies to high speed optical interfaces.

MJ

Major (alarm).

MML

Human-Machine Language.

MN

Minor (alarm).

Multiplexing

The process of combining several distinct digital signals into a single composite digital signal.

N

NCDRH

National Center for Devices and Radiological Health.

NE

Network Element — Refers to an FT-2000 OC-48 Repeater Bay or FT-2000 OC-48 Add/Drop-Rings Terminal in a network.

NE ACTY

Near-End Activity — An LED on the user panel that is lighted when an alarm or status condition exists at the local FT-2000 OC-48 Repeater Bay or FT-2000 OC-48 Add/Drop-Rings Terminal.

NEBS

Network Equipment-Building System.

NID

Node Identifier — A unique number from 0 to 15 used to identify an FT-2000 OC-48 Add/Drop-Rings Terminal in a bidirectional ring application. In Release 6 and later releases, the NID is automatically provisioned.

nm

Nanometer — 10^{-9} meters.

NMA

Network Monitoring and Analysis System — Bellcore's alarm surveillance operations system.

NMON

Not Monitored — A memory administrative state for ports. This refers to a port that is not monitored and will not transition to the IS state if a good signal is detected.

Node ID

Node Identifier — See NID.

Nonautonomous Indicators

The nonautonomous indicators are those indicators that are not subject to incoming signal alarm delay. These indicators include the circuit pack FAULT LEDs, all CIT reports, TBOS alarm and status points, TL1 command response messages, and the LEDs on the user panel (except CR, MJ, and MN).

Non-Preemptible Protection Access

Available on a per STS-3 or STS-1 tributary basis. This feature increases a nodes "service traffic" capacity at the expense of reducing bandwidth on the protection fiber. Tributaries that are used this way are themselves "non-protected" and are not preempted in the advent of a switch from the service fiber to the protection fiber.

Nonrevertive Switching

In nonrevertive switching, there is an active and standby line, circuit pack, etc. When a protection switch occurs, the standby line, circuit pack, etc., is selected causing the old standby line, circuit pack, etc., to become the new active line, circuit pack, etc. The original active line, circuit pack, etc., becomes the standby line, circuit pack, etc. This status remains in effect when the fault clears. Therefore, this protection scheme is "nonrevertive" in that there is no switch back to the original status in effect before the fault occurred.

NRZ

Nonreturn to Zero.

NSA

Non-Service Affecting.

NSAP

AddressNetwork Services Access Point Address — An automatically assigned number that uniquely identifies a Network Element for the purpose of routing DCC messages.

Null Modem

A null modem cable allows a CIT local access to the FT-2000 OC-48 Lightwave System via the DTE port on the interconnection panel of the Low Speed Shelf - System Controller or Repeater Shelf - System Controller.

O

O&M

Operation and Maintenance.

OALAN

Overhead Access Local Area Network — The internal local area network that provides communications between the System Controller circuit pack and the Overhead Controller circuit pack.

OAM&P

Operations, Administration, Maintenance, and Provisioning.

OC, OC-n

Optical Carrier — The optical signal that results from an optical conversion of an STS signal; that is, OC-1 from STS-1 and OC-n from STS-n.

OC3 Optical Interface Circuit Pack

The FT-2000 OC-48 Lightwave System OC3 Optical Interface circuit pack interfaces with one bidirectional OC-3 signal.

OC12 Optical Interface Circuit Pack

The FT-2000 OC-48 Lightwave System OC12 Optical Interface circuit pack interfaces with one bidirectional OC-12 signal.

OC48 RCVR

The FT-2000 OC-48 Lightwave System OC48 Receiver circuit pack interfaces with the incoming OC-48 high speed line (receive direction).

OC48 REGENR

The FT-2000 OC-48 Lightwave System OC48 Regenerator circuit pack regenerates one OC-48 signal.

OC48 TRMTR

The FT-2000 OC-48 Lightwave System OC48 Transmitter circuit pack interfaces with an outgoing OC-48 high speed line (transmit direction).

