Lucent Technologies
Bell Labs Innovations

DDM-2000 OC-3 Multiplexer Release 13.0 and Later

User/Service Manual — Volume I

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Notice

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

Mandatory Customer Information

Interference Information: Part 15 of Federal Communications Commission (FCC) Rules.

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

Security Statement

In rare instances, unauthorized individuals make connections to the telecommunications network through the use of remote access features.

In such event, applicable tariffs require that the customer pay all network charges for traffic. Lucent Technologies cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

Trademarks

Warranty

Lucent Technologies provides a 5-year limited warranty to this product. For more information, consult your local Account Executive.

Document Ordering Information

The ordering number for this document is 363-206-200. To order this document, call 1-888-582-3688. For more ordering information, refer to “How to Order Documents” in the section “About This Document.”

Customer Assistance and Technical Support

The Lucent Technologies Regional Technical Assistance Center (RTAC) provides a technical assistance telephone number which is staffed 24 hours a day. For technical assistance, simply call 1-800-225-RTAC in accordance with local operating procedures.

Documentation Support Telephone Number

Lucent Technologies provides a telephone number for you to report errors or to ask questions about the information in this document. The support telephone number is 1-978-960-6838.

Developed by Lucent Technologies Network Systems Customer Training and Information Products.

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About This Document

Purpose

This *DDM-2000 OC-3 Multiplexer User/Service Manual, Volume I,* covers Release 15.0 and provides the following:

- Detailed descriptive information to circuit pack level
- Technical specifications
- Commands and reports descriptions.

The *DDM-2000 OC-3 Multiplexer User/Service Manual (TOP), Volume II,* covers Release 15.0 and provides operation and maintenance (O&M) task oriented practice (TOP) supporting acceptance, turnup, and maintenance.

Intended Audiences

This user/service manual is used by training and by the end users responsible for O&M of the DDM-2000 OC-3 Multiplexer. It may be used by anyone desiring specific information about the DDM-2000 OC-3 Multiplexer O&M.

Reason for Reissue

This document, Issue 2, replaces the *DDM-2000 Multiplexer User/Service*, Issue 1. Descriptive, application and engineering information has been added for the DDD-2000 OC-3 Multiplexer through Release 15.0. The release descriptions are listed in Section 1, "Introduction."

Major changes in this issue are noted by bars (|) in the outermost margins. Major changes include adding information for the following:

- Software Release 15.0 for the DDM-2000 OC-3 Multiplexer
- Multi-Vendor Interworking with Target ID Address Resolution Protocol (TARP) for OC-3. See the following page for further information on TARP and its impact on Operations Interworking
- Large networks up to 256 nodes using Level 1 provisioning and Level 2 routing
- STS-3c 0X1 when shelf is equipped with 29G-U/29H-UOLIUs in MAIN slots and 22-Type OLIUs in FUNCTION UNITS slots
- STS-1/VT1.5 0X1 when shelf is equipped with 29-Type/24-Type/22-Type OLIUs in MAIN slots and 22-Type OLIUs in FUNCTION UNITS slots
- DCC provisioning on MAIN slots for OC-3/OC-12 to allow a remote OC-3 shelf to interconnect through its MAIN ring interfaces with a 1+1 extension on a host OC-3, OC-12, or OC-48 shelf
- Provisioning of asynchronous CIT port to run TL1, as well as the provisioning of the synchronous X.25 port to be used for asynchronous TL1 interface
- Remote alarm status using AGNE and Alarm Group concept
- 24H-U OLIU 1550 nm long reach OC-12 circuit packs
- 29G-U OLIU 1310 nm long reach OC-12 circuit packs
- 29H-U OLIU 1550 nm long reach OC-12 circuit packs
- 21G3-U OLIU 1310 nm long reach OC-3 circuit packs
- 22G4-U OLIU 1310 nm long reach OC-3 circuit packs
- BBG2B MXRVO to supply power to BBF6 T1EXT circuit packs in Group 4 or earlier shelves
- IMA LAN Interface circuit packs: BBF9 LAN 10/100 BaseT and BBF10 100 BaseFX circuit pack
- BBF4 TG3 Stratum 3 Timing Generator circuit pack (OC-3 and OC-12)
- BBF2C TGS circuit packs
- BBF6 T1EXT circuit pack with individual T1 facility loopback capabilities.

NOTE:
This User/Service Manual covers software releases up to and including TARP releases R15.0. The impact of introducing TARP will affect many areas of this document. Be aware that both TARP and the Lucent Directory Services (LDS) protocol operations are discussed, and that some operations and features available in pre-TARP releases will no longer be applicable in Releases 15.0.

Operations Interworking using TARP

Release 15.0 of the DDM-2000 OC-3 Multiplexer uses Telcordia Technologies' GR-253 Target ID Address Resolution Protocol (TARP). The Operations Interworking function provided by TARP offers an alternative to the Lucent Directory Services protocol (LDS)* but will impact operations in a number of ways. The following synopsis highlights TARP and its impact on network operations:

Why — Lucent Technologies offers TARP for Operations Interworking as a standard protocol recommended by Telcordia Technologies for TL1 OS applications to support interworking with other vendor's equipment (TARP is supported by multiple vendors).

When — DDM-2000 OC-3 Releases 15.0 use TARP for OI use (transmission through non-TARP NEs will not be affected). Future releases of DDM-2000 FiberReach (R4.0), FT-2000 (R9.1), and *SLC*-2000 (R4.7) will also be TARP compatible.

Impact — The following items list some of the areas impacted by the implementation of TARP. For more detailed information refer to the *DDM-2000 OC-3 Release 15.0 Software Release Description*, 363-206-231, Issue 1.

- Remote alarms are not reported via the DCC using the AGNE and Alarm Group concept in TARP OC-3 Release 13.x.
  TL1/X.25 OS systems will also retrieve remote network alarm information.
- Remote alarms will be reported via the DCC using the AGNE and Alarm Group concept in TARP Release 15.0. TL1/X.25 OS systems will also retrieve remote network alarm information.
- There will no longer be a DSNE, TBOS, Site, and NE information. TARP data cache will be maintained by each individual NE for its connectivity.
- CPro-2000 Release 10.0 and ITM SNC Release 10.0 will support DDM-2000 OC-3/OC-12 Releases 15.0.

* Release 11.1 and any future non-TARP releases will continue to support LDS.

- Releases 15.0 still support Lucent proprietary applications such as: remote Craft Interface Terminal (CIT) login, remote software download, and remote NE to NE automatic time/date synchronization at start-up.

Subnetworks of up to 256 NEs will be supported using subnetwork partitioning into multiple Level 1 areas.

Safety Instructions

Product Safety Labels

Important safety instructions are in this manual. In addition to the instructions on the following page, there are other safety instructions you must follow. These instructions involve lasers, lightwave optical cable and connectors, and precautions when handling circuit packs to prevent damage from electrostatic discharge. This manual also contains admonishments in the form of ***DANGERS***, ***WARNINGS***, and ***CAUTIONS*** which must be followed at all times.

These admonishments have the following definitions:

- ***DANGER*** indicates the presence of a hazard that *will* cause death or severe personal injury if the hazard is not avoided.
- ***WARNING*** indicates the presence of a hazard that *can* cause death or severe personal injury if the hazard is not avoided.
- ***CAUTION*** indicates 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.

Other important safety instructions that you should read are in the "Operation and Maintenance" section of this manual. Only trained personnel should perform the procedures in that section.

The alert symbol • appears throughout this product and in this manual to alert the user to the presence of important operating and maintenance (servicing) instructions for the DDM-2000 OC-3 Multiplexer.

Lightwave Safety Guidelines

General Laser Information

Lightwave/lightguide systems, their associated test sets, and similar operating systems use semiconductor laser transmitters that emit light at wavelengths between approximately 800 nanometers and 1600 nanometers. 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. The term monochromaticity means 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 LEDs in the 400-1400nm 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 energy that reaches the retina is approximately10^5 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 (that is, 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 retinal area.

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 four major Classes — Class I, II, IIa, IIIa, IIIb, or IV. Lasers are classified according to the accessibly emission limits and their potential for causing injury. Lightwave systems are generally classified as Class I, because, under normal operation conditions, all energized laser transmitting circuit packs are terminated on optical fibers which enclose the laser energy with fiber sheath, forming a protective housing. Also, covers are in place over the circuit pack shelves.

Lightwave Safety Precautions

In its normal operating mode, a 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 intensity) 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 mW 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.

CAUTION:
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, lightwave transmission systems are completely enclosed; nonetheless, the following precautions should be observed:

1. 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.
2. Under no circumstances shall lightwave/lightguide operations be performed by a technician before satisfactorily completing an approved training course.
3. 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 OPICAL INSTRUMENTS.

Safety Precautions for Unenclosed Systems

During service, maintenance, or restoration, a lightwave transmission system is considered unenclosed. Under these conditions, follow these practices:

1. Only authorized, trained personnel shall 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 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 are not considered magnifying lenses or optical instruments.)
2. Only authorized, trained personnel shall use the lightwave test equipment during installation or servicing since this equipment contains semiconductor lasers. (Some examples of lightguide test equipment are OTDR's, Hand-Held Loss Test Sets, and Feature Finders.)
3. Under no circumstances shall any personnel scan a fiber with an optical test set without verifying that all lightwave sources on the fiber are turned off.
4. All unauthorized personnel shall 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.

* Registered trademark of American Standards Institute, Inc.

The following precautions should be observed when handling circuit packs in order to prevent damage by electrostatic discharge:

- Assume all circuit packs contain solid state electronic components that can be damaged by ESD. Use only Lucent Technologies' manufactured UL recognized circuit packs in this system. Recognized circuit packs are listed in this user/service manual.
- 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. If a static-dissipating floor mat is used, be sure that it is clean.
- 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. If a static-dissipating table mat is used, be sure that it is clean.
- 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. Upon removal from the bay, immediately put circuit packs into static-safe packages.
- Whenever possible, maintain relative humidity above 20 percent.

* Registered trademark of The Dow Chemical Company.

To reduce the possibility of ESD damage, shelves are equipped with grounding jacks to enable personnel to ground themselves using wrist straps (see Figure A) while handling circuit packs or working on a shelf(s). The jacks for connection of wrist straps are located at the lower right-hand corner of each shelf and are labeled. When grounding jacks are not provided, an alligator clip adapter enables connection to bay frame ground.

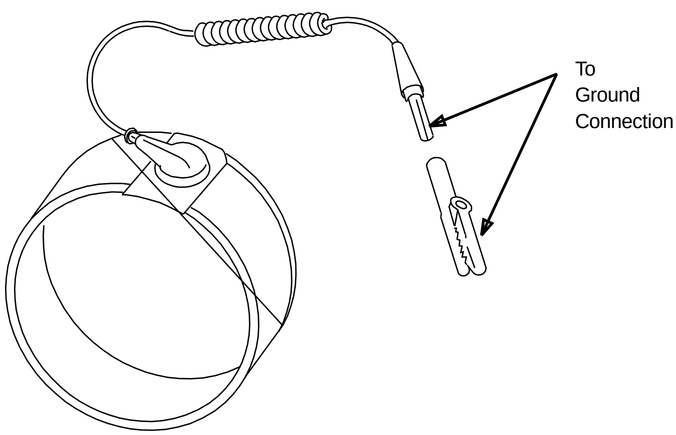

Figure A. Static Control Wrist Strap

IMPORTANT SAFETY INSTRUCTIONS

1. Read and understand all instructions.
2. Follow all warnings and instructions marked on the product.
3. Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.
4. Slots and openings in this product's back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered. This product should not be placed in a built-in installation unless proper ventilation is provided. For information on proper ventilation requirements, consult the "Equipment Installation Considerations" section of 363-206-204, *DDM-2000 OC-3 Multiplexer Installation Manual*.
5. This product should be operated only from the type of power source indicated on the marking label. For information on proper electrical distribution and power requirements, refer to the "Power" and "Technical Specifications" sections of this user/service manual.
6. Never push objects of any kind into this product through cabinet 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.
7. To reduce the risk of electrical shock, do not disassemble this product. Service should be performed by trained personnel only. Opening or removing covers and/or circuit packs may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electrical shock when the unit is subsequently used.
8. ***Caution: Disconnect two (2) power connections when removing power from the system.***
9. Use only Lucent manufactured UL recognized circuit packs in this system. Recognized circuit packs are listed in this user/service manual.

SAVE THESE INSTRUCTIONS.

IMPORTANT INSTALLATION SAFETY INSTRUCTIONS

1. Read and understand all instructions.
2. Installation and maintenance procedures must be followed and performed by trained personnel only.
3. All DS1 and DS3 interfaces should not leave the building premises unless connected to telecommunication devices providing primary or secondary protection, as applicable.
4. For information on proper mounting instructions, consult 363-206-204, *DDM-2000 OC-3 Multiplexer Installation Manual*.
5. Never install telecommunication wiring during a lightning storm.
6. Never install telecommunication connections in wet locations.
7. Never touch uninsulated telecommunication wires or terminals unless the telecommunication line has been disconnected at the DS1 or DS3 interface.
8. Use caution when installing or modifying telecommunication lines.

SAVE THESE INSTRUCTIONS.

Related Documentation

The following documents provide additional information about the DDM-2000 Multiplexers:

- Number: 365-576-130 (User Manual only) Release 7.0
  Number: 365-576-131 (User Manual & Software) Release 7.0

  Title: *CPro-2000 User Manual*

  Audience: Maintenance personnel

  Content: Using the tool to provision and maintain ring networks

- Number: 363-206-200

  Title: *DDM-2000 OC-3 and OC-12 Multiplexers Applications, Planning, and Ordering Guide*

  Audience: Network planners, equipment engineers, and sales teams

  Content: Features, applications, high-level description, operations, administration, maintenance, and provisioning (OAM&P), system planning, ordering, product support, reliability information, technical specifications, and a synchronous optical network (SONET) overview.

- Number: 363-206-201

  Title: *DDM-2000 OC-3 Multiplexer, System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-3 Multiplexers through Release 7.2

- Number: 363-206-204

  Title: *DDM-2000 OC-3 Multiplexer Installation Manual*

  Audience: Customers planning to install the equipment

  Content: Customer installation instructions

- Number: 363-206-206

  Title: *DDM-2000 OC-12 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-12 Multiplexers through Release 3.1

- Number: C107564270

  Title: *ITM SNC Users Guide*

  Audience: Operations personnel

  Content: Integrated Transport Management Subnetwork Controller information

- Number: 363-206-207

  Title: *DDM-2000 OC-12 Multiplexer and OC-12 Regenerator User/Service Manual*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, commands and reports, and O&M procedures for DDM-2000 OC-12 Multiplexers through Release 3.1 and OC-12 Regenerator through Release 2.0

- Number: 363-206-208

  Title: *DDM-2000 OC-12 Multiplexer Installation Manual*

  Audience: Customers planning to install the equipment

  Content: Customer installation instructions

- Number: 363-206-220

  Title: *DDM-2000 OC-3/OC-12 Multiplexer Circuit Pack Options Job Aid*

  Audience: Maintenance personnel

  Content: List of circuit pack options

- Number: 363-206-222

  Title: *DDM-2000 OC-3/OC-12 Multiplexer Acceptance Task List Job Aid*

  Audience: Maintenance personnel

  Content: Checklist of acceptance and turnup procedures

- Number: 363-206-223

  Title: *DDM-2000 OC-12 Regenerator — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters

- Number: 363-206-281

  Title: *DDM-2000 OC-3 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-3 Multiplexers Releases 8.1 and 9.1

- Number: 363-206-291

  Title: *DDM-2000 OC-12 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

Content: Abbreviated list of system commands and parameters for DDM-2000 OC-12 Multiplexers Release 5.x

- Number: 363-206-295

  Title: *DDM-2000 OC-12 Multiplexer User/Service Manual, Volumes I and II*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, commands and reports (Volume I), and operations and maintenance procedures (Volume II) for DDM-2000 OC-12 Multiplexer Release 7.0

- Number: 363-206-300

  Title: *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*

  Audience: Network Planners, equipment engineers, and sales teams

  Content: Features, applications, high-level description, operations, administration, maintenance, and provisioning (OAM&P), system planning, ordering, product support, reliability information, technical specifications, and a synchronous optical network (SONET) overview

- Number: 363-206-305

  Title: *DDM-2000 FiberReach Multiplexer Wideband/Narrowband TARP Shelf User/Service Manual*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, and O&M procedures for the DDM-2000 FiberReach Multiplexer Wideband Shelf.

- Number: 363-206-310

  Title: *DDM-2000 FiberReach Multiplexer Installation Manual*

  Audience: Users planning to install the equipment

  Content: Customer installation instructions

- 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 the Lucent Technologies Product Family 2000 systems, including DDM-2000 Multiplexers and FT-2000 OC-48 Lightwave Systems in multi-vendor subnetworks

- Number: 824-102-147

  Title: *Lucent Technologies 2000 Product Family Operations Interworking Guide*

Audience: System planners and engineers I

Content: Operations interworking information for the Lucent Technologies Product Family 2000 systems, including DDM-2000 Multiplexers and FT-2000 OC-48 Lightwave System

- Number: 824-102-151

  Title: *DDM-2000 Multiplexers Operations Systems Engineering Guide*

  Audience: Engineers

  Content: Operations systems engineering information for the DDM-2000 Multiplexers

- DDM-2000 OC-3 Drawings:

ED-8C724-10	OC-3 and OC-3/OC-12 Combined Bay Arrangements
ED-8C724-15	Cabling Plan (Rear Access)
ED-8C724-16	Cabling Plan (Front Access)
ED-8C724-20	Cable Assemblies
ED-8C724-21	Cable Assemblies
ED-8C724-30	DDM-2000 Shelf Assembly
ED-8C724-31	User Panel Assembly
ED-8C724-42	Release 13 Software Ordering
ED-8C724-43	Release 15 Software Ordering
ED-8C733-30	Fan, Filter, and Baffle Assemblies
SD-7C510-01	Application Schematic
T7C510-31	Interconnect Wiring (Rear Access)
T7C510-32	Interconnect Wiring (Front Access)
801-525-168	Floor Plan Data Sheets

- DDM-2000 OC-12 Drawings:

ED-8C724-10	OC-3 and OC-3/OC-12 Combined Bay Arrangements
ED-8C727-10	Typical Bay Arrangements
ED-8C727-15	Cabling Plan (Rear Access)
ED-8C727-16	Cabling Plan (Front Access)
ED-8C727-20	Cable Assemblies
ED-8C727-21	Cable Assemblies
ED-8C727-30	Shelf Assembly
ED-8C727-31	User Panel Assembly
ED-8C727-37	DDM-2000 OC-12 Release 7 Software Ordering
ED-8C727-41	DDM-2000 OC-12 Regenerator Release 2 Software Ordering
SD-7C513-01	Application Schematic
T7C513-31	Interconnect Wiring Diagram (Rear Access)
T7C513-32	Interconnect Wiring (Front Access)
801-525-168	Floor Plan Data Sheets

DDM-2000 equipment is also available in traditional loop enclosure arrangements, descriptions of which may be found in the following Lucent Technologies practices:

- Number: 363-205-000

  Title: *SLC® Series 5 Carrier System Ordering Guide — Loop Transmission Systems* (to be replaced by 363-205-010)
- Number: 363-205-010

  Title: *SLC® Series 5 System Applications and Planning Guide*
- Number: 363-208-000

  Title: *SLC®-2000 Access System, Applications, Planning, and Ordering Guide*
- Number: 363-208-001

  Title: *SLC®-2000 Access System, User/Service Manual*
- Number: 626-500-105

  Title: *80-Type Cabinets Ordering Information and Lettering Guide*

- Number: 626-500-115

  Title: *90-Type Cabinets Coding and Ordering Information*

The following documents provide additional information about related equipment:

- Number: 365-303-102

  Title: *DSX-3 Cross-Connect Bay, Description, Operation, and Maintenance Manual*

- Number: 365-301-130

  Title: *System III DSX-3/4, Planning, Engineering, Installation, and Operation — System Reference Guide*

- Number: 365-331-000

  Title: *DACS III-2000 Release 2.0 Applications, Planning, and Ordering Guide*

- Number: 365-340-800

  Title: *DACS IV-2000 Release 5.0 Reference Manual*

- Number: 365-575-100

  Title: *FT-2000 OC-48 Lightwave System Applications, Planning, and Ordering Guide*

- Number: 636-299-120

  Title: *LGX® Distribution System, Planning, Engineering, Installation, and Operation System Reference Guide*

- Title: MegaStar* 2000 Documents

Comcode 107585648	Installation Manual
Comcode 407397512	Schematic Package
Comcode 107585655	Reference Manual
Comcode 107585671	System Application Manual

* Registered trademark of Harris Corporation.

Related Training

The Customer Training and Information Products Centers at Altamonte Springs, Florida, and Lisle, Illinois, provides management courses for planning, engineering, and ordering, as well as training for telecommunications technicians in installation, operations, and maintenance. Suitcasing of these courses is available. Consult your local Lucent Technologies' Account Executive for more information or reservations.

Call **1-888-LUCENT8 (1-888-582-3688), prompt 2** for enrollment.

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

- Number: LW2211 (CD-ROM)

  Title: DDM-2000 OC-3/OC-12 Multiplexer Fundamentals

  Audience: A CD-ROM-based course for anyone interested in learning the fundamentals of operation of the DDM-2000 OC-3/OC-12 Multiplexers

  Content: General information about the DDM-2000 OC-3 and OC-12 Multiplexers including a product overview, applications, and architecture

- Number: LW2212

  Title: DDM-2000 OC-3 and OC-12 Multiplexer Applications and Architecture

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

  Content: General information about the DDM-2000 OC-3 and OC-12 Multiplexers including a product overview, applications, architecture, and deployment planning (a course prerequisite for LW2312)

- Number: LW2312

  Title: DDM-2000 OC-3 and OC-12 Multiplexer Equipment Engineering and Planning

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

  Prerequisite: LW2212

  Content: Information and guidelines required to plan and order DDM-2000 OC-3 and OC-12 Multiplexer equipment for loop feeder and interoffice applications

- Number: LW2604

  Title: DDM-2000 OC-3 Multiplexer Ring/Linear Networks, Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations, maintenance, and provisioning of ring and/or linear DDM-2000 OC-3 Multiplexers. On-site shelves are used for extensive hands-on experience.

- Number: LW2610

  Title: DDM-2000 FiberReach Wideband Shelf, Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in DDM-2000 FiberReach network functions

  Prerequisite: LW2212, LW2312, LW2603, or LW2608

  Content: Information supporting operations, maintenance, and provisioning of DDM-2000 FiberReach Wideband Shelf. On-site shelves are used for extensive hands-on experience.

- Number: LW2611

  Title: DDM-2000 FiberReach Multiplexer Self-Paced Course

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in DDM-2000 FiberReach network functions

  Prerequisite: LW2212, LW2312, LW2603, or LW2608

  Content: Information supporting system engineering and planning, applications, operations, maintenance, and provisioning of DDM-2000 FiberReach networks

- Number: LW2612

  Title: DDM-2000 OC-12 Multiplexer Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations, maintenance, and provisioning of the DDM-2000 OC-12 Multiplexer. Includes information on DDM-2000 OC-12 linear and ring applications. On-site shelves are used for extensive hands-on experience.

- Number: LW2614

  Title: 2000 Product Family Surveillance and Performance Monitoring

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations interfaces using X.25 links to an operations center

- Number: LW2618

  Title: Advanced Ring Network Applications, Operations, and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day operations of FT-2000 and/or DDM-2000 OC-3/OC-12 rings having dual ring interworking (DRI) traffic

  Prerequisites: LW2608 and LW2616

  Content: Information supporting operations, maintenance, and provisioning of DRI networks. On-site shelves are used for extensive hands-on experience.

Customer Technical Support (CTS)

CTS is available through a toll-free technical assistance number. Lucent maintains a highly-skilled, multi-tier support structure consisting of regional engineers, product specialists, and system designers to support your network equipment. All levels of technical expertise may be called upon to solve the customer problem (refer to Figure B).

The CTS organization provides remote, diagnostic support. On-site assistance is available on a billable contract or time and material basis. Support services may include the following activities:

- Responding to all requests for assistance
- Tracking and maintaining visible ownership of all reported problems, from inception through resolution
- Analyzing and diagnosing reported problems
- Providing restoration and recovery service
- Providing preventive and/or circumvention measures
- Communicating the actions, plans, and problem status to the reporting customer
- Initiating action to establish Modification Requests (MRs) for design issues
- Writing and distributing technical bulletins (Urgent Problem Notification).

CTS services are available on a contract basis in three levels to meet varying customer needs: Preferred, Standard, and Basic Agreements. The Preferred level of support guarantees 24 x 7 (24 hour, 7 day-a-week) coverage of the customer's network. Guaranteed performance commitments for response, service restoration, and problem resolution times are validated by published Service Performance Reports. The Standard level of support guarantees 8 x 5 (8 hour, 5 day-a-week) coverage. Performance commitments are also validated by Service Performance Reports. Out-of-hours support is available for an additional fee. The Basic level of support guarantees 8 x 5 coverage with hourly billing for each support call. Out-of-hours coverage is available with additional fees.

When the customer experiences a problem, the initial point of contact within Lucent is the Regional Technical Assistance Center (RTAC). RTAC is divided into three regions covering North America: region East (includes Canada), region South, and region West. They can be reached by calling 1-800-CAL-RTAC (1-800-225-7822). Lucent works with the customer to define the problem and determine its severity. Problems are worked during the customer's contracted coverage period. By prior agreement, service-affecting problems are worked immediately regardless of contracted coverage with billing reconciliation if required. Acting as a single point of contact with the customer, the RTAC engineer will involve all necessary tiers of support to solve the customer problem.

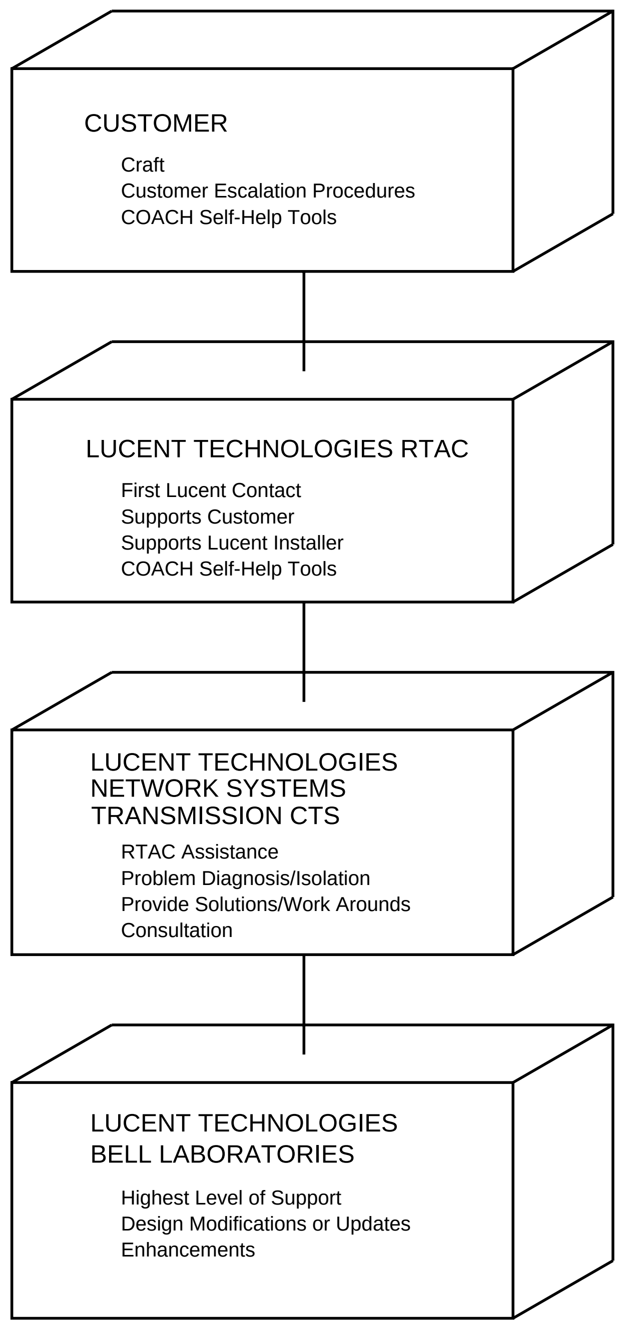

Figure B. Customer Support Levels

The following COACH tools are available to the user:

- Diagnostic Dictionary

  The diagnostic dictionary contains histories of previously encountered problems and 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 COACH, the News and Bulletins tool displays bulletins containing urgent information related to 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 COACH 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.

- COACH User's Guide

  COACH supplies an on-line version of its User's Guide. The COACH User's Guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

For information on obtaining a COACH login, contact:

COACH Software Development
Lucent Technologies
1600 Osgood St.
North Andover, MA. 01845

Telephone: **1-800-238-4021**

The RTAC and CTS organization strive to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, the RTAC and CTS organization provide the best possible customer support.

Engineering and Installation Services

The Lucent Technologies Customer Support and Operations (CS&O) organization provides customers with quality product support services. Whether you need assistance in engineering, installation, normal system maintenance, or disaster recovery, the support staff provides you with the quality technical support you need to get your job done. Each segment of the CS&O organization regards the customer as its highest priority and understands your obligation to maintain quality service for your customer.

Within the CS&O organization, the Engineering and Installation Services group provides a highly skilled force of support personnel to provide customers with quality engineering and installation services. These engineering and installation specialists use state-of-the-art technology, equipment, and procedures to provide customers with highly competent, rapid response services. These services include analyzing your equipment request, preparing a detailed specification for manufacturing and installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

When the CS&O organization provides job records and installs the equipment, operationally affective changes to the system are automatically identified and applied to the system at no additional cost.

The Engineering and Installation Services group provides the customer with an individually tailored, quality-tested job that meets our published high standards and the customer's operational requirements. The group ensures that the customer's system order is integrated into a complete working system tailored to office conditions and preferences. This process provides for the customer's complete needs. It includes provisions for cabling, lighting, power equipment, and ancillary connections to local and/or remote alarm systems. The group will also respond to any customer changes that occur during installation.

All equipment engineered and installed by Lucent is thoroughly tested and integrated into a reliable system at cutover. Once approved by Lucent's Quality Assurance Test group, the system is turned over to the customer.

The group also provides any specialized engineering and installation services required for unusual or highly individualized applications. These services may include engineering consultations and database preparation. Your local Lucent Technologies’ Account Executive can provide more information about these services.

Customer Technical Support Enhanced Services

The goal of Lucent Technologies' Customer Technical Support Enhanced Services is to keep Lucent Transmission Systems products operating at maximum performance and to prevent problems from interrupting service to customers.

Typical Enhanced Services include:

- Network design, growth planning, and performance analysis
- Multivendor troubleshooting
- Network Integration
- Preventive and remedial maintenance
- Hardware and software upgrade services
- On-site maintenance programs
- Customized MOP (Method of Procedure) development.

For more information on Lucent Technologies' Customer Technical Support Services, contact your Lucent Technologies' Account Executive.

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The Lucent Technologies Customer Training and Information Products organization provides a contact to report errors or to ask questions about information in this document. The document support telephone number is **(1-800-645-6759)** (Monday through Friday, 8:00 a.m. to 4:00 p.m. EST).

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RBOC/BOC	Process through your Company Documentation Coordinator	

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Customer Training and Information Products
2400 Reynolda Road
Winston-Salem, NC 27106

You may also report errors or request changes to this document by calling the toll free number, **1-800-645-6759**, and giving the 9-digit document number.

Electronic Documentation

Documentation for the DDM-2000 OC-3 Multiplexer is now available in electronic form, on compact disk, read-only memory (CD-ROM). CD-ROM has many advantages over traditional paper documentation, including cost savings, search and retrieve capability, and the assurance of the most current documentation.

CD-ROM is available by annual subscription (on standing order).

- To order, call your Technical Information Resource Manager, your Lucent Technologies’ Account Executive, or the Lucent Customer Information Center**1-888-LUCENT8 (1-888-582-3688)**.

- For pricing information, contact your Lucent Technologies Network Systems' Account Executive or the Lucent Customer Information Center **1-888-LUCENT8 (1-888-582-3688)**.

  The CD-ROM Product Line Order Number for the All Access and Transport Products Grouping is 300-100-010.

- For technical information, call Lucent Technologies Documentation Support **(1-800-645-6759)**.

System Introduction

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1 System Introduction

Overview

This section introduces the Lucent Technologies 2000 Product Family and briefly describes the DDM-2000 OC-3 Multiplexer.

Lucent 2000 Product Family

Lucent Technologies is focused on a carefully planned and growing product family designed to provide total network solutions. The 2000 Product Family complies with the synchronous optical network (SONET) standard and builds on features and capabilities that customers have found to be useful and successful in networks, such as single-ended maintenance features and product upgrade capabilities. These 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 the significant elements of the Lucent Service Net-2000 Architecture.

Lucent's Service Net-2000 Architecture starts with the network as it exists today and provides real-world solutions to build upon your existing base. It also allows a graceful evolution from rigid wire centers to a network of flexible nodes. This network distributes intelligence to where it functions best.

The Service Net-2000 Architecture offers access bandwidth, service on demand, and self-healing network applications. Access bandwidth offers increased capacity, giving end-users the ability to access any desired service. This increased access bandwidth, provided over fiber, offers superior network reliability while opening up new revenue opportunities.

Service on demand offers high-capacity services implemented in short intervals. This application gives local exchange carriers the opportunity to generate new revenue faster by provisioning new services at a competitive "fast start" pace. At the same time, they help maintain the existing revenue base by increasing customer satisfaction. Service on demand also reduces start-up costs, thereby improving capital management.

The self-healing network application involves careful planning and provisioning of cross-product capabilities with the 2000 Product Family. At the core of this network is DACS III-2000 and DACS IV-2000 Cross-Connect Systems, the nerve center of interoffice transmission. The intelligent DACS III-2000 and DACS IV-2000 Cross-Connect Systems, working with the ITM XM Controller, can identify failed connections and reroute signals according to a preestablished recovery plan.

The Lucent 2000 Product Family includes the:

- DDM-2000 OC-3 Multiplexer
- DDM-2000 OC-12 Multiplexer
- DDM-2000 FiberReach Multiplexer
- FT-2000 OC-48 Lightwave System
- DACS III-2000 Cross-Connect System
- DACS IV-2000 Cross-Connect System
- ITM XM
- *SLC*®-2000 Access System
- Business Remote Terminal-2000 (BRT-2000)
- ITM SNC Sub-Network Controller.
- CPro-2000

DDM-2000 Product Family

The DDM-2000 Product Family includes the DDM-2000 OC-3 Multiplexer, the DDM-2000 OC-12 Multiplexer, the DDM-2000 FiberReach Multiplexer, and DDM-Plus. The DDM-2000 OC-3 and OC-12 Multiplexers are designed for loop (access), interoffice (transport), and customer location applications. They start with many of the proven features of Lucent's DDM-1000 Multiplexer and extend into the future with the flexibility of the SONET standard. The DDM-2000 OC-3 Multiplexer operates at 51 Mb/s,155 Mb/s or 622 Mb/s, the DDM-2000 OC-12 Multiplexer operates at 622 Mb/s, and the DDM-2000 FiberReach Multiplexer operates at 51 Mb/s. These multiplexers provide flexible and evolvable network solutions. With common operations practices and circuit pack reuse, your investment (for example, technician training, circuit pack inventory) is preserved as the network evolves to higher capacities and advanced topologies.

The DDM-Plus provides a cost-effective fiber extension from the DDM-1000 or DDM-2000 Multiplexers transporting one to four DS1s on a fiber pair, either in a 1x1 protected or unprotected configuration.

The DDM-2000 FiberReach Multiplexer is the newest member of the DDM-2000 product family. The DDM-2000 FiberReach Multiplexer is a full-service access product, combining a 48-line optical network unit with a complete DS1 interface product. DDM-2000 FiberReach is a SONET product that is "hosted" by either a DDM-2000 OC-3 Multiplexer or a *SLC*-2000 Access System. The extension from the host node is an OC-1 signal in a ring topology. The DDM-2000 FiberReach Multiplexer operates at 51.84 Mb/s. The DDM-2000 FiberReach Multiplexer can be used in DDM-Plus applications where increased capacity and interworking features are needed. See 363-206-300, *DDM-2000 FiberReach Applications, Planning, and Ordering Guide*, for more information.

The DDM-2000 OC-3 Multiplexer supports many network topologies, such as point-to-point, OC-3 fiber hubbing, and linear and ring DS1/DS3/EC-1 add/drop and OC-1, OC-3, and OC-12 rings with time slot interchange (TSI) in a single 8.5 inch high shelf. Each topology is supported with efficiency and a full complement of operations features. The DDM-2000 OC-3 Multiplexer provides integrated DS1 to OC-12 multiplexing.

The DDM-2000 OC-12 Multiplexer supports several stand-alone topologies, including point-to-point, hubbing, add/drop, and ring configurations. The DDM-2000 OC-12 Multiplexer also supports regenerator applications in balanced and unbalanced modes.

The DDM-2000 Multiplexers are designed for easy installation and operation. Centralized operations are supported by a full set of single-ended control and maintenance features. Integrated test capabilities and default provisioning simplify installation. Most tasks can be performed using a craft interface terminal (CIT) to give access to sophisticated provisioning, maintenance and reporting features.

A personal computer (PC) is needed to download software and to run the CPro-2000 graphical user interface tool software.

In this document, the term "DDM-2000 Multiplexer" is used to reflect the DDM-2000 OC-3, DDM-2000 OC-12, and DDM-2000 FiberReach Multiplexers. Since many features, functions, and circuit packs are common among these multiplexers, information generic to all multiplexers is presented with the DDM-2000 Multiplexer designation. Information specific to a multiplexer is described with the DDM-2000 OC-3, DDM-2000 OC-12, or DDM-2000 FiberReach designation, as appropriate.

Introduction to the DDM-2000 OC-3 Multiplexer

The DDM-2000 OC-3 Multiplexer is a single shelf SONET digital multiplexer. It is capable of multiplexing up to 84 DS1 signals, or 3 DS3 signals, or 3 EC-1 signals, or 6 OC-1 signals, or a combination of DS1, EC-1, and DS3, and OC-1 signals, into a SONET standard 51.84 Mb/s OC-1, 155.52 Mb/s OC-3 or 622.08 Mb/s OC-12 signal. The OC-1, OC-3, and OC-12 lines, all transmission-affecting circuit packs, and the –48 V DC power feeders may be optionally protected. The shelf can be equipped to serve many diverse network applications and supports a variety of operations interfaces for current and evolving network operations needs.

The DDM-2000 OC-3 Multiplexer is designed for loop (access), interoffice (transport), and customer location applications. The DDM-2000 OC-3 Multiplexer starts with many of the proven features of Lucent's DDM-1000 multiplexer and extends into the future with the flexibility of the SONET standard.

A single 8.5-inch high shelf supports a mix of DS1, DS3, OC-1, OC-3, OC-12, EC-1, OC-3c (STS-3c), and IS-3 signal interfaces, satisfying a wide range of lightwave terminal and SONET electrical multiplexer applications. It supports point-to-point, hubbing, DS1/DS3/EC-1 add/drop, STS-1 drop applications, ring networks and OC-1 extensions.

The DDM-2000 OC-3 Multiplexer is designed for easy installation and operation. Centralized operation is supported by a full set of single-ended operations (SEO), control, and maintenance features. Integrated test capabilities and default provisioning simplifies installation. Some tasks can be performed using faceplate LED displays and controls, while a CIT gives access to sophisticated maintenance, provisioning, and reporting features. A PC is needed to download software and to run CPro-2000 graphical user interface tool software.

Built-in maintenance capabilities support both installation and system operation. A DDM-2000 OC-3 Multiplexer can be fully tested and installed without external test equipment.

The DDM-2000 OC-3 Multiplexer has a phased release plan. This manual has been issued to introduce Release 13.0 and will be updated to cover additional releases as they become available.

DDM-2000 OC-3 Multiplexer Releases

Release Descriptions

The following paragraphs provide brief descriptions of the DDM-2000 OC-3 Multiplexer releases.

Release 2 and later features allow additional circuit pack configurations to activate hubbing and STS-1 linear drop applications. The TL1 message-based interface to Telecordia Technologies Network Monitoring and Analysis (NMA) operations system feature comes as part of the controller hardware and software which must always be furnished separately with Release 2 and later equipment.

Release 3.2 features include two new circuit packs (and associated software): the 22F intermediate reach optical line interface unit (OLIU), which provides full DS1 and DS3 add/drop capability and the BBF2B TGS circuit pack, which provides DS1 timing outputs. The DS1 timing output is derived from the OC-3 signal. Release 3 includes a security feature that offers security against unauthorized access to the CIT system functions. Logins, passwords, and user categories are provided. Security can be enabled or disabled.

Release 5.1 supersedes Release 5.0 (from this release on, odd feature numbers are for ring releases while even feature numbers are for linear releases) and is a two-fiber, virtual tributary (VT) path switched, ring release that requires the use of 22F OLIUs in the Main-1 and Main-2 slots of all shelves in the ring. Time slots must be reserved all the way around the ring limiting the ring capacity to 84 DS1s. The ring interfaces include DS1 low-speed, DS3 with STS-1 path protection switching and cross-connections, EC-1 low-speed with VT1.5 or STS-1 based cross-connections, or mixed DS1, DS3, and EC-1 interfaces with a total capacity not exceeding the OC-3 bandwidth.

Release 5.1 features include two new circuit packs (and associated software): the BBF3 DS1PM which provides DS1 performance monitoring and the BBG6 STS1E (EC-1) provisioned for low-speed operation. The DS1PM can be mixed with the DS1 circuit packs in the Low-Speed Group slots. The optional DS1 PM feature allows measuring of near-end performance and the extended superframe (ESF) far-end performance report of the incoming DS1 signal. This allows the service provider to determine the end-to-end performance of the DS1 signal. SONET synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork.

Release 6.0 supports linear applications with new features that include OC-3/OC-12 interworking using the open systems interconnection (OSI) 7-layer protocol stack over the data communications channel (DCC). The OSI 7-layer protocol stack refers to the OSI reference model, a logical structure for network operations standardized by the international standards organization (ISO). This OC-3c transport feature is used to interface with broadband terminals.

Release 6.0 includes one new circuit pack (and associated software): the BBG6 STS1E which provides a high-speed or low-speed EC-1 interface. The STS1E circuit packs are used in the Function Unit slots for EC-1 electrical multiplexer (high-speed) or EC-1 low-speed applications. The optional VT1.5 performance monitoring (PM) feature provides the PM of the V5 byte for errored seconds (ES), severely errored seconds (SES), and unavailable seconds (UAS). The optional DS1 PM feature allows measuring of near-end performance and the ESF far-end performance report of the incoming DS1 signal. This allows the service provider to determine the end-to-end performance of the DS1 signal. Enhanced security features include additional logins. The TL1 message-based interface, introduced in Release 2.0 and enhanced in subsequent releases, for centralized surveillance by NMA systems is enhanced in this release to allow Telcordia’s OPS/INE system to provide centralized flow through provisioning of ports and cross-connections.

Release 6.2 replaces Release 6.1 and includes linear optical extensions from an OC-3 ring and an automatic synchronization reconfiguration feature. Automatic synchronization reconfiguration provides the ability to automatically select another synchronization source and to automatically reconfigure the synchronization provisioning in the event of a synchronization source failure or a synchronization change in the network, for example, a fiber cut. The feature can be enabled or disabled. Additional TL1 messages support provisioning, maintenance, testing, PM, and security functions.

Release 6.2 includes *SLC*-2000 Release 3.1 and 3.2 interworking and channel state provisioning. Channel state provisioning is a capability provided on DDM-2000 Multiplexers that suppresses reporting of alarms and events during provisioning by supporting multiple states (automatic, in-service, and not-monitored) for VT1.5 and STS-1 channels.

Release 7.0 is an enhanced ring release. Release 7.0 supports a "drop and continue" feature which is used with DRI applications and an automatic synchronization reconfiguration feature. Release 7.0 features include two new plug-ins (and associated software): the 22D-U and the 22G-U OLIUs. The 22D-U OLIU provides a short-reach IS-3 with TSI optical interface between colocated OC-3 and OC-12 and *SLC*-2000 ring shelves. The 22G-U OLIU has the same functionality of the 22F OLIU but with a 23 dB outside plant loss budget allowing for spans of up to 51 km. The 22D-U and 22G-U OLIUs support signal degrade protection switching. The "U" designation for the 22D-U and 22G-U OLIUs means the OLIUs have universal optical connectors. These OLIUs have adapters that allow the use of *ST* ®, SC, or FC connectors on the faceplates. The 22D-U and

22G-U OLIUs can be used in all releases that currently support 22F OLIUs (Release 3.1 and later).

Release 7.1 is an enhanced ring release featuring interworking with an OC-12 ring and interworking with *SLC*-2000 Release 3.1 and 3.2 in a ring. Release 7.1's new features include channel state provisioning, STS-1 signal degrade protection switching, OC-12 VT1.5 path switched ring (ring 0x1 low-speed interface) optical interconnections between DDM-2000 OC-3 and OC-12 ring shelves (OC-3/IS-3), enhanced DS3 PM, and additional TL1 commands and enhancements.

Channel state provisioning is a capability provided on DDM-2000 OC-3 and OC-12 Multiplexers that suppresses reporting of alarms and events during provisioning by supporting multiple states (automatic, in-service, and not-monitored) for VT1.5 and STS-1 channels. The STS-1 signal degrade feature requires the 22G-U or 22D-U OLIUs and measures the BIP-8 (B3) parity violations and causes a protection switch to the alternate path if the provisioned bit error rate threshold is crossed. The OC-12 VT1.5 path switched ring (ring 0x1 low-speed interface) OC-3/IS-3 interface offers a significant advantage over the 1+1 protected OC-3/IS-3 interface for VT1.5 path switched ring applications. Ring (0x1) low-speed interface means two service lines (no protection lines) are used between the OC-12 Multiplexer ring and the OC-3 Multiplexer ring. Switching is not done on the DDM-2000 OC-12 Multiplexer; rather VT1.5 or STS-1 level switching is done at the DDM-2000 OC-3 Multiplexer.

Enhanced DS3 PM provides a collection (from the fiber or high-speed interface) of the DS3 parity-bit (P-Bit) and frame and multiframe (F&M) bit ES, SES, and UAS to the already provided coding violations and severely errored frame seconds (SESF). The feature is mainly used for DS3 tariff verification.

Release 7.2 is a ring release that provides OC-3 operations interworking with the FT-2000 OC-48 Lightwave System. It also allows interworking between the old controllers (BBG5 and BBG7) and the new controllers (BBG8/BBG8B and BBG9). DDM-2000 FiberReach (OC-1) extensions can be added to Release 7.1 rings by upgrading the rings to Release 7.2 and adding a Release 9.0 OC-3 host node. Only OC-3 DDM-2000 FiberReach host nodes need Release 9.0 software and the new controllers.

- New applications:
  - OC-3 operations interworking with FT-2000 OC-48 Lightwave System. Single-ended operations and DCC connectivity supported over OC-3 interfaces. Requires FT-2000 OC-48 Lightwave System Release 6.0 software.
  - OC-3/IS-3 DRI with VT1.5/STS-1 drop and continue. Single-ended operations and DCC connectivity between DDM-2000 systems or DDM-2000 and FT-2000 OC-48 Lightwave Systems in DRI applications.
  - Increased network size. A DDM-2000/*SLC*-2000/FT-2000 OC-48 Lightwave System subnetwork of 24 network elements (NE).

- New features:
  - — Multiple OS Gateway Network Element (GNE). In DDM-2000/*SLC*-2000 networks, more than one NE can be physically connected to X.25 allowing OSs to automatically select an alternate GNE in case of primary GNE failure. The feature also allows different GNEs to support different OSs simultaneously.
  - — Provisionable X.25 packet size of 128 or 256 bytes.
  - — Enhanced PM. Enhancements to DS1 and DS3 line and path PM to further support tariff verification. Enhanced DS3 PM requires the new BBG4B DS3 circuit pack.
  - — CPro-2000 R3.0, 4.0, 5.0, and 6.0.

Release 8.0 is a linear release using the new BBG8/BBG8B system controller and BBG9 overhead controller circuit packs.

- New applications:
  - — OC-3 operations interworking with FT-2000 OC-48 Lightwave System. Single-ended operations and DCC connectivity supported over OC-3 interfaces. Requires FT-2000 OC-48 Lightwave System Release 6.0 software.
  - — OC-3/IS-3 linear extensions from OC-12 rings. 1+1 linear OC-3 and IS-3 extensions from OC-12 rings.
  - — Increased subnetwork sizes. A DDM-2000/*SLC*-2000 subnetwork of 32 NEs. A mixed DDM-2000/*SLC*-2000/FT-2000 OC-48 Lightwave System/OC-3 Release 7.2 subnetwork of 24 to 32 NEs.
- New features:
  - — Multiple Operations System (OS) Gateway Network Element (GNE). In DDM-2000/*SLC*-2000 networks, more than one NE can be physically connected to X.25 allowing OSs to automatically select an alternate GNE in case of primary GNE failure. The feature also allows different GNEs to support different OSs simultaneously.
  - — Additional X.25 switched virtual circuits. Nine virtual circuits can be provisioned in any combination of switched and permanent virtual circuits for connections to OSs.
  - — Provisionable X.25 packet size of 128 or 256 bytes.
  - — Centralized operations over X.25 link. DDM-2000 CIT commands have equivalent TL1 commands. This allows centralized operations of DDM-2000 systems via the TL1/X.25 link as an alternative to CIT commands.

- New controllers. The new BBG8/BBG8B and BBG9 controller circuit packs provide expanded memory and processing capacity needed to support large networks. Feature enhancements available with the new controllers include:
  - Remote software download. Software can be downloaded from a PC connected to a DDM-2000/*SLC*-2000 NE to either the local or remote DDM-2000/*SLC*-2000 NE.
  - Electronic provisioning. Provisionable parameters are set by software, thus decreasing the need for DIP switches. CIT baud rate is provisioned automatically via autobaud detection.
  - User-assigned RT miscellaneous discretes increased from 15 to 21.
  - Upgrades to the new controllers can be done in service.
- Enhanced PM. Enhancements to DS1 and DS3 line and path PM to further support tariff verification. Enhanced DS3 PM requires the new BBG4B DS3 circuit pack.
- Enhanced security. General and reports-only users increased from 50 to 100. Lockout of nonpriviliged users and log of all login attempts is provided.
- Electrical facility loopbacks. DS1, DS3, and EC-1 equipment loopbacks of the incoming low-speed signal back towards the DSX.
- STS path trace. Provided in the J1 byte of the SONET path overhead to verify STS path continuity. Allows "labeling" of STS-1s and retrieval of the path by the "label." For example, "ABC #1." STS path trace requires the new BBG4B DS3 circuit pack.
- Provisionable AIS or unequipped conditions. Path AIS provisionable on a path basis. Provides user provisionable generation of AIS or path unequipped signal on a per-shelf basis. Useful in managing cross-connection provisioning if cross-connections are inadvertently deleted.
- Provisionable line and path AIS alarm levels. Alarm levels can be provisioned on a per-line or per-path basis.
- Brownout protection. If the voltage to the shelf drops below the safe operating voltage, the system will suspend normal operations and wait for safe operating voltage to return. Assuming a sufficient voltage level, an "L" will be displayed on the system controller (SYSCTL).

— SYSCTL optical faceplate latch. An optical switch on the BBG8/BBG8B SYSCTL circuit pack latch causes a suspension of controller operations and an "F" to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset.

— CPro-2000, ITM SNC. Release 8.0 is supported by CPro-2000 Releases 4.0, 5.0, and 6.0, and ITM SNC Release 2.1.

Release 8.1 is a linear release supporting *MegaStar*[*] 2000 SONET Radio. Release 8.1 requires the BBG8/BBG8B SYSCTL system controller and BBG9 or new BBG10 OHCTL overhead controller. Release 8.1 may be used for non-*MegaStar* 2000 applications when S1 byte synchronization messaging is desired. Release 8.1 will interwork with Releases 7.2 or 9.0.

- New Applications:
  - *MegaStar* 2000 SONET Radio. Part of Lucent Technologies and Harris-Farinon *MegaStar* 2000 Radio system supporting mixed fiber and radio topologies. *MegaStar* applications require the BBG10 OHCTL.
- New Features:
  - S1 Byte synchronization messaging. Uses the S1 byte of the SONET overhead to pass timing status information to different nodes in a loop-timed network. Synchronization messaging mode (S1 byte or K2 byte) is provisionable on a per OC-N basis.
  - CPro-2000, ITM SNC. Release 8.1 is supported by CPro-2000 Releases 5.0, 6.0, and ITM SNC Release 4.0.

Release 9.0 provides all of the features of Release 7.2 and is a ring release using the new BBG8/BBG8B system controller and BBG9 overhead controller circuit packs.

- New applications:
  - OC-3 DDM-2000 FiberReach host. An OC-3 shelf equipped with 27G-U dual OC-1 OLIUs that supports OC-1 ring extensions from an OC-3 ring, linear, or stand-alone network.
  - Automatic synchronization reconfiguration of timing from both Main and Function Unit C slots.
  - Increased subnetwork sizes. A DDM-2000/*SLC*-2000 subnetwork of 32 NEs. A mixed DDM-2000/*SLC*-2000/FT-2000 OC-48 Lightwave System/OC-3 Release 7.2 subnetwork of 24 to 32 NEs.

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* MegaStar is a registered trademark of Harris Corporation.

  - VT hairpin. Cross-connections are allowed between Function Unit A to Function Unit C and Function Unit B to Function Unit C. Optical extensions from Function Unit A slots are also allowed.
  - Dual homing. Ring (0x1) low-speed interface cross-connections between Main and Function Unit slots for dual homing applications between DDM-2000 OC-3 Multiplexers and DDM-2000 FiberReach.
  - Locked cross-connections. Ring (0x1) low-speed interface or VT locked cross-connections between low-speed and high-speed time slots, locking ring traffic onto a designated ring rotation. Used in utility market applications.
- New features:
  - Additional X.25 switched virtual circuits. Nine virtual circuits can be provisioned in any combination of switched and permanent virtual circuits for connections to OSs.
  - Centralized operations over X.25 link. DDM-2000 CIT commands have equivalent TL1 commands. This allows centralized operations of DDM-2000 systems via the TL1/X.25 link as an alternative to CIT commands.
  - New controllers. The new BBG8/BBG8B and BBG9 controller circuit packs provide expanded memory and processing capacity needed to support large networks. Feature enhancements available with the new controllers include:
    - Remote software download. Software can be downloaded from a PC connected to a DDM-2000/*SLC*-2000 network element to either the local or remote DDM-2000/*SLC*-2000 NE.
    - Electronic provisioning. Provisionable parameters are set by software, thus decreasing the need for DIP switches. CIT baud rate is provisioned automatically via autobaud detection.
    - User-assigned RT miscellaneous discretes increased from 15 to 21.
    - Upgrades to the new controllers can be done in service.
  - Enhanced PM. Enhancements to DS1 and DS3 line and path PM to further support tariff verification. Enhanced DS3 PM requires the new BBG4B DS3 circuit pack.
  - Enhanced security. General and reports-only users increased from 50 to 100. Lockout of nonpriviliged users and log of all login attempts provided.
  - Electrical facility loopbacks. DS3, and EC-1 equipment loopbacks of the incoming low-speed signal back towards the DSX.

- — STS path trace. Provided in the J1 byte of the SONET path overhead to verify STS path continuity. Allows "labeling" of STS-1s and retrieval of the path by the "label." For example, "ABC #1." STS path trace requires the new BBG4B DS3 circuit pack.
- — Provisionable AIS or unequipped conditions. Path AIS provisionable on a path basis. Provides user provisionable generation of AIS or path unequipped signal on a per-shelf basis. Useful in managing cross-connection provisioning if cross-connections are inadvertently deleted.
- — Provisionable line and path AIS alarm levels. Alarm levels can be provisioned on a per-line or per-path basis.
- — OC-1 line state provisioning. A capability provided on DDM-2000 OC-3 Multiplexers that suppresses reporting of alarms and events by supporting multiple states (in-service and not monitored) for OC-1 lines.
- — Brownout protection. If the voltage to the shelf drops below the safe operating voltage, the system will suspend normal operations and wait for safe operating voltage to return. Assuming an insufficient voltage level, an "L" will be displayed on the SYSCTL.
- — SYSCTL optical faceplate latch. An optical switch on the BBG8/BBG8B SYSCTL circuit pack latch causes a suspension of controller operations and an "F" to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset.

Release 9.1 is a ring release which provides all the features of Release 9.0 and requires the BBG8/BBG8B and BBG9 or BBG10 controller hardware. In addition, Release 9.1 supports the following applications and features:

- New Applications:
  - — *MegaStar* 2000 SONET Radio. Part of Lucent Technologies and Harris-Farinon *MegaStar* 2000 Radio system supporting mixed fiber and radio topologies. *MegaStar* 2000 applications require BBG10 OHCTL.
  - — Extended FiberReach topologies. Using the new 27G2-U OLIU and Release 2.0 or 2.1 of FiberReach, Release 9.1 supports:
    - Hairpin single and dual 0x1 cross-connects between OC-1s within the same 27G2-U OLIU.
    - Hairpin single and dual 0x1 cross-connects between 27G2-U OLIUs in different function units.
    - Pass-through cross-connects for an OC-1 ring terminated on 27G2-U OLIUs in a function unit.
    - Mixing of all supported cross-connect types.

- New Features:
  - — S1-byte Synchronization Messaging. Uses the S1 byte of the SONET overhead to pass timing status information to different nodes in a loop-timed network. Synchronization messaging mode (S1 byte or K2 byte) is provisionable on a per-OC-3 basis.
  - — Enhanced DS1 PM. Provides 15 minute bins for DS1 path and line PM data.
  - — Fourth Level of Security. A new Maintenance security level, which allows access to Reports and some maintenance activities is provided in addition to the three current levels of privileged, general, and reports-only.
  - — Quad-DS1 electrical loopbacks. Provides an electrical facility loopback of four DS1 interfaces from a given BBF1B or BBF3 DS1 circuit pack.
  - — Large networks. Supports DDM-2000 and FiberReach networks of up to 50 nodes.
  - — CPro-2000, ITM SNC support. Release 9.1 is supported by CPro-2000 Releases 5.0 and 6.0, and ITM SNC Releases 2.2 and 4.0.
  - — 27G2-U OLIU. The new 27G2-U OLIU supports the new cross-connects necessary to provide enhanced FiberReach topologies.

Release 11.0 is an enhanced ring release which provides all the features of Release 9.1. In addition, Release 11.0 supports the following applications and features:

- New Applications:
  - — OC-12 high-speed optics for OC-3 shelf. Increases ring capacity by providing low-speed DS1 and FiberReach services directly from an OC-12 ring via the OC-3 shelf. Minimizes need for back-to-back equipment. Supports mixing of OC-3 and OC-12 shelves on the same ring during upgrades.
  - — Enhanced FiberReach topologies. Supports a hairpin local drop of traffic from an OC-1 ring terminated on 27G2-U OLIUs in a function unit to a DS1/EC-1/OC-3 interface in the other function unit group. The 27G2-U is required for these applications. Release 11.0 also supports mixing of local drop, pass-through, and 0x1 cross-connect types.
  - — Multi-media Data Services: A new DS3 interface provides the flexibility to offer a full range of multi-media data services via embedded and new DDM-2000 networks. This full-solution offering

is made possible by interfacing DDM-2000 to any of the numerous commercially available data edge devices which provide the various data services interfaces.

— Native Mode LAN Interface. By deploying DDM-2000 with an adjunct LAN router/ATM switch, Release 11.0 provides a Native Mode LAN Interface. DDM-2000 offers up to 4 LAN ports per STS-1 of bandwidth. Point-to-point and point-to-multi-point service is provided. In a later release, this functionality will be integrated directly in the DDM-2000 shelf.

- New Features:

  — New OC-12 OLIU (24G-U) for OC-3 shelf. The new 24G-U OLIU provides OC-12 optics directly from the DDM-2000 OC-3 shelf. This allows the OC-3 shelf to support an OC-12 ring, with the low-speed inputs and capacity of the OC-3 shelf. The 24G-U OLIU provides visibility to the full STS-12 bandwidth and allows for selection of any traffic from any 3 STS-1s on the OC-12 ring for drop at the OC-3 shelf. Remaining traffic can be passed-through on the OC-12 ring.

  — Data Services Interface. A new DS3 circuit pack and cross-connect software provide the DDM-2000 interface to an external LAN router/ATM switch for providing Native Mode LAN or general data services via the SONET network.

  — Enhanced Software Download. The software upgrade from Release 9.1 to 11.0 and later releases provides a software installation or copy capability which allows compressed files containing the new software generic to be downloaded—locally or remotely—to the DDM-2000 system while the current version is still running. This enhancement reduces both the time the controller is unavailable and the time to download the software. When the appropriate command is initiated, the new generic is installed. Installation of the new generic can be scheduled, allowing coordination of cutover of several NEs in the subnetwork.

  — CPro-2000, ITM SNC support. Release 11.0 is supported by:

  CPro-2000 Release 6.0 and ITM SNC Release 4.0.

  — Frequency error monitoring. STS pointer justification performance monitoring and thresholding provide a means to detect frequency errors in the synchronization network.

DDM-2000 OC-3 Multiplexer Release 13.0

Release Description

NOTE:
DDM-2000 OC-3 Release 13.0 is NOT compatible with previous releases of DDM-2000 OC-3. Therefore, when upgrading a subnetwork, care should be taken to avoid isolating NEs that have not yet been upgraded to Release 13.0.

The following paragraphs provides a brief description of the DDM-2000 OC-3 Multiplexer Release 13.0.

Release 13.0 is an enhanced ring release which provides all the transmission features of previous DDM-2000 releases. In addition, Release 13.0 supports the following applications and features:

- New Applications:
  - Enhanced FiberReach topologies. Supports enhanced routing with the single OC-1 26G2-U OLIU. The 26G2-U, with built-in multiplexer capabilities, can drop DS1s without the need for the MXRVO Multiplexer or BBF5 Jumper circuit packs. The 26G2-U provides OC-1 ring pass-through, OC-1 ring hairpin single-homed and dual-homed, and OC-1 ring hairpin local drop applications.
  - Transmultiplexer DS3 path termination. The new TMUX circuit pack (BBG20) provides path termination functions for an M13 or C-bit parity DS3 signal. It demultiplexes the DS3 into 28 DS1s, performs DS1 PM, maps each DS1 into a VT1.5, and multiplexes the 28 VT1.5s into an STS-1.
  - High bit rate Digital Subscriber Line (HDSL). The HDSL circuit pack (BBF8) provides HDSL interface capability on the DDM-2000 OC-3 shelf. It allows the transport of T1 payloads, for up to 12,000 feet, over two metallic 24 AWG twisted-pair lines.[*]
  - Interworking with Tellabs *TITAN* [†] 5500/S Release 5.0 Digital Cross-Connect System.

* The HDSL circuit pack can also be installed in DDM-2000 OC-3 shelves running linear Releases 6.2 and later, and ring Releases 7.1 and later. Refer to information included with each circuit pack for provisioning instructions.

† *TITAN* is a trademark of Tellabs, Inc.

- New Features:
  - — Multi-Vendor Operations Interworking (OI) compatibility.
    - DDM-2000 is compatible with any other-vendor NEs that support Target ID Address Resolution (TARP) protocol, OSI on the DCC, IAO LAN, and TL1/X.25 as specified in Telcordia GR-253.
    - Compatible with Tellabs *TITAN* 5500/S Release 5.0 Digital Cross-Connect System, including TL1/X.25 OS access with *TITAN* serving as the TL1/X.25 GNE.
  - — Lucent 2000 Product Family OI compatibility.
    - Compatible with DDM-2000 OC-12 R7.0, FiberReach R3.0, and FT-2000 R8.0 (but not with earlier releases due to multi-vendor OI support).
    - DDM-2000 OC-3 R13.0 can serve as the TL1/X.25 GNE for FT-2000 R8.0 remote NEs.
  - — Large subnetworks.
    - Supports large subnetworks of up to 256 NEs by partitioning into multiple areas connected via Level 2 Intermediate Systems (ISs).
  - — IntrAOffice LAN (IAO LAN).
    - Provides an extension of the SONET DCC for operations data communications. All NE-to-NE features supported over the DCC are supported over the IAO LAN.
    - Supports ITM SNC software download to DDM-2000[*]
    - Supports ITM SNC as the TL1-GNE for DDM-2000.
  - — Stratum 3 timing generator circuit pack (BBF4).[†] The TG3 operates with an internal oscillator of ±4.6 ppm long term accuracy.
  - — STS-1 hairpin cross-connection.
  - — Single DS1 facility loopback using the BBF3B circuit pack.
  - — Intermediate node STS performance monitoring. This feature collects, reports, and thresholds PM status for the SONET STS-1 Path (B3) derived parameters at intermediate Network Element interfaces.

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* This feature will be useful when upgrading from DDM-2000 OC-3 R13.0 to later releases.

† Available third quarter 1998 for use with Release 13.0 and later.

- Alarm severity escalation. Allows the user to provision (enable/ disable) the alarming of service affecting/non-service affecting entities.
- CPro-2000, ITM SNC support. Release 13.0 is supported by:

  CPro-2000 Release 7.0; ITM SNC Release 5.0 (supports enhanced database backup and restore capabilities).
- Reports all active users through the DCC and X.25.
- Default TID. The default Target Identifier (TID) for R13.0 is LT-DDM-2000, instead of the previous default of Site#NE#.
- TL1 commands:
  - RTRV-CID-SECU (also new CIT command RTRV-SECU) to report the active user logins.
  - RTRV-LOG to report the 500 most recent events in the history log (equivalent to existing CIT command RTRV-HSTY).
  - ENT-FECOM to provision DCC user-side/network-side settings and to enable or disable remote access via each DCC (equivalent to existing CIT command SET-FECOM which is now supported via CIT remote login and OS).
  - RTRV-FECOM to report the provisioned state of each DCC (equivalent to existing CIT command RTRV-FECOM).

Release 15.0 is an enhanced ring release which provides all the transmission features of Release 13.0. In addition, Release 15.0 supports the following applications and features:

- New Applications:
  - IMA LAN Interface. With the introduction of a new low-speed circuit pack, Release 15.0 provides a direct IMA LAN to WAN interface through the DDM-2000 OC-3.
    - The IMA LAN (BBF9 metallic or BBF10 optical) circuit pack provides an interface for one 10/100BaseT, 100BaseFX IEEE 802.3 standard compliant interface.
  - T1 Interface. The T1EXT (BBF6) circuit pack provides line termination for two bi-directional T1 line interfaces. Signals received from the T1 interface are mapped into SONET VT1.5 signals. The resulting signals are routed to the OLIU circuit packs. The T1EXT circuit pack is used only with the enhanced MXRVO (BBG2B) circuit pack in Groups 3 and 4 shelves. This can also be used in Group 3 shelves per C8854. Requires separate secondary lightning and surge protection in outside plant applications.

- — STS-3c 0x1 Configuration. This application provides the ability of transporting STS-3c services on OC-3c low speed FUNCTION UNITS optical interfaces that have been provisioned for 0x1 with 29G-U/29H-U OLIUs in MAIN and 22-Type OLIUs in FUNCTION UNITS slots. STS-3c routing is restricted to FUNCTION UNITS C.
- — STS-1/VT1.5 0x1 Configuration. This application provides the ability of transporting STS-1 services on OC-3 low speed FUNCTION UNITS optical interfaces that have been provisioned for 0x1 with 29/24/22-Type OLIUs in MAIN and 22-Type OLIUs in FUNCTION UNITS slots of the host OC-3 shelf.

■ New Features:

- — Support the OC-12 optics through the 29G-U/29H-U OLIU circuit packs in the Main Unit slots. The related features are as follows.
  - ■ STS-1/STS-3c/VT1.5 pass-through cross-connections on the 29G-U/29H-U OC-3 equipped shelves.
  - ■ STS-1 and VT1-5 cross-connections between MAIN slots equipped with the 29G-U/29H-U OLIU and FUNCTION UNITS slots, providing a fully flexible assignment of VT and STS-1 timeslots out of any of the 12 STS-1s that are available on the 29-type OLIU.
  - ■ In service upgrades to the new 29G-U/29H-U OLIU
- — Stratum 3 timing generator circuit pack (BBF4). The TG3 operates with an internal oscillator of ±4.6 ppm long term accuracy.
- — Support DCC provisioning on MAIN (identical/distinct) for OC-3/OC-12 ring interface. An Identical DCC mode will allow a remote OC-3 shelf to interconnect through its MAIN ring interfaces with a 1+1 linear extension on a host OC-3, OC-12, or OC-48 shelf using ring software.
- — Support the provisioning of asynchronous CIT port to run TL1, as well as the provisioning of the synchronous X.25 port to be used for asynchronous TL1 interface.
- — Remote alarm status (using the AGNE and the Alarm Group concept)
- — CPro-2000, ITM SNC support. Release 15.0 is supported by:

  CPro-2000 Release 10.0; ITM SNC Release 10.0.
- — Software download to upgrade BBF9 and BBF10 IMA LAN circuit pack.

Applications

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Overview

The DDM-2000 Multiplexers serve a wide range of service applications in a wide variety of network configurations economically and efficiently. The first part of this section, "Network Configurations," describes some of the network configurations in which the DDM-2000 Multiplexers and related products can be used to provide specific service applications. The second part of this section, "Service Applications," describes some of the many service applications that can be served with DDM-2000 Multiplexers.

Because the DDM-2000 Multiplexers are very flexible, most of the service applications described in the second part of this section can be served with many of the network configurations described in the first part. The particular network configuration used for a particular service application depends on many factors such as the physical locations involved, cost, mix of multiple services to be provided with a single network, required interconnections to other networks, and others.

Introduction

DDM-2000 Multiplexers provide the flexibility required for operation in today's changing telecommunications networks. With topology and capacity upgrades, a DDM-2000 network can be installed with minimum first cost and then easily grown to add new sites and new services. Many DDM-2000 circuit packs are common with other Lucent Technologies 2000 Product Family products, resulting in further savings as the network evolves.

The DDM-2000 OC-3 and OC-12 Multiplexers are also an ideal solution for private network and customer location applications. The DDM-2000 OC-3 and OC-12 Multiplexers comply with electromagnetic compatibility (EMC) requirements per FCC Title 47, Part 15, and safety requirements per *UL* 1459 for equipment in dedicated equipment rooms. The DDM-2000 Multiplexers also have Canadian Standards Association (CSA) Certification Standard C22.2 No. 225-M90. Standard access node configurations are available in Lucent's 51A, 80-type and 90-type BRT-2000 cabinets. Fiber distribution of DS1 services is supported with the DDM-Plus extension shelf or DDM-2000 FiberReach, which allows mixing of DS1 line repeater interfaces for embedded metallic facilities and protected quad DS1 optical interfaces. DS0 and Integrated Services Digital Network (ISDN) services are supported from the *SLC*®-2000 Access System through copper and fiber distribution.

The DDM-2000 FiberReach Multiplexer is the newest member of the DDM-2000 product family and can be used in all DDM-Plus applications where increased capacity and integrated operations, maintenance, and provisioning features are needed. Only representative DDM-2000 FiberReach Multiplexer applications are included in this section. For more application information, see 363-206-300, *DDM-2000 FiberReach Applications, Planning, and Ordering Guide*.

Network Configurations

This part describes many of the network configurations in which the DDM-2000 Multiplexers can be used. In addition to the configurations specifically described, many other combinations of these network configurations can be used to meet specific application needs.

To clarify interface terminology, the terms **single 0x1** and **dual 0x1** have been replaced with the term **ring (0x1) low-speed interface(s)** or simply (0x1). The terms single and dual are used in describing homing topologies. The term **1+1** has been replaced by the term **linear (1+1) low-speed interface(s)** or simply (1+1). To clarify timing terminology, the term **loop timing** is a special case of **line timing**. See the "Glossary" for definitions of these terms.

Path Switched Rings

The need to prevent service outage caused by network failure has created a new class of applications. The 2000 Product Family offers a wide range of self-healing network features that automatically protect against service outage caused by cable cuts and equipment failures, which in turn protect customers and generate increased revenue. These self-healing features include flexible DACS-based restoration with the *ITM XM* controller, FT-2000 OC-48 Lightwave System two- and four-fiber rings, DDM-2000 OC-3 and OC-12 virtual tributary 1.5 (VT1.5) and STS-1 path switched rings, and *SLC*-2000 Access System path switched rings.

DDM-2000 OC-3, *SLC*-2000 Access System, and DDM-2000 OC-12 self-healing rings offer the performance and administrative benefits demonstrated by the successful Lucent FT Series G Ring Diversity Switch. Since the DDM-2000 OC-3 and OC-12 path switched rings operate in an integrated, single-ended fashion, complex network-level coordination is not necessary to restore traffic. This means restoration is faster and more reliable. Furthermore, bandwidth administration and network reconfigurations (for example, adding or deleting nodes) can be easier because path switching does not require special time slot assignment rules.

A network which requires the bulk of its traffic to be dropped at a single node is an ideal application for path switched rings. A typical loop feeder network, where most traffic is between the subscriber loop to a central office, fits this mold. Such an application calls for the delivery of protected DS1 and DS3 service to customer locations. In many cases, where the network serves only voice traffic and DS1s, a DDM-2000 OC-3/*SLC*-2000 path switched ring is a perfect fit. If DS3 service or a mixture of DS1 and DS3 service is needed, multiple OC-3 rings or an OC-12 ring may be necessary. Cost, fiber availability, and bandwidth flexibility all play a part in determining whether a single OC-3 ring, multiple OC-3 rings, or an OC-12 ring will be the best network solution.

The DDM-2000 OC-3 and OC-12 VT1.5 or STS-1 path switched rings operate as shown in Figure 2-1(a.). Traffic entering a path switched ring node is sent onto both rotations of the ring. At the receiving node, the signal having the highest integrity (based on SONET path information) is selected and dropped as outgoing traffic. At intermediate nodes, the traffic is "passed-through" without changing the SONET path information. The DDM-2000 OC-3/OC-12's VT1.5/STS-1 Time Slot Interchange (TSI) capabilities make the provisioning of add/drop and pass-through traffic quick and easy.

The self-healing nature of the path switched ring is shown in Figure 2-1(b.). In this case, the fiber failure between nodes C and D causes node C to switch from the counterclockwise ring to the clockwise ring, thus maintaining service between node A and C.

In addition, the backup and restoral capability of CPro-2000 can be used to significantly reduce the effort and increase the accuracy of installing several complex ring shelves having similar or identical configurations. After manually provisioning the first node, CPro-2000 can be used to make a copy of the configuration. This copy can then be used to quickly and easily configure all of the remaining nodes using the restoral feature of CPro-2000. Using system backup and restoral in this fashion provides a much quicker and less error-prone installation than manual provisioning.

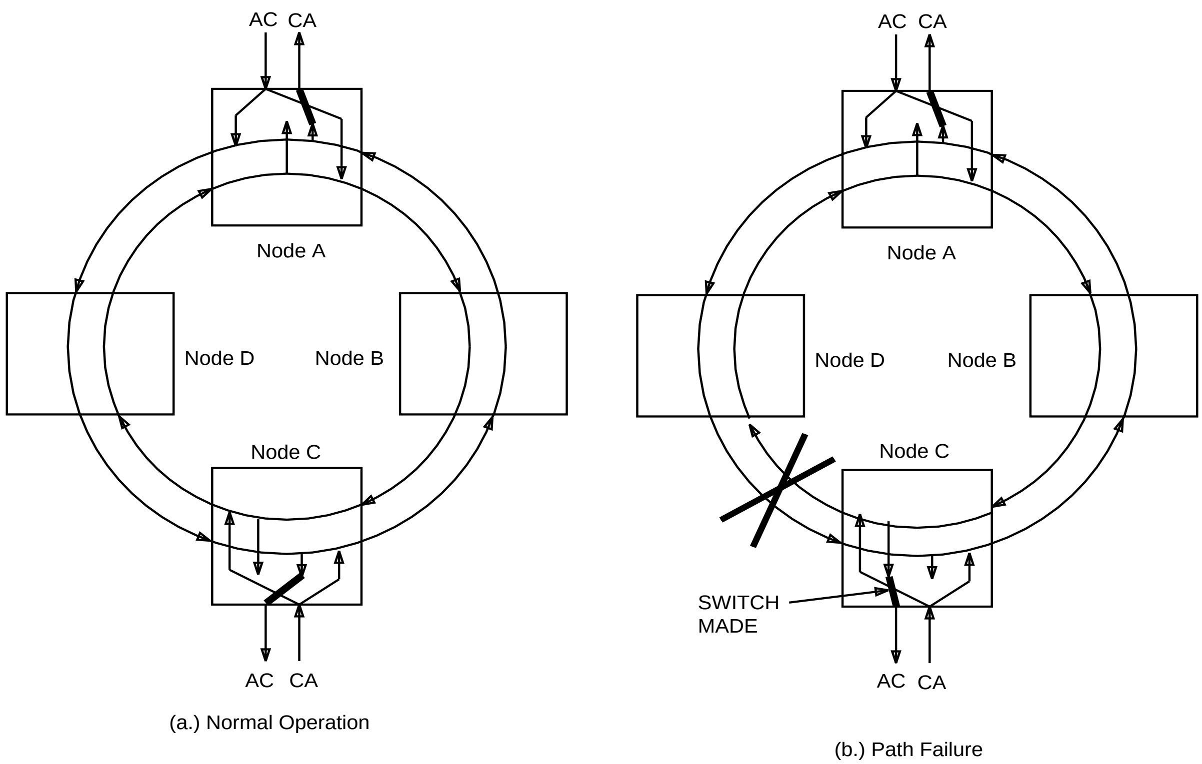

Figure 2-1. Path Switched Ring

OC-3 Path Switched Ring

The OC-3 path switched ring allows several remote sites to share the two-fiber ring facility back to the CO (Figure 2-2). The DDM-2000 OC-3 Multiplexer interfaces to the ring through the Main slots at the OC-3 rate and uses its programmable VT1.5/STS-1 TSI capability. Path switching can be done on VT1.5 paths, STS-1 paths, or a mixture of these. Up to 84 DS1s, 3 DS3s, 3 EC-1s, or equivalent combination can be added/dropped from the DDM-2000 OC-3 Multiplexer path switched ring at any node. Because of the ring's path protection scheme, time slots must be reserved all the way around the ring for all ring traffic, limiting the capacity of the ring to the OC-3 line rate. Like the DDM-2000 OC-3 add/drop topology, the TSI feature offers full flexibility in assigning signals between low-speed DS1, DS3, or EC-1 ports, and the high-speed interface at each node. The DDM-2000 OC-3 Multiplexer can easily adapt to unpredicted growth at a ring node.

Extensive equipment reuse between DDM-2000 OC-3 terminal, add/drop, and ring nodes offers a significant operational advantage. The DDM-2000 OC-3 Multiplexer ring shelf is the same shelf as used in terminal and add/drop applications. Also, circuit packs can be retained when upgrading a linear network to a ring.

The ring topology routes traffic between a CO site and a set of RT sites, as in the add/drop topology, while providing complete protection. In addition, only two OLIUs are needed per DDM-2000 OC-3 Multiplexer, which provides a cost savings over the add/drop topology. Traffic can also be routed between RT sites. The ring can start with as few as two nodes and grow to support many nodes through in-service node additions.

For protection against a CO failure, it may be desirable to include a second CO node in the ring. This dual homing architecture allows all services to be routed to the alternate CO while the first CO is out of service.

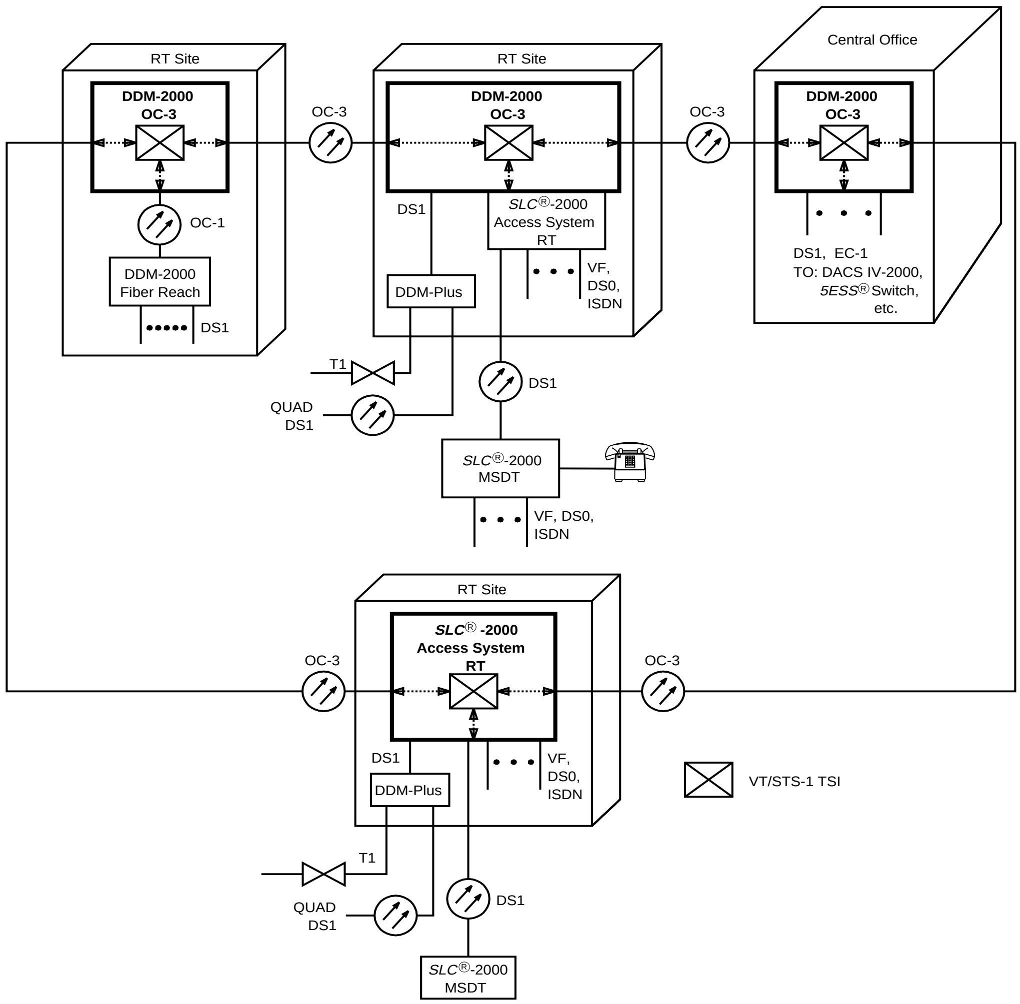

Figure 2-2. OC-3 Path Switched Ring

A DDM-2000 OC-3 Multiplexer VT1.5/STS-1 path switched ring is a very effective self-healing network topology for small cross-section interoffice networks such as outstate trunks. Low-density routes that primarily transport DS1 traffic are ideally suited to the DDM-2000 OC-3 Multiplexer path switched ring. DS3s/EC-1s may also be carried between offices on DDM-2000 OC-3 Multiplexers (Figure 2-3).

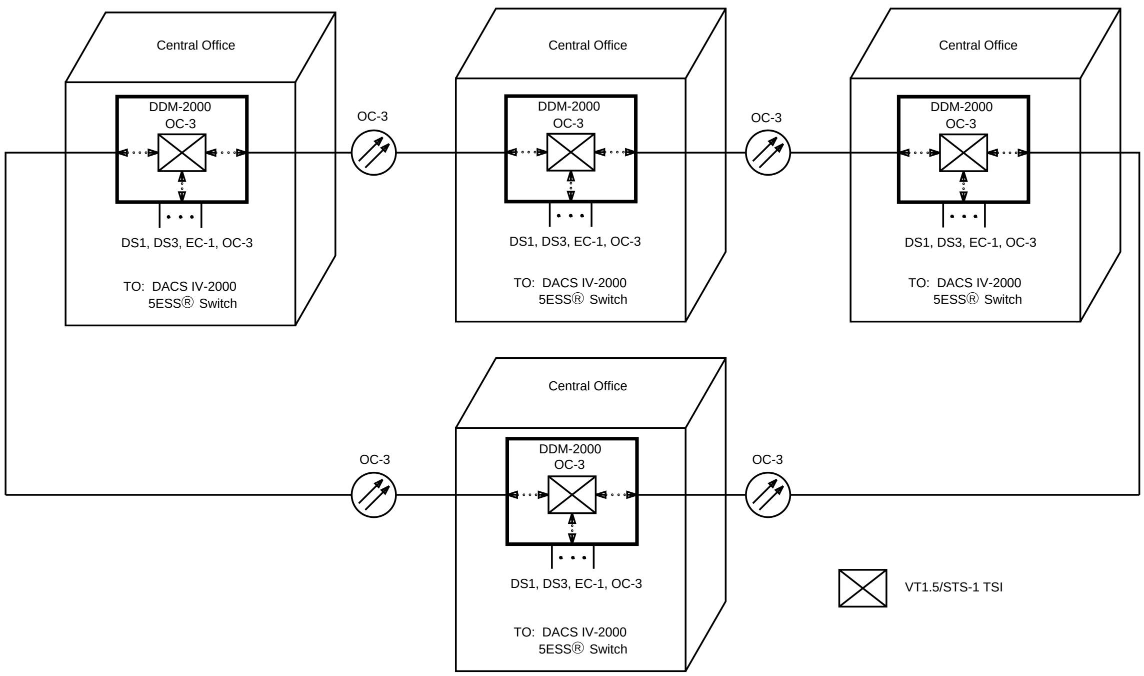

Figure 2-3. DDM-2000 OC-3 Path Switched Interoffice Ring

OC-12 Path Switched Rings

The DDM-2000 OC-12 Multiplexer provides STS-1/STS-3c level path protection switched ring capability. As shown in Figure 2-4, it provides transport of 12 DS3s, 12 EC-1s, 4 OC-3cs, or a mixture with path switching at the STS-1 level (STS-3c level for OC-3c traffic). Such a ring provides an economical, flexible, and reliable solution for loop feeder networks.

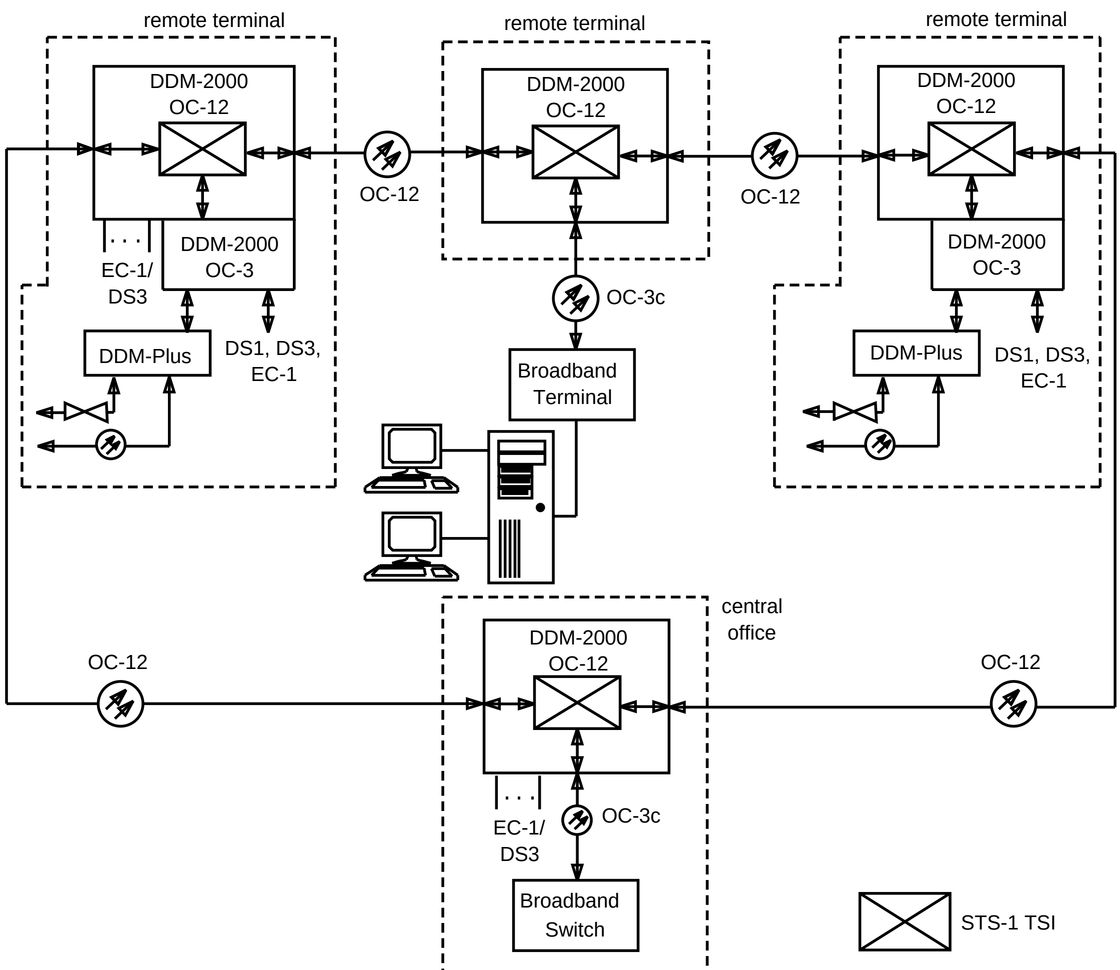

Figure 2-4. OC-12 Path Switched Ring — STS-1 Level Path Switching

Figure 2-5 shows how DDM-2000 OC-3 and OC-12 Multiplexers can be used together to provide a path switched ring operating simultaneously at the VT1.5, STS-1, and STS-3c levels. This ring is especially useful for loop feeder applications with large bandwidth needs. It can also be developed as a result of an upgrade from an OC-3 ring in an environment where growth has exhausted the bandwidth of the OC-3 ring.

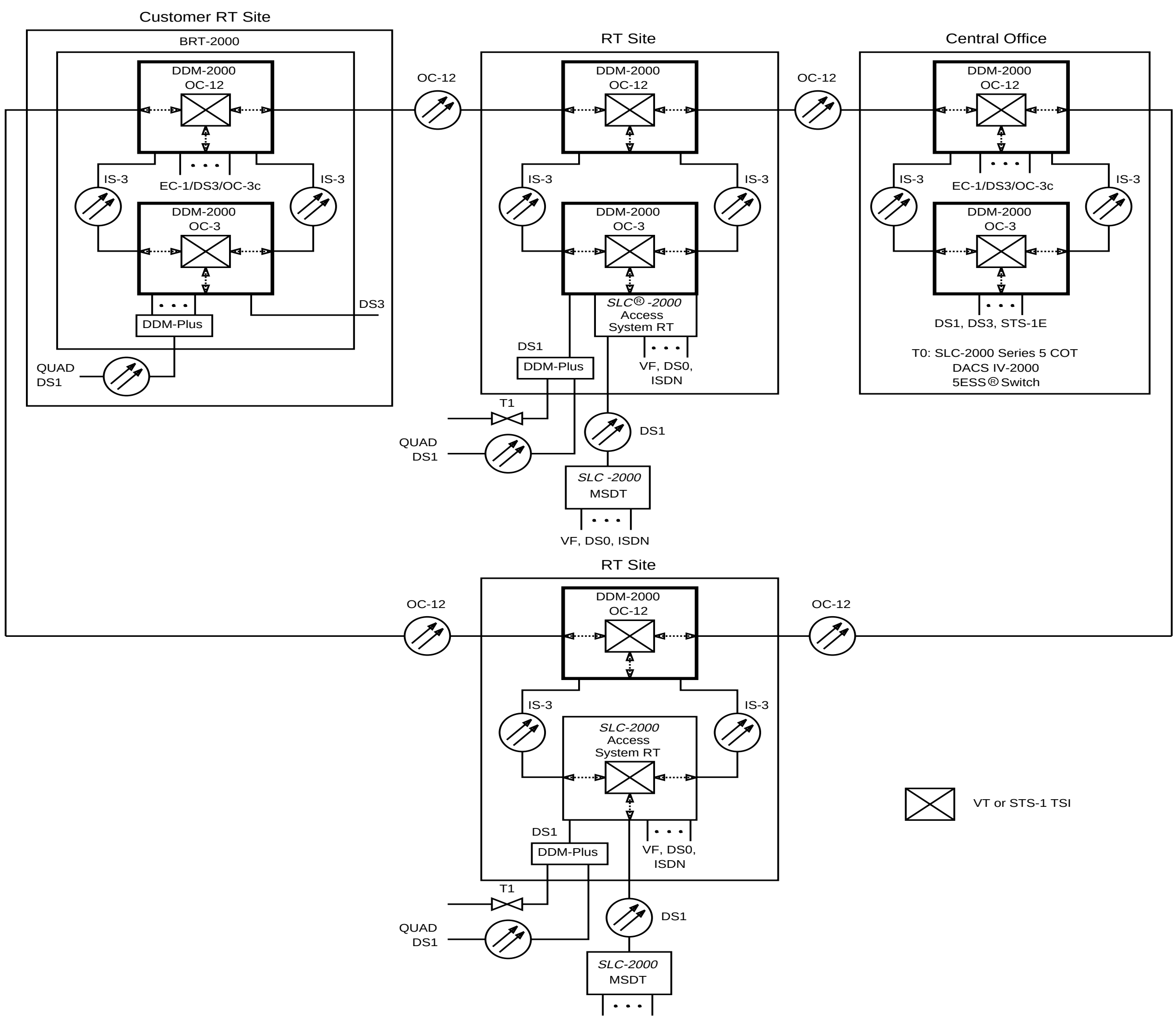

Figure 2-5. OC-12 Path Switched Ring Using OC-12 Multiplexer—Mixed STS-1 and VT1.5 Path Switching

Alternatively, a DDM-2000 OC-3 Multiplexer can be equipped with OC-12 optics. This option offers a cost effective solution at locations where the dropped traffic is primarily VT1.5 based and is accessed from any three of the 12 STS-1s. OC-12 and OC-3 multiplexers equipped with OC-12 optics can be mixed in the same OC-12 ring. The OC-12 multiplexers can be used at sites requiring DS3 and other higher bandwidth STS path-switched traffic, while the OC-3 multiplexer is used at sites requiring VT path access for DS1, FiberReach, etc. Figure 2-6 shows an OC-12 ring that includes both OC-3 and OC-12 multiplexers.

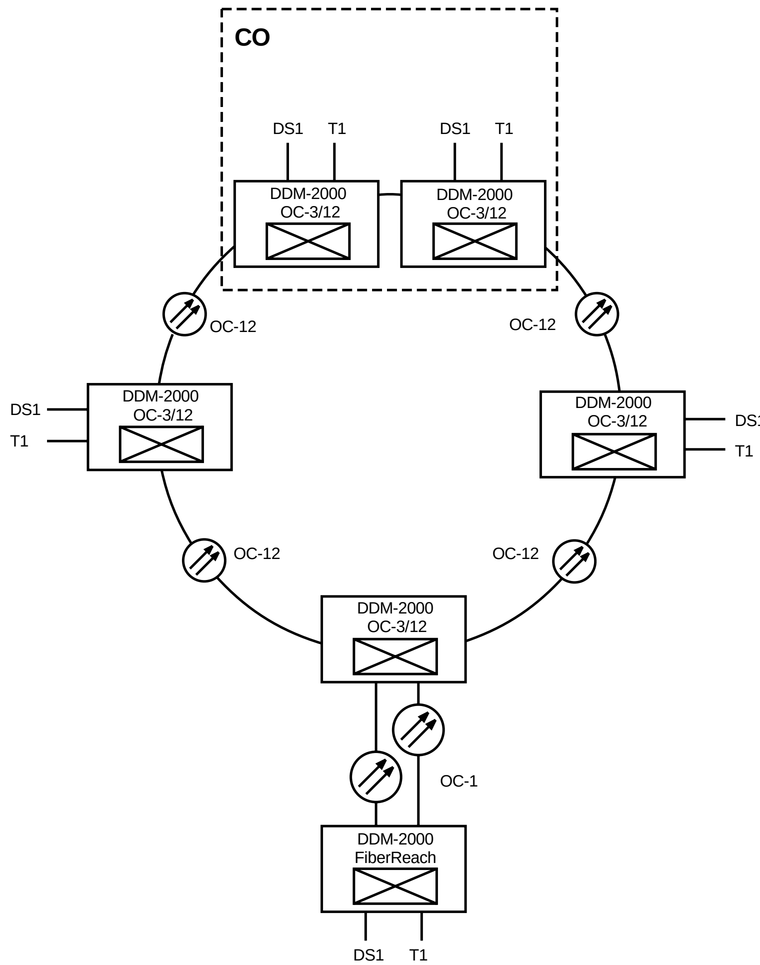

Figure 2-6. OC-12 VT Path Switched Ring Using DDM-2000 OC-3 Multiplexer With OC-12 Optics

Alternatively, a DDM-2000 FiberReach can be equipped with OC-12 optics. This option offers a cost effective solution at locations where the dropped traffic is primarily VT1.5 based and is accessed from any one of the 12 STS-1s. OC-12 and OC-3 multiplexers equipped with OC-12 optics can be mixed in the same OC-12 ring. The OC-12 multiplexers can be used at sites requiring DS3 and other higher bandwidth STS path-switched traffic, while the FiberReach multiplexer is used at sites requiring VT path access for DS1, T1, etc. Figure 2-7 shows an OC-12 ring that includes both OC-3, OC-12, and FiberReach multiplexers.

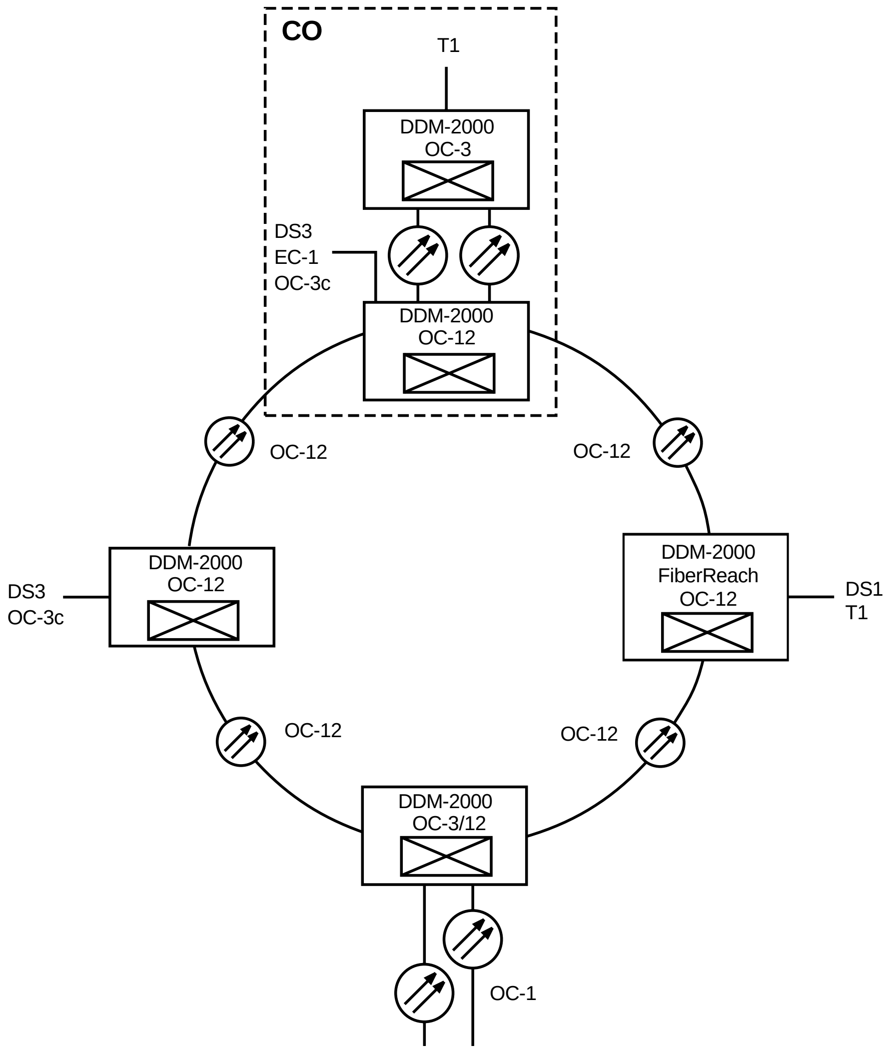

Figure 2-7. OC-12 Path Switched Ring Using DDM-2000 OC-12, OC-3, and FiberReach Multiplexers With OC-12 Optics

OC-3 Ring with OC-12 Ring Transport

If fiber exhaustion is a problem, the 2000 Product Family provides several alternatives for the network planners to pick from, depending on the specifics of their application. If fiber is available, multiple DDM-2000 OC-3 Multiplexer rings can be installed; or if fiber is unavailable or if the administrative ease of a single ring is desired, a single DDM-2000 OC-12 Multiplexer ring can be installed. Fiber exhaustion often occurs when customer demand for voice, DS1, and DS3 services grows to fill the OC-3 ring's capacity. If the growth has come from only one or two sites and there is spare fiber in place, these high demand sites may be cut to a new OC-3 ring without interrupting service. Alternatively, driven by fiber exhaustion or evolution to customer DS3 services, the OC-3 ring may be upgraded in service to an OC-12 ring. In this configuration (Figure 2-8), DDM-2000 OC-3 Multiplexer equipment is colocated with a DDM-2000 OC-12 Multiplexer shelf to provide a unified VT1.5 path switched ring node with an OC-12 high-speed interface.

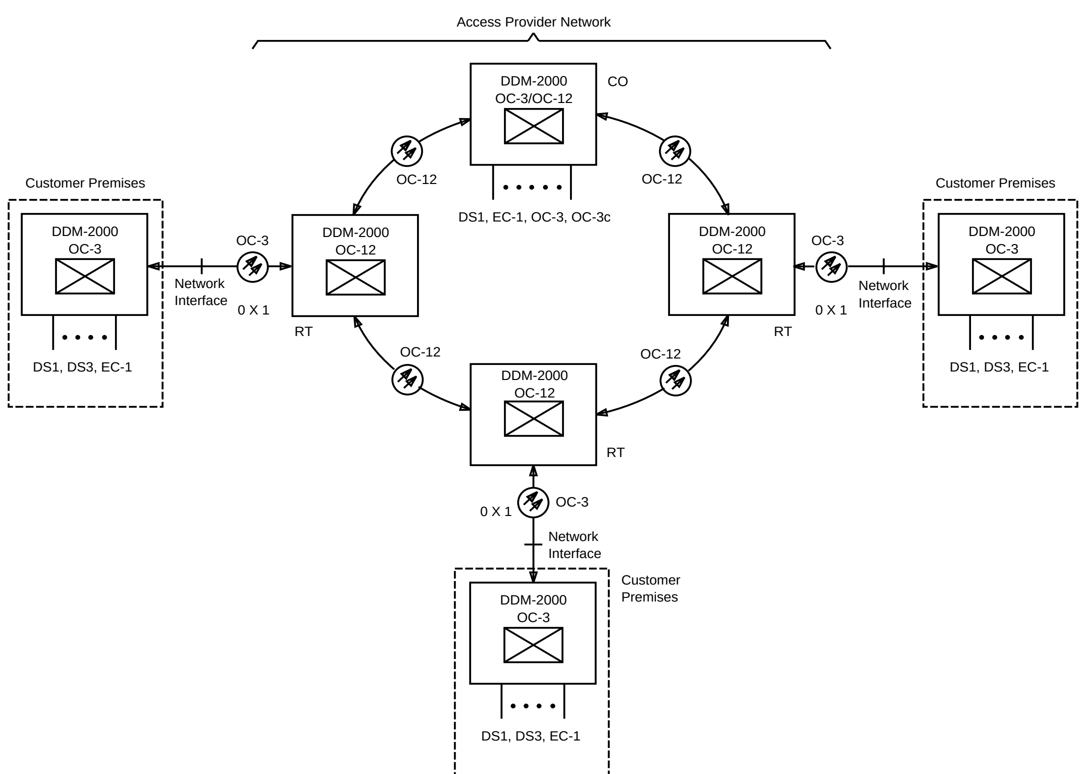

Figure 2-8. OC-3 Ring with OC-12 Ring Transport

VT1.5 bandwidth rearrangement is available which allows the unused VT1.5s from an STS-1 dropped at one site to be dropped at other sites. All DDM-2000 OC-3 and OC-12 Multiplexer shelves connected together in this subnetwork can communicate, using the single-ended operations capability of DDM-2000 Multiplexers. Once the DDM-2000 Multiplexer OC-12 ring is in place, it can be used by itself to provide STS-1 level path switching with DDM-2000 OC-3 Multiplexers to provide VT1.5 level path switching, or in a mixed configuration where both STS-1 level and VT1.5 level switching are supported simultaneously.

The link between the DDM-2000 OC-12 and OC-3 Multiplexers is 0x1 protected for this ring configuration. In this case, the DDM-2000 OC-12 Multiplexer feeds STS-1s directly off of each ring rotation to the DDM-2000 OC-3 Multiplexer where path switching is done. Switching is not done on the DDM-2000 OC-12 Multiplexer; rather VT1.5 or STS-1 level switching is done on the DDM-2000 OC-3 Multiplexer. Interconnecting the DDM-2000 OC-12 and OC-3 Multiplexers via a 0x1 interface allows the same STS-1 to be dropped to DDM-2000 OC-3 shelves at several nodes on the OC-12 ring. This combination of interconnected DDM-2000 OC-12 and OC-3 Multiplexers provides full VT1.5 switching granularity across the entire OC-12 bandwidth at any node on the ring, resulting in a full-fledged VT1.5 path switched OC-12 ring.

The DDM-2000 OC-12 path switched ring can be used in conjunction with the DDM-2000 OC-3 Multiplexer by an access provider to provide OC-3 ring service on an OC-12 ring for end users. It is becoming more frequent that a single end user desires a virtual private network from an access provider to connect several sites in a metropolitan area together. It is accomplished by deploying a DDM-2000 OC-12 ring in conjunction with DDM-2000 OC-3 Multiplexers. As described previously, the DDM-2000 OC-3 Multiplexers provide VT1.5 and STS-1 path switching; however, in this case, they are placed at end-user locations. The DDM-2000 OC-3 equipment is then used exclusively by that end user and three STS-1s worth of bandwidth are reserved on the OC-12 ring for that end user.

The end user is given logon privileges to the OC-3 equipment located on their premises, allowing them to gather performance data, provision service, and administer their virtual OC-3 ring network. From the end user's point of view, they have a virtual OC-3 ring network at their disposal.

For customers who have significant bandwidth demands or whose geographical situation requires additional OC-3 shelves from a single OC-12 location, Figure 2-9 shows how these applications can also be met. In addition, diverse routing to two separate OC-12 shelves can increase the reliability of the network even further.

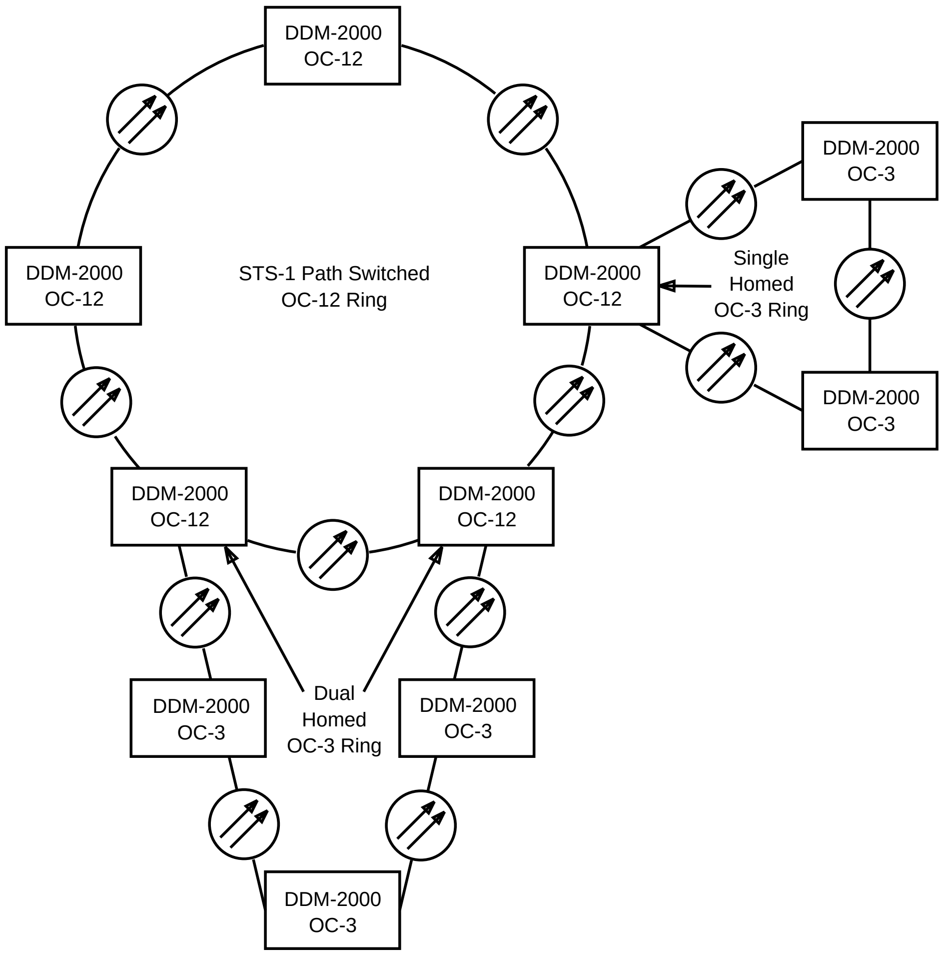

Figure 2-9. Multinode OC-3 Ring With OC-12 Ring Transport

The DDM-2000 OC-3 and OC-12 Multiplexers' path switched ring capabilities work together to provide cost-effective transport for small or medium cross-section interoffice networks such as outstate trunks. Such a ring, shown in Figure 2-10, provides DS1, DS3, EC-1, and OC-3c transport.

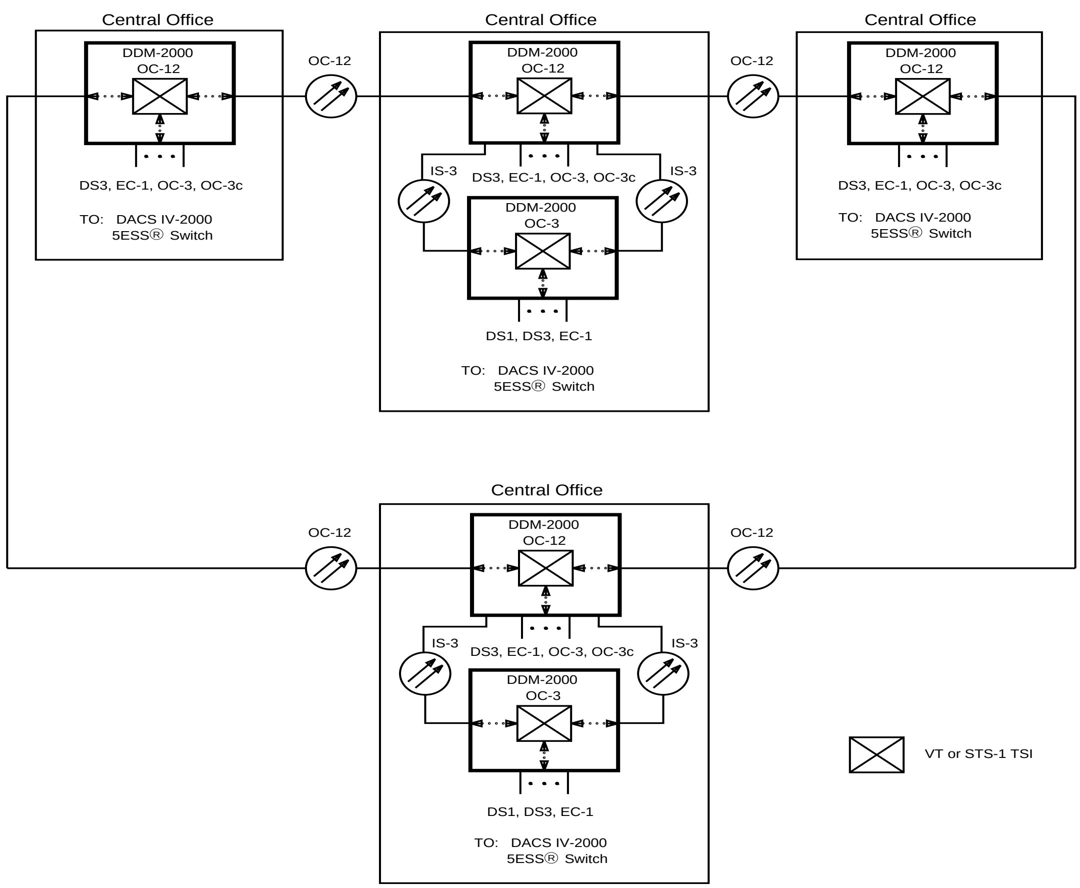

Figure 2-10. DDM-2000 OC-12 Path Switched Interoffice Ring

In a ring configuration, the DDM-2000 OC-12 Multiplexer can provide two high-speed optical interfaces. At a 1310 nm wavelength, it supports a span length of up to 51 kilometers (32 miles) without regenerators. At a 1550 nm wavelength, it supports a span length of up to 100 kilometers (61 miles) without regenerators. Regenerators or add/drop systems can be used to increase the distances for 1310 nm installations.

Each ring node can be independently synchronized from a Building Integrated Timing Supply (BITS) clock. This BITS clock can also be timed using the DDM-2000 DS1 timing output feature.

OC-12 STS-1/VT1.5 Path Switched Ring (0x1)

The DDM-2000 OC-12 ring supports (0x1) OC-3/IS-3 interfaces in its Function Unit slots. These interfaces must be provisioned as 0x1. Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 Function Unit slot FN(x)-1 is connected to OC-3 Main-1 and OC-12 Function Unit slot FN(x)-2 is connected to OC-3 Main-2. Switching is not done on the DDM-2000 OC-12 Multiplexer on these lines, or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves) or the OC-12 node can provision different STS-1s at different sites. With 0x1 operation, the OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site. Since the high-speed signals from the OC-3 ring(s) are sent as two copies (one clockwise, the other counter-clockwise) on the OC-12 ring, the OC-12 ring capacity is limited to the OC-12 line rate.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring (0x1) fashion, behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

The STS-1/VT1.5 0x1 feature has been added to DDM-2000 OC-3 Release 15.0 to allow a single remote OC-3 or FiberReach shelf (FiberReach requires Release 4.0 for DCC) to interconnect through its Main ring interface to a single host OC-3 shelf (Figure 2-11) in a single homed 0x1 configuration. Alternately, one or more remote OC-3 or FiberReach shelves can be connected through their Main ring interfaces to two host OC-3 shelves through their OC-3 Low Speed interfaces in a dual homed 0x1 configuration.

Each OC-3 node provisions the same STS-1/VT time slots as the other OC-3 nodes on the same ring. With 0x1 application, the host OC-3 or OC-12 ring passes the content of the STS-1/VT time slots to the hosted OC-3 shelf(ves) without terminating them or performing protection switching on them. Ring path switching is not done on the DDM-2000 OC-12 ring; rather STS-1/VT level path switching is done elsewhere in the network.

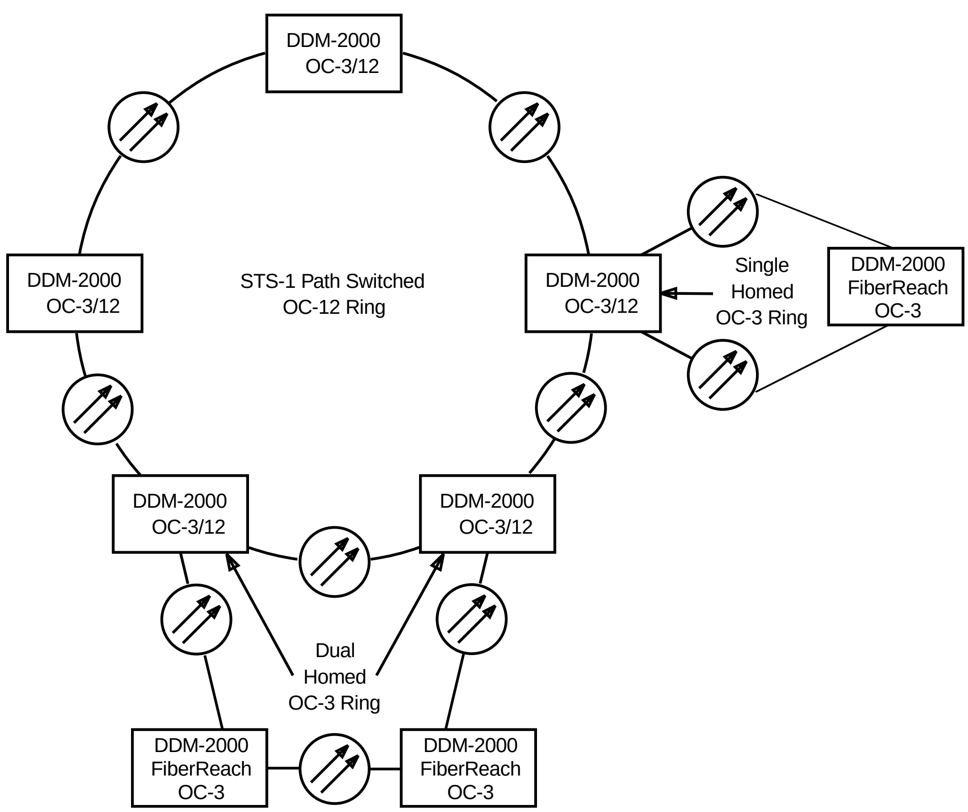

Figure 2-11. OC-12 Ring Transport (STS-1/VT1.5 0x1) With FiberReach OC-3 Rings

OC-1 Path Switched Ring

DDM-2000 FiberReach Multiplexers can be configured in an OC-1 path switched ring. The path switched OC-1 ring is best suited for DS1, DS0, and broadband channel transport in a campus or other self-contained environment where there is no need for the additional capacity and flexibility of an OC-3 backbone network.

Folded Ring

DDM-2000 OC-3 and OC-12 rings offer several benefits in addition to service assurance. Economically, a ring network minimizes overall network cost by requiring fewer optical transmit/receive units than a comparable linear add/drop network. Operationally, a ring network provides significant flexibility to increase bandwidth at existing nodes and to add new nodes at locations where unanticipated bandwidth is required.

These benefits make rings highly desirable even when fiber route diversity is not available. When route diversity is not available on part or all of the ring, ring technology can be used to support split and tapered feeder routes to derive economic benefits, provide bandwidth flexibility, ease the process of adding and deleting nodes and supply survivability against single-node failures.

When route diversity is not available or fiber cable cuts are not a driving concern, the two-fiber path switched ring feature can be applied in a "folded" (a folded ring is a single path ring) configuration (Figure 2-12). This use of DDM-2000 OC-3, OC-12, and *SLC*-2000 access resource manager (ARM) path switched rings applies in particular to hubbing and linear topologies where there is no return path from the end remote site to the CO. While a complete cut through the fiber cable cannot be protected, single-node equipment failures are still protected. Furthermore, a two-fiber ring ARM uses only one optical transmitter/receiver in each direction (two per remote shelf), in contrast to a 1+1 line protection arrangement that requires four optical transmitter/receivers per remote shelf. Thus the ring configuration reduces equipment costs, a benefit independent of its survivability advantage. The ring topology also makes node addition/deletion straightforward.

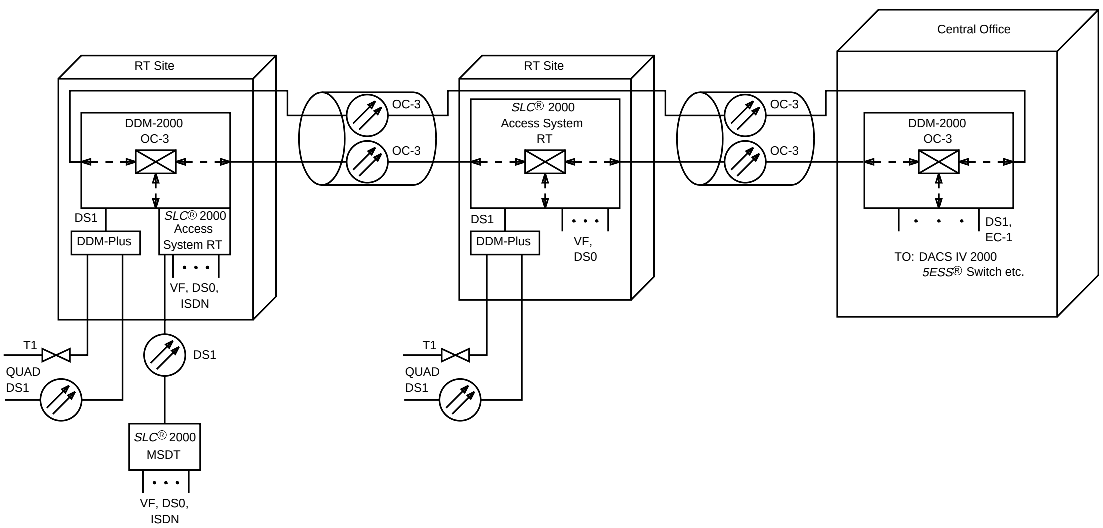

Figure 2-12. Folded Ring Configuration

OC-1 Ring Transport on OC-3 Ring

OC-1 ring transport on OC-3 rings can be used in both single-homed and dual-homed configurations. Figure 2-13 shows how single-homed OC-1 extensions can satisfy a growing access network. Single-homing applications connect both rotations of the OC-1 extension to a single DDM-2000 OC-3 or *SLC*-2000 Access System host. The DDM-2000 FiberReach is located at the customer's location, such as in a telecommunications equipment closet on each floor of a high-rise office complex, and delivers up to 16 fully protected DS1 channels per system.

The OC-1 ring capability allows multiple DDM-2000 FiberReach systems to be connected to the backbone network via a single facility. Compared to other optical extension products that are limited to a single remote node per extension, the ring-based DDM-2000 FiberReach solution uses far less fiber and host optics for typical serving areas with multiple business locations. Network growth is as easy as adding another DDM-2000 FiberReach node on the ring; no additional fiber or host circuit packs need to be added.

With the dual OC-1 capability of the 27-type OLIU, a DDM-2000 OC-3 ring node supports up to six single-homed OC-1 extensions; a *SLC*-2000 Access System ARM shelf can supply up to two single-homed OC-1 extensions. Thus, competing businesses in the same serving area can receive a dedicated access facility into the backbone ring, alleviating any privacy concerns.

The single OC-1 26G2-U OLIU further expands the options by allowing the dropping of DS1s without the need for the MXRVO or BBF5 Jumper circuit packs (a Group 4 shelf is required).

The DDM-2000 FiberReach remote systems employ standard path protection switching for a highly reliable network that guarantees 60 millisecond recovery from any single facility or equipment failure. Path protection switching occurs at the nodes where a channel is dropped from the ring to a low-speed interface. Channels pass between the OC-1 and OC-3 rings at the host DDM-2000 OC-3 and *SLC*-2000 systems with a 0x1 low-speed cross-connection. This arrangement supports full TSI assignment between low-speed and high-speed time slots while preserving independent service and protection paths between the host and extension rings.

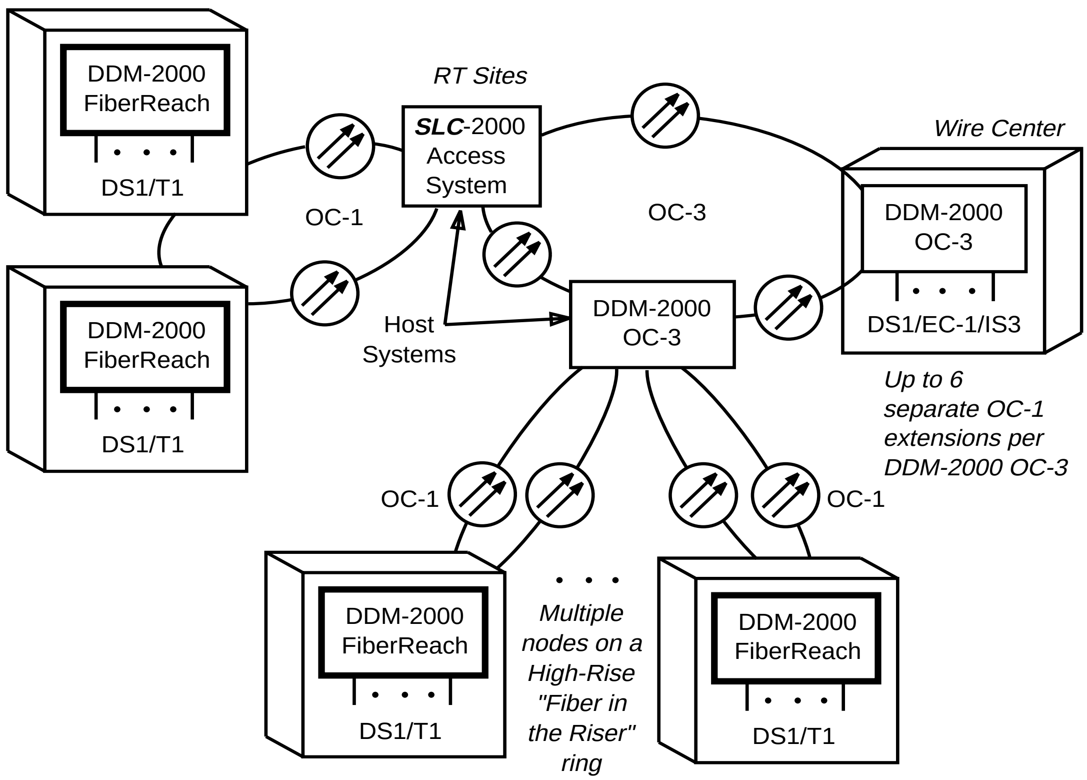

Figure 2-13. OC-1 Ring Transport on OC-3 Ring Configuration

Stand-Alone OC-1 Ring/Hub Networks

In applications such as campus or other self-contained environments, DDM-2000 FiberReach can be deployed in a stand-alone OC-1 ring. This OC-1 ring extension can be configured directly from a DDM-2000/*SLC*-2000 shelf with 27-type OLIUs in the main slots. A mix of DS1 and T1 carrier traffic from remote DDM-2000 FiberReach nodes can be flexibly groomed and dropped at the host to a mix of DS1, EC-1, and OC-3 interfaces, as shown in Figure 2-14. Channels can be established directly between two DDM-2000 FiberReach remotes on the same OC-1 ring. This configuration would be very effective for customers within a short radius of the wire center or for isolated demand at a distant location where there is no appropriate access network yet in place.

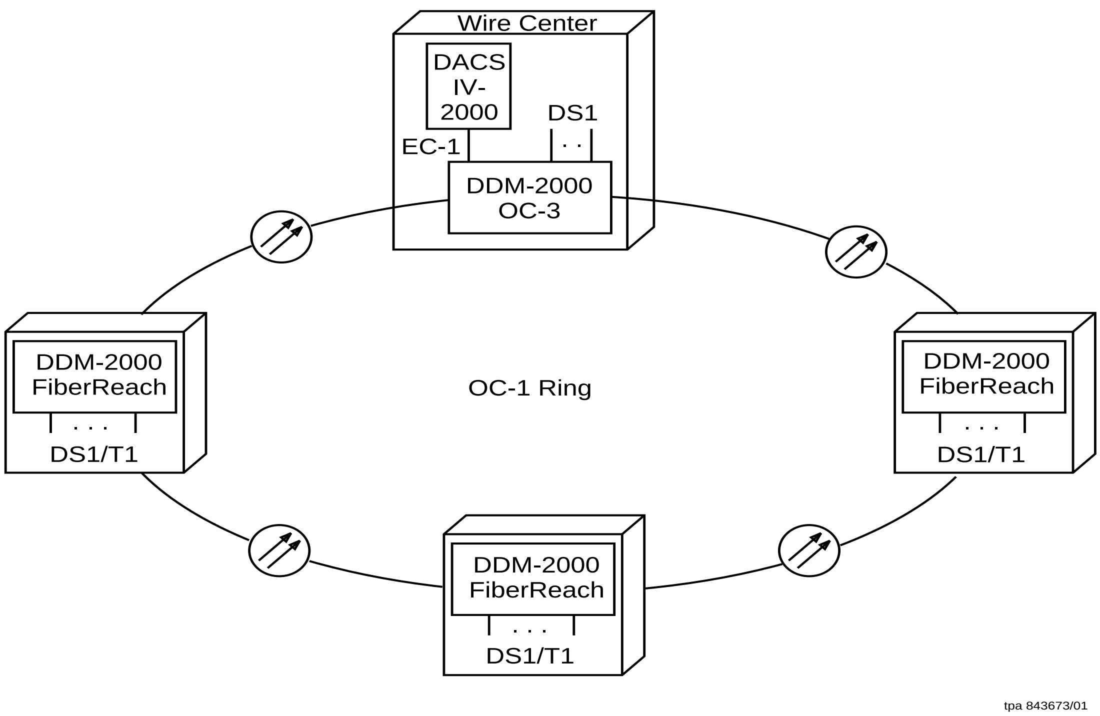

Figure 2-14. DDM-2000 FiberReach Stand-Alone OC-1 Ring

This application can be further expanded to hub up to two OC-1 rings from a stand-alone DDM-2000/*SLC*-2000 host system, as shown in Figure 2-15.

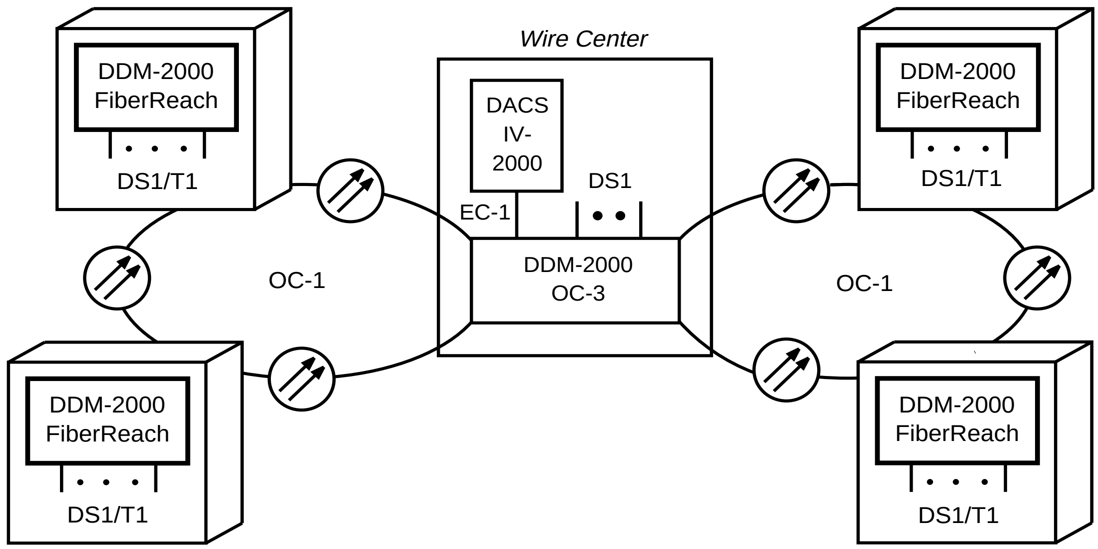

Figure 2-15. DDM-2000 FiberReach Single Homing to a Stand-Alone OC-1 Hub Host

Dual Homing

End-users are demanding service with higher and higher availability. Service providers are responding with tariffs that rely on self-healing networks to offer such high availability service. Some of these tariffs even call for penalties for the service provider when service is interrupted or has a high error rate. The Lucent SONET product family offers many options for meeting these service needs.

OC-1 Ring transport on OC-3 Ring and OC-3 Ring transport on OC-12 ring networks can be implemented in dual homing configurations.

OC-1 Ring Transport on OC-3 Ring

Dual homing offers even more survivability than a single-homed network, as even the catastrophic failure of a host node can be protected. Figure 2-16 shows a dual-homed OC-1 extension from two remote nodes on an OC-3/OC-12 access ring. OC-1 extensions from OC-12 rings are available in R11 using OC-12 optics in the OC-3 shelf. The host nodes can be two DDM-2000 OC-3/OC-12 or two *SLC*-2000 Access Systems, or one DDM-2000 OC-3/OC-12 Multiplexer and one *SLC*-2000 Access System.

Path protection switching is employed for dual-homed applications, just like in single-homed applications. That is, 60 millisecond path switching is supplied by the remote DDM-2000 FiberReach nodes and the DDM-2000 OC-3 or OC-12 systems in the wire center. The OC-3 host node configuration differs from that used for single-homing because each host node terminates only one leg of the OC-1 extension. At each host node, a connection is made from the single OC-1 extension to just one rotation of the OC-3/OC-12 host ring. Dual- and single-homed extensions can also be mixed at a host node, allowing the access network to be tailored efficiently to different groups of customers.

Dual and single-homed extensions can also be mixed at a host node, allowing the access network to be tailored efficiently to different groups of customers.

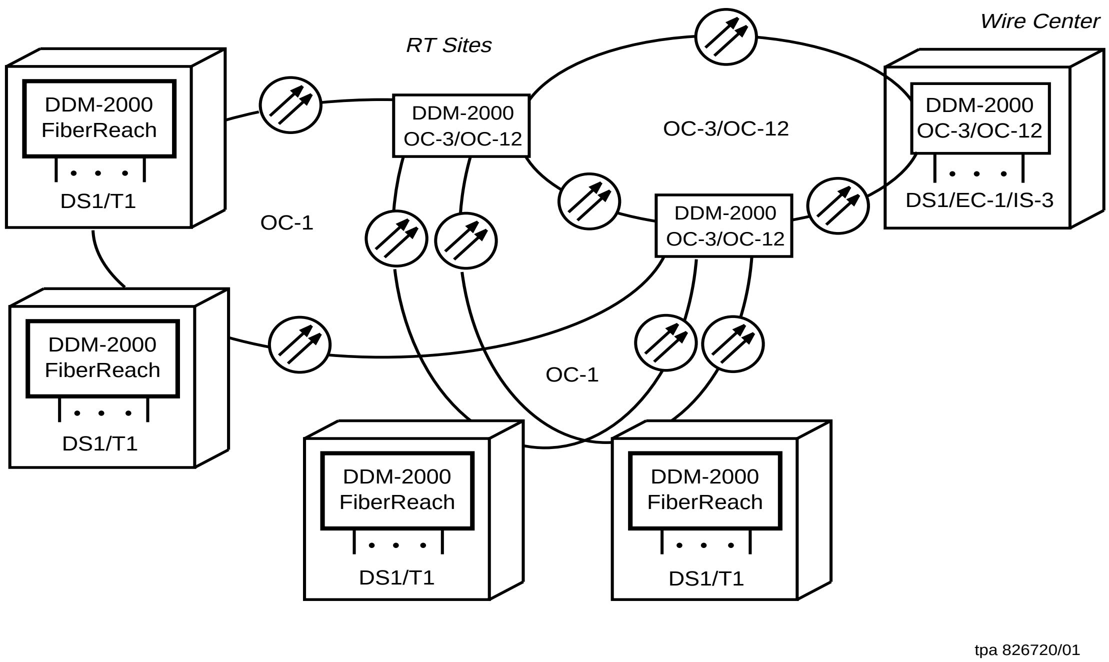

Figure 2-16. DDM-2000 FiberReach Dual Homing to a DDM-2000 OC-3 Ring

Dual Ring Interworking (DRI)

In an interconnected ring or DRI topology two rings are connected together at two geographically separate nodes. In addition to the facility and node failure protection that a single ring provides, the dual node interconnection between the rings provides an automatic alternate route in the event of a catastrophic failure at one of the interconnecting nodes. Typically, such a topology is used to interconnect a loop feeder access ring to a higher bandwidth interoffice ring as shown in Figure 2-17. This architecture can withstand any single equipment or fiber failure in each of the rings or a failure (which could range from a CO shutdown in the case of fire, for example, or equipment failure, or failure of the facility connecting the two rings) of either of the two interconnecting nodes without losing service on either the access ring or the interoffice ring. Such a catastrophic failure would cause a service outage for a simple ring architecture.

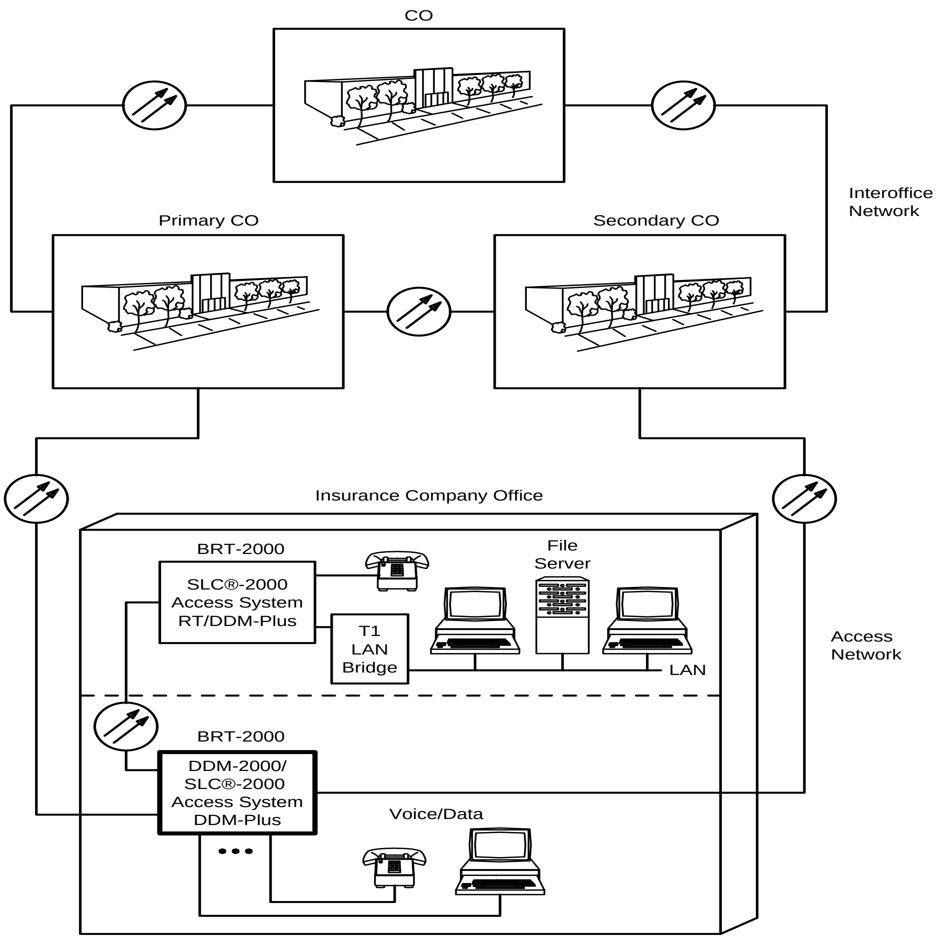

Figure 2-17. Dual Access Configuration

As Figure 2-18 shows, DRI allows a circuit (for instance, between nodes A and Z) with one termination in the upper ring and the other termination in the lower ring to survive a failure of the shared node that is currently carrying service for the circuit. The failure is depicted by an "X" in the figure. The two shared nodes are in CO B and CO C. Both nodes have the signal available to them at all times. When a failure occurs, the two terminating nodes and the two shared nodes switch so that traffic is carried through CO C and around the node failure.

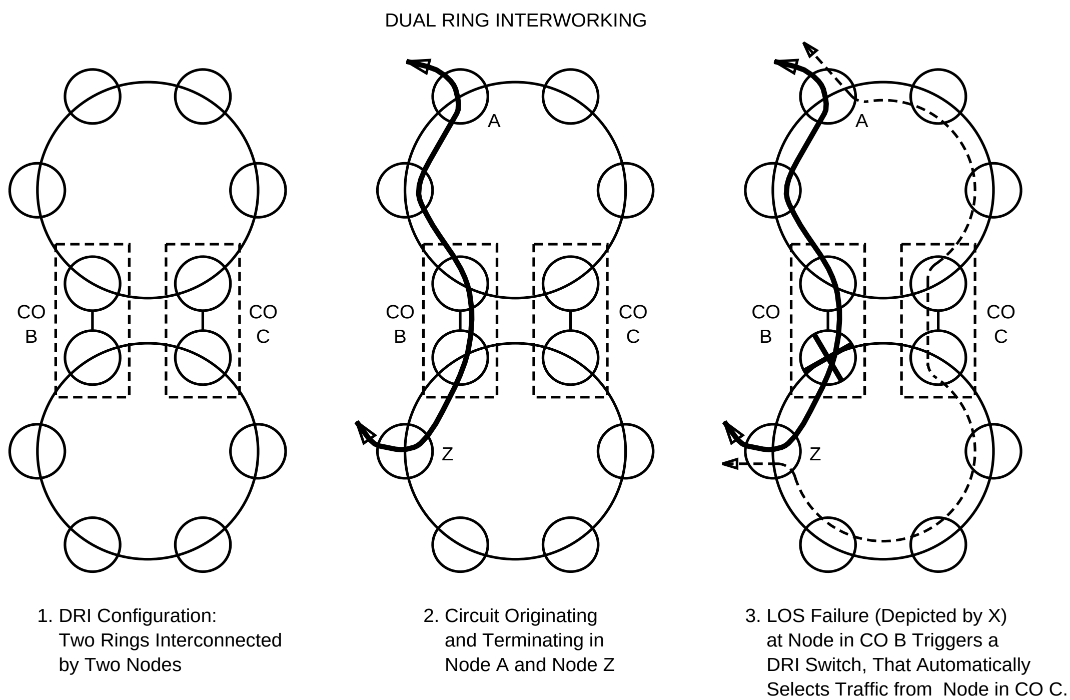

Figure 2-18. Dual Ring Interworking Concepts

DDM-2000 OC-3, OC-12, and FT-2000 OC-48 Lightwave Systems can be configured to offer this topology. Often the DDM-2000 equipment is used for the loop feeder access ring, and the FT-2000 OC-48 Lightwave System equipment is used for the interoffice ring. Figure 2-19 shows a DDM-2000 OC-3 (or OC-12) path switched ring interworking with an FT-2000 OC-48 Lightwave System bidirectional line-switched ring.

The DDM-2000 OC-12 Multiplexer also supports DS3 DRI in addition to the EC-1 and OC-3 interfaces. In the event of a DS3 failure, the OC-12 Multiplexer inserts an STS-1 AIS signal into the STS-1 ring channel used by the DS3 to activate the downstream STS path protection switch.

In this application, the DDM-2000 provides an appearance of loop traffic at both the primary and secondary nodes by dropping traffic at the primary node and simultaneously continuing it on to the secondary node. This capability is called "drop-and-continue." The DDM-2000 OC-3 Multiplexer allows DS1 signals to be multiplexed for handoff at an economical EC-1 or OC-3 rate in the COs. Also, the DDM-2000 OC-3's flexible TSI can be used to prepackage all DRI protected DS1s into a single EC-1 for economical handoff to the OC-48 ring. This capability allows for the easy mixing of DRI and non-DRI services on the same ring network. In this way, only specially tariffed services need to be configured for the extra reliability that DRI provides. DS3/STS1 clear channel services are also supported. The companion FT-2000 OC-48 Lightwave System ring picks up the traffic at these two nodes and carries it to the destination node, unless a failure condition causes a protection switch to the secondary signal. In the reverse direction, a similar process is followed with the OC-48 ring handing off the two copies of the signal at the primary and secondary nodes and the OC-3 ring providing the switching at the destination node.

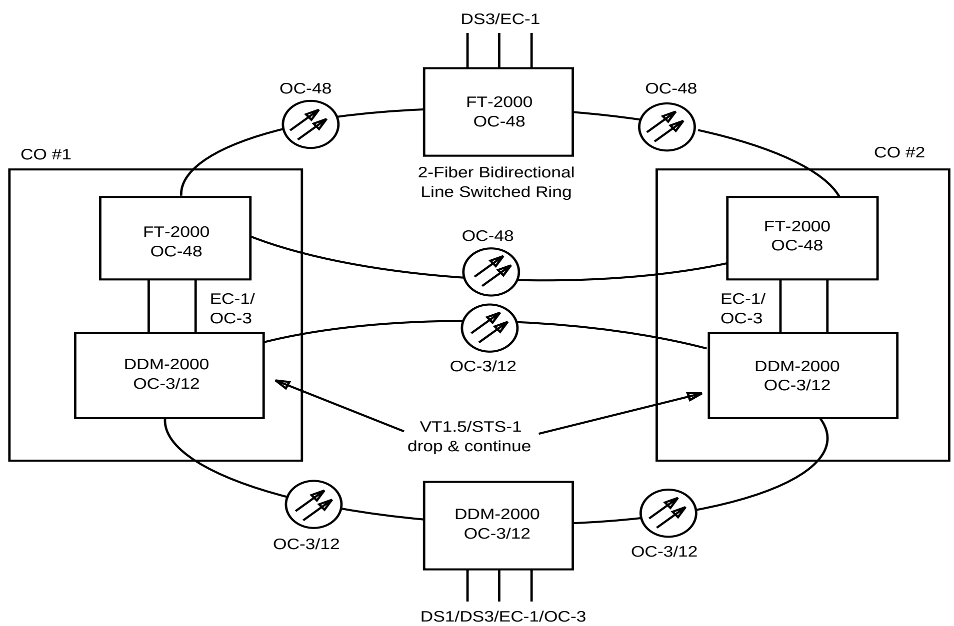

Figure 2-19. OC-3/12 to FT-2000 OC-48 Lightwave System Dual Ring Interworking

The DDM-2000 drop-and-continue feature also finds an excellent application in interconnecting two rings via an intermediate transport network. In the example shown in Figure 2-20, DDM-2000 OC-3 Multiplexer access rings act as a DRI pair via an FT-2000 OC-48 Lightwave System and DACS IV-2000 interoffice network. The advantage of this network is the grooming for DRI traffic provided by the DACS IV-2000. Both DDM-2000 OC-3 rings provide drop and continue at each of their two duplicate COs. Both copies of the signal are transported as separate tributaries through the interoffice network, and path switching is implemented at the edges of the network. Signal redundancy is preserved on an end-to-end basis.

In offices where SONET interconnections are not available, DS3 interfaces can be used between dual OC-12 offices. This architecture is not recommended over the all SONET architecture, since DS3 interface failures are potentially service affecting.

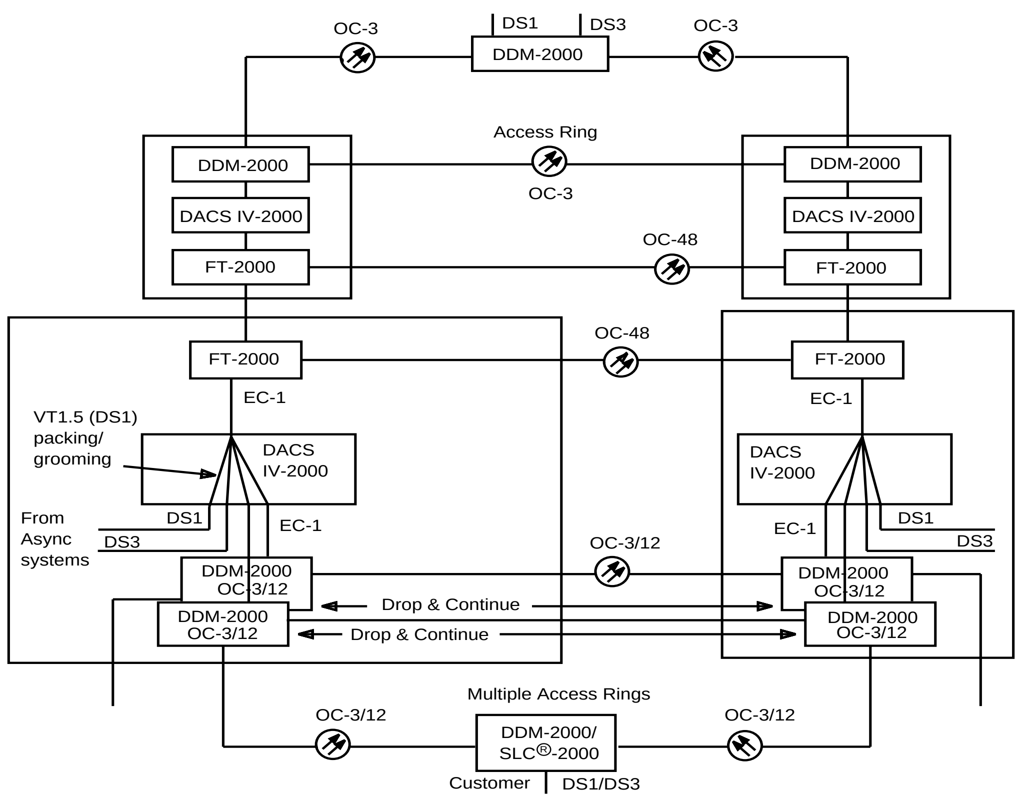

Figure 2-20. DDM-2000 Ring Interworking with FT-2000 OC-48 Lightwave System Transport and DACS IV-2000 Grooming

Dual Homing with DRI

The survivability and networking benefits of Lucent's DRI solution are cost-effectively extended to smaller locations via DDM-2000 FiberReach dual-homing capabilities. Figure 2-21 shows an OC-3 feeder ring from duplicated wire centers, with dual-homed DDM-2000 FiberReach extensions from selected feeder ring remote sites.

The host nodes and remote DDM-2000 FiberReach systems are configured just like the previously described dual-homing configuration with single 0x1 cross-connections employed by the host. In the dual wire center architecture, the access network is also protected from a catastrophic failure of one wire center, because the access and interoffice networks have duplicate points of interworking. The DDM-2000 OC-3 systems in the two wire centers employ the drop and continue cross-connection.

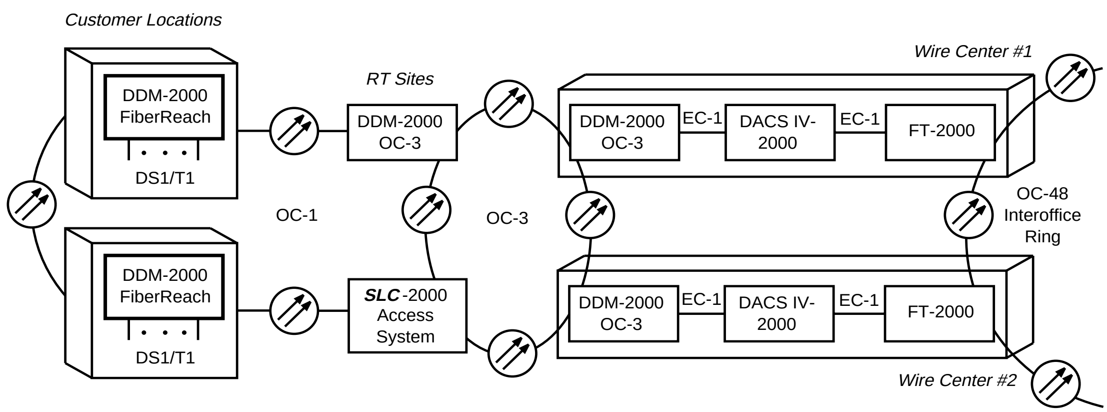

Figure 2-21. DDM-2000 FiberReach Ring Dual Homing to a DDM-2000 OC-3 Ring in a Dual Wire Center Application

OC-3/OC-12 Linear Optical Extensions from OC-3, OC-12, and FT-2000 Rings

An additional topological flexibility offered by the DDM-2000 OC-3 and OC-12 Multiplexers is 1+1 protected or unprotected linear OC-3 and IS-3 optical extensions from OC-3, OC-12, and FT-2000 rings. Using this capability, the DDM-2000 OC-3 and OC-12 Multiplexers can support many of the new network configurations desired in the evolving loop feeder environment. An access provider can use linear optical extensions from an OC-12 or FT-2000 ring to provide OC-3/OC-3c signals directly to end users. This gives the end users the bandwidth they need for large bandwidth applications, such as video, and provides it to them via the path switched ring architecture. Full single-ended operations are available on all NEs. This gives the end user full control of performance monitoring (PM) data, network reconfigurations, and provisioning of the network.

OC-3 optical extensions can also be used to interconnect SONET subnetworks. Examples include interconnection of two access networks and interconnection between access and interoffice rings. Optical extensions can be used to interconnect OC-3 and OC-12 ring subnetworks to an OC-3 terminal, OC-3 and OC-12 add/drop networks, and another OC-3, OC-12,or FT-2000 ring.

The DDM-2000 OC-3 Release 15.0 allows the Main OC-3/OC-12 ring interface on the DDM-2000 OC-3 shelf to support “identical” DCC data link mode. This will allow an OC-3 shelf to interconnect through its Main ring interface to an OC-N 1+1 interface on another NE(Function Unit of host NE). The user must provision the remote (hosted) OC-3 NE for “identical” DCC mode on the Main interfaces. Only protected OC-3 interfaces are supported. This allows a TARP extension using Release 15.0 ring software.

Hairpin Cross-Connections on Rings

The DDM-2000 OC-3 Multiplexer supports a VT1.5 "hairpin" cross-connection where VT1.5 signals from one Function Unit can be cross-connected to VT1.5 signals in another Function Unit. Figure 2-22 shows a hairpin cross-connection between Function Unit C and Function Unit A or Function Unit C and Function Unit B.

The advantage of hairpin cross-connections is equipment savings. If there is a need to access a DS1 within an OC-3 signal, rather than install another OC-3 shelf, you can use the unused Function Unit slots in any other OC-3 shelf. This type of cross-connection does not use any time slots on the OC-3 ring itself.

Figure 2-22 also shows how hairpin cross-connections can be used on a ring. Hairpin cross-connections can also be used in ring configurations with multiple optical extensions to provide a hubbing topology with a ring at the hub.

See Section 4, "Product Description," for more information on hairpin cross-connections.

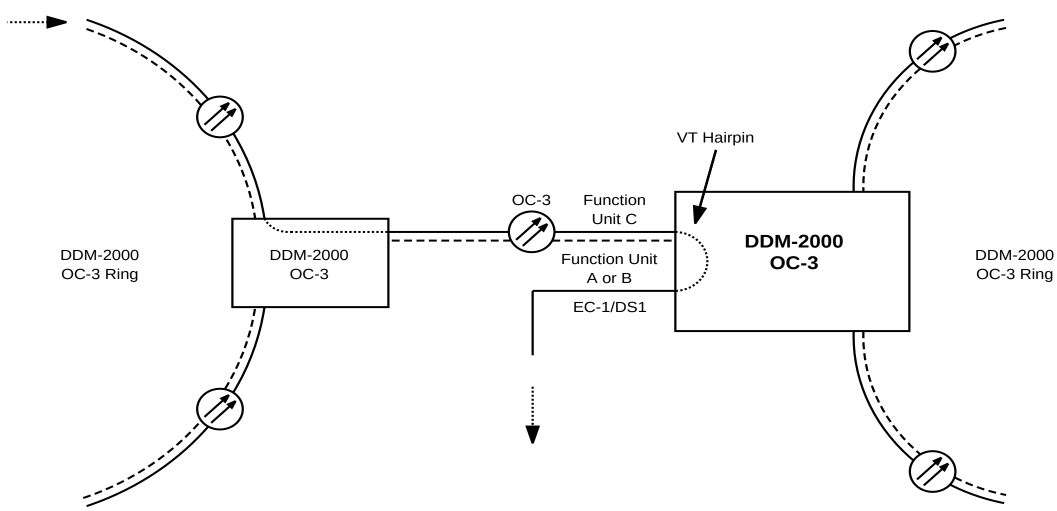

Figure 2-22. VT1.5 Hairpin Cross-Connections

Enhanced Routing

DDM-2000 FiberReach hosts can support a collection of enhanced routing features as shown in Figure 2-23, Figure 2-24, Figure 2-25, and Figure 2-26. These features support cross-connections within and across function units without using bandwidth on the main OC-3 or OC-12 rings. This allows even greater networking flexibility and efficiency. While the high-speed OC-3 interface can carry up to 84 VT1.5 channels, each of the 3 function units has a two OC-1 capacity, or up to an additional 168 VT1.5 channels. For example, a DDM-2000 OC-3 system with 22-type OLIUs in the main slots and 27G2-U dual OC-1 OLIUs in each function unit supports up to 168 VT1.5 channels: 84 between high-speed OC-3 and low-speed OC-1, and another 84 channels that pass directly between this host's remote FiberReach system.

The OC-1 ring interconnection enhanced routing options utilize 0x1 or pass-through cross-connections at the DDM-2000 host. Path protection switching is performed at the DDM-2000 FiberReach systems at the path endpoints. The local drop enhanced routing option employs path protection switching in the OC-3 host's function unit in order to drop to local EC-1, DS1, or OC-3 ports.

OC-1 Ring Pass-Through

This enhanced routing option establishes pass-through cross-connections for channels on an OC-1 ring terminating on a pair of 27G2-U OLIUs in a function unit as shown in Figure 2-23. These cross-connections are just like the pass-through cross-connections that can be provisioned for rings terminating on main slots. This allows traffic to be routed from one FiberReach node to another FiberReach node on the same OC-1 ring without using bandwidth on the OC-3/OC-12 ring.

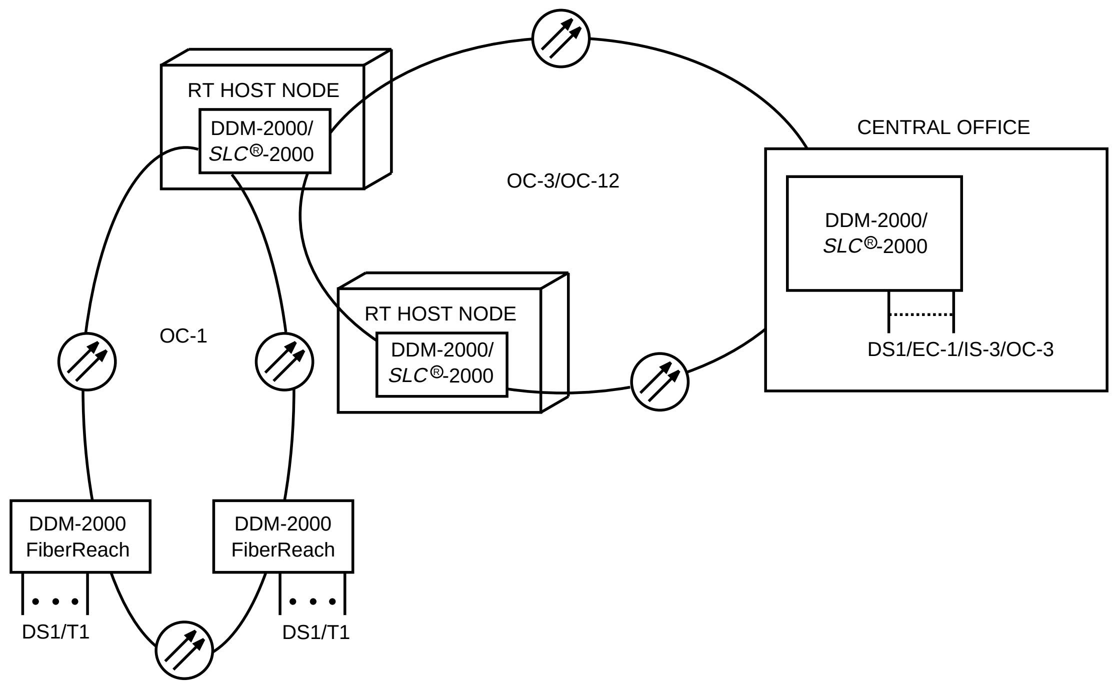

Figure 2-23.   OC-1 Ring Pass-Through in a Function Unit

OC-1 Ring Hairpin Routing, Single-Homed

This routing option establishes cross-connections between channels on two separate OC-1 facilities that terminate on 27G2-U OLIU circuit packs, in either the same or different function units as shown in Figure 2-24. In the single-homed configuration, both rotations of each of the two OC-1 rings terminate on a pair of 27G2-U OLIUs. There may be a single pair of 27G2-U OLIUs that terminates both rings, or one pair of 27G2-U OLIUs in each of two function units that terminates the rings. Each rotation of one ring is cross-connected to the corresponding rotation of the other ring. This allows traffic to be routed from one FiberReach node on one OC-1 ring, to any other FiberReach node on another OC-1 ring, without using bandwidth on the OC-3/OC-12 ring.

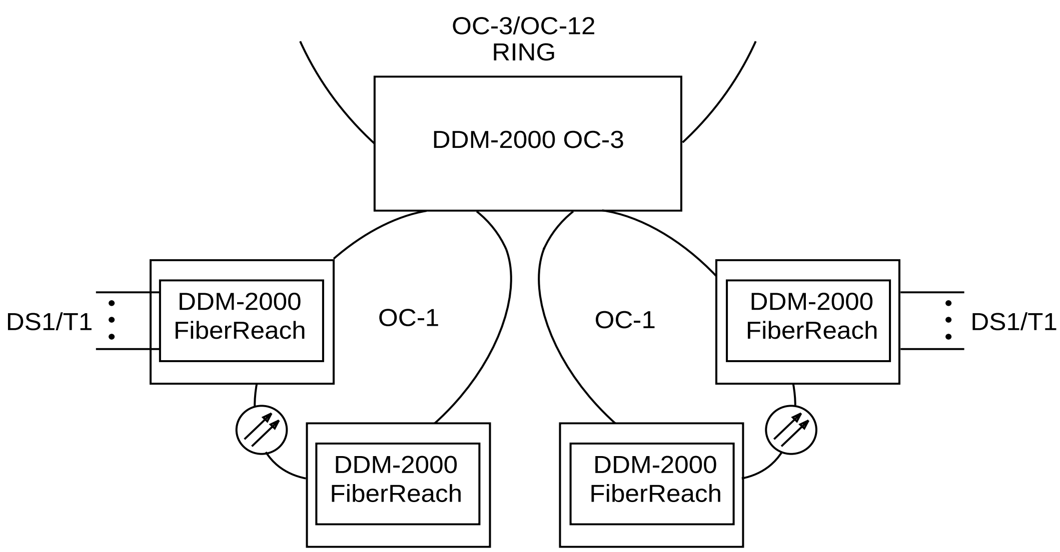

Figure 2-24. Single-Homed Hairpin Routing

OC-1 Ring Hairpin Routing, Dual-Homed

With this routing option, shown in Figure 2-25, cross-connections are established between channels on two separate OC-1 facilities that terminate on 27G2-U OLIU circuit packs in either the same or different function units. In the dual-homed arrangement, only one rotation of each of the two OC-1 rings terminates on a single OC-3 shelf. At the OC-3 shelf, there may be a single 27G2-U OLIU that terminates both rings or a 27G2-U OLIU in each of two function units that terminates the rings. The other rotation of each ring terminates on a different OC-3 shelf. This allows traffic to be routed from one FiberReach node on one OC-1 ring to any other FiberReach node on another OC-1 ring without using bandwidth on the OC-3/OC-12 ring.

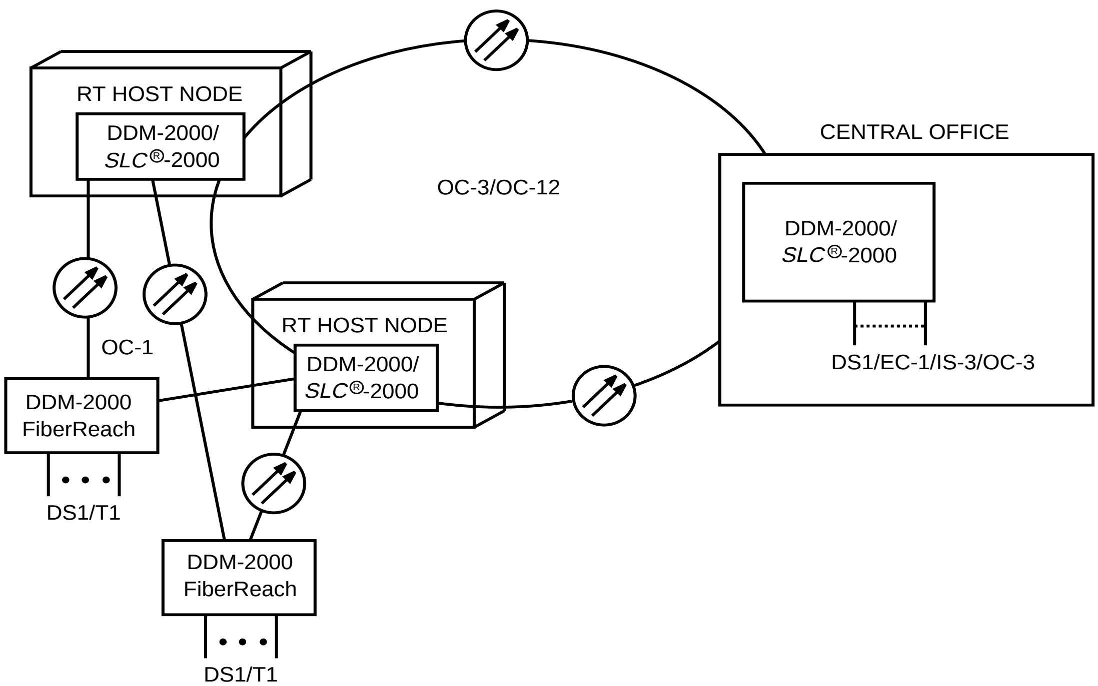

Figure 2-25. Dual-Homed Hairpin Routing

Hairpin Local Drop Routing

Figure 2-26 shows hairpin local drop routing. In this configuration, path-protection switched drop cross-connections are established between channels on an OC-1 ring and ports/channels on DS1/EC1/OC-3 circuit packs. The OC-1 facility terminates on a pair of 27G2-U OLIU circuit packs in a function unit. These connections are just like the drop cross-connections that can be established between channels on a ring terminating on the main slots and ports or channels in a function unit. This allows traffic to be routed from a FiberReach node on an OC-1 ring to a local drop without using bandwidth on the OC-3/OC-12 ring.

A mix of the enhanced routing services shown in Figure 2-23, Figure 2-24, Figure 2-25, and Figure 2-26 can be created in a single DDM-2000 FiberReach host. 27G2-U OLIUs are needed for these services.

Beginning with Release 13.0, the single OC-1 26G2-U OLIU, with built-in multiplexer capabilities, further expands the options by allowing the dropping of DS1s without the need for the MXRVO or BBF5 Jumper circuit packs (a Group 4 shelf is required).

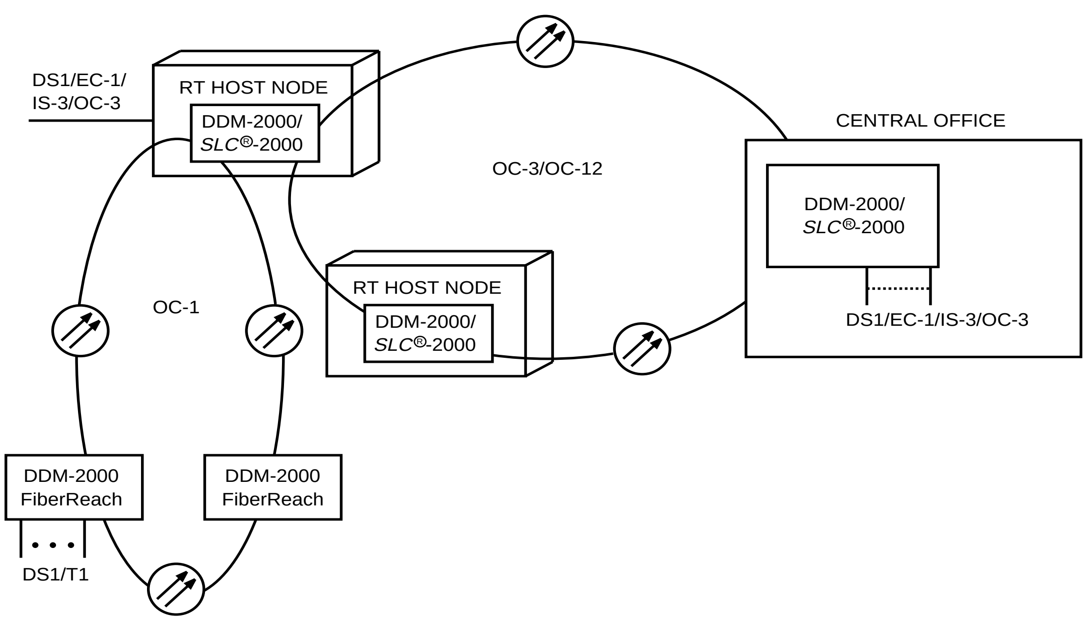

Figure 2-26. Hairpin Local Drop Routing

Point-to-Point Topologies

OC-3 Point-to-Point (Folded Ring)

The point-to-point application is the traditional means of providing optical transport in the loop feeder. In situations where new demand is isolated to a small number of carrier-serving areas along a given feeder route, maximum simplicity and cost efficiency make point-to-point configurations a good choice. The point-to-point application has the added benefit of consistency with existing operations systems and operations practices.

The point-to-point applications provide an ideal platform from which the loop network can evolve in step with changing service needs. Evolution to multispan applications like add/drop, hubbing, and path switched rings offers planning flexibility and network equipment savings. Starting at the OC-3 rate, the access network can be sized to maximize utilization with an easy upgrade to higher capacities like OC-12.

A single 8.5-inch shelf provides OC-3 optical transport for a mix of DS1 and DS3 traffic. Equipped in this manner, the DDM-2000 OC-3 Multiplexer is a low-cost, full-function terminal. The OC-3 point-to-point network (Figure 2-27) consists of OC-3 Multiplexers in the CO and RT sites, connected by four single-mode or multimode fibers (two service, two protection). At the RT site, the OC-3 Multiplexer typically interfaces to digital loop carrier systems like the *SLC* Series 5 Carrier System. DS1 extensions to customer premises or another RT site are provided by the DDM-Plus low-speed extension shelf or DDM-2000 FiberReach, with a choice of DS1 line repeaters or quad DS1 optical interfaces. DDM-Plus optical interfaces can be terminated at a DDM-Plus extension shelf or a DDM-Plus distant terminal.

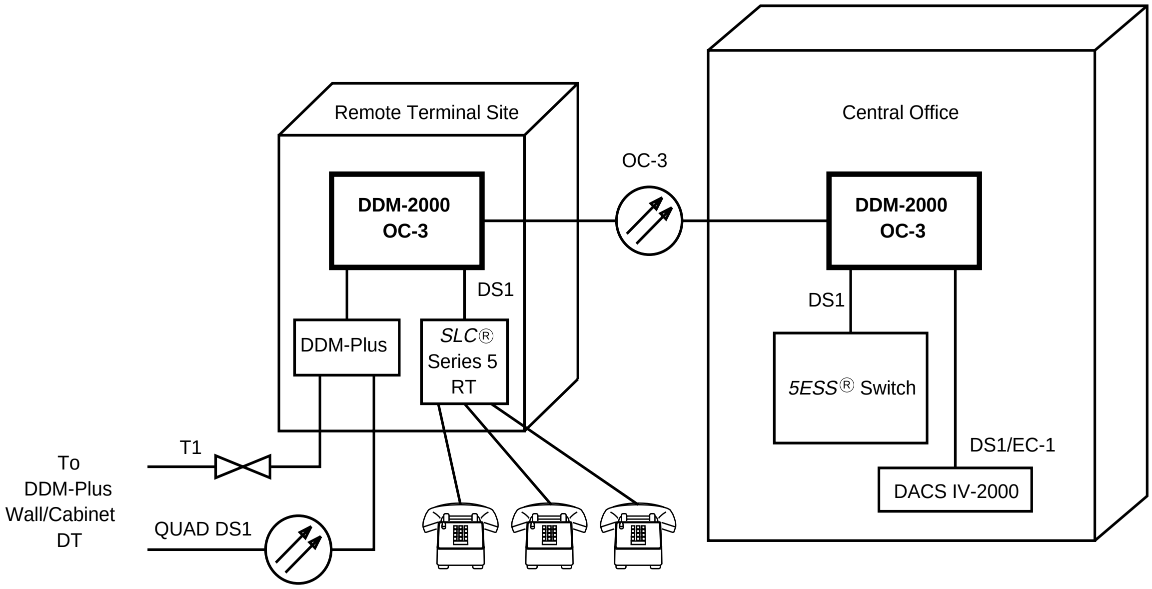

Figure 2-27. OC-3 Point-to-Point Topology (Folded Ring)

Figure 2-28 and Figure 2-29 show two typical applications in a metropolitan high-rise, where an OC-3 point-to-point folded ring topology network runs from the CO to the customer's building. Figure 2-28 shows an initial application with preexisting copper wiring in the building risers. From a basement cabinet, the DDM-2000 OC-3 Multiplexer and DDM-Plus or DDM-2000 FiberReach provide direct DS1 service over this wiring to cabinets on the floors above.