OHCTL (TERM)

The FT-2000 OC-48 Lightwave System Overhead Controller - Terminal circuit pack provides user access to the OC-48 SONET overhead channels.

OLS

OLS is a stand-alone optical multiplexing (up to 20 Gb/s per fiber) system. The OLS has its own telemetry, fault location, and performance monitoring capability.

Operations Interface

Any interface that provides information on the system behavior or control. These include the equipment LEDs, user panel, CIT, office alarms, and all telemetry interfaces.

Operations Interworking (OI)

The capability to access, operate, provision, and administer remote systems through CIT access from any site in a SONET network or from a centralized operations system.

Optical Line Buildout

An equalizer network between the FT-2000 OC-48 Add/Drop-Rings Terminal and the lightguide cross-connect panel (or equivalent). It guarantees the proper received signal level at OC48 RCVR circuit pack.

Original Value

The value given to a CIT provisionable parameter at the factory.

Original Value Provisioning

The original values are the values given to CIT provisionable parameters at the factory. At system start-up, the original values are copied and become the current values. These current values can be changed using local or remote provisioning. The original values can never be changed.

OS

Operations System — A central computer-based system used to provide operations, administration, and maintenance functions.

OSI

Open Systems Interconnection — Referring to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

OTDR

Optical Time Domain Reflectometer.

P

Parameter

A characteristic of the system that affects its operation.

Path

A path at a given rate is a logical connection between the point at which a standard frame format for a signal at the given rate is assembled and the point at which the standard frame format for the signal is disassembled.

Path AIS

Path Alarm Indication Signal — A path level code that is sent downstream in a digital network as an indication that an upstream failure has been detected and alarmed by some upstream equipment, if the upstream alarm has not been suppressed.

Path Terminating Equipment

Network elements in which the path overhead is terminated.

Path Trace Signal

The path trace signal is provided in the STS-1 path trace byte (J1) of the path overhead. The path trace signal is transmitted repetitively to verify the continuity of the STS-1 path. The DS3 circuit pack is the only low speed interface circuit pack that generates or terminates the STS-1 path overhead.

Path Unequipped Signal

The path unequipped signal is provided in the STS-1 path signal label byte (C2) of the path overhead. The path unequipped signal is transmitted to notify downstream equipment that the STS-1 path is incomplete (for example, a low speed interface slot in the AUTO state or the absence of a valid cross-connection). The DS3 circuit pack is the only low speed interface circuit pack that terminates the STS-1 path overhead.

Path Yellow Signal

A maintenance signal used to indicate the presence of an alarm, detected at the remote terminal, in the path originating locally. Also, refer to the path remote defect indicator $\wedge$ (RDI-P) signal.

Payload Pointer

The offset in bytes from the Pointer Action Byte (H3) to the beginning of the synchronous payload envelope.

PC

Personal Computer.

PCN

Product Change Notification — Product change notifications are issued to notify customers that in-service product changes are required to correct an existing or potential problem. Product change notifications are issued through the Design Change Management System.

Phase Locked

An operating condition of a network element in which it is locked to an external reference. (Also referred to as Externally Timed in Release 5 and later releases.)

Platform

In the FT-2000 OC-48 Lightwave System, a platform is a family of equipment and software configurations designed to support a particular set of applications.

Plesiochronous Network

A network that contains multiple subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant.

PLL

Phase Locked Loop.

PM

Performance Monitoring — Measures the quality of service and identifies degrading or marginally operating systems (before an alarm would be generated).

POH

Path Overhead — Overhead assigned to and transported with the payload until the payload is demultiplexed. It is used for functions that are necessary to transport the payload.

Preemptible Traffic

Also called "Extra Traffic"/ Traffic, which has a lower priority than that carried on the service fiber. Low priority (unprotected) traffic that is carried on a protection fiber and is subject to being dropped — if the service fiber should fail and a protection switch occurs.

Preprovisioning

The capability to provision a slot before installing a circuit pack.