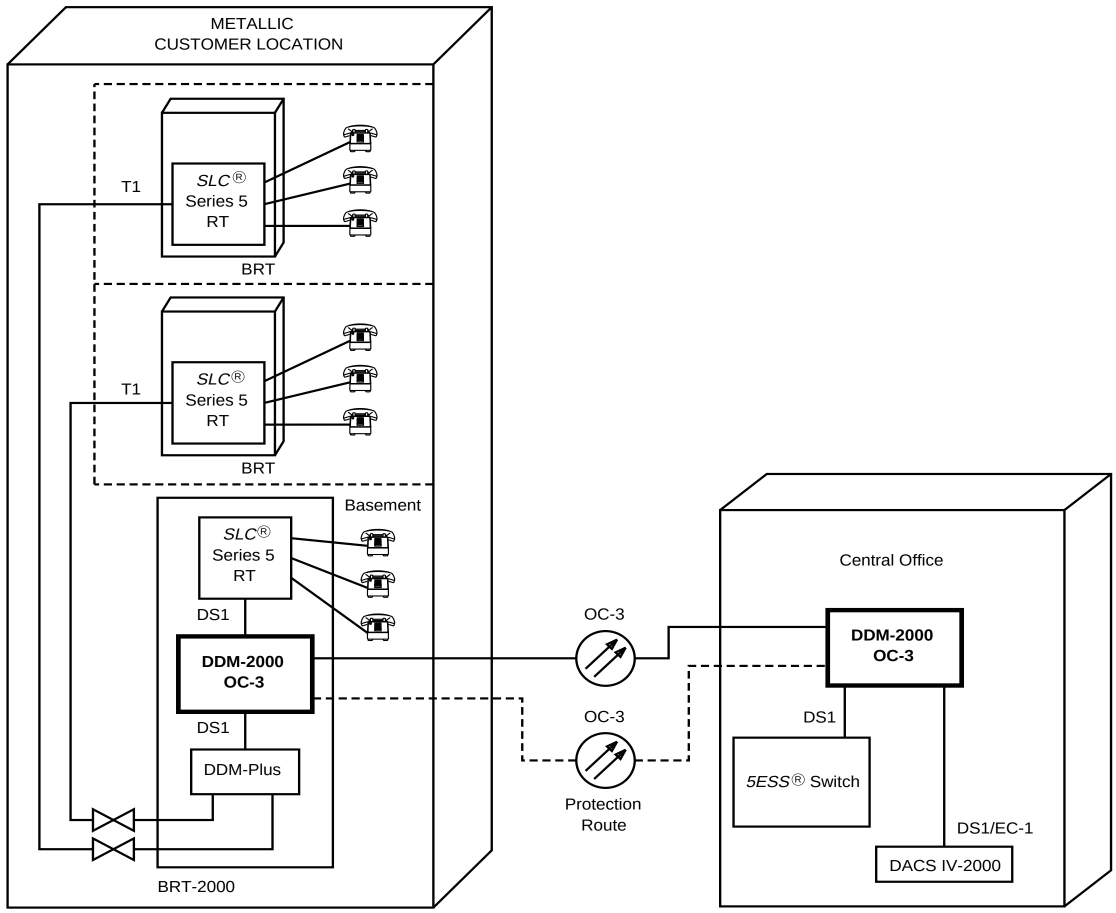

Figure 2-28. Metro Application — Copper in the Riser

Figure 2-29 shows a larger application with fiber in the riser, using the optical extension capability of DDM-Plus or DDM-2000 FiberReach, to extend optical bandwidth to individual floors. Satellite locations contain the DDM-Plus distant terminal (DT) to convert the optical extension interface into four standard DS1 signals. Self-healing needs can be met with cabled ring or diverse routing. The OC-3 bandwidth to customer locations also positions the network to deliver higher bandwidth services, such as video.

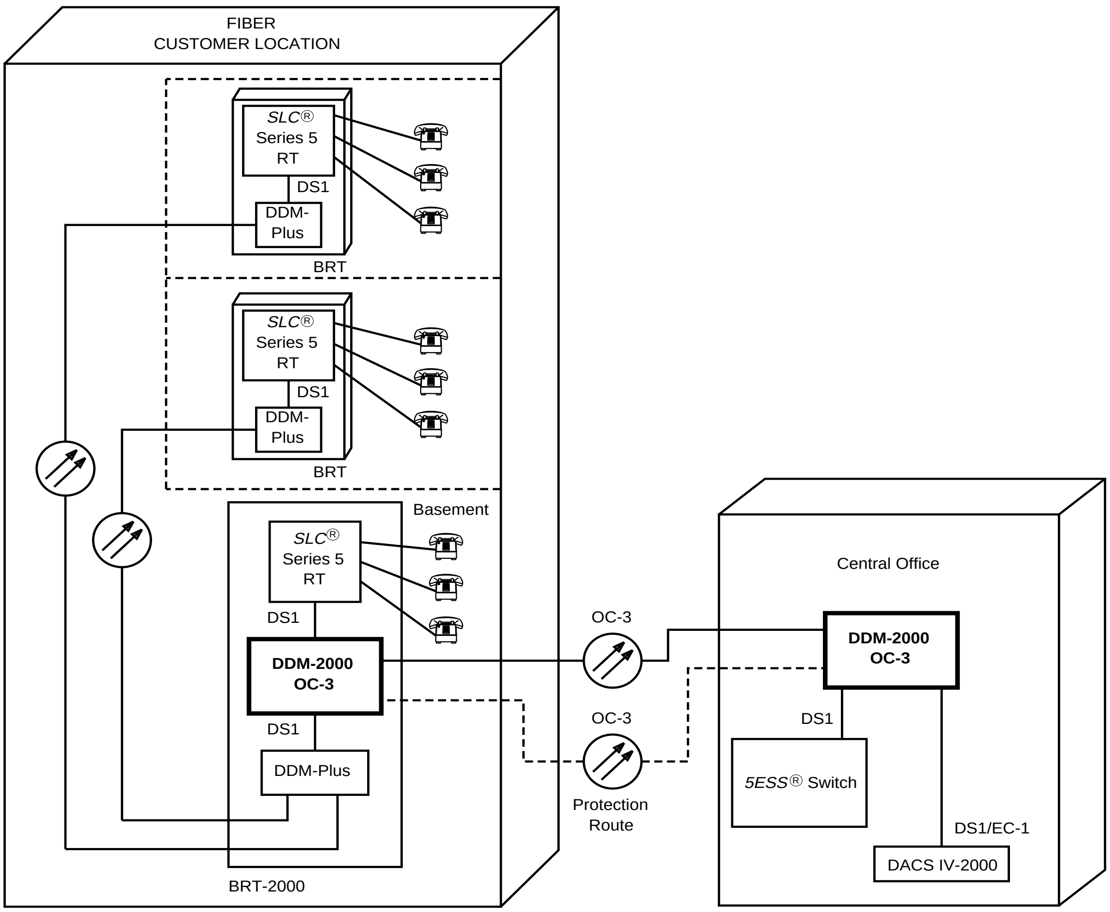

Figure 2-29. Metro Application — Fiber in the Riser

DDM-2000 OC-3 and DDM-Plus or DDM-2000 FiberReach systems provide bandwidth features to improve the delivery of CENTREX services. In a multisite campus application (Figure 2-30), *SLC* Series 5 Carrier System RTs and DDM-Plus optical extensions carry voice traffic from each building to a DDM-2000 OC-3 Multiplexer at a conveniently located remote terminal site. The DDM-2000 OC-3 Multiplexer provides economical and reliable access to the serving *5ESS*® switch. The OC-3 capacity supports a growing campus, as up to 84 DS1s (2016 voice channels) can be provisioned as needed.

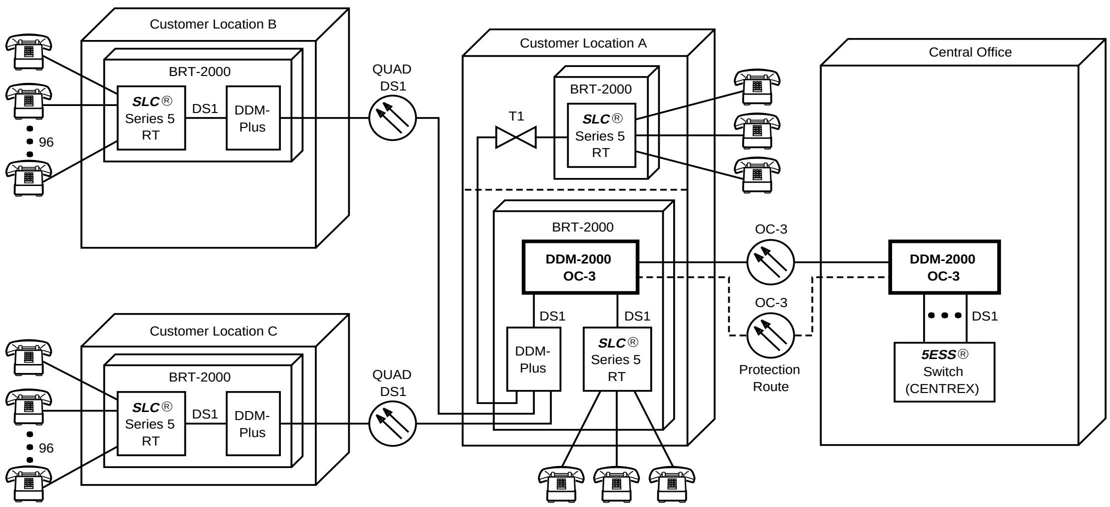

Figure 2-30. Campus CENTREX Configuration

2000 Product Family Interworking

SLC-2000 Access System

The *SLC*-2000 Access System is Lucent's next generation digital loop carrier (DLC) system. The *SLC*-2000 Access System can be installed in any existing pair gain application, providing telephone service, integrated services digital network (ISDN) capability, DS1 pipes, and special services. Full DS0 bandwidth management capabilities (based on Telcordia Technologies TR-303) provide for more efficient and flexible network growth.

Figure 2-31 shows a business narrowband application using the DDM-2000 FiberReach Multiplexer on an OC-1 path switched ring. This application provides protected POTS, ISDN, and special services, as well as DS1 services. The ring host is a DDM-2000 OC-3/OC-12 remote node on an OC-3/OC-12 path switched ring via a *SLC*-2000 ARM or a DDM-2000 OC-3 Multiplexer.

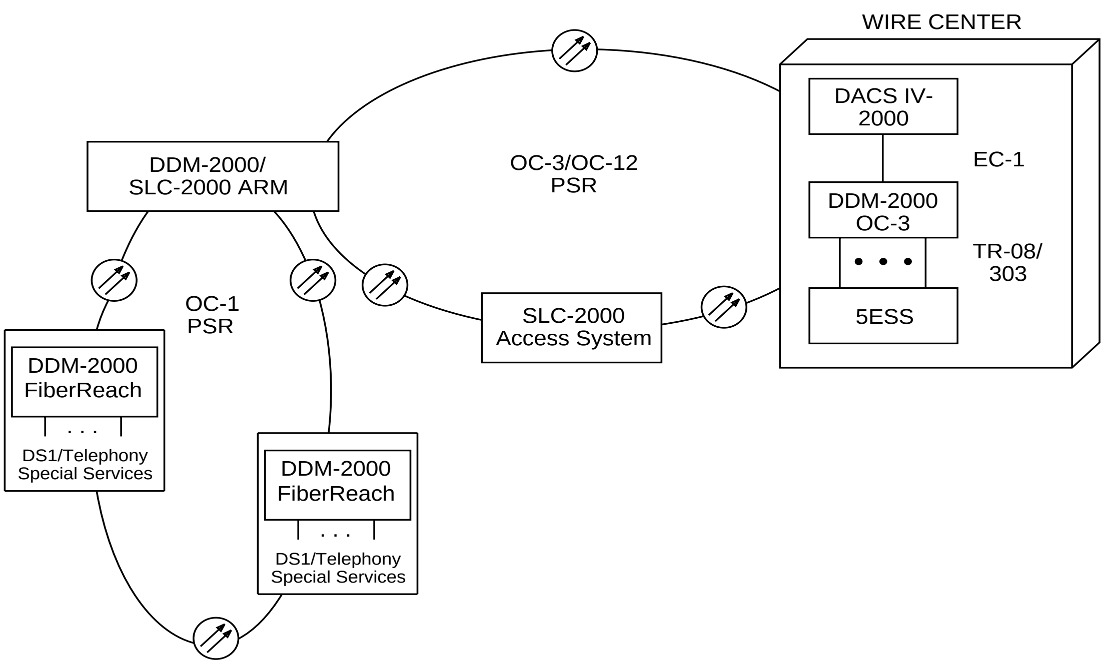

Figure 2-31. OC-3 Loop Carrier Interface Configuration

FT-2000 OC-48 Lightwave System

Operations interworking (OI) provides the capability to access, operate, provision, and administer remote Lucent SONET NEs from any location in a SONET subnetwork or from a centralized OS. Figure 2-32, Figure 2-33, and Figure 2-34 are examples of OI applications with DDM-2000 Multiplexers and FT-2000 OC-48 Lightwave Systems. Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guid*e, for more information.

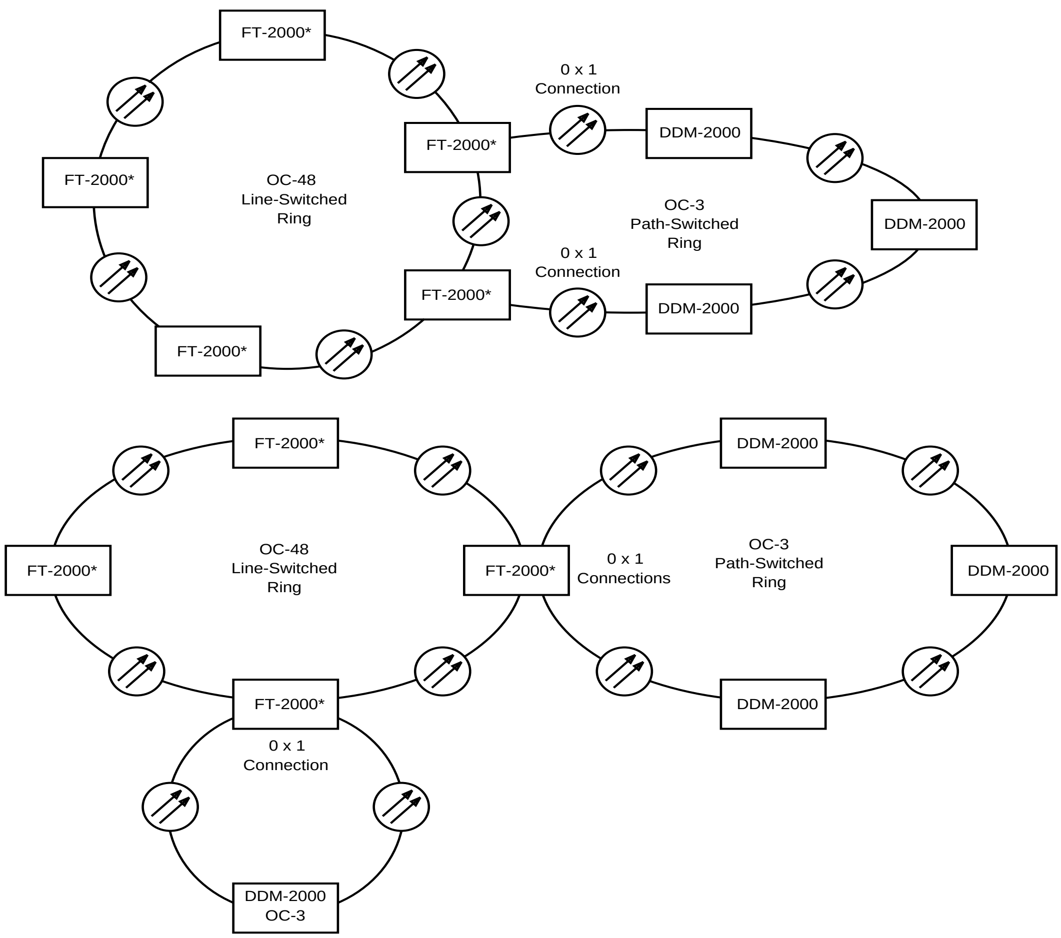

Figure 2-32. Operations Interworking Application

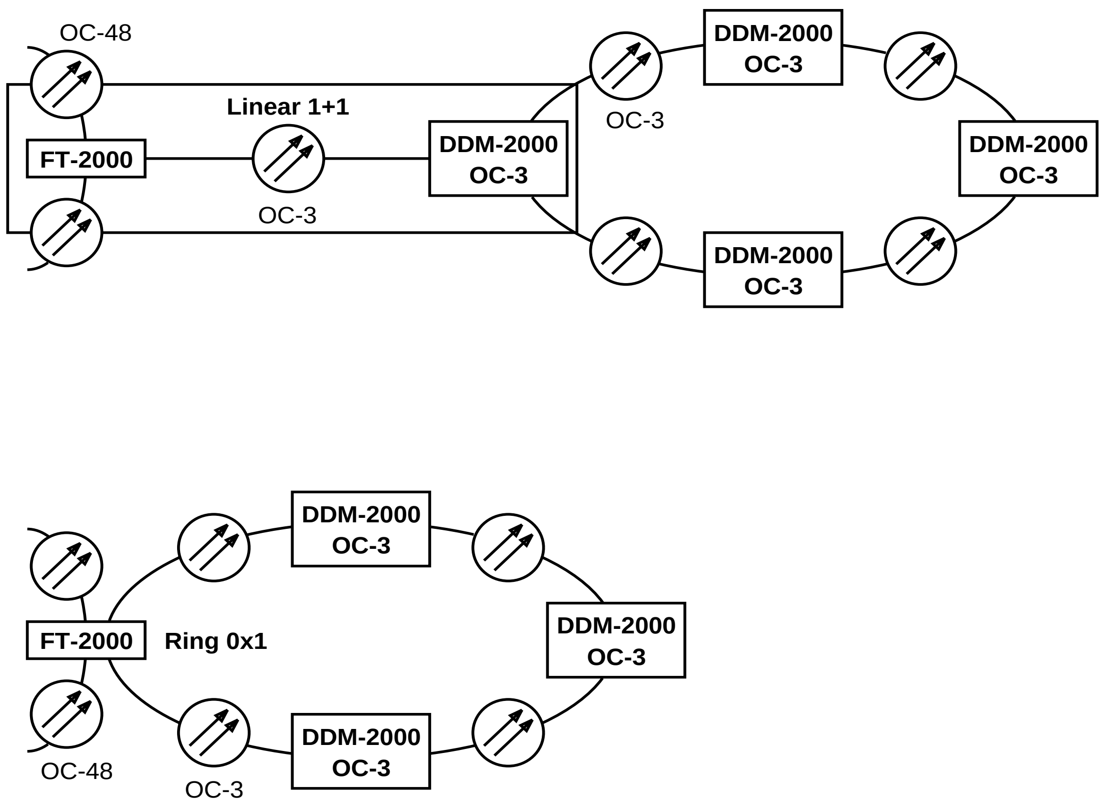

Figure 2-33. OC-3 Ring Interfaces with FT-2000 OC-48 Lightwave System

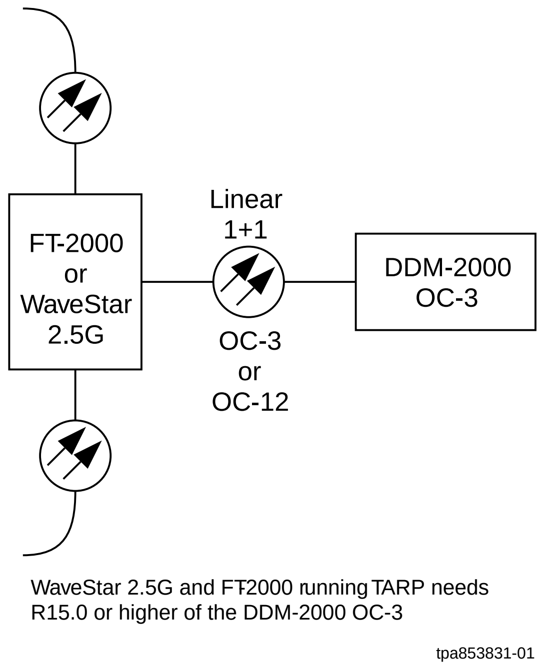

Figure 2-34. OC-3 Linear Extension from FT-2000 Lightwave System

*Wavestar 2.5G and FT-2000 runing TARP needs R15.0 or higher of the DDM-2000 OC-3.

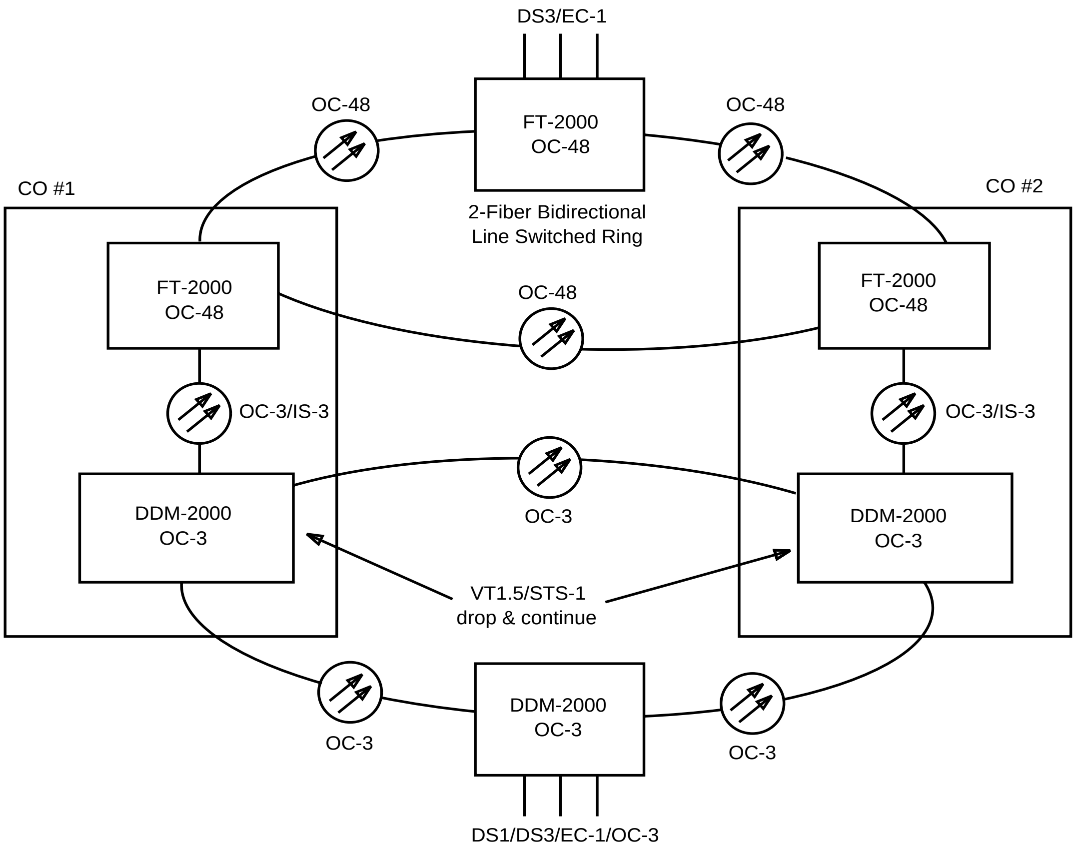

Figure 2-35. OC-3 Ring Interfaces with FT-2000 OC-48 Lightwave System

Multi-Vendor OI Applications

Figure 2-36 shows a multi-vendor application partnering Lucent's DDM-2000, FT-2000, and ITM SNC with Tellabs *TITAN*[*] *5500* DCS. This OI, based on SONET standards, allows service providers to offer more flexible services to generate revenues and improve overall network maintenance efficiency.

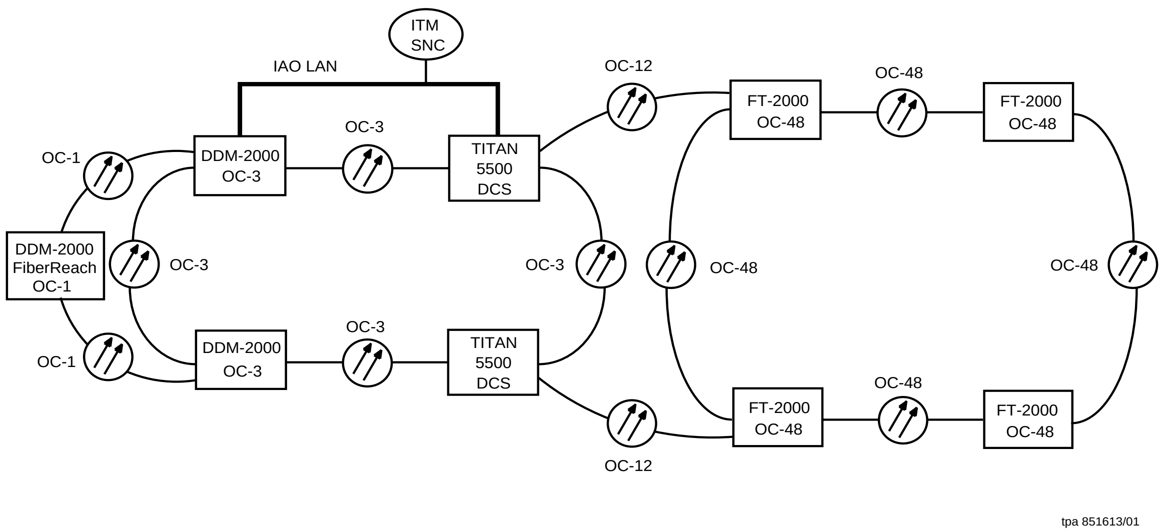

Figure 2-36. Interworking of OC-1/OC-3/OC-12/OC-48 with Tellabs *TITAN 5500* DCS

* *TITAN* is a trademark of Tellabs, Inc.

Service Applications

Loop Feeder

The DDM-2000 Multiplexers provide a full set of interfaces, topologies, operations and upgradability to provide the flexibility and ease of operation required to meet the dynamic requirements of the loop feeder environment.

The DDM-2000 Multiplexers are particularly suited to the evolving needs of loop feeder applications. They offer many essential features: compact size, environmental hardening, single-ended operations, and capacity and topology upgrades. The DDM-2000 Multiplexers' extensive set of topologies allows the network to be optimized for a particular route geography, service mix, and growth forecast. See Figure 2-27 for loop feeder examples.

Interoffice Transport

The DDM-2000 Multiplexers provide the features necessary for interoffice transport applications. Examples include long span optics, OC-12 regenerators, easy capacity upgrades, and full DS1 and DS3 add/drop capability. Interoffice applications include point-to-point, stand-alone SONET electrical multiplexing, add/drop, path switched ring, and DRI.

The DDM-2000 OC-3 and OC-12 Multiplexers provide the following features for interoffice applications:

- DS1 transport
- DS3 transport
- EC-1 transport
- OC-3c transport
- Synchronization distribution
- Single-ended or independent operations
- Single-mode fiber spans up to 55 kilometers (34 miles) for OC-3, up to 51 kilometers (32 miles) for OC-12 at a wavelength of 1310 nm, and up to 100 kilometers (61 miles) for OC-12 at a wavelength of 1550 nm.

A VT1.5/STS-1 path switched OC-3 ring is a very effective self-healing network configuration for small cross-section interoffice networks, such as outstate trunks.

Any number of nodes in a DDM-2000 interoffice network can be independently synchronized from a BITS clock. Timing inputs can also be provided to the BITS from a DDM-2000 OC-3 or OC-12 Multiplexer using the DS1 timing output feature.

Broadband Business Access

New telecommunications needs for customer networks include higher bandwidth services based on DS1, DS3, and STS-3c rates; a self-healing capability for businesses most sensitive to service disruption; and rapid service deployment and rearrangement to keep pace with a changing environment. The flexible, advanced capabilities of the DDM-2000 OC-3 and OC-12 Multiplexers create a powerful platform along with other Lucent 2000 Product Family systems to keep pace with these dynamic customer needs.

The more a business relies on telecommunications, the more important self-healing networks become. In particular, finance, medical, transportation, education, and government users are insisting on a highly reliable network. These users are also driving for higher bandwidth data and video services.

The large multisite medical facility shown in Figure 2-37 uses broadband services for intersite imaging and video needs as well as lower bandwidth voice and data services into the public network based in ISDN primary rate interface (PRI) and basic rate interface (BRI) interfaces. These services can be delivered efficiently with the DDM-2000 OC-3, OC-12, and *SLC*-2000 Access System's flexible TSI and add/drop capabilities. The ring architecture prevents service outage due to a cable cut or node failure.

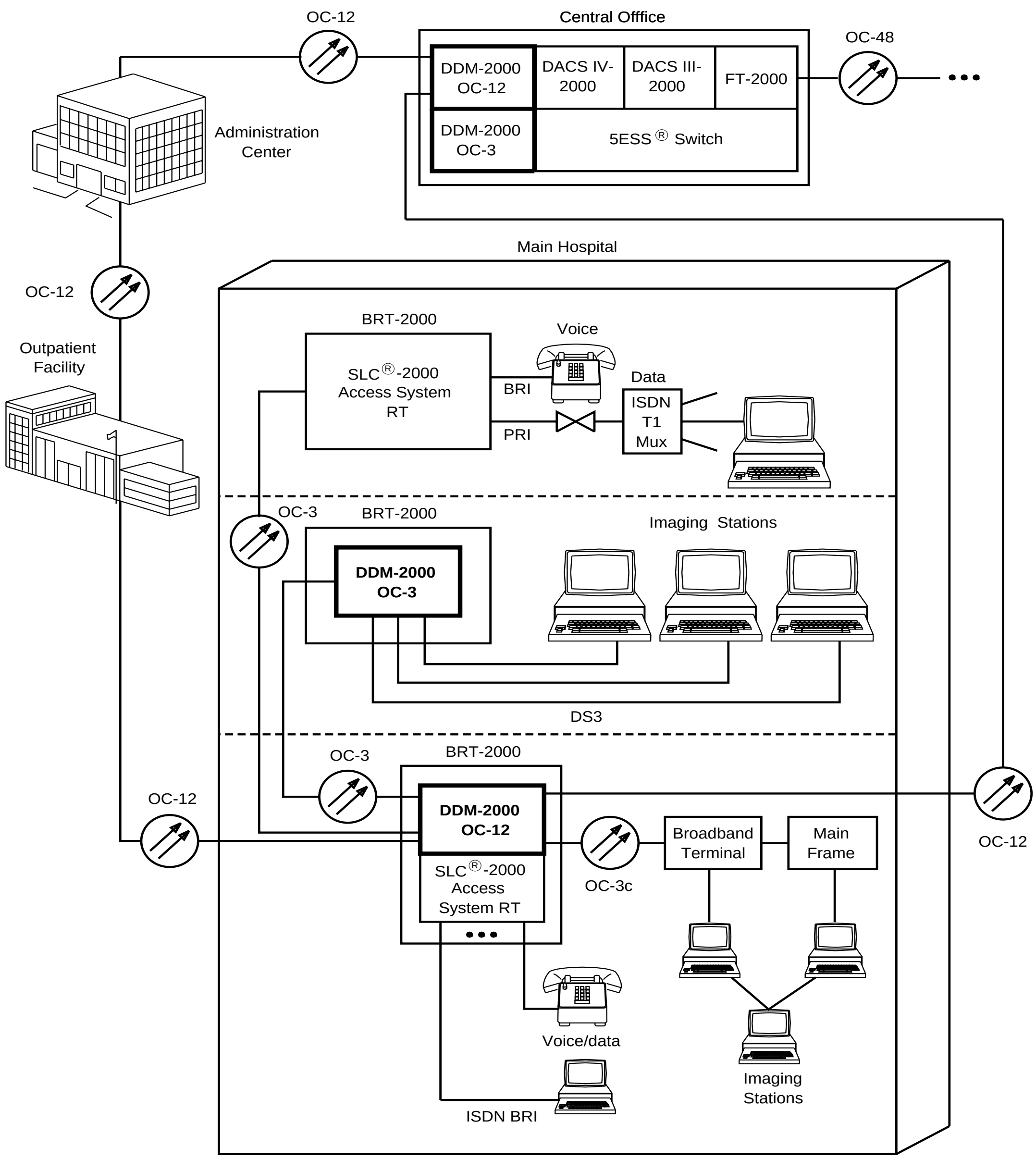

Figure 2-37. Self-Healing Medical Campus Network Application

LAN/WAN Data Networking

Increasing demands for data and multimedia applications have led to a significant growth in local area network (LAN) service needs among business customers. To transport these LAN data services over the public network, LAN routers and concentrators collect the data at a LAN location and the LAN circuit pack maps it with 1 to 8 DS1 transmission signals using the ATM forum IMA protocol. These DS1 signals can then be transmitted over an Access/Transport Network to another location where the data can be dropped to a LAN circuit pack (see Figure 2-38). DDM-2000 OC-3 Multiplexers are ideally suited to serving the growing demands for such LAN services. The DS1s from the LAN circuit pack can also be multiplexed into a DS3 by a transmultiplexer (TMUX) circuit pack (see Figure 2-39) and connected to an ATM edge switch that supports the IMA protocol for transmission over the ATM transport ATM transport network or a facilities ring SONET network. Using such an approach, DDM-2000 OC-3 Multiplexers can provide the necessary transport and bandwidth management capabilities to meet the business customer LAN interconnect service needs. Delivering LAN interconnect services using DDM-2000 provides the same high level of reliability and availability for these services as is supported for all other premium business services. Beginning with Release 15.0, the Low Speed slots of the DDM-2000 OC-3 shelf will support the LAN circuit pack to be used to interconnect a LAN through its IEEE standard 802.3 compliant interface.

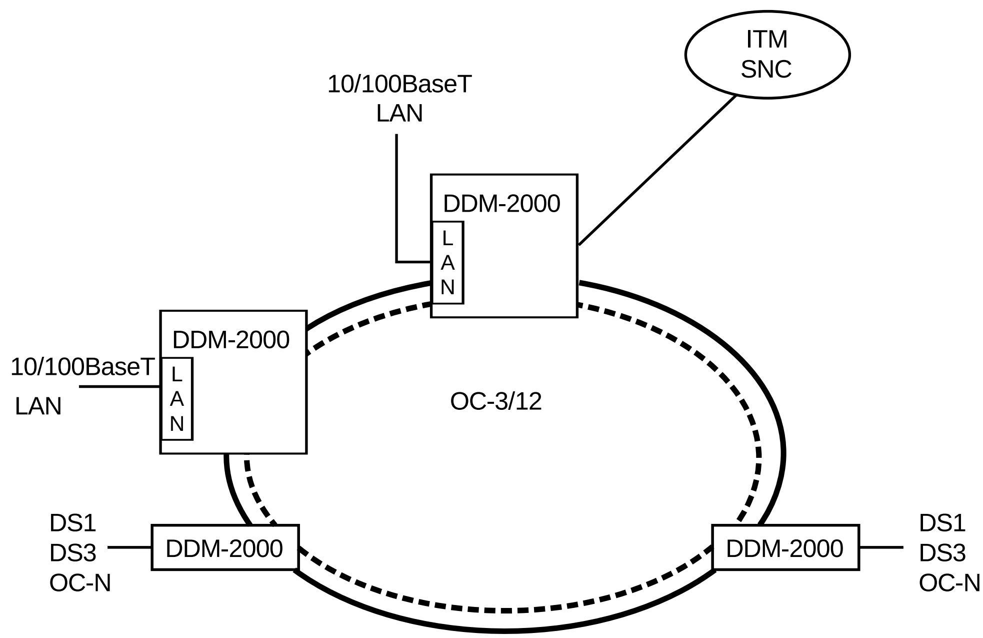

Figure 2-38. LAN/WAN Data Networking Using DS1/VT Cross-Connections

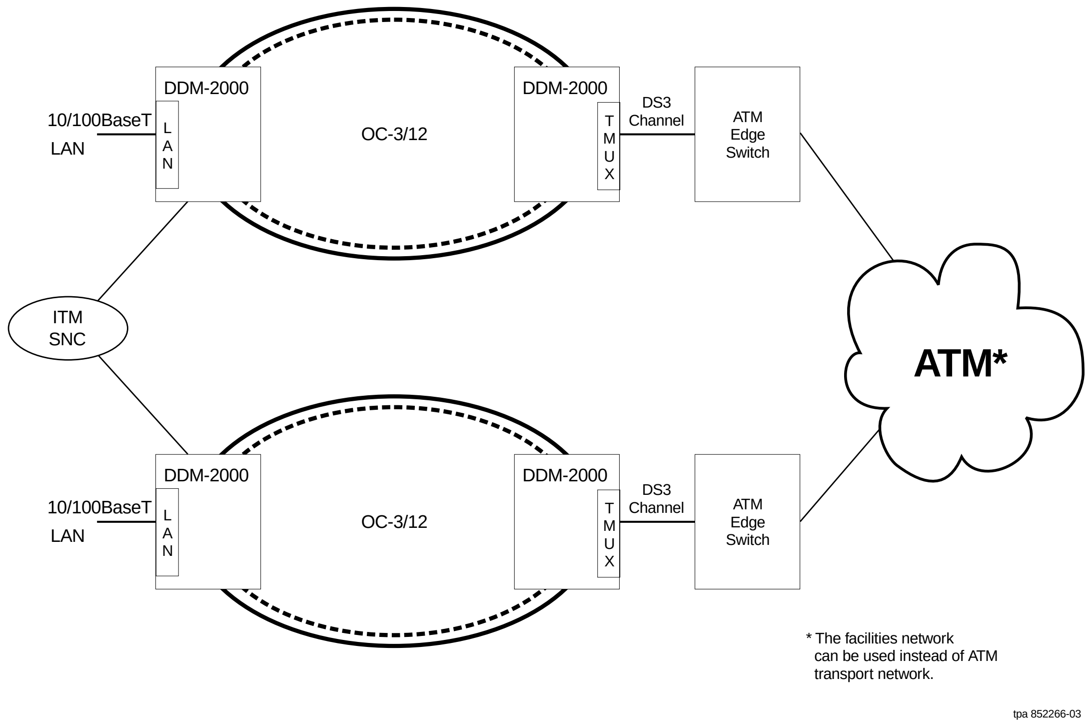

Figure 2-39. LAN/ATM Data Networking Using Transmultiplexer Circuit Pack

Release 11.0 introduced a DS3 Data Services Interface circuit pack (BBG19) for use with data edge devices. Figure 2-40 shows an example of the DDM-2000 providing ring access to ATM Switch. Up to four BBG19s can be installed in the DDM-2000 function units connecting data edge devices with services such as Ethernet, Token Ring, ATM, FDDI, Frame Relay, and others to the SONET access ring.

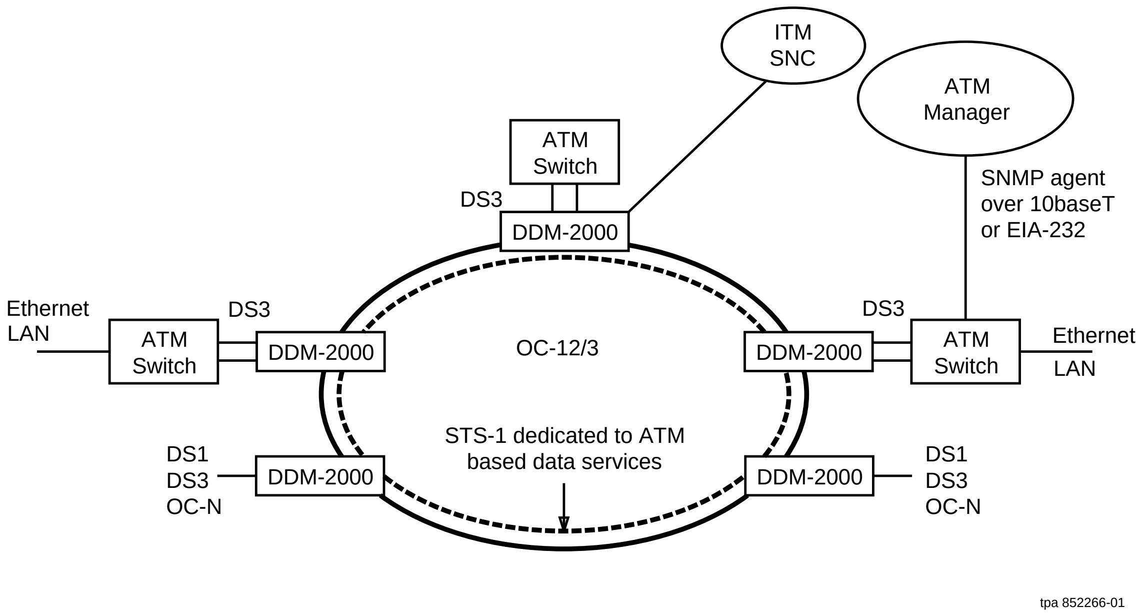

Figure 2-40. DDM-2000 Data Service with ATM Switch

Gateway Between SONET and Asynchronous Interfaces

Figure 2-41 shows an OC-12 STS-1 drop and continue to DS3 interface application for DDM-2000 OC-12 ring releases. The application is a DRI network with the following components and releases:

- DDM-2000 OC-3 Multiplexers with Release 7.1 or later software/*SLC*-2000 with Release 3.1 or later software path switched ring with VT1.5 drop and continue to EC-1 interfaces.
- DACS IV-2000 Release 3.0 or later to provide EC-1/DS3 (M13) conversions and cross-connections
- DDM-2000 OC-12 Multiplexers with Release 3.1 or later software.

This configuration is a specific application for interfacing DS1 signals at one end of a SONET system and DS3 interfaces at the other end.

NOTE:
A complete loss of CO 1 or CO 2 would protect the end-to-end path. However, unless there is a specific application requiring this gateway functionality, it is recommended that DRI be done with standard SONET EC-1 interfaces. This is because incoming asynchronous DS3 failures, such as AIS at drop and continue nodes, will not generate SONET STS AIS if drop and continue cross-connections are made on a 3DS3 circuit pack. As a result, path protection switching will not occur on the OC-12 ring resulting in unusable signals at the terminating end. (R5.1 OC-12.) DS3 LOS, however, will generate AIS.

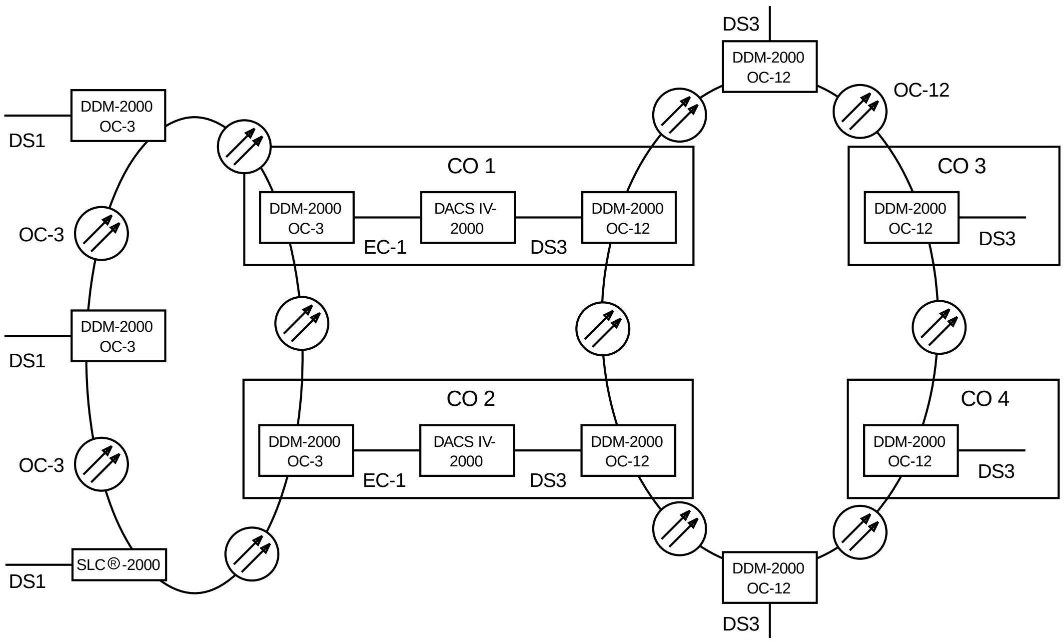

Figure 2-41. OC-12 STS-1 Drop-and-Continue to DS3 Interfaces

Locked STS-3c (0x1) Broadband Services

Beginning with Release 5.0 DDM-2000 OC-12 Multiplexer and with Release 15.0 DDM-2000 OC-3 Multiplexer (when the MAIN slots are equipped with 29-type OLIU OC-12 optics) the OC-12 ring will transport STS-3c 0x1 services through 22-type OLIU (in OC-3 NEs).

STS-3c path switching does not take place on the DDM-2000 OC-12 ring; it is executed elsewhere in the network (e.g., when the OC-12 ring transports ATM STS-3c traffic path switching is performed through the external ATM-based router).

Figure 2-42 shows an STS-3c 0x1 application. Each OC-12 node provisions the same dropped STS-3c time slot as other nodes on the same ring. For different applications, an OC-12 node can assign the other STS-3cs to different time slots at different sites. With 0x1 applications the OC-12 ring passes the contents of these STS-3c time slots between the low-speed OC-3/IS-3 lines and the OC-12 high-speed lines without terminating them or performing path protection switching.

Since the STS-3c traffic is received by the low-speed interfaces and transmitted as two copies on the OC-12 ring (one clockwise, one counterclockwise), the ring capacity is limited to the OC-12 line rate.

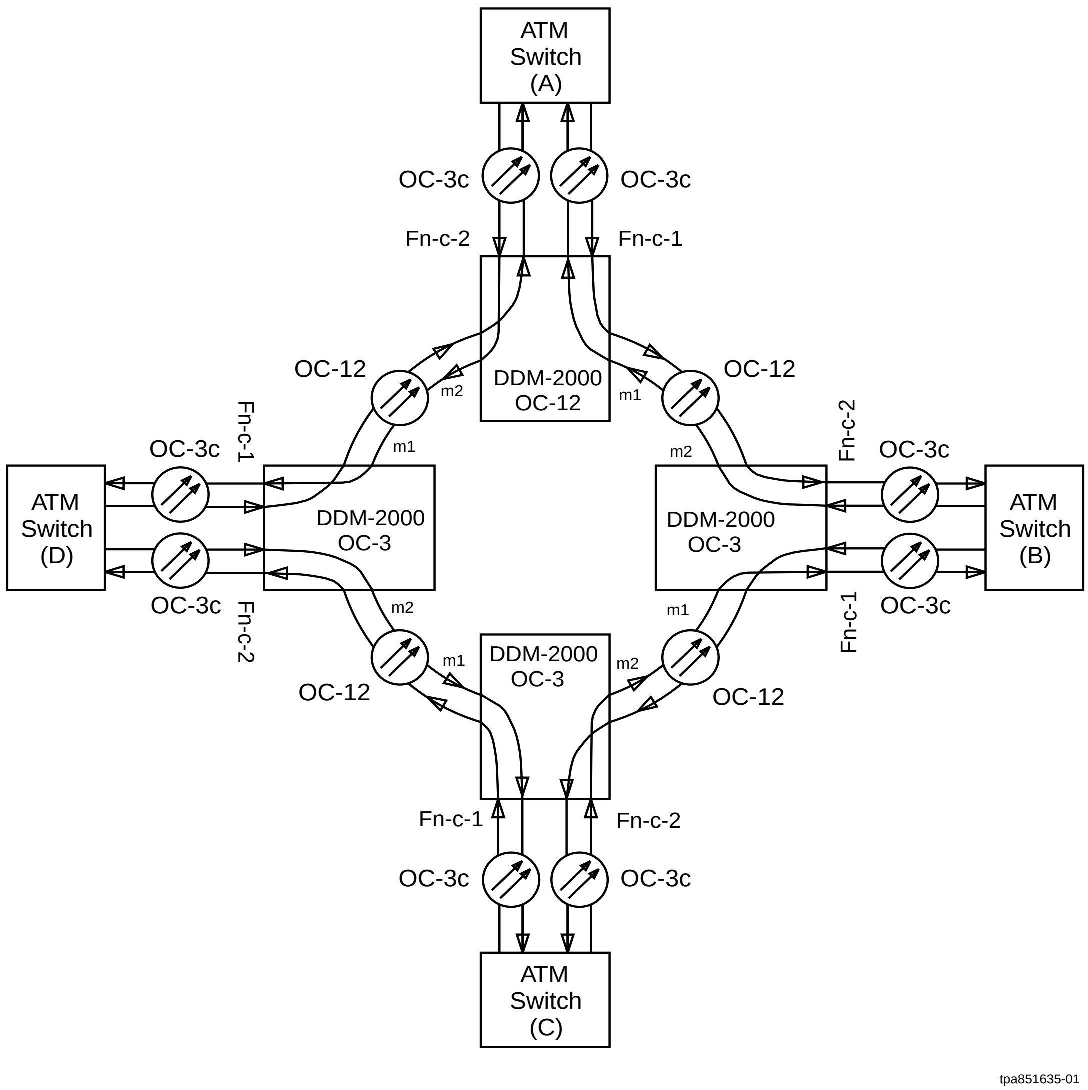

Figure 2-42. Locked (0x1) STS-3c - Broadband Services Using DDM-2000 OC-3 Multiplexer With OC-12 Optics

Teleprotection and SCADA Applications

Electric utilities are facing an unprecedented demand for increased communications bandwidth to support modern operations and business applications such as substation automation, computer networking, and video teleconferencing. Many electric utilities are installing SONET fiber optic backbones to meet these needs. SONET fiber optic backbones are a valuable communications resource that can also be used for real time protective relay and supervisory control and data acquisition (SCADA) applications.

DDM-2000 OC-3, DDM-2000 OC-12, and DDM-2000 FiberReach Multiplexers can be used in a flexible backbone network among electrical substations and other important sites. These systems provide an innovative "locked cross-connection" feature that enhances the ability of SONET rings to transport protective relay and SCADA communications. The locked cross-connection feature meets the teleprotection requirements for minimum and stable transmission delay, minimum system outage during a protection switch, and DS0 level bandwidth management at all ring nodes.

The locked cross-connection feature allows a DS1 to be removed from the TR-496 compliant VT path protection switching algorithm and provisioned as an unprotected path between any two nodes on the ring. As shown in Figure 2-43, locked cross-connection can be used to interconnect adjacent nodes all the way around SONET rings, thereby permitting access to the DS1 at each SONET node. Figure 2-43 shows a single DS1 locked between ring nodes, but this can be extended to an arbitrary number of DS1s within the available SONET bandwidth. This locked cross-connection feature fixes the ring rotation (and delay) of the DS1 paths on the ring and also permits DS0 grooming of the DS1s at each DDM-2000 or DDM-2000 FiberReach node using an external drop/insert multiplexer, such as the RFL 9001 Intelligent Multiplexer. Figure 2-43 shows the DDM-2000 interconnecting at the DS1 level with an adjacent RFL 9001 Intelligent Multiplexer that, in turn, connects on the low-speed side to protective relay and SCADA equipment. Specially designed channel units in the RFL 9001 Intelligent Multiplexer detect when a fault occurs on the power line or substation and communicate at the DS0 level with other substation nodes to isolate the power grid fault.

In addition to the efficient DS0 grooming capability, the RFL 9001 Intelligent Multiplexer implements its own protection algorithm that can restore the DS0 level circuits within the locked cross-connections should the ring be cut. This algorithm operates much faster than the SONET TR-496 algorithm, thereby minimizing system outage during a protection switch.

Figure 2-43 also shows an optical drop/insert DS1 extension from the SONET rings implemented with RFL 9001 Intelligent Multiplexers. This extension is useful for serving low bandwidth sites remote from the SONET backbone. The figure shows a single host DDM-2000 interconnecting the rings, but the application could be a DRI to provide node survivability.

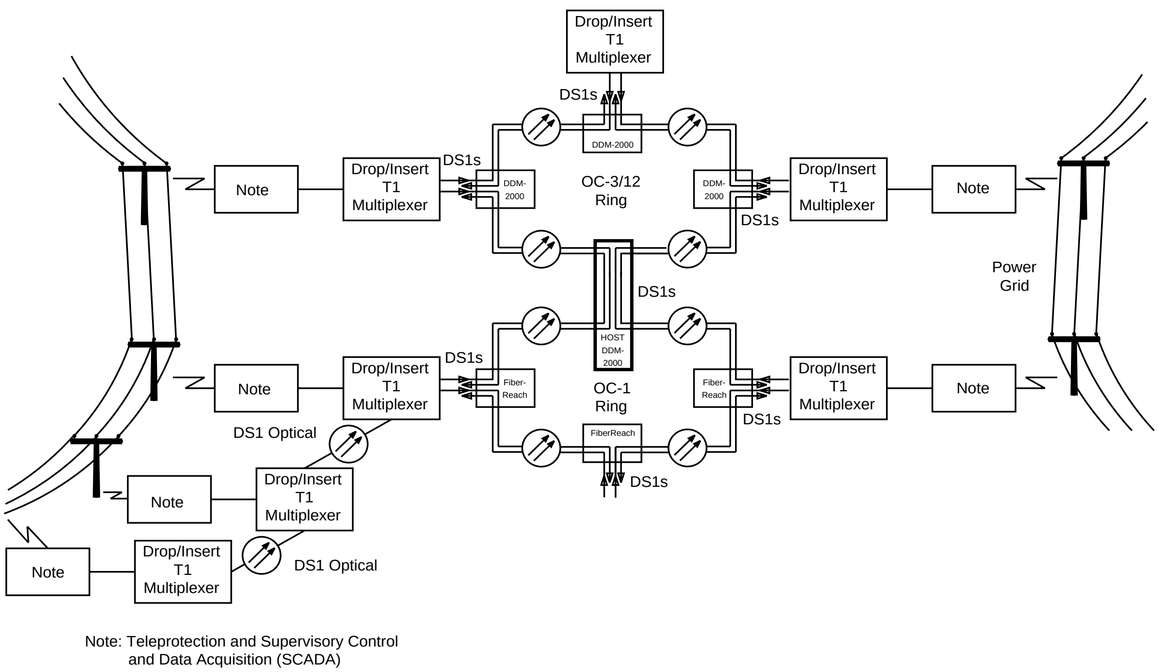

Figure 2-43. Teleprotection and SCADA Application

Intelligent Vehicle Highway System (IVHS) Applications

IVHSs are beginning and will grow to play a major role in the roadway systems of the future. Their primary use in the near-term is to reduce congestion. This is done in several ways.

- The IVHS provides more efficient and optimal traffic management which attempts to avoid congestion in the first place.
- The IHVS provides better management of congestion caused by random occurrences such as accidents or breakdowns.
- The IVHS eliminates many of the foreseeable causes of congestion, such as toll-taking, by automating these functions.

In the future, these systems will also help travelers plan their routes by providing up-to-the-minute traffic and highway information. The DDM-2000 OC-3 and OC-12 Multiplexers are a perfect match for the networking needs of these systems.

Figure 2-44 shows a typical IVHS application. An IVHS network calls for carrying data between roadside equipment, such as traffic counters, speed sensors, variable messaging signs, video cameras, toll-taking equipment, pay phones and call boxes, and a traffic operations center, where incoming data is processed and responses are generated. The DDM-2000 OC-3 and OC-12 Multiplexers provide a perfect backbone for carrying this information. The DDM-2000 OC-3 Multiplexer SONET ring capability, when coupled with diverse fiber routing on opposite sides of the roadway, makes the backbone completely self-healing in the face of failures. Such reliability is absolutely essential, especially as travelers come to depend more and more on IVHS networks. The VT1.5 and STS-1 bandwidth management capabilities of the DDM-2000 OC-3 and OC-12 Multiplexers allow flexible allocation of bandwidth to match the dynamics of a roadway system which is undergoing unpredictable changes in traffic patterns, breakdowns, accidents, and repairs. Such bandwidth management provides a system which meets the IVHS network needs in a cost-effective manner. DDM-2000 OC-3 and OC-12 Multiplexers completely meet the transmission needs of an IVHS network.

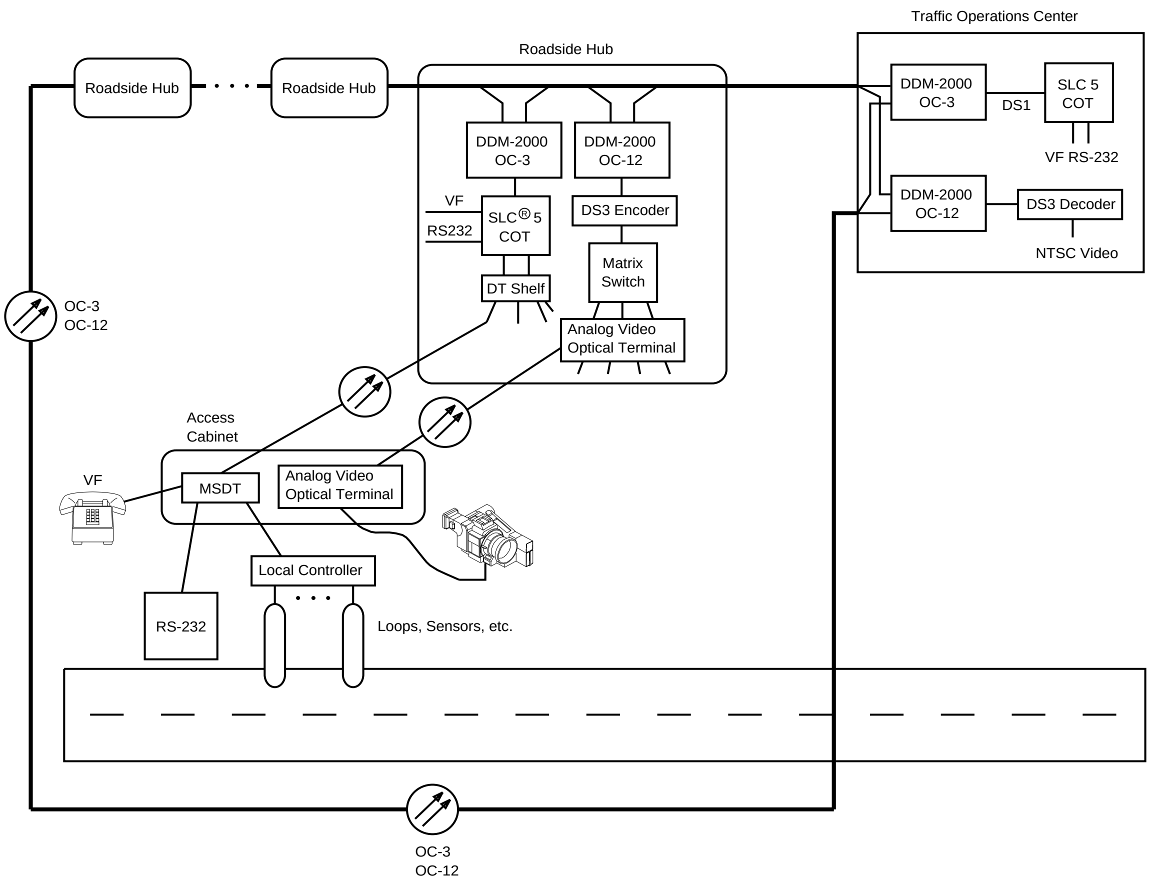

Figure 2-44. Intelligent Vehicle Highway System (IVHS) Application

DS1 Performance Monitoring for Tariff Verification

It is critical in the growing, high-reliability DS1 services market that DS1 performance be accurately measured and recorded in order to verify the terms of a DS1 tariff. The DDM-2000 OC-3 Multiplexer's DS1 PM capability allows a service provider to access this lucrative market by gathering and maintaining DS1 path performance data. The service provider can then use this data to confidently verify the terms of a DS1 tariff.

Figure 2-45 demonstrates a typical configuration for DDM-2000 OC-3 Multiplexers configured to provide DS1 PM. In this example, a business customer is using DS1s to interconnect a LAN at their remote office with an LAN at their corporate headquarters. The DS1 circuit is provided by a public carrier. Starting at the corporate headquarters (location A), an extended superframe (ESF) formatted DS1 is fed into the DDM-Plus or DDM-2000 FiberReach and DDM-2000 OC-3 equipment, carried across the public network, and delivered to the LAN bridge/ router at the company's remote office (location Z). There the LAN bridge/router (owned by the business customer) evaluates the number of bit errors occurring in the trip from headquarters to the remote office and sends a message in the opposite direction of the ESF data link, reporting these error statistics. The DDM-2000 OC-3 Multiplexer receives this message and stores the information locally on its DS1PM circuit pack. The DDM-2000 OC-3 Multiplexer does this continuously, gradually building a repository of DS1 performance data on the link from location A to location Z. This information is always available to the public carrier's operations center by querying the DDM-2000 OC-3 Multiplexer via its CIT or TL1 links. Similarly, the DDM-2000 OC-3 Multiplexer at the company headquarters maintains all the performance data on the link from location Z to A and this data is also transmitted over the TL1 interface. Taken together, these two sources of data provide verification of the 2-way DS1 link between location A and Z.

Beginning with Releases 11.1 and 13.0, a DS3 Transmultiplexer (TMUX) circuit pack is available for installation in the function unit slots of the DDM-2000 OC-3 shelf. The TMUX accepts an M13 or C-bit formatted DS3 signal and demultiplexes it into 28 DS1s. Performance monitoring can then be done at the DS3 and DS1 (measuring the same path parameters as the DS1 PM circuit pack) levels . This new circuit pack eliminates the need for a separate M13 multiplexer and can add versatility to your tariff verification capabilities (TMUX not shown in Figure 2-45). See Figure 2-46 for a DS3 Transmultiplexer application.

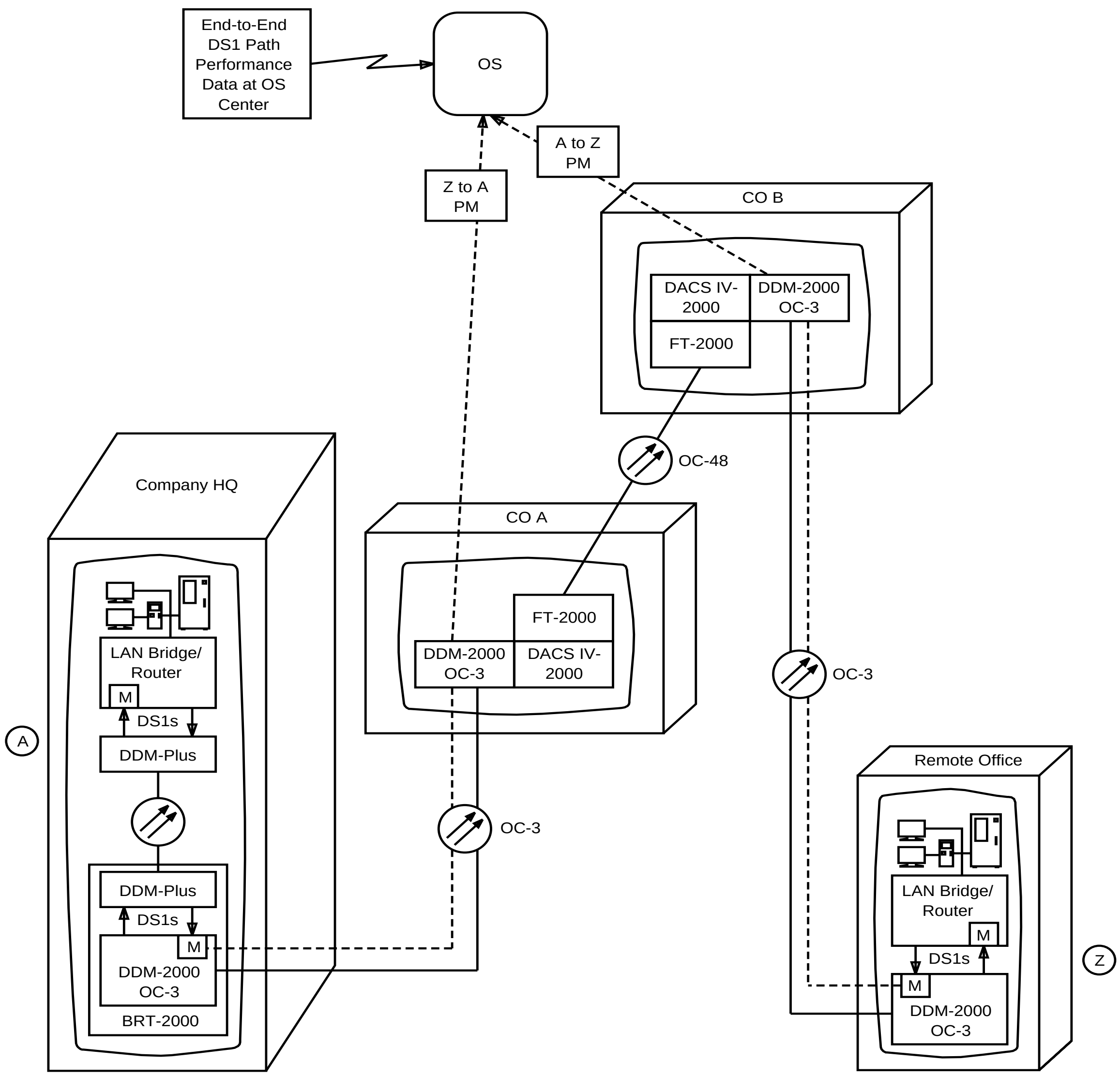

Figure 2-45. DS1 Path Performance Monitoring for Tariff Verification

DS3 Transmultiplexer (TMUX) Application.

The transmultiplexing feature provides an economical means for collection of DS1s at a customer site, and handoff of a fully groomed asynchronous DS3 to the interexchange carrier without the need for external M13 multiplexers.

Figure 2-46 shows an example of a total of 28 DS1s connected to three NEs and transported on three different STS-1s. The DS1s are collected and groomed in the DDM-2000 OC-3 shelf on the right, multiplexed to a DS3, and then passed on to the interexchange carrier. The DS3 Transmultiplexer (TMUX) circuit pack provides this feature.

In the transmit direction the TMUX accepts one DS3 signal and demultiplexes it into 28 DS1s. Performance monitoring can then be performed on the DS1s before they are mapped into floating VT1.5s. The 28 VT1.5s are then multiplexed into STS-1s before being sent to the high-speed OLIU. In the receive direction the reverse process takes place. The TMUX circuit pack also provides enhanced DS3 performance monitoring as well as DS1, VT, and STS-1 PM.

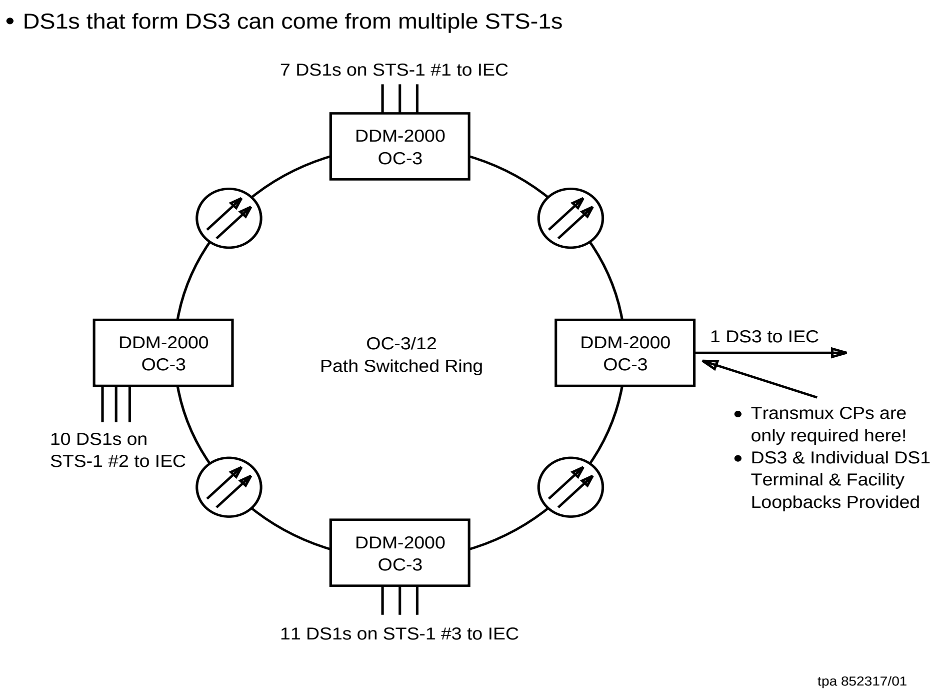

Figure 2-46. DS3 Transmultiplexer Application

High Bit Rate Subscriber Line (HDSL) Application.

The HDSL circuit pack (BBF8) provides HDSL interface capability on the DDM-2000 OC-3 shelf to compatible PairGain® equipment at the customer premises. It allows the transport of T1 payloads, for up to 12,000 feet, over two metallic 24 AWG twisted-pair lines. Figure 2-47 shows examples of HDSL circuit packs providing this capability in both the DDM-2000 OC-3 and the DDM-2000 FiberReach shelves. Applications for business customers, the private network, cell sites, PBXs, customer premises equipment (CPE), and other applications are supported.

The BBF8 circuit pack fits into the low-speed slots and provides two, four-wire HDSL interfaces. Each interface provides a full DS1 payload capacity mapped to a SONET VT1.5 and then VT cross-connected into an STS-1. Once in SONET, the DS1 payload is treated as a normal DS1.[*]

[*] Note that the HDSL circuit pack can be installed in DDM-2000 OC-3 shelves running linear Releases 6.2 and later, and ring Releases 7.1 and later. Refer to information included with each circuit pack for provisioning instructions.

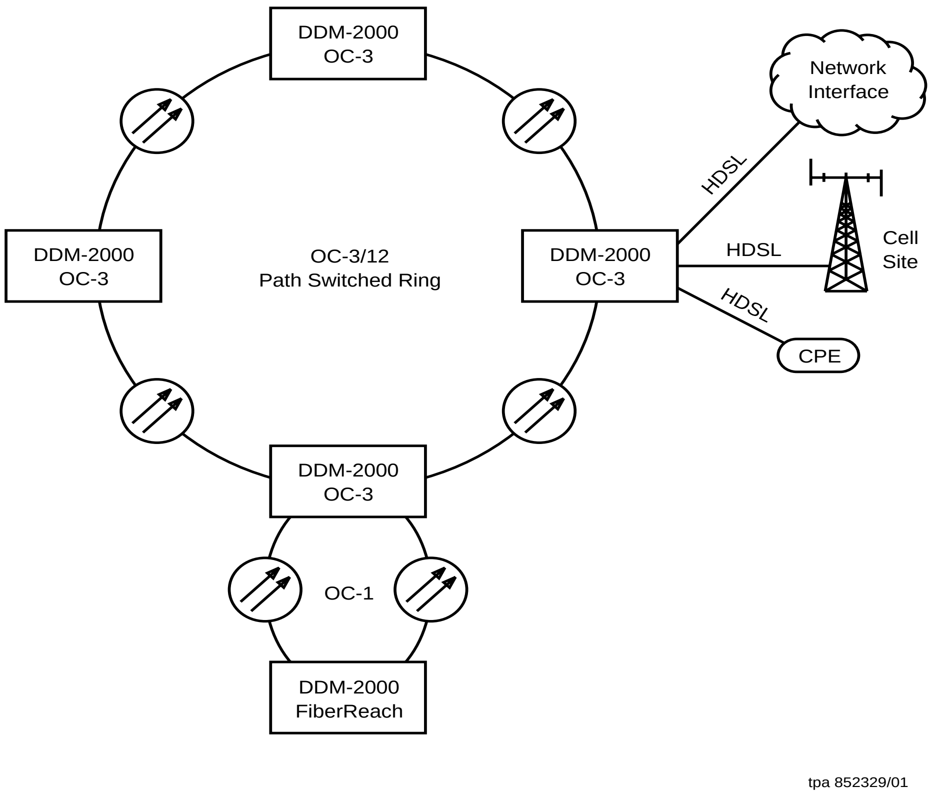

Figure 2-47. HDSL Application

Shelf Descriptions and Configurations

3

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Table of Contents

Shelf Descriptions and Configurations

3

Overview

This section provides the physical description of the DDM-2000 OC-3 Multiplexer shelf and illustrates typical shelf equipage for different configurations. In addition, this section provides a physical description of the DDM-2000 Fan Shelf.

DDM-2000 OC-3 Multiplexer Shelf

The DDM-2000 OC-3 Multiplexer is shown in Figure 3-1 and Figure 3-2. Figure 3-1 is the Group 4 Shelf. This shelf measures 8.5 inches high by 21.25 inches wide by 13.25 inches deep and fits in a standard 23-inch wide bay. The Group 1 or Group 3 shelf measures 8.5 inches high by 21.25 inches wide by 12 inches deep and fits in a standard 23-inch wide bay. User panels are interchangeable between shelves (old in the new or new in the old). Each shelf is a stand-alone entity with its own fiber cabling and interfaces to DSX-1, DSX-3, STSX-1 office power, and operations interfaces. Cabling for office alarms, craft interface terminal (CIT) interfaces, and DS1 timing inputs can be shared among shelves in a bay. The default configuration provides rear access cabling. Front access through dangler cables is available as an option. Front-access optical connectors interconnect to optical fiber facilities and facilitate shelf loopback and fiber tests. The optical connectors are mounted on the optical line interface unit (OLIU) circuit pack faceplate.

The DDM-2000 OC-3 Multiplexers provide Lucent Technologies' universal optical connector on all OLIUs. These OLIUs are designated by a -U. The universal optical connectors are receptacles on the faceplate of the OLIUs that allow a single OLIU to support either *ST*®, FC-PC, or SC connectors as needed.

A DDM-2000 OC-3 Multiplexer shelf consists of the following:

- 36 circuit pack slots
  - 26 four-inch slots
  - 10 eight-inch slots
- User panel
- Fully connectorized backplane
- Front and back covers.

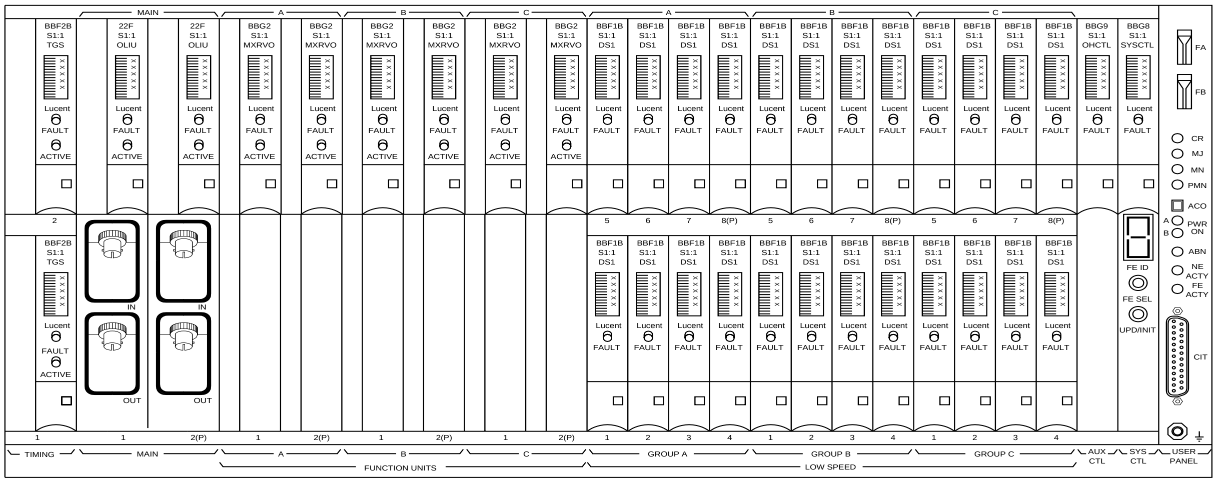

Figure 3-1. DDM-2000 OC-3 Group 4 Shelf — Front View

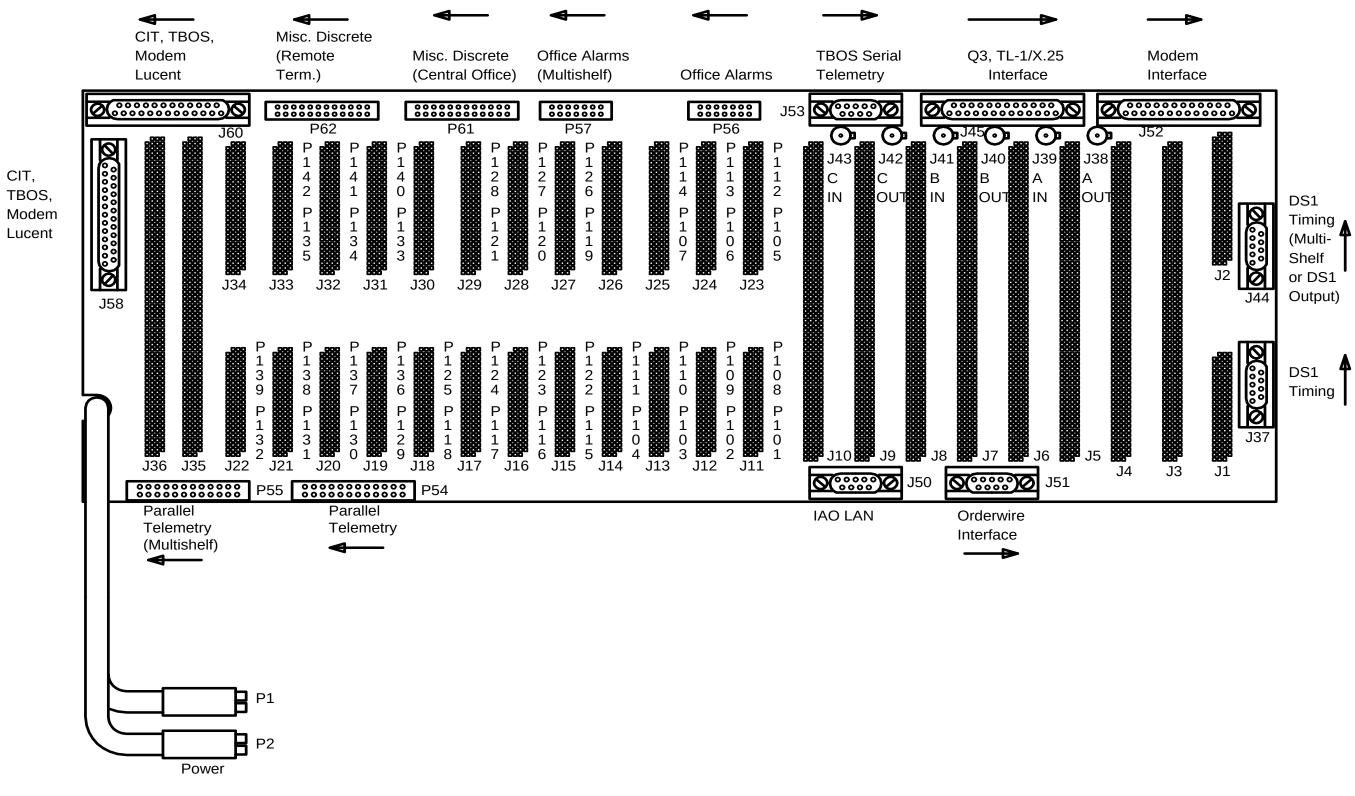

Figure 3-2. DDM-2000 OC-3 Shelf — Rear View

Table 3-1 lists the DDM-2000 OC-3 Multiplexer plug-ins.

Table 3-1. DDM-2000 OC-3 Plug-Ins

Product Code	Functional Name	Functional Designation
BBF1B	DS1 Low-speed Interface	DS1
BBF2B	Synchronous Timing Generator	TGS
BBF3/BBF3B	DS1 Performance Monitoring	DS1PM
BBF4	Synchronous Timing Generator 3	TG3
BBF5 *	Jumper circuit pack	JUMPER
BBF6	T1 Extensions	T1EXT
BBF8	HDSL Interface	HDSL
BBF9	LAN Interface (10/100 BaseTX)	LAN
BBF10	LAN Interface (100 BaseFX)	LAN
BBG2	VT-to-STS-1 Multiplexer	MXRVO
BBG2B %	VT-to-STS-1 Multiplexer	Enhanced MXRVO
BBG4B †	DS3 Low-speed Interface	DS3
BBG5	System Controller	SYSCTL
BBG6	EC-1 Interface	STS1E (EC-1)
BBG7	Overhead Controller	OHCTL
BBG8/BBG8B	System Controller	SYSCTL
BBG9 ‡	Overhead Controller	OHCTL
BBG19	DS3 Data Services Interface	DS3
BBG20	Transmultiplexer	TMUX
22F2-U	OC-3 OLIU with TSI	OLIU
22G-U/22G2-U	OC-3 OLIU with TSI	OLIU
22G3-U	OC-3 OLIU with TSI	OLIU
22D-U	IS-3 OLIU with TSI	OLIU
24G-U	OC-12 Ring OLIU	OLIU
26G2-U §	OC-1 OLIU	OLIU
27G-U/27G2-U ‡	OC-1 (Dual OC-1) OLIU	OLIU
29G-U	OC-12 OLIU with TSI	OLIU
29H-U	OC-12 OLIU with TSI (Long Reach)	OLIU
177A	Retainer	

* Required in Group 1 and Group 3 shelves serving as DDM-2000 FiberReach host with 27-type OLIUs. Required in Slot 8(P) of the low-speed group associated with the function unit(s) housing 27G-U OLIUs. Required in low-speed slots 4 and 8 associated with function units(s) housing 27G2-U OLIUs.

† Required for enhanced DS3 performance monitoring. Replaces BBG4.

‡ Used in DDM-2000 FiberReach host shelves.

§ Requires Group 4 shelf.

% For supplying -48V to low-speed slots equipped with BBF9/BBF10 or BBF6 circuit packs. Furthermore, BBF9/BBF10 packs can be used with BBG2 (regular MXRVO).

As shown in Figure 3-1, starting at the far left, two 4-inch slots are reserved for service and protection timing circuit packs (TG).

The next two 8-inch slots are reserved for service and protection main dual OC-1, OC-3, IS-3 or OC-12 OLIU circuit packs.

The following six 8-inch slots are for the function units. These slots are divided in three groups designated A, B, and C. The function unit slots can be equipped, depending on the application, with DS3, TMUX, MXRVO, EC-1 or OC-1 or OC-3 OLIU circuit packs.

The next section of the shelf is reserved for the DS1 low-speed interface or HDSL circuit packs. These slots are also divided into three groups designated A, B, and C which correspond to the function unit groups. Each group consists of eight 4-inch slots for service and optional protection DS1 circuit packs (1x7 protected). Unused low-speed interface slots within a partially equipped group must be equipped with retainer cards (177A retainer) if DS1 protection is used.

The next section of the shelf consists of two 8-inch slots reserved for control circuit packs. The auxiliary control slot is reserved for a required overhead controller (OHCTL) circuit pack. The system controller (SYSCTL) slot is reserved for the SYSCTL circuit pack.

The user panel, mounted on the right side of the shelf, consists of the following:

- Two –48 volt fuses (5A)
- Four alarm LEDs
- ACO/TEST pushbutton control
- Four (five on Group 4 shelves) status LEDs
- CIT port
- Electrostatic discharge (ESD) jack.

Accidental insertion of same-size circuit packs in incorrect slots is prevented through circuit pack keying. Three keying combinations are provided. The key mechanism is located on the faceplate latch, with an interference mechanism on the shelf.

As shown in Figure 3-3, the front of the shelf is covered with an electromagnetic compatibility (EMC) cover. If the shelf needs to be accessed for maintenance activities, the cover is hinged to drop down 180 degrees, or it can be easily removed by pulling out when at 45 degrees. The back of the shelf is covered by an inner cover over the DS1 interface connectors and an outer cover over the rear of the shelf. All covers are necessary to meet the EMC guidelines set by the Federal Communications Commission (FCC).

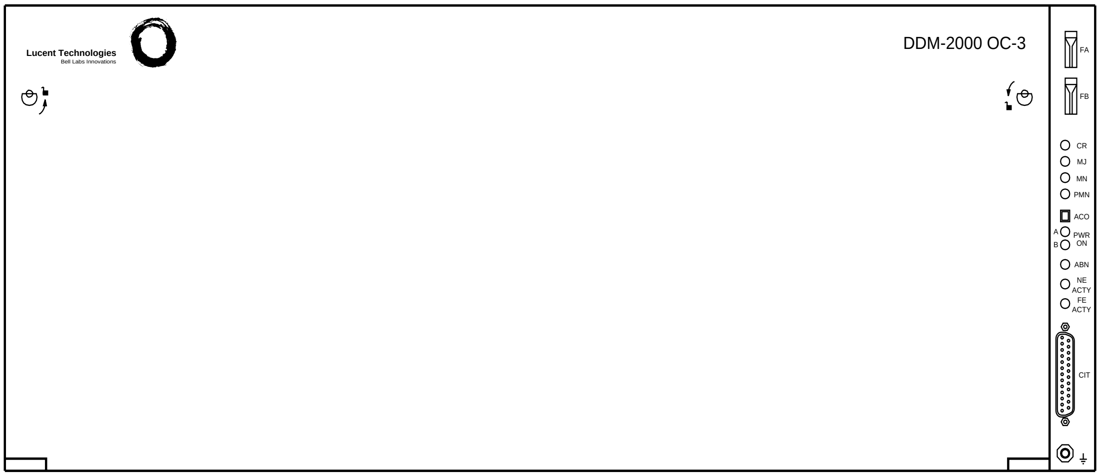

Figure 3-3. DDM-2000 OC-3 Multiplexer Front Panel

DDM-2000 OC-3 Shelf Capacity

The DDM-2000 OC-3 Multiplexer provides multiplexing and transport for up to three STS-1 signals in a terminal, add/drop, or ring configuration. In a ring configuration, the drop capacity of 3 STS-1s may be utilized in any combination of low-speed inputs as follows:

- 84 DS1s
- 56 DS1s and 1 DS3 (or EC-1 or OC-1 or 2 partially filled OC-1s)
- 28 DS1s and 2 DS3s (or EC-1s or up to 4 partially filled OC-1s)
- 3 DS3s (or EC-1s or up to 6 partially filled OC-1s)
- 3 (partially filled) OC-3s
- 6 single-homed or 12 dual-homed OC-1 extensions or a mix with other services not to exceed the OC-3 shelf capacity.

In a linear add/drop configuration, this capacity may be utilized in any combination of low-speed inputs as follows:

- 56 DS1s
- 28 DS1s and 1 DS3 (or EC-1)
- 2 DS3s (or EC-1s)
- 2 OC-3s.

System growth proceeds in a modular fashion. Capacity can grow in increments of 4 DS1 signals, up to 28 DS1s per STS-1. The DDM-2000 OC-3 Multiplexer can also provide transport of a single STS-3c signal from one OC-3 interface to another.

In many instances, the OC-3 capacity may be sufficient for many years of growth. Should network needs grow beyond the OC-3 capacity, the facility can be upgraded while in service to the OC-12 capacity using the 24G-U OLIUs.

Shelf Configurations

A single DDM-2000 OC-3 shelf supports all the DDM-2000 OC-3 applications. Users configure shelves for an application by equipping slots with the appropriate circuit packs and providing the required external cabling and software. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide* for cabling information. Only Lucent designated cables should be used with the DDM-2000 OC-3 Multiplexer. Failure to use Lucent designated cables could void the product warranty. Each shelf configuration requires a SYSCTL and OHCTL circuit pack to provide the basic maintenance feature set, single-ended operations (SEO), data communication channel (DCC) processing, and the TL1/X.25 interface. A synchronous timing generator (TGS) circuit pack distributes a common clock to the transmission circuit packs and is required for all configurations. A protection TGS circuit pack is recommended. Equipage of other slots depends on the application.

All applications should be equipped with a heat baffle as shown in ED-8C724-10.

Table 3-2 is a list of circuit packs that are allowed mapped by release and shelf slots. See Section 10, "Technical Specifications," for information on mixing OLIUs. See Section 7, "Circuit Pack Descriptions," for more information on these and other circuit packs.

Table 3-2. DDM-2000 OC-3 Multiplexer Circuit Pack and Software Compatibility Matrix

Release Number	Slot Name							
	TG	**Main**	**Fn-A**	**Fn-B**	**Fn-C**	**LS Group***	**AUXCTL**	**SYSCTL**
13.0/ 15.0† (Ring)	BBF2 BBF2B‡ BBF4	22F/22F-U/ 22F2-U§ 22D-U 22G-U/22G2-U 22G3-U 24G-U†† 27G-U/ 27G2-U¶ 29G-U 29H-U	22D-U 22F/22F-U/ 22F2-U 22G-U/22G2-U 22G3-U 26G2-U‡‡ 27G-U/ 27G2-U¶¶ BBG2/2B BBG4/4B*** BBG6(ls)††† BBG19‡‡‡ BBG20	22D-U 22F/22F-U/ 22F2-U 22G-U/22G2-U 22G3-U 26G2-U‡‡ 27G-U/ 27G2-U¶¶ BBG2/2B BBG4/4B*** BBG6(ls)††† BBG19‡‡‡ BBG20	22D-U 22F/22F-U/ 22F2-U 22G-U/22G2-U 22G3-U 26G2-U‡‡ 27G-U/ 27G2-U¶¶ BBG2/2B BBG4/4B*** BBG6(ls)††† BBG19‡‡‡ BBG20	BBF1B BBF3/ BBF3B¶ BBF5** BBF8§§ BBF6¶ BBF9 BBF10	BBG9	BBG8/ BBG8B

* 177A Retainer card must be installed in unused slots of a partially equipped muldem. Not required with BBF5.

† The 22-type OLIUs must be present in main-1 and main-2 for proper ring operation. If signal degrade protection is not used, the 22F/22F-U and 22G-U/22G2-U OLIUs can be mixed in the same shelf. The 22F2-U provides signal degrade protection switching and can be mixed with 22G-U/22G2-U OLIUs. The BBF2B TGS is recommended for rings to minimize protection switching times in case of a manual circuit pack removal.

‡ The BBF2B circuit pack optionally provides DS1 timing outputs. It is recommended for rings to minimize protection switching times in case of a manual circuit pack removal.

§ Signal degrade protection switching requires 22D-U or 22G-U/22G2-U or 22F2-U OLIUs.

¶ The BBF3 is the DS1PM circuit pack which can be used in place of or mixed with the BBF1/1B. If mixed within a low-speed group the protection circuit pack must be a BBF3. If the DS1PM feature is "enabled" using the **`set-feat`** command, the BBF3 has additional performance monitoring capabilities. The BBF3B can perform individual DS1 loopbacks using R13 or later.

** Required in Group 1 and Group 3 shelves functioning as DDM-2000 FiberReach hosts with 27G-U/27G2-U OLIUs.

†† When 24G-Us are used in a G3 shelf (the 24G-Us must be deployed in pairs), the front cover must be modified using the G3 to G4 Front Cover Modification Kit. The 24G-Us also require an Interconnect Cable Assembly 847721271.

‡‡ 26G2-U requires OC-3 Group 4 Shelf.

§§ Up to three BBF8s can be installed per low-speed group. Future enhancements may support higher density.

¶¶ The 27G2-U is required for some enhanced FiberReach host topologies with Release 13.0. When the 27G-U/27G2-U is used in a G3 shelf, the front cover must be modified using the G3 to G4 Front Cover Modification Kit.

*** BBG4B DS3 required to support enhanced DS3 performance monitoring.

††† The BBG6(ls) is the BBG6 circuit pack with its switch set for low-speed.

‡‡‡ Due to cable congestion, it is recommended that no more than four BBG19s be used per shelf. A G4 shelf or G3 to G4 Fron Cover Modification Kit is required.

Note: The following circuit packs require the G4 Shelf, or G3 to G4 Front Cover Upgrade Kit: 24G-U OLIU, 27G-U/27G2-U OLIUs 26G2-U OLIU (always requires G4 Shelf for backplane compatibility), and BBG19 DS3. Additionally, the G3 to G4 upgrade k is recommended wherever fiber contusion and/or cable dressing is a concern.

The BBF1, BBF2, BBG4, 22F, 22F-U and 22G-U circuit packs have been rated discontinued availability (DA).

A single DDM-2000 OC-3 shelf supports various shelf configurations including:

- STS-1 drop
- Ring
- Dual Ring Interworking
- Optical extension
- VT Hairpin
- DDM-2000 FiberReach host
- Dual homing
- Enhanced routing.

The following sub-sections describe some examples of how the DDM-2000 OC-3 Multiplexer could be equipped for each of these configurations.

OC-3 Ring Shelf

An example of an OC-3 ring shelf is shown in Figure 3-4. The 22-type OLIU circuit packs are equipped in the main positions. The ring shelf optionally supports DS1, DS3, and EC-1 low-speed interfaces. Total ring capacity must not exceed 84 DS1s.

The shelf can be used in an OC-12 VT1.5 path switched ring (0x1) application. Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

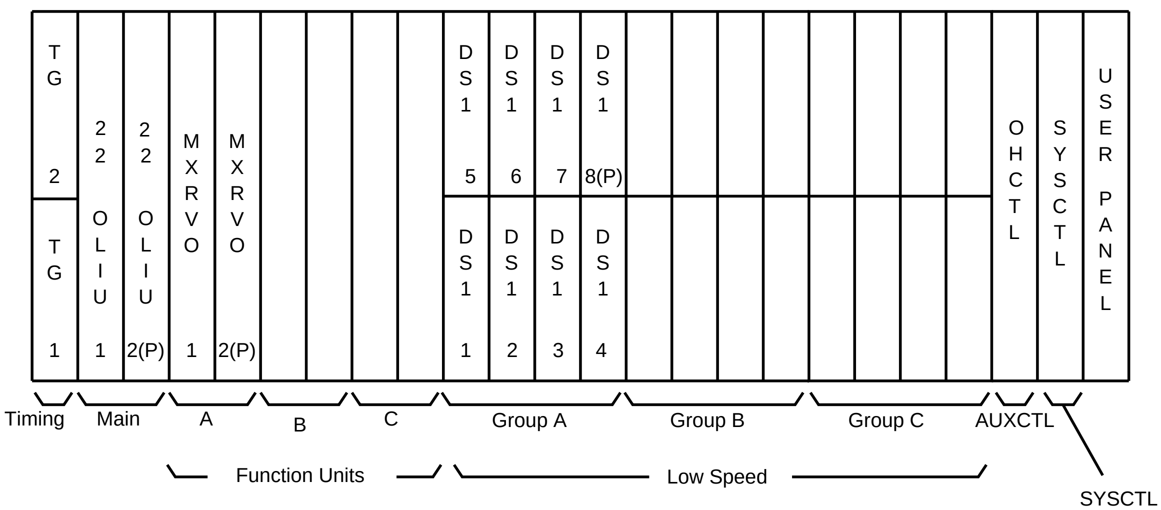

Figure 3-4. DDM-2000 OC-3 Ring Shelf

OC-3 Dual Ring Interworking (DRI) Shelf

An example of an OC-3 DRI shelf is shown in Figure 3-5. The 22-type OLIU circuit packs are equipped in the main positions and can be equipped in function units A, B, or C. At least one pair of STS1E circuit packs must be equipped in at least one of the function unit slots. A DRI shelf can also support MXRVOs and DS3 interfaces for non-DRI circuits.

DRI traffic can be interconnected using 22-type OLIU circuit packs in the function unit slots. Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

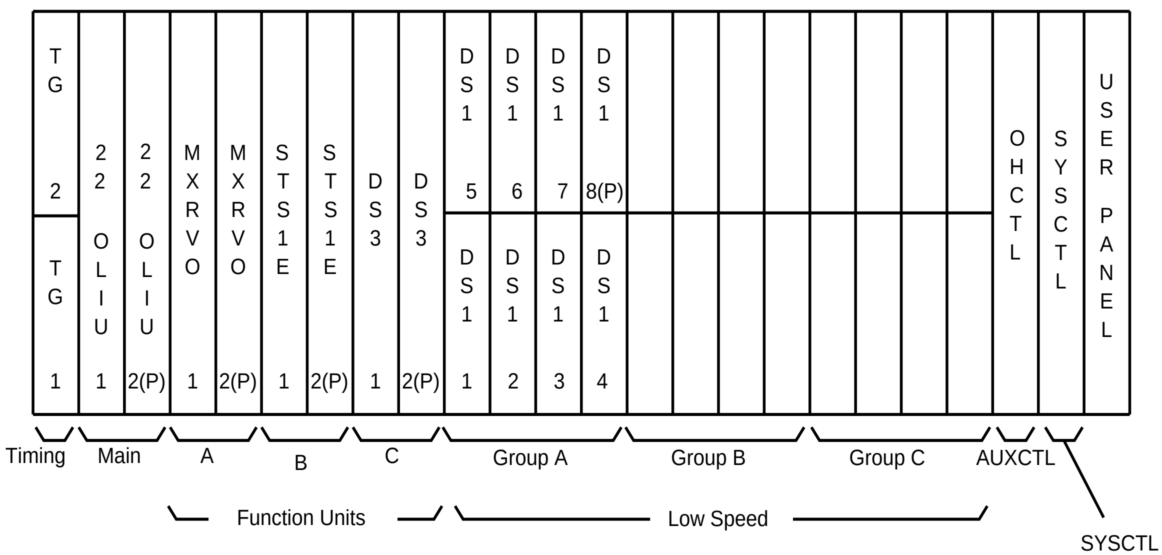

Figure 3-5. **DDM-2000 OC-3 DRI Shelf**

OC-3 Ring Shelf with Optical Extension

An example of an OC-3 ring shelf with an optical extension is shown in Figure 3-6. The 22-type OLIU circuit packs in the main positions carry ring traffic. The 22-type OLIU circuit packs in function unit B or C positions provide the optical extension capability. Optical extensions can also be provided from function unit A.

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

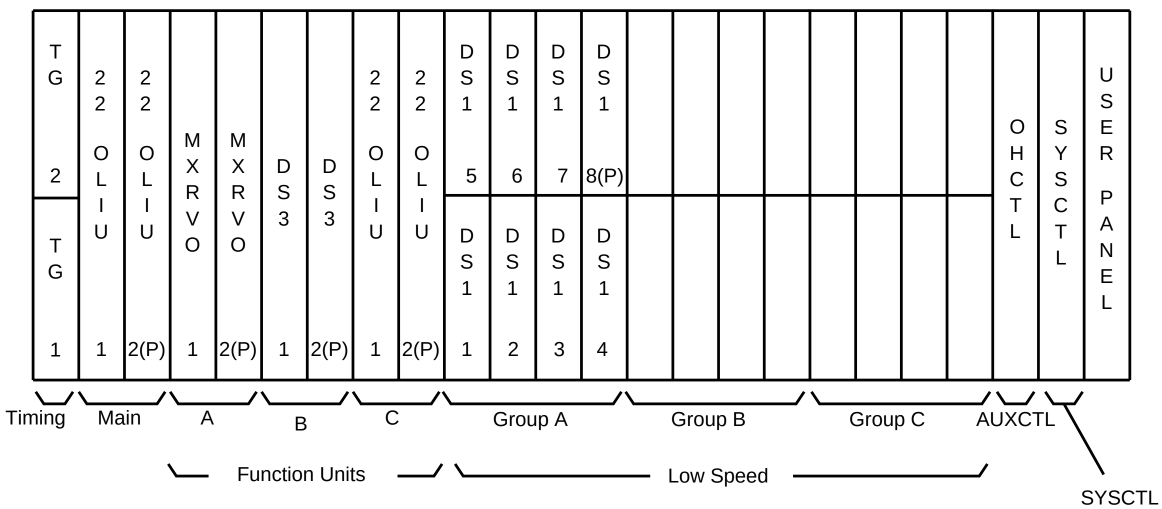

Figure 3-6. DDM-2000 OC-3 Ring Shelf With an Optical Extension

OC-3 VT/STS Hairpin Shelf

An example of an OC-3 shelf equipped to allow both VT and STS hairpin cross-connects is shown in Figure 3-7. The VT/STS hairpin feature allows cross-connections from Function Units C to A, or C to B. In this example, the VT hairpin feature allows cross-connections between Function Units A and C when those Function Units are equipped with 22-type OLIUs, STS1E, or MXRVO circuit packs (MXRVO-to-MXRVO cross-connections are not allowed); the STS hairpin feature allows cross-connections between Function Units B and C when equipped with 22-type OLIUs, STS1E, or DS3 circuit packs.

The hairpin feature keeps local VT/STS traffic from being placed on the OC-3 ring. This increases the usable bandwidth on the OC-3 ring and may remove the need to add additional OC-3 shelves.

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

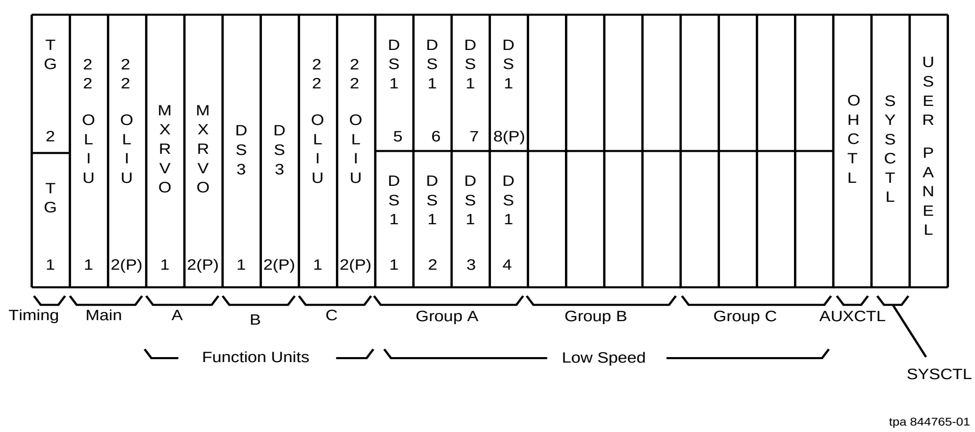

Figure 3-7. DDM-2000 OC-3 VT/STS Hairpin Shelf

DS3 Data Services in OC-3 Shelf

Figure 3-8 shows an example of DS3 Data Services in an OC-3 shelf. The BBG19 DS3 circuit packs installed in function units A and B can provide a full range of Multimedia Data Services Offerings. Four BBG19s are recommended due to cable dressing (right angle BNC connectors are required) for use in function units A, B, or C. However, up to six BBG19s can be installed connecting customer data edge devices with services such as Ethernet, Token Ring, ATM, FDDI, Frame Relay, and others, to the OC-3 ring.

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

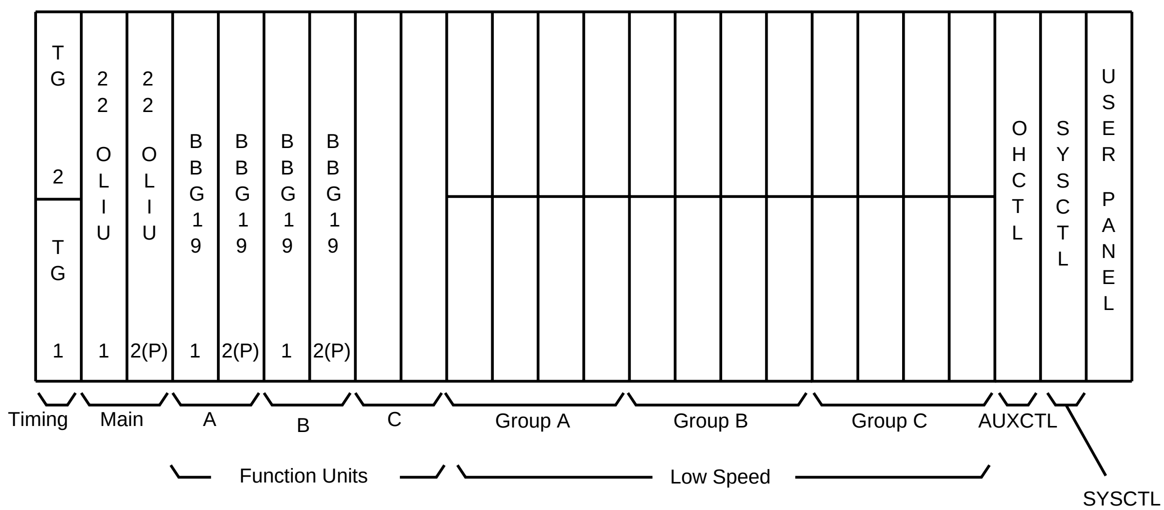

Figure 3-8. DS3 Data Services in OC-3 Shelf

OC-3 Dual Homing Shelf

Figure 3-9 shows a DDM-2000 OC-3 shelf equipped for a dual homing configuration, allowing two hosts to be active on the same OC-3 ring. This allows a 0x1 application where traffic is routed to both hosts to provide host protection. Each host node is connected to the low-speed ring through OLIUs in the Function Unit. In this application, two DDM-2000 OC-3 shelves are hosting one or two DDM-2000 FiberReach OC-1 rings.

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

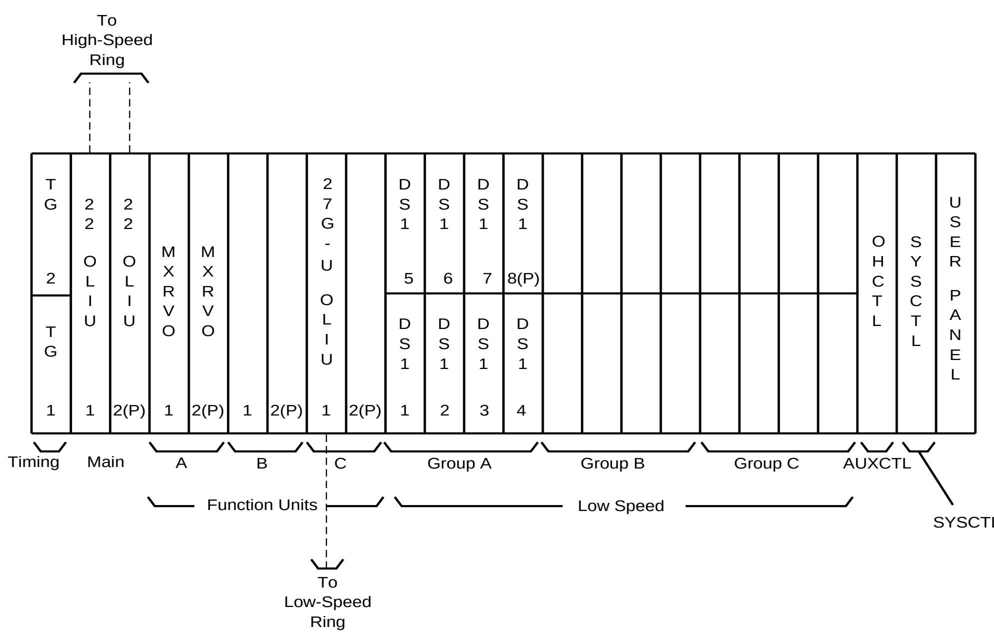

Figure 3-9. DDM-2000 OC-3 Dual Homing Shelf

OC-3 DDM-2000 FiberReach Host Shelf

An example of an OC-3 DDM-2000 FiberReach host shelf is shown in Figure 3-10. As a host node, the OC-3 shelf provides add/drop capability between the OC-3 ring and OC-1 rings (DDM-2000 FiberReach extensions). The ring (0x1) cross-connection between the rings supports full TSI assignment between the low-speed and high-speed time slots while preserving independent service and protection paths between the rings. Using 27-type dual OC-1 OLIUs in the Function Units, a single OC-3 shelf can support up to six OC-1 extensions in a single-homing arrangement (the 27-type OLIUs must be equipped in pairs). When fully loaded with six 27-type OLIUs, the OC-3 shelf can support up to 12 OC-1 extensions in a dual-homing arrangement (for a maximum capacity of 84 DS1s).

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

Note that In Group 1 or 3 shelves, a BBF5 jumper circuit pack must be installed in Slot 8 of the low-speed group associated with the Function Unit equipped with a pair of 27-type OLIUs. In addition, a BBF5 must be installed in Slot 4 if both OLIUs in the function unit are 27G2-Us.

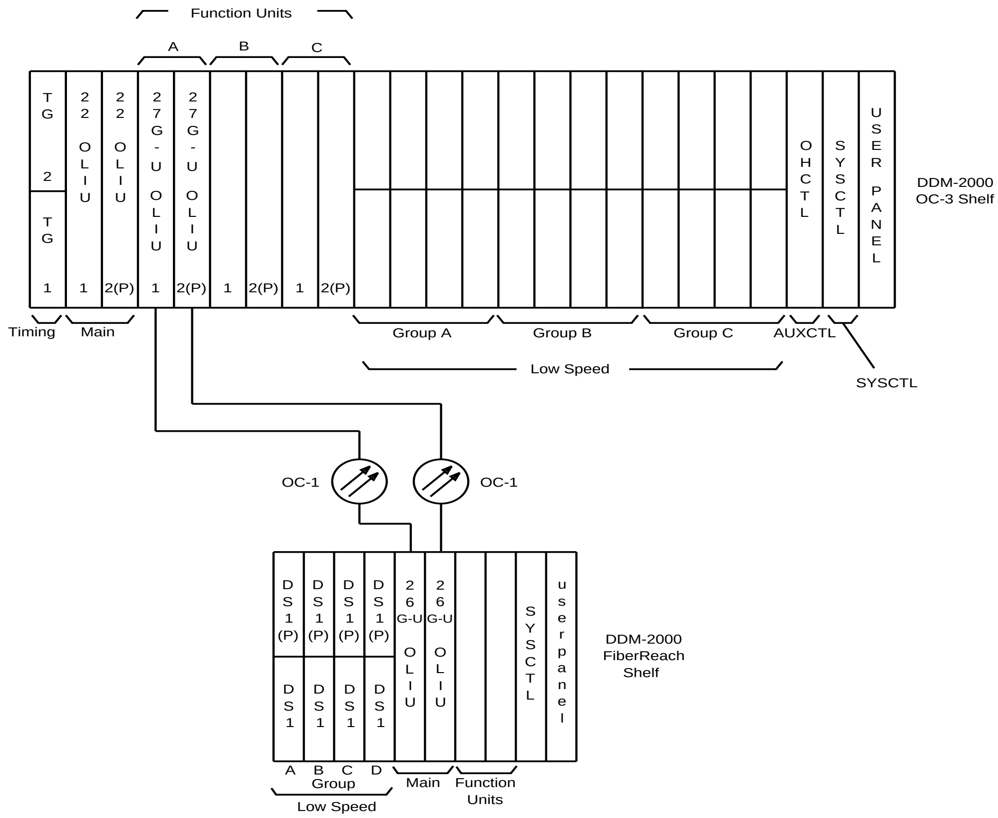

Figure 3-10. OC-3 DDM-2000 FiberReach Host Shelf

OC-3 FiberReach Host Shelf - Enhanced Routing

When hosting FiberReach Enhanced Routing Topologies (OC-1 Ring Pass-Through, OC-1 Ring Hairpin Single-Homed and Dual-Homed, and OC-1 Ring Hairpin Local Drop), an OC-3 shelf changes in only two ways. First, 27G2-U OLIUs must be used instead of 27G-U OLIUs. Second, when using Group 1 or Group 3 shelves, two BBF5 jumper circuit packs must be installed in the low-speed group associated with the Function Unit equipped with the 27G2-U OLIUs, one in slot 4 and one in slot 8. As an example, Figure 3-11 shows a host shelf that is equipped for the OC-1 Ring Hairpin Local Drop application.

Equipping the main slots with 24-type OLIUs allows the shelf to provide an OC-12 ring interface.

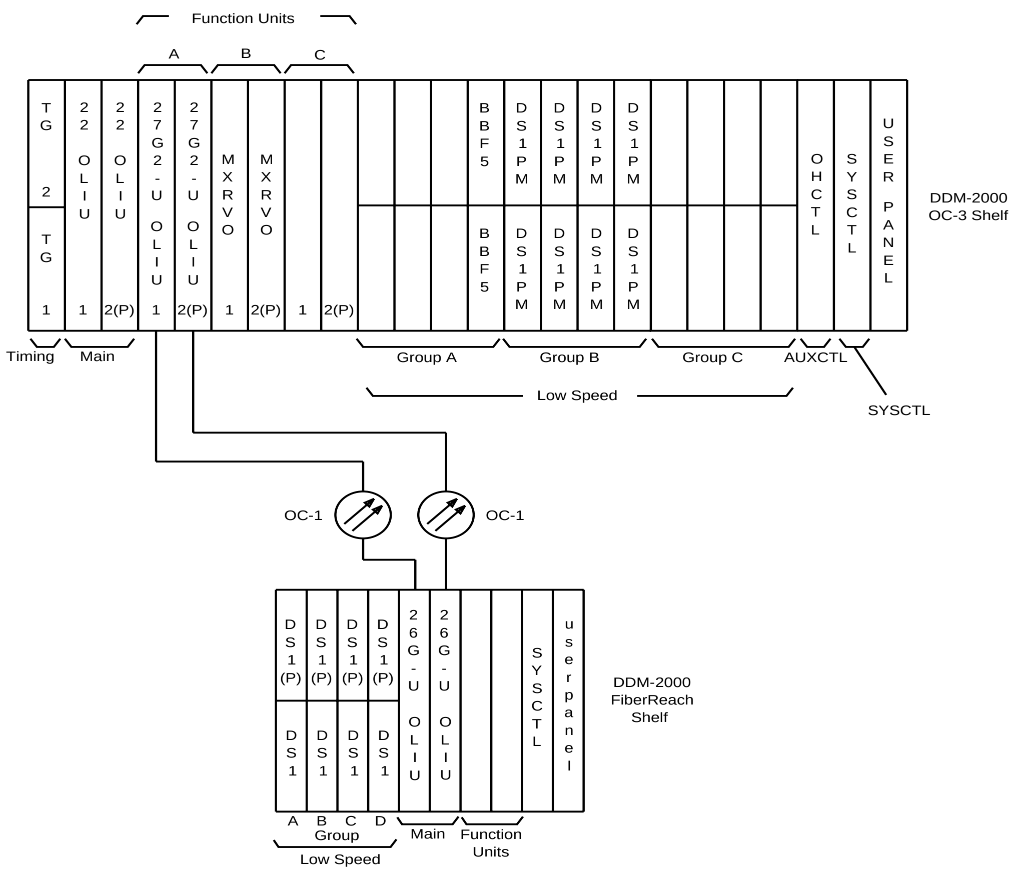

Figure 3-11. OC-3 DDM-2000 FiberReach Host Shelf - Enhanced Routing Topologies

OC-3 FiberReach Host Shelf - Enhanced Routing with 26G2-U OLIU

Figure 3-12 shows enhanced routing with the single OC-1 26G2-U OLIU in place of the dual OC-1 27G2-U OLIU. The 26G2-U can drop DS1s without the need for the MXRVO Multiplexer or BBF5 Jumper circuit packs. The 26G2-U provides OC-1 Ring Pass-Through, OC-1 Ring Hairpin Single-Homed and Dual-Homed, and OC-1 Ring Hairpin Local Drop applications. The Group 4 shelf is required.

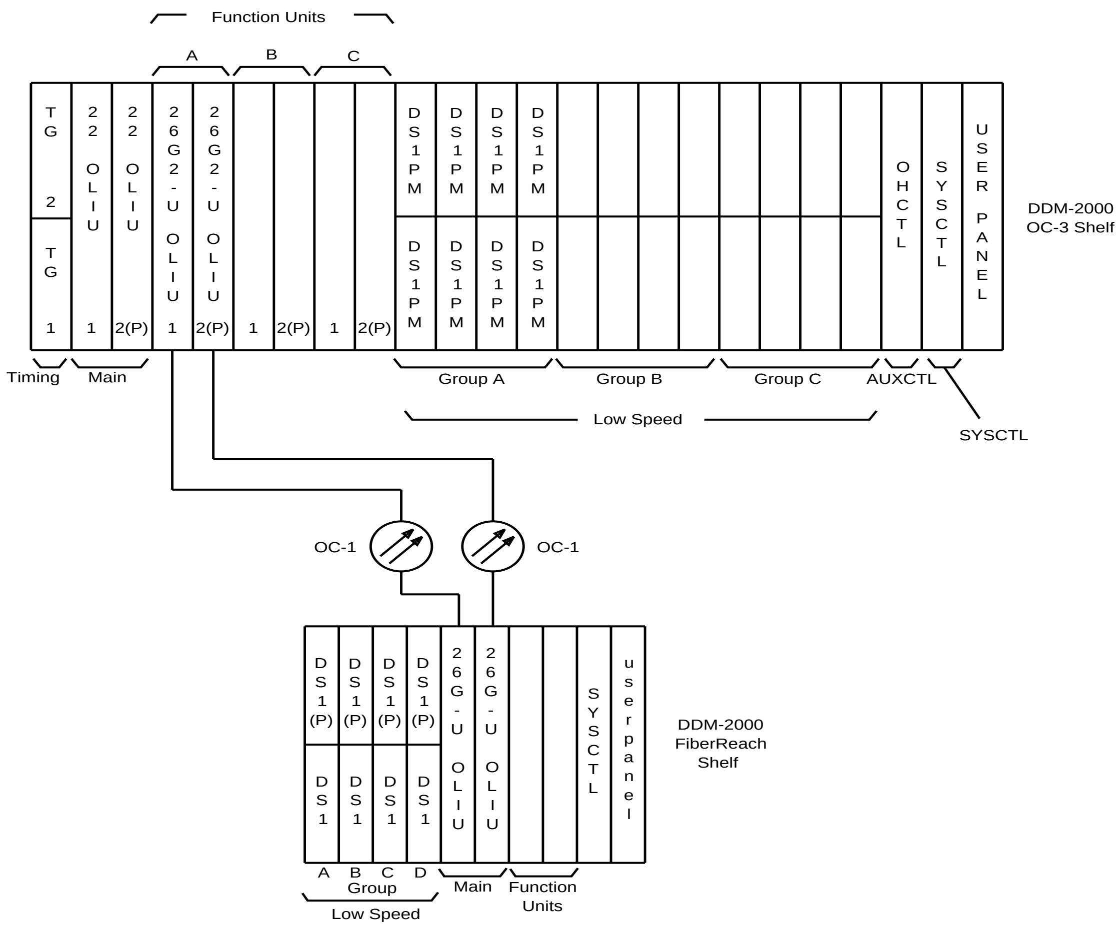

Figure 3-12. **OC-3 DDM-2000 FiberReach Host Shelf - Enhanced Routing with 26G2-U OLIU**

LAN Interface

Figure 3-13 shows examples of BBG2B MXRVO circuit packs in function unit B, coupled with BBF9 or BBF10 LAN circuit packs in slots 1 through 6 of low-speed group B.* BBG2B or BBG2 MXRVOs can be used when LAN circuit packs are installed in low speed slots. A LAN circuit pack uses two low speed slot positions and is **not** protected.

In function unit B the BBG2B supports one to three LAN interfaces, the LANs are connected through the backplane to the BBG2Bs in function unit group B. The LAN circuit packs convert a 100BaseFX LAN optical signal or a 10/100BaseT electrical signal and pass it on to the BBG2Bs. These interfaces provide for either electrical or optical LANs. A maximum of three LAN circuit packs are allowed per LOW SPEED GROUP. Both FUNCTION UNITS slots must be equipped with MXRVO circuit packs. Mixing with DS1, DS1PM, or T1EXT circuit packs is allowed within the same LOW SPEED GROUP.

Equipping the main slots with 22-type, 24-type, 27-type, or 29-type OLIUs support a LAN interface.

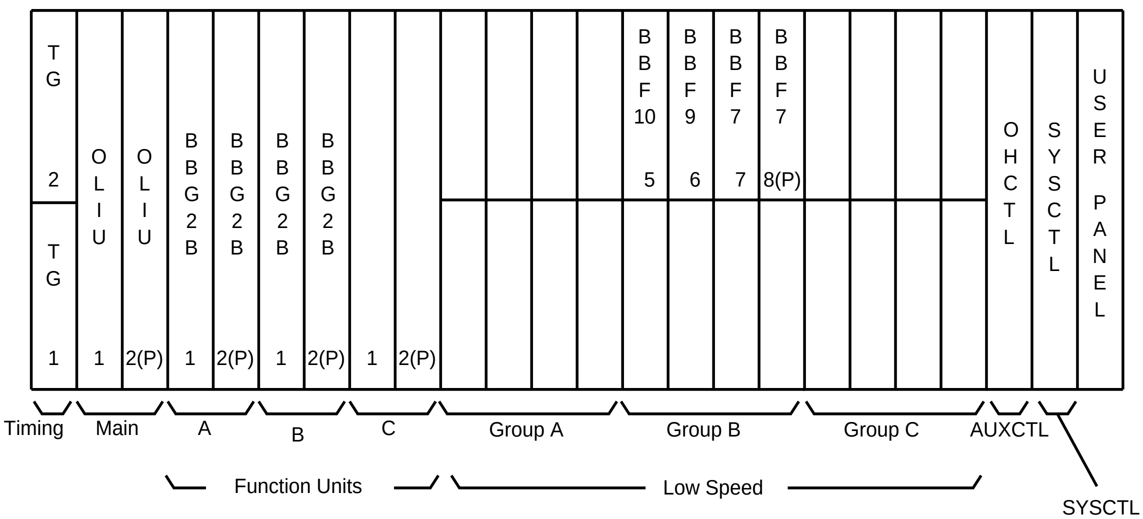

Figure 3-13. OC-3/OC-12 Shelf with LAN Interface

* The example in Figure 3-13 uses a Group 4 shelf. If a Group 3 shelf is used, the G3 to G4 Front Cover Upgrade Kit must be installed for proper cable dressing.

HDSL Interface

The BBF8 circuit pack provides for HDSL interface capability on the DDM-2000 OC-3 shelf. It allows the transport of T1 payloads, for up to 12,000 feet, over two metallic 24 AWG twisted-pair lines. Figure 3-14 shows examples of HDSL circuit packs providing this capability. Function group A is an example of a 1xN (1x2) protected configuration, while function group C is in the unprotected mode. At the present time there is a limit of three HDSL circuit packs per function unit (including the Protection slot). Future enhancements will increase this capacity.

Equipping the main slots with 24-type or 29-type OLIUs allows the shelf to provide an OC-12 ring interface.

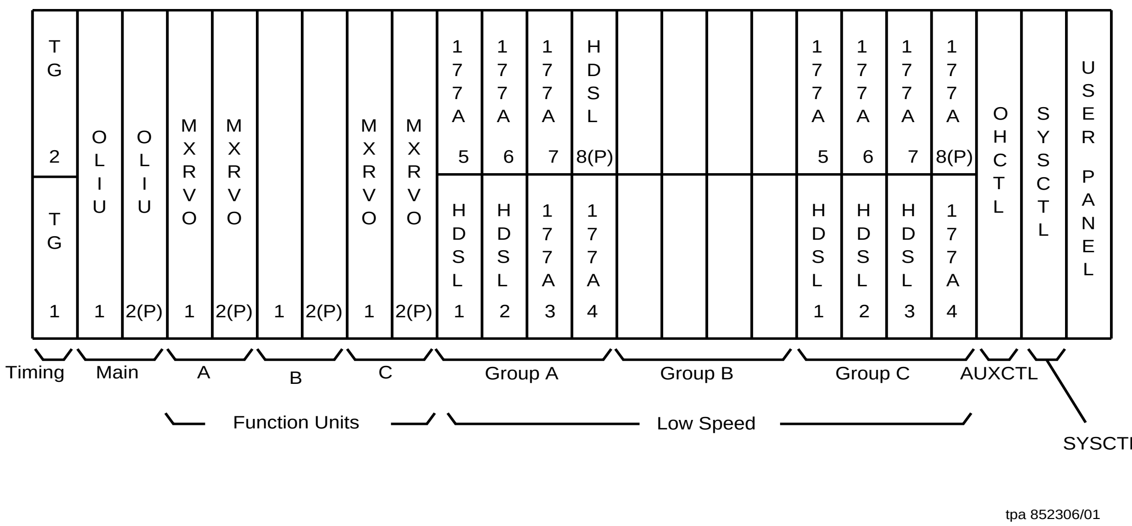

Figure 3-14. OC-3/OC-12 Shelf with HDSL Interface

Transmultiplexer

The DS3 Transmux interface circuit pack (TMUX) provides a mapping between the DS3 low-speed signal and internal STS-1 signals. Up to three DS3 interfaces (1x1 protected) may be supported per shelf. Figure 3-15 shows TMUX packs in function unit A.

In the transmit direction, the BBG20 TMUX circuit pack accepts one 44.736 Mb/s bipolar 3-zero substitution (B3ZS) coded DS3 signal and demultiplexes it into 28 DS1s. Performance monitoring is performed on the DS1s before they are mapped into floating VT1.5s. The 28 VT1.5s are then multiplexed into STS-1 payload envelope(s) using SONET asynchronous mapping. The STS-1 path overhead and pointer bytes are added and the resulting signal is sent to the high-speed OLIU circuit pack.

In the receive direction the reverse process takes place: The STS-1 signal(s) from the OLIU circuit pack goes through STS-1 pointer interpretation, path overhead is removed and processed, and the twenty-eight VT1.5s are stripped of their overhead to produce 28 DS1s. The DS1s are then multiplexed back into the DS3.

Equipping the main slots with 24-type or 29-type OLIUs allows the shelf to provide an OC-12 ring interface.

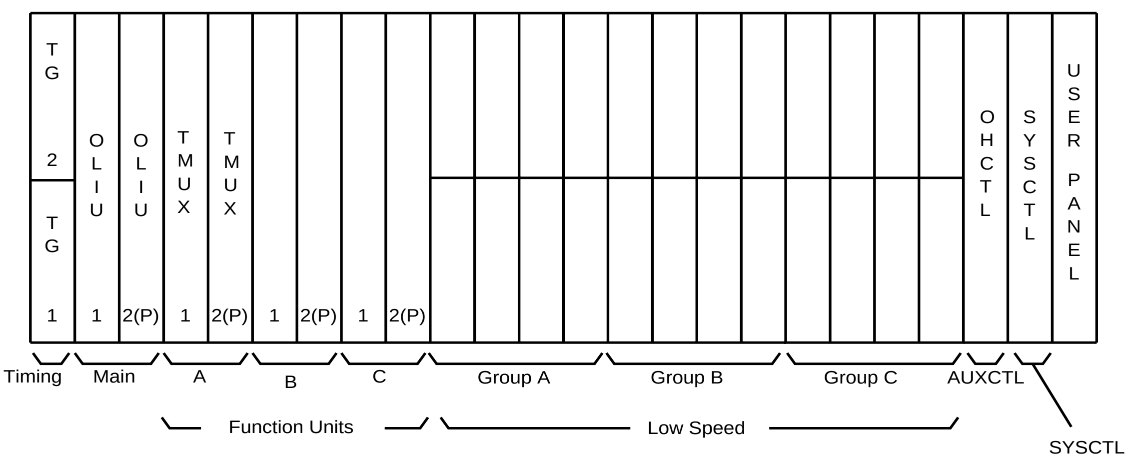

Figure 3-15. OC-3/OC-12 Shelf with Transmultiplexers

DDM-2000 Fan Shelf

The DDM-2000 Fan Shelf (Figure 3-16) provides forced convection cooling to DDM-2000 OC-3 shelves in uncontrolled environments.

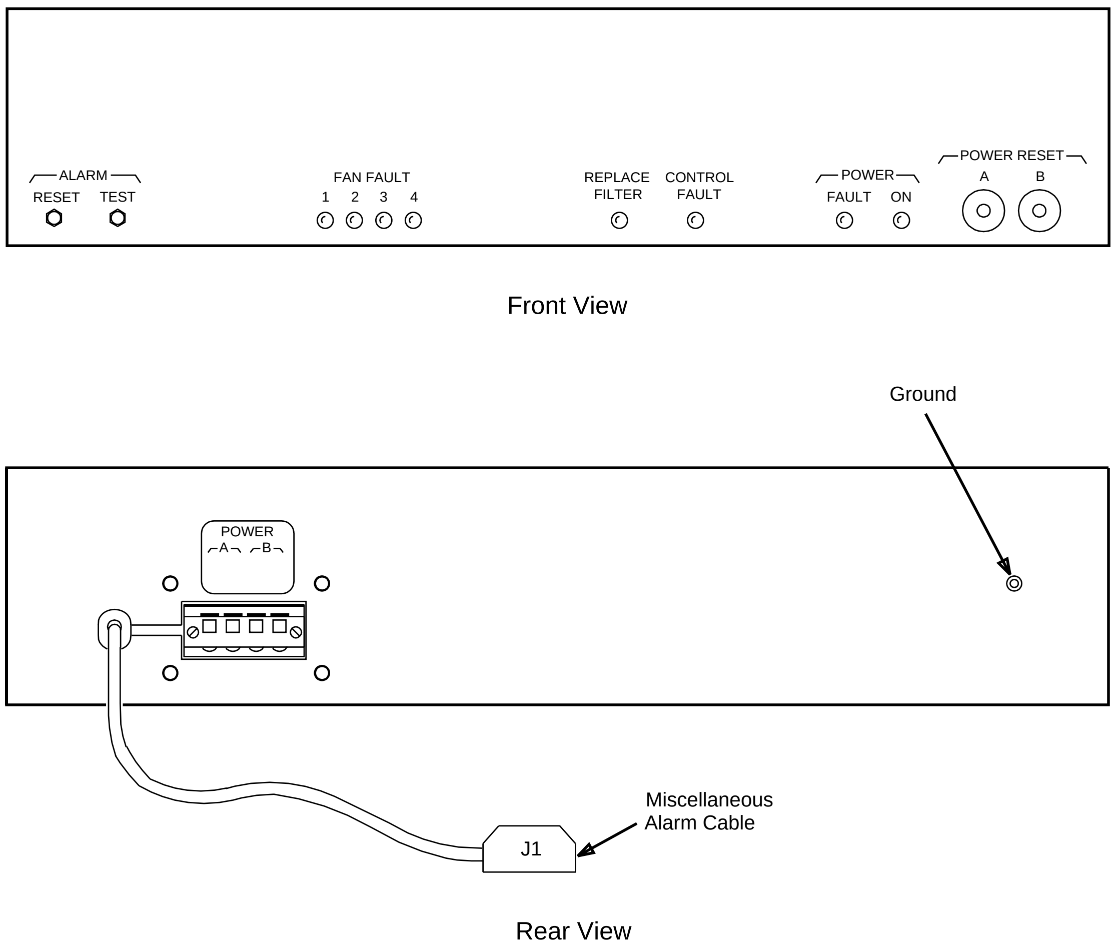

Figure 3-16. DDM-2000 Fan Shelf

The fan shelf is only required in DDM-2000 OC-3 non-Network Equipment Building Standards (NEBS) environments (direct air inlet temperatures exceeding 50° C). The fan shelf is not required in DDM-2000 OC-3 controlled environment applications. All applications should be equipped with a heat baffle as shown in ED-8C724-10 for the DDM-2000 OC-3 Multiplexer.

One DDM-2000 Fan Shelf can cool two DDM-2000 OC-3 shelves.

The fan shelf is 3.9 inches high by 9.3 inches deep by 21.2 inches wide and weighs 25 pounds. Mounting brackets can be attached in three positions to accommodate both front and rear access installations in different bay frames. The fan shelf is fully accessible from the front for service and maintenance.

When the front cover is removed, the four fan units and a four-part switch to the left of center on the front of the shelf are visible (see Figure 3-17). The switches should be set as shown in Table 3-3.

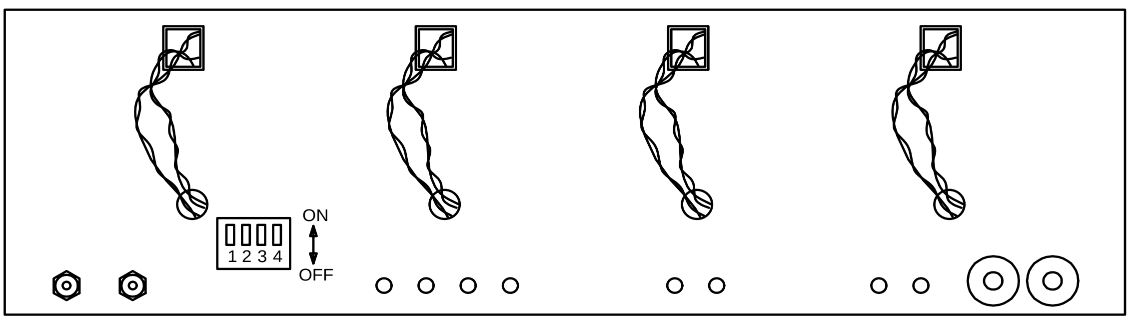

Figure 3-17. DDM-2000 Fan Shelf — Fan Switches — Front Cover Removed

Table 3-3. DDM-2000 Fan Shelf Switch Settings

Cooling Arrangement	Set Point	Switch Settings			
		S1	S2	S3	S4
DDM-2000 OC-3 *	400 fpm	on	off	on	on

* Non-NEBS environments (direct air inlet temperatures exceeding 50° C).

The four fan units are independent of each other; any of them can be removed by removing the connectorized fan cord and the screws that hold the fan unit in the shelf.

A filter must be installed on the bottom of the DDM-2000 OC-3 shelf that is directly under the fan shelf. The filter is attached to the bottom of the DDM-2000 OC-3 shelf by magnetic strips attached to the top of the filter frame.

A terminal block is provided for the direct termination of the two –48 V power feeders. If direct termination is not needed, optional cable assemblies are available (in DDM-2000 OC-12) to connect the power feeders from the DDM-2000 bay power cables to the terminal strip on the rear of the fan shelf. A dangler cable provides an alarm interface so that fan shelf alarms can be reported through an associated DDM-2000 system. The alarm output is a dry contact closure. It is activated whenever a fault is detected on the fan shelf and whenever one or both -48 V power feeders fail. Alarm and power cable openings are provided for both rear and front access installations. A ground stud is provided on the left rear of the fan shelf to meet the UL grounding requirements for rear- and front-access applications. Two ground cables are provided with the fan shelf, one 6-inch cable for rear-access applications and one 18-inch cable for front-access applications. To reach the front of the fan shelf, the 18-inch front-access ground cable must go through the rear cable access opening, through the fan shelf, and exit from the right front cable access opening.

The following pushbuttons and LEDs are accessible through the front cover of the fan shelf:

- The ALARM RESET pushbutton near the left side of the front of the shelf is used to reset fan shelf alarms and register a new combination of set-point switch settings. Once a fan shelf alarm is turned on, it can be reset only by clearing the trouble condition and then pressing the ALARM RESET pushbutton.

- The ALARM TEST pushbutton provides a test of the fan shelf alarms. When pressed and held, all LEDs except the CONTROL FAULT LED and POWER FAULT LED will be lit. After a test is done, the ALARM RESET pushbutton must be pressed to turn the LEDs off. This is a local test; the alarm on the fan shelf alarm interface is not activated.
- Four red FAN FAULT LEDs indicate faults in each of the four independent fan units.
- The red FILTER REPLACE LED indicates that it is time to replace the filter.
- The red CONTROL FAULT LED indicates a fault in the fan shelf monitoring and control system.
- The red POWER FAULT LED indicates a failure in one of the –48 V power feeders.
- The green POWER ON LED indicates that the fan shelf is receiving power from one of the two –48 V power feeders.
- Two pushbutton circuit breakers are located near the right side of the front of the shelf.

Power

4

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Power

4

Overview

This section describes the power distribution of the DDM-2000 OC-3 Multiplexer.

Introduction

The DDM-2000 OC-3 Multiplexer is powered by –48 volts direct current. The voltages required to power the circuits within the DDM-2000 OC-3 Multiplexer are generated by DC-to-DC converters mounted on circuit packs within the shelf.

The information in this section is for typical applications only. Refer to Section 10, "Technical Specifications," 801-525-168, *DDM-2000 Floor Plan Data Sheets,* and T-82046-30, Power Systems DC Distribution Circuit for Digital Transmission System, for proper engineering of battery plant and feeders for OC-3 Systems.

Power Description

Two independent –48 volt office power feeders (A and B) enter the shelf through dangler cables and are distributed, after fuses, to the circuit packs. These feeder fuses are located on the user panel. Power conversion is performed through modular power converters located on the circuit packs. In each circuit pack, the two feeders are diode ORed, fused, filtered, and regulated by the board-mounted power modules. This provides the required redundancy in case of the loss of one feeder or one fuse. Figure 4-1 shows which circuit packs have converters mounted on the printed wiring boards. Power modules are located on the TG, OLIU, MXRVO, OHCTL, SYSCTL, STS1E, and DS3/TMUX circuit packs. The power converter on the MXRVO/STS1E circuit pack in the Function Unit slots also provides power to the DS1/DS1PM circuit packs located in the corresponding multiplexer group.

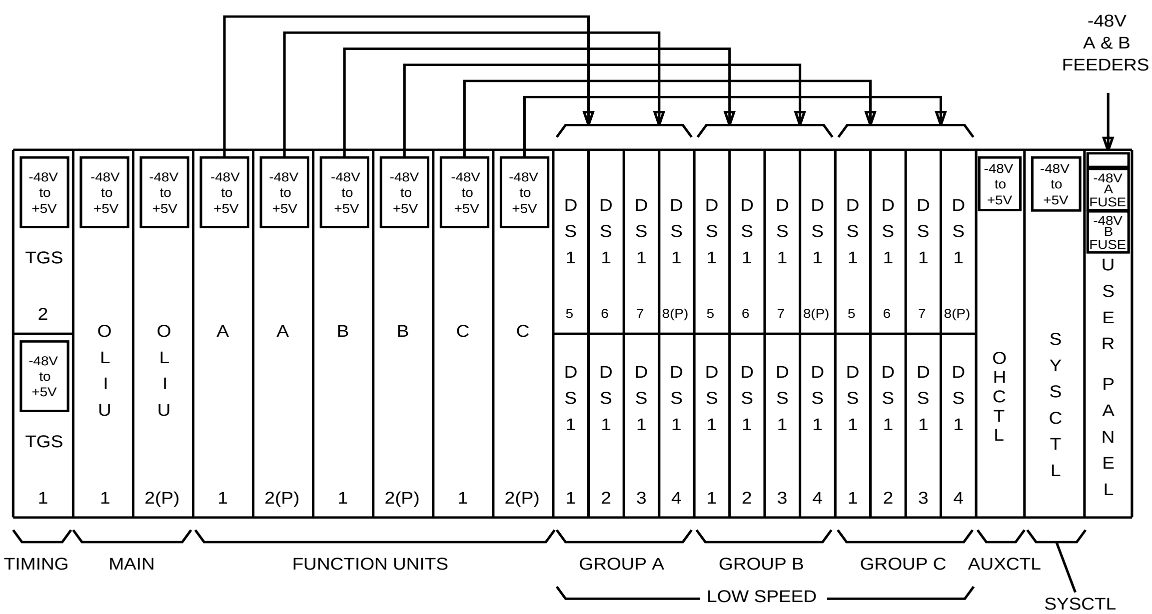


Figure 4-1. DDM-2000 OC-3 Power Architecture

Circuit Packs

OLIU Circuit Packs

The OLIU circuit packs are powered by two DC-to-DC converters located on the circuit packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and are fuse-mounted on each of the circuit packs. One converter supplies +5 volts and the other supplies –5.2 volts.

TG Circuit Packs

The TG circuit packs are powered by –48 volt to +5 volt DC-to-DC converters located on the packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and a fuse mounted on each of the circuit packs. The converters provide +5 volts DC power for the TG circuit packs.

DS3/TMUX Circuit Packs

The DS3/TMUX circuit packs are powered by –48 volt to +5 volt DC-to-DC converters located on the packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and a fuse mounted on each of the circuit packs. The converters provide +5 volts DC power for the DS3/TMUX circuit packs.

STS1E Circuit Packs

The STS1E circuit packs are powered by –48 volt to +5 volt DC-to-DC converters located on the circuit packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit packs. The STS1E circuit packs provide +5 volt DC power for their associated DS1/DS1PM circuit packs.

MXRVO Circuit Packs

The MXRVO circuit packs are powered by –48 volt to +5 volt DC-to-DC converters located on the circuit packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit packs. The MXRVO circuit packs provide +5 volt DC power for their associated DS1/DS1PM circuit packs.

DS1/DS1PM/HDSL/T1EXT/LAN Circuit Packs

The DS1/DS1PM/HDSL/LAN circuit packs receive +5 volt power via backplane connections from the MXRVO circuit packs. The DS1/DS1PM/HDSL packs in the

"A Group" receive power from the MXRVO/STS1E packs mounted in the "A" Function Unit slots. The "B" and "C" DS1/DS1PM/HDSL circuit packs likewise receive +5 volt power from the MXRVO/STS1E circuit packs in the "B" and "C" Function Unit slots. Both MXRVO/STS1E circuit packs in a protection pair supply power to the DS1/DS1PM/HDSL packs. Power selector circuits (diode ORed) and fuses for the +5 volts are located on the DS1/DS1PM/HDSL circuit packs. The fuses on the DS1/DS1PM/HDSL circuit packs protect the backplane and prevent DS1/DS1PM/HDSL unit failures from affecting service in the other DS1 units or MXRVO/STS1E units within the group.

The power selector circuits on the DS1/DS1PM/HDSL/LAN circuit packs automatically select power from either MXRVO/STS1E circuit pack. Each MXRVO/STS1E power converter can support the load of all DS1/DS1PM/HDSL circuit packs in the group (a condition that occurs if there is an MXRVO/STS1E circuit pack failure).

NOTE:

If any DS1PM/HDSL/LAN circuit packs are used in a Function Unit group, both Function Unit slots must be equipped with MXRVO/STS1E circuit packs. Requirements for equipping both Function Unit slots prevent the potential for continued loss of service after a shelf power failure and subsequent power recovery.

Removal of a single MXRVO/STS1E circuit pack is allowed during maintenance activities (for example, circuit pack failure and replacement) and a non-service-affecting alarm will be activated until the removed circuit pack is replaced.

Control Circuit Packs

The SYSCTL and OHCTL circuit packs are each powered by a –48 volt to +5 volt DC-to-DC converter located on the pack. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit packs.

LEDs

Two green power on (PWR ON A and B) on Group 4 shelves or a single PWR ON on Group 1 and Group 3 shelves—LED(s) on the user panel—indicate that the shelf is receiving fused –48 volt power. The LED will remain illuminated as long as either –48 volt feeder is supplying power to the shelf.

Normally the FAULT LED on the circuit pack faceplates is operated via the controller which provides a ground return for current generated by the on-board converter. In the event of a DC-to-DC converter failure, the LED will be operated via the –48 volt power leads. The –48 volt power leads are supplied through an electronic gate or relay contact normally held open by the converter. The power, fusing, and LED circuits shown in Figure 4-2 are used on all circuit packs with on-board DC-to-DC converters.

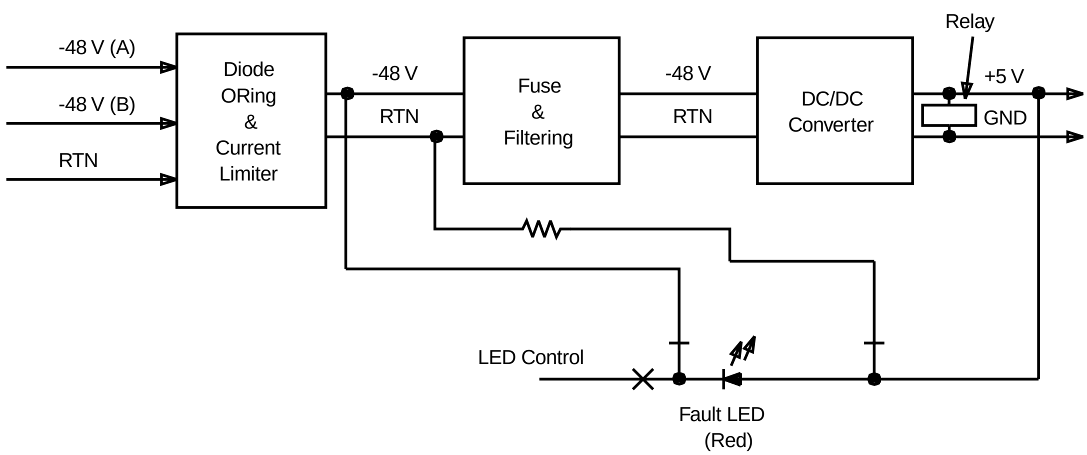


Figure 4-2. Circuit Pack Power and LED Control

Power Minor Alarm

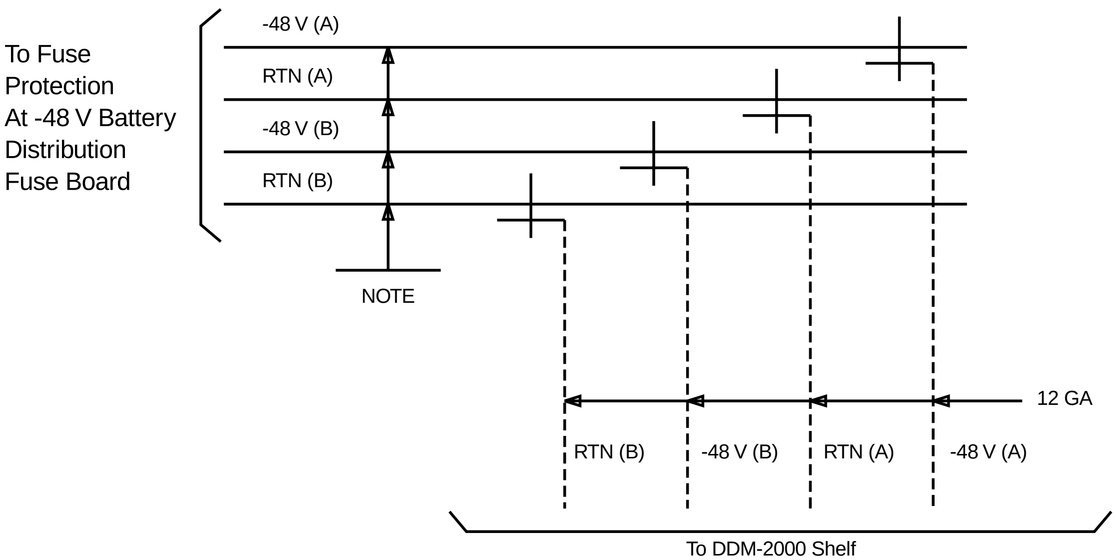
A yellow power minor (PMN) alarm LED is provided on the user panel to indicate an AC power failure at the remote terminal. The PMN alarm can be provisioned by a switch on the SYSCTL circuit pack at the central office (CO) to be either an office minor (MN) or office major (MJ) alarm.

Power Distribution

See "Power Requirements" in Section 10, "Technical Specifications," for power dissipation values.

Figure 4-3 shows a typical battery feeder interface for a single shelf.

CAUTION:
This information is for a typical application only. Consult 801-525-168*, DDM-2000 Floor Plan Data Sheets, and T-82046-30, Power Systems DC Distribution Circuit for Digital Transmission System, for proper engineering of battery plant and feeders.*



NOTE: Feeder size is selected per T82046-30 and EIM 90MV001, Issue 5.

Figure 4-3. Typical –48 Volt Power Supply for DDM-2000 OC-3 Multiplexer Single Shelf

Transmission and Synchronization Interfaces

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5 Transmission and Synchronization Interfaces

Overview

This section describes the DDM-2000 OC-3 Multiplexer transmission and synchronization interfaces. Table 5-1 summarizes the DDM-2000 OC-3 Multiplexer transmission interfaces for the current software release.

Table 5-1. DDM-2000 OC-3 Multiplexer Transmission Interfaces

Application	Ring	
	R13.0	R15.0
DS1 Low-Speed	X	X
DS3 Low-Speed	X	X
DS3 Data	X	X
EC-1 Low-Speed	X	X
IMA LAN		X
IS-3	X	X
OC-3	X	X
OC-1	X	X
OC-12	X*	X
24-type and 29-type	X	X

* 24G-U OLIU only

Transmission Interfaces

The DDM-2000 OC-3 Multiplexer supports DS1, DS3, 10/100 BaseT and 100 BaseFX low-speed interfaces, EC-1 low-speed and high-speed interfaces, OC-3 low-speed and high-speed interfaces, OC-1 low-speed and high-speed interfaces, and an IS-3 interface. The DS1 and DS3 interfaces accept any DSX-1 or DSX-3 compatible signal (clear channel interfaces) and can be mixed on a per-STS-1 basis.

Figure 5-1 is an overall block diagram of the DDM-2000 OC-3 Multiplexer in a terminal configuration. Internally, the OC-3 Multiplexer uses synchronous optical network (SONET) standard multiplexing (refer to Appendix A). On the low-speed side, each group of 28 DS1 signals map into 28 asynchronous floating mode VT1.5 signals. The VT1.5 signals are combined into seven VT groups and then multiplexed to one STS-1 signal. A DS3 signal maps directly to an STS-1 signal via the asynchronous mapping. An EC-1 or OC-1 signal is converted to an STS-1 signal. Three internal STS-1 signals are multiplexed to an STS-3 signal and converted to an OC-3 optical signal.

In the opposite direction, a received OC-3 signal is converted back to an electrical STS-3 signal. The STS-3 signal is then demultiplexed to three STS-1 signals. DS3, EC-1, and OC-1 signals are recovered from their STS-1 signals, while a DS1-formatted STS-1 signal is demultiplexed to 7 VT1.5 groups and then to 28 VT1.5 signals.

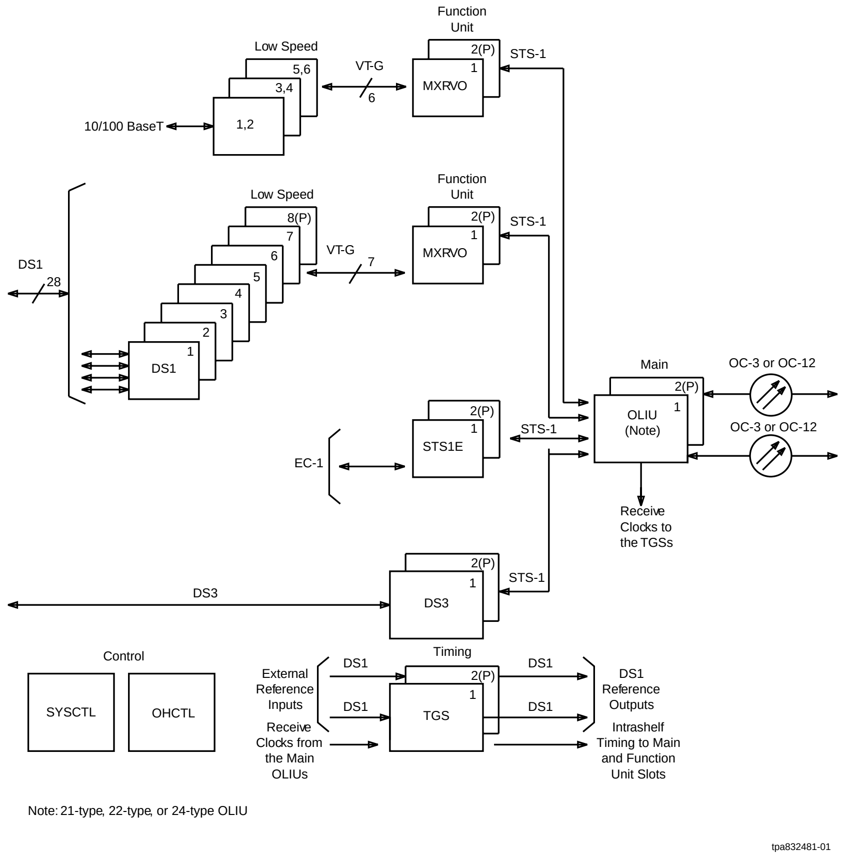


Figure 5-1. **DDM-2000 OC-3 Multiplexer Block Diagram — Terminal**

With OC-3 interfaces installed in the function unit positions, the OC-3 Multiplexer can be configured for the STS-1 drop (Figure 5-2) and OC-3 hubbing (Figure 5-3) applications. STS-1 drop addresses linear network routes by sending through traffic directly from the OLIU circuit packs in the main positions to the OLIU circuit packs in the C Function Group positions. The hubbing application equips the B and/or A Function Groups with OLIU circuit packs in addition to the OLIUs used in the main and C groups for STS-1 drop. This allows multiple optical extensions from one shelf or a fiber hub as shown in Figure 5-2. In this application, STS-1 signals are routed between the main slots and the function group slots. For both STS-1 drop and hubbing applications, default STS-1 routing is provided based on circuit pack equipage with other routing options supported through provisioning.

The OC-3 Multiplexer also supports an optimized interface, the IS-3, to the DDM-2000 OC-12 Multiplexer. This is implemented via a cost-effective optical interface (21D-U OLIU) in the main slots, allowing all the OC-3 applications to be upgraded to an OC-12 line rate.

Dual OC-1 interfaces provided by the 27-type OLIU can be equipped in the function unit slots to support DDM-2000 FiberReach host applications.

The BBG6 STS1E circuit pack converts the seven virtual tributary group (VT-G) signals into a standard EC-1 electrical signal that reuses the same coaxial backplane interface as the DS3 signals.

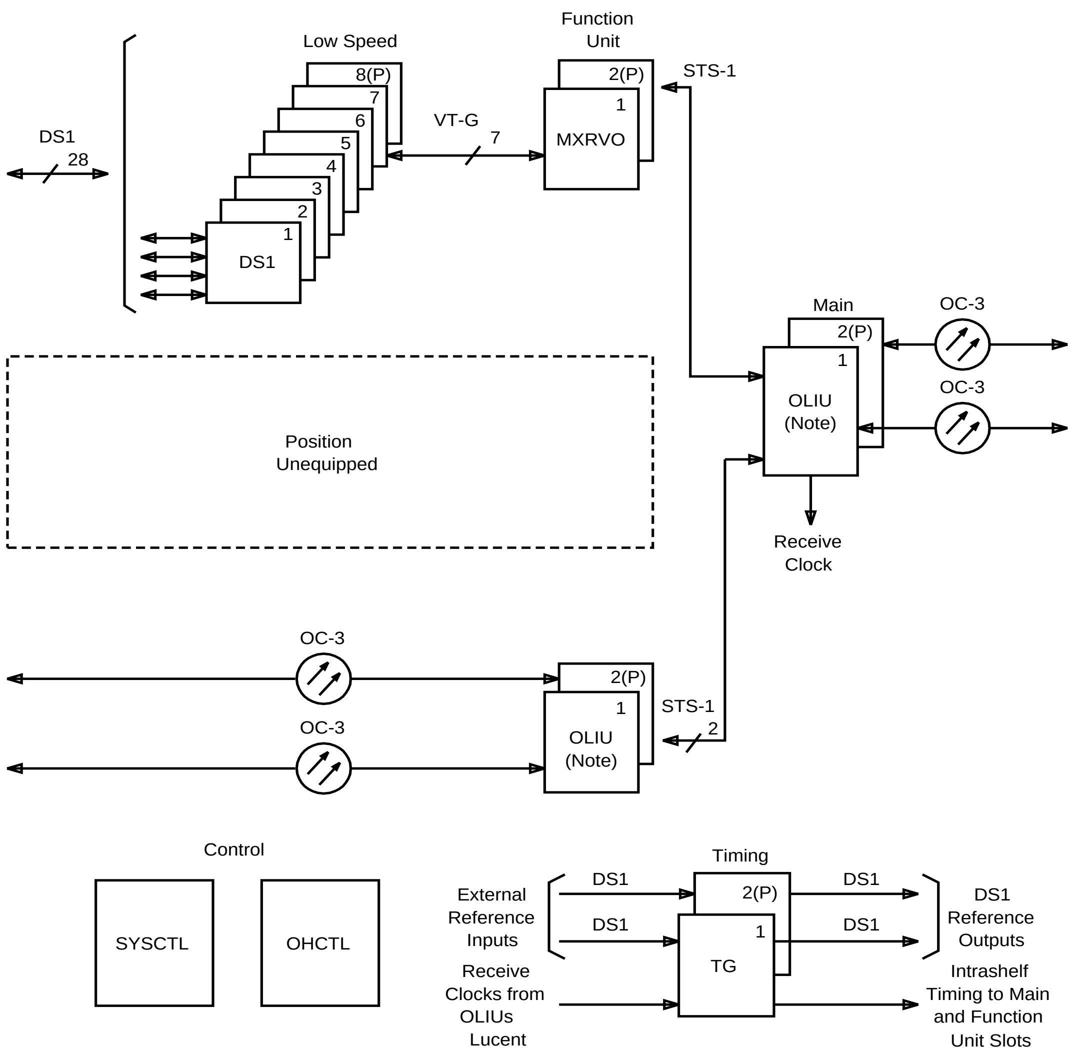


Figure 5-2. DDM-2000 OC-3 Multiplexer Block Diagram — STS-1 Drop

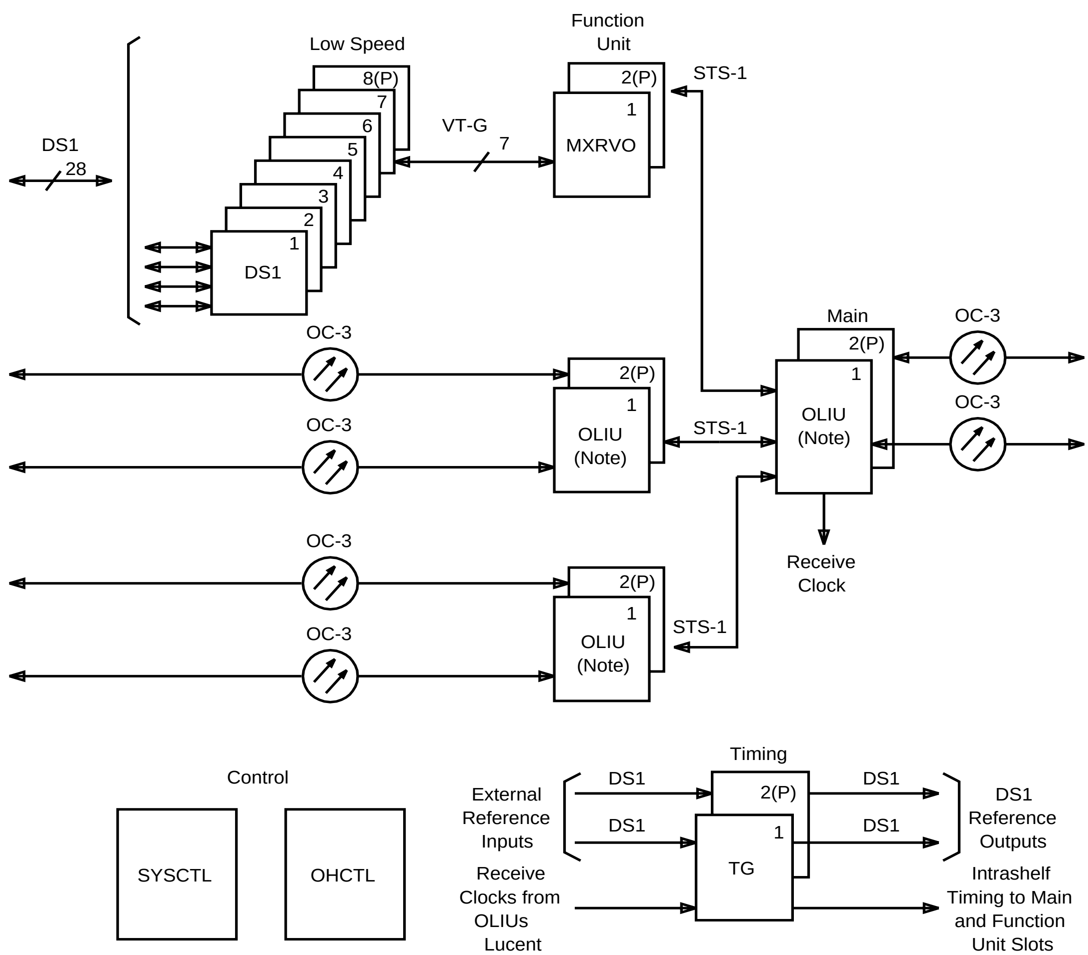


Figure 5-3. DDM-2000 OC-3 Multiplexer Block Diagram — Hubbing

For the DS1 add/drop and ring (Figure 5-4) application, the time slot interchange (TSI) feature of the 22-type OLIUs provides full flexibility in selecting traffic for each DS1, DS3, or EC-1 low-speed port from any high-speed time slot. The TSI function supports cross-connections across the full bandwidth of each OC-3 interface as well as to any low-speed port.

Figure 5-4 is a block diagram of the DDM-2000 OC-3 Multiplexer VT1.5/STS-1 path switched ring application. The DDM-2000 OC-3 Multiplexer interfaces to the ring through the main slots at the OC-3 rate and uses the programmable VT1.5/ STS-1 TSI capability. Path switching can be done on VT1.5 paths, STS-1 paths, or a mixture of these. Up to 84 DS1s, 3 DS3s, 3 EC-1s, 1 OC-3/IS-3 1+1 linear optical extensions, or equivalent combination can be added/dropped from the DDM-2000 OC-3 Multiplexer self-healing ring at any node. Because of the ring's path protection scheme, time slots must be reserved all the way around the ring for all ring traffic, limiting the capacity of the ring to the OC-3 line rate. Like the add/drop topology, the TSI feature offers full flexibility in assigning signals between low-speed DS1, DS3, EC-1 or OC-3 ports and the high-speed interface at each shelf.

The DDM-2000 OC-3 Multiplexer dual ring interworking (DRI) application uses the same shelf configuration as the OC-3 path switched ring (Figure 5-4). The main difference is that the VT1.5/STS-1 paths desired for DRI should be provisioned for drop and continue. As with the VT1.5/STS-1 path switched ring, path selection is at the VT1.5/STS-1 level. The DDM-2000 OC-3 and OC-12 Multiplexer path switched ring architecture allows mixing of drop and continue circuits with standard path switched circuits. TSI flexibility is also maintained in the assignment of low-speed ports to the high-speed interface.

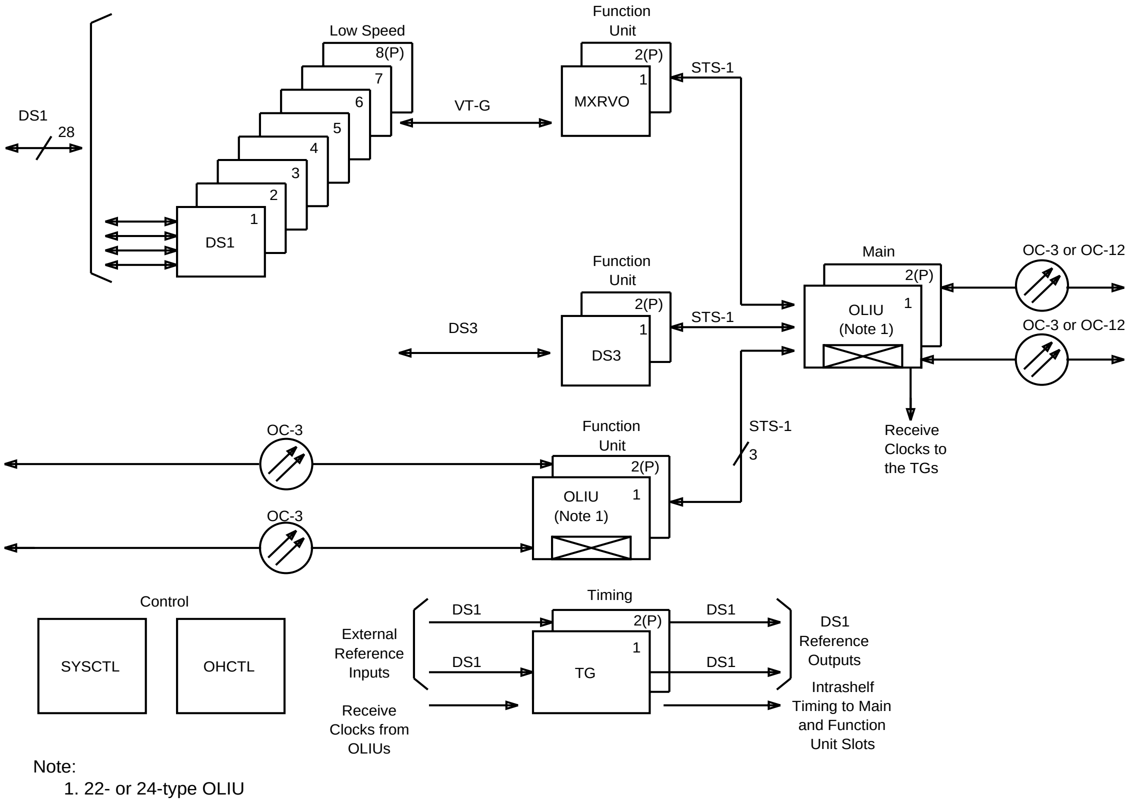


Figure 5-4. **DDM-2000 OC-3 Multiplexer Block Diagram — DS1/DS3/EC-1 Add/Drop, and VT1.5/STS-1 Path Switched Ring**

Figure 5-5 is an overall block diagram of the DDM-2000 OC-3 Multiplexer in a terminal configuration. In this case, however, 29 type OLIUs are installed in main providing OC-12 optics in an OC-3 shelf.

The 29 type OLIU receives an OC-12 signal and converts it to an electrical STS-12. This STS-12 is then demultiplexed into 12 STS-1 signals with the capability of routing any of these 12 STS-1s to the function unit slots. The STS-1s that are dropped can contain any combination of VT-G, EC-1, or DS3 signals routed to the function units.

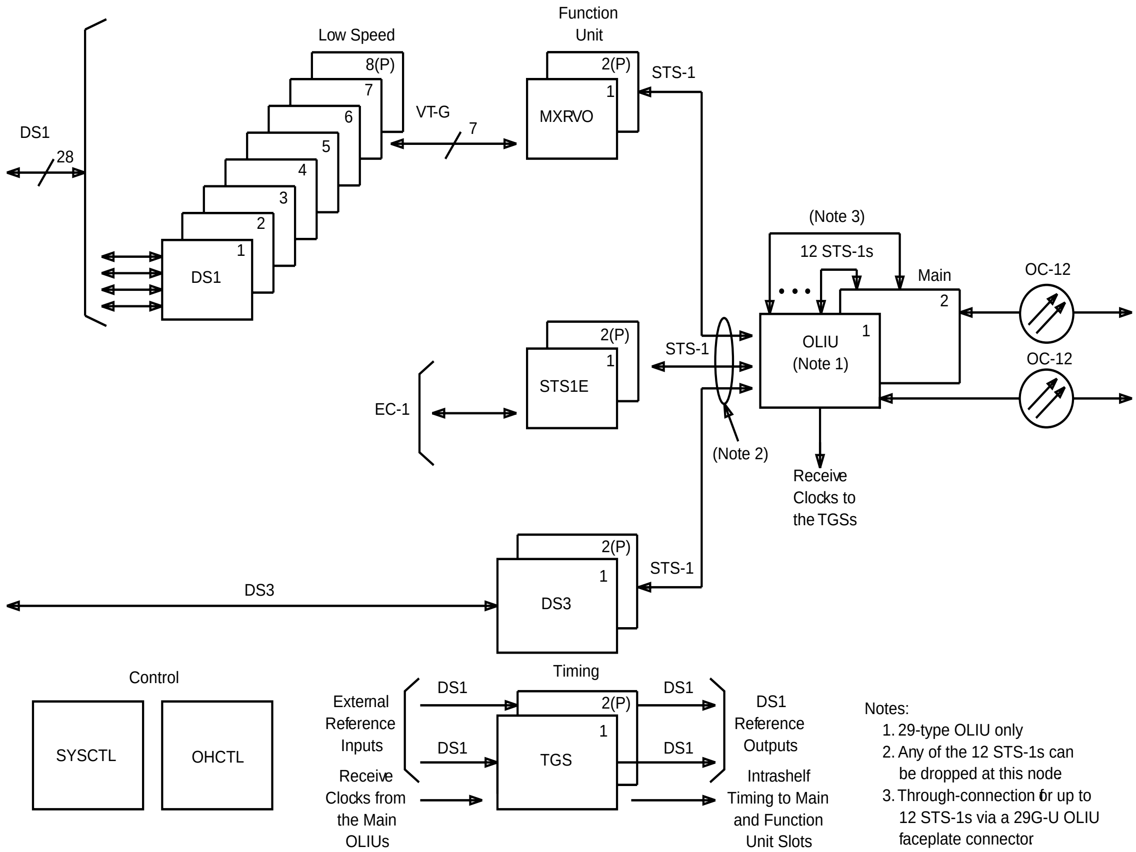
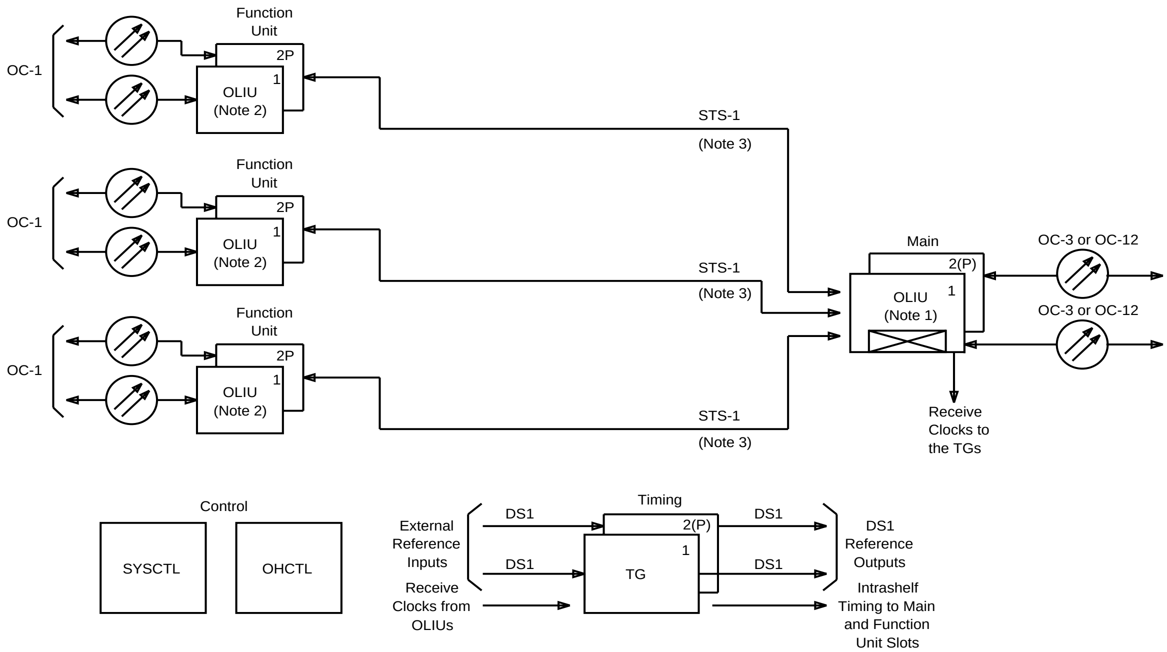


Figure 5-5. DDM-2000 OC-3 Multiplexer with OC-12 Optics Block Diagram

Figure 5-6 is a block diagram of the DDM-2000 OC-3 Multiplexer serving as a DDM-2000 FiberReach host. Dual OC-1 interfaces provided by the 27-type OLIU can be equipped in the function unit slots to support single-homing and dual-homing applications.

Figure 5-6 shows a single-homing arrangement with six 27-type OLIUs in the function unit slots. Each OLIU supports one leg (transmit and receive) of two independent OC-1 rings for a total termination capacity of six OC-1s. Each OC-1 has the capacity of up to 28 VT1.5s. Enhanced routing hairpin connections between OC-1 rings terminating on function unit slots do not consume bandwidth on the ring supported by the OLIUs in the main unit slots. This increases the total capacity of the shelf beyond the 84 VT1.5s supported by the main unit OLIUs.

The 27-type OLIU circuit pack interfaces between two 1310 nm OC-1 optical lines in the transmit and receive directions. It can be used in the main and/or function unit slots of the DDM-2000 OC-3 Multiplexer. Each pair of 27-type OLIUs supports up to two independent OC-1 ring interfaces on a DDM-2000 OC-3 Multiplexer (see Figure 5-8). To support dual homing applications, one 27-type of a pair can be installed in one DDM-2000 OC-3 shelf and the other can be installed in another DDM-2000 OC-3 shelf on the same ring.



Notes:

1. 22 or 24-type OLIU.
2. 27-type OC-1 OLIU. One direction of two independent OC-1 rings.
3. One or two STS-1s. Shelf capactiy is 3 STS-1s (84 DS1s).

Figure 5-6. DDM-2000 OC-3 Multiplexer Block Diagram — DDM-2000 FiberReach Host — Single Homing

With 27-type OLIUs in the main slots, VT1.5 or STS-1 signals from the function slots can be routed to either of the two OC-1 ring interfaces. The signal is transmitted on both rotations of the ring. Standard SONET overhead is added on each OC-1 interface transmitted by the 27-type OLIU. In the receive direction, the 27-type OLIU processes the SONET overhead, monitors the received signals (for parity errors, loss of signal, line and path AIS, etc.), performs standard STS-1 or VT1.5 path switching as required, and routes the signals to any function unit. In both directions of transmission, the two OC-1 ring interfaces are handled independently. Figure 5-7 is an example of this configuration.

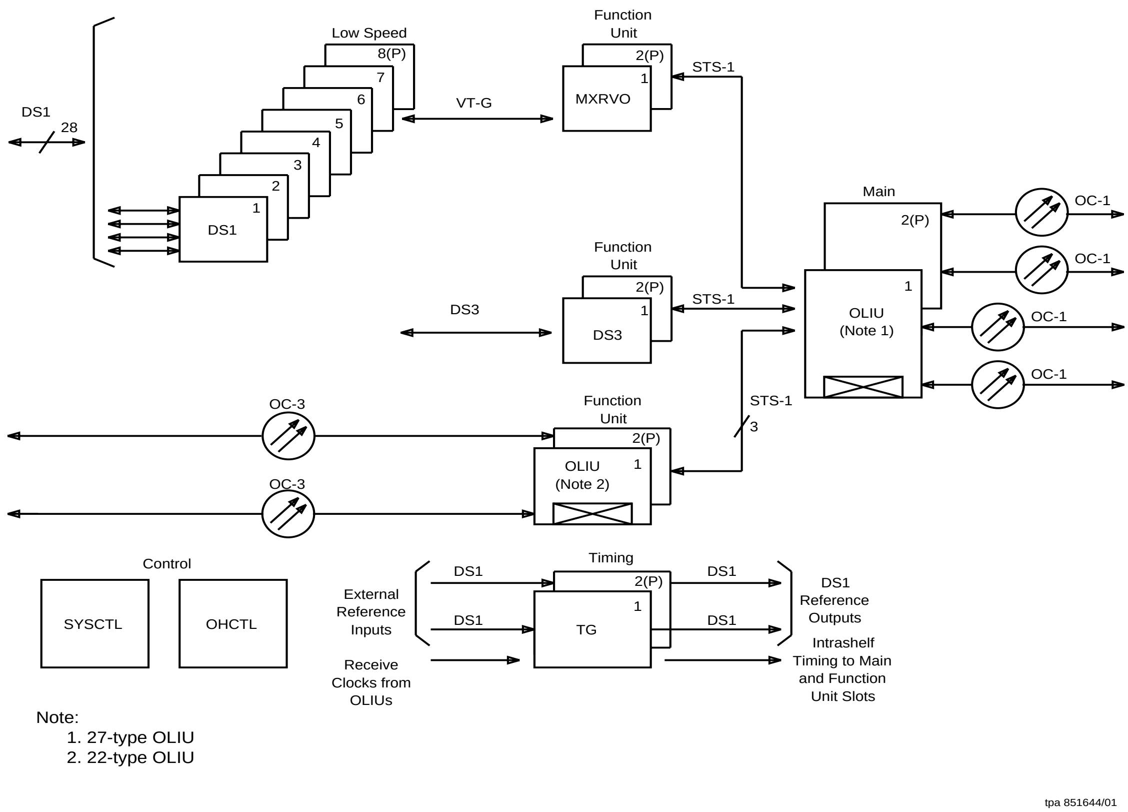


Figure 5-7. DDM-2000 OC-3 Multiplexer Block Diagram—FiberReach Stand-Alone Host Configuration

Fiber access is via four universal optical connectors on the faceplate: one transmit and one receive for each of the two OC-1 ring interfaces (OC-1 line 1 and OC-1 line 2; OC-1 line 1 is the bottom pair). These connectors support *ST*®, SC, and FC type optical connectors. Single mode fiber is suggested for optimum performance; multimode facilities are also supported. The 27-type OLIU photonics exceed the span length requirements for SONET intermediate reach interfaces. The 27-type OLIU optical interfaces are compatible with those of the 26-type OLIU, which is used in the DDM-2000 FiberReach Wideband Shelf.