Primary Node

The primary node is the interconnecting node in the Dual Ring Interworking application where a 1-way-dri cross-connection has been entered. When a fault occurs, the through cross-connection at the primary node switches to the active state, and the add cross-connection switches to the standby state.

Proactive Maintenance

Refers to the process of detecting degraded conditions not severe enough to initiate protection switching or alarming, but indicative of an impending signal fail or signal degrade defect.

Provisioning

Assigning a value to a parameter in memory.

PSC

Protection Switch Counts — The number of times that a protection switch has been performed. The protection switch counts are monitored for the OC-48 line and OC-3 line.

PVC

Permanent Virtual Circuit.

PWR

Power.

R

RBP

Receive Byte Processor — A device on the OC48 RCVR and OC48 REGENR circuit packs.

RDI-L Signal

Line Remote Defect Indication Signal— An indication returned to a transmitting terminal that the receiving terminal has detected an incoming failure. This is new terminology adopted by the T1M1 committee for the SONET environment, which replaces the far-end-receive-failure (FERF) signal. If the RDI-L signal is integrated for a specified period of time, it becomes a remote failure indication (RFI) signal (a defect becomes a failure). Also refer to RFI.

RDI-P Signal

Path Remote Defect Indicator — A maintenance signal inserted toward the OC-48 line by the DS3 circuit pack to show the presence of an alarm, detected at the remote terminal, in the path originating locally. This is new terminology adopted by the T1M1 committee for the SONET environment, which replaces the path yellow signal. If the RDI-P signal is integrated for a specified period of time, it becomes a remote failure indication (RFI) signal (a defect becomes a failure). Also refer to RFI.

RDS

Ring Diversity Switch.

Reactive Maintenance

Refers to detecting defects/failures and clearing them.

Revertive Switching

In revertive switching, there is a service and protection high speed line, circuit pack, etc. When a protection switch occurs, the protection line, circuit pack, etc., is selected. When the fault clears, service "reverts" back to the original service line. Also see 1x1 Line Protection.

RF

Raio Frequency.

RFI

Remote Failure Indication — A signal that alerts upstream STS-1 path terminating equipment that a downstream failure has been alarmed along the STS-1 path. This action prevents multiple alarms from being activated for the same failure.

RMS

Root Mean Square.

RPP

Reliability Prediction Procedure.

RTAC

Regional Technical Assistance Center — A Lucent Technologies organization that helps customers maintain installed systems.

RZ

Return to Zero.

S

SA

Service Affecting.

SAS

Severely Errored Frame/AIS Seconds — A second in which there is an out of frame or AIS defect detected in the DS3 signal received from OC-48 line (DS3 path).

SD

Signal Degrade — A provisionable parameter for the incoming OC-48 high speed signal and DS3 signal (from cross-connect panel) that determines the threshold at which a signal degrade condition is declared.

SDH

Synchronous Digital Hierarchy.

Secondary Node

The secondary node is the interconnecting node in the Dual Ring Interworking application where only a 2-way add/drop (or a 1-way add and a 1-way drop) cross-connection has been entered. The secondary node is adjacent to the primary node (also see Primary Node).

SEFS

Severely Errored Frame Seconds — The number of seconds during which an out-of-frame event occurred. The severely errored frame seconds are monitored for the ^STS-48 section, STS-3 section, and EC-1 section.

SES

Severely Errored Seconds — A second in which the coding violations detected reach a fixed threshold. The severely errored seconds are monitored for the OC-48 line, OC-3 line, STS-48 section, STS-3 section, STS-1 path, EC-1 line, and DS3 path.

SF

Signal Fail — Refers to a condition when an incoming signal's bit error rate exceeds a fixed value.

Single-Ended Operations

The capability to perform operations, administration, maintenance, and provisioning of remote network elements on a centralized basis.