When used in the main shelf position, the 27-types can pass through signals on the OC-1 rings, route signals between the OC-1 ring interfaces and interfaces in the function unit slots, and route signals between function unit slots. When used in the function unit shelf positions, the 27-type can route signals from the OC-1 ring interfaces to the main slots. 27G2-U OLIUs route signals between OC-1 interfaces in the same or different function unit slots.

In DDM-2000 FiberReach host applications using the DDM-2000 OC-3 Multiplexer Group 1 or Group 3 shelves, the BBF5 jumper circuit pack is a passive circuit pack that provides a method for connecting DCC related control signals and transmission signals between slots in a function unit equipped with 27-type OLIUs. **The BBF5 circuit pack is not needed in Group 4 shelves**. A single BBF5 should be installed in Slot 8(P) of the low-speed group associated with the function unit where the 27G-U OLIUs are equipped. A pair of BBF5 circuit packs should be installed in slots 4 and 8 of the low-speed group associated with the function unit where 27G2-U OLIUs are equipped.

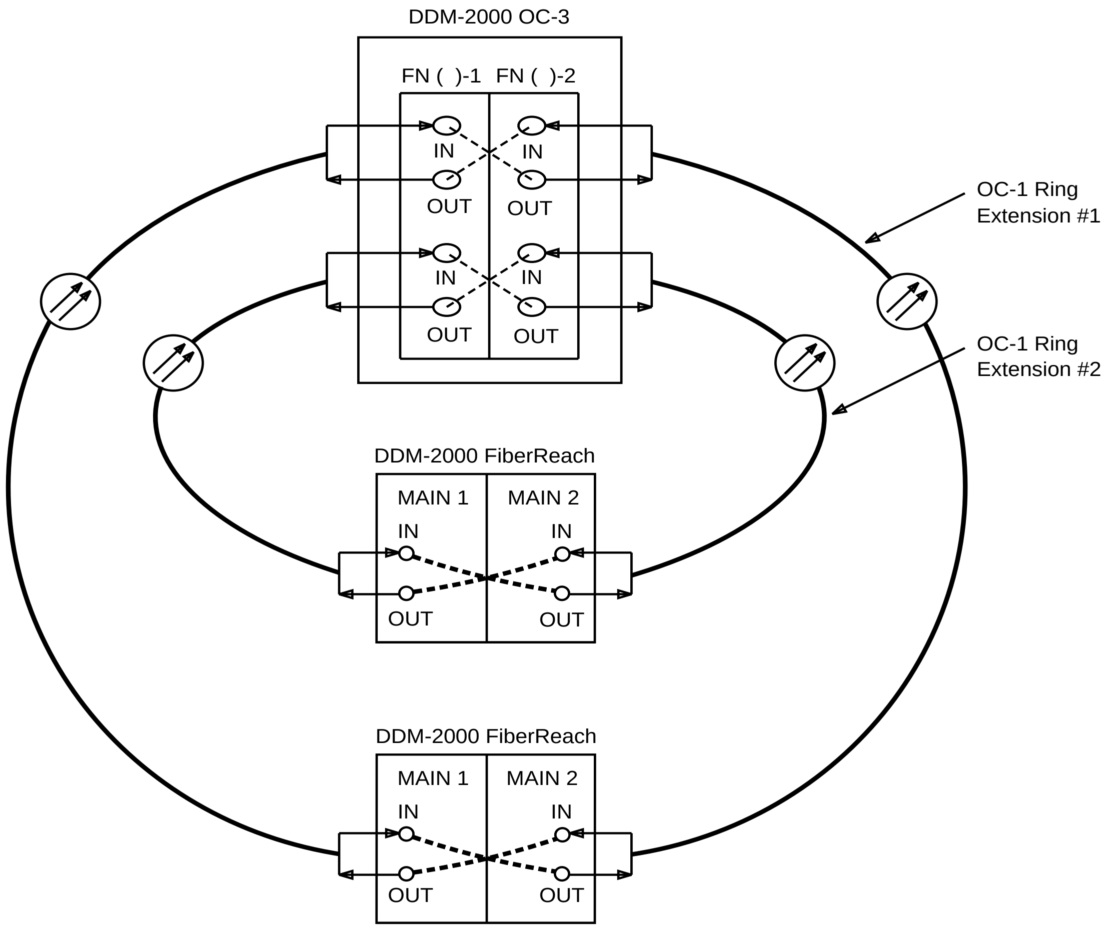


Figure 5-8. Single Homing with 27G-U Dual OC-1 OLIUs

Ring Interfaces

Ring interfaces can be used in single or dual homing applications. This part describes the following ring interfaces:

- OC-3/OC-12 ring (0x1) single homing
- OC-3/OC-12 ring (0x1) dual homing
- OC-3/OC-12 linear (1+1) optical extensions
- OC-3/OC-1 ring (0x1) single homing
- OC-3/OC-1 ring (0x1) dual homing.

OC-3/OC-12 Ring (0x1)

The DDM-2000 OC-12 ring supports (0x1) OC-3/IS-3 interfaces in its function unit slots. These interfaces must be provisioned as 0x1 in either single homing or dual homing applications (see Figure 5-9 and Figure 5-10). Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 function unit slot FN(x)-1 is connected to OC-3 main-1 and OC-12 function unit slot FN(x)-2 is connected to OC-3 main-2. Switching is not done on the DDM-2000 OC-12 Multiplexer on these lines, or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves) or the OC-12 node can provision different STS-1s at different sites. The OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring (0x1) fashion, behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

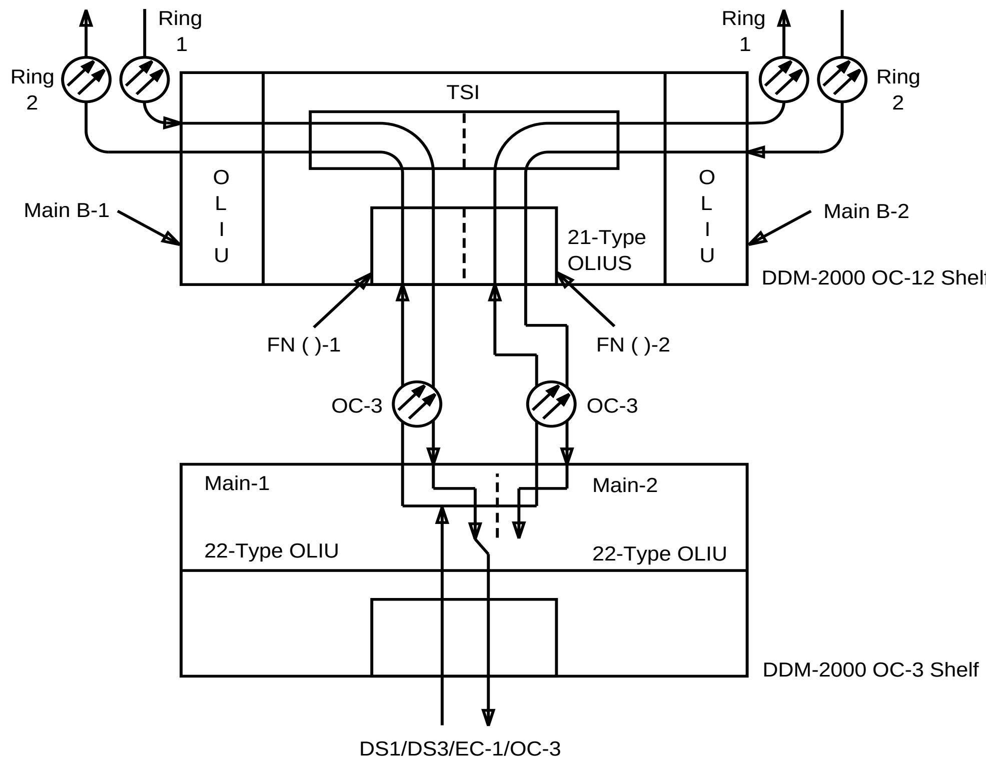


Figure 5-9. OC-3/OC-12 Ring (0x1) Single Homing

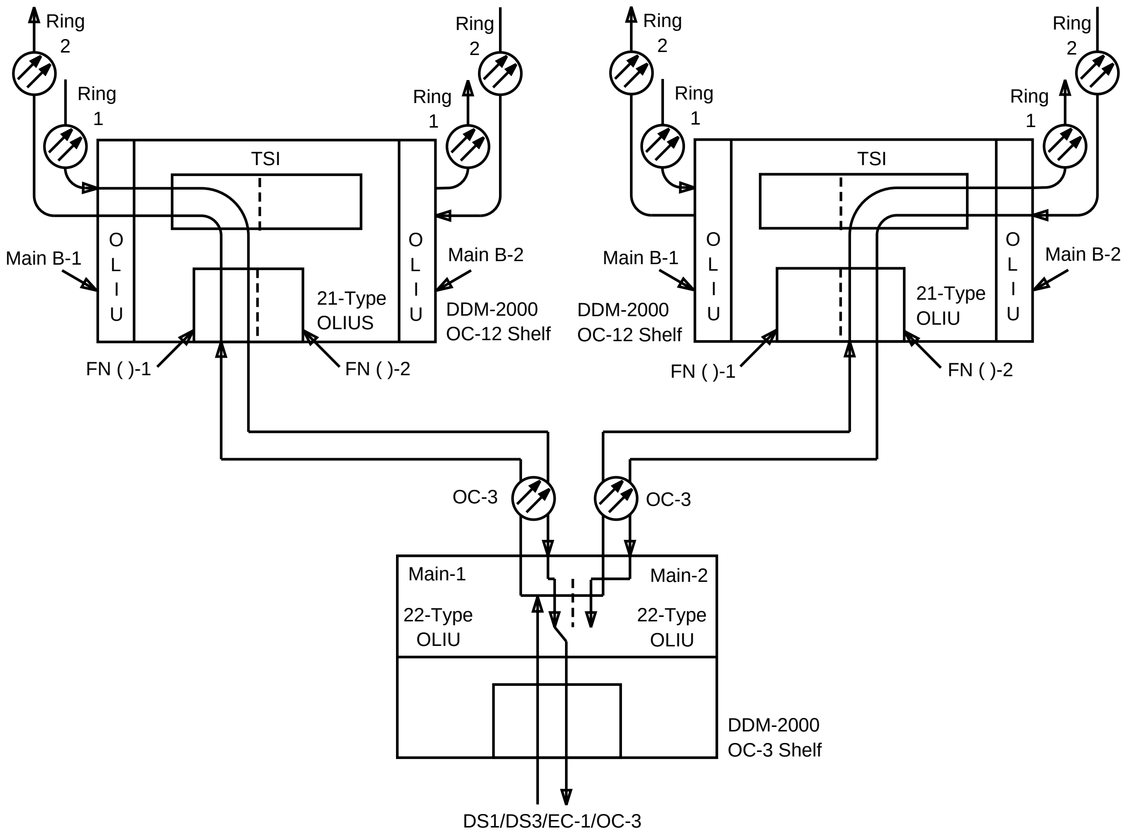


Figure 5-10. OC-3/OC-12 Ring (0x1) Dual Homing

DS3 Data Services on an OC-3 Ring

Figure 5-11 shows an example of using the BBG19 DS3 Data Services Interface circuit pack to connect to data edge devices providing access to the SONET ring for ATM, Ethernet, Token Ring, FDDI, Frame Relay, and other data services.

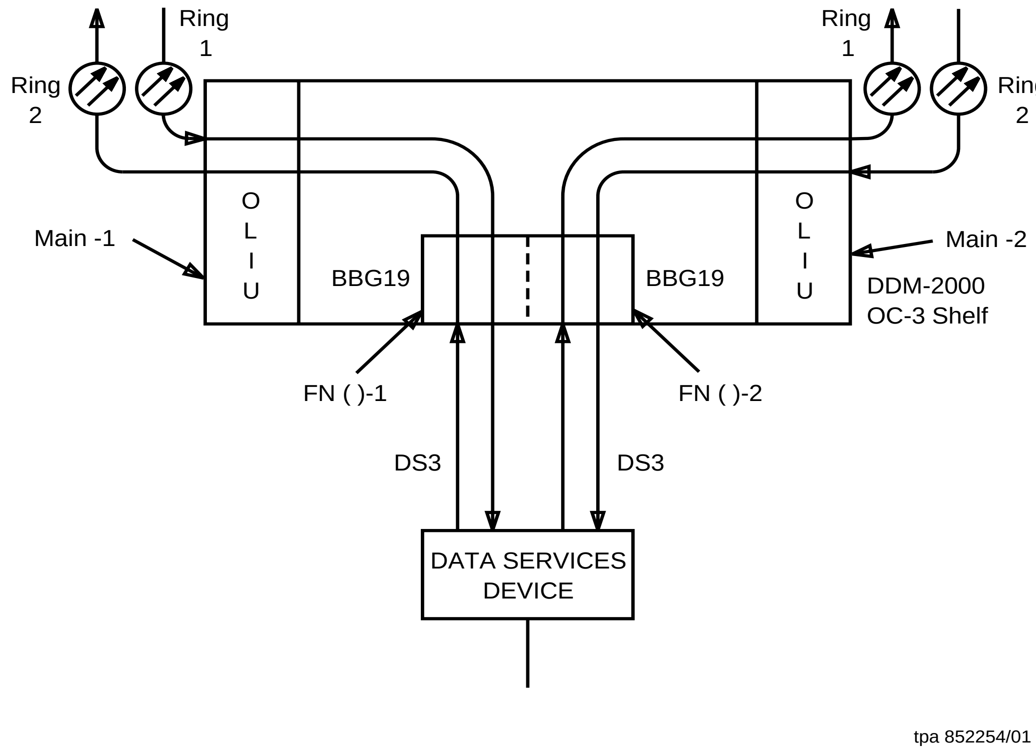


Figure 5-11. DS3 Data Services on an OC-3 Ring

OC-3/OC-1 Ring (0x1)

The OC-3/OC-1 path switched ring is similar to the OC-3/OC-12 ring-on-ring. A DDM-2000 FiberReach shelf interconnects with a DDM-2000 OC-3 ring host shelf through 0x1 provisioned low-speed OC-1 interfaces on a single OC-3 ring shelf. VT/STS path protection switching is done on the DDM-2000 FiberReach shelf.

In single homing, the DDM-2000 FiberReach ring interconnects through the ring interface with the low-speed OC-1 0x1 interface on a single OC-3 shelf.

In dual homing, the OC-1 ring interconnects with the OC-1 0x1 interfaces on two separate and normally non-colocated OC-3 shelves. Different function unit slots on the two shelves must be used to connect the OC-1 ring. For example, function unit C2 on one shelf and function unit C1 on the other shelf (see Figure 5-12 and Figure 5-13).

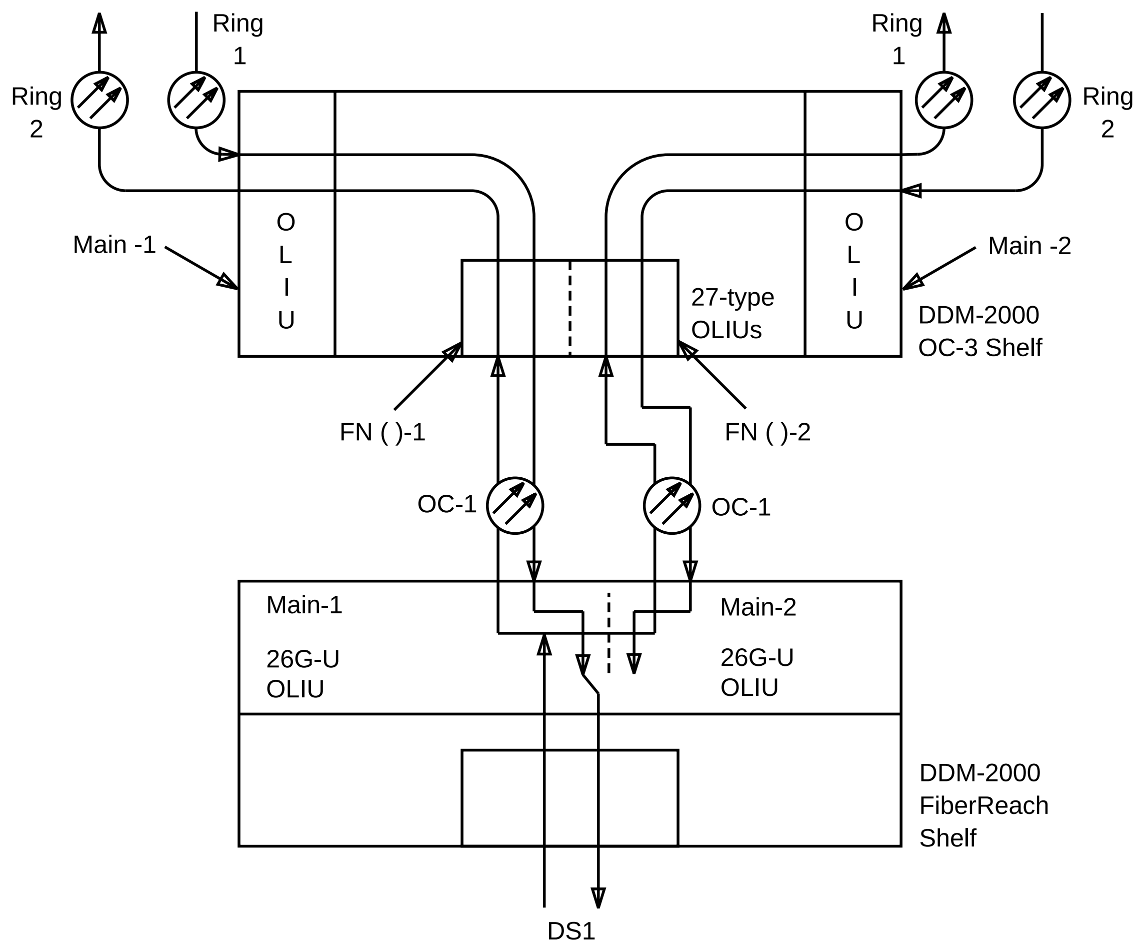


Figure 5-12. OC-3/OC-1 Ring (0x1) Single Homing

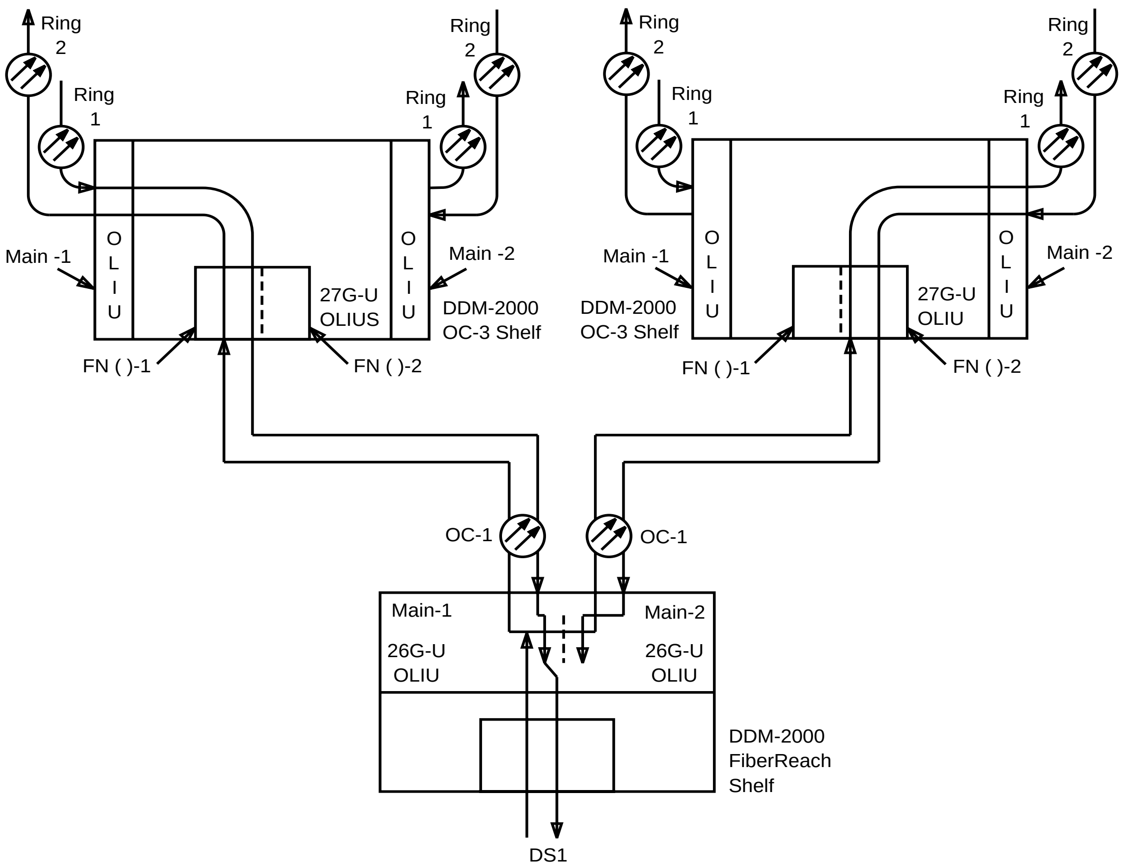


Figure 5-13. OC-3/OC-1 Ring (0x1) Dual Homing

OC-1 Ring Function Unit Pass-Through

The OC-1 ring function unit pass-through is identical in functionality to the pass-through supported in the main slots. A function unit pass-through connection consumes no bandwidth on the ring supported by the OLIUs in the main slots. Figure 5-14 shows an example of this configuration.

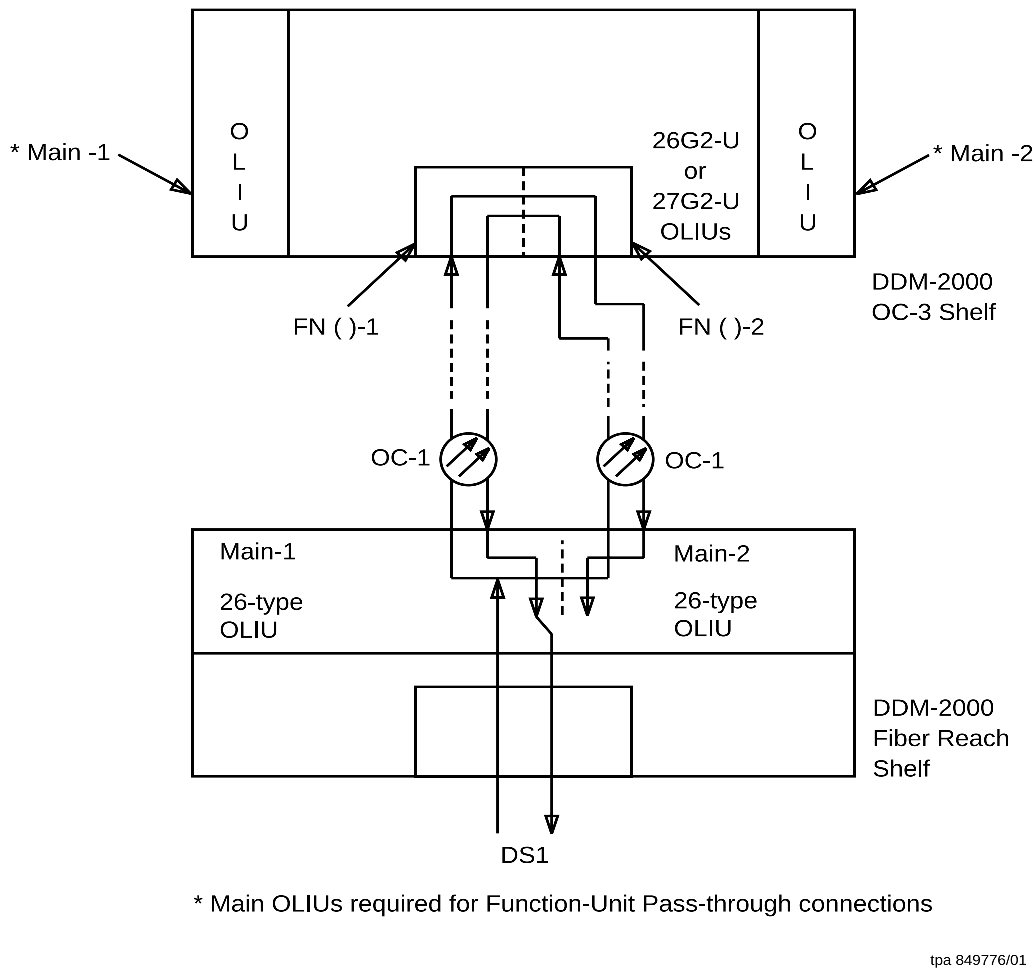


Figure 5-14. OC-1 Ring Function Unit Pass-Through

OC-1/OC-1 Function Unit Hairpin Ring

The OC-1/OC-1 Function Unit Hairpin Ring is the interconnection of two OC-1 rings terminated in function units. Figure 5-15 through Figure 5-18 show four configurations of OC-1/OC-1 function unit hairpin rings. Each OC-1 ring terminates on 0x1 protected 27G2-U OLIUs. In the single homing cases, both rotations of an OC-1 ring terminate on a pair of 27G2-U OLIUs in the same function unit. In the dual homing cases, each rotation of an OC-1 ring terminates on a 27G2-U OLIU in a function unit in a different OC-3 shelf.

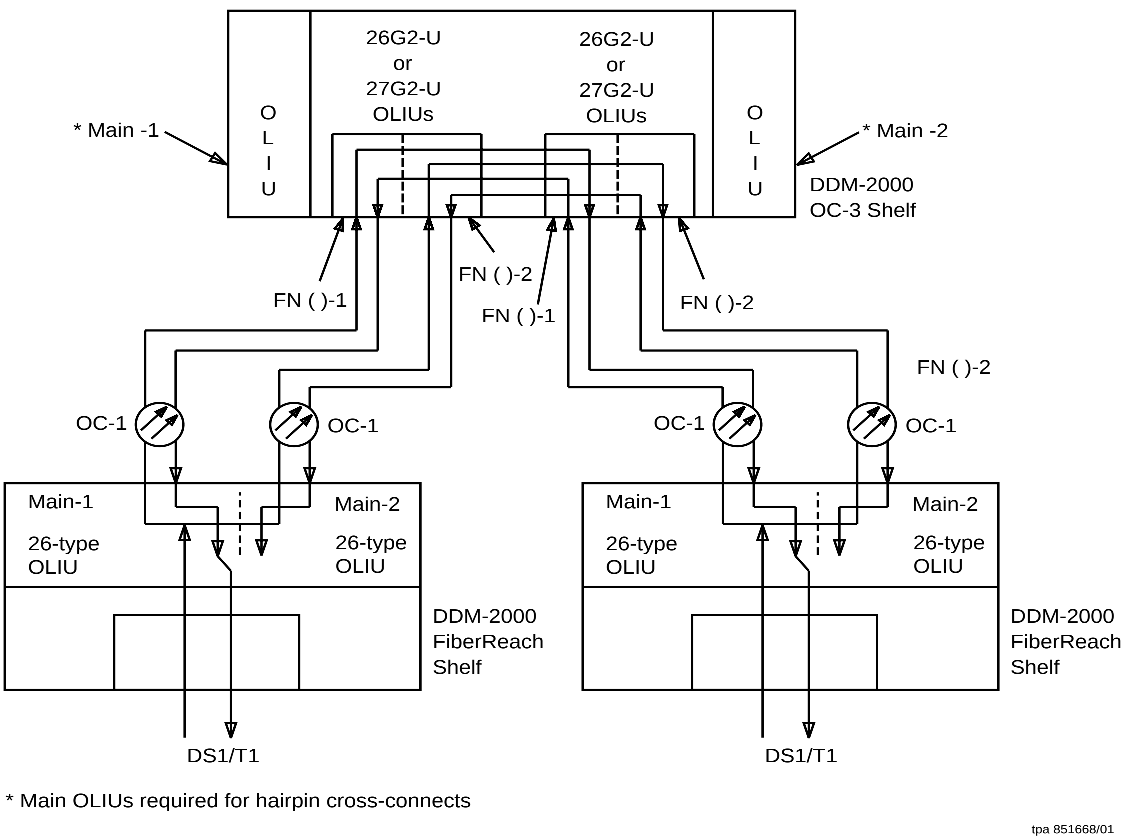


Figure 5-15. OC-1/OC-1 Function Unit Hairpin Ring—Inter-Function Unit Single Homing

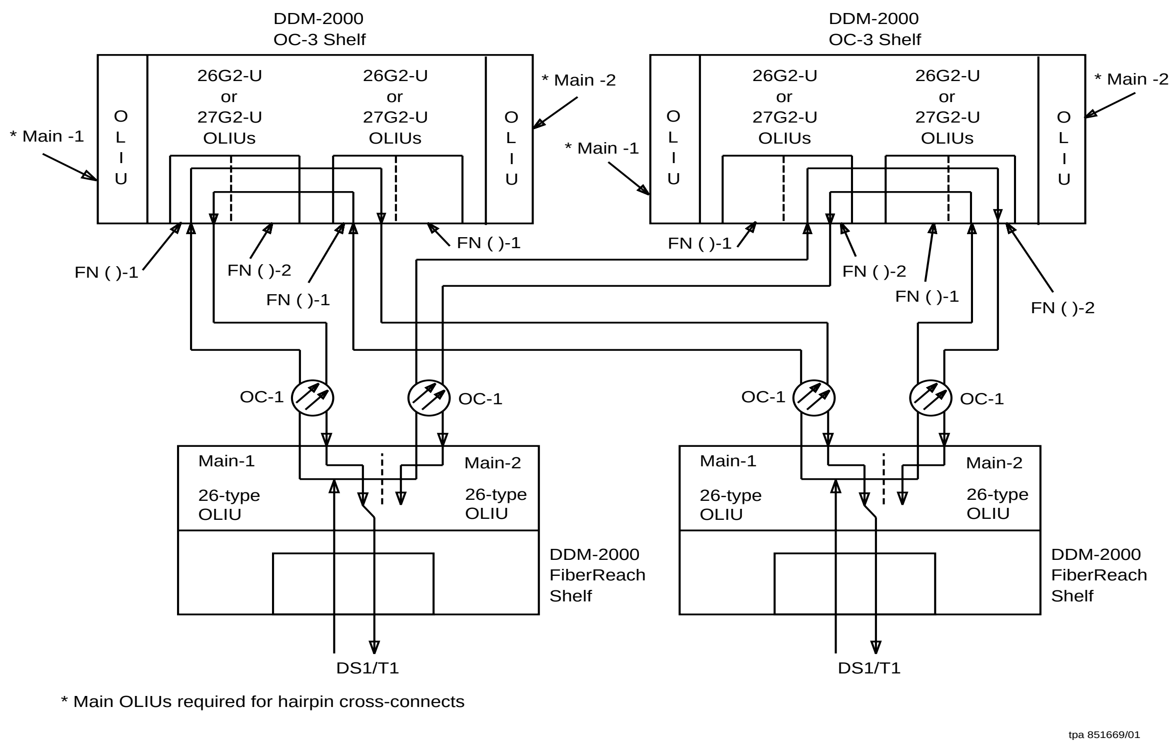


Figure 5-16. OC-1/OC-1 Function Unit Hairpin Ring—Inter-Function Unit Dual Homing

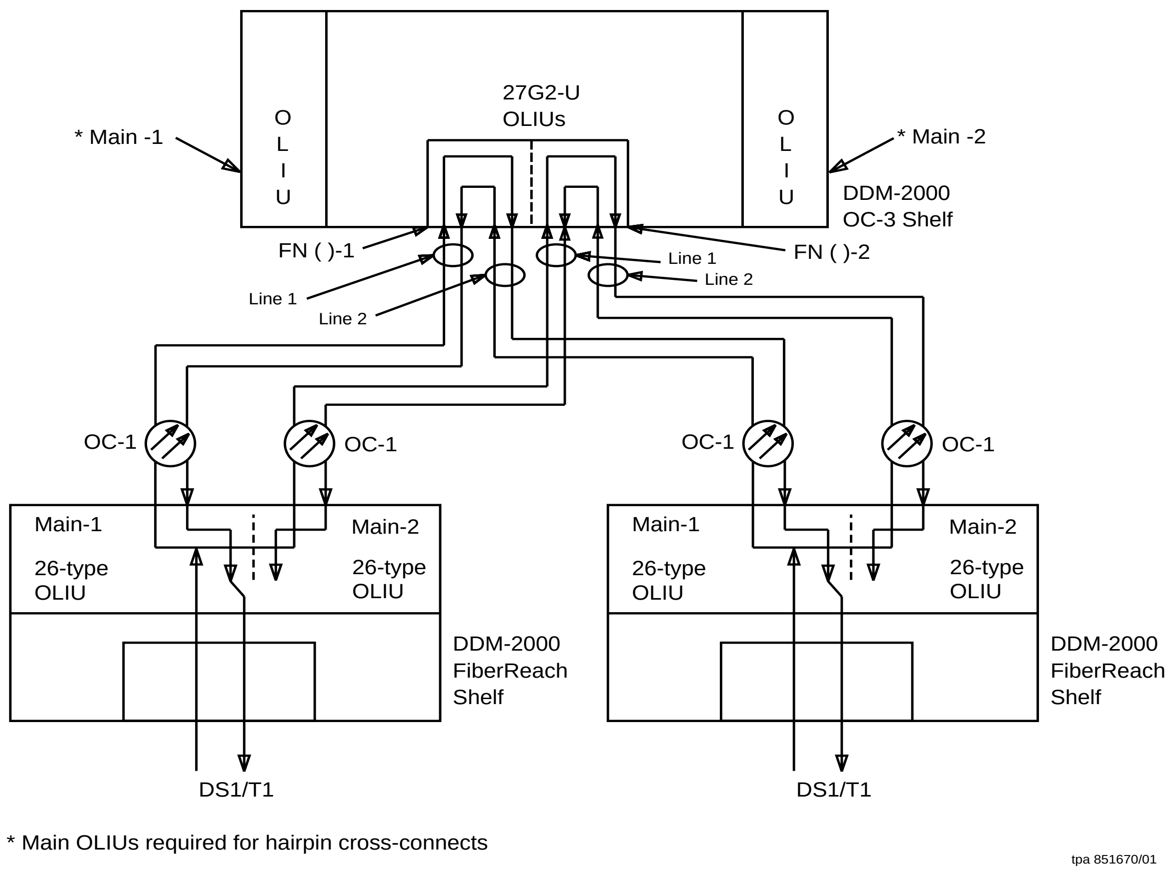


Figure 5-17. OC-1/OC-1 Function Unit Hairpin Ring—Intra-Function Unit Single Homing

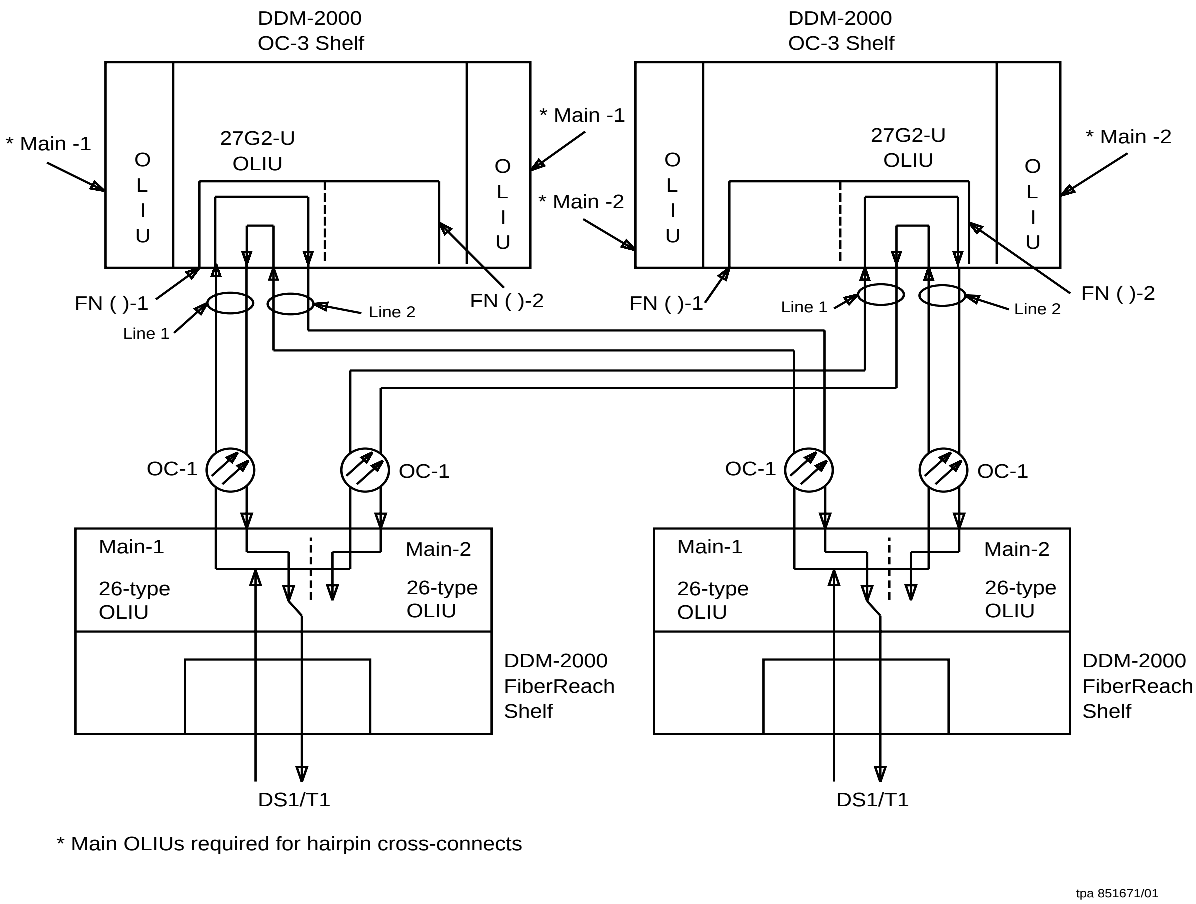


Figure 5-18. OC-1/OC-1 Function Unit Hairpin Ring—Intra-Function Unit Dual Homing

Synchronization Interfaces

Timing Modes

Each DDM-2000 OC-3 Multiplexer can be provisioned to one of three timing modes:

- Free-running from an internal oscillator
- Line-timed from an incoming optical interface. This timing reference is used to generate all outgoing signals.
- External timing from the digital synchronization network via DS1 references (DS1 External).

NOTE:
The synchronization and timing examples used throughout this chapter reference the timing generators as "TG." This could represent either the BBF2B TGS or the stratum 3 BBF4 TG3.

Free-Running

For free-running operation, the TG derives timing from a temperature-compensated, voltage-controlled crystal oscillator (TCVCXO) and a digital phase-locked loop (DPLL) with a full temperature range end-of-life accuracy of ±15 parts-per-million (ppm) for the BBF2B TGS, and ±4.6 ppm for the BBF4 TG3.

Line Timing

The reference signal feeding the PLL is selected from the internal oscillator or a line timing clock derived from the incoming optical line. In line timing mode, the OC-N line being selected for transmission is also selected as the timing reference. In addition, the OC-3 line in function unit C selected for transmission can optionally be selected for the timing reference. This selection is under the control of the on-board microcontroller and the SYSCTL circuit pack and is dependent on the timing mode selected by the user via on-board selection switches and the status of the references. Loss of both line timing references causes the TG circuit pack to go into holdover mode to maintain system timing.

The terms loop timing and line timing have been changed to clarify timing terminology. When the OLIU derives local shelf timing from the incoming optical signal and the shelf is an intermediate shelf (choice of OC-N lines for timing) in a linear network for example, it is called line timing. Loop timing is a subset of line timing used to describe the timing mode of the terminating node (single source of timing) of a linear network, for example.

DS1 External

Each TG circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to its companion TG circuit pack in the same shelf. If the microprocessor on one TG circuit pack detects an incoming DS1 reference failure, it will signal the microprocessor on the companion TG circuit pack. Thus, each TG circuit pack has two DS1 references to choose from, one which is input directly and the other cross-fed. Both TG circuit packs will normally select the same DS1 input. A loss of both DS1 references results in the TG circuit pack entering holdover mode.

Holdover

The TG circuit pack has an internal TCVCXO that maintains shelf timing within ± 4.6 ppm (BBF2B TGS) or ± 0.37 ppm (BBF4 TG3) for 24 hours in the event of an unprotected timing DS1 reference failure.

DS1 Output Modes: MULT and SYNC OUT

The DDM-2000 supports two DS1 output modes: MULT and SYNC OUT. Both modes are used in conjunction with external synchronization modes but only one may be supported on a single shelf.

DS1 Output Mode, MULT

In a CO environment where multiple DDM-2000 Multiplexers are installed in a network bay frame, a single pair of DS1 timing references from the building integrated timing supply (BITS) can be used to externally synchronize all shelves in a bay. This unique feature reduces the number of BITS output ports required to externally synchronize multiple DDM-2000s, thus minimizing network costs.

Each DDM-2000 provides two sets of DS1 input and output ports, one set per TG circuit pack. A DS1 timing reference is initially connected to the bottom shelf in the bay (shelf 1) and each TG terminates and actively buffers this timing reference. The reference is then used as a synchronization reference for that shelf. The buffered signal is also output from each TG as a DSX level (with adjustable equalization). (The TG does not retime or influence the DS1 output when in the holdover mode.) This DS1 output is then connected to the DS1 input port of the next DDM-2000 in the bay via a special (MULT) cable forming a MULT chain. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for cabling information.

If a TG in the MULT chain is removed, shorting contacts in the backplane will redirect input and output signals so the subsequent shelves continue to receive valid DS1 signals. However, if a BBF2B/BBF4 provisioned for SYNC OUT is inserted in the MULT chain, the traceability of the DS1 output will be affected. This could result in untraceable timing or the creation of timing loops. To ensure that replacement circuit packs are provisioned correctly, the DDM-2000 software will monitor newly inserted packs for the correct “shelf provisioning.” If a newly inserted pack does not match the shelf provisioning, the fault LED is lit on that pack and indicates that a provisioning error has occurred. It is always best to verify TG provisioning **before** insertion.

DS1 Output Mode, SYNC OUT

In a CO environment, it may be necessary to externally synchronize a BITS to a SONET reference with traceability to a primary reference source (PRS). When optioned for SYNC OUT, the DDM-2000 will output a derived DS1 traceable to a selected OC-3 or OC-12 input. The frequency of the optical line is divided down to a 1.544 MHz signal and used to create the derived DS1.

When using SYNC OUT, two input timing modes are available: DS1 external-timing or line-timing. These timing modes will only influence the synchronization source used for the derived DS1. In SYNC OUT mode the DDM-2000 uses an external DS1 reference for synchronization. This external reference typically comes from a BITS. In line-timing SYNC OUT mode, the DDM-2000 will use a selected optical reference for synchronization. The derived DS1 is carried to the BITS by a special SYNC OUT cable which is capable of externally timing the DDM-2000 if the DS1 external SYNC OUT mode is selected. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for cabling information.

If a TG provisioned for MULT is inserted into a DDM-2000 provisioned for SYNC OUT, the traceability of the DS1 output will be altered. This could result in untraceable timing or the creation of timing loops. To ensure that replacement packs are provisioned correctly, the DDM-2000 software monitors newly inserted packs for the correct “shelf provisioning.” If a newly inserted pack does not match the shelf provisioning, the fault LED is lit on that pack and indicates that a provisioning error has occurred. It is always best to verify TG provisioning **before** insertion.

The Free-Running, Line Timing, and DS1 External Timing modes can be combined into various subnetwork configurations, some of which are shown in Figure 5-19. The figures show basic single span configurations. In more complex subnetworks, such as hubbing, these basic span configurations are duplicated and/or mixed, depending on the application, to produce a subnetwork synchronization configuration.

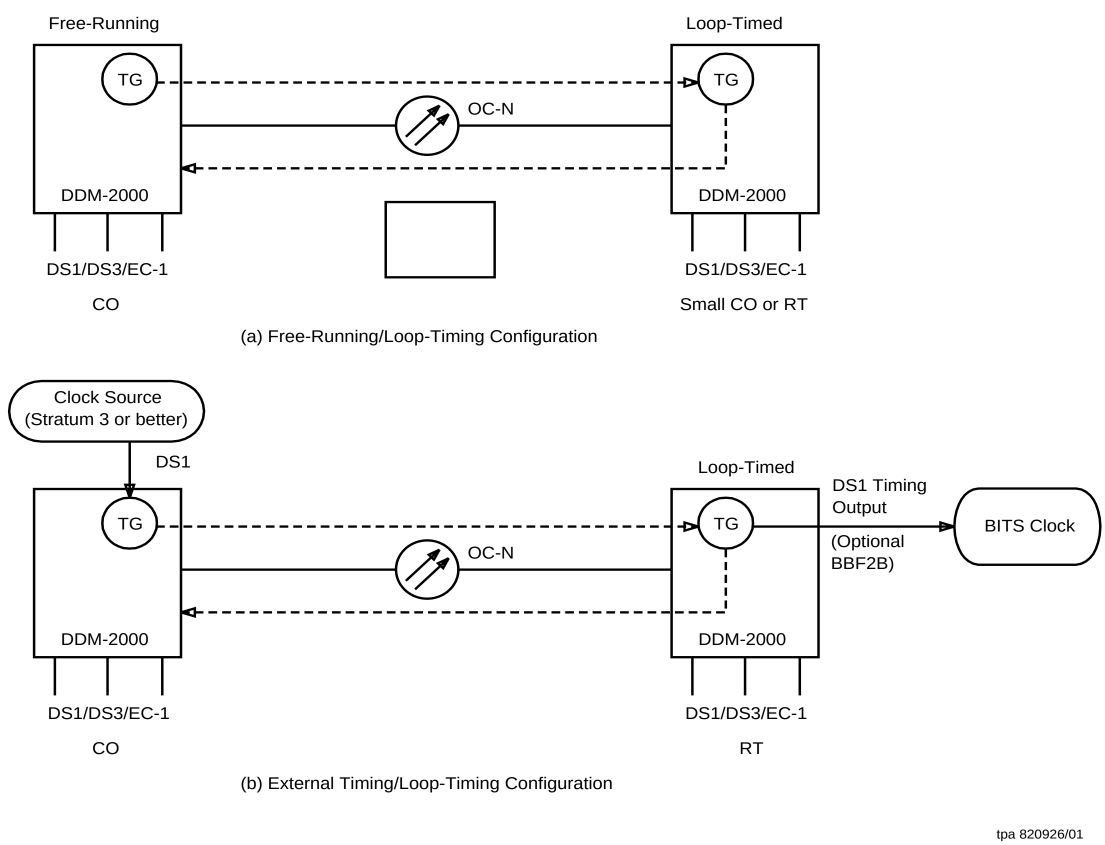


Figure 5-19. Synchronization Timing Configurations (Sheet 1 of 2)

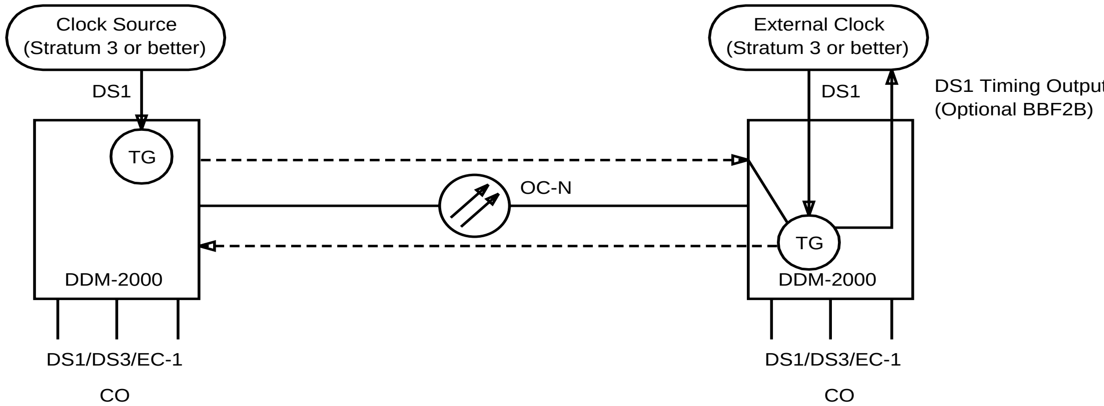
Figure 5-19a shows that the CO system is internally timed (free-running). At the RT, the TG derives its timing from the incoming optical signal and uses it to time itself and loop timing back to the CO.

Figure 5-19b and Figure 5-19c show the CO timed from an external stratum 3 or better timing source. The RT derives its timing from the incoming optical line and can send a DS1 output to a BITS clock.

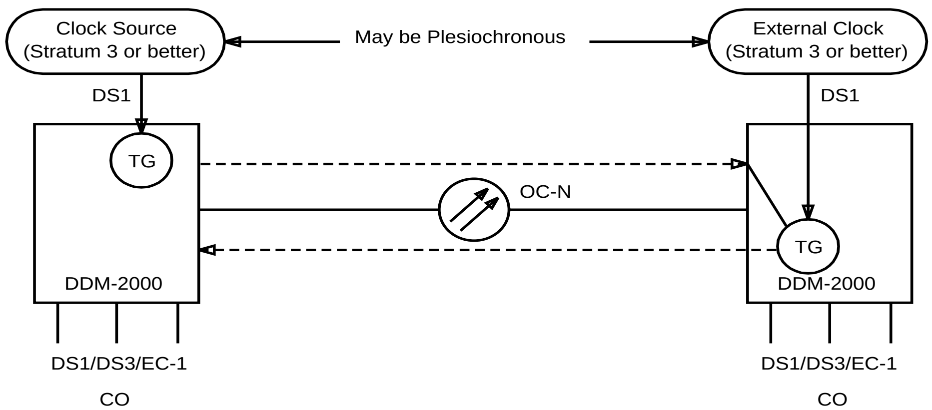
The external timing configuration (Figure 5-19d) uses external DS1 timing to each DDM-2000 Multiplexer in the network. Since this configuration requires local office clocks at each site, it is most suited to interoffice applications. A DDM-2000 network may have all DS1 references traceable to a primary reference source (PRS) called synchronous operation or multiple PRSs called plesiochronous operation.

The PRS is equipment that provides a timing signal whose long-term accuracy is maintained at 10^{-11} or better with verification to universal coordinated time (time and frequency standard maintained by the U.S. National Institute of Standards and Technology), and whose timing signal is used as the basis of reference for the control of other clocks in a network.

An interoffice ring should have each node externally timed if BITS clocks are available. All other rings should have one node externally timed (two in some dual homing architectures) and the rest of the nodes line-timed. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide,* for more synchronization information.



(c) External Timing At Both Ends Configuration



(d) External Timing Plesiochronous (BBF2B)

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Figure 5-19. Synchronization Timing Configurations (Sheet 2 of 2)

Table 5-2 summarizes the DDM-2000 OC-3 synchronization modes for the current software release.

Table 5-2. DDM-2000 OC-3 Synchronization

Application	Ring
	R13.0
Free-Running	X
Line Timing	X
External Timing	X
DS1 Sync Output	X
Synchronization Messaging	X
Line Timing from Fn-C	X
Automatic Synchronization Reconfiguration	X

Synchronization Messaging

SONET synchronization messaging is used to communicate the quality of subnetwork timing, internal timing status, and timing states throughout a subnetwork. Transitions to and from holdover or between OC-N references, for shelf timing, and to and from DS1 AIS, for the DS1 Output, are based on synchronization messages received over the OC-N line from which the DDM-2000 system is extracting timing.

In ring networks with synchronization messaging, the TG circuit pack allows line timing and automatic switching from either of the two ring optical interfaces or function unit C.

The DDM-2000 OC-3 and OC-12 Multiplexers provide a synchronization messaging feature to ensure the integrity of network synchronization during both normal and abnormal conditions. Through the use of synchronization messaging, the current quality of the timing source can be conveyed from one DDM-2000 OC-3 Multiplexer to the next.

NOTE:
If the DDM-2000 is used in a multi-vendor environment, certain synchronization options may need to be exercised. If used to provide or receive line-timing with a non-Lucent SONET multiplexer, the DDM-2000 S1 Byte synchronization messaging must be enabled. This allows the flow of sync messages between the two SONET multiplexers.

This capability allows the DDM-2000 OC-3 and OC-12 Multiplexers to automatically change their timing reference in order to always maintain the highest quality timing available. The capability also allows the DDM-2000 OC-3 and OC-12 Multiplexers to inform a local BITS clock when the DS1 timing output has been degraded and should no longer be used as a reference. This synchronization messaging feature is based on the scheme developed in the *ANSI* T1X1 standards committee.

Applications

The applications that are currently supported with the synchronization messaging feature can be divided into three categories:

1. DS1 timing output integrity
2. Automatic synchronization reconfiguration
3. Synchronization provisioning integrity.

DS1 Timing Output Integrity

The DS1 timing outputs are typically used to distribute timing from the BITS clock in one office (master) to the BITS clock in the next office (slave), using the SONET transmission facilities between them as the synchronization vehicle. The BITS are typically of stratum 2 or stratum 3 accuracy. The DDM-2000 Multiplexer does not introduce its own internal timing source onto the SONET facility but merely transfers the quality of its timing reference. This ability preserves the required hierarchical structure of the timing network and should be maintained at all times.

If the DDM-2000 Multiplexer at the master office enters holdover due to a disconnected reference cable or a local BITS failure, the quality of the DS1 timing output at the slave office will now be traceable directly to the DDM-2000 Multiplexer. If the master DDM-2000 system contains a TG3 circuit pack, stratum 3 accuracy will be maintained indefinitely. This provides acceptable timing for stratum 3 NEs at slave offices. If the master DDM-2000 contains a TGS circuit pack, stratum 3 accuracy will be maintained for the first 24 hours of holdover. After the first 24 hours, the DDM-2000 system could exceed stratum 3 accuracy.

If a DDM-2000 system contains a TGS pack, it may change the output of its derived DS1 under some conditions. If the incoming synchronization message is better than internal clock (IC) the derived DS1 will be an ‘all ones’ with framing. This format is suitable for providing synchronization to a BITS of stratum 3 accuracy. If the co-located DDM-2000 enters holdover or the incoming synchronization message is IC or worse, the derived DS1 format will change to ‘all ones’ without framing (AIS). This will prevent a BITS from using this input and force the BITS to either select a new input or enter holdover. This change to AIS preserves the stratum timing hierarchy by allowing the BITS to synchronize from a clock of equal or higher quality.

Available in R13.0 and later is the threshold AIS feature. This feature allows the user to select the value of the incoming message that causes the derived DS1 output to output AIS. This feature will allow stratum 2 BITS clock to receive timing from a TGS or TG3 without violating stratum timing rules.

As shown in Figure 5-20 (an OC-3 linear application, although not supported in Release 13.0, is used to explain the concepts of synchronization messaging), the use of SONET synchronization messaging notifies the DDM-2000 OC-3 Multiplexer at the slave site to place AIS on the DS1 timing output. This BITS can then enter holdover or switch to an alternate reference.

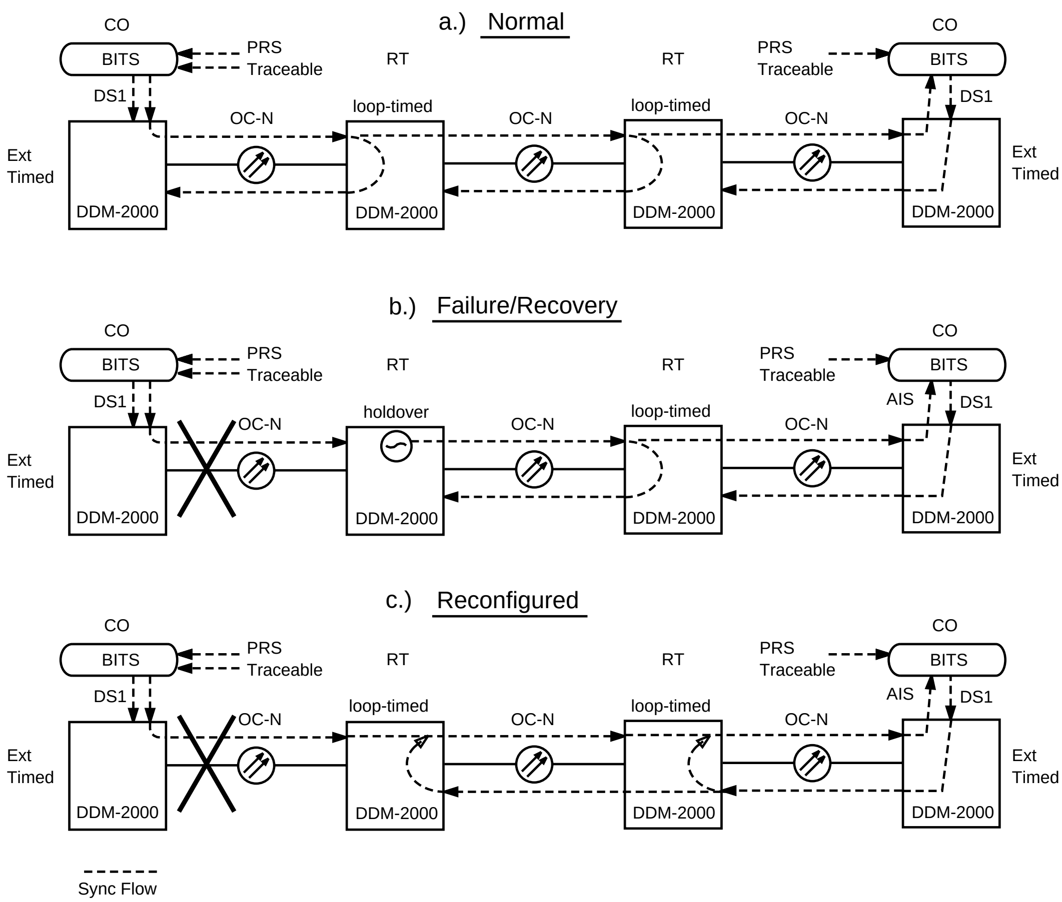


Figure 5-20. DS1 Timing Output — Dual Homing Linear

Automatic Synchronization Reconfiguration

SONET was designed to operate optimally in a synchronous environment. Although plesiochronous and asynchronous operation can be supported through the use of pointer adjustments, transmission quality is affected by the generation of additional jitter and wander due to pointer adjustments. Because of this, it is desirable to maintain synchronous operation whenever possible. Through the use of synchronization messages, the quality of the different timing references can be made available at each DDM-2000 OC-3 Multiplexer. The DDM-2000 OC-3 Multiplexer shelf can be optioned to determine the best timing reference and switch to it. Through this mechanism, the synchronous operation of the subnetwork can be maintained. The switching of timing references is hitless, and the synchronization messages also allow it to be done without creating timing loops in the process.

In the linear dual-homing network in Figure 5-20c, normal operation includes an external timing reference at each of the COs. The RT sites are each line-timed from the CO DDM-2000 OC-3 Multiplexers on the left. If a fiber failure occurs between the first two DDM-2000 OC-3 Multiplexers, the automatic synchronization reconfiguration feature will cause the line-timed DDM-2000 OC-3 Multiplexers to change their direction of line timing. This prevents any DDM-2000 OC-3 Multiplexer from operating in holdover for an extended period of time.

Consider the access ring network in Figure 5-21. Under normal operation, the ring has one DDM-2000 OC-3 Multiplexer externally timed and the others line-timed in the counterclockwise direction. If a fiber failure occurs between the first two DDM-2000 OC-3 Multiplexers, the automatic synchronization reconfiguration feature will cause the DDM-2000 OC-3 Multiplexers to change their line timing directions to clockwise. The result is that the ring is again operating synchronously. The ring already provides self-healing restoration of the traffic, so it is especially important to maintain synchronous operation during this type of failure to prevent service degradation due to increased jitter and wander.

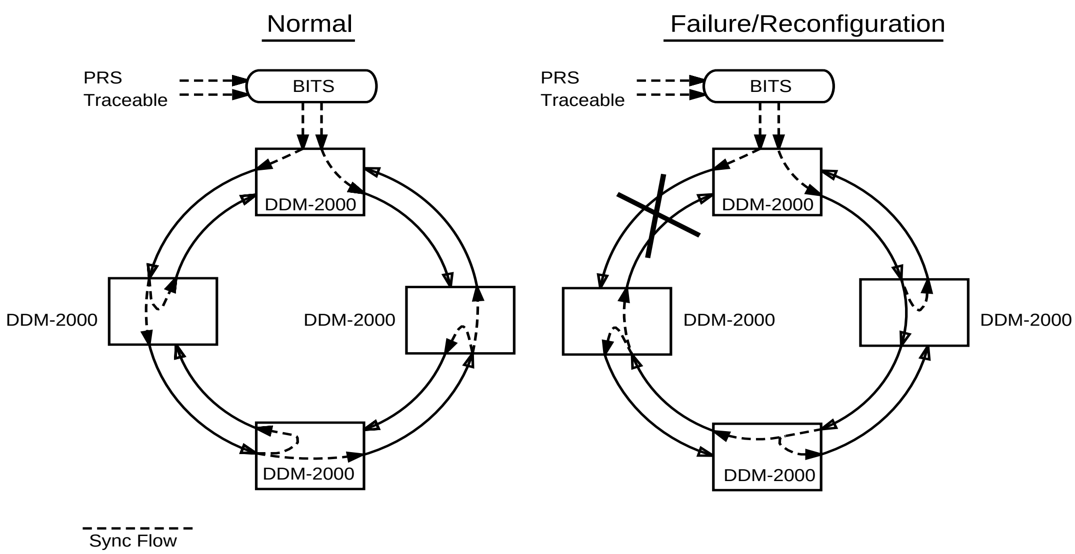


Figure 5-21. Synchronization Reconfiguration — Access Ring

Synchronization Provisioning Integrity

A welcomed side feature of synchronization messaging is that it helps prevent provisioning errors. Provisioned timing loops on the DDM-2000 OC-3 Multiplexers will be quickly detected through the synchronization messaging algorithm and prevented by forcing a shelf into holdover. The system can then be reprovisioned correctly.

Feature Details and Options

As mentioned previously, SONET synchronization messaging is used to communicate the quality of the subnetwork timing throughout the subnetwork. This is done using bits 1-3 of the K2 byte found in the SONET overhead. In OC-3 Release 9.1 and later releases, synchronization messaging can also be done using bits 5-8 of the S1 byte in the SONET overhead (not supported on OC-1 links). If a DDM-2000 OC-3 system is deriving timing from a given OC-N interface and synchronization messaging is enabled on that interface (Kbyte messages and Sbyte messages are provisioned using the **`set-ocn`** command), the system interprets the received message to determine its internal timing status. The system also determines the state of the DS1 output, if the DS1 output is enabled. The DDM-2000 OC-3 system also transmits over the particular OC-N interface and all other OC-N interfaces that are enabled for synchronization messaging, the appropriate message indicating the quality of its timing, and its active timing mode. Table 5-3 and Table 5-4 list the associated internal timing status and DS1 output states that are associated with synchronization messages received from the OC-N interface when synchronization messaging is enabled. The tables list the messages from low- to high-quality.

Table 5-3. Synchronization Messages using K2 Byte

Received Message	Active Timing Mode *	Default DS1 Output State	Quality Level
Don't Use	Holdover	AIS	7
Timing Looped Back (TLB)	Holdover	AIS	7
Stratum 4 †	Holdover	AIS	6
Internal Clock (IC)	OK to use	AIS	5
Internal Clock (IC) (w/TG3)	Holdover	AIS	5
Stratum 3 †‡	OK to use	Good	4
Stratum 2 †	OK to use	Good	3
Sync Quality Unknown (SQU)	OK to use	Good	2
Stratum 1 †	OK to use	Good	1

* This column applies only when provisioned for line-timing mode.

† Presently, DDM-2000 OC-3 Multiplexers cannot generate these messages, but they could be retransmitted and supported for autoreconfiguration if any of these are received by a DDM-2000 OC-3 Multiplexer.

‡ The TG3 circuit pack can generate a stratum 3 signal.

Table 5-4. Synchronization Messages using S1 Byte *

Received Message	Active Timing Mode †	Default DS1 Output State	Quality Level
Don't Use	Holdover	AIS	7
Traceable SONET minimum Clock	OK to use	AIS	5
Traceable SONET Clock minimum (w/TG3)	Holdover	AIS	5
Traceable Stratum 3 ‡§	OK to use	Good	4
Traceable Stratum 2 ‡	OK to use	Good	3
Sync Trace Unknown	OK to use	Good	2
PRS Traceable ‡	OK to use	Good	1

* S1 byte not supported on OC-1 links.

† This column applies only when provisioned for line-timing mode.

‡ Presently, DDM-2000 OC-3 Multiplexers cannot generate these messages, but they could be retransmitted and supported for autoreconfiguration if any of these are received by a DDM-2000 OC-3 Multiplexer.

§ The TG3 circuit pack can generate a stratum 3 message.

Synchronization messaging using the SONET K2 byte and S1 byte can be disabled on a per OC-N interface using the **`set-ocn`** command (not supported by OC-1). Zeros will be transmitted on bits 1-3 of the K2 byte if this is done; all ones will be transmitted on bits 5-8 of the S1 byte if this is done. The timing and synchronization status of a shelf can be determined using the **`rtrv-sync`** command.

The "Don't Use" message is sent when the system determines that its timing is not suitable for synchronization; for example, due to failure.

When the DDM-2000 OC-3 system is configured for external timing and its DS1 output port is provisioned for MULT mode, the message Sync Quality Unknown (SQU) for K byte, or Sync Trace Unknown (STU) for S byte, is sent on all the OC-N interfaces where synchronization messaging is provisioned. When the capability of communicating with a BITS clock over the DS1 overhead exists, the quality of the reference signal will be transmitted instead; for example, Stratum 1.

When the DDM-2000 OC-3 system is configured for external timing and its DS1 output port is provisioned for SYNC OUT mode, the Timing Looped Back (TLB) message for K byte, or “Don’t Use” message for S byte, will be sent on the OC-N interfaces towards the NE from which the DS1 timing output is being derived. The SQU message for K byte or STU for S byte will be sent on all other OC-N interfaces where synchronization messaging is provisioned. If the DS1 output is generating AIS while the system is configured in this way, the message SQU for K byte, or STU for S byte, will be transmitted on all OC-N interfaces.

When the DDM-2000 OC-3 system is configured for free run or is in holdover mode, the Internal Clock message for K byte or Traceable SONET Clk for S byte will be sent on all OC-N interfaces where synchronization messaging is provisioned.

When the DDM-2000 OC-3 system is configured for line timing, the TLB message for K byte and “Don’t Use” for S byte will be sent on the OC-N interfaces towards the NE from which the timing is being derived. The message received on the OC-N interface will be sent on all other OC-N interfaces where synchronization messaging is provisioned.

With automatic synchronization reconfiguration, the DDM-2000 OC-3 Multiplexer systems use and compare the incoming synchronization messages on the OC-N interfaces available for line timing to select the highest quality synchronization reference available. If the received quality levels are the same on the references available for timing, the existing line timing reference take precedence. This feature guarantees the non-revertive operation of reconfiguration. The line timing reference is provisioned by the **`set-sync`** command.

The existence of automatic synchronization reconfiguration does not change the system's behavior on traditional line failures; for example, LOF, LOP, LOS, and others.

There are synchronization references in the DDM-2000 OC-3 system that can be provisioned as network timing sources but are not considered as timing sources for automatic synchronization reconfiguration. Examples of these are the linear extensions off of a DDM-2000 OC-3 ring. This type of interface is considered a linear interface, and the system treats it as such with regards to synchronization.

Table 5-5 lists the synchronization references available on DDM-2000 OC-3 and OC-12 system topologies.

Table 5-5. Available Synchronization References

System	Manually Provisionable	Automatically Reconfigurable
OC-3 Linear	Main, Fn-C	Main, Fn-C
OC-3 Rings	Main-1, Main-2, Fn-C	Main-1, Main-2, Fn-C
OC-12 Linear	Main-B	Not applicable
OC-12 Rings	Main-B-1, Main-B-2	Main-B-1, Main-B-2

Function unit C, when equipped with an OC-3/IS-3 OLIU, can be selected as an option for automatic synchronization reconfiguration. This is useful in DRI networks where an OC-3 ring is connected through an OC-3/IS-3 optical interface to an OC-12 or FT-2000 OC-48 Lightwave System ring.

Sending DS1 AIS on the output of the BBF2B/BBF4 circuit pack can be provisioned by using the **set-sync** command. Depending on the quality level of the incoming sync messages, this new parameter can be provisioned to send DS1 AIS upon receiving level 5 (default), level 4, level 3, or level 2. Refer to Table 5-3 and Table 5-4 for definitions of quality levels. AIS will be sent as long as the received message is at the provisioned or greater in quality level number.

Examples

In this part, some detailed examples are given to show specifically how the synchronization messages propagate through the DDM-2000 OC-3 network and assist in the recovery from a fiber failure.   Through these examples, one can extend the same concept to any other network that may include different topologies, number of sites, failure locations, and number of BITS clocks.

NOTE:
All nodes in a ring using automatic synchronization reconfiguration must have the synchronization messaging and automatic synchronization reconfiguration features enabled to prevent alarms.

In all of the following examples, if the sync message parameter within the **set-oc3** command has been provisioned to “S byte” for an optical interface, then the equivalent quality level S byte message will be transmitted from that optical interface. The following are equivalent messages:

K2: Sync Quality Unknown is the same as, S1: Sync Trace Unknown

K2: Timing Looped Back is the same as, S1: Don’t Use

K2: Internal Clock is the same as, S1: Traceable SONET minimum Clock

K2: Stratum 3 is the same as, S1: Traceable Stratum 3.

Synchronization Reconfiguration Using an Externally Timed Access Ring

Figure 5-22a shows an externally timed access ring operating in its normal configuration. The DDM-2000 OC-3/OC-12 Multiplexer at the CO (Site A) is externally timed from a BITS clock referenced to a PRS traceable source (host node). The remaining DDM-2000 OC-3/OC-12 Multiplexers are externally timed from a BITS clock referenced to a derived DS1. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used.

Automatic synchronization reconfiguration is not an option for externally timed DDM-2000 OC-3/OC-12 Multiplexers; therefore, a change in the synchronization message will not cause an automatic synchronization reconfiguration.

The stratum level of the BITS clock at the CO (Site A) must be equal to or better (more accurate) than the stratum level of the BITS clocks used at the other sites. This is necessary to maintain the stratum level hierarchy.

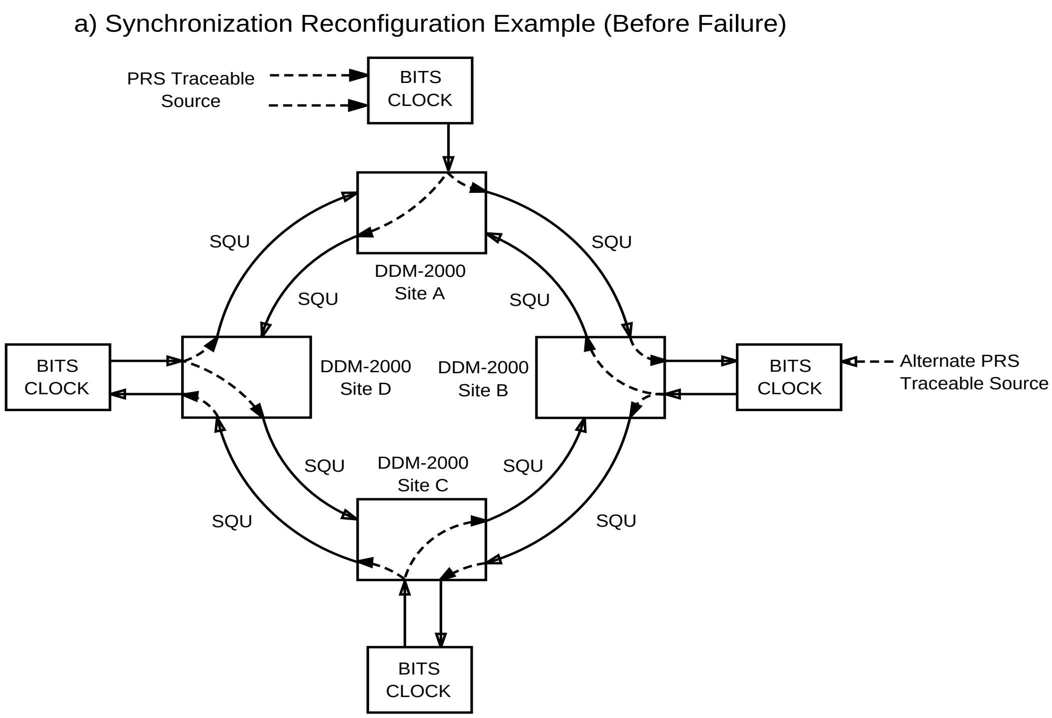


Figure 5-22. Synchronization Reconfiguration — Externally Timed Access Ring (Sheet 1 of 2)

In Figure 5-22b, a fiber has been cut between sites A and B. Immediately the DDM-2000 OC-3/OC-12 Multiplexer at site B changes the format of its derived DS1 to AIS. This forces the BITS clock at site B to enter holdover or switch input source (if a valid one is available). Because automatic synchronization reconfiguration is not available, the synchronization status messages are not used. All other non-host nodes will track the holdover clock at site B. Although no timing loops have been formed, the timing of all non-host nodes will differ from the host node by the accuracy of the holdover clock at site B.

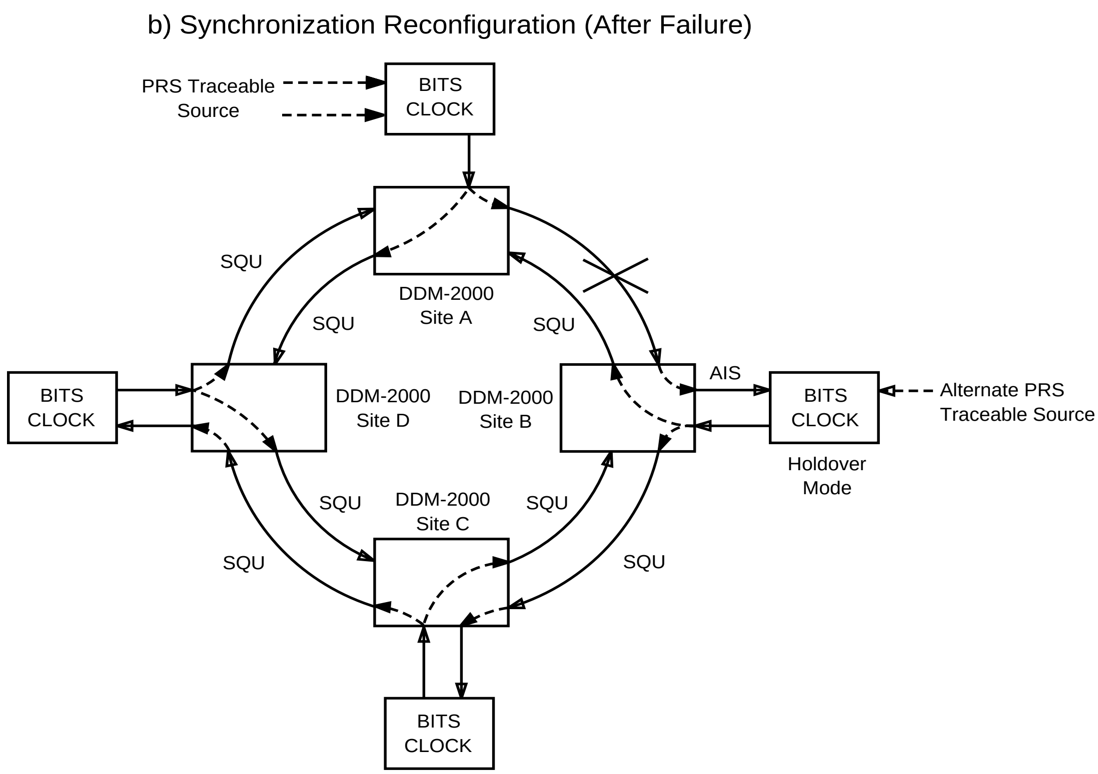
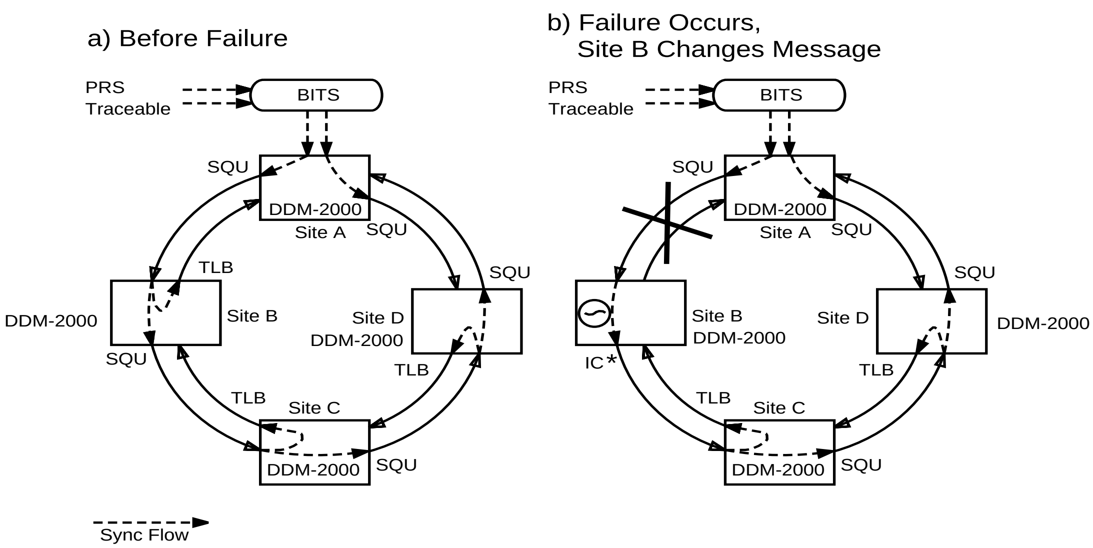


Figure 5-22. Synchronization Reconfiguration — Externally Timed Access Ring (Sheet 2 of 2)

Synchronization Reconfiguration in an Access Ring

Figure 5-23a shows the access ring operating in its normal configuration. The DDM-2000 OC-3 Multiplexer at the CO is externally timed, and each of the other DDM-2000 OC-3 Multiplexers are line-timed in a counterclockwise direction. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The TLB message is sent on the interface that is being used as the line timing reference and, thus, where using that timing would create a timing loop. Synchronization messaging and automatic synchronization have both been enabled for this network.

In Figure 5-23b, a fiber has been cut between sites A and B. Immediately, the DDM-2000 OC-3 Multiplexer at site B enters holdover and sends out the internal clock (IC) message to site C. The DDM-2000 OC-3 Multiplexer at site B cannot switch to line time from site C because it is receiving the TLB message on that interface.

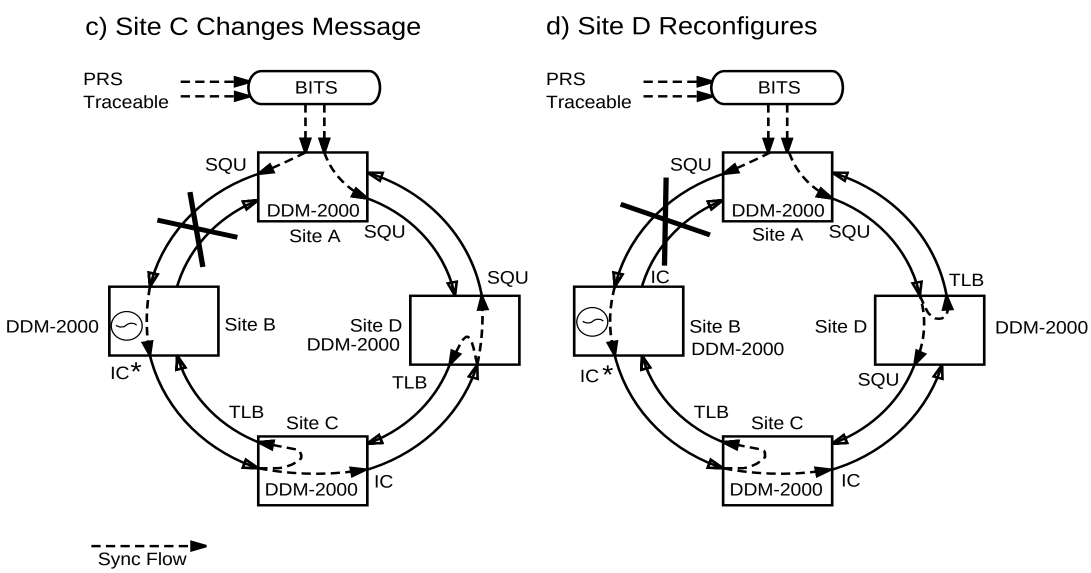


*STRATUM 3 if using a TG3 at site B, or IC if using a TGS.

Figure 5-23. Synchronization Reconfiguration — Access Ring (Sheet 1 of 3)

In Figure 5-23c, the DDM-2000 OC-3 Multiplexer at site C detects the incoming IC message and sends out the IC message to site D. The DDM-2000 OC-3 Multiplexer at site C cannot switch to line time from the other rotation because it is receiving the TLB message on that interface.

In Figure 5-23d, the DDM-2000 OC-3 Multiplexer at site D detects the incoming IC message. Because this DDM-2000 OC-3 Multiplexer is receiving the SQU message from site A, it will switch to line time from site A because SQU is higher quality than IC. After the switch occurs, the TLB message is sent back to site A and the SQU message is retransmitted to site C.

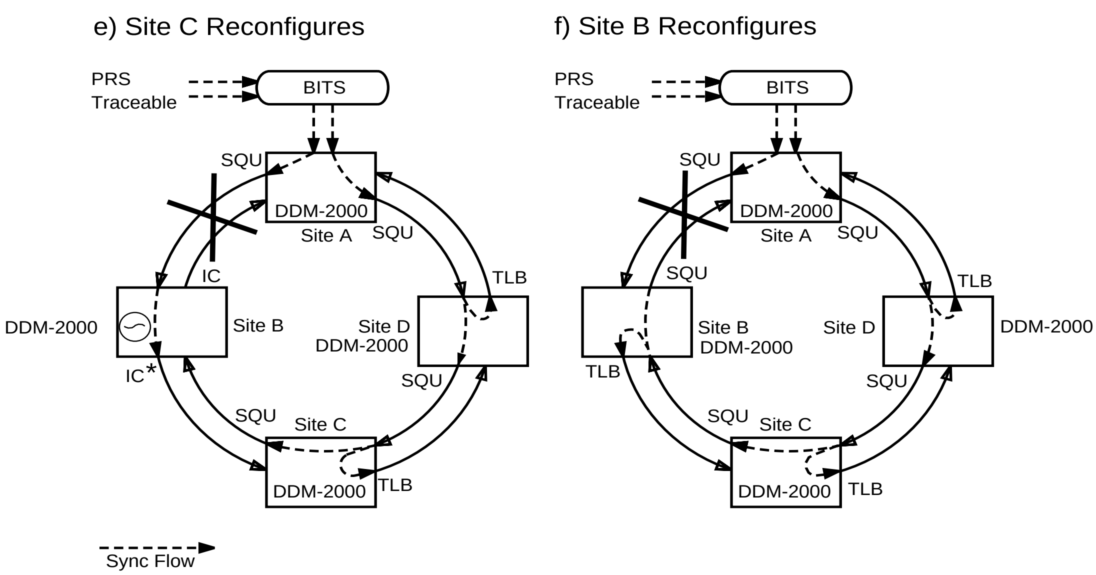


* STRATUM 3 if using a TG3 at Site B, or IC if using a TGS.

Figure 5-23. Synchronization Reconfiguration — Access Ring (Sheet 2 of 3)

In Figure 5-23e, the DDM-2000 OC-3 Multiplexer at site C detects the incoming SQU message from site D. The SQU message is a better quality message than the IC message being received from site B, so the DDM-2000 OC-3 Multiplexer at site C switches to line time from site D. After the switch occurs, the TLB message is sent back to site D, and the SQU message is retransmitted to site B.

In Figure 5-23f, the DDM-2000 OC-3 Multiplexer at site B detects the incoming SQU message from site C. The SQU message is a better quality message than the internal holdover capability, so the DDM-2000 OC-3 Multiplexer at site B switches to line time from site C. After the switch occurs, the TLB message is sent back to site C, and the SQU message is forwarded to site A. When the failure clears, the synchronization remains in the new configuration unless it is manually switched back.



*STRATUM 3 if using a TG3 at site B, or IC if using a TGS.

Figure 5-23. Synchronization Reconfiguration — Access Ring (Sheet 3 of 3)

Synchronization Messaging to Support DS1 Timing Outputs

Figure 5-24a (an OC-3 linear application, although not supported in Release 13.0, is used to explain the concepts of synchronization messaging) shows a dual homing linear network operating in its normal configuration. The DDM-2000 OC-3 Multiplexer at site A is externally timed, and the DDM-2000 OC-3 Multiplexers at sites B and C are line-timed from site A. The DDM-2000 OC-3 Multiplexer at site D is also externally timed from another BITS. Both BITS should be PRS traceable. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The TLB message is sent to indicate where line timing has been used and, thus, where using that timing would create a timing loop. Synchronization messaging has been enabled for this network, but automatic synchronization reconfiguration has not been enabled.

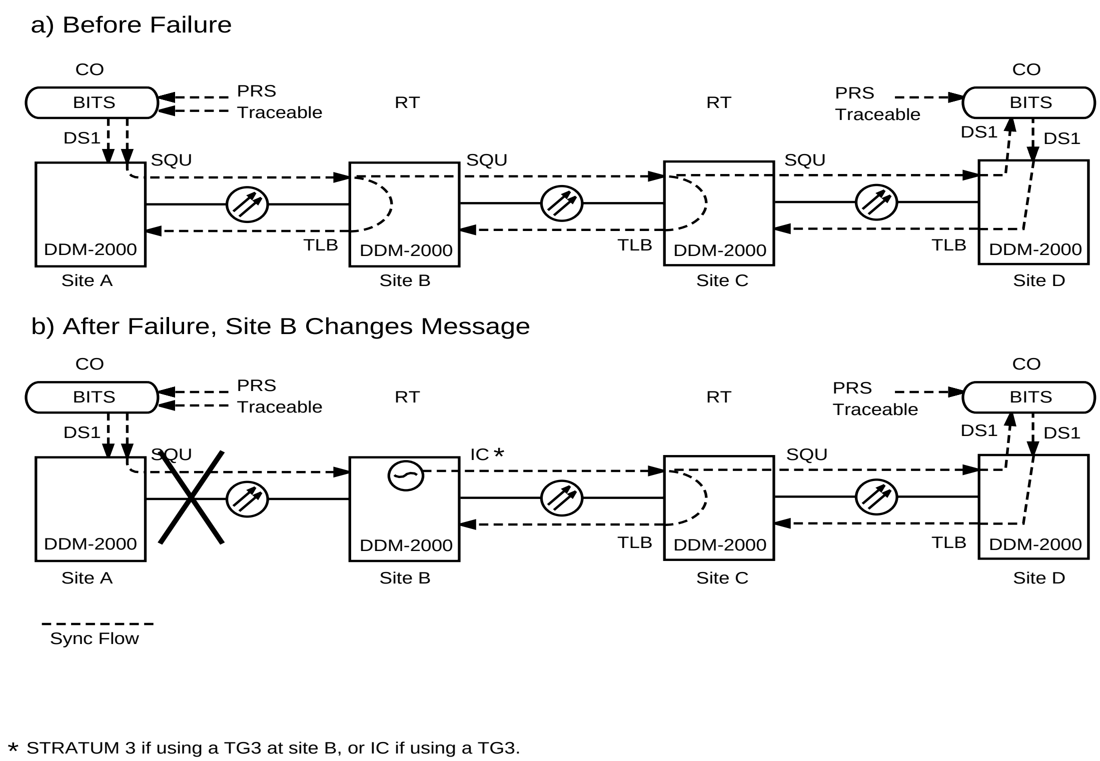


Figure 5-24. DS1 Timing Output with Fiber Failure (Sheet 1 of 2)

In Figure 5-24b, a fiber has been cut between sites A and B. Immediately, the DDM-2000 OC-3 Multiplexer at site B enters holdover and sends out the IC message to site C.

In Figure 5-24c, the DDM-2000 OC-3 Multiplexer at site C detects the incoming IC message from site B and forwards it on to site D.

In Figure 5-24d, the DDM-2000 OC-3 Multiplexer at site D detects the incoming IC message from site C and sends out AIS to the BITS. The BITS will either switch to an alternate reference, if available, or enter holdover.

If the automatic synchronization reconfiguration feature had been enabled in this example, at this point, sites C and B would attempt to switch line timing directions to retime from site D.

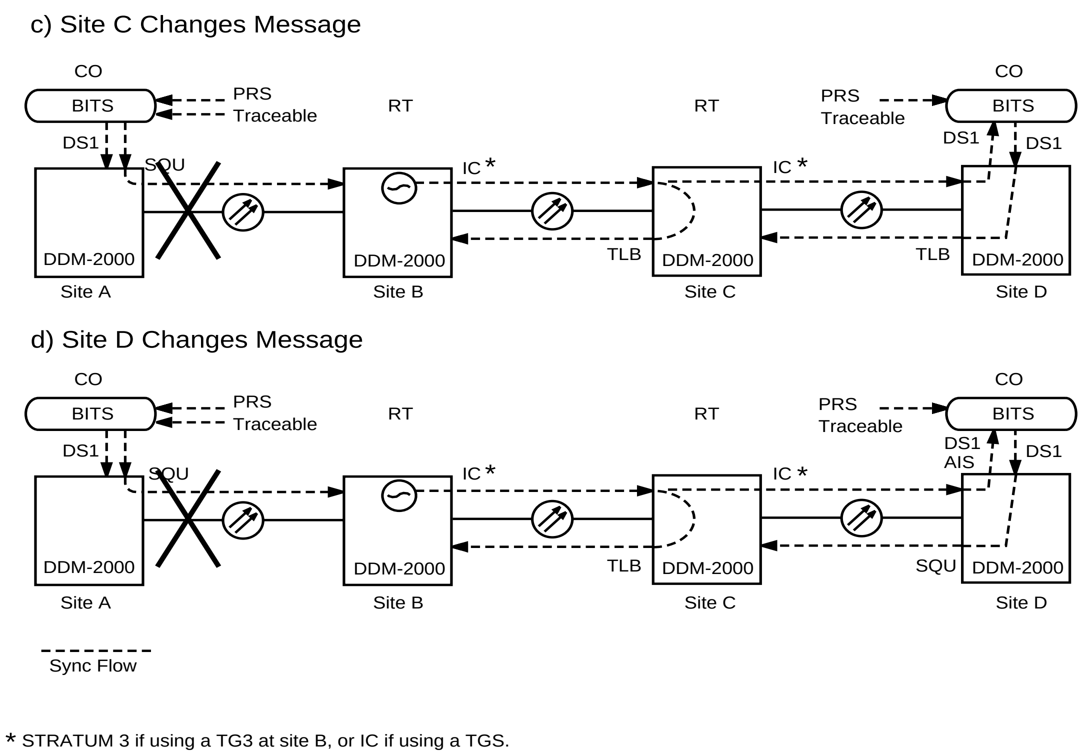


Figure 5-24. DS1 Timing Output with Fiber Failure (Sheet 2 of 2)

Dual Homing DRI Synchronization Configurations

OC-3 and FT-2000 OC-48 Lightwave System

Figure 5-25 shows how OC-N timing can be distributed from an FT-2000 OC-48 Lightwave System line switched ring to a DDM-2000 OC-3 path switched ring using a dual homing DRI configuration. The OC-3 DRI nodes are connected via OC-3 point-to-point links terminating in function unit C slots. The major characteristics of this configuration are:

- The FT-2000 OC-48 Lightwave System nodes are through-timed and derive timing from different rotations of the OC-48 ring.
- The FT-2000 OC-48 Lightwave System must be provisioned to write stratum 3 synchronization message to the K2 byte so the DDM-2000 ring can use synchronization messaging.
- The two DDM-2000 OC-3 DRI nodes coordinate timing using synchronization status messages on the OC-3 ring so that all nodes will accept timing in the same direction.
- The two DDM-2000 OC-3 DRI nodes must be provisioned for line timing with timing derived from function unit C. Synchronization messaging on the OC-3 span between the two OC-3 DRI nodes must be disabled so timing loops are not formed. Synchronization messaging and automatic synchronization reconfiguration should be enabled on all other OC-3 interfaces on the DRI nodes.
- All other OC-3 nodes must be provisioned for line timing with synchronization messaging and automatic synchronization reconfiguration enabled.

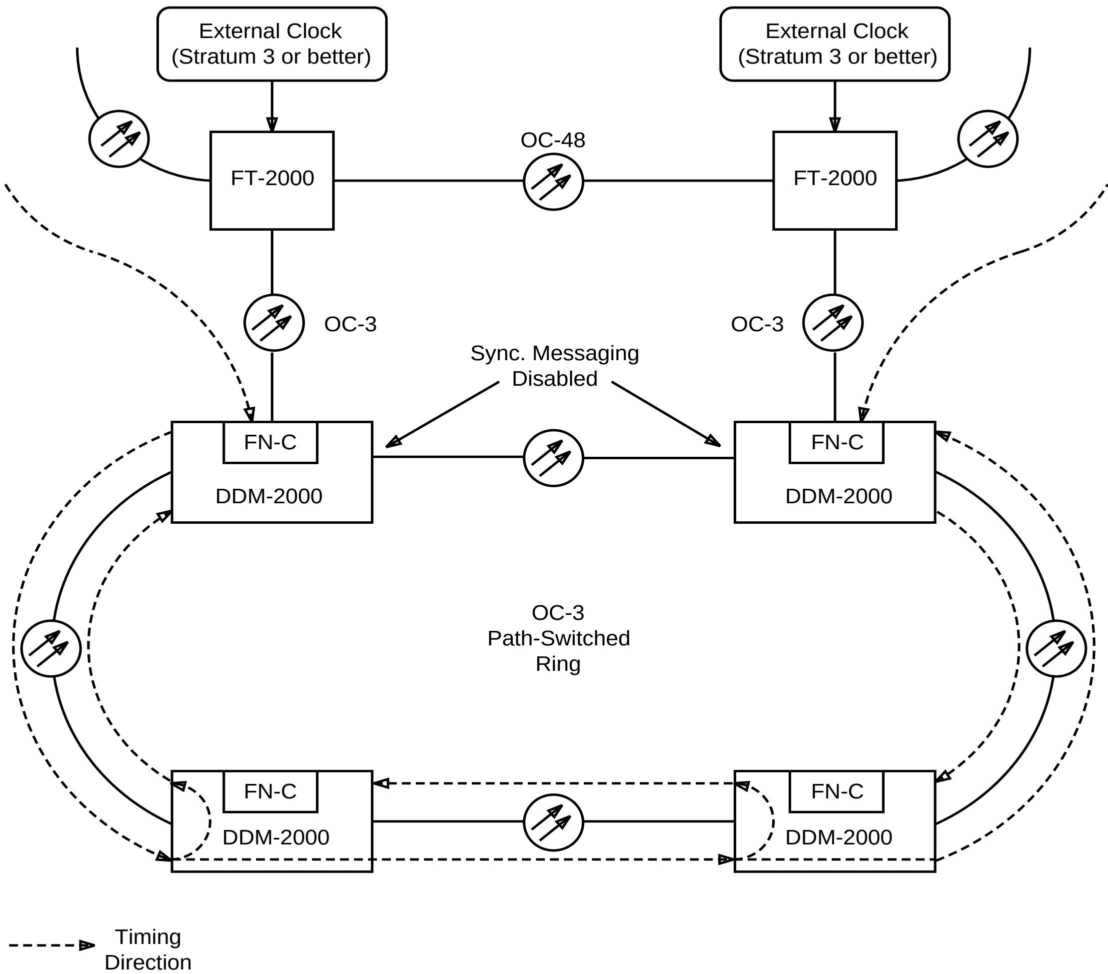


Figure 5-25.   OC-3 and FT-2000 OC-48 Lightwave System Dual Homing DRI Configuration

OC-3 and OC-12

Figure 5-26 shows how timing can be distributed from an OC-12 line switched ring to a DDM-2000 OC-3 path switched ring using a dual homing DRI configuration. The OC-3 DRI nodes are connected via OC-3 point-to-point links terminating in function unit C slots. The major characteristics of this configuration are:

- The OC-12 nodes are externally timed
- The two DDM-2000 OC-3 DRI nodes coordinate timing using synchronization status messages on the OC-3 ring so that all nodes will accept timing in the same direction.
- The two DDM-2000 OC-3 DRI nodes must be provisioned for line timing with timing derived from function unit C. Synchronization messaging on the OC-3 span between the two OC-3 DRI nodes must be disabled so timing loops are not formed. Synchronization messaging and automatic synchronization reconfiguration should be enabled on all other OC-3 interfaces on the DRI nodes.
- All other OC-3 nodes must be provisioned for line timing with synchronization messaging and automatic synchronization reconfiguration enabled.

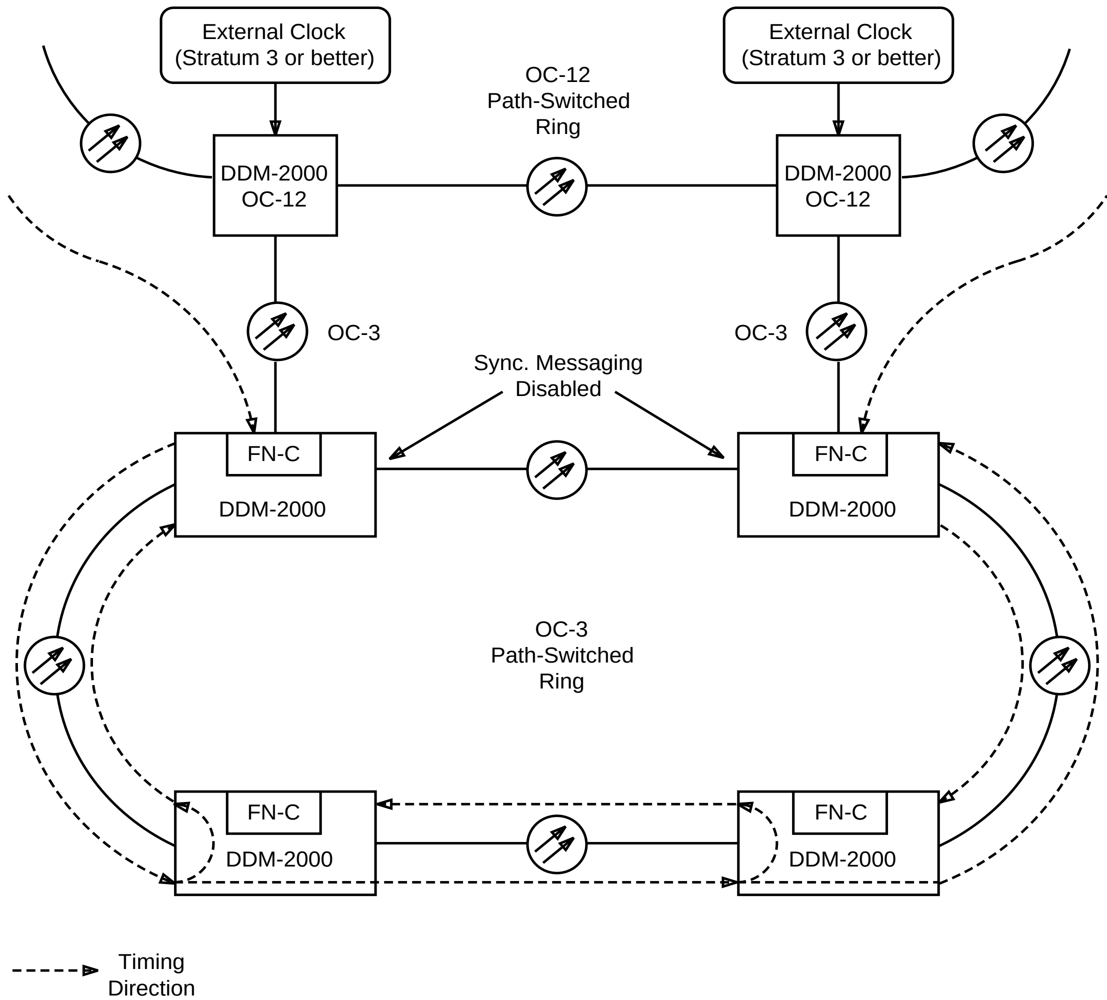


Figure 5-26. OC-3 and OC-12 Dual Homing DRI Configuration

OC-3 and OC-1 External/Line Timing

The external/line-timing configuration (shown in Figure 5-27) integrates loop feeder and customer location networks into the digital synchronization network as required by the SONET standard. This application is ideal for networks where only one location has a BITS; for example, a loop feeder. The network is synchronized to a local CO clock via DS1 references. The local office clock should be stratum 3 or better, with timing traceable to a primary reference source. The local DDM-2000 OC-3 Multiplexer times its transmitted signals at the low- and high-speed interfaces from the internal oscillator that is locked on the external reference. The remote DDM-2000 FiberReach Multiplexer recovers timing from the incoming OC-N signal and unidirectional timing path and uses this timing for its transmitted signals.

This timing configuration is also recommended for multispan topologies. Line timing can be extended to many DDM-2000 sites without any degradation of timing quality. In the ring topology, synchronization messaging allows automatic synchronization reconfiguration in the event of a fiber or equipment failure. See 363-206-305, *DDM-2000 FiberReach Multiplexer Wideband/ Narrowband TARP Shelf User/Service Manual*, for more OC-1 timing configurations.

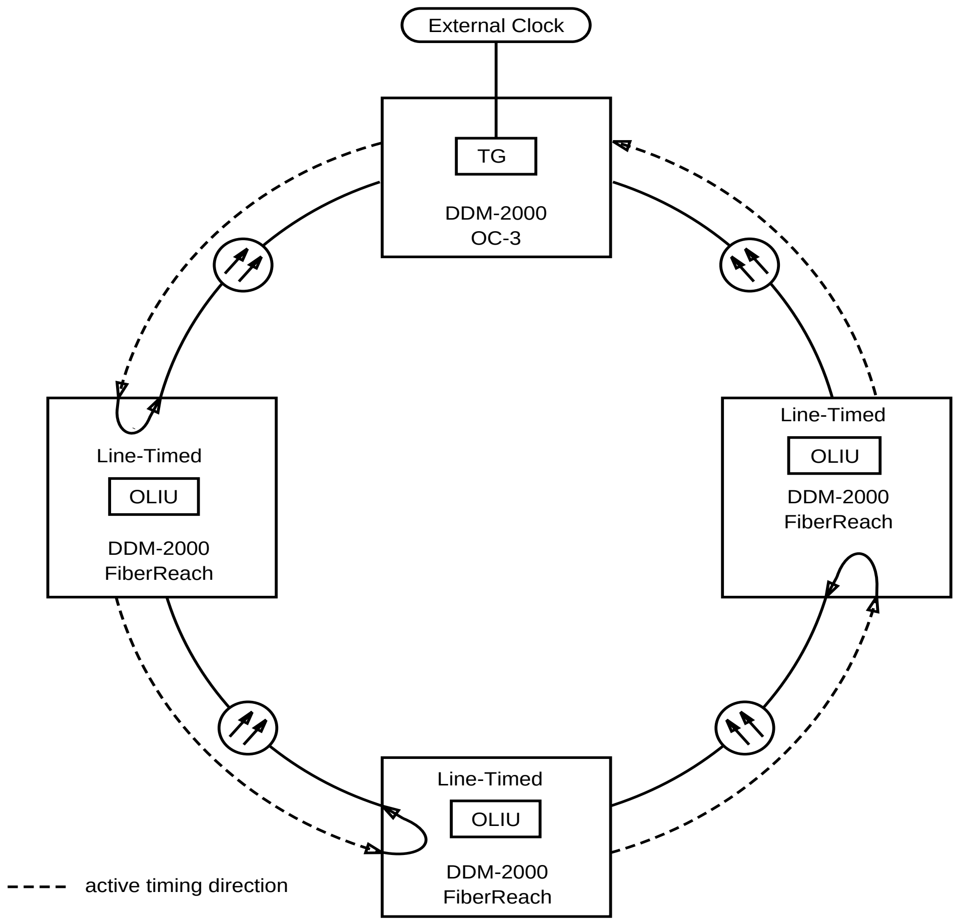


Figure 5-27. OC-3 and OC-1 External/Line Timing

Network Timing Distribution

DS1 signals have long been used to pass timing information through the network synchronization hierarchy. These DS1 timing references should be transmitted between master and slave clock sources over the most reliable facilities available. In some cases, these DS1 signals also carry traffic. The facility of choice has evolved from T-carrier through asynchronous lightwave systems to SONET lightwave systems. As these systems are upgraded to SONET systems, timing distribution plans should be revisited to ensure the quality of the timing signals are not degraded. With proper planning, SONET can be used to improve the overall quality of the network timing.

Interoffice Timing Distribution

One way SONET can be used to improve the quality of interoffice network timing is through the use of OC-N timing distribution. DDM-2000 OC-3 supports the evolution to interoffice OC-N timing distribution by providing a DS1 timing output derived from the incoming OC-N signal. The DS1 timing output is traceable to the clock source that times the DDM-2000 OC-3 subnetwork and has extremely low jitter and wander. This is true regardless of the number of DDM-2000 OC-3 systems connected in the network. This DS1 can be fed to the local BITS clock which subsequently times the local DDM-2000 OC-3 and the other equipment in the office. If a BITS clock is not available in the office, the DS1 timing output can be used to time other equipment (including another DDM-2000 OC-3) directly. DDM-2000 OC-3 can provide DS1 timing outputs in all supported topologies (for example, point-to-point, add/drop, and ring).

With OC-N timing distribution, the OC-N line signal, rather than a DS1 multiplexed into the SONET payload, will provide a timing transport mechanism better suited to a complex, heavily interconnected SONET network. In this configuration, a DS1 reference from the CO BITS clock still times the OC-N transmitted to the remote site. At the remote site, a DS1 output reference is created directly from the received OC-N signal (Figure 5-28).

The stratum level of the BITS clock at the CO must be equal to or better (more accurate) than the stratum level of the BITS clocks used at the RT site. This is necessary to maintain the stratum level hierarchy.

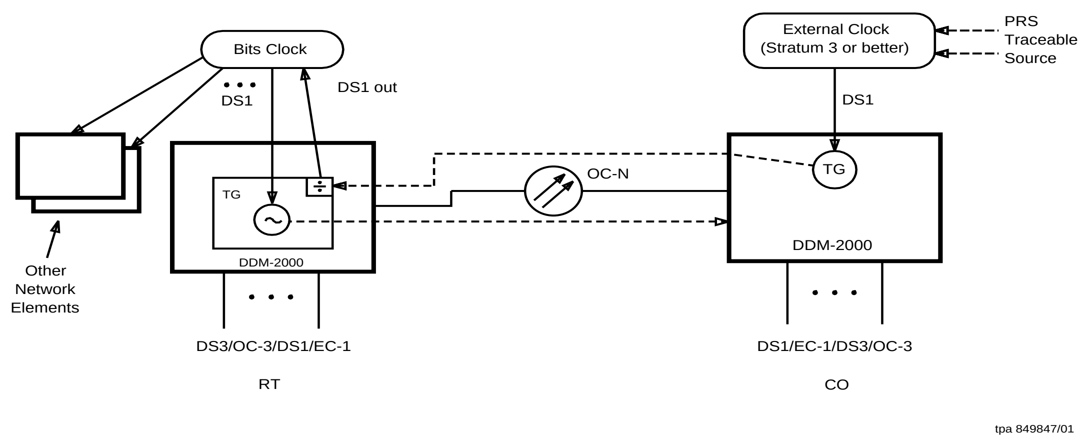


Figure 5-28. OC-N Derived DS1 Timing Reference

OC-N timing distribution has several potential advantages. It preserves transport bandwidth for customer services and guarantees a high-quality timing signal. Also, as the CO architecture evolves to replace DSX interconnects with SONET EC-1 and IS-3 interconnects and direct OC-N interfaces, OC-N distribution becomes more efficient than multiplexing DS1 references into an access facility in the CO.

A previous drawback to using OC-N timing distribution was that network timing failures could not be communicated to downstream clocks via DS1 AIS, since the DS1 signal does not pass over the OC-N interface. With synchronization messaging, clock stratum levels can be passed from NE to NE, allowing downstream clocks to switch timing references without creating timing loops, if a network synchronization failure occurs. If a quality timing reference is no longer available, the DDM-2000 OC-3 sends AIS over the DS1 interface. If the local OC-N lines fail, DDM-2000 OC-3 outputs AIS on the DS1 output or an upstream DDM-2000 OC-3 system enters holdover.

Access Network Timing Distribution

OC-N timing distribution can also be used in access networks or to small COs. In this configuration, a DS1 reference from the CO BITS clock still times the OC-N transmitted to the remote site. The line-timing capability of the DDM-2000 OC-3 Multiplexers provides the ability to recover OC-N timing. The DS1 timing output feature can be used to also extend timing to customer networks or remote sites. In this case, the DS1 timing output can be used to time switch remotes, DDM-2000 OC-3 and OC-12 shelves, or other local equipment directly. Ideally, the equipment can provide an external timing reference. Otherwise, the signal must be input to a traffic DS1 port on the external equipment which will tie up some of this equipment's bandwidth. In this configuration, it is important that the DS1 reference to the DDM-2000 OC-3 in the CO be traceable to the same clock used to source the DS1s being carried to the customer site or small CO. If it is not, slips may occur.

Although an ideal source of timing, OC-N timing distribution, via a DS1 timing output, cannot be used to provide timing in all applications. In cases where the local equipment is not provided with an external timing reference input, or in some private networks where the timing is to be distributed from another private network location, timing may be distributed via traffic-carrying DS1s. In these applications, a stable DS1 timing source can be achieved by ensuring that all elements in the SONET network are directly traceable to a single master clock via line timing. In this environment, the high-performance desynchronizer design of the DDM-2000 OC-3 Multiplexer allows a DS1 timing reference to be carried as a multiplexed DS1 payload[*].

It is recommended that, where possible, the DS1 sources (switch, PBX, or other equipment) be traceable to the same timing source used to time the DDM-2000

* Synchronous operation via line timing eliminates the generation of VT pointer adjustments, thus maintaining the phase stability needed for a high-quality DS1 timing reference. Cross-connecting at the STS-1 level also eliminates the VT pointer adjustments. While the design of the DDM-2000 OC-3 Multiplexer maintains jitter/wander within standard DS1 interface requirements, even in the presence of VT pointer adjustments, and while the DS1 is likely to be stable enough for most equipment to use as a timing reference, some equipment may have more stringent stability requirements for its timing references.

OC-3 SONET network. Multiplexed DS1 reference transport is also consistent with current planning and administration methods. Applications include passing synchronization from the public switched network to a PBX-based private network (Figure 5-29) and synchronizing an end-office remote switch to a larger office's host switch.

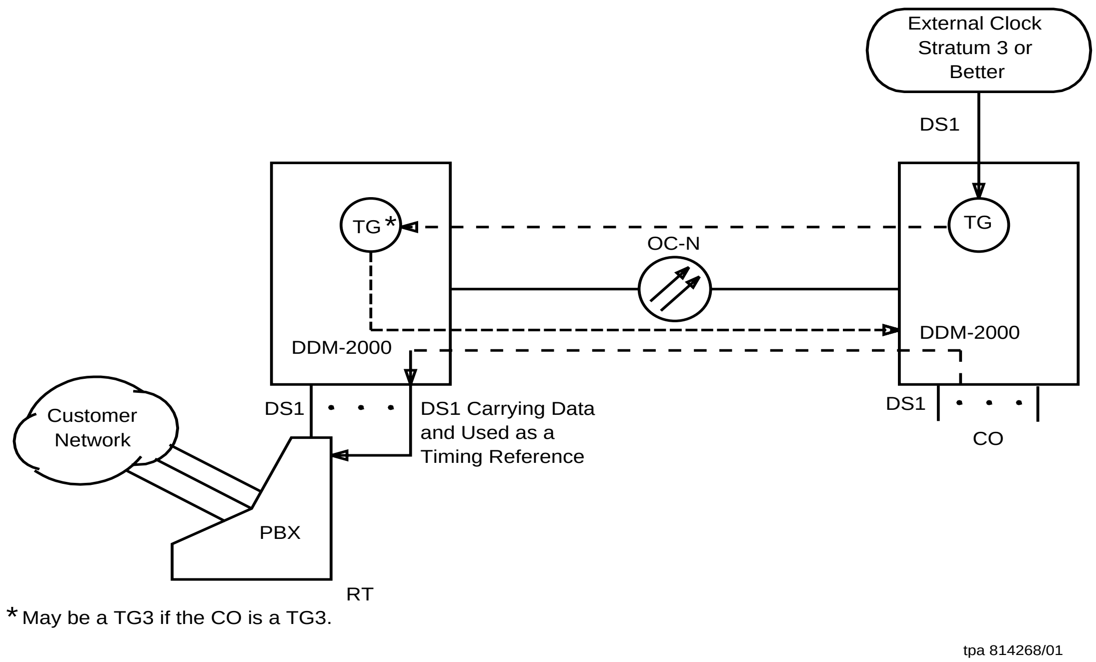


Figure 5-29. Timing from Multiplexed DS1

Operations Interfaces

6

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Operations Interfaces

6

Overview

This section presents the operations interfaces that support technician and provisioning access to the DDM-2000 OC-3 Multiplexer and allow alarms and status information generated by the system to be reported.

Operations interfaces include:

- Two EIA-232-D craft interface terminal (CIT) interfaces
- User panel controls and indicators
- Equipment status indicators
- Office alarms
- TL1/X.25 interface to an alarm surveillance OS, such as Telcordia's Network Monitoring and Analysis (NMA), Operations Systems/Intelligent Network Elements (OPS/INE), and Lucent Technologies ITM SNC (Integrated Transport Management SubNetwork Controller)
- IntrAOffice LAN (IAO LAN) interface for use with ITM SNC
- User definable miscellaneous discrete environmental alarms and controls
- Order Wire.

Complete detailed information on the OS interfaces is provided in 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Craft Interface Terminals (CIT)

The DDM-2000 OC-3 Multiplexer supports three types of access mechanisms through the CIT that can be supported simultaneously.

- Local access
- Remote access via a modem port
- Remote access via the data communications channel (DCC).

A CIT is recommended for installation, maintenance, and administrative activities. The CIT can be either an RS-232-D terminal or personal computer (PC). An *MS-DOS* * PC is required for software download and to run CPro-2000 software. Any PC may function as a CIT when loaded with a commercially-available terminal emulation program. See Section 10, "Technical Specifications," for PC specifications.

Table 6-1 lists some of the terminals and PCs that can be used with the CIT interface. Note that some terminals and PCs may no longer be commercially available but can still be used.

* Registered trademark of Microsoft Corporation.

Table 6-1. Craft Interface Terminals

AT&T 610 terminal	*DEC*§ VT100 terminal
AT&T 615 terminal	ADM 5A terminal
AT&T 630 terminal	*HP*¶ 2621 terminal
AT&T 730 terminal	*HP* 2623 terminal
AT&T 5425 terminal†	*HP* 110 computer**
AT&T 6286 WGS computer‡	*IBM*†† XT computer
AT&T 6312 WGS computer‡	*Toshiba*‡‡ T1000 computer
AT&T 6386 WGS computer‡	*Toshiba* T12000 computer
AT&T 6300 computer‡	AT&T 6300 Plus computer‡
AT&T *Safari** computer	*NCR*§§ 3170 computer

* Safari is a registered trademark of AT&T.

† Was Teletype 5425 or ATTIS 4425.

‡ These *MS-DOS* (*MS-DOS* is a registered trademark of Microsoft Corporation) PCs were tested with *PROCOMM* (*PROCOMM* is a registered trademark of Datastorm Technologies, Inc.) terminal emulation software for maintenance. Other terminal emulation software may also work properly. CTRM software is required for software downloads and is supplied with the DDM-2000 OC-3 and OC-12 Multiplexer software.

§ Trademark of Digital Equipment Corporation.

¶ Registered trademark of Hewlett-Packard Company.

** With terminal emulation software.

†† Registered trademark of International Business Machines Corporation.

‡‡ Registered trademark of Toshiba Corporation.

§§ Registered trademark of NCR Corporation.

Local Access

Figure 6-1 shows the system has two EIA-232-D compatible interfaces for a CIT. The front access interface is configured as data communications equipment (DCE) for direct CIT access (CIT 1). The rear access CIT interface (CIT 2) is configured as data terminal equipment (DTE) to allow a permanent modem connection without requiring a null modem. However, a null modem is required when connecting a CIT directly to the rear access DTE interface. CIT access via a modem connection is identical to local CIT access.

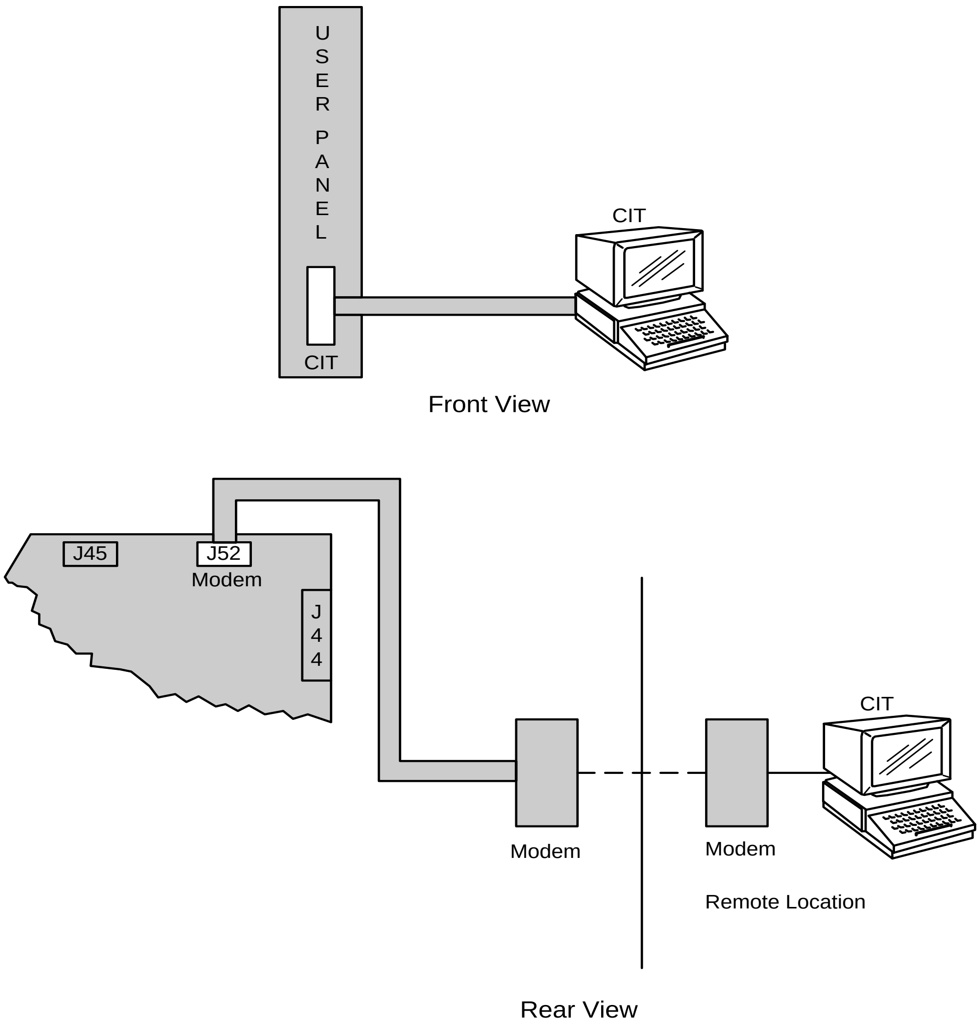

Figure 6-1. Craft Interface Terminal Connectors

The terminal sessions over the front and rear CIT ports (and over the DCC) are independent of one another. Up to three simultaneous CIT login sessions can be supported at any given time (see Figure 6-2).

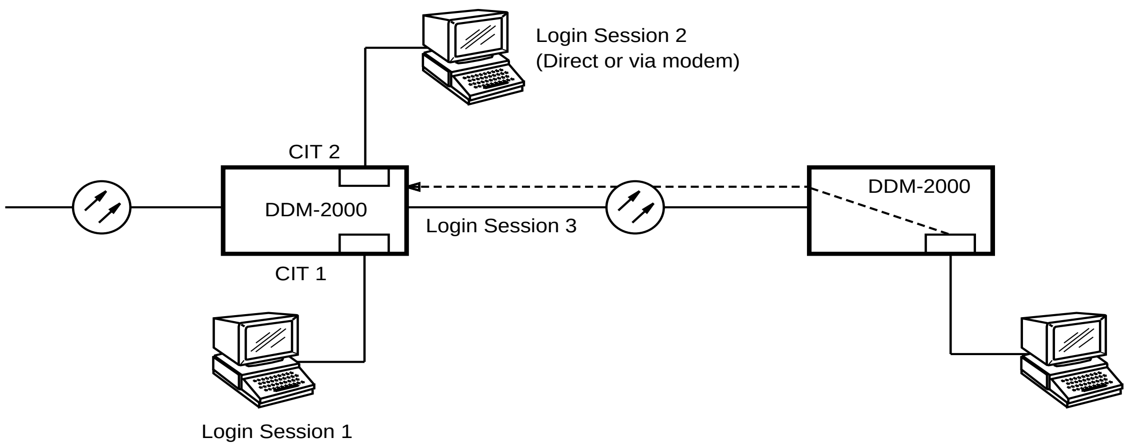

Figure 6-2. Craft Interface Terminal Login Sessions

The DDM-2000 OC-3 CIT interface is based on the Telcordia TL1 language and provides prompt and command modes of operation. On-line context sensitive help is always available to help the technician through command execution. The output messages and reports are presented in easy-to-read sentences and tables. The following functions are provided via the CIT interfaces for the local and remote DDM-2000 OC-3 Multiplexer shelves:

- Loopbacks and testing
- Protection switching
- Performance monitoring (PM)
- Provisioning
- Fault management
- Software downloading
- Security management.

Detailed specifications of the CIT interface are provided in Section 10, "Technical Specifications."

In a bay multiple CIT cabling arrangement, connecting a CIT to any shelf in the bay provides CIT access to that DDM-2000 shelf and any other DDM-2000 OC-3 or OC-12 Multiplexer shelf in that bay. The shelf is selected by using the shelf ID login. In this arrangement, only one front and one rear CIT access can be used. Also with this arrangement, access to shelves in multiple subnetworks can be achieved from the same physical interface. A subnetwork consists of all shelves interconnected with the SONET DCC.

For example, with 6 shelves per bay and 8 bays in a subnetwork, access to 48 shelves is achieved with a single physical interface.

Using a PC as a CIT

In addition to CIT functions, a PC is required for software downloads and facilitates software program updates. Any *MS-DOS* PC can be used to emulate a traditional CIT through a variety of low-cost terminal emulator software packages; thus, an *MS-DOS* PC can serve DDM-2000 OC-3 Multiplexer needs very efficiently. In addition, the DDM-2000 OC-3 Multiplexer user interface can be accessed from within *Windows** (Version 3.0 or later) on an *MS-DOS* PC.

The DDM-2000 OC-3 Multiplexer uses flash erasable program memory (EPROM) devices that can be upgraded through direct download from an *MS-DOS* PC. Upgrades are made available through the distribution of floppy disks compatible with the recommended PCs.

Modem Access

The rear access CIT interface (CIT 2) is configured as DTE to allow a permanent modem connection without requiring a null modem. However, a null modem is required when connecting a CIT directly to the rear access DTE interface. CIT access via a modem connection is identical to local CIT access. Automatic selection (autobaud detection) data rates of 1200, 2400, 4800, 9600, and 19,200 baud are provided for both CIT interfaces.

NOTE:
The DDM-2000 OC-3 Multiplexer CIT interface supports data rates up to 19,200 baud but does not provide flow control. Some terminals and PCs when set for higher data rates will not work properly at these rates with equipment like the DDM-2000 OC-3 Multiplexer that does not provide flow control. The system may appear to stop working when reports or long prompts are displayed. If this happens, try setting the terminal to a lower data rate. The data rate of the DDM-2000 OC-3 Multiplexer is automatically set to match the data rate of the terminal (autobaud).

* Registered trademark of Microsoft Corporation.

The *NCR*[*] 3170 computer and the AT&T *Safari*[†] computer have a built-in modem and meet the modem requirements.

The following stand-alone modems meet the modem requirements and can be used with the DDM-2000 OC-3 system. This is not an exhaustive list of compatible modems:

- *Paradyne*[†] 2224-CEO modem (at 1200 and 2400 baud)
- *Paradyne* 2224 modem (at 1200 and 2400 baud)
- *Paradyne* 4024 modem (at 1200 and 2400 baud)
- *Paradyne* 2296 modem (at 4800 and 9600 baud)
- Hayes [‡] *V-series* Smartmodems
- *Penril* [§] Alliance V.32 modem.

Remote Access Using the Data Communications Channel (DCC)

The DDM-2000 OC-3 system supports CIT remote access from the local terminal to a remote system using the data communications channel (DCC) over OC-N interfaces or the IAO LAN. The DDM-2000 OC-3 system supports one incoming remote login session and one outgoing login session over the DCC at a time. For example, a local user can gain remote access to a remote DDM-2000 in the same subnetwork at the same time a remote user at another DDM-2000 in the subnetwork can gain remote access to the local system. CIT remote login is also supported in multi-vendor subnetworks, but only between DDM-2000 Multiplexers (or from FT-2000 to DDM-2000).

Operations Interworking (OI) also allows remote logins between DDM-2000 and the *SLC*-2000 Access System and from the FT-2000 OC-48 Lightwave System to other Lucent 2000 Product Family systems in the same subnetwork.

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* Trademark of NCR Corporation.
† Registered trademark of AT&T.
‡ Trademark of Hayes Microcomputer Products, Inc.
§ Registered trademark of Penril Corporation.

CPro-2000 Graphical User Interface and Provisioning Tool

The CPro-2000 Graphical User Interface (GUI) and Provisioning Tool is a *Microsoft** *Windows* based user interface that can optionally be used with the DDM-2000 OC-3 Multiplexer. The tool simplifies and mechanizes administration, maintenance, and provisioning operations. With the tool a user can:

- Display and control cross-connections at each NE in a ring and the entire ring, including dual ring interworking (DRI) (for example, drop and continue paths at DRI nodes).
- Obtain and display graphical images of the ring configuration, equipment, and cross-connections.
- Perform an analysis of the ring to detect provisioning errors.
- Retrieve and store data about a selected NE.
- Backup and restore provisioning information including cross-connections, DS1 port options, DS3 port options, EC-1 port options, and OC-3 line options.

In response to a user, the tool automatically compiles and sends all the necessary commands to perform a task. If the user is provisioning cross-connections, for example, the tool automatically prevents provisioning errors by comparing the new provisioning information with the ring inventory. For more information, see 365-576-130, *CPro-2000 User Manual,* Release 7.0. See Section 10, "Technical Specifications," for PC requirements to use the tool.

User Panel

The user panel for the Group 4 shelf, shown in Figure 6-3, provides system-level information and control functions, while the ACTIVE and FAULT LED on each faceplate provide circuit pack level information. These features let many operations tasks (for example, fault isolation or circuit pack replacement) to be performed when a CIT or external test equipment is not available.

The user panel is a factory-installed unit mounted next to the right-hand flange. Additional LEDs and controls are mounted on the SYSCTL faceplate to support basic operations, administration, and maintenance functions without a CIT.

* Registered trademark of Microsoft Corporation.

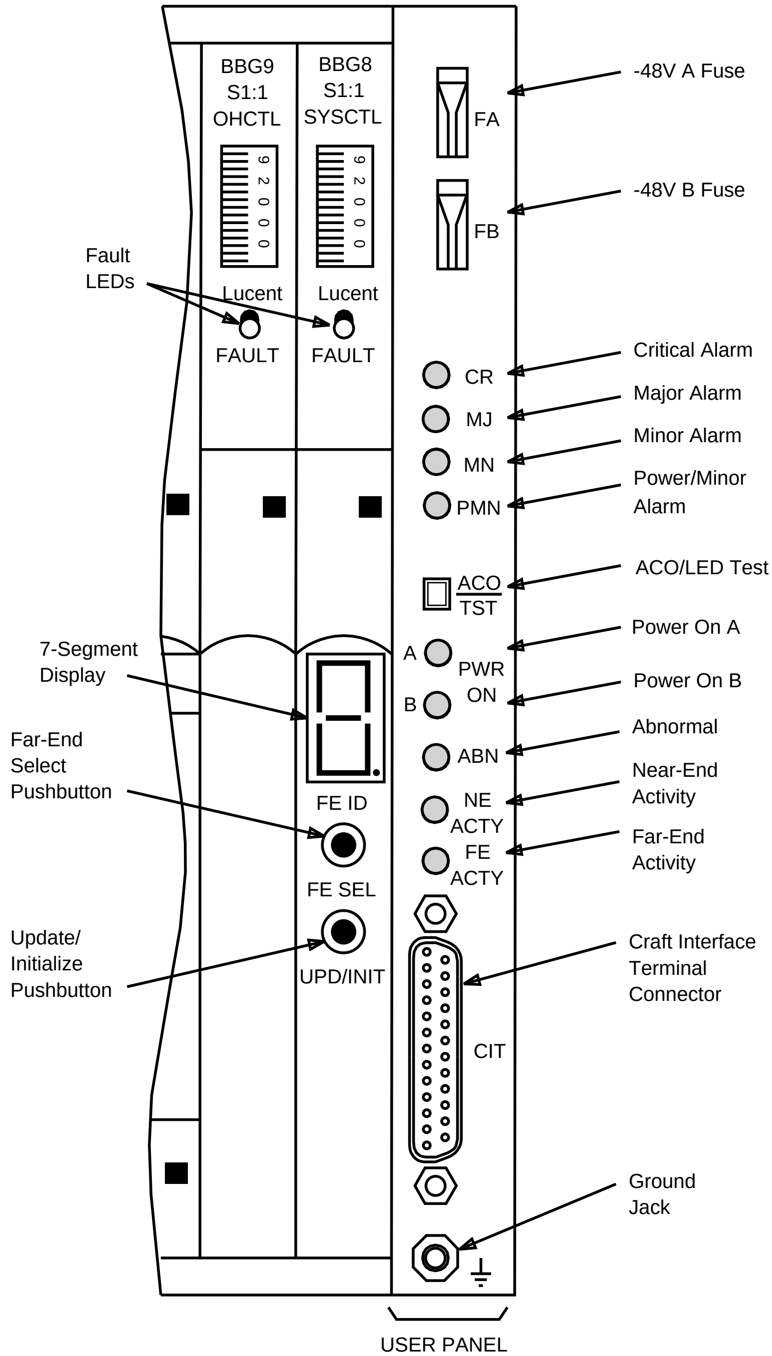

Figure 6-3. User Panel for Group 4 Shelf

User Panel LEDs

The user panel LEDs show a composite of all alarms and status conditions in the local shelf. The composite is defined as follows:

- The highest level alarm LED (CR, MJ, PMN, or MN) of all alarms at the local shelf is lit. (At most, one alarm LED will be lit at any time.)
- The ABN LED is lit if an abnormal condition exists on this shelf.
- The ACO LED is lit if the alarm cutoff function is active on this shelf.
- Each PWR ON LED is lit if the local shelf is receiving –48 V power from its power feeders.
- The NE ACTY LED is lit if any alarm, ABN, or "activity" condition exists on this shelf.

When this composite information is being displayed on the user panel, the 7-segment FE ID is blank.

FE SEL Pushbutton

In DDM-2000 OC-3 TARP Release 15.0 the FE SEL pushbutton allows technicians to see far-end DDM-2000 conditions from the local shelf. In TARP Release 13.0 when the FE SEL pushbutton is pushed for the first time, the FE ID display shows "L" and the user panel LEDs show the conditions of the local shelf only.

Each time the FE SEL pushbutton is pushed again within 15 seconds, the FE ID display will show the local shelf address (with the decimal point), and the user panel LEDs will again show a composite of the alarm and status condition of that same shelf.

ACO/TST Pushbutton

The ACO/TST pushbutton tests all the LEDs on the shelf. All LEDs on the shelf will be lit while the pushbutton is pressed. If the ACO pushbutton is pressed and held for more than 2 seconds, the three digits of the software release number are displayed in the 7-segment FE ID display. If there are any active alarms when the ACO pushbutton is pressed, the audible office alarms will be silenced and the ACO LED (part of the pushbutton) on the user panel will be lit.

UPD/INIT Pushbutton

This pushbutton is used to initialize a controller when it is first installed in a shelf, to update the system's internal equipment inventory when signals or equipment are removed from the shelf, and when circuit pack options are changed. The system automatically detects new equipment or signals added to the shelf. In these cases, it is not necessary to push the UPD/INIT pushbutton.

An optical switch on the BBG8/BBG8B SYSCTL circuit pack latch causes a suspension of controller operations and an “F” to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset.

Pushbutton Combinations

The three pushbuttons described previously are used in combinations to perform seven functions. These functions, listed in Table 6-2, are used as part of the procedures described in the TOP section of this manual (Volume II).

Table 6-2. DDM-2000 OC-3 Pushbutton Combinations

Function	Pushbutton		
	ACO/TST	**UPD/INIT**	**FE SEL**
1. Update		Press	
2. SYSCTL Initialization *		Press	
3. Remove SYSCTL †	Press		Press
4. Software version	Hold		
5. LED test	Hold		
6. Alarm cutoff	Press		
7. Software download †		Hold	Hold

* Used after a SYSCTL is replaced. Press pushbutton during the 10-second interval that the CR LED on the user panel is flashing.

† See TOP section of this manual (Volume II) for detailed procedures.

Equipment Indicators

FAULT Indicators

Red FAULT indicators are provided on all circuit packs. Retainer cards and the BBF5 JMPR circuit pack do not have LEDs. The circuit pack FAULT indicator is lit whenever a failure has been isolated to that pack.

Common failures (for example, power, synchronization, control, etc.) do not cause the FAULT indicators on all circuit packs affected by the failure to be lit; only the FAULT indicator on the failed pack is lit.

FAULT indicators on high- and low-speed transmission interface and timing circuit packs are flashed when a failure of the incoming signal is detected (for example, LOS, LOF, LOP, or crossing of the signal fail or signal degrade threshold).

The FAULT LED on the BBG9 OHCTL blinks when a failure of the DCC from a far-end shelf is detected.

ACTIVE Indicators

A green ACTIVE indicator is provided on each 1x1, 0x1, and 1+1 protected circuit pack. It indicates which circuit packs, "service" and/or "protection," are active (carrying service) at any given time.

Although there is no ACTIVE LED on each low-speed circuit pack to indicate it is carrying service, the status of the circuit packs can normally be determined without the CIT. If a service DS1 circuit pack FAULT LED is lit and the DS1 protection circuit pack FAULT LED is not lit, then the protection circuit pack is carrying service and the failed circuit pack can be removed. The exception to this rule is if a manual protection switch has been executed. In this case, the ABN LED on the user panel will be lit and the user will have to use a CIT to check the status of the system.

Office Alarms

The DDM-2000 OC-3 Multiplexer provides relay contacts for wiring to the office audible and visual alarms. Contacts are provided for each alarm condition: CR (critical), MJ (major), and MN (minor).

The MJ and CR contact closures are designed to allow these office alarms to be ORed together and reported as an office MJ alarm.

The CR alarms are fail-safed against power failures. They are activated even if the shelf loses both power feeders.

The audible office alarms for a given site are silenced through activation of the ACO function. Visual alarms are not extinguished by the ACO function.

An alarm hold-off delay is provided, to prevent transient failures from causing unnecessary maintenance activity. The office alarms will not be activated unless a condition of greater duration than the alarm hold-off delay occurs. When a failure clears, an alarm clear delay prevents premature clearing of the alarm.

As with the user panel indicators, when multiple alarms are active, the highest level office alarm (audible and visual) is activated. When the highest level alarm clears, the office alarm "bumps down" to the next highest level active alarm.

If the ACO function has been activated to silence all active audible alarms, then when a "bump down" occurs the audible alarms remain silent. (That is, the lower level visual alarm is activated, but the corresponding audible alarm is not re-activated.) If another alarm occurs while the ACO is active, the highest level audible alarm is activated even if the new alarm is a lower level condition. (For example, if a MJ and MN alarm were active and silenced via the ACO and another MN alarm occurred, the MJ audible alarm would sound.)

See Section 8, "Administration and Provisioning," for more information.

TL1/X.25 Interface

The DDM-2000 OC-3 Multiplexer supports a TL1/X.25 interface via a rear access, synchronous, EIA-232-D port capable of speeds of 1200, 2400, 4800, 9600, and 19,200 baud to control and report alarm and status conditions and PM data to an alarm surveillance OS such as Telcordia's NMA. This TL1/X.25 interface provides detailed information such as identifying specific circuit packs and facilities.

The TL1 maintenance messages of the DDM-2000 OC-3 Multiplexer are based on Telcordia's TR-NWT-000833, Issue 3, Rev. 1, Issue 4, Supplement 1, and Issue 5, Rev. 1. The TL1 provisioning messages of the DDM-2000 OC-3 Multiplexer are based on Telcordia's TR-NWT-000199, Issue 2, and TA-NWT-000199, Issue 6, Supplement 1.

The DDM-2000 serves as the TL1/X.25 GNE for DDM-2000 TL1-RNEs. DDM-2000 can now serve as the TL1/X.25 GNE for FT-2000 TL1-RNEs (as an alternative to FT-2000's existing capability to serve as the TL1/X.25 GNE for DDM-2000 TL1-RNEs). ITM SNC (see following paragraph) or other vendor NEs, such as Tellabs *TITAN*, may also be the TL1/X.25 GNE for DDM-2000 TL1-RNEs. The reverse is not necessarily supported; the DDM-2000 can not serve as a TL1/X.25 GNE for Tellabs *TITAN* R5.0.

The GNE serves as a single interface to the OS for the Lucent NEs in the same Lucent 2000 Product subnetwork, using X.25 interfaces. The GNE receives operations information from all the Lucent NEs through the DCC and reports this information, as well as its own information, to the OS. The operations information is in the form of TL1 messages. Through the GNE, the OS can send TL1 commands to any Lucent NE in the subnetwork.

The OS can use more than one NE as a GNE to provide redundancy and/or to distribute TL1 message volume across multiple X.25 links. For example, two NEs could each be connected via their TL1/X.25 interface to the same type of OS with one GNE serving as a backup for the other.

Autonomous and command/response messages are also supported. Section 10, "Technical Specifications," provides detailed specifications for the X.25 interface. Detailed information about engineering a subnetwork with multiple DDM-2000 GNEs and the input and output parameters for TL1 messages is provided in 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

ITM SNC

ITM SNC is an element management system (EMS) that supports SONET NEs such as the Lucent Technologies' DDM-2000, FT-2000, *SLC*®-2000, and the Fujitsu Lightwave Multiplexer (FLM). ITM SNC provides fault, provisioning, configuration, and security management functions via a Graphical User Interface

(GUI). Through these functions, ITM SNC is able to support TL1/X.25 communication multiplexing or concentration, to provide network security, and to record all database changes. ITM SNC also provides a cut-through capability, allowing the ITM SNC user to access an NE through its native (TL1) command set.

ITM SNC operates as an enhanced graphical tool and as a general configuration management aid. It provides NE, port, cross-connection, and path provisioning, as well as flowthrough from provisioning OSs to NEs. ITM SNC also provides fault management through subnetwork alarm and event pre-processing prior to sending fault information to a network surveillance system such as Telcordia's Network Monitoring and Analysis-Facility (NMA-F).

IAO LAN Interface

DDM-2000 OC-3 R13.0 and OC-12 R7.0 support an IntrAOffice LAN (IAO LAN) interface for operations data communications. The IAO LAN is necessary to support the following ITM SNC R5.0 features:

- ITM SNC as the TL1-GNE for DDM-2000
- ITM SNC software download to DDM-2000.*

Because the IAO LAN is effectively an extension of the SONET DCC, the IAO LAN may also be used to join multiple, otherwise separate subnetworks. All NE-to-NE OI features that are supported by DDM-2000 OC-3 R13.0 and OC-12 R7.0 over the DCC are also supported over the IAO LAN.

The IAO LAN interface is a software-only enhancement to DDM-2000 OC-3 R13.0 and OC-12 R7.0. The current DDM-2000 overhead controller (OHCTL) circuit packs already support the IAO LAN interface (via an RJ45 connector). DDM-2000's IAO LAN interface is compatible with 10BaseT Ethernet hubs operating at 10 Mb/s over 4-wire twisted pair cables (per Telcordia GR-253, ANSI/IEEE 802.2 [ISO 8802-2] and ANSI/IEEE 802.3 [ISO 8802-3]).

See also 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide.*

* This feature will be useful when upgrading from DDM-2000 OC-3 R13.0 and OC-12 R7.0 to subsequent releases.

User-Definable Miscellaneous Discretes— Environmental Alarms and Controls

To allow monitoring and control of equipment in a DDM-2000 OC-3 Multiplexer, a set of user-definable miscellaneous discrete environmental alarms and controls is provided.

Twenty-one miscellaneous discrete alarm/status points are provided to monitor environmental conditions in a DDM-2000 shelf (open door, high temperature, etc.). The first 14 points and points 16 through 21 are activated by contact closures. The fifteenth point (External Minor) is for monitoring of remote structure power and fan apparatus (for example, DC power shelf failure); this point is activated by a –48 volt input.

Four control points are provided to control equipment (pumps, generators, etc.) at remote terminal sites. When activated, the control points provide a contact closure between the control point output and ground.

OS access to all miscellaneous discretes alarm/status points (1 through 21) is provided via TL1/X.25. Figure 6-4 shows OS access to miscellaneous discretes through the DDM-2000 Multiplexer at the CO. Access to all miscellaneous discrete alarm/status points is also provided through the CIT. The state of the control points can be reported, but not controlled, through the CIT; control points are activated by the TL1 command “OPR-EXT-CONT.”

The names and alarm levels of the 21 alarm/status points and the names of the four control points can be provisioned through the CIT in remote systems. (Refer to the **`set-attr-env, set-attr-cont, rtrv-attr-env,`** and **`rtrv-attr-cont`** commands in Section 11, "Commands and Reports.")

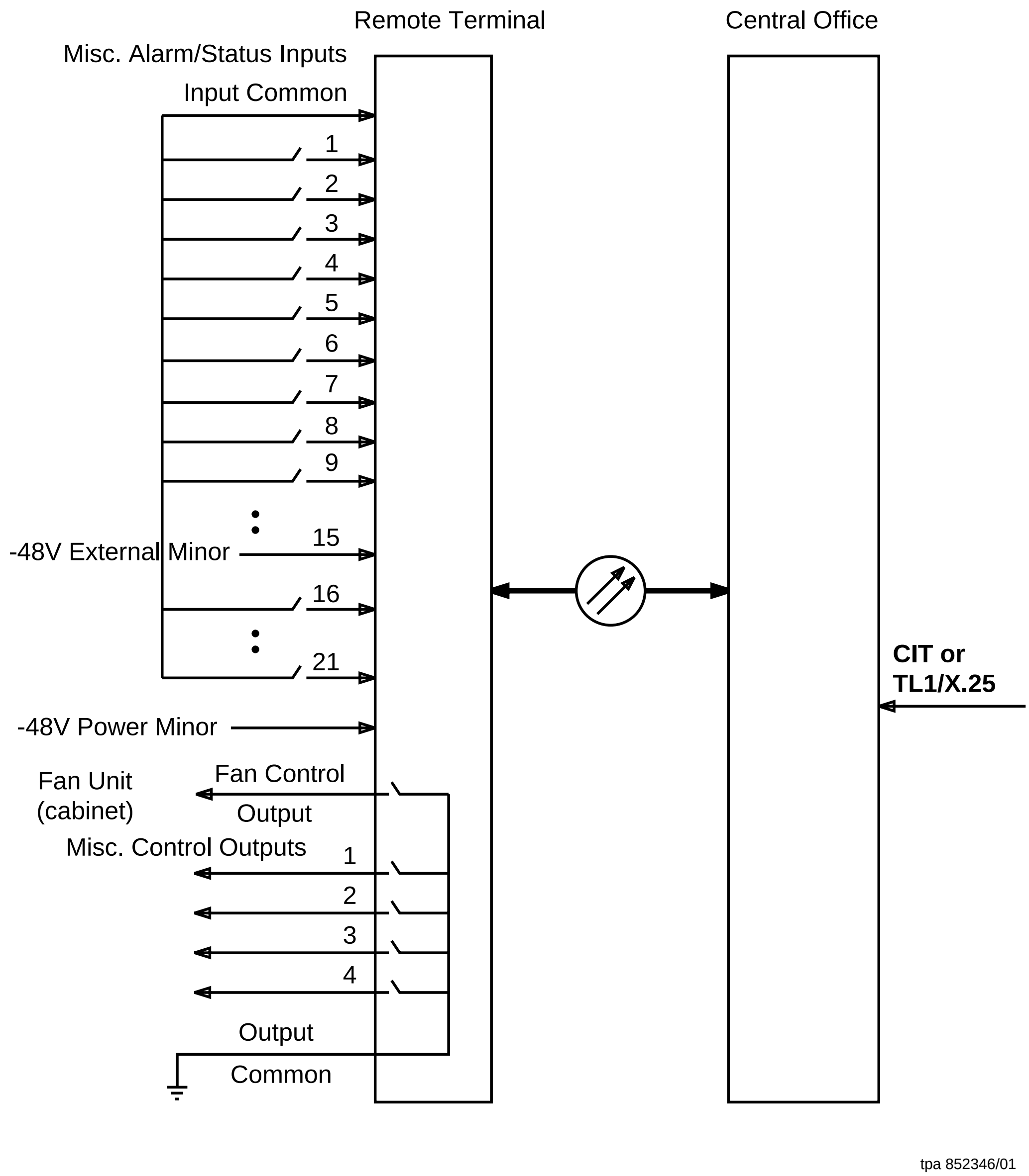

Figure 6-4. Miscellaneous Discretes

Order Wire

The DDM-2000 OC-3 Multiplexer uses the E1 byte in the SONET overhead and provides a 64 kb/s complimentary metal oxide semiconductor (CMOS) or transistor-transistor logic (TTL) compatible interface to an external order wire shelf to provide point-to-point voice communication between DDM-2000 OC-3 systems. The order wire shelf must be installed within 3 feet of the DDM-2000 OC-3 Multiplexer to which it is connected.

The order wire is available only between DDM-2000 OC-3 shelves connected to each other via OLIUs in the Main slots. In multi-span applications order wire communication is available only between the CO and the first RT.

The BBG10 OHCTL provides enhanced order wire capability (intended for *MegaStar* applications). Six 64Kb/s overhead channels (E1, E2, and F1 from two OLIUs) are multiplexed onto a DS1 interface for connection to an external Channel Service Unit. The DS1 interface uses the same connector (J51) normally used for the E1-Only interface.

The E1-Only interface of the DDM-2000 OC-3 Multiplexer has been tested with the *DANTEL*[*] Order Wire Assembly A18-04588-02, and the multiplexed order wire interface has been tested with the Harris/Farinon CSU.

* Registered trademark of Dantel, Inc.

Circuit Pack Descriptions

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Circuit Pack Descriptions

7

Overview

This section provides a detailed functional description of the DDM-2000 OC-3 Multiplexer circuit packs.

Introduction

The circuit packs in the DDM-2000 OC-3 Multiplexer are divided into three main categories:

- Control circuit packs
  - BBG8/BBG8B system controller (SYSCTL)
  - BBG9 overhead controller (OHCTL)
- Synchronization circuit pack
  - BBF2B timing generator (TGS)
  - BBF4 timing generator 3 (TG3)
- Transmission circuit packs
  - BBF1/BBF1B DS1 low-speed interface (DS1)
  - BBF3/BBF3B DS1 performance monitoring (DS1PM)
  - BBF8 high bit rate digital subscriber line (HDSL)
  - BBG2/BBG2B VT to STS-1 multiplexer (MXRVO)
  - BBG4/BBG4B DS3 low-speed interface (DS3)
  - BBG6 EC-1 high-speed and low-speed interface (STS1E)
  - BBG19 DS3 data services interface
  - BBG20 Transmultiplexer
  - 22F/22F-U/22F2-U OC-3 (Intermediate Reach) OLIU

- — 22D/22D-U OC-3 (IS-3) OLIU
- — 22G-U/22G2-U/22G3-U/22G4-U OC-3 (Long Reach) OLIU
- — 24G-U OC-12 OLIU on OC-3 shelf
- — 24H-U OLIU 1550 OC-12 (nm Long Reach) OLIU
- — 26G2-U OC-1 OLIU
- — 27G-U/27G2-U OC-3 (Dual OC-1 Long Reach) OLIU
- — 29G-U 1310 OC-12 (nm Long Reach) OLIU
- — 29H-U 1550 OC-12 (nm Long Reach) OLIU.

Compatibility

Note the following circuit pack compatibility requirements:

- The BBG8/BBG8B SYSCTL circuit pack and the BBG9 OHCTL circuit pack are both required and must be running compatible software.

Control

There are two control circuit pack slots, one for the SYSCTL and one for an OHCTL. The control system controls and reports the status of the signal transmission through the DDM-2000 OC-3. All system features are implemented or supported through the control system. However, transmission is unaffected by control system failure. If a controller does fail, protection switches are not done. Therefore, if there is another circuit pack failure requiring a protection switch along with the controller failure, service may be affected depending on the function of the failed circuit pack. The control system continuously monitors the equipment to determine if a protection switch is necessary and to provide equipment performance information.

The control system in each DDM-2000 in a subnetwork can communicate with the control system of other DDM-2000 NEs in that subnetwork via the SONET section data communications channel (DCC). This allows a user at one point in the subnetwork to control the shelves throughout the subnetwork.

BBG8/BBG8B SYSCTL Circuit Pack Description

Purpose of Circuit

The BBG8/BBG8B SYSCTL circuit pack is the main system controller in the system. Together, with its companion overhead controller (OHCTL), it has control over all shelf functions and provides all user interfaces into the system. The BBG8/BBG8B SYSCTL must be used with the BBG9 OHCTL.

BBG8/BBG8B SYSCTL Faceplate Controls and Indicators

The BBG8/BBG8B SYSCTL circuit pack faceplate controls and indicators are shown in Figure 7-1. The SYSCTL has a red FAULT LED and a 7-segment numeric LED display, as well as the FE SEL and UPD/INIT pushbuttons on its faceplate. The red FAULT LED lights on detection of a circuit pack failure.

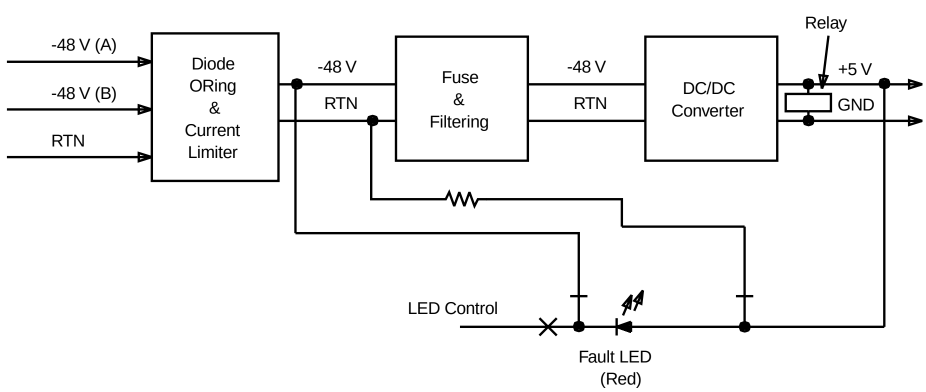

Figure 7-1. BBG8/BBG8B SYSCTL Circuit Pack

An optical switch on the circuit pack latch causes a suspension of controller operations and an “F” to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset. Controls and indicators are discussed in more detail under "User Panel" in Section 6, "Operations Interfaces."

General Description of Operation

The SYSCTL circuit pack provides the majority of the control functions on the shelf. These include circuit pack monitoring, PM, protection switching, and user interfaces.

The SYSCTL, which contains a microprocessor, controls links to all other circuit packs in the system and links to user interfaces. The processor also provides link access procedure (LAPD) and LAPD packet data processing to support SONET section DCC.

Detailed Description of Operation

Control Circuitry

Processor. Figure 7-2 provides an overall block diagram of the SYSCTL circuit pack. This processor is the highest level processor in the system.

Memory

Program Flash-EPROM . The main program is stored in the flash-EPROM, which combines the nonvolatility of EPROM with the in-circuit reprogramming ability of electrically erasable programmable read-only memory (EEPROM). Electrically Erasable Programmable Read-Only Memory FEPROM allows in-service software upgrades to be performed locally or remotely without replacing the SYSCTL circuit pack. Program upgrades of remote DDM-2000 OC-3 shelves can also be done via the DCC. Of course, software upgrades may also be accomplished by replacing circuit packs with packs that have already had software upgrades.

RAM. The main processor's random access memory (RAM) is used to store all volatile information, such as system alarms, PM information, and parameters, for the main processor's operating system.

EEPROM. All nonvolatile parameters, such as provisioning, are stored in the EEPROM, which maintains its data indefinitely during a power loss.

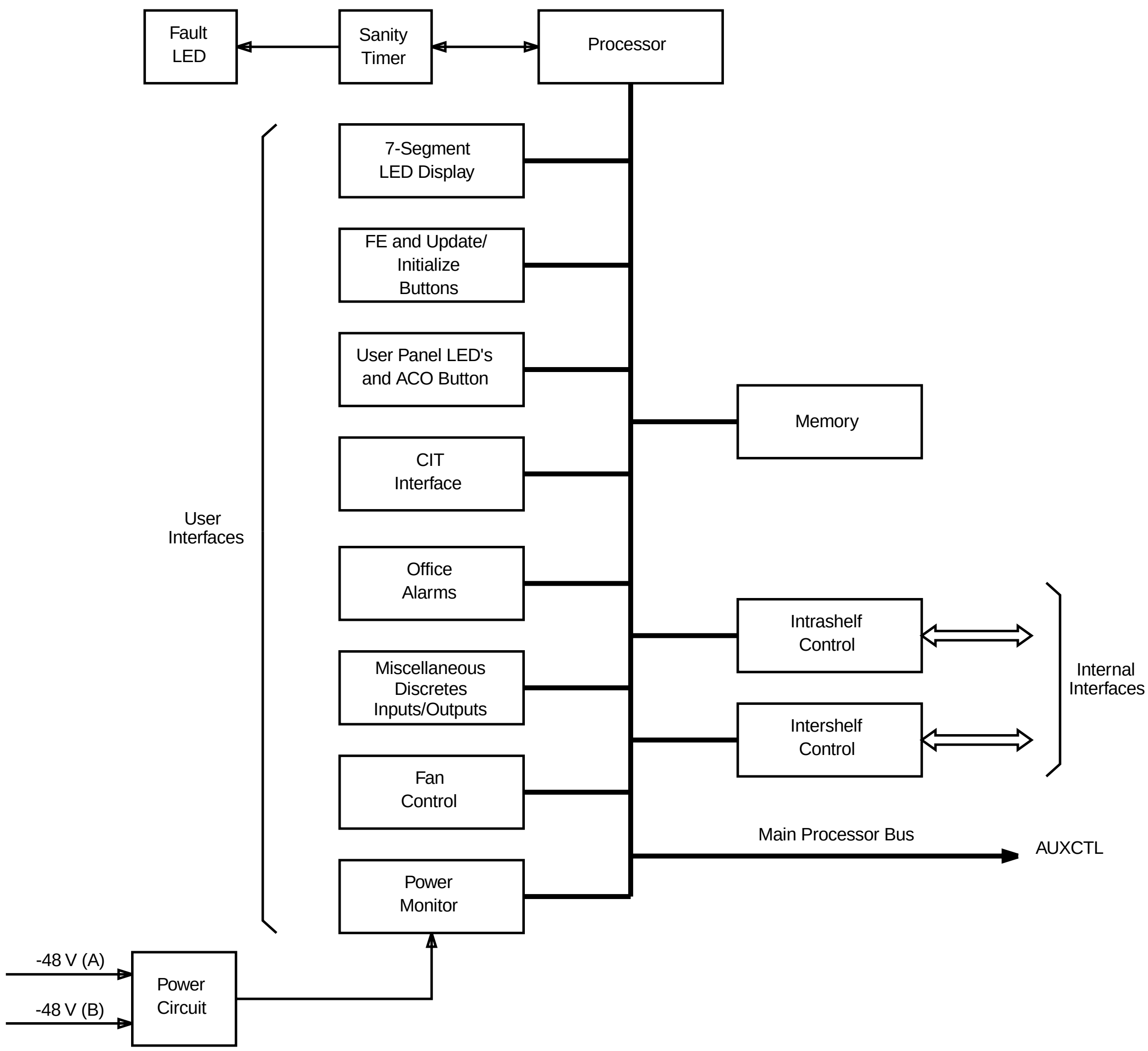

Figure 7-2. BBG8/BBG8B SYSCTL Circuit Pack Block Diagram

Transmission/Timing Circuit Pack Interfaces

The main processor can read and write parameters on the transmission circuit packs through a custom serial interface called the intra-shelf control bus. These circuit packs have a built-in serial link receiver which provides an address map into the device. Through this interface, the processor accesses the custom devices and circuit pack parameters, as well as a small EEPROM which stores each circuit pack's inventory information (*Common Language** code, date of manufacture, etc.). Through this link, the main processor can also light the faceplate LEDs on the circuit packs.

Redundancy has been built into this bus to allow a pack to be switched out of service in the event of a failure within a circuit pack.

Operation Interfaces

The SYSCTL supports all of the operations interfaces described in Section 6, "Operations Interfaces."

OC-3 Transport Overhead Channel

The OHCTL terminates an overhead channel from each main and function unit slot in the shelf, passing information to the SYSCTL over the intra-shelf processor bus.

Power Monitoring and Fan Control

The SYSCTL monitors the two –48 volt feeders and generates an alarm if one fails. It also monitors AC power in a RT application via a PMN alarm input closure and can control the external fan based on an on-board temperature sensor. The system also monitors the fan control relay for contact failure.

If the voltage to the shelf drops below the safe operating voltage, the system will suspend normal operations and wait for safe operating voltage to return. This is referred to as "brownout protection." Assuming a sufficient voltage level, an "L" will be displayed on the SYSCTL. The BBG8 operates in integrated grounding (-48VRTN connected to frame ground) architecture systems. The BBG8B operates in either integrated or isolated grounding (-48VRTN not connected to frame ground) architecture systems.

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* Common Language is a registered trademark, and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

Interface to Other DDM-2000 OC-3 Shelves

The SYSCTL interfaces with SYSCTLs of other DDM-2000 OC-3 shelves through inter-shelf control bus. This interface allows the user to access each DDM-2000 OC-3 shelf in a bay via a modem or craft interface terminal (CIT) connected to any shelf in that bay.

Power Circuitry

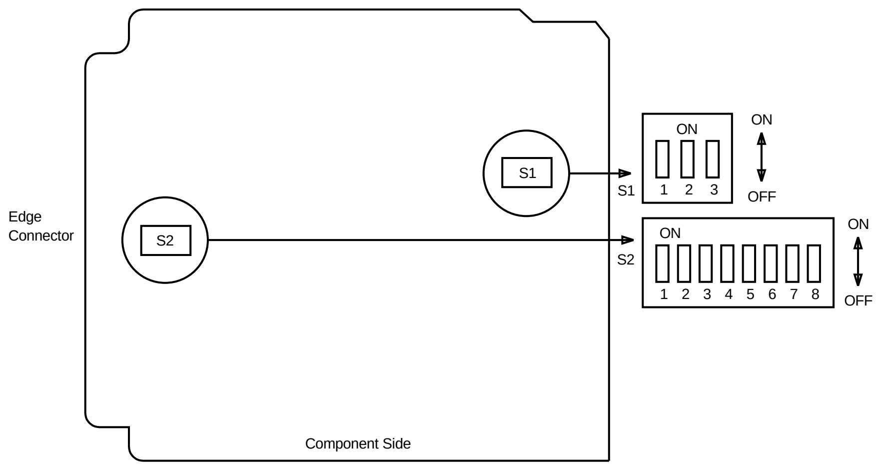
The SYSCTL receives two sources of –48 volts which are diode ORed, fused, and filtered prior to conversion to a +5 volt source to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG8/BBG8B SYSCTL Hardware Setting

The BBG8/BBG8B has two hardware switches, Switch 1 (S1) for Product Identification (see Figure 7-3) and Switch 2 (S2) for TBOS Termination used with Release 11.1 and earlier releases. Settings for S2 are not applicable for Release 13.0 and later releases.

Switch 1 (S1) Settings

Product Identification			
VALUE	**S1-1**	**S1-2**	**S1-3**
DDM-2000/*SLC*-2000/ DDM-2000 FiberReach	OFF	OFF	OFF



Notes:
1. The switch is set by moving the slide toward the desired position.
2. The FAULT LED will also light if the companion OHCTL is not inserted.

Figure 7-3. BBG8/BBG8B SYSCTL Option Switches

BBG8/BBG8B SYSCTL Quick Reference Summary

Interface Functions

Intra-shelf interface functions performed by the SYSCTL are as follows:

- Direct control of other circuit packs via a serial control link and intra-shelf control bus
- Control of circuit pack and user panel LEDs
- Detecting the presence of, and identifying, circuit packs installed in the system.

Craft Interface:

- Local and remote craft interface automatically provisioned to 300, 1200, 2400, 4800, 9600, or 19,200 baud
- Provides interface for all advanced provisioning, PM, administration, and maintenance activities.

User Panel

- Alarm and status indicators
- Controls.

Miscellaneous Discrete Functions

Miscellaneous discrete functions provided by the SYSCTL are as follows:

- Miscellaneous discrete environmental alarms and control.

Maintenance Functions

Maintenance functions provided by the SYSCTL are as follows:

- Automatic reset on powerup
- Fault detection, isolation, and reporting
- Protection switching control of other circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.).

BBG9 OHCTL Circuit Pack Description

Purpose of Circuit

The overhead controller (OHCTL) circuit pack is used in conjunction with the DDM-2000 OC-3 BBG8/BBG8B system controller (SYSCTL). It provides overhead channel interfaces for the system.

Faceplate Indicator

The OHCTL circuit pack faceplate indicator is shown in Figure 7-4. The red FAULT LED lights on detection of circuit pack failure. The red FAULT LED flashes in the event of a SONET DCC failure.

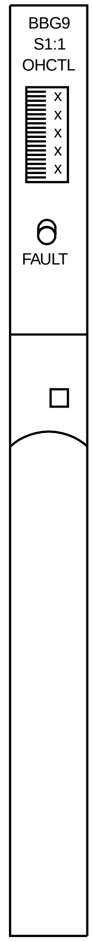


Figure 7-4. BBG9 OHCTL Circuit Pack

General Description of Operation

The BBG9 OHCTL circuit pack provides the following basic functions:

- Overhead communications channels
- X.25 message-based OS interface
- IntrAOffice Local Area Network (IAO LAN) interface
- Basic order wire interface.

Detailed Description of Operation

OC-3 Transport Overhead Channel

Figure 7-5 provides an overall block diagram of the BBG9 OHCTL circuit pack.

The OHCTL terminates an overhead channel from each main and function unit slot. The overhead channel includes a 192 kb per section DCC (SONET bytes D1-D3) and a 64-kb/s order wire channel (SONET byte E1).

User Definable Miscellaneous Discrete Environmental Alarms and Controls

The system provides four miscellaneous discrete control outputs and 21 miscellaneous discrete alarm/status inputs when the DDM-2000 OC-3 is configured as a RT. For this application, the SYSCTL supplies all of the necessary miscellaneous discrete I/O. Alarms are reported via CIT or TL1/X.25. Controls are also via the CIT or TL1/X.25.

X.25 Message-Based OS Interface

The BBG9 OHCTL provides the TL1/X.25 interface to OSs such as Telcordia Network Monitoring and Analysis (NMA).

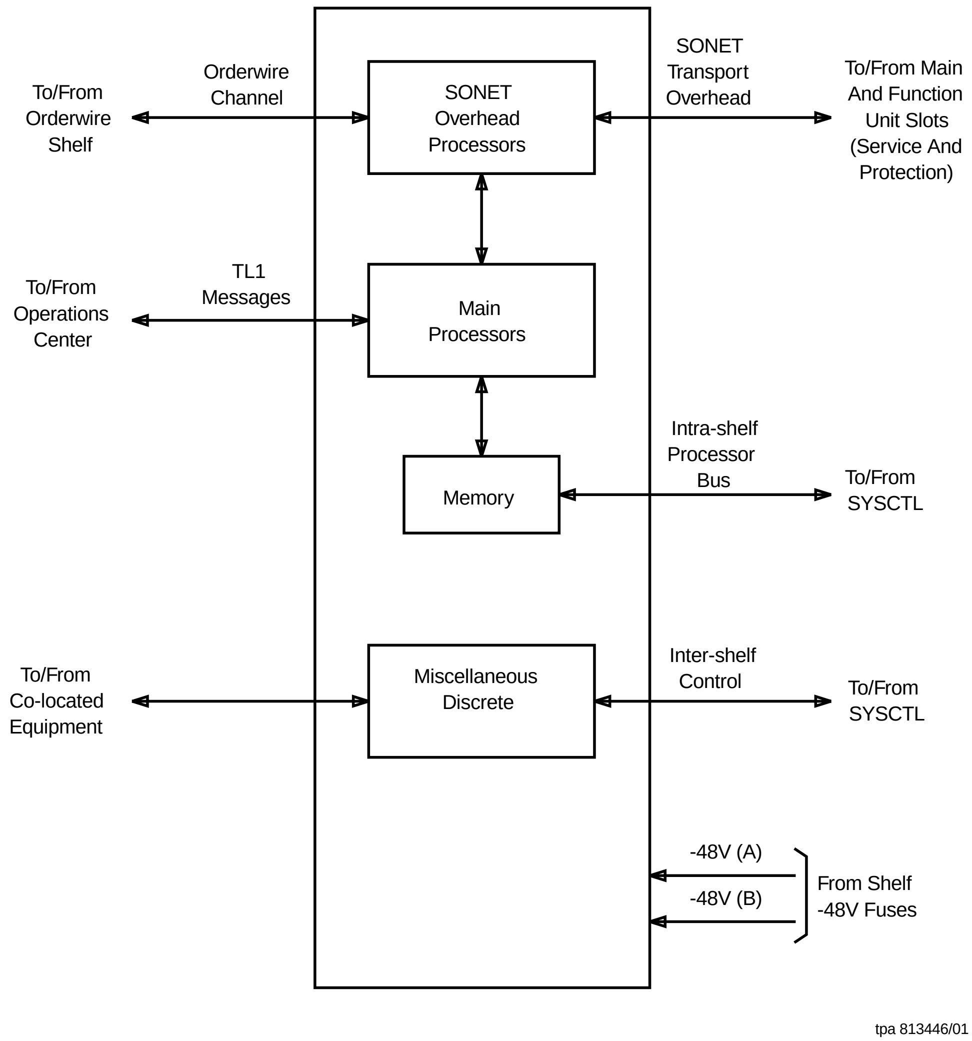


Figure 7-5. BBG9 OHCTL Circuit Pack Block Diagram

Order wire Interface

The BBG9 OHCTL provides order wire capability via the overhead E1 byte. An external analog to digital converter supplying 64 kb/s data and clock signals is required to use this capability.

BBG9 OHCTL Quick Reference Summary

Functions

Major functions of the OHCTL circuit packs are as follows:

- SONET overhead communications channel interface to OLIU circuit packs
- An X.25 message-based OS interface
- External order wire interface
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Intra-office (IAO) LAN interface.

  DDM-2000 OC-3 R13.0 and OC-12 R7.0 support an IntrAOffice LAN (IAO LAN) interface for operations data communications.

Synchronization

Synchronization Functions

The DDM-2000 OC-3 Multiplexer supports three synchronization modes:

1. DS1 timing input from stratum 3 or better office clock for CO applications
2. Free-running in CO applications when external timing inputs are not available
3. Line (formerly loop) timing for remote timing functions.

In addition, the BBF2B/BBF4 TGS/TG3 circuit pack provides a DS1 timing output that is used for network synchronization and allows line (formerly loop) timing and DS1 Output timing to be derived from either the main or function unit C OLIU.

The timing circuit packs distribute clock and frame signals, derived from the selected reference source, to the transmission circuit packs. The BBF4 circuit pack provides stratum 3 accuracy while the BBF2B provides stratum 4 accuracy.

BBF2B/BBF4 TGS/TG3 Circuit Pack Description

Purpose of Circuit

The synchronous timing generator (TG) circuit pack provides timing for the shelf. Other functions include a derived DS1 output for use as a reference signal by a building integrated timing supply (BITS) or a DS1 MULT capability for synchronizing other shelves in the bay. The derived DS1 is traceable to timing from either the main or function unit C OLIUs.

TG Faceplate Indicators

The TG circuit pack faceplate indicators are shown in Figure 7-6.

The red FAULT LED lights on detection of circuit pack hardware failure or improper switch settings.

The red FAULT LED flashes in the event of an incoming DS1 timing reference failure.

The green ACTIVE LED lights when the circuit pack is providing timing to the rest of the shelf.

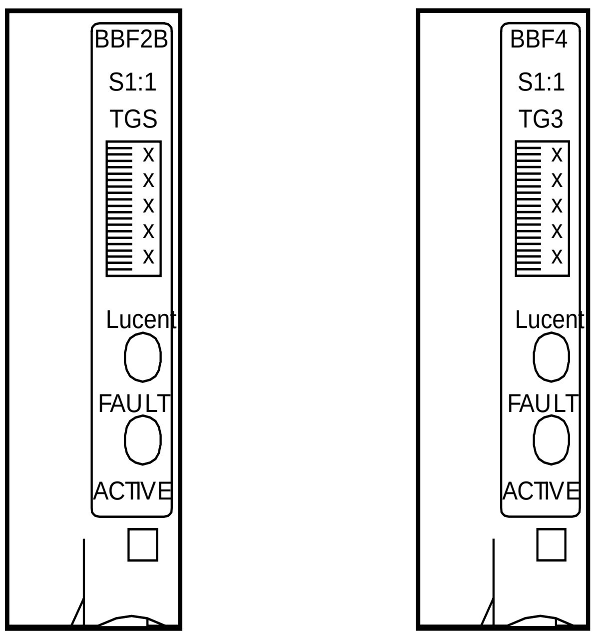


Figure 7-6. BBF2B TGS and BBF4 TG3 Circuit Pack

General Description of Operation

The TG circuit pack provides timing signals to the DDM-2000 OC-3 circuit packs. The TG circuit pack is microprocessor controlled and has the capability to synchronize to external DS1 references or to loop references from an incoming optical signal. The on-board oscillator has sufficient accuracy to provide timing signals without synchronization references for point-to-point systems (free-running) and a DS1 timing output for network timing distribution.

The TG circuit pack supports three timing modes to serve a wide range of DDM-2000 OC-3 synchronization needs: external timing, line (formerly loop) timing, and free-running. In addition, external timing or line (formerly loop) timing with DS1 output provisioned for network synchronization is provided.

In external timing mode, each TG circuit pack accepts one DS1 reference from an external stratum 3 or better clock and one cross-coupled from its companion TG circuit pack. A high-stability digital phase-locked loop (DPLL) removes any transient impairments on the DS1 reference for improved jitter performance.

In line (formerly loop) timing mode, the TG circuit pack derives local shelf timing from the received OC-N signal. In addition, the timing function can also be derived from an OLIU equipped in function unit C. This option is only available through software provisioning

In free-running mode, the TG circuit pack derives timing from a high stability temperature-compensated, voltage-controlled crystal oscillator.

In case of unprotected synchronization reference failure, the TG circuit pack will switch to "holdover mode" and continue to provide system timing, using the internal oscillator to maintain the last known good reference frequency.

DS1 Timing Output

The DS1 Output provided by the TG circuit pack can be provisioned to one of two modes of operation:

- MULT
  - This mode is normally used to distribute a DS1 timing reference to other shelves in the bay. In this mode, the distributed DS1 Output is buffered from the external DS1 reference that is input to the shelf.
- SYNC OUT
  - This mode is used to distribute a derived DS1 timing reference to a BITS. In this mode, the distributed DS1 Output is based on the timing signal the TG circuit pack has derived from the received OC-3 signal from either the main OLIU or an OLIU equipped in function unit C.
  - If the DS1 output is provisioned for SYNC OUT mode, DS1 AIS will be inserted on detection of unprotected OC-N line failure.

Detailed Description of Operation

Control Circuitry

Figure 7-7 is an overall block diagrams of the BBF2B TGS and BBF4 TG3 circuit packs. The TG circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Through this interface, the SYSCTL monitors the health of the TG circuit pack to provide alarm reporting. The SYSCTL also controls TG circuit pack switching and mode functions, as well as controlling the faceplate LEDs.

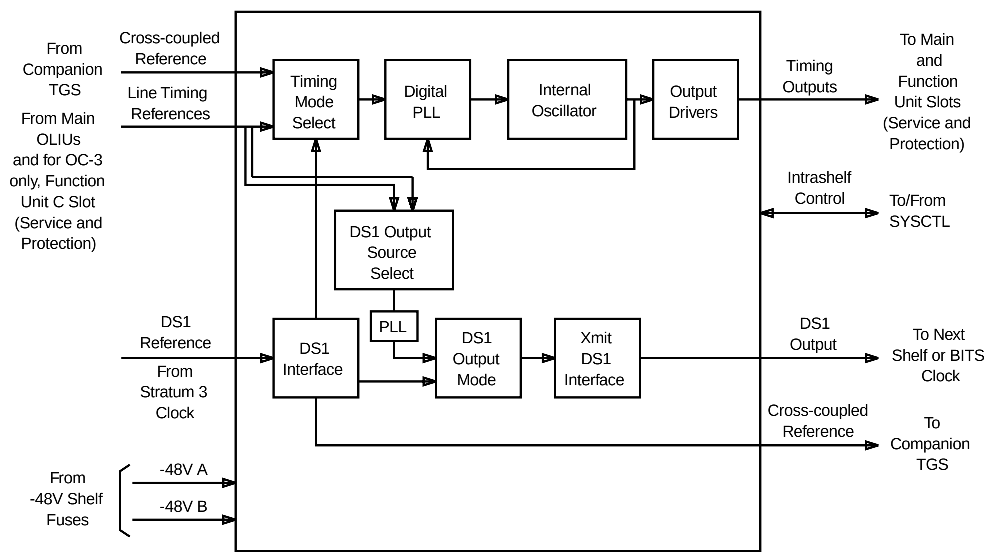


Figure 7-7. BBF2B TGS and BBF4 TG3 Circuit Pack Block Diagram

Timing Circuitry

DS1 External Timing. Each TG circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to its companion TG circuit pack in the same shelf. If the microprocessor on one TG circuit pack detects an incoming DS1 reference failure, it will signal the microprocessor on the companion TG circuit pack. Thus, each TG circuit pack has two DS1 references to choose from, one which is input directly and the other cross-fed. Both TG circuit packs will normally select the same DS1 input. A loss of both DS1 references will result in the TG circuit pack entering holdover mode.