Site Address

The confirmed F-byte address of the FT-2000 network element as reported on both the East and West lines for FT-2000 ADR Release 4.0 and later. The site address for the 1W line of the network element is derived from the auto-provisioning function based on the number of sections in the OC-48 line on the west side of the network element. The site address for the 1E line of the network element is always zero in a ring application. The site address consists of the line address and site number (for example, site-1e-0/site-1w-4), and is calculated with respect to the East side of the adjacent FT-2000 ADR node. Each FT-2000 ADR node will always label the East side as 1E-0.

SLM

Single Longitudinal Mode.

Software Ready

The software that runs on the FT-2000 OC-48 Lightwave System will accept, run, boot, and operate normally when future hardware (circuit packs) is installed.

SONET

Synchronous Optical NETwork — The American National Standards Institute's standard for broad-band optical fiber communications.

Source Node

The source node is the node in a ring where the low speed signals on an STS-3 tributary originate. The source node and destination node of an STS-3 tributary are always in the same ring. Also see Destination Node.

SPE

Synchronous Payload Envelope — A 125-microsecond frame structure composed of STS path overhead and bandwidth for the payload.

Squelch Map

A map (table) containing information for each cross connection in the ring and indicates the source and destination nodes for the low speed circuit that define the cross connection. This information is used to prevent traffic misconnection in rings with isolated nodes or arguments. (This term is sometimes referred to as "Ring Squelch Map").

Squelching

To avoid misconnected traffic when performing a 2-fiber ring protection switch, the FT-2000 OC-48 Add/Drop-Rings Terminal inserts STS-1 path AIS on protection tributaries for traffic that cannot be terminated because of node failures or multiple failures in the ring. Squelching is only performed by nodes that have an active protection switch.

Standby

Standby refers to a 1+1 protected OC-3 line that is not currently selected by the receiving terminal at either end as the payload carrying signal. (Also refer to Active.)

Status

Status is a condition that does not raise an alarm.

STS, STS-n

Synchronous Transport Signal — The basic logical building block signal with a rate of 51.840 Mb/s for an STS-1 signal and a rate of n times 51.840 Mb/s for an STS-n signal.

STS-1

This refers to the FT-2000 OC-48 Add/Drop-Rings Terminal internal electrical signal with an EC-1 format.

STS-1E

The FT-2000 OC-48 Lightwave System STS1 Electrical Interface circuit pack interfaces with up to three bidirectional EC-1 signals.

STS-1 Granularity

The FT-2000 OC-48 Add/Drop-Rings Terminal has an STS-1 time slot assignment capability that allows any service STS-1 tributary to be cross-connected to any service low speed port or to the same-numbered service STS-1 tributary in the opposite direction.

STS-1 Group

Three STS-1 signals in the same STS-3 signal.

Subnetwork

SONET networks with data communications channel connectivity. In Release 8.0 and later releases, the recommended maximum subnetwork size is 256 network elements.

Sync Messaging

A method whereby nodes within a FT2000 ring communicate their synchronization status with other nodes in the ring.

Synchronous

Refers to network elements that are timed from references traceable to a single timing source.

Synchronous Network

The synchronization of synchronous transmission systems with synchronous payloads to a master (network clock that can be traced to a single reference clock).

SYSCTL

The System Controller and System Memory circuit packs provide the highest level of system control for the FT-2000 OC-48 Lightwave System. The System Controller circuit pack provides overall administrative control of the system.

SYSTEMEM

The System Memory and System Controller circuit packs provide the highest level of system control for the FT-2000 OC-48 Lightwave System. The System Memory circuit pack provides memory support for the SYSCTL circuit pack.

T

T1X1 and T1M1

The *ANSI* committees responsible for telecommunications standards.

TA

Technical Advisory.

TARP

Target ID (TID)-to-Address Resolution Protocol — Section 8 of Bellcore standard GR-253, which specifies layer 4 of the OSI model, deals with how to translate the TID of TL1 messages to the NSAP. In FT-2000 ADR R8.0/R8.1, TARP (rather than Lucent Directory Services) will be used to support Multi-Vendor interoperability.

TBP

Transmit Byte Processor — A device on the OC48 TRMTR and OC48 REGENR circuit packs.

TCA

Threshold-Crossing Alert — A condition set when a counter exceeds a user-selected high or low threshold. A TCA does not generate an alarm but is available on demand through the CIT.

TEC

Thermo-Electric Cooler.

TG3 (DS1)

The FT-2000 OC-48 Lightwave System Timing Generator, Stratum 3 - DS1 circuit pack generates clock signals for distribution to the transmit circuits. It operates in the free running, loop timed, through timed, externally timed, and holdover modes.

Through Timed

Refers to a network element that derives its transmit timing in the east direction (Line 1E) from a received line signal in the west direction (Line 1W) and the transmit timing in the west direction (Line 1W) from a received line signal in the east direction (Line 1E).

TID

Target Identifier — A provisionable parameter used to identify the FT-2000 OC-48 Lightwave System.

TIE

Time Interval Error — The variation of time delay of a given timing signal with respect to an ideal timing signal over a particular period of time.

TL1

Transaction Language 1 — A machine-to-machine communications language that is a subset of CCITT's human-machine language.

TOHCTL

The FT-2000 OC-48 Lightwave System Overhead Controller - Tributary circuit pack provides user access to the OC-3 data communications channel (DCC). The TOHCTL terminates up to eight OC-3 DCCs.

TOP

Task Oriented Practice.

TR

Technical Reference.

Tributary

A 51.84 Mb/s signal (STS-1 level) or 155 Mb/s signal (STS-3 level) within the FT-2000 OC-48 Lightwave System. The maximum capacity of an OC-48 signal is forty-eight 51.84 Mb/s tributaries (or sixteen 155 Mb/s tributaries).

TSA

Time Slot Assignment — This is a capability of the FT-2000 OC-48 Add/Drop-Rings Terminal that allows any service STS-3 tributary to be cross-connected to any service low speed interface slot or to the same-numbered service STS-3 tributary in the opposite direction. In Release 7 and later releases, the FT-2000 OC-48 Add/Drop-Rings Terminal has an STS-1 TSA capability that allows any service STS-1 tributary to be cross-connected to any service low speed port or to the same-numbered service STS-1 tributary in the opposite direction.

TSO

Technical Support Organization — Refer to as Customer Technical Support (CTS).

U

UAS

Unavailable Seconds — A second during which the monitored facility is unavailable. The unavailable seconds are monitored for the OC-48 line, OC-3 line, STS-1 path, EC-1 line, and DS3 path.

Upgrade

An upgrade is the addition of new capabilities (features) to an existing platform. This requires new software and may require new hardware.

V

Value

A number, text string, or other menu selection associated with a parameter.

VF Circuit

Voice Frequency Circuit — A 64-kb/s digitized signal.

VM

Violation Monitor — A provisionable mode for the DS3 output that causes parity violations to be monitored but not corrected before the DS3 signal is B3ZS encoded.

VMR

Violation, Monitor, and Removal — A provisionable mode for the DS3 output that causes parity violations to be monitored and corrected before the DS3 signal is B3ZS encoded.

VT

Virtual Tributary — A structure designed for transport and switching of sub-STS-1 payloads. There are currently four sizes: VT1.5 (1.728 Mb/s), VT2 (2.304 Mb/s), VT3 (3.456 Mb/s), and VT6 (6.912 Mb/s).

VT-G

Virtual Tributary Group — A 9-row by 12-column structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte interleaved with the VT-organized synchronous payload envelope.

W

Wander

The wander of a digital signal is defined as the *long term* variations of the significant instants of a digital signal from their ideal positions in time.

WDM

Wavelength Division Multiplexing.

Wideband Communications

Voice, data, and/or video communications from the DS0 rate (64 kb/s) to the DS1 rate (1.544 Mb/s).

Z

Zero Code Suppression

A technique used to reduce the number of consecutive zeros in a line-codes signal (B3ZS for DS3 signals).

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