Line Timing. The reference signal feeding the phase-locked loop is selected from the internal oscillator or a loop-timing clock derived from the incoming optical line. In line (formerly loop)-timing mode, the OC-N line being selected for transmission is also selected as the timing reference. The OC-3 line in function unit C selected for transmission can optionally be selected for the timing reference. This selection is under the control of the on-board microcontroller and the SYSCTL and is dependent on the timing mode selected by the user via on-board selection switches and the status of the references. Loss of both line (formerly loop)-timing references will cause the TG circuit pack to go into holdover mode to maintain system timing.

Free-Running. For free-running operation, the TG derives timing from a temperature-compensated, voltage-controlled crystal oscillator (TCVCXO) and a digital phase-locked loop (DPLL) with a full temperature range end-of-life accuracy of ±15 parts-per-million (ppm) for the BBF2B TGS, and ±4.6 ppm for the BBF4 TG3.

DS1 Output. The DS1 output port of the TG circuit pack can be provisioned for either MULT or SYNC OUT mode via a hardware switch. In the SYNC OUT mode, the derived DS1 output signal is generated from the incoming OC-N lines through timing synchronization signals from the DDM-2000 OC-3 main OLIUs (main-1 or main-2), which is the default, or function unit C by software command. In the MULT mode, the DS1 output signal is buffered from an external DS1 input reference. This external reference is typically a DS1 from a building integrated timing supply (BITS).

Selection of these timing synchronization signals for the DS1 output in SYNC mode is controlled by the SYSCTL circuit pack. This selection can be provisioned via software command to "track" the active received side of the OC-N line used for transmission, to always select its timing from the specified OC-3 line (main-1 or main-2), or function unit C (fn-c-1 or fn-c-2), regardless of its maintenance condition. Loss of timing reference for the DS1 output will result in the insertion of DS1 AIS on this output port.

Holdover. The TG circuit pack has an internal TCVCXO that will maintain shelf timing in the event of an unprotected timing DS1 reference failure (that is, holdover mode). The TGS (BBF2B) will maintain frequency stability to better than a SONET minimum clock (SMC) accuracy. The TG3 (BBF4) will maintain frequency stability to better than a stratum 3 accuracy. Beyond this 24 hour period holdover will gradually return to a free-run accuracy.

Clock Output Functions

Intra-shelf Timing Distribution. The generated timing signals are distributed through output drivers to the main and function unit slots. The TG circuit pack provides eight differential 51.84-MHz master clock signals and eight differential 8-kHz composite STS-1 frame sync signals. In the 8-kHz sync signal, every fourth pulse is stretched to double width, providing an embedded 2-kHz reference for the virtual tributary (VT) superframe synchronization.

DS1 Outputs . The DS1 output port can be provisioned by hardware switches for MULT mode or DS1 timing synchronization (SYNC OUT) mode.

- SYNC OUT Mode
  - The DS1 output port of the BBF2B/BBF4 TGS circuit pack can be provisioned to be a derived DS1 signal traceable to a received optical line used for network timing distribution. The SYNC OUT capability is available for a DDM-2000 set for external-timing or line-timing.
- MULT Mode
  - The DS1 output port of the TGS circuit pack can be provisioned to output a buffered copy (at a DSX level) of the DS1 signal at the input port. A DS1 traceable source is applied to the first DDM-2000 shelf. The output of the first shelf is then cabled to the second shelf, and all subsequent shelves fed from the previous ones. In this way, a MULT chain is formed from a single DS1 reference. The MULT capability is only available for a DDM-2000 provisioned for external-timing.

Protection Circuitry

In both external and line (formerly loop)-timing modes, the synchronization references are continuously monitored for error-free operation. If the active reference becomes corrupted, the TG circuit pack will select the standby reference without causing service degradations (that is, hitless reference switching). If both reference inputs are corrupted, the TG circuit pack enters holdover mode where the DPLL holds the on-board oscillator frequency at the last good reference sample while the references are repaired.

In addition, optional 1x1 nonrevertive TG circuit pack protection is provided. When the active TG circuit pack microcontroller determines that its clock output is out of tolerance, it suppresses its timing outputs and signals its TG circuit pack companion unit of its failed condition. The suppressed timing outputs cause a timing hardware switch to the standby TG circuit pack by the transmission circuit packs.

Fault Detection Circuitry

The TG circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the TG circuit pack is inserted or recovers from a transient failure.

The incoming DS1 references are monitored for:

- LOS (128 consecutive zeros)
- DS1 AIS
- LOF
- Excessive out-of-frame count
- Greater than 10^{-3} bit error ratio (BER).

Power Circuitry

The TG circuit pack receives two sources of –48 volts which are diode ORed, fused, and filtered prior to conversion to a +5 volt source to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

TG Hardware Settings

The TG circuit pack option switches provide the following functions:

- DS1 Reference Line Coding — Selects either alternate mark inversion (AMI) or AMI with bipolar 8-zero substitution (B8ZS) line coding for both DS1 input and DS1 output.
- DS1 Reference Format — Selects either super frame (SF) or extended super frame (ESF) for both DS1 input and DS1 output.
- Timing Mode — Sets timing mode to free run, external DS1, or line (formerly loop) timed.
- DS1 output mode — Sets DS1 output (SF or ESF "all ones" signal) for intra-shelf timing derived either from DS1 external input or from network timing distribution derived from received line. Reference for DS1 timing output is taken from either the main or function unit C OLIU groups.
- Sets equalizer switch for proper cable length when provisioned for SYNC OUT mode. Equalizer settings will be automatically set to shortest cable length when the DS1 output is provisioned for MULT mode.

Figure 7-8 shows the location of the option switches for the BBF2B/BBFY TGS circuit pack.

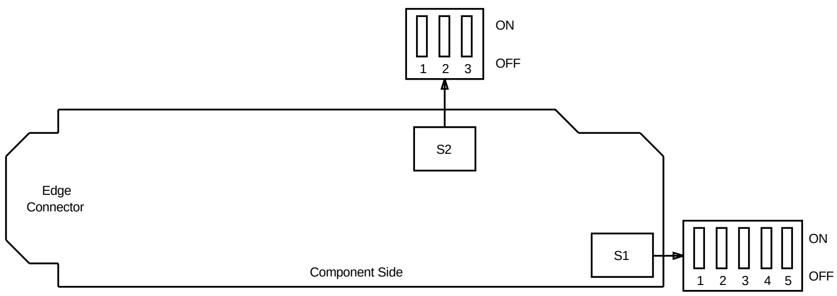


Figure 7-8. TG Option Switches for DDM-2000 OC-3 (Sheet 1 of 2)

Notes:
1. The switches are set by moving the slide toward the desired position.
2. If the invalid switch setting is selected, the FAULT LED lights and an alarm is generated.

3. The main OLIU is the default reference when in Line Timing or SYNC OUT mode.

TG DS1 Line Coding and Frame Format Switch Settings (Note)

DS1 Line Code	Switch S1-1	DS1 Frame Format	Switch S1-2
AMI *	ON	SF *	ON
B8ZS	OFF	ESF	OFF

***Note*:** Controls line coding and frame format for both DS1 input and output.

* Factory default.

TG Timing Mode Switch Settings

Timing Mode	Switch Settings		
	S1-3	S1-4	S1-5 (DS1 Output)
Free-Running	ON	ON	OFF
DS1 External, MULT Mode*	OFF	ON	OFF
Line Timing Main†	ON	OFF	OFF
Line Timing, SYNC OUT Mode†	ON	OFF	ON
DS1 External, SYNC OUT Mode†	ON	ON	ON
Invalid	OFF	OFF	ON
Invalid	OFF	OFF	OFF
Invalid	OFF	ON	ON

* Factory default.

† Main OLIU is default; function unit C by **`set-sync`** command.

Equalizer Switch Settings

Equalization (Note)	S2-1	S2-2	S2-3
0' to 131'	ON	ON	OFF
131' to 262'	ON	OFF	ON
262' to 393'	ON	OFF	OFF
393' to 524'	OFF	ON	ON
524' to 655'	OFF	ON	OFF
Invalid	OFF	OFF	OFF
Invalid	OFF	OFF	ON
Invalid	ON	ON	ON
***Note*:** Distance in feet for 22 gauge PIC (ABAM) cable.			

Figure 7-8. TG Option Switches for DDM-2000 OC-3 (Sheet 2 of 2)

TG Quick Reference Summary

Provisioned Modes

The TG circuit pack can be provisioned through on-board option switches to any one of three timing modes: (a) External timing mode (b) Line (formerly loop) timing mode or (c) Free-running mode.

In addition, the TGS circuit pack can be provisioned through on-board option switches to provide a DS1 output for network timing distribution or for shelf timing distribution. Line (formerly loop) timing from the main OC-3 line is the factory default. Line (formerly loop) timing for function unit C can be provisioned with the CIT.

Holdover Mode

The holdover mode maintains the last good reference frequency during unprotected failure of external or line (formerly loop)-timing references.

Maintenance and Control

The following maintenance functions are provided on the TG circuit pack: (a) DS1 reference monitoring, (b) TG and OLIU circuit pack protection switching, and (c) inventory information (*CLEI* code, date of manufacture, etc.).

DS1 Output

- — DS1 Output (MULT) — a buffered copy of the external DS1 input reference used for intershelf timing
- — DS1 Output (SYNC OUT) — derived from received OC-3 line for network timing distribution.

Transmission - Electrical Interface

The electrical transmission circuit packs are the DS1, DS1PM, HDSL, MXRVO, DS3, TMUX, and STS1E.

BBF1/BBF1B DS1 Circuit Pack Description

Purpose of Circuit

The DS1 circuit pack provides a low-speed interface between asynchronous DS1 rate signals and SONET virtual tributary group (VT-G) signals.

DS1 Faceplate Indicator

The DS1 circuit pack FAULT indicator is shown in Figure 7-9. This red FAULT LED is lit by the SYSCTL on detection of a DS1 circuit pack failure. In the event of an incoming signal failure, this LED flashes on and off.

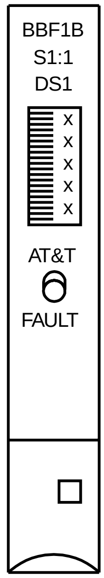


Figure 7-9. BBF1/BBF1B DS1 Circuit Pack

General Description of Operation

The DS1 circuit pack terminates four bidirectional DS1 lines complying with standard DSX-1 signal specifications. The DS1 circuit pack interfaces to the MXRVO/STS1E circuit pack at the VT-G rate (6.912 MHz) and to the SYSCTL.

The BBF1 and BBF1B DS1 circuit packs are functionally equivalent. Either one can be used to replace the other. The BBF1B has improved protection switching performance on circuit pack removal and insertion.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-10 provides an overall block diagram of the DS1 circuit pack. The transmit direction points towards the VT-G and the receive direction points toward the DS1s. In the transmit direction, the DS1 receives four balanced DS1 bipolar signals. Each of these signals passes through a relay to a DS1 interface circuit that converts it to unipolar nonreturn to zero (NRZ) format, recovers its clock, and sends it to the multiplexer (MUX) circuit. The MUX circuit converts each DS1 rate input into a 1.728 Mb/s VT1.5 signal, and then byte interleaves the four VT1.5s to create a VT-G signal that it sends to the MXRVO/ STS1E pack using the frame sync and clock received from the MXRVO/STS1E.

Receive Direction. The DS1 receives a VT-G with clock and frame information from the MXRVO/STS1E and demultiplexes the VT-G into four unique VT1.5 signals. Each VT1.5 passes through circuitry that performs pointer interpretation, removes the VT path overhead bits, the fixed stuff bits, and the overhead communications channel bits, and desynchronizes the embedded DS1. The DS1 rate signal is AMI or B8ZS encoded, pre-equalized with a selectable line buildout (LBO). It is then sent as a balanced signal to a DSX-1 that may be located up to 655 feet from the DDM-2000 OC-3.

Control Circuitry

The DS1 circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The DS1 provides maintenance elements for reporting the status of the circuit pack and the incoming VT1.5 and DS1 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the DS1 responds to control signals from the SYSCTL (such as FAULT LED control).

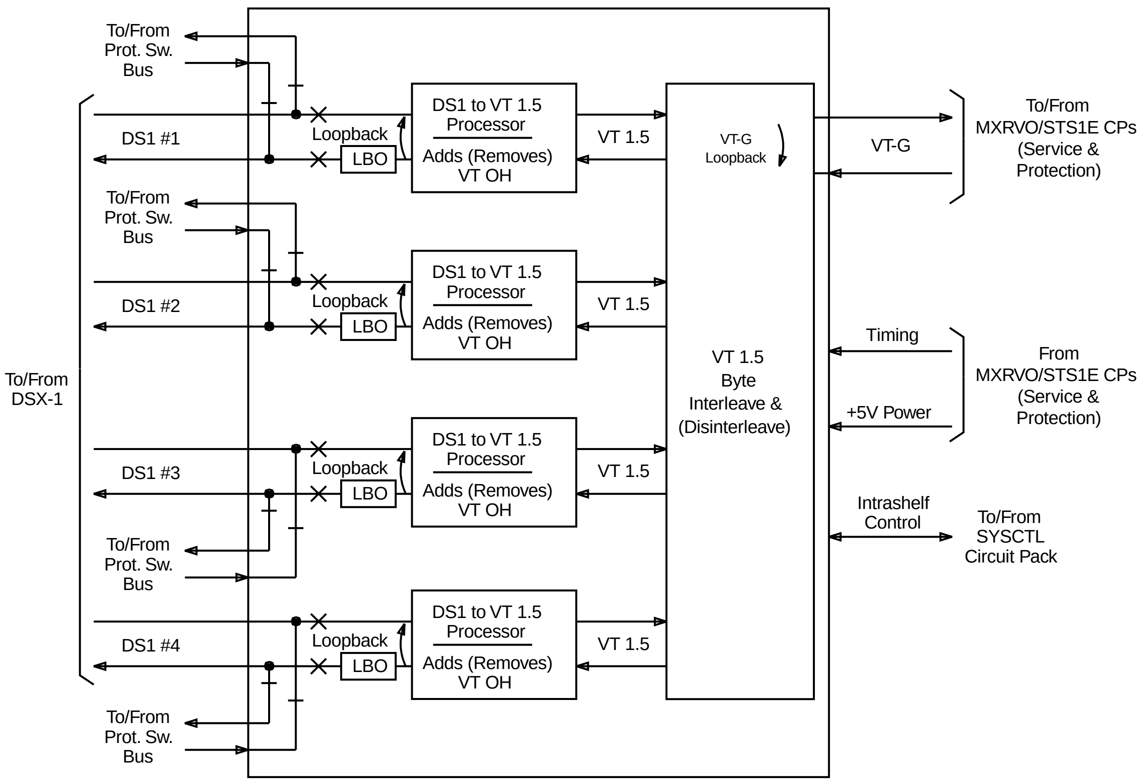


Figure 7-10. BBF1/BBF1B DS1 Circuit Pack Block Diagram

Timing Circuitry

The timing distribution to the DS1 contains ten timing signals: two high-speed clocks (active and standby), four VT-G clocks (two active and two standby), and four frame sync signals (two active and two standby).

The DS1 receives from the MXRVO/STS1E a synchronous transport signal (STS-1) rate high-speed clock that provides the frequency reference for the desynchronizing phase-locked loop. This high-speed reference clock is also used to synthesize the DS1 rate AIS clock source for the DS1 devices and to provide a DS1 test signal.

The DS1 uses the VT-G clocks (6.912 MHz) and the frame sync signals it receives from the MXRVO/STS1E to clock VT-G data to/from the MXRVO/STS1E.

Protection Circuitry

Optional 1x7 revertive DS1 circuit pack protection is provided and this protection is independent of the MXRVO/STS1E circuit pack(s). The DS1 protection switch points are implemented with on-board relays on the DSX-1 side and with logic selectors at the VT-G level on the active and standby MXRVO/STS1E circuit packs. The SYSCTL controls these relays through two serial interfaces so that a failure of one serial interface to the DS1 does not prevent control of the relays. If +5 V power on the DS1 fails, the relays default to the protection state. If the SYSCTL is removed, the relays remain in their current state.

Shorting contacts are provided in the DS1 backplane connector so that when the circuit pack is removed, the DSX-1 cable pairs short through to the protection bus.

CAUTION:
Unused low-speed interface slots within a partially equipped group must be equipped 177A Retainer cards if DS1 protection is used. Failure to do so may result in corrupted transmission. The BBF3 DS1PM circuit pack can be mixed with the BBF1/1B. If mixed, the protection circuit pack must be a BBF3 DS1PM.

When a DS1 circuit pack is inserted, the relays are in the protection state until the SYSCTL determines that the circuit pack is good.

Fault Detection Circuitry

The DS1 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the DS1 circuit pack is inserted or recovers from a transient failure. The incoming DS1 signal is monitored for bipolar threshold crossings in excess of 10^{-3} or 10^{-6}. Incoming VT1.5 signals are monitored for VT AIS, VT LOP, and yellow.

Loopbacks

The DS1 circuit pack has a DS1 terminal loopback controlled by the SYSCTL via the intra-shelf control bus.

The terminal loopback is provided on the DS1 circuit pack for each DS1 low-speed interface. The loopback is done inside the MUX/DEMUX/DESYNC device and bridges the desynchronizer output signal (transmitted towards the DSX-1) back to the DS1 synchronizer input. When the loopback is operated, the DS1 interface device forces AIS towards the DSX-1.

The DS1 circuit pack also provides a facility loopback for all four DS1 signals (Release 9.1 and later) on a circuit pack. When this loopback is completed, all four DS1 signals received from the DSX are simultaneously looped back toward the DSX. The loopback is a bridge, so the transmitted DS1 signals (towards the high-speed interface) are not affected.

Performance Monitoring

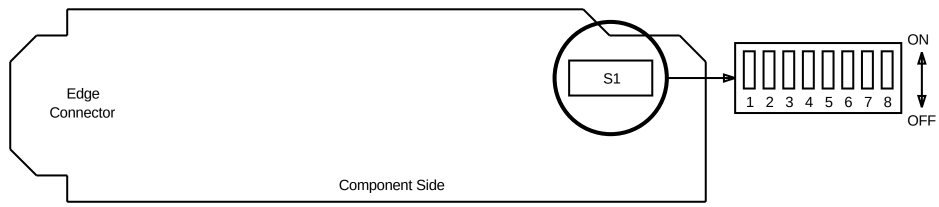
The DS1 circuit pack monitors VT path parameters derived from the V5 coding violations.

Power Circuitry

The MXRVO/STS1E circuit packs supply +5 V power to the DS1 circuit packs in the corresponding DS1 circuit pack groups. These two inputs are diode ORed and the output is fused and then filtered before it is used to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

DS1 Hardware Settings

The line coding and line build out (LBO) are switch settable. The locations of the DS1 circuit pack option switches are shown in Figure 7-11.



Note: The switches are set by moving the slide toward the desired position.

DS1 Cable LBO Settings

613C (608C) Cable Length (feet)	1249C Cable Length (feet)	Other Cable dB Loss at 772 KHz	DIP Switch Settings		
			S1-1	S1-2	S1-3
0 to 133*	0 to 90*	0 to 0.6	OFF	OFF	OFF
>133 to 267	>90 to 180	>0.6 to 1.2	OFF	OFF	ON
>267 to 400	>180 to 270	>1.2 to 1.8	OFF	ON	OFF
>400 to 533	>270 to 360	>1.8 to 2.4	OFF	ON	ON
>533 to 655	>360 to 450	>2.4 to 2.8	ON	OFF	OFF

* Minimum of 30 feet required to meet EMI requirements.

DS1 Line Code Settings

Line Code Format (Note 2)	DIP Switch Settings (Note 1)			
	S1-4 (Port 1)	**S1-5 (Port 2)**	**S1-6 (Port 3)**	**S1-7 (Port 4)**
B8ZS	OFF	OFF	OFF	OFF
AMI	ON	ON	ON	ON

***Notes*:**
1. Switch section 8 (S1-8) is unused and ignored by the system.
2. Line code is software overrideable.

Figure 7-11. BBF1/BBF1B DS1 Option Switches

DS1 Quick Reference Summary

Transmit Functions

Major transmit functions of the DS1 circuit pack are as follows:

- Receives four AMI or B8ZS encoded DS1 signals from a DSX-1
- Recovers DS1 clock and NRZ data from each DS1 signal
- Synchronizes and maps each data signal to a VT1.5 synchronous payload envelope (SPE)
- Inserts VT path overhead
- Multiplexes four VT1.5 SPEs to a byte-interleaved VT-G signal
- Provides the VT-G signal to a MXRVO/STS1E circuit pack.

Receive Functions

Major receive functions of the DS1 circuit pack are as follows:

- Receives a SONET VT-G clock and frame synchronizing signals from its associated MXRVO/STS1E
- Demultiplexes the VT-G into four VT1.5 signals
- Terminates VT path and the embedded DS1 signal from each VT1.5 SPE
- Desynchronizes the DS1 signals
- Encodes each DS1 signal into either AMI or B8ZS format
- Pre-equalizes (with LBO) each DS1 and provides them to a DSX-1 as bipolar signals.

Control Functions

The major control functions of the DS1 circuit pack are as follows:

- Protection switching for MXRVO/STS1E circuit pack protection
- VT path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects VT path AIS
- Inserts DS1 AIS toward fiber and toward DSX-1
- Inserts and detects VT path yellow signal.

BBF3/BBF3B DS1PM Circuit Pack Description

Purpose of Circuit

The DS1PM circuit pack provides all of the functions of a BBF1B circuit pack and also provides performance monitoring (PM) of SF and ESF signals to allow for T1 tariff verification. For PM, the DS1 signals from the DSX are monitored; PM data from the opposite direction is provided by accessing the ESF data link. The new BBF3B has the additional capability of allowing single DS1 facility loopbacks.

DS1PM Faceplate Indicator

The DS1PM circuit pack FAULT indicator is shown in Figure 7-12. This red FAULT LED is lit by the SYSCTL on detection of a DS1PM circuit pack failure. In the event of an incoming signal failure, this LED flashes on and off.

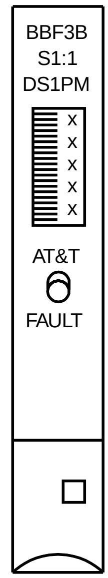


Figure 7-12. BBF3/BBF3B DS1PM Circuit Pack

General Description of Operation

The DS1PM circuit pack terminates four bidirectional DS1 lines complying with standard DSX-1 signal specifications. The DS1PM circuit pack interfaces to the MXRVO/STS1E circuit pack at the VT-G rate (6.912 MHz) and to the SYSCTL.

The DS1 and DS1PM circuit packs are, with respect to transmission, functionally equivalent. In addition to performing all of the functions of the DS1 circuit pack, the DS1PM circuit pack provides PM for the DS1 rate transmit signals.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-13 provides an overall block diagram of the DS1PM circuit pack. The transmit direction points towards the VT-G and the receive direction points toward the DS1s. In the transmit direction, the DS1PM receives four balanced DS1 bipolar signals. Each of these signals passes through a relay to a DS1 interface circuit that converts it to unipolar NRZ format, recovers its clock, and sends it to the MUX and framing (framer) circuits. The MUX circuit converts each DS1 rate input into a 1.728 Mb/s VT1.5 signal and then byte-interleaves the four VT1.5s to create a VT-G signal that it sends to the MXRVO/STS1E circuit pack, using the frame sync and clock received from the MXRVO/STS1E.

Receive Direction. The DS1PM receives a VT-G with clock and frame information from the MXRVO/STS1E and demultiplexes the VT-G into four unique VT1.5 signals. Each VT1.5 passes through circuitry that performs pointer interpretation, removes the VT path overhead bits, the fixed stuff bits, and the overhead communications channel bits, and desynchronizes the embedded DS1. The DS1 rate signal is AMI or B8ZS encoded, pre-equalized with a selectable LBO, and then sent as a balanced signal to a DSX-1 that may be located up to 655 feet from the DDM-2000 OC-3.

Control Circuitry

The DS1PM circuit pack interfaces with the SYSCTL over the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The DS1PM provides maintenance elements for reporting the status of the circuit pack and the incoming VT1.5 and DS1 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the DS1PM responds to control signals from the SYSCTL (such as FAULT LED control). The PM processor collects information from the framing circuitry and generates DS1 PM parameters which are sent to the SYSCTL.

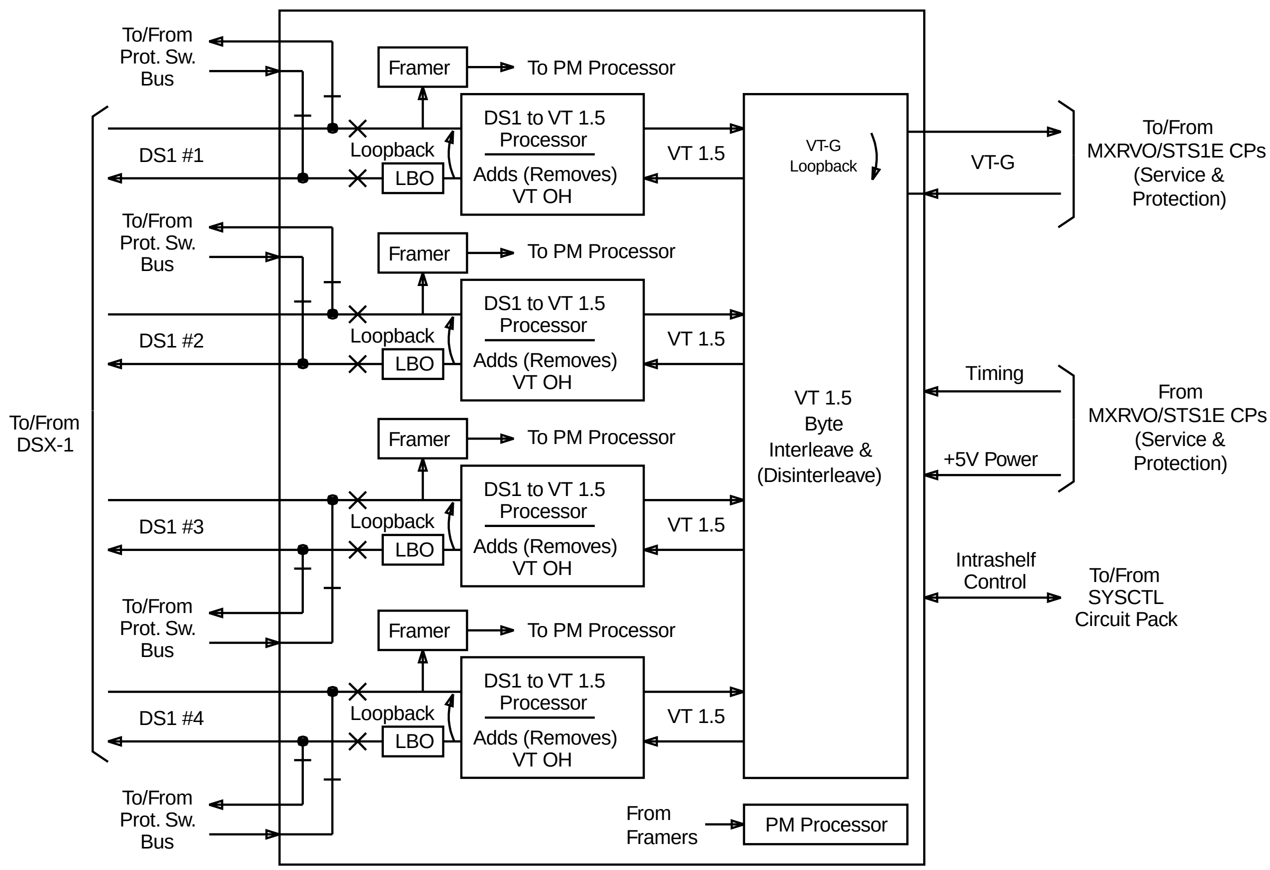


Figure 7-13. DS1PM Circuit Pack Block Diagram

The framer circuit acquires frame information (either SF or ESF) from the DS1 signal and sends the information to the PM processor. The PM processor then generates near-end and far-end (ESF only) DS1 PM parameters. When provisioned for DS1 clear channel, no PM path parameters are generated.

Timing Circuitry

The timing distribution to the DS1PM contains ten timing signals: two high-speed clocks (active and standby), four VT-G clocks (two active and two standby), and four frame sync signals (two active and two standby).

The DS1PM receives from the MXRVO/STS1E an STS-1 rate high-speed clock that provides the frequency reference for the desynchronizing phase-locked loop. This high-speed reference clock is also used to synthesize the DS1 rate AIS clock source for the DS1 devices and to provide a DS1 test signal.

The DS1PM uses the VT-G clocks (6.912 MHz) and the frame sync signals it receives from the MXRVO/STS1E to clock VT-G data to/from the MXRVO/STS1E.

Protection Circuitry

Optional 1x7 revertive DS1PM circuit pack protection is provided, and this protection is independent of the MXRVO/STS1E circuit pack(s). The DS1PM protection switch points are implemented with on-board relays on the DSX-1 side and with logic selectors at the VT-G level on the active and standby MXRVO/STS1E circuit packs. The SYSCTL controls these relays through two serial interfaces so that a failure of one serial interface to the DS1PM does not prevent control of the relays. If +5 V power on the DS1PM fails, the relays default to the protection state. If the SYSCTL is removed, the relays remain in their current state.

Shorting contacts are provided in the DS1PM backplane connector so that when the circuit pack is removed, the DSX-1 cable pairs short through to the protection bus.

CAUTION:
Unused low-speed interface slots within a partially equipped group must be equipped with 177A Retainer cards if DS1PM protection is used. Failure to do so may result in corrupted transmission. The BBF3 DS1PM circuit pack can be mixed with the BBF1/1B. If mixed, the protection circuit pack must be a BBF3 DS1PM. Failure to do so may result in loss of transmission.

When a DS1PM circuit pack is inserted, the relays are in the protection state until the SYSCTL determines that the circuit pack is good.

Fault Detection Circuitry

The DS1PM circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the DS1PM circuit pack is inserted or recovers from a transient failure. The incoming DS1 signal is monitored for bipolar threshold crossings in excess of 10^{-3} or 10^{-6}. Incoming VT1.5 signals are monitored for VT AIS, VT LOP, and yellow.

Loopbacks

The DS1PM circuit pack has two loopback types: terminal and facility. Both loopbacks are controlled by the SYSCTL via the intra-shelf control bus. The two loopbacks must be done independently.

A terminal loopback is provided on the DS1PM circuit pack for each DS1 low-speed interface. The loopback is done inside the MUX/DEMUX/DESYNC device and bridges the desynchronizer output signal (transmitted towards the DSX-1) back to the DS1 synchronizer input. When the loopback is operated, the DS1 interface device forces AIS towards the DSX-1.

The DS1PM circuit pack also provides a facility loopback for all four DS1 signals (Release 9.1 and later) on a circuit pack. When this loopback is completed, all four DS1 signals received from the DSX are simultaneously looped back toward the DSX. The loopback is a bridge, so the transmitted DS1 signals (towards the high-speed interface) are not affected.

The new BBF3B DS1PM circuit pack also has single DS1 facility loopback capability. The loopback, however, is not a bridge and AIS will be transmitted toward the high-speed interface. This feature requires Release 13.0 or higher. The circuit pack is backwards compatible and can be used in place of the BBF3.

Performance Monitoring

The DS1PM circuit pack provides PM circuitry for the following performance parameters:

- VT path parameters derived from V5 coding violations
- DS1 PM derived from SF/ESF frame format depending on provisioning.

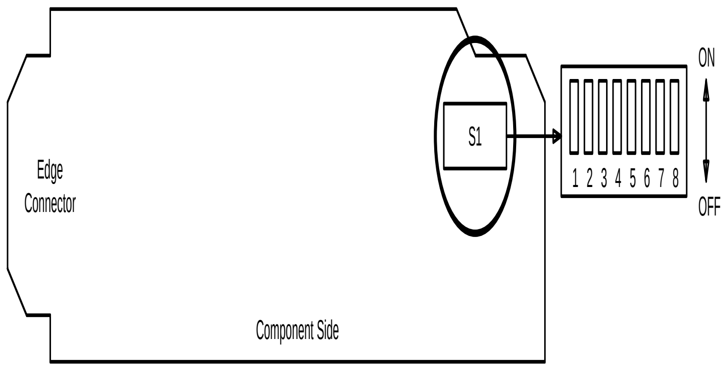
Power Circuitry

The MXRVO/STS1E circuit packs supply +5 V power to the DS1PM circuit packs in the corresponding DS1PM circuit pack groups. These inputs are diode ORed and the output is fused and then filtered before it is used to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

CAUTION:
For power reliability, when a muldem is equipped with DS1PM circuit packs, the associated function unit must be equipped with two MXRVO/STS1E circuit packs.

DS1PM Hardware Settings

The line coding and LBO are switch settable. Other parameters are provisionable through the CIT. The locations of the DS1PM circuit pack option switches are shown in Figure 7-14.



Note: The switches are set by moving the slide toward the desired position.

DS1 Cable LBO Settings

613C (608C) Cable Length (feet)	1249C Cable Length (feet)	Other Cable dB Loss at 772 KHz	DIP Switch Settings		
			S1-1	**S1-2**	**S1-3**
0 to 133*	0 to 90*	0 to 0.6	OFF	OFF	OFF
>133 to 267	>90 to 180	>0.6 to 1.2	OFF	OFF	ON
>267 to 400	>180 to 270	>1.2 to 1.8	OFF	ON	OFF
>400 to 533	>270 to 360	>1.8 to 2.4	OFF	ON	ON
>533 to 655	>360 to 450	>2.4 to 2.8	ON	OFF	OFF

* Minimum of 30 feet required to meet EMI requirements.

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DS1 Line Code Settings

Line Code Format (Note 2)	DIP Switch Settings (Note 1)			
	S1-4 (Port 1)	S1-5 (Port 2)	S1-6 (Port 3)	S1-7 (Port 4)
B8ZS	OFF	OFF	OFF	OFF
AMI	ON	ON	ON	ON

***Notes*:**
1. Switch section 8 (S1-8) is unused and ignored by the system.
2. Line code is software overrideable.

Figure 7-14. BBF3 DS1PM Option Switches

DS1PM Quick Reference Summary

Transmit Functions

Major transmit functions of the DS1PM circuit pack are as follows:

- Receives four AMI or B8ZS encoded DS1 signals from a DSX-1
- Recovers DS1 clock and NRZ data from each DS1 signal
- Synchronizes and maps each data signal to a VT1.5 SPE
- Inserts VT path overhead
- Multiplexes four VT1.5 SPEs to a byte-interleaved VT-G signal
- Provides the VT-G signal to a MXRVO/STS1E circuit pack.

Receive Functions

Major receive functions of the DS1PM circuit pack are as follows:

- Receives a SONET VT-G clock and frame synchronizing signals from its associated MXRVO/STS1E
- Demultiplexes the VT-G into four VT1.5 signals
- Terminates VT path and the embedded DS1 signal from each VT1.5 SPE
- Desynchronizes the DS1 signals
- Encodes each DS1 signal into either AMI or B8ZS format
- Pre-equalizes (with LBO) each DS1 and provides them to a DSX-1 as bipolar signals.

Control Functions

The major control functions of the DS1PM circuit pack are as follows:

- Protection switching for MXRVO/STS1E circuit pack protection
- VT path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Monitors a DS1 signal with SF or ESF frame format and generates PM data.

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Monitors DS1 signal for near-end and far-end performance
- Detects VT path AIS
- Inserts DS1 AIS toward fiber and toward DSX-1
- Inserts and detects VT path yellow signal.

177A Retainer Card Description

Purpose of Card

To ensure proper operation of DS1/DS1PM circuit pack protection switching, the 177A Retainer card (Figure 7-15) must be installed in all unused slots within a low-speed group that is partially equipped with DS1/DS1PM circuit packs.

CAUTION:
Unused low-speed interface slots within a partially equipped group must be equipped with 177A Retainer cards if DS1 protection is used. Failure to do so may result in corrupted transmission.

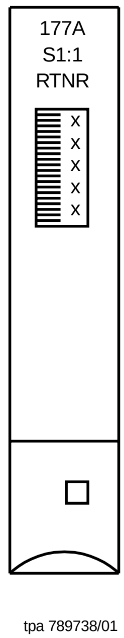
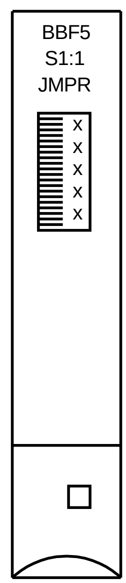


Figure 7-15. 177A Retainer Card

BBF5 Jumper Circuit Pack Description

Purpose of Circuit

In DDM-2000 FiberReach host applications using the DDM-2000 OC-3 Multiplexer Group 1 or Group 3 shelves, the BBF5 jumper circuit pack (Figure 7-16) connects signals between slots of a function unit equipped with 27-type OLIUs. The BBF5 also cross-couples the STS-1 signals between function units equipped with 27G2-U OLIUs. **The BBF5 circuit pack is not needed in Group 4 shelves in any application**. The BBF5 must be installed in Slot 8 of the low-speed group associated with the function unit where both function unit slots are equipped with 27G-U OLIUs. BBF5 circuit packs must be installed in slots 4 and 8 of the low-speed group associated with the function unit where both function unit slots are equipped with 27G2-U OLIUs. Depending on the cross-connection configuration, the removal of a BBF5 may affect transmission and/or communications over the DCC interface.



tpa 789738/02

Figure 7-16. BBF5 Jumper Circuit Pack

BBF8 High bit rate Digital Subscriber Line

Purpose of Circuit

The HDSL circuit pack (BBF8) provides HDSL interface capability on the DDM-2000 OC-3 shelf to compatible *PairGain®* equipment at the customer premises. It allows the transport of T1 payloads, for up to 12,000 feet, over two metallic 24 AWG twisted-pair lines.

The BBF8 circuit pack fits into the low-speed slots and provides two, four-wire HDSL interfaces. Each interface provides a full DS1 payload capacity mapped to a SONET VT1.5 and then VT cross-connected into an STS-1. Once in SONET, the DS1 payload is treated as a normal DS1.

HDSL Faceplate Indicator

The HDSL circuit pack FAULT indicator is shown in Figure 7-17. This red FAULT LED is lit by the SYSCTL on detection of an HDSL circuit pack failure. In the event of an incoming signal failure, this LED flashes on and off.

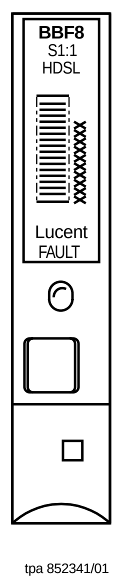


Figure 7-17. BBF8 HDSL Circuit Pack

General Description of Operation

Figure 7-18 provides an overall block diagram of the HDSL circuit pack. The BBF8 circuit pack provides an HDSL interface capability on the DDM-2000 OC-3 Multiplexer. HDSL is an access technology that allows the transport of DS1 payloads over metallic twisted pairs. This technology performs an inverse multiplexing function which splits the DS1 payload into two 784 Kb/s data streams. These two data streams are combined at the far-end to reconstruct the original DS1 payload.

HDSL is a point-to-point transmission technology between two nodes. One of the nodes (master) is responsible for establishing communications over the *PairGain* proprietary embedded operations channel (EOC). The EOC is required for synchronizing the two HDSL data streams as well as providing OAM&P between the two nodes. The other node (slave) may only retrieve or view these parameters. In each pair of HDSL nodes there must be one master and one slave.

The HDSL signal format used by the BBF8 is compatible with *PairGain* HDSL equipment. Since the BBF8 circuit pack does not provide line powering, the far-end *PairGain* HDLS equipment must be externally powered.

Detailed Description of Operation

Transmission Circuitry

The BBF8 fits into a low-speed slot and provides two, four-wire (2 pair) HDSL interfaces. These interfaces are compatible with *PairGain* HDSL equipment which may be located up to 12,000 feet away. A 2B1Q line code is used on each transmission pair. Each interface provides a full DS1 payload capacity which is mapped to a SONET VT1.5. The HDSL overhead is in a *PairGain* proprietary format and can only be terminated by equipment capable of processing this information. As with the BBF1B (Quad DS1) circuit pack, an MXRVO must be used in the DDM-2000 OC-3 shelf to perform a VT cross-connect function. Once in SONET, the DS1 payload is treated as a normal DS1.

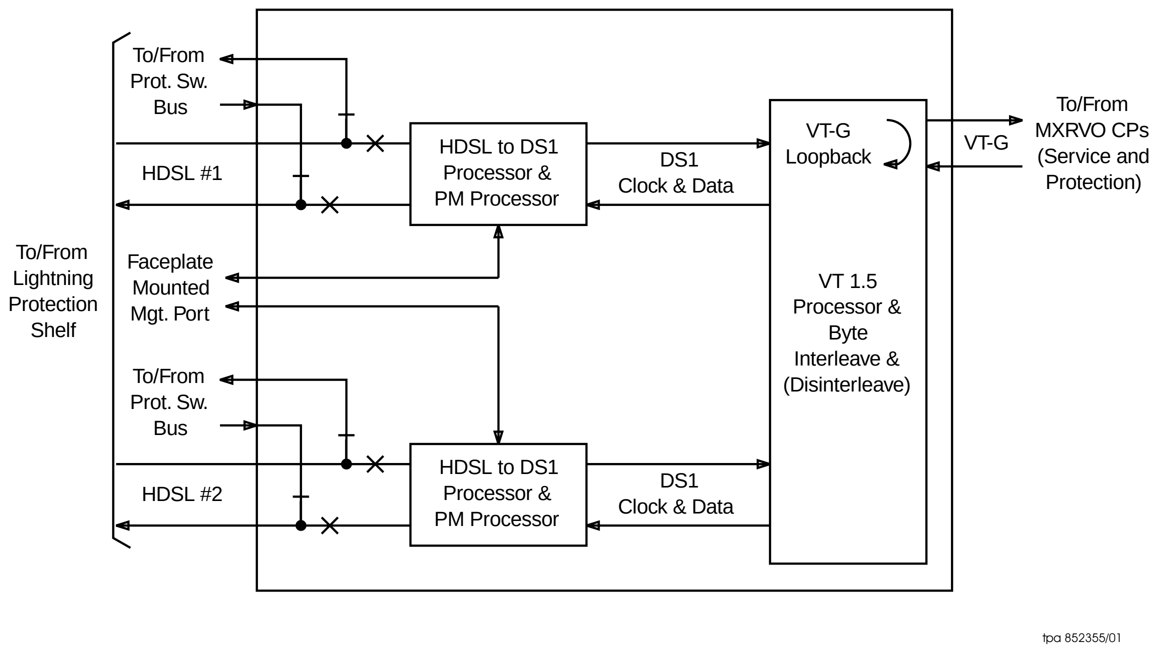


Figure 7-18. HDSL Circuit Pack Block Diagram

The distance limitations for HDSL are based on a maximum signal attenuation of 35 dB. Since signal attenuation decreases as the cable gauge (number) decreases, the lower the gauge the greater the length the HDSL can be extended. Table7-2 identifies and lists these distances, as well as indicates the loss on the line, in dB per feet, at 196 kHz.

Due to the increased power needs of the BBF8, only three BBF8 circuit packs (including Protection) may be used in a function group. Powering for these packs is determined by the MXRVO for the OC-3 shelf. The 28-type OLIU is required for powering in the FiberReach shelf. Pack mixing with Quad DS1 circuit packs is not allowed. The HDSL interfaces do not support line powering. The BBF8 is compatible with DDM-2000 Release 6.2 and later.

Table 7-1. HDSL Line Specifications

Cable Gauge	Loss at 196 kHz dB/ft	Ohms per kft	Maximum Loop for 35 dB Loss	Ohms at Maximum Length
26/0.40 mm	3.880	83.3	9.0 kft/2.75 km/1.7 mi	750
24/0.51 mm	2.841	51.9	12.3 kft/3.75 km/2.3 mi	638
22/0.61 mm	2.177	32.4	16.1 kft/4.9 km/3.0 mi	520
19/0.91 mm	1.535	16.1	22.8 kft/6.95 km/4.3 mi	367

Control Circuitry

The HDSL circuit pack interfaces with the SYSCTL over the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The HDLS provides maintenance elements for reporting the status of the circuit pack and the incoming VT1.5 and HDSL signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the HDSL responds to control signals from the SYSCTL (such as FAULT LED control). The PM processor collects information from the framing circuitry and generates DS1 PM parameters which are stored in the HDSL pack. Access to the PM information is via a faceplate-mounted connector. Each connector supports two RS-232 interfaces (one for each HDSL port). The port is accessed by using a cable supplied with the circuit pack.

Timing Circuitry

The timing distribution to the HDSL contains ten timing signals: two high-speed clocks (active and standby), four VT-G clocks (two active and two standby), and four frame sync signals (two active and two standby).

The HDSL receives from the MXRVO an STS-1 rate high-speed clock that provides the frequency reference for the desynchronizing phase-locked loop. This high-speed reference clock is also used to synthesize the DS1 rate AIS clock source for the DS1 devices and to provide a DS1 test sigtnal.

The HDSL uses the VT-G clocks (6.912 MHz) and the frame sync signals it receives from the MXRVO to clock VT-G data to/from the MXRVO.

Protection Circuitry

Optional 1xN revertive HDSL circuit pack protection is provided, and this protection is independent of the MXRVO circuit pack. The HDSL protection switch points are implemented with on-board relays on the HDSL side and with logic selectors at the VT-G level on the active and standby MXRVO circuit pack. The

SYSCTL controls these relays through two serial interfaces so that a failure of one serial interface to the HDSL does not prevent control of the relays. If +5V power on the HDSL fails, the relays default to the protection state.

Shorting contacts are provided in the HDSL backplane connector so that when the circuit pack is removed, the HDSL cable pairs short through to the protection bus.

CAUTION:
Unused low-speed interface slots within a partially equipped group must be equipped with 177A Retainer cards if HDSL protection is used. Failure to do so may result in corrupted transmission. The HDSL circuit pack can not be mixed with the BBF1/1B/3Bs.

When a HDSL circuit pack is inserted, the relays are in the protection state until the SYSCTL determines that the circuit pack is good.

Fault Detection Circuitry

The HDSL circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the HDSL circuit pack is inserted or recovers from a transient failure. The incoming HDSL signal is monitored for HDSL synchronization errors. Incoming VT1.5 signals are monitored for VT AIS, VT LOP, and yellow.

Loopbacks

The HDSL circuit pack has two types of loopback, terminal and facility. Both types are controlled by the SYSCTL via the intra-shelf control bus. The two loopbacks must be done independently.

The terminal loopback is provided on the HDSL circuit pack for each HDSL interface. The loopback is done inside the VT1.5 processor device and bridges the desynchronizer output signal (transmitted towards the far-end HDSL equipment) back to the DS1 synchronizer input. When the loopback is operated, the DS1 interface device forces AIS towards the far-end HDSL equipment.

The facility loopback is provided for both HDSL signals on the circuit pack. When this loopback is completed, all DS1 clock and data signals received from the VT1.5 processor are simultaneously looped back toward the far-end HDSL equipment. The loopback is a bridge, so the transmitted DS1 signals (towards the high-speed interface) are not affected.

Optional HDSL Settings

All system settings are stored in NVRAM at the unit designated as the system Master. Access to these settings is through the RS-232 faceplate port only. These settings are downloaded to the slave unit at system synchronization and at regular intervals during operation to keep the slave unit updated. The NVRAM is guaranteed to have a capability of 1,000 write cycles. The current state of loopbacks is not considered a system setting, and an active loopback becomes inactive during system resynchronization. Provisioning is not available at either the slave unit or doubler units. The following system settings are available:

- Smartjack Loopback Code Detection: ENABLE or DISABLE
- Special Loopback Code Detection: A1LB, A2LB, A3LB, A4LB, or A5LB
- Errored Second Threshold: NONE, 17, or 170 per 24 hours
- Loopback Time-out: NONE, 20, 60, 120 minutes
- Alarm Notification: ENABLE or DISABLE
- Allocation of DS0 time slots on HDSL loop: ALTERNATE or CONTIGUOUS
- Margin Alarm Threshold: 0-15 dB, 1 dB increments
- DS0 blocking: individually (T1, FT1)
- Fast Loss of Sync Word (LOSW): ENABLE or DISABLE

Performance Monitoring

From any unit in a system, HDSL performance data may be accessed for each HDSL span in the circuit, including up to two HDSL doublers (three total HDSL spans). Access to all PM data is through the faceplate RS-232 port only. Any unit provides access to the following:

- HDSL Span Current Status:
  - Alarms
  - Loopbacks
  - Margins
  - HDSL Pulse Attenuation
  - HDSL clock offset (PPM)
  - 24-hour HDSL Errored Seconds
  - 24-hour HDSL Unavailable Seconds
- HDSL Span History:
  - 15-min, 24-hour, 7-day HDSL Errored Seconds
  - 15-min, 24-hour, 7-day HDSL Unavailable Seconds

- HDSL Alarm History
  - LOSW, HDSL1 - Loss of Sync on Loop 1
  - LOSW, HDSL2 - Loss of Sync on Loop 2
  - ES, HDSL1 - Exceeded ES Threshold on Loop 1
  - ES, HDSL2 - Exceeded ES Threshold on Loop 2
  - Margin, HDSL1 - Exceeded Threshold on Loop 1
  - Margin, HDSL2 - Exceeded Threshold on Loop 2

Power Circuitry

The MXRVO circuit packs supply +5V power to the HDSL circuit packs in the corresponding DS1PM circuit pack groups. These inputs are diode ORed and the output is fused and then filtered before it is used to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

CAUTION:
For power reliability, when a muldem is equipped with HDSL circuit packs, the associated function unit must be equipped with two MXRVO circuit packs.

Figure 7-19 shows HDSL options selectable via S1.

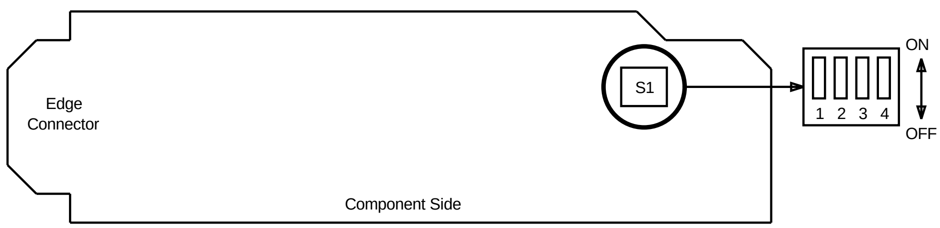


Figure 7-19. HDSL DIP Switch Settings

HDSL Options		DIP Switch Settings			
		HDSL Port #1		HDSL Port #2	
		S1-1	S1-2	S1-3	S1-4
HDSL START-UP	Master	—	OFF	—	OFF
	Slave	—	ON	—	ON
HDSL MANAGEMENT	Local	OFF	—	OFF	—
	Through	ON	—	ON	—

HDSL Quick Reference Summary

Transmission Functions

Major transmission functions of the HDSL circuit pack are as follows:

- Multiplexes four VT1.5 SPEs to a byte-interleaved VT-G signal
- Provides the VT-G signal to a MXRVO/STS1E circuit pack
- Inserts VT path overhead
- *PairGain* compatible, 4-wire HDSL
- Bi-directional transmission port of 1.544 Mb/s over twisted pair
- Loopback options
- Receives up to two HDSL formatted signals
- Receives a SONET VT-G clock and frame synchronizing signals from its associated MXRVO/STS1E
- Demultiplexes the VT-G into four VT1.5 signals
- Terminates VT path and the embedded DS1 signal from each VT1.5 SPE
- Desynchronizes the DS1 signals and maps directly into *PairGain* HDSL
- Provides HDSL to VT1.5 mapping
- Recovers DS1 clock and NRZ data from each HDSL payload
- Synchronizes and maps each data signal to a VT1.5 SPE.

Control Functions

The major control functions of the HDSL circuit pack are as follows:

- Protection switching for MXRVO/STS1E circuit packs
- VT path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Monitors a DS1 signal with SF or ESF frame format and generates PM data

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Monitors DS1 signal for near-end and far-end performance
- Detects VT path AIS
- Inserts DS1 AIS toward fiber and far-end HDSL equipment

- Inserts and detects VT path yellow signal.

BBF9/BBF10 IMA LAN Circuit Pack Description

Purpose of Circuit

The BBF9 electrical 802.3 compliant LAN port circuit pack provides a low-speed interface between a single 10/100 BaseT LAN port and from 1 to 8 DS1 signals. The BBF10 provides the same function as the BBF9, but provides a 100 BaseFX LAN port.

IMA LAN Faceplate Indicator

The BBF9/BBF10 circuit pack FAULT indicator is shown in Figure 7-20. This red FAULT LED is lit by the SYSCTL on detection of a IMA LAN circuit pack failure. In the event of an incoming LAN signal failure, this LED flashes on and off.

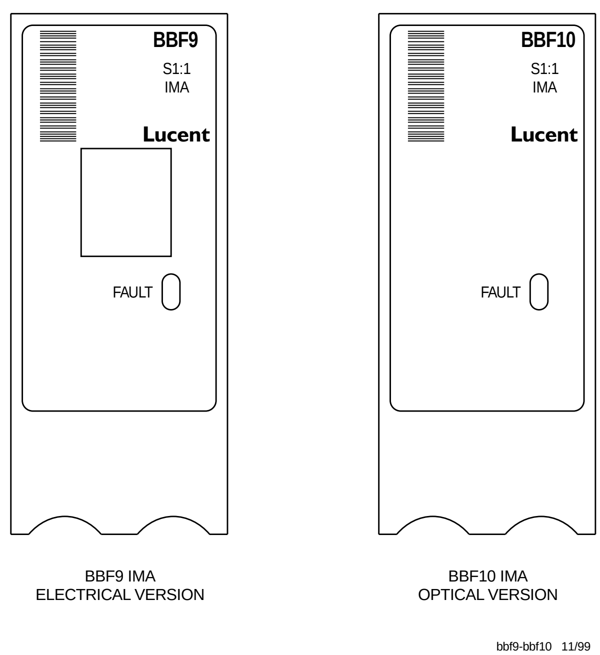


Figure 7-20. BBF9/BBF10 IMA LAN Circuit Pack

LAN Interface (BBF9)

- Electrical Specification:

  The BBF9 LAN circuit pack provides a single 10/100BaseT, IEEE 802.3 compliant interface. The LAN port performs protocol transparent filtering and bridging of incoming MAC frames. MAC frames with a destination address on the local bus are filtered by the BBF9 to prevent unnecessary transmission of frames over the wide area network (WAN). The LAN interface autonegotiates mode (full/half duplex) and speed (10/100 Mb/s) when interfacing with other 802.3 compliant devices over twisted pair media. The circuit pack occupies two adjacent low-speed slots and uses from one to 8 DS1 signals to provide native mode LAN transport through a SONET WAN.

- LAN port:
  - 10/100BaseT IEEE 802.3 compliant
  - RJ-45 faceplate connector
  - Cat-3 or CAT-5 UTP (unshielded twisted pair) medium
  - Buffering .5 MByte for each direction

- Format Specification:

  The LAN interface converts incoming MAC frames to an ATM cell format using ATM adaptation layer 5 (AAL5) encapsulation as specified in IETF RFC-1483. ATM cells are distributed in round robin order on 1 to 8 ESF formatted DS1 signals using the ATM forum IMA Specification Version 1.1 for inverse multiplexing. The DS1 signals are mapped into asynchronous VT1.5 signals, four of which are muxed to create a VT-G for transport through a SONET network. Two VT-G signals are sent to the MXRVO for multiplexing into an STS-1. The circuit pack can compensate for up to 50 ms of differential delay among the 8 DS1s and uses a single IMA group with one ATM virtual channel (VC). The following provisioning options are provided:

  - AAL5 Protocol - VC multiplex or LLC encapsulation (Bridged)
  - MAC Frame Check Sequence (FCS) Preservation - enable or disable
  - ATM Virtual Path ID and Virtual Channel ID
  - IMA group ID
  - IMA Frame Length - 32, 64, 128, 256
  - ATM scrambler - on/off
  - ATM polynomial - on/off.

  The IMA link IDs are assigned automatically by the system in the range 0 to 7. The IMA protocol operates in symmetric configuration with common clock.

- Alarms:

  Local LAN port failures are detected by monitoring for the presence of either MAC frames or Link Pulses per IEEE 802.3. From the SONET direction, failures are detected by monitoring for VT1.5 (AIS, LOP), DS1 LOF, Loss of IMA frame, Loss of IMA Delay Synchronization (LODS), Loss of Cell Delineation (LCD) and excessive AAL5 CRC errors. The alarm level for a local LAN port failure is user provisionable (Major, Minor, Not Alarmed).

LAN Interface (BBF10)

- Electrical Specification:

  The BBF10 LAN circuit pack provides a single 100BaseFX, IEEE 802.3 compliant interface. The LAN port performs protocol transparent filtering and bridging of incoming MAC frames. MAC frames with a destination address on the local bus are filtered by the BBF10 to prevent unnecessary transmission of frames over the wide area network (WAN). The LAN interface autonegotiates mode (full/half duplex) and speed (100 Mb/s) when interfacing with other 802.3 compliant devices over fiber. The circuit pack occupies two adjacent low-speed slots and converts an optical signal to from one to 8 DS1 signals to provide native mode LAN transport through a SONET WAN.

- LAN port:
  - 100BaseFX IEEE 802.3 compliant
  - SC optical connector
  - 1300 nm nominal center wavelength
  - 62.5 micron multimode fiber
  - Buffering .5 MByte for each direction
  - See Table 10-2 for optical characteristics.

- Format Specification:

  The LAN interface converts incoming MAC frames to an ATM cell format using ATM adaptation layer 5 (AAL5) encapsulation as specified in IETF RFC-1483. ATM cells are distributed in round robin order on 1 to 8 ESF formatted DS1 signals using the ATM forum IMA Specification Version 1.1 for inverse multiplexing. The DS1 signals are mapped into asynchronous VT1.5 signals for transport through a SONET network. The circuit pack can compensate for up to 50 ms of differential delay among the 8 DS1s and uses a single IMA group with one ATM virtual channel (VC). The following provisioning options are provided:

  - AAL5 Protocol - VC multiplex or LLC encapsulation (Bridged)

— MAC Frame Check Sequence (FCS) Preservation - enable or disable
— ATM Virtual Path ID and Virtual Channel ID
— IMA group ID
— IMA Frame Length - 32, 64, 128, 256
— ATM scrambler - on/off
— ATM polynomial - on/off.

The IMA link IDs are assigned automatically by the system in the range 0 to 7. The IMA protocol operates in symmetric configuration with common clock.

■ Alarms:

Local LAN port failures are detected by monitoring for the presence of either MAC frames or Link Pulses per IEEE 802.3. From the SONET direction, failures are detected by monitoring for VT1.5 (AIS, LOP), DS1 LOF, Loss of IMA frame, Loss of IMA Delay Synchronization (LODS), Loss of Cell Delineation (LCD) and excessive AAL5 CRC errors. The alarm level for a local LAN port failure is user provisionable (Major, Minor, Not Alarmed).

Control Circuitry

The IMA LAN circuit pack interfaces with the SYSCTL via the intra-shelf control bus. It provides maintenance elements for reporting the status of the circuit pack and the incoming VT1.5 signal, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). The status of the 10/100 BaseT or 100BaseFx LAN signal is also reported as well as data protocol errors at the MAC, ATM and AAL5 levels. These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the DS1 responds to control signals from the SYSCTL (such as FAULT LED control).

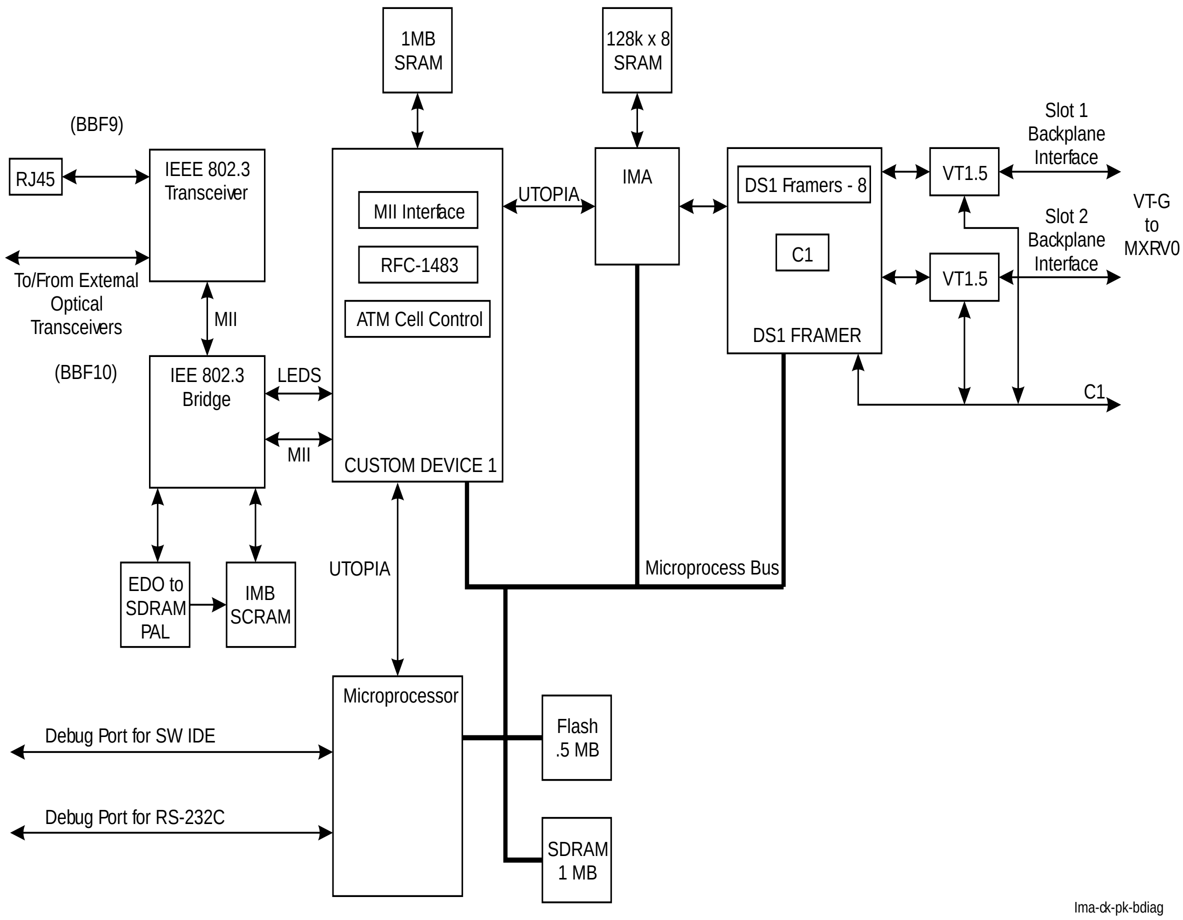


Figure 7-21. BBF9/BBF10 IMA LAN Circuit Pack Block Diagram

Timing Circuitry

The timing distribution to the IMA LAN contains timing signals: four high-speed clocks (active and standby), eight VT-G clocks (four active and four standby), and eight frame sync signals (two active and two standby).

Fault Detection Circuitry

The DS1 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the DS1 circuit pack is inserted or recovers from a transient failure. The incoming DS1 signals are monitored for DS1 OOF. Incoming VT1.5 signals are monitored for VT AIS, VT LOP, and yellow.

Loopbacks

The IMA LAN circuit pack has a DS1 terminal loopback controlled by the SYSCTL via the intra-shelf control bus.

The terminal loopback is provided on the circuit pack for each DS1. The loopback is done inside the MUX/DEMUX/DESYNC device and bridges the desynchronizer output signal (transmitted towards the DSX-1) back to the DS1 synchronizer input.

Performance Monitoring

In addition to DS1 path and VT1.5 path performance monitoring, the BBF9/BBF10 circuit pack supports performance monitoring of data flow in both directions. The parameters supported are:

- Transmit MAC packets forwarded (towards the WAN)
- Transmit MAC packets discarded
- Receive MAC packets forwarded (towards the LAN)
- Receive MAC packets discarded.

In addition, to monitor the efficiency of the IMA link the following parameters are supported:

- Transmit ATM cells total
- Transmit ATM idle cells
- Receive ATM cells total
- Received ATM cells Idle.

Software Download

The BBF9/BBF10 support software download via a local CIT or via the DCC.

Power Circuitry

The MXRVO circuit packs supply +5 V power and (-48 V for BBA2B) to the circuit packs in the corresponding DS1 circuit pack groups. These two inputs are diode ORed and the output is fused and then filtered before it is used to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

IMA LAN Power Settings

Take care to avoid damaging the LEDs that protrude through the opening in the faceplate of the **IMA** LAN circuit pack.

The only hardware option settings on **IMA** LAN circuit packs are the power settings (located on the bottom circuit board) shown in Figure 7-1. If there are other jumpers on the circuit pack similar to the power jumpers, they are factory test points and should be ignored.

Refer to Figure 7-1 and Table A and set power jumpers.

Table A – IMA LAN Power Settings

Corresponding FUNCTION UNITS	IMA Power Setting	
MXRVO Circuit Pack	+5 V	–48 V
BBG2 MXRVO	X	
BBG2B MXRVO		X

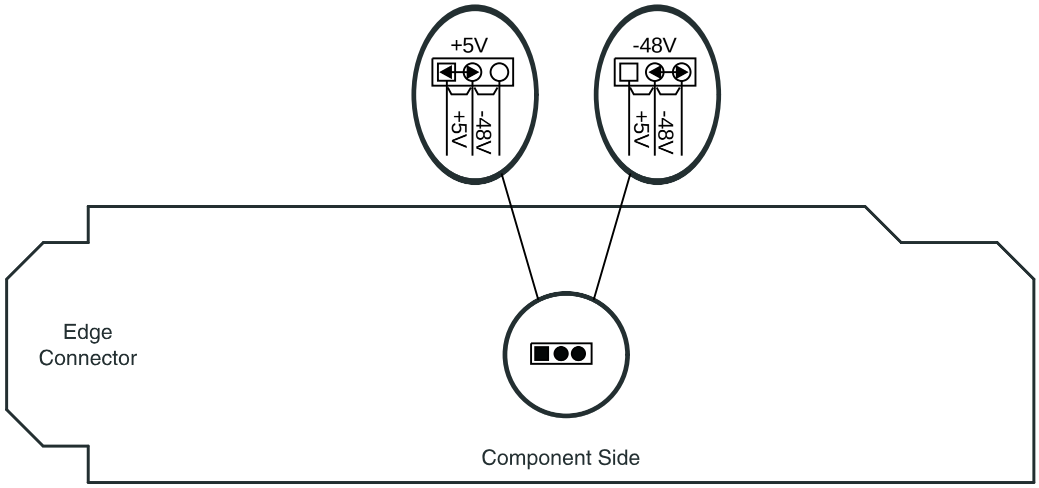


Figure 7-22. IMA LAN Power Settings

BBG2/22G2B MXRVO Circuit Pack Description

Purpose of Circuit

The virtual tributary (VT) to optical multiplexer (MXRVO) circuit pack interfaces between the DS1 and OLIU circuit packs.

MRXVO Faceplate Indicators

The MXRVO circuit pack faceplate indicators are shown in Figure 7-23.

The red FAULT LED lights on detection of circuit pack hardware failure.

The green ACTIVE LED lights when the circuit pack is active (carrying service).

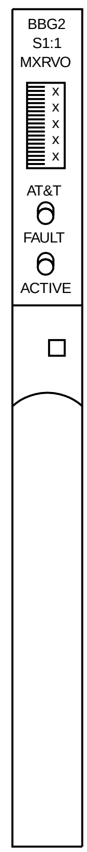


Figure 7-23. BBG2 MXRVO Circuit Pack

General Description of Operation

The MXRVO circuit pack accepts eight VT-G signals from DS1 circuit packs, selects seven, combines them to form an STS-1 signal, inserts STS-1 path overhead, and sends the resulting STS-1 signal to active and standby OLIUs.

The MXRVO selects one of two received STS-1 signals from the OLIUs, terminates STS-1 path overhead, and demultiplexes the STS-1 into seven VT-G signals.

The MXRVO interfaces with the OLIU at the STS-1 rate, to eight low-speed DS1 circuit packs at the VT-G rate, and with the SYSCTL circuit pack.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. In the transmit direction (from the DS1 low-speed packs), the VT-G signals from each DS1 are combined into an STS-1 signal (see Figure 7-24). The STS-1 path overhead and pointer are inserted, and the signal is transmitted to the OLIU.

Receive Direction. In the receive direction (from the OLIU), the STS-1 path is terminated. Then, the STS-1 signal is split into seven VT-G signals for transmission to the DS1 circuit packs.

Control Circuitry

The MXRVO circuit pack interfaces with the SYSCTL via the intra-shelf control bus. The MXRVO provides maintenance elements for reporting the status of the circuit pack and the incoming STS-1 and VT-G signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the MXRVO responds to control signals from the SYSCTL (such as ACTIVE and FAULT LED controls).

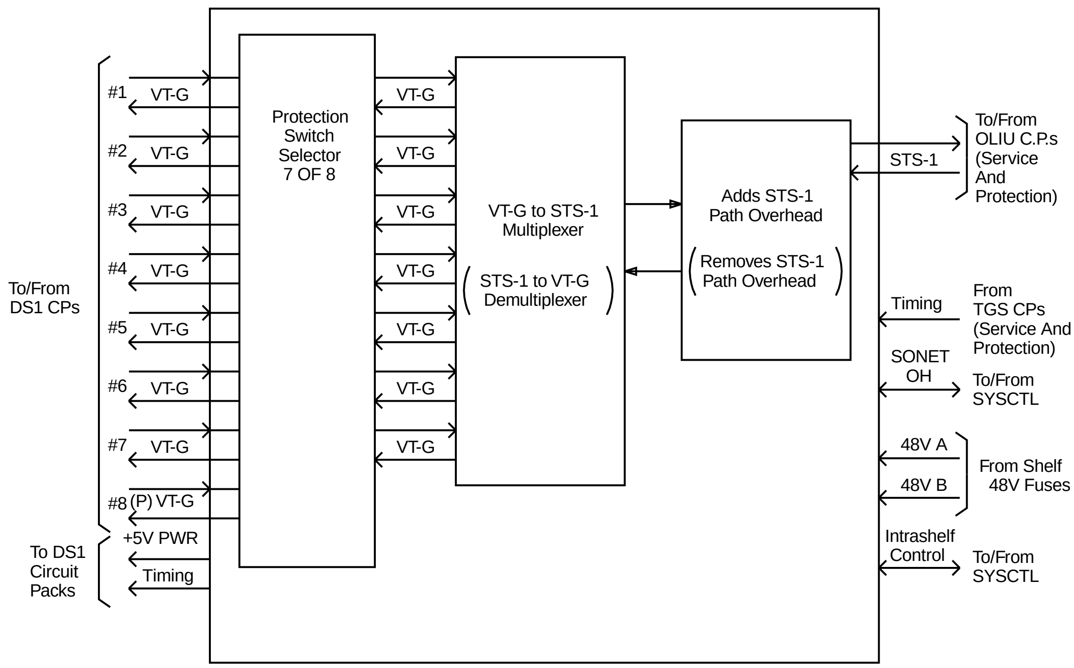


Figure 7-24. BBG2 MXRVO Circuit Pack Block Diagram

Timing Circuitry

The MXRVO receives STS-1 timing signals which are traceable to the STS-1 clocks generated by the TG circuit packs.

The MXRVO can select between the supplied timing signals as requested by the SYSCTL via the intra-shelf control bus. The selected timing signals are used to time both the receive and transmit directions of the MXRVO.

Protection Circuitry

The MXRVO protection switch points reside on the OLIU and on each low-speed circuit pack for the STS-1 and VT-G signals, respectively. Optional 1x1 nonrevertive MRXVO circuit pack protection is provided and is independent of the OLIU and low-speed DS1 circuit packs.

The MXRVO provides protection switching for the VT-G side of the low-speed circuit packs. The MXRVO can be requested by the SYSCTL through the intra-shelf control bus to replace any of the seven service VT-G inputs with the protection VT-G input. The MXRVO can be requested by the SYSCTL to bridge any of the seven VT-G service outputs to the protection output.

The MXRVO provides SYSCTL-controlled selectors for the STS-1 side of the main OLIU protection switch.

The MXRVO provides selectors for an STS-1 timing switch. The timing switch may be performed autonomously by the MXRVO based on the quality of the received timing signals or by the SYSCTL.

Fault Detection Circuitry

The MXRVO circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and any errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the MXRVO circuit pack is inserted or recovers from a transient failure.

Performance Monitoring

The MXRVO circuit pack provides PM circuitry for STS path parameters derived from B3 coding violations.

Power Circuitry

The MXRVO provides power to the corresponding DS1 low-speed circuit packs associated with the function unit group that the MXRVO is in. It receives two sources of –48 volts which are diode ORed, fused, and filtered prior to conversion into a +5 volt source for use by the MXRVO and the low-speed DS1 circuit packs. A failure of the fuse or converter causes the red FAULT LED to light.

CAUTION:
For power reliability, when a muldem is equipped with DS1PM circuit packs, the associated function unit must be equipped with two MXRVO/STS1E circuit packs.

MXRVO Quick Reference Summary

Transmit Functions

The major transmit functions of the MXRVO are as follows:

- Selects and multiplexes seven VT-G channels into one STS-1 SPE
- Adds STS-1 path overhead

- Provides STS-1 signal to main OLIU circuit packs.

Receive Functions

The major receive functions of the MXRVO are as follows:

- Terminates STS-1 path
- Demultiplexes the STS-1 SPE into seven VT-G signals
- Supplies the seven VT-G signals to the DS1 circuit packs
- Provides timing signals to DS1 circuit packs.

Control Functions

Major control functions are as follows:

- STS-1 path overhead processing
- Protection switching for OLIU circuit pack protection
- Protection switching for DS1 circuit pack protection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Inserts VT path AIS
- Inserts and detects STS-1 path yellow signals
- Inserts VT path unequipped signals.

BBG4/BBG4B DS3 Circuit Pack Description

Purpose of Circuit

The BBG4/BBG4B DS3 circuit pack provides a low-speed interface between asynchronous DS3-rate signals and SONET STS-1 signals. The BBG4B DS3 provides the same functions as the BBG4 DS3 and can be used in place of the BBG4 DS3 in all applications. In addition, the BBG4B DS3 has enhanced DS3 PM capabilities.

BBG4/BBG4B DS3 Faceplate Indicators

The BBG4/BBG4B DS3 circuit pack faceplate indicators are shown in Figure 7-25.

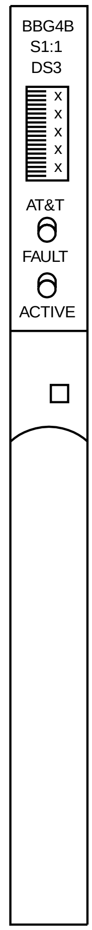


Figure 7-25. BBG4B DS3 Circuit Pack

The red FAULT LED lights by the SYSCTL on detection of BBG4/BBG4B DS3 circuit pack failure. In the event of an incoming DS3 signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

General Description of Operation

The BBG4/BBG4B DS3 circuit pack provides bidirectional transport of one DS3 signal through DDM-2000 OC-3 in either clear channel (CC) mode, violation monitor and removal (VMR) mode, or violation monitor (VM) mode, by mapping the DS3 into an STS-1 signal. The BBG4/BBG4B DS3 performs maintenance and provisioning functions associated with the STS-1 and DS3 signals and provides access to the STS-1 path overhead. It interfaces to the OLIU at the STS-1 rate, to the DSX-3, and to the SYSCTL, and receives timing signals traceable to the TG circuit pack. When provisioned for the CC mode, the DS3 can transport any DS3 rate signal that meets specified electrical interface requirements. When provisioned for the VMR or VM mode, the DS3 signal must meet both electrical and DS3 frame format requirements.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-26 provides an overall block diagram of the BBG4/BBG4B DS3 circuit pack. The transmit direction is the direction towards the STS-1 signal, and receive direction refers to the direction towards the DSX-3. In the transmit direction, the BBG4/BBG4B DS3 receives an incoming B3ZS encoded DS3 signal from the DSX-3. A closed protection relay contact routes the DS3 to a circuit that splits the signal and sends one output to the companion (standby) circuit pack and the other to its own receiver. The BBG4/BBG4B DS3 receiver performs equalization and clock recovery. The MUX circuitry performs B3ZS decoding, optional automatic DS3 AIS insertion, and a provisionable VMR function, then synchronizes and maps the DS3 to the STS-1 rate. The DS3 signal is then synchronized to the STS-1 payload rate, STS-1 path overhead is inserted, and an STS-1 rate signal is transmitted to an OLIU pair.

Receive Direction. The BBG4/BBG4B DS3 receives STS-1 data from both the active and standby OLIUs, selects one STS-1, performs pointer interpretation, processes and removes the path overhead, desynchronizes the embedded DS3, provides a provisionable VMR function, and then B3ZS encodes the signal for transmission to the DSX-3. A jumper allows the user to insert or remove an LBO network (225 ft. of 734A-type cable equivalent) to provide the required signal level and shape at the DSX-3.

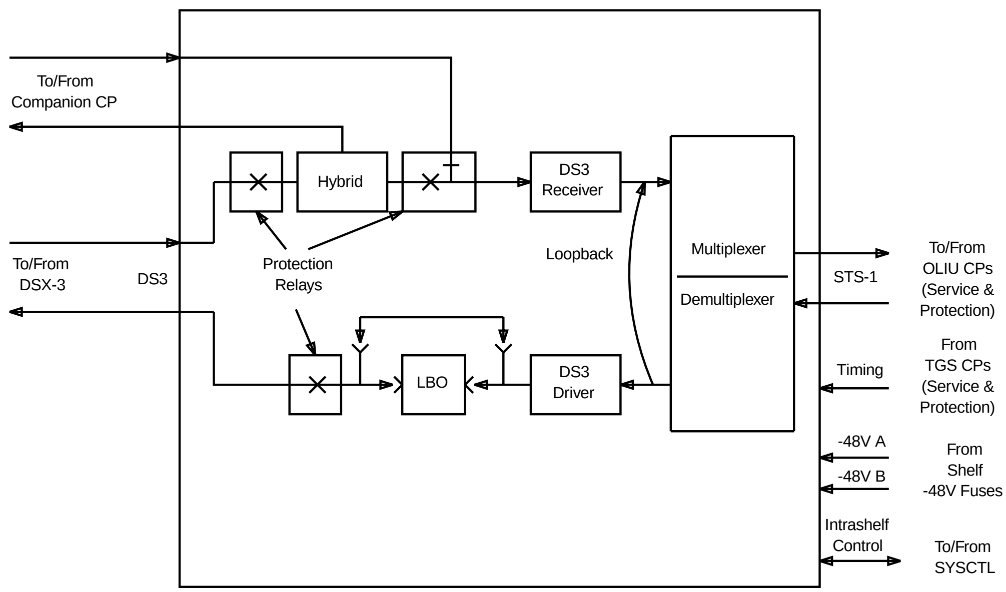


Figure 7-26. BBG4/BBG4B DS3 Circuit Pack Block Diagram

VMR Function

Before the DS3 signal is B3ZS-encoded (receive) or decoded (transmit), a VMR function can be provisioned via the control circuitry for one of three possible modes. These three modes are as follows:

- VMR with DS3 AIS insertion—default
- VM without removal of violations but with AIS insertion
- No violation monitoring CC mode with options for
  - — AIS insertion
  - — No AIS insertion.

Control Circuitry

The BBG4/BBG4B DS3 circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The BBG4/BBG4B DS3 provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and DS3 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG4/BBG4B DS3 responds to control signals from the SYSCTL (such as active and fault LED controls).

Timing Circuitry

The BBG4/BBG4B DS3 derives its timing information from the recovered DS3 clock from the DSX-3 incoming signal. In the transmit direction, a 44.736 MHz clock is recovered from the incoming DS3 signal and is used to recover DS3 data. In the receive direction, a smoothed 44.736 MHz clock is generated by a phase-locked loop to accompany the DS3 signal extracted from the STS-1 payload.

In addition to the recovered DS3 clock, the BBG4/BBG4B DS3 circuit pack requires STS-1 timing supplied, via the circuit pack edge connector, from the backplane.

Protection Circuitry

Optional 1x1 nonrevertive BBG4/BBG4B DS3 circuit pack protection is provided. Switch points for the STS-1 side of the DS3 are located on the OLIU circuit packs. Switch points for the DS3 side are implemented with relays on the BBG4/BBG4B DS3 circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL, via the control interfaces. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the DS3 side, a single DS3 input from a DSX-3 is sent to both the active and standby BBG4/BBG4B DS3 circuit packs. Only the active unit selects the DS3 input. The SYSCTL supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the DS3 input signal and sends it to the standby unit and to its own receiver. To implement a protection switch on the DS3 side, the SYSCTL switches the relays on each unit to their opposite state.

When a BBG4/BBG4B DS3 is removed, shorting contacts on the backplane connector operate so that the DS3 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

The BBG4/BBG4B DS3 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG4/BBG4B DS3 circuit pack is inserted or recovers from a transient failure.

The incoming DS3 signal is monitored for bipolar threshold crossings in excess of 10^{-3} or 10^{-6}, LOS, DS3 OOF, and DS3 AIS. Incoming STS-1 signals are monitored for STS AIS, STS LOP, and yellow and are also monitored for DS3 OOF and AIS.

Loopbacks

Two loopbacks are provided on the BBG4/BBG4B DS3. The terminal loopback bridges the DS3 desynchronizer output signal (transmitted towards the DSX-3) back into the DS3 synchronizer input. Operation of the loopback does not affect the signal transmitted to the DSX-3. The facility loopback bridges the STS-1 output signal to the OLIU back towards the DSX-3. Operation of this loopback does not affect the signal transmitted to the fiber. Both loopbacks are controlled by the SYSCTL through the intra-shelf control bus.

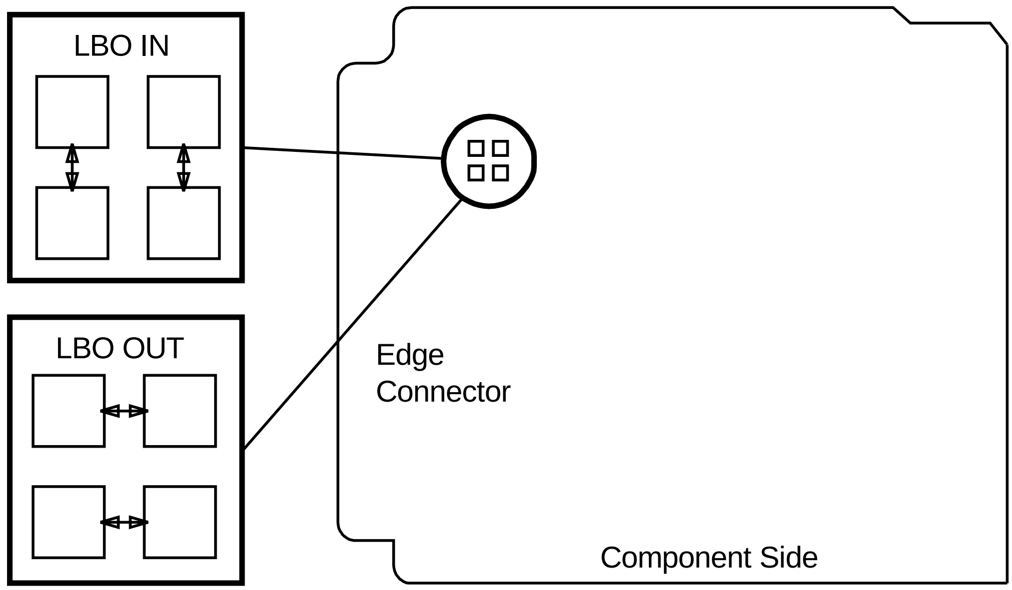
Performance Monitoring

The BBG4/BBG4B DS3 circuit pack provides PM circuitry for the following performance parameters:

- STS path parameters derived from B3 coding violations
- DS3 path parameters derived from P-bit coding violations
- DS3 path parameters derived from frame and multiframe (F&M) bit errors
- DS3 line errors based on B3ZS violations (BBG4B only)
- DS3 P-bit and F&M bit PM for both directions of transmission (BBG4B only)
- C-bit parity and FEBE performance monitoring for both directions of transmission (BBG4B only).

BBG4/BBG4B DS3 Hardware Settings

The location of the BBG4/BBG4B DS3 circuit pack LBO jumpers is shown in Figure 7-27. The BBG4/BBG4B DS3 LBO settings are shown in the table.



BBG4/BBG4B DS3 LBO Settings

Cable Length (Ft)		LBO Setting
735A Cable	734D Cable	
0 to 125 >125 to 250	0 to 225 >225 to 450	LBO IN LBO OUT

Figure 7-27. BBG4/BBG4B DS3 Line Build-Out (LBO) Jumpers

Power Circuitry

The BBG4/BBG4B DS3 circuit pack receives two sources of –48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG4/BBG4B DS3 Quick Reference Summary

Transmit Functions

The BBG4/BBG4B DS3 transmit functions are as follows:

- Receives a B3ZS-encoded DS3 signal from a DSX-3
- Recovers DS3 clock and NRZ data
- Optionally checks and/or corrects P-bit parity errors
- Synchronizes the data signal to STS-1 signal rate
- Inserts STS-1 path overhead
- Provides the STS-1 signal to the OLIU circuit packs.

Receive Functions

The following receive functions are performed by the BBG4/BBG4B DS3 circuit pack:

- Desynchronizes the incoming STS-1 signal
- Terminates the STS-1 path
- Optionally checks and/or corrects P-bit parity errors
- B3ZS encodes the outgoing DS3 signal
- Pre-equalizes the DS3 signal (with LBO) and transmits it to a DSX-3.

Control Functions

The major control functions are as follows:

- Protection switching for BBG4/BBG4B DS3 circuit packs
- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Detects STS-1 path unequipped signal coming from the fiber
- Inserts DS3 AIS toward the fiber and DSX-3
- Detects DS3 AIS coming from the fiber
- Inserts and detects STS-1 path yellow signal to/from the fiber
- Detects DS3 OOF from the fiber
- Detects DS3 B3ZS violation threshold crossings from the DSX-3
- Inserts and detects STS-1 path trace (BBG4B only).

BBG6 STS1E Circuit Pack Description

NOTE:
All references to “high-speed” applications of the BBG6 STS1E circuit pack are not applicable to DDM-2000 OC-3 Release 13.0.

Purpose of Circuit

The STS1E circuit pack provides an interface between EC-1 and DS1-rate (high-speed) or EC-1 and OC-3-rate (low-speed) applications.

STS1E Faceplate Indicators

The STS1E circuit pack faceplate indicators are shown in Figure 7-28.

The red FAULT LED is lighted by the SYSCTL on detection of STS1E circuit pack failure. In the event of an incoming signal failure, this LED flashes on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

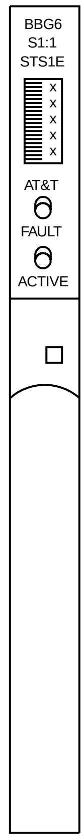


Figure 7-28. BBG6 STS1E Circuit Pack

General Description of Operation

The STS1E circuit pack provides bidirectional transport of one EC-1 signal through the DDM-2000 OC-3 Multiplexer and has two operating modes, EC-1 low-speed (Figure 7-29a) and EC-1 high-speed (Figure 7-29b).

In the low-speed mode, the STS1E circuit pack interfaces with the OLIU circuit pack at the STS-1 rate (51.84 Mb/s). In the high-speed mode, the STS1E circuit pack interfaces with the DS1/DS1PM circuit pack at the VT-G rate (6.192 Mb/s).

The STS1E circuit pack interfaces with the SYSCTL for maintenance, provisioning, and PM functions and interfaces to the TG circuit pack for timing.

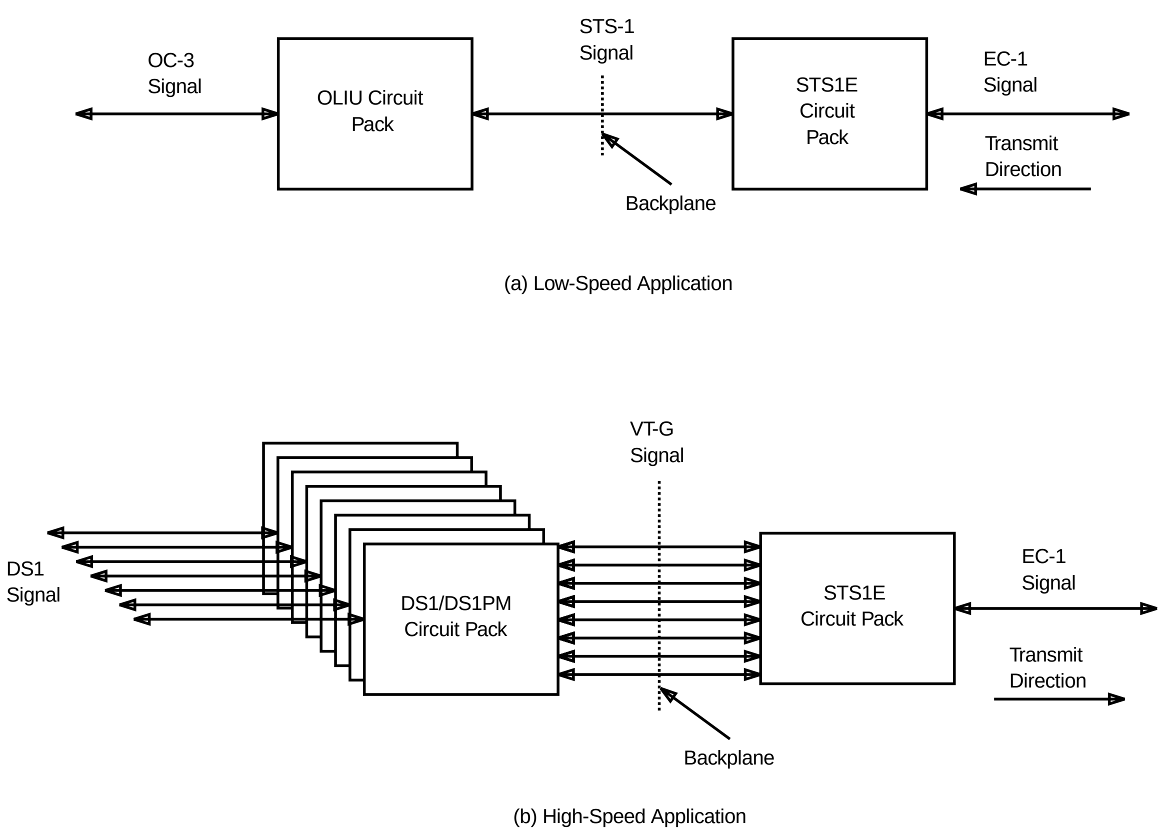
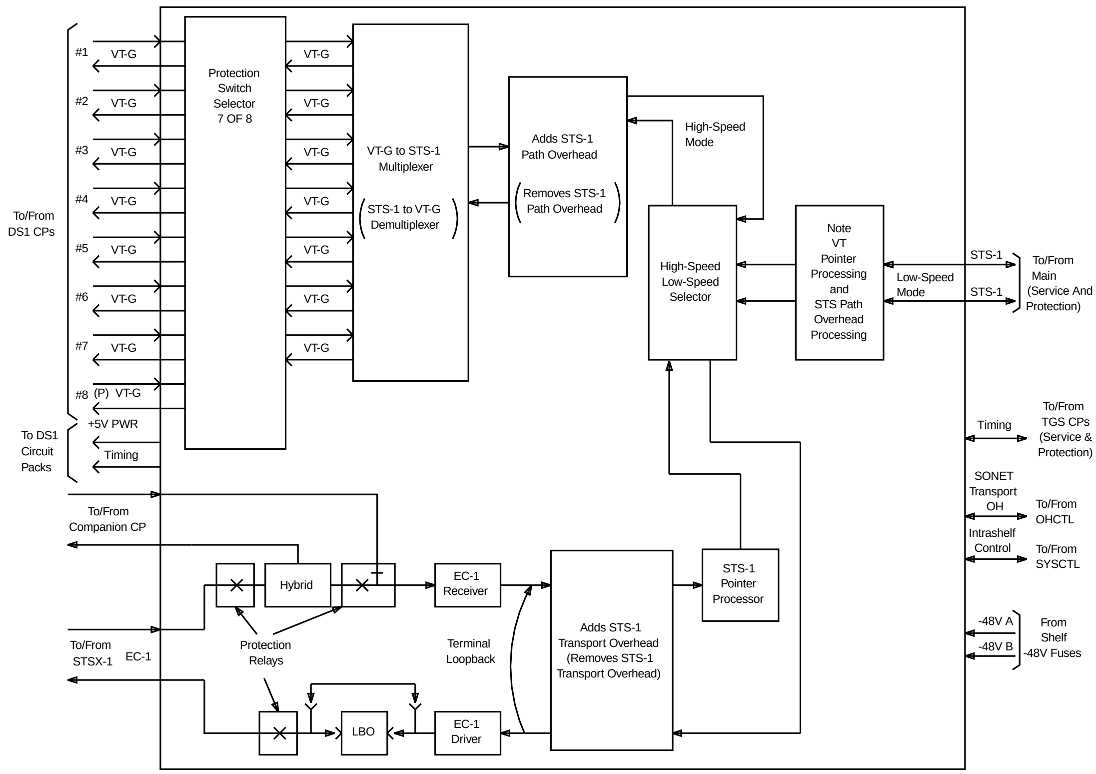


Figure 7-29. STS1E Circuit Pack Low-Speed and High-Speed Modes



Note: Applicable in the low-speed mode with VT cross-connects.

Figure 7-30. BBG6 STS1E Circuit Pack Block Diagram

Detailed Description of Operation

Figure 7-30 is a block diagram of the STS1E circuit pack. The STS1E circuit pack has two modes of operation determined by the setting of a hardware switch, VT-G to and from EC-1 (high-speed mode) or STS-1 to and from EC-1 (low-speed mode).

In the high-speed mode, the STS1E circuit pack receives eight incoming VT-G channels (seven service and one protection) from the eight low-speed DS1/ DS1PM circuit packs and selects seven channels. These seven channels, along with STS-1 path overhead, transport overhead, a valid STS-1 pointer, and parity are byte-interleaved into an STS-1 formatted signal and transmitted as an EC-1 signal. In the receive direction, the incoming EC-1 signal is demultiplexed into seven VT-G signals.

In the low-speed mode, the STS1E circuit pack selects an STS-1 signal, either service or protection, from the OLIU circuit pack backplane and sends the signal to the EC-1 interface (receive direction). In the transmit direction, the incoming EC-1 signal is processed and routed to the backplane as an STS-1 signal.

In the low-speed mode, the STS1E circuit pack can be configured for a VT-based STS-1. In this case, the STS-1 path overhead (POH) for the EC-1 is terminated. For non-VT-based STS-1s, the STS-1 path is sent through the STS1E circuit pack unaffected.

Regardless of the operating mode, the STS1E circuit pack:

- Inserts transport overhead
- Provides scrambling and descrambling
- Provides B3ZS encoding and decoding
- Provides waveshaping
- Provides optional LBO for transmission to the STSX-1.

Control Circuitry

The STS1E circuit pack interfaces with the SYSCTL and OHCTL circuit packs.

The SYSCTL receives maintenance elements for reporting the status of the circuit pack, the status of the incoming signal, and inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used for fault detection and isolation. Conversely, the STS1E circuit pack responds to signals from the SYSCTL including protection switching and LED control commands.

The STS1E circuit pack accesses the SONET transport overhead and routes it, via the transport overhead channel interface, to the OHCTL.

Timing Circuitry

The STS1E circuit pack receives timing signals which are traceable to the clocks generated by the TG circuit packs.

The STS1E circuit pack can select between the supplied timing signals as requested by the SYSCTL via the intra-shelf control bus. The selected timing signals are used to time both the receive and transmit directions of the STS1E circuit pack.

Protection Circuitry

Optional 1x1 nonrevertive STS1E circuit pack protection is provided.

In the high-speed mode, the STS1E provides protection switching for the VT-G side of the low-speed circuit packs. The STS1E can be requested by the SYSCTL through the intra-shelf control bus to replace any of the seven service VT-G inputs with the protection VT-G input. The STS1E can be requested by the SYSCTL to bridge any of the seven VT-G service outputs to the protection output. In the low-speed mode, the STS1E provides SYSCTL-controlled selectors for the STS-1 side of the main OLIU protection switch.

STS1E circuit pack protection switch points for the STS-1 side are located on the OLIU circuit packs. Switch points for the EC-1 side are implemented with relays on the STS1E circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL, via the control interface. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the EC-1 side, a single STS-1 input from an STSX-1 is sent to both the active and standby STS1E circuit packs. Only the active unit selects the STS-1 input. The SYSCTL supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the STS-1 input signal and sends it to the standby unit and to its own receiver. To implement a protection switch on the EC-1 side, the SYSCTL switches the relays on each unit to their opposite state.

When an STS1E is removed, shorting contacts on the backplane connector operate so that the STS-1 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

The STS1E circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the STS1E circuit pack is inserted or recovers from a transient failure.

Loopbacks

One loopback is provided on the STS1E circuit pack. This terminal loopback loops the EC-1 output signal transmitted towards the STSX-1 back into the STSX-1 transport overhead processor input.

Performance Monitoring

The STS1E provides PM circuitry for the following performance parameters:

- Line parameters derived from B2 coding violations
- STS-1 parameters derived from B3 coding violations.

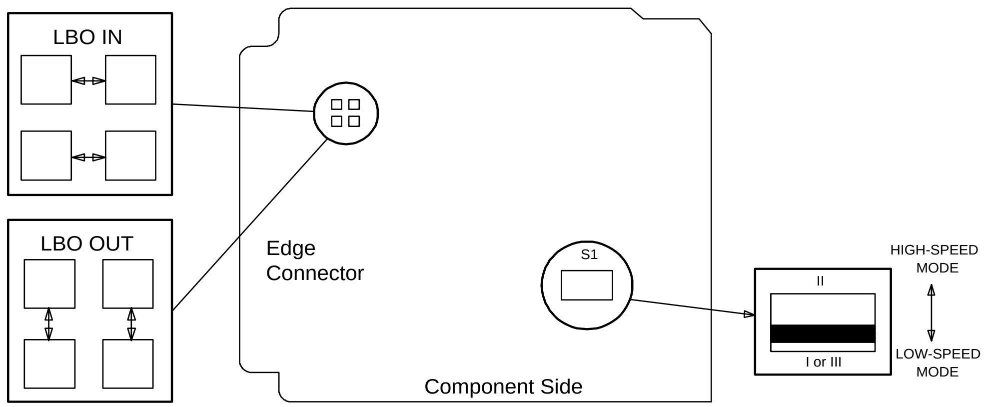
Power Circuitry

The STS1E receives two sources of –48 volts that are diode ORed, fused, and filtered before being converted to +5 volts to power the circuit pack and +5.3 volts to power the DS1/DS1PM circuit packs in the low-speed slots.

CAUTION:
For power reliability, when a muldem is equipped with DS1PM circuit packs, the associated function unit must be equipped with two MXRVO/STS1E circuit packs.

STS1E Hardware Settings

The location of the STS1E circuit pack LBO jumpers and mode switch are shown in Figure 7-31. The STS1E LBO settings are shown in the table.



STS1E LBO Settings

Cable Length (Ft)		LBO Setting
735A Cable	734D Cable	
0 to 125 >125 to 250	0 to 225 >225 to 450	LBO IN LBO OUT

Figure 7-31. BBG6 STS1E Line Build-Out (LBO) Jumpers and Mode Switch

STS1E Quick Reference Summary

Transmit Functions (High-Speed Mode)

The STS1E transmit (high-speed mode) functions are as follows:

- Selects VT-Gs from DS1/DS1PM circuit packs, multiplexes VT-Gs with protection selection into a SPE, and adds STS-1 path overhead
- Adds SONET transport overhead, B3ZS encodes and scrambles data, converts to bipolar format, and sends it to the STSX-1.

Transmit Functions (Low-Speed Mode)

The STS1E transmit (low-speed mode) functions are as follows:

- Receives B3ZS-encoded and scrambled EC-1 (STS-1) signal from STSX-1
- B3ZS decodes and descrambles the signal and removes transport overhead
- Processes STS-1 pointers and frame synchronizes the signal
- Optionally provides 6.48 Mb/s reference clock for TG circuit packs
- Terminates STS-1 path (VT-based only).

Receive Functions (High-Speed Mode)

The STS1E receive functions (high-speed mode) are as follows:

- Receives B3ZS-encoded and scrambled EC-1 signal from STSX-1
- B3ZS decodes and descrambles signal and removes transport overhead
- Processes STS-1 pointers and frame synchronizes the STS-1 signal
- Optionally provides 6.48 Mb/s reference clock for TG circuit packs
- Terminates STS-1 path
- Demultiplexes the SPE into seven VT-G signals and supplies VT-G signals to the DS1/DS1PM circuit packs.

Receive Functions (Low-Speed Mode)

The STS1E receive (low-speed mode) functions are as follows:

- Selects an STS-1 input from the OLIU circuit pack and adds transport overhead
- B3ZS encodes and scrambles data, converts to bipolar format, and sends it to the STSX-1.

Control Functions

The major control functions are as follows:

- STS-1 path overhead processing
- Protection switching for OLIU and DS1/DS1PM circuit packs
- Protection switching for TG circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions (High-Speed Mode)

The STS1E major maintenance signal functions (high-speed mode) are as follows:

- Detects STS-1 path AIS
- Detects VT1.5 path AIS
- Detects STS-1 LOP
- Detects VT LOP
- Inserts VT path AIS
- Inserts STS-1 path unequipped signal
- Inserts and detects EC-1 line AIS
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow signal
- Detects EC-1 line failures (LOS, LOF, AIS, and BER)
- Detects EC-1 line signal degrade BER.

Maintenance Signal Functions (Low-Speed Mode)

The major maintenance signal functions (low-speed mode) are as follows:

- Detects STS-1 path AIS (VT cross-connected)
- Detects STS-1 LOP
- Detects VT LOP (VT cross-connected)
- Inserts VT path AIS (VT cross-connected)
- Inserts STS path AIS (STS cross-connected)
- Inserts STS-1 path unequipped signal
- Inserts and detects EC-1 line AIS
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow signal (VT cross-connected)
- Detects EC-1 line failures (LOS, LOF, AIS, and BER)
- Detects EC-1 line signal degrade BER.

BBG19 DS3 Data Services Interface Circuit Pack Description

Purpose of Circuit

The BBG19 DS3 circuit pack provides a low-speed interface between asynchronous DS3-rate signals and SONET STS-1 signals. It provides front access to DS3 Data Services, such as Ethernet, Token Ring, ATM, FDDI, Frame Relay, and others, via BNC faceplate connectors.

BBG19 DS3 Faceplate Indicators

The BBG19 DS3 circuit pack faceplate indicators are shown in Figure 7-32.

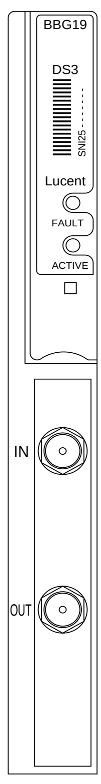


Figure 7-32. BBG19 DS3 Circuit Pack

The red FAULT LED lights by the SYSCTL on detection of BBG19 DS3 circuit pack failure. In the event of an incoming DS3 signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

General Description of Operation

The BBG19 DS3 circuit pack provides bidirectional transport of one DS3 signal through DDM-2000 OC-3 in either CC mode, VMR mode, or VM mode, by mapping the DS3 into an STS-1 signal. The BBG19 DS3 performs maintenance and provisioning functions associated with the STS-1 and DS3 signals and provides access to the STS-1 path overhead. It interfaces to the OLIU at the STS-1 rate, to the data services device, and to the SYSCTL, and receives timing signals traceable to the TG circuit pack. When provisioned for the CC mode, the DS3 can transport any DS3 rate signal that meets specified electrical interface requirements. When provisioned for the VMR or VM mode, the DS3 signal must meet both electrical and DS3 frame format requirements.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-33 provides an overall block diagram of the BBG19 DS3 circuit pack. The transmit direction is the direction towards the STS-1 signal, and receive direction refers to the direction towards the data services device. In the transmit direction, the BBG19 DS3 receives an incoming B3ZS encoded DS3 signal from the data services device. BNC connectors on the faceplate of the BBG19 provide input and output for the data services signal. The BBG19 DS3 receiver performs equalization and clock recovery. The MUX circuitry performs B3ZS decoding, optional automatic DS3 AIS insertion, and a provisionable VMR function, then synchronizes and maps the DS3 to the STS-1 rate. The DS3 signal is then synchronized to the STS-1 payload rate, STS-1 path overhead is inserted, and an STS-1 rate signal is transmitted to an OLIU pair.

Receive Direction. The BBG19 DS3 receives STS-1 data from the OLIUs, selects one STS-1, performs pointer interpretation, processes and removes the path overhead, desynchronizes the embedded DS3, provides a provisionable VMR function, and then B3ZS encodes the signal for transmission to the data services device. A jumper allows the user to insert or remove an LBO network (225 ft. of 734A-type cable equivalent) to provide the required signal level and shape at the data services device.

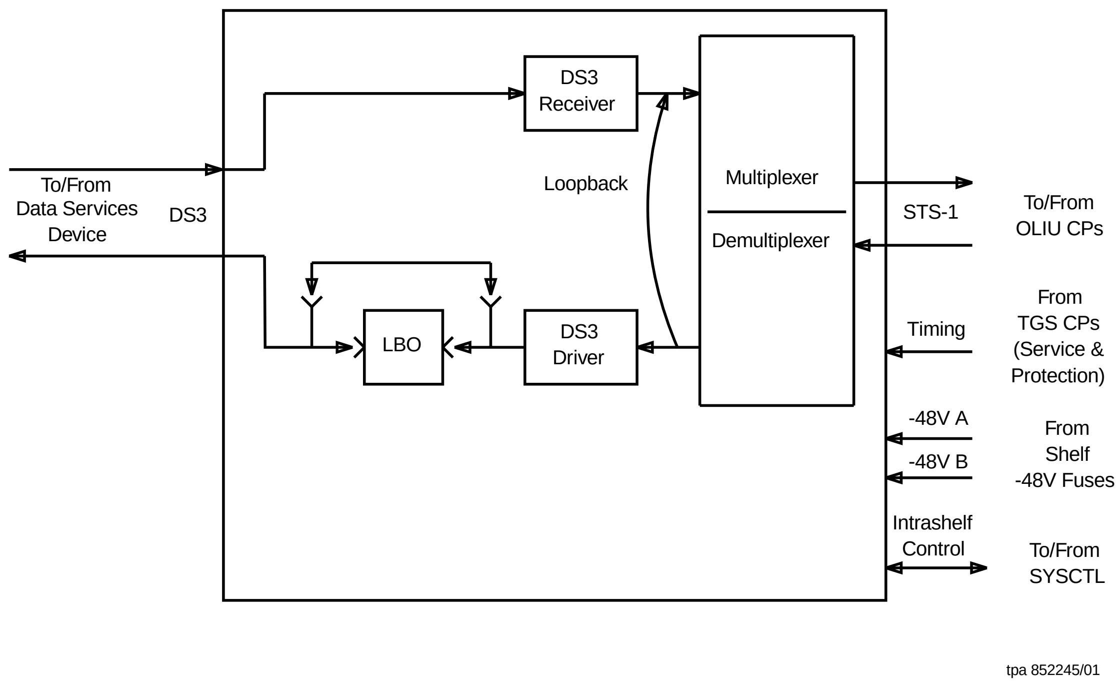


Figure 7-33. BBG19 DS3 Circuit Pack Block Diagram

VMR Function

Before the DS3 signal is B3ZS-encoded (receive) or decoded (transmit), a VMR function can be provisioned via the control circuitry for one of three possible modes. These three modes are as follows:

- VMR with DS3 AIS insertion—default
- VM without removal of violations but with AIS insertion
- No violation monitoring CC mode with options for
  - AIS insertion
  - No AIS insertion.

Control Circuitry

The BBG19 DS3 circuit pack interfaces with the SYSCTL via the intra-shelf control bus. The BBG19 DS3 provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and DS3 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG19 DS3 responds to control signals from the SYSCTL (such as active and fault LED controls).

Timing Circuitry

The BBG19 DS3 derives its timing information from the recovered DS3 clock from the data services device incoming signal. In the transmit direction, a 44.736 MHz clock is recovered from the incoming DS3 signal and is used to recover DS3 data. In the receive direction, a smoothed 44.736 MHz clock is generated by a phase-locked loop to accompany the DS3 signal extracted from the STS-1 payload.

In addition to the recovered DS3 clock, the BBG19 DS3 circuit pack requires STS-1 timing supplied, via the circuit pack edge connector, from the backplane.

Locked DS3 Circuitry

The DDM-2000 OC-3 accepts two BBG19s installed side-by-side in a dual 0x1 configuration. This configuration allows for efficient bandwidth utilization in the network for data services traffic. Each DS3 is assigned to both rotations of the ring using the same STS-1 time slot. This dual 0x1 interface also provides route diversity for point to multi-point interconnectivity and route restoration to data networking devices utilizing the BBG19s for access to the SONET network.

Fault Detection Circuitry

The BBG19 DS3 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG19 DS3 circuit pack is inserted or recovers from a transient failure.

The incoming DS3 signal is monitored for bipolar threshold crossings in excess of 10^{-3} or 10^{-6}, LOS, DS3 OOF, and DS3 AIS. Incoming STS-1 signals are monitored for STS AIS, STS LOP, and yellow and are also monitored for DS3 OOF and AIS.

Loopbacks

Two loopbacks are provided on the BBG19 DS3. The terminal loopback bridges the DS3 desynchronizer output signal (transmitted towards the data services device) back into the DS3 synchronizer input. Operation of the loopback does not affect the signal transmitted to the data services device. The facility loopback bridges the STS-1 output signal to the OLIU back towards the data services device. Operation of this loopback does not affect the signal transmitted to the fiber. Both loopbacks are controlled by the SYSCTL through the intra-shelf control bus.

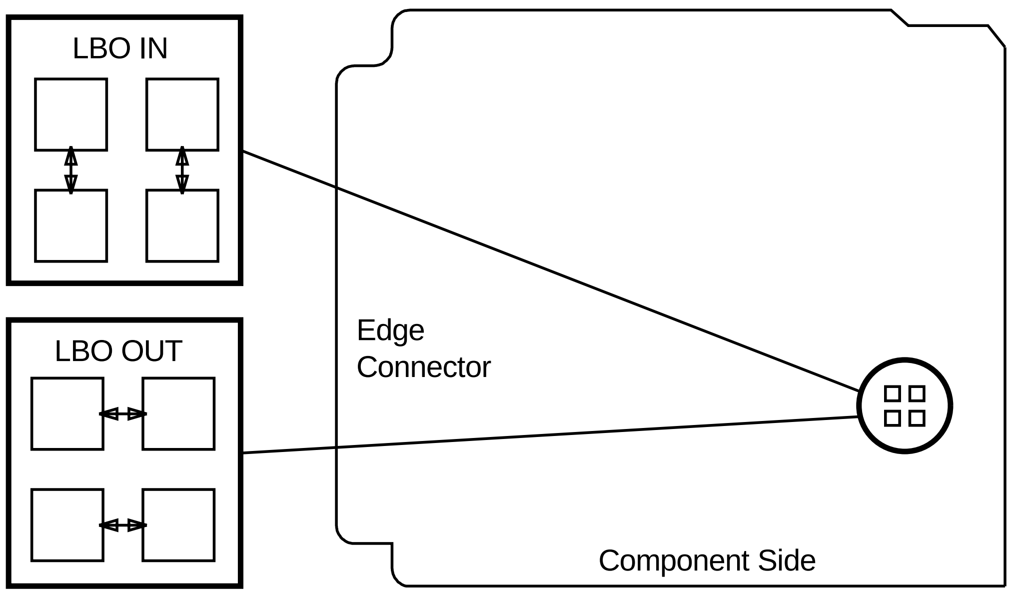
Performance Monitoring

The BBG19 DS3 circuit pack provides PM circuitry for the following performance parameters:

- STS path parameters derived from B3 coding violations
- DS3 path parameters derived from P-bit coding violations
- DS3 path parameters derived from F&M bit errors
- DS3 line errors based on B3ZS violations
- DS3 P-bit and F&M bit PM for both directions of transmission
- C-bit parity and FEBE PM for both directions of transmission.

BBG19 DS3 Hardware Settings

The location of the BBG19 DS3 circuit pack LBO jumpers is shown in Figure 7-34. The BBG19 DS3 LBO settings are shown in the table.



BBG19 DS3 LBO Settings

Cable Length (Ft)		LBO Setting
735A Cable	734D Cable	
0 to 125 >125 to 250	0 to 225 >225 to 450	LBO IN LBO OUT

Figure 7-34. BBG19 DS3 Line Build-Out (LBO) Jumpers

Power Circuitry

The BBG19 DS3 circuit pack receives two sources of –48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG19 DS3 Quick Reference Summary

Transmit Functions

The BBG19 DS3 transmit functions are as follows:

- Receives a B3ZS-encoded DS3 signal from a data services device
- Recovers DS3 clock and NRZ data
- Optionally checks and/or corrects P-bit parity errors
- Synchronizes the data signal to STS-1 signal rate
- Inserts STS-1 path overhead
- Provides the STS-1 signal to the OLIU circuit packs.

Receive Functions

The following receive functions are performed by the BBG19 DS3 circuit pack:

- Desynchronizes the incoming STS-1 signal
- Terminates the STS-1 path
- Optionally checks and/or corrects P-bit parity errors
- B3ZS encodes the outgoing DS3 signal
- Pre-equalizes the DS3 signal (with LBO) and transmits it to a data services device.

Control Functions

The major control functions are as follows:

- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Detects STS-1 path unequipped signal coming from the fiber
- Inserts DS3 AIS toward the fiber and data services device
- Detects DS3 AIS coming from the fiber
- Inserts and detects STS-1 path yellow signal to/from the fiber
- Detects DS3 OOF from the fiber
- Detects DS3 B3ZS violation threshold crossings from the data services device
- Inserts and detects STS-1 path trace.

BBG20 Transmultiplexer

Purpose of Circuit

The BBG20 Transmultiplexer (TMUX) circuit pack provides a low-speed interface between asynchronous DS3-rate signals and SONET STS-1 signals. The BBG20 TMUX provides DS1, DS3, VT, and STS-1 performance monitoring capabilities with R13.0 and later.

BBG20 TMUX Faceplate Indicators

The TMUX circuit pack faceplate indicators are shown in Figure 7-35. The red FAULT LED lights by the SYSCTL on detection of BBG20 TMUX circuit pack failure. In the event of an incoming DS3 signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

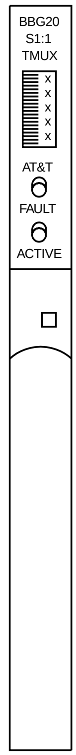


Figure 7-35. TMUX Circuit Pack

General Description of Operation

The BBG20 TMUX circuit pack provides bidirectional transport of one DS3 signal through the DDM-2000 OC-3 shelf.

In the transmit direction, the BBG20 TMUX circuit pack accepts one 44.736 Mb/s bipolar 3-zero substitution (B3ZS) coded DS3 signal and demultiplexes it into 28 DS1s. Performance monitoring is performed on the DS1s before they are mapped into floating VT1.5s. The 28 VT1.5s are then multiplexed into an STS-1 payload envelope using SONET asynchronous mapping. The STS-1 path overhead and pointer bytes are added and the resulting signal is sent to the high-speed OLIU circuit pack.

In the receive direction the reverse process takes place: The STS-1 signal from the OLIU circuit pack goes through STS-1 pointer interpretation, path overhead is removed and processed, and the 28 VT1.5s are stripped of their overhead to produce 28 DS1s. The DS1s are then multiplexed back into the DS3.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-36 provides an overall block diagram of the BBG20 TMUX circuit pack. The transmit direction is the direction towards the STS-1 signal, and receive direction refers to the direction towards the DSX-3. In the transmit direction, the BBG20 TMUX receives an incoming B3ZS encoded DS3 signal from the DSX-3. A closed protection relay contact routes the DS3 to a circuit that splits the signal and sends one output to the companion (standby) circuit pack and the other to its own receiver. The BBG20 TMUX receiver performs equalization and clock recovery. The TMUX circuitry performs B3ZS decoding and demultiplexes it into 28 DS1s. Performance monitoring is performed on the DS1s before they are mapped into floating VT1.5s. The 28 VT1.5s are then multiplexed into an STS-1 payload envelope using SONET asynchronous mapping. The STS-1 path overhead and pointer bytes are added and the resulting signal is sent to the high-speed OLIU circuit pack.

Receive Direction. The BBG20 TMUX receives STS-1 or VT1.5 data from both the active and standby OLIUs, performs pointer interpretation, processes and removes the path overhead, and strips the 28 VT1.5s of their overhead to produce 28 DS1s. The DS1s are then multiplexed back into the DS3.

A jumper allows the user to insert or remove an LBO network to provide the required signal level and shape at the DSX-3.

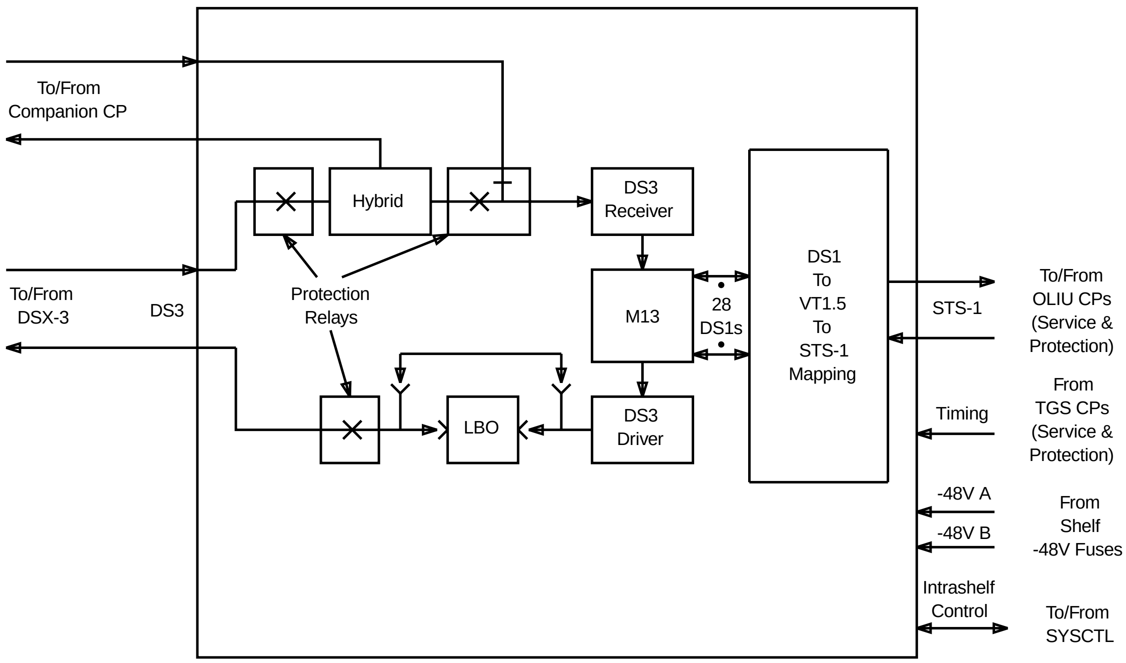


Figure 7-36. TMUX Circuit Pack Block Diagram

Control Circuitry

The BBG20 TMUX circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The BBG20 TMUX provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and DS3 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG20 TMUX responds to control signals from the SYSCTL (such as active and fault LED controls).

Timing Circuitry

The BBG20 TMUX recovers DS3 clock from the DSX-3 incoming signal. In the transmit direction, a 44.736 MHz clock is recovered from the incoming DS3 signal and is used to recover DS3 data and to generate the clocks needed by the M13 device to convert the DS3 into 28 DS1s. The circuit pack provides a 44.736 MHz clock to time the DS3 output signal.

In addition to the recovered DS3 clock, the BBG20 TMUX circuit pack requires STS-1 timing supplied, via the circuit pack edge connector, from the backplane.

Protection Circuitry

Optional 1x1 nonrevertive BBG20 TMUX circuit pack protection is provided. Switch points for the STS-1 side of the pack are located on the OLIU circuit packs. Switch points for the DS3 side are implemented with relays on the BBG20 TMUX circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL via the control interfaces. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the DS3 side, a single DS3 input from a DSX-3 is sent to both the active and standby BBG20 TMUX circuit packs. Only the active unit selects the DS3 input. The SYSCTL supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the DS3 input signal and sends it to the standby unit and to its own receiver. To implement a protection switch on the DS3 side, the SYSCTL switches the relays on each unit to their opposite state.

When a BBG20 TMUX is removed, shorting contacts on the backplane connector operate so that the DS3 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

The BBG20 TMUX circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG20 TMUX circuit pack is inserted or recovers from a transient failure.

The incoming DS3 signal is monitored for parity threshold crossings in excess of 10^{-3} or 10^{-6}, LOS, DS3 OOF, and DS3 AIS. Incoming STS/VT signals are monitored for STS/VT AIS, STS/VT LOP, STS/VT Unequipped, and yellow.

Loopbacks

Four loopback types are provided on the BBG20 TMUX. Both DS1 and DS3 terminal and facility loopbacks are provided on this pack. For DS1 loopbacks, all 28 are individually addressable. All loopbacks are controlled by the SYSCTL through the intra-shelf control bus.

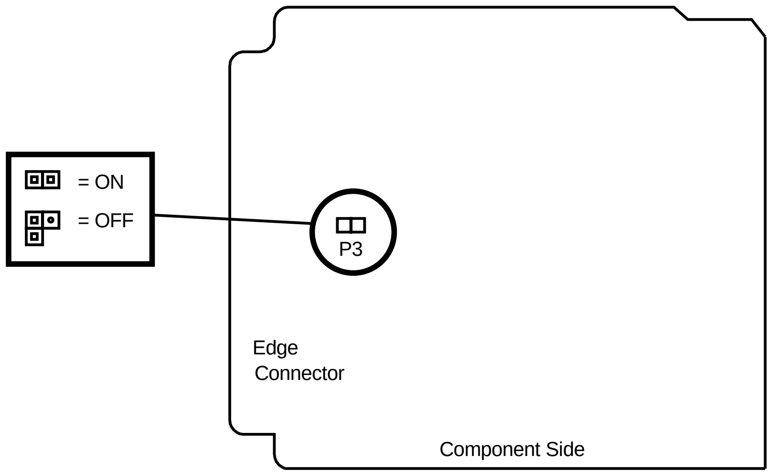
Performance Monitoring

The BBG20 TMUX circuit pack provides PM circuitry for the following performance parameters:

- STS path parameters derived from B3 coding violations
- VT path parameters derived from V5 coding violations
- DS3 path parameters derived from P-bit, F&M-bit, or C-bit coding violations
- DS3 line errors based on B3ZS violations
- DS1 path parameters derived from near-end SF or ESF framed signals and far-end ESF framed signals.

BBG20 TMUX Hardware Settings

The location of the TMUX circuit pack LBO jumpers is shown in Figure 7-37. The TMUX DS3 LBO settings are shown in the table.



BBG20 TMUX LBO Settings

Cable Length (Ft)		LBO Setting
735A Cable	734D Cable	
0 to 65 >65 to 250	0 to 120 >120 to 450	LBO ON LBO OFF

Figure 7-37. BBG20 TMUX Line Build-Out (LBO) Jumpers

Power Circuitry

The BBG20 TMUX circuit pack receives two sources of -48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG20 TMUX Quick Reference Summary

Transmit Functions

The BBG20 TMUX transmit functions are as follows:

- Receives a B3ZS-encoded DS3 signal from a DSX-3
- Recovers DS3 clock and NRZ data
- Calculates parity errors on the DS3 input
- Demultiplexes the M13 or C-bit formatted DS3 signal into 28 DS1s
- Maps the 28 DS1s into VT1.5s and then into an STS-1
- Inserts STS-1 path overhead
- Provides the STS-1 signal to the OLIU circuit packs.

Receive Functions

The BBG20 TMUX receive functions are as follows:

- Interprets the STS-1 pointer values
- Terminates the STS-1 path
- Disinterleaves the STS-1 signal into 28 VT1.5s and interprets VT pointer values
- Converts the VT1.5 signals to 28 DS1 signals
- Multiplexes the 28 DS1 signals to an M13 or C-bit formatted DS3 signal
- B3ZS encodes the outgoing DS3 signal
- Pre-equalizes the DS3 signal (with LBO) and transmits it to a DSX-3.

Control Functions

The major control functions are as follows:

- Protection switching for BBG20 TMUX circuit packs
- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.)

Maintenance Signal Functions

The BBG20 TMUX detects the following DS3 signal failures from the DSX-3:

- LOS
- OOF
- AIS
- BER.

The BBG20 TMUX inserts DS1 AIS on all DS1 outputs (toward fiber) upon detection of DS3 LOS, OOF, and AIS, and DS2 OOF.

Transmission - Optical Interface

Universal Optical Connector

Circuit packs having a "-U" after their designation indicate that these circuit packs have a universal optical connector.

The following circuit packs are available with the connector:

- 22D-U OLIU
- 22G-U/22G2-U/22G3-U/22G4-U* OLIU
- 24G-U/24H-U OLIU
- 22F-U/22F2-U
- 26G2-U OLIU
- 27G-U/27G2-U OLIU
- 29G-U/29H-U*

*Ship with SC buildout and ST shiped loose with each pack.

This connector, 29G-U/29H-U (Figure 7-38), is a two-part connector consisting of a faceplate-mounted block and an optical buildout. The faceplate block optionally supports an *ST®*, SC, or FC-type optical buildout.

A 0 dB *SC*-type connector is shipped as standard with each OLIU. Optional ST 0 dB buildouts are shipped loose with each OLIU. Optional SC, ST, or FC-PC 0 dB or attenuated buildouts can be ordered separately. See Chapter 10, "Technical Specifications," for a list of universal buildout attenuators. All OLIU’s will phase to SC buildout mountd and ST shipped loose.

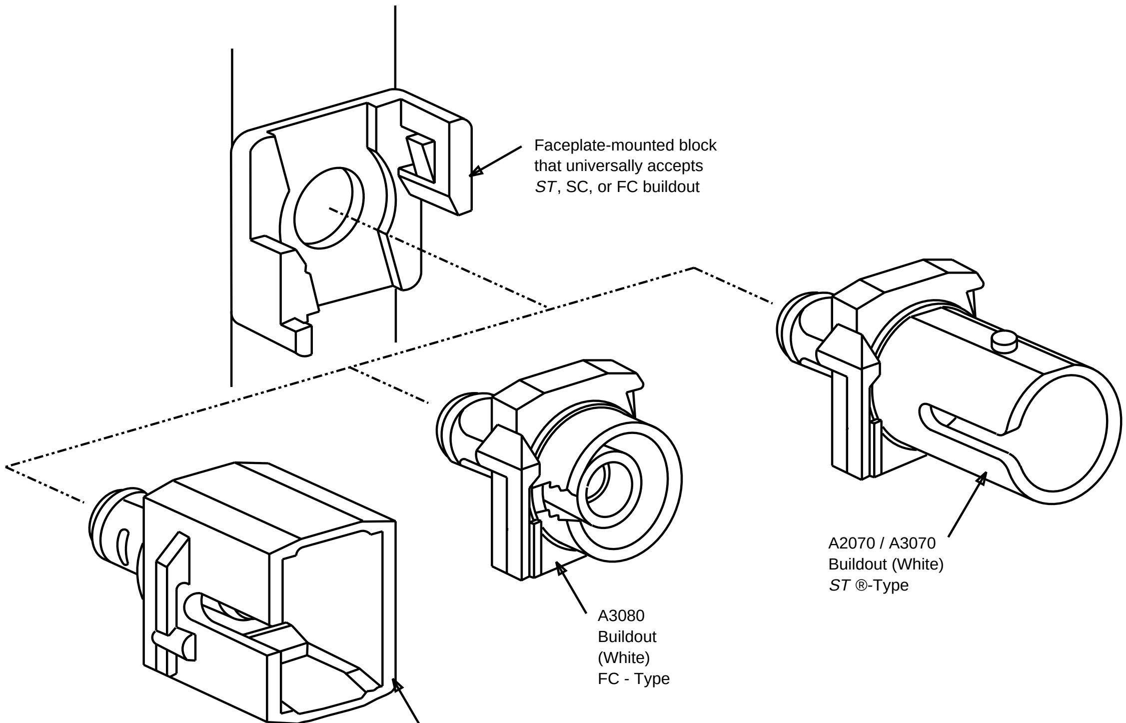


Figure 7-38. Universal Optical Connector

Optical Interface Circuit Packs

Table7-2 lists the DDM-2000 OLIU Feature Summary

Table 7-2. DDM-2000 OLIU Feature Summary

OLIU	Line Rate (Mb/s)	Span Length (Km)	VT/STS Sig. Degrade PS	TSI	Fiber Type	Ext. Atten.	System	See Note
22D-U	155.52	< 3	Yes	STS-1/VT1.5	MM	No	OC-3	
22F	155.52	33	No	STS-1/VT1.5	SM/MM	No	OC-3	1, 3
22F-U	155.52	33	No	STS-1/VT1.5	SM/MM	No	OC-3	3
22F2-U	155.52	33	Yes	STS-1/VT1.5	SM/MM	No	OC-3	
22G-U	155.52	51	Yes	STS-1/VT1.5	SM/MM	7.0 dB	OC-3	3
22G2-U	155.52	51	Yes	STS-1/VT1.5	SM/MM	No	OC-3	
22G3-U	155.52	55	Yes	STS-1/VT1.5	SM/MM	No	OC-3	
22G4-U	155.52	55	Yes	STS-1/VT1.5	SM/MM	No	OC-3	
24G-U	622.08	51	Yes	STS-1/STS-3c/ VT1.5	SM	8.0 dB	OC-3	7
24H-U								
26G2-U	51.84	44	Yes	STS-1/VT1.5	SM/MM	13.8 dB	FiberReach/ OC-1	
27G-U	51.84	44	Yes	STS-1/VT1.5	SM/MM	13.8 dB	OC-3	2
27G2-U	51.84	44	Yes	STS-1/VT1.5	SM/MM	13.8 dB	OC-3	2, 4
29G-U	622.08	51	Yes	STS-1/VT1.5	SM/MM	10 dB	OC-1,3	6
29H-U	622.08	94	Yes	STS-1/VT1.5	SM	10 dB	OC-1,3	6

See notes on following page.
* Not available at time of issue.

Table 7-2. DDM-2000 OLIU Feature Summary (Contd)

Notes:

1. OLIU has *ST*® connectors on faceplate.
2. OLIU has two sets of optical interfaces.
3. OLIU is discontinued. Functionally equivalent alternatives are available or planned: See the next line in the table. See Chapter 10 for availability.
4. OLIU has extended TSI capabilities to support pass-through and hairpin cross-connections for OC-1 rings terminated in function units of a DDM-2000 OC-3.
5. OLIU has 0 dB SC connectors installed and 0 dB ST connectors shipped loose.
6. 24G-U or higher OLIUs ship with SC connectors installed and ST connectors shipped loose.

All OLIUs have universal optical connectors (compatible with *ST*, SC, and FC connectors) unless specified otherwise.

All OLIUs operate at 1310 nm (nominal), except 24H-U and 29H-U.

All OLIUs have one optical transmitter and one optical receiver unless specified otherwise.

The “Span Length” column shows maximum span length for single mode fiber in controlled environment, based on certain assumptions about loss budget. (See Chapter 10 “Technical Specifications” for details.)

The “VT/STS Sig. Degrade PS” column indicates which OLIUs support VT1.5 path protection switching based on signal degrade conditions on individual VT1.5 channels. These OLIUs also support path protection switching based on STS signal degrade and VT unequipped conditions.

The “TSI” column indicates what type of cross-connection (time slot interchange) capability is supported by each OLIU.

The “Fiber Type” column indicates whether the OLIU is compatible with single-mode fiber, multimode fiber, or both.

The “Ext. Atten.” column indicates whether an external attenuator is required for optical loopbacks and short span lengths. “No” indicates none required. A dB value indicates the minimum attenuation required.

The “System” column indicates whether the OLIU can be used in the DDM-2000 OC-3 system the DDM-2000 OC-12 system, or both.

22F/22F-U/22F2-U OLIU Circuit Pack Description

Purpose of Circuit

The 22F/22F-U/22F2-U OLIU circuit pack performs the optical/electrical conversion between the OC-3 and STS-3 signals, multiplexing between STS-3 and three STS-1 signals and SONET transport overhead access. This circuit pack also provides routing of the STS-1s and VT1.5s between the OC-3 interface and other main and function unit slots in the shelf and DS1/DS3 add/drop and ring capability. When used to perform DS1/DS3 add/drop or VT1.5 routing, STS-1 path overhead access is also provided.

The 22F-U provides a universal optical connector capable of interfacing with STS-1. The 22F2-U provides additional VT1.5/STS-1 path signal monitoring to support VT1.5/STS-1 path protection switching. All three circuit packs have the same optical interface specifications.

22F/22F-U/22F2-U OLIU Faceplate Indicators

The 22F/22F-U/22F2-U OLIU circuit pack faceplate indicators are shown in Figure 7-39.

The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming signal failure, this LED will flash on and off.

The green ACTIVE LED lights when the circuit pack is active (carrying service).

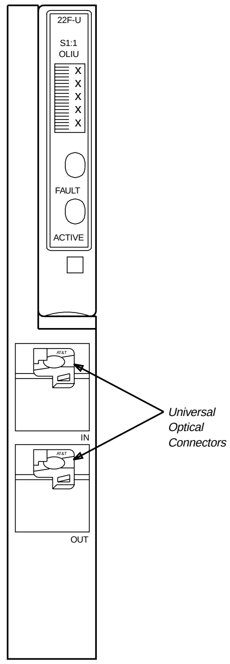


Figure 7-39. 22F/22F-U/22F2-U OLIU Circuit Pack

General Description of Operation

The 22F-type OLIUs multiplex three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed into three STS-1 signals, and transport/path overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a VT1.5 cross-connection.

Each 22F-type OLIU provides timing signals to, and receives timing signals from, the TG circuit packs.

Fiber access is via a pair of *ST* lightguide cable connectors from the OLIU faceplate. The 22F-type OLIU photonics comply with SONET intermediate-reach specifications. While single-mode fiber is suggested for optimum performance, multimode facilities are also supported as long as a single-mode jumper is placed between the 22F-type OLIU optical output connector and the multimode fiber.

Detailed Description of Operation

Figure 7-40 is a block diagram of the 22F-type OLIU.

Transmission Circuitry

STS-1 Router and VT1.5 Cross-Connect. The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the VT1.5 cross-connect. Outgoing STS-1s may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

Transmit Direction. The STS-1 router selects three of the STS-1 signals directly from the other main and function unit slots or from the VT1.5 cross-connect. SONET path overhead is then added to STS-1s sourced by the VT1.5 cross-connect before the signals are sent to the multiplexer. The multiplexer takes the three STS-1 signals, adds SONET transport overhead, then byte-interleaves and scrambles the signal with a frame synchronous scrambler. The output from the multiplexer is in the SONET STS-3 format and is used to amplitude modulate the laser transmitter, converting the electrical signal to an NRZ-encoded SONET compatible OC-3 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-3 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock (155.520 MHz) and uses it to retime the received data. The demultiplexer circuit accepts the retimed STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes OC-3 transport overhead. The overhead information is sent to the SYSCTL circuit pack via the intra-shelf control bus and to the OHCTL circuit pack by the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the STS-1 pointer processor which performs pointer interpretation and generation on each received STS-1, using the local timing signals. The output of the STS-1 pointer processor is three STS-1 signals, frame synchronous to each other, which are sent to the VT1.5 pointer processor. VT1.5 pointer processing is performed on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends each of the three STS-1 signals to the appropriate main or function unit slots.

Control Circuitry

The 22F-type OLIU circuit packs interface with the BBG8/BBG8B SYSCTL and with the OHCTL circuit packs.

The 22F-type OLIUs provide maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 22F-type OLIUs respond to control signals from the SYSCTL, such as STS-1 routing, VT1.5 routing, protection switching, and LED control commands.

The 22F-type OLIUs access the SONET transport overhead and routes it via the transport overhead channel interface to the OHCTL.

The 22F-type OLIUs access the STS-1 path overhead and routes it via the intra-shelf control bus to the SYSCTL circuit pack.

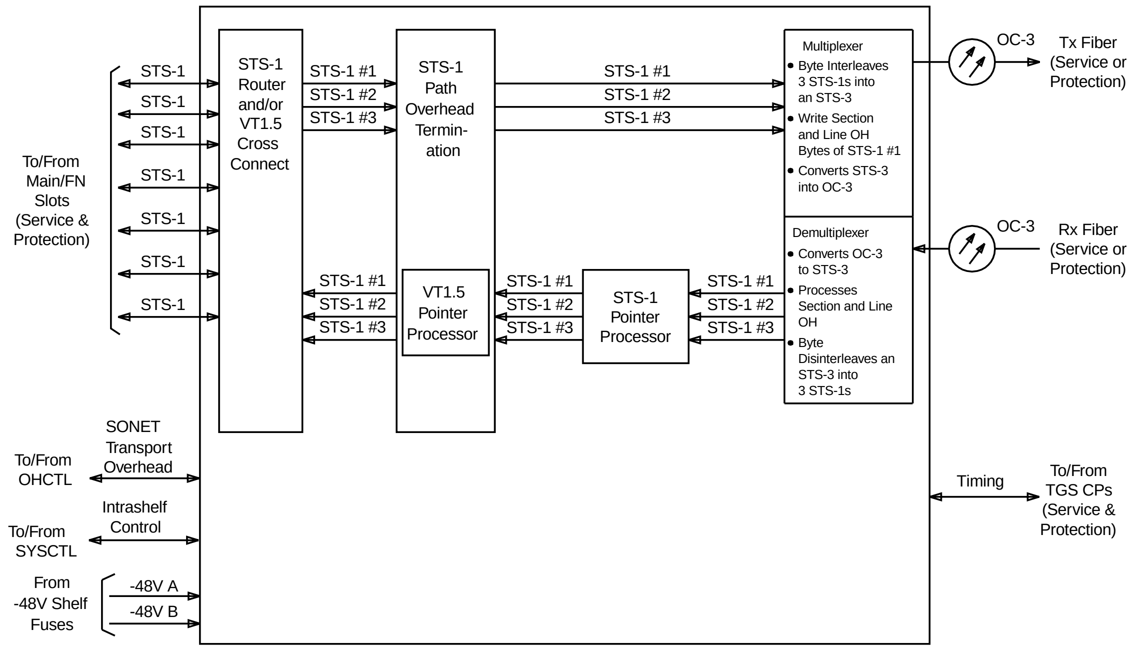


Figure 7-40. 22F-type OLIU Circuit Pack Block Diagram

Timing Circuitry

Each TG circuit pack sends timing signals to each 22F-type OLIU. Each 22F-type OLIU monitors the timing inputs from both TG circuit packs. The 22F-type OLIU normally selects the timing signals from the TG selected by the SYSCTL. Each 22F-type OLIU provides timing signals derived from the incoming optical signal to both TG circuit packs for line (formerly loop) timing and DS1 output (BITS).

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 22F-type OLIU is protection switched by the SYSCTL in response to an external command, incoming optical signal failure, or internal equipment fault. The 22F OLIU circuit pack is protection switched with the OC-3 line.

The 22F-type OLIU interfaces with STS-1 signals from the circuit packs in the main and function unit slots. It selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 22F-type OLIU provides selectors for timing signals from the TG circuit packs, monitors these inputs, and autonomously selects either TG circuit pack. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 22F-type OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 22F-U OLIU has provisionable VT signal degrade and STS signal degrade BER threshold capabilities for path protection switching.

Performance Monitoring

The 22F-type OLIU provides PM circuitry for the following performance parameters:

- Section SEFS count
- Line parameters derived from B2 coding violations
- STS-1 path parameters derived from B3 coding violations.

Power Circuitry

Power for the 22F-type OLIU circuit pack is provided by two DC-to-DC converters located on the 22F-type OLIU circuit pack. One converter supplies +5 volts and the other supplies –5.2 volts. Both A and B –48 volt backplane busses supply power to the converters through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or either converter causes the red FAULT LED to light.

22F-type OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 22F-type OLIU circuit pack are as follows:

- Selects STS-1 inputs from MXRVO, DS3, STS1E, or other OLIU circuit packs
- Provides STS-1/VT1.5 signal cross-connections
- Adds SONET transport overhead and, if VT1.5 cross-connected, adds STS-1 path overhead
- Byte-interleaves and scrambles the three selected STS-1 signals to produce an STS-3 signal
- Uses a laser transmitter to produce a SONET standard OC-3 optical signal from an STS-3 electrical signal.

Receive Functions

The following are major receive functions of the 22F-type OLIU circuit pack:

- Receives a SONET standard OC-3 optical signal and converts it to an electrical STS-3 signal
- Extracts STS-3 clock and retimes the received data
- Demultiplexes the STS-3 signal into three STS-1 signals
- Extracts transport overhead and, if VT1.5 cross-connected, extracts path overhead
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal, if VT1.5 cross-connected
- Provides STS-1/VT1.5 signal cross-connections
- Processes the received clock and provides a reference clock to the TG circuit packs.

Control Functions

The major control functions are as follows:

- Switches protection for OC-3 line and DS3, MXRVO, STS1E, other OLIU, and TG circuit packs
- Processes transport and path overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.)
- Supports VT and STS signal degrade protection switching (22F2-U only)
- Supports STS-1 BER signal fail (10^{-3} or 10^{-6}) path protection switching
- Supports path protection switching based on STS-1 unequipped, STS-1 AIS, STS-1 LOP, VT AIS, and VT LOP
- Supports path protection switching based on VT unequipped (22F2-U only).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS or inserts and detects VT1.5 path AIS
- Inserts and detects OC-3 line AIS
- Inserts and detects STS-1 path unequipped signal
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow, if VT1.5 cross-connected
- Inserts and detects the STS-1 unequipped signal
- Inserts and detects the VT unequipped signal (22F2-U only)
- Detects OC-3 line failures (LOS, LOF, AIS, and BER)
- Detects OC-3 line signal degrade BER.

22D-U OLIU Circuit Pack Description

Purpose of Circuit

The 22D-U OLIU circuit pack is used to interconnect colocated DDM-2000 OC-3 and OC-12 shelves or *SLC*®-2000 at the OC-3 rate. The 22D-U OLIU circuit pack performs the optical/electrical conversion between the optical interconnect signal level 3 (IS-3) and STS-3 signals. The 22D-U OLIU circuit pack also does MUX/DEMUXing between STS-3 and three STS-1 signals and SONET transport overhead access. It also provides routing of the STS-1s between the IS-3 interface and other main and function unit slots in the shelf.

22D-U OLIU Faceplate Indicators

The 22D-U OLIU circuit pack faceplate indicators are shown in Figure 7-41. The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

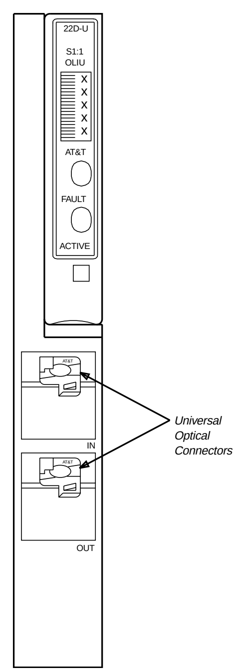


Figure 7-41. 22D-U OLIU Circuit Pack

A faceplate-mounted universal optical connector allows the 22D-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. The 22D-U OLIU comes with a 0 dB *ST* buildout. Various combinations of buildouts and connectors are also available. See Section 10, "Technical Specifications," for a list of universal buildout attenuators. A 10 dB attenuator is required for loopback testing. The 22D-U OLIU circuit pack provides cost effective interconnect for intra-office applications and is used only for DDM-2000 OC-3 and OC-12 or *SLC*-2000 interworking over multimode fiber.

General Description of Operation

The 22D-U OLIU circuit pack multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives an LED transmitter to create the IS-3 output.

The received IS-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. The STS-1 signals go through a pointer processor to guarantee frame alignment to the local system clock before being routed to the other main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a VT1.5 cross-connection.

The 22D-U OLIU circuit pack provides timing signals to and receives timing signals from the TG circuit packs.

Detailed Description of Operation

Figure 7-42 is a block diagram of the 22D-U OLIU circuit pack.

The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the VT1.5 cross-connect. Outgoing STS-1s may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

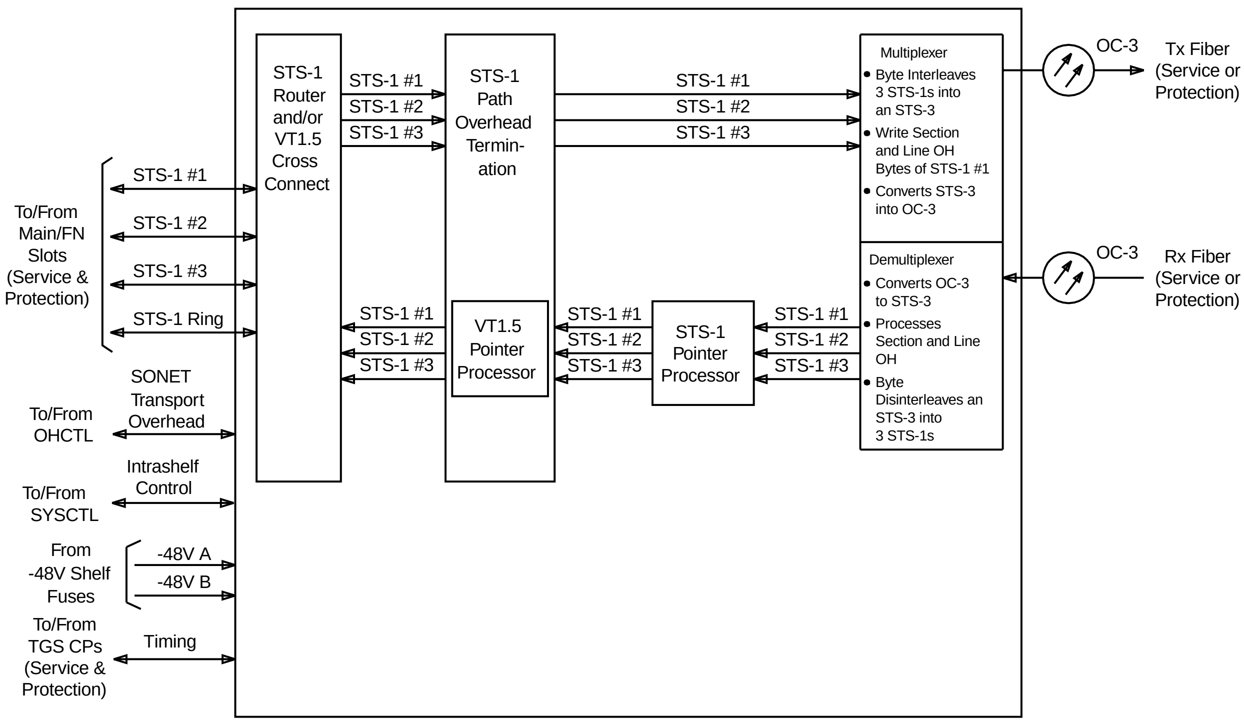


Figure 7-42. 22D-U OLIU Circuit Pack Block Diagram

Transmit Direction. The STS-1 router selects three of the STS-1 signals directly from the other main and function unit slots or from the VT1.5 cross-connect. SONET path overhead is then added to STS-1s sourced by the VT1.5 cross-connect before the signals are sent to the multiplexer. The multiplexer takes the three STS-1 signals, adds SONET transport overhead, then byte-interleaves and scrambles the signal with a frame synchronous scrambler. The output from the multiplexer is in the SONET STS-3 format and is used to amplitude modulate the

LED transmitter, converting the electrical signal to an NRZ-encoded SONET compatible IS-3 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded IS-3 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock (155.520 MHz) and uses it to retime the received data. The demultiplexer circuit accepts the retimed STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes transport overhead. The overhead information is sent to the SYSCTL circuit pack via the intra-shelf control bus and to the OHCTL circuit pack by the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the STS-1 pointer processor which performs pointer interpretation and generation on each received STS-1, using the local timing signals. The output of the STS-1 pointer processor is three STS-1 signals, frame synchronous to each other, which are sent to the VT1.5 pointer processor. VT1.5 pointer processing is performed on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/ VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends each of the three STS-1 signals to the appropriate main or function unit slots.

Control Circuitry

The 22D-U OLIU circuit pack interfaces with the SYSCTL and with the OHCTL circuit packs.

The 22D-U OLIU circuit pack provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 22D-U OLIU circuit pack responds to control signals from the SYSCTL, such as STS-1 routing, protection switching, and LED control commands.

The 22D-U OLIU circuit pack accesses the SONET transport overhead and routes it via the transport overhead channel interface to the AUXCTL slot and/or to the SYSCTL. The transport overhead is routed from the main slots to both the AUXCTL and SYSCTL slots and from the function unit slots to the AUXCTL slot.

Timing Circuitry

Each TG circuit pack sends timing signals to each OLIU. Each OLIU monitors the timing inputs from both TG circuit packs. The 22D-U OLIU normally selects the timing signals from the active TG. Each OLIU provides timing signals derived from the incoming optical signal to both TG circuit packs for line (formerly loop) timing and DS1 timing outputs (BITS).

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 22D-U OLIU is protection switched by the SYSCTL in response to an external command, incoming signal failure, or internal equipment fault. The 22D-U OLIU circuit pack is protection switched with the optical line.

The 22D-U OLIU circuit pack interfaces with STS-1 signals from the circuit packs in the main and function unit slots and selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 22D-U OLIU provides selectors for timing signals from the TG circuit packs. The 22D-U OLIU monitors these inputs and can autonomously select either one. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 22D-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 22D-U OLIU has provisionable VT signal degrade and STS signal degrade BER threshold capabilities for path protection switching.

Performance Monitoring

The 22D-U OLIU provides PM circuitry for the following performance parameters:

- Section SEFS count
- Line parameters based on B2 coding violations.

Power Circuitry

Power for the 22D-U OLIU circuit pack is provided by a DC-to-DC converter located on the circuit pack. The converter supplies +5 volts and –5.2 volts. Both A and B –48 volt backplane busses supply power to the converter through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or converter causes the red FAULT LED to light.

22D-U OLIU Quick Reference Summary

Transmit Functions

The following are the major transmit functions of the 22D-U OLIU circuit pack:

- Selects STS-1 inputs from MXRVO, DS3, STS1E, or other OLIU circuit packs
- Provides VT1.5/STS-1 signal cross-connections
- Adds SONET transport overhead and, if VT1.5 cross-connected, adds STS-1 path overhead
- Byte-interleaves and scrambles the three selected STS-1 signals to produce an STS-3 signal
- Converts the STS-3 electrical signal to an IS-3 optical signal and transmits it over the fiber.

Receive Functions

The following are major receive functions of the 22D-U OLIU circuit pack:

- Receives an IS-3 optical signal and converts it to an electrical STS-3 signal
- Extracts STS-3 clock and retimes the received data
- Demultiplexes the STS-3 signal into three STS-1 signals
- Extracts transport overhead and, if VT1.5 cross-connected, extracts path overhead
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal, if VT1.5 cross-connected
- Provides STS-1/VT1.5 signal cross-connections
- Processes the received clock and provides a reference clock to the TG circuit packs
- Provides express processing for VT AIS.

Control Functions

The following are the major control functions of the 22D-U OLIU circuit pack:

- Switches protection for the optical line and DS3, MXRVO, STS1E, and TG circuit packs
- Processes transport overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.)
- Supports VT and STS signal degrade path protection switching.
- Supports STS-1 BER signal fail (10^{-3} or 10^{-6}) path protection switching
- Supports path protection switching based on STS-1 unequipped, STS-1 AIS, STS-1 LOP, VT AIS, VT unequipped, and VT LOP.

Maintenance Signal Functions

The following are the major maintenance signal functions of the 22D-U OLIU circuit pack:

- Inserts and detects STS-1 path AIS or inserts and detects VT1.5 path AIS
- Inserts and detects SONET line AIS and inserts and detects line FERF
- Inserts and detects STS-1 path unequipped signal
- Inserts and detects VT path unequipped signal
- Inserts and detects STS-1 path yellow, if VT1.5 cross-connected
- Detects IS-3 line failures (LOS, LOF, AIS, and BER)
- Detects IS-3 line signal degrade BER.

22G-U/22G2-U/22G3-U/22G4-U OLIU Circuit Pack Description

Purpose of Circuit

The 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack performs the optical/electrical conversion between the optical carrier level 3 (OC-3) and STS-3 signals, multiplexing between STS-3 and three STS-1 signals and SONET transport overhead access. The 22G-U/22G2-U/22G3-U/22G4-U OLIU also provides routing of the STS-1s between the OC-3 interface and other main and function unit slots in the shelf as well as VT1.5/STS-1 add/drop and ring capabilities. When used to perform VT1.5 add/drop or ring capabilities, STS-1 path overhead access is also provided.

The 22G2-U/22G3-U/22G4-U OLIU is the same as the 22G-U but has improved receiver overload sensitivity, eliminating the need for an external attenuator. The 22G2-U/22G3-U/22G4-U OLIU can be used in place of the 22G-U in all applications.

22G-U/22G2-U/22G3-U/22G4-U OLIU Faceplate Indicators

The 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack faceplate indicators are shown in Figure 7-43.

The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming signal failure, this LED will flash on and off.

The green ACTIVE LED lights when the circuit pack is active (carrying service).

A faceplate-mounted universal optical connector allows the 22G-U/22G2-U/22G3-U/22G4-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. The 22G-U/22G2-U/22G3-U/22G4-U OLIU comes with a 0 dB *ST* buildout. For the 22G-U, a 10 dB attenuator is required for loopback testing. The 22G2-U/22G3-U/22G4-U does not need an external attenuator for loopback testing. The 22G-U/22G2-U/22G3-U/22G4-U OLIU operates over single mode fiber. Various combinations of buildout attenuators and connectors are also available. See Chapter 10, "Technical Specifications," for a list of universal buildout attenuators.

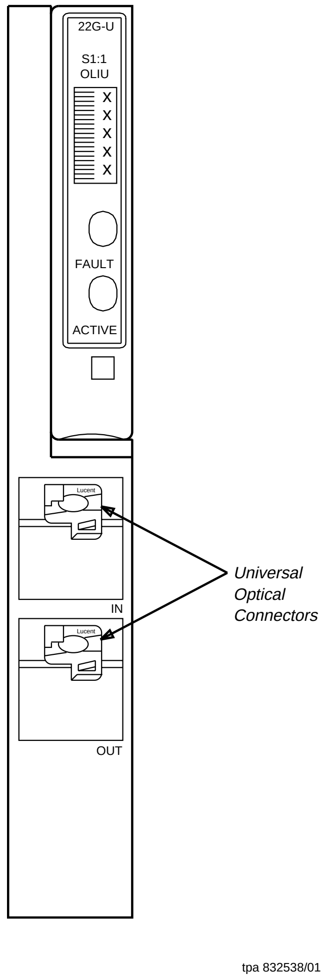


Figure 7-43. 22G-U/22G2-U/22G3-U OLIU Circuit Pack

General Description of Operation

The 22G-U/22G2-U/22G3-U/22G4-U OLIU multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed into three STS-1 signals, and transport/path overhead is accessed. Some of the overhead (for example, section DCC) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a limited VT1.5 cross-connection.

Each 22G-U/22G2-U/22G3-U/22G4-U OLIU provides timing signals to and receives timing signals from the TG circuit packs.

Detailed Description of Operation

Figure 7-44 is a block diagram of the 22G-U/22G2-U/22G3-U/22G4-U OLIU.

Transmission Circuitry

STS-1 Router and VT1.5 Cross-Connect. The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the limited VT1.5 cross-connect. Outgoing STS-1s may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

Transmit Direction. The STS-1 router selects three of the STS-1 signals directly from the other main and function unit slots or from the VT1.5 cross-connect. SONET path overhead is then added to STS-1s sourced by the VT1.5 cross-connect before the signals are sent to the multiplexer. The multiplexer takes the three STS-1 signals, adds SONET transport overhead, then byte-interleaves and scrambles the signal with a frame synchronous scrambler. The output from the multiplexer is in the SONET STS-3 format and is used to amplitude modulate the laser transmitter, converting the electrical signal to an NRZ-encoded SONET compatible OC-3 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-3 signal to equivalent electrical pulses and recovers the received clock (155.520 MHz) and uses it to retime the received data. The demultiplexer circuit accepts the retimed STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes OC-3 transport overhead. The overhead information is sent to the SYSCTL circuit pack via the intra-shelf control bus and to the OHCTL circuit pack by the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the STS-1 pointer processor which performs pointer interpretation and generation on each received STS-1, using the local timing signals. The output of the STS-1 pointer processor is three STS-1 signals, frame synchronous to each other, which are sent to the VT1.5 pointer processor. VT1.5 pointer processing is performed on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends each of the three STS-1 signals to the appropriate main or function unit slots.

Control Circuitry

The 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack interfaces with the BBG8/BBG8B SYSCTL and with the OHCTL circuit packs.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 22G-U/22G2-U/22G3-U/22G4-U OLIU responds to control signals from the SYSCTL, such as STS-1 routing, VT1.5 routing, protection switching, and LED control commands.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU accesses the SONET transport overhead and routes it via the transport overhead channel interface to the OHCTL.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU accesses the STS-1 path overhead and routes it via the intra-shelf control bus to the SYSCTL circuit pack.

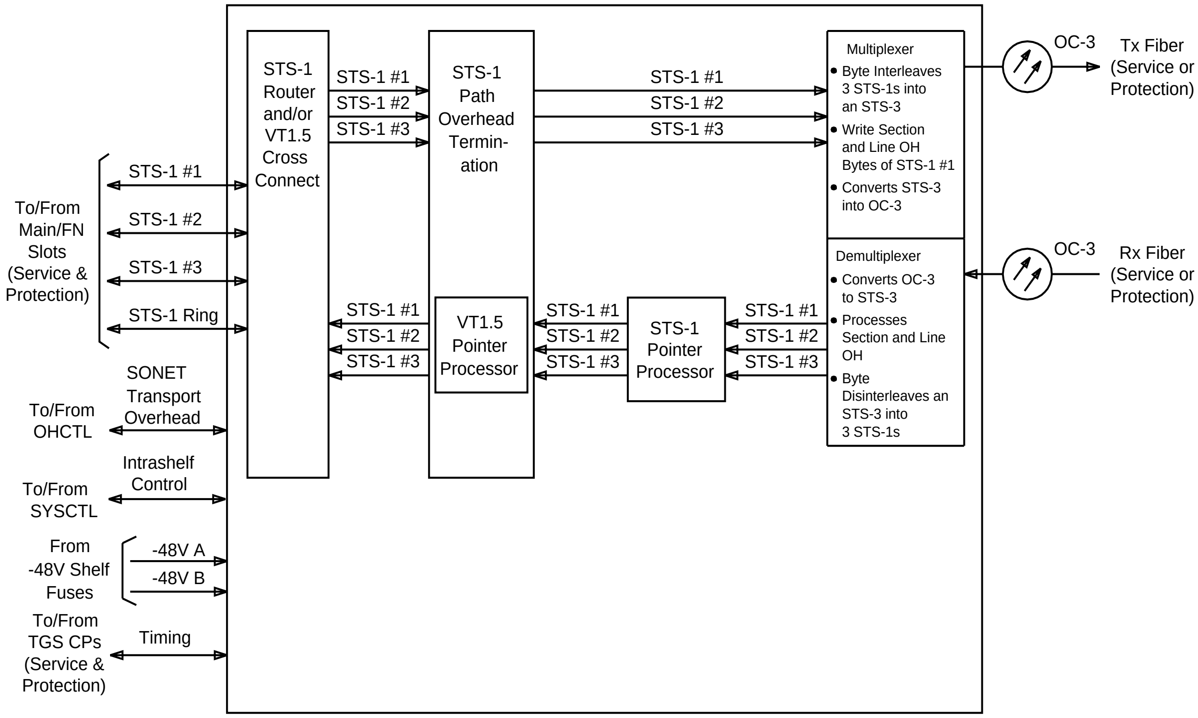


Figure 7-44. 22G-U/22G2-U/22G3-U/22G4-U OLIU Circuit Pack Block Diagram

Timing Circuitry

Each TG circuit pack sends timing signals to each 22G-U/22G2-U/22G3-U/22G4-U OLIU. Each 22G-U/22G2-U/22G3-U/22G4-U OLIU monitors the timing inputs from both TG circuit packs. The 22G-U/22G2-U/22G3-U/22G4-U OLIU normally selects the timing signals from the TG selected by the SYSCTL. Each 22G-U/22G2-U/22G3-U/22G4-U OLIU provides timing signals derived from the incoming optical signal to both TG circuit packs for line (formerly loop) timing and DS1 output (BITS).

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 22G-U/22G2-U/22G3-U/22G4-U OLIU is protection switched by the SYSCTL in response to an external command, incoming optical signal failure, or internal equipment fault. The 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack is protection switched with the OC-3 line.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU interfaces with STS-1 signals from the circuit packs in the main and function unit slots. It selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU provides selectors for timing signals from the TG circuit packs, monitors these inputs, and autonomously selects either TG circuit pack. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 22G-U/22G2-U/22G3-U/22G4-U OLIU has provisionable VT signal degrade and STS signal degrade BER threshold capabilities for path protection switching.

Performance Monitoring

The 22G-U/22G2-U/22G3-U/22G4-U OLIU provides PM circuitry for the following performance parameters:

- Section SEFS count
- Line coding violation counts
- STS-1 path coding violation counts.

Power Circuitry

Power for the 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack is provided by two DC-to-DC converters located on the 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack. The converters supply +5 volts. Both A and B –48 volt backplane busses supply power to the converters through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or converters causes the red FAULT LED to light.

22G-U/22G2-U/22G3-U/22G4-U OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack are as follows:

- Selects STS-1 inputs from MXRVO, DS3, STS1E, or other OLIU circuit packs
- Provides VT1.5/STS-1 signal cross-connections
- Adds SONET transport overhead and, if VT1.5 cross-connected, adds STS-1 path overhead
- Byte-interleaves and scrambles the three selected STS-1 signals to produce an STS-3 signal
- Uses a laser transmitter to produce a SONET standard OC-3 optical signal from an STS-3 electrical signal.

Receive Functions

The following are major receive functions of the 22G-U/22G2-U/22G3-U/22G4-U OLIU circuit pack:

- Receives a SONET standard OC-3 optical signal and converts it to an electrical STS-3 signal
- Extracts STS-3 clock and retimes the received data
- Demultiplexes the STS-3 signal into three STS-1 signals
- Extracts transport overhead and, if VT1.5 cross-connected, extracts path overhead
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal, if VT1.5 cross-connected
- Provides VT1.5/STS-1 signal cross-connections

- Processes the received clock and provides a reference clock to the TG circuit packs
- Provides express processing for VT AIS.

Control Functions

The major control functions are as follows:

- Switches protection for OC-3 line and DS3, MXRVO, STS1E, other OLIU, and TG circuit packs
- Processes transport and path overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.)
- Supports VT and STS signal degrade protection switching
- Supports STS-1 BER signal fail (10^{-3} or 10^{-6}) path protection switching
- Supports path protection switching based on STS-1 unequipped, STS-1 AIS, STS-1 LOP, VT AIS, VT unequipped, and VT LOP.

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS or inserts and detects VT1.5 path AIS
- Inserts and detects OC-3 line AIS
- Inserts and detects STS-1 path unequipped signal
- Inserts and detects VT path unequipped signal
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow, if VT1.5 cross-connected
- Detects OC-3 line failures (LOS, LOF, AIS, and BER)
- Detects OC-3 line signal degrade BER.

24G-U OLIU Circuit Pack Description

Purpose of Circuit

The 24G-U OC-12 OLIU circuit pack performs the optical/electrical conversion between the optical carrier level 12 (OC-12) and STS-12 signals, multiplexing between STS-12 and twelve STS-1 signals, and SONET transport overhead access. The 24G-U OLIU also provides routing of any 3 of the twelve STS-1s between the OC-12 interface and other main and function unit slots in the shelf as well as VT1.5/STS-1 add/drop and ring capabilities. When used to perform VT1.5 add/drop or ring capabilities, STS-1 path overhead access is also provided.

The 24G-U OLIU can also be used as an OC-12 upgrade from an OC-3 ring.

24G-U OLIU Faceplate Indicators

The 24G-U OLIU circuit pack faceplate indicators are shown in Figure 7-45.

The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming signal failure, this LED will flash on and off.

The green ACTIVE LED lights when the circuit pack is active (carrying service).

A faceplate-mounted universal optical connector allows the 24G-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. An additional interconnect cable assembly is required between faceplates of the two 24G-Us to support pass-through traffic on the OC-12 ring (see Figure 7-45). The 24G-U OLIU comes with a 0 dB *ST* buildout. For the 24G-U, a 10 dB attenuator is required for loopback testing. The 24G-U OLIU operates over single-mode fiber. Various combinations of buildout attenuators and connectors are also available. See Section 10, "Technical Specifications," for a list of universal buildout attenuators.

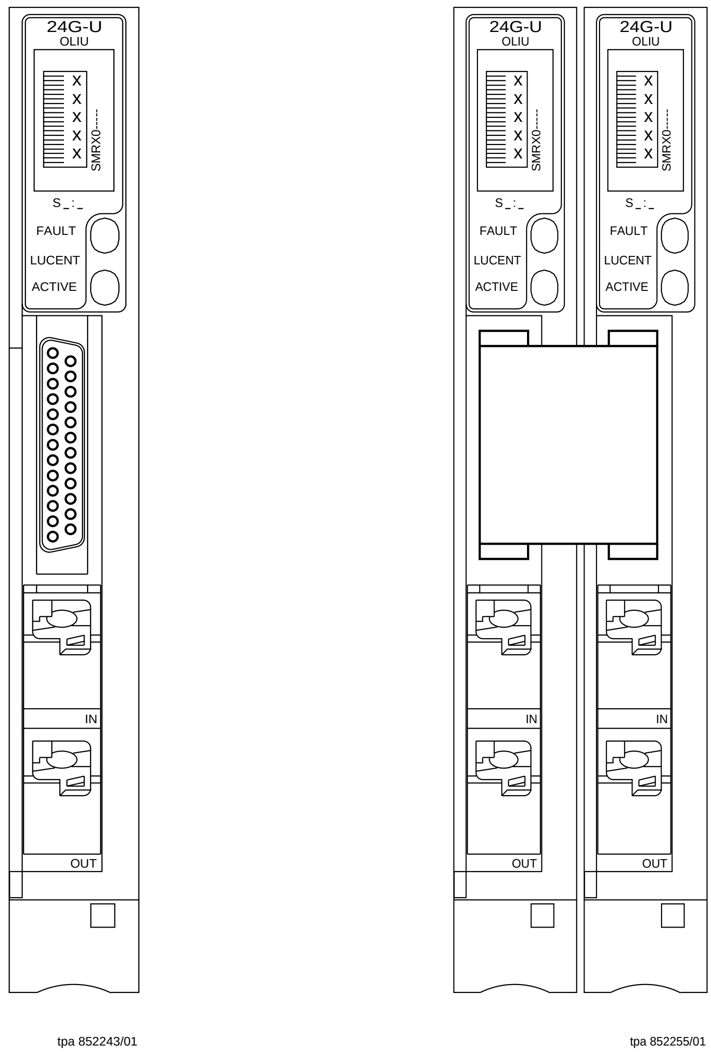


Figure 7-45. 24G-U OC-12 OLIU Circuit Pack — 24G-U Pair with Interconnect Cable Assembly

General Description of Operation

The 24G-U OLIU multiplexes twelve STS-1 signals to an STS-12, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-12 signal drives the laser transmitter to create the OC-12 output.

The received OC-12 signal is converted to an electrical STS-12. This STS-12 is descrambled and demultiplexed into twelve STS-1 signals, and transport/path overhead is accessed. Some of the overhead (for example, section DCC) is passed via serial data links to the control packs, while other bytes (for example, framing, parity check) are processed on board. The twelve STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other main and function unit slots. Any three of the twelve STS-1s can be routed to the function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a limited VT1.5 cross-connection.

Each 24G-U OLIU provides timing signals to and receives timing signals from the TG circuit packs.

Detailed Description of Operation

Figure 7-46 is a block diagram of the 24G-U OLIU.

Transmission Circuitry

STS-1 Router and VT1.5 Cross-Connect. The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the limited VT1.5 cross-connect. Outgoing STS-1s may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

Transmit Direction. The STS-1 router selects up to three of the STS-1 signals directly from the other main and function unit slots or from the VT1.5 cross-connect. SONET path overhead is then added to STS-1s sourced by the VT1.5 cross-connect before the signals are sent to the multiplexer. The multiplexer takes these three STS-1 signals and the remaining STS-1s from the ring (through the faceplate connector), adds SONET transport overhead, then byte-interleaves and scrambles the signal with a frame synchronous scrambler. The output from the multiplexer is in the SONET STS-12 format and is used to amplitude modulate the laser transmitter, converting the electrical signal to an NRZ-encoded SONET compatible OC-12 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-12 signal to equivalent electrical pulses and recovers received clock (622.08 MHz) and uses it to retime the received data. The demultiplexer circuit accepts the retimed STS-12 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into twelve STS-1 signals, and processes OC-12 transport overhead. The overhead information is sent to the SYSCTL circuit pack via the intra-shelf control bus and to the OHCTL circuit pack by the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the STS-1 pointer processor which performs pointer interpretation and generation on each of the twelve received STS-1, using the local timing signals. The output of the STS-1 pointer processor is twelve STS-1 signals, frame synchronous to each other. Any three of these STS-1s then are sent to the VT1.5 pointer processor. VT1.5 pointer processing is performed on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends each of the three STS-1 signals to the appropriate main or function unit slots. All twelve of the received STS-1s are passed through the faceplate connector to the other main OLIU.

Control Circuitry

The 24G-U OLIU circuit pack interfaces with the BBG8/BBG8B SYSCTL and with the BBG9 OHCTL circuit packs.

The 24G-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 24G-U OLIU responds to control signals from the SYSCTL, such as STS-1 routing, VT1.5 routing, protection switching, and LED control commands.

The 24G-U OLIU accesses the SONET transport overhead and routes it via the transport overhead channel interface to the OHCTL.

The 24G-U OLIU accesses the STS-1 path overhead and routes it via the intra-shelf control bus to the SYSCTL circuit pack.

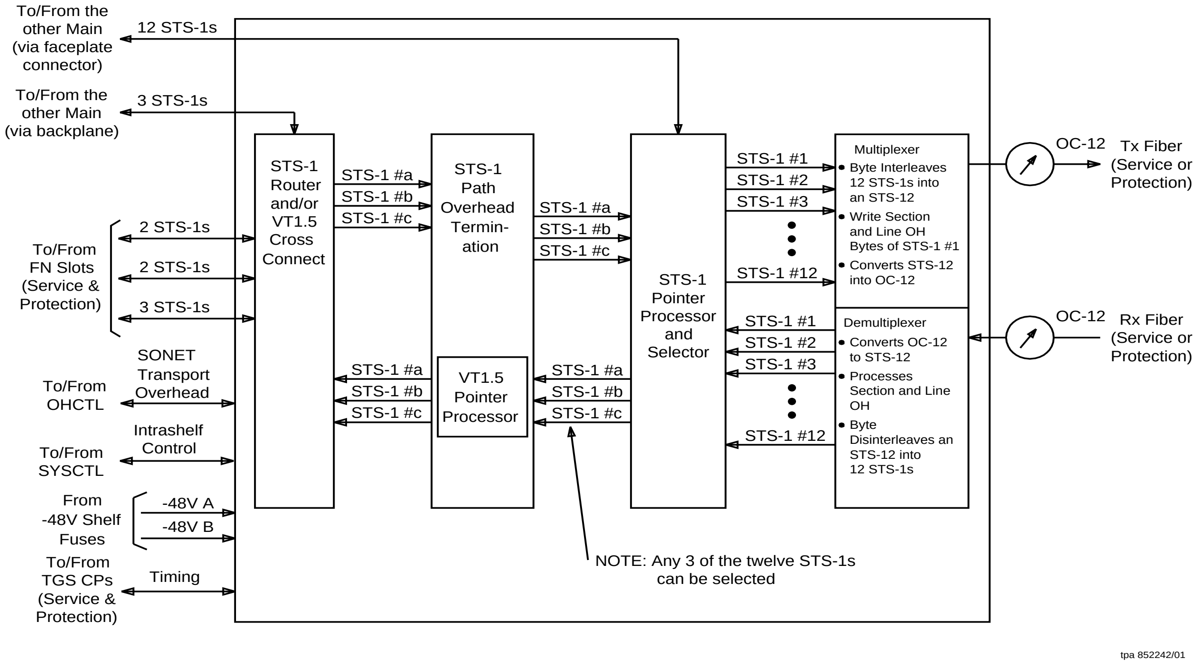


Figure 7-46. 24G-U OLIU Circuit Pack Block Diagram

Timing Circuitry

Each TG circuit pack sends timing signals to each 24G-U OLIU. Each 24G-U OLIU monitors the timing inputs from both TG circuit packs. The 24G-U OLIU normally selects the timing signals from the TG selected by the SYSCTL. Each 24G-U OLIU provides timing signals derived from the incoming optical signal to both TG circuit packs for line timing and DS1 output (BITS).

Protection Circuitry

The 24G-U OLIU is protection switched by the SYSCTL in response to an external command or internal equipment fault. The 24G-U OLIU also supports protection switching for unidirectional path switched rings at the VT and STS level.

The 24G-U OLIU interfaces with STS-1 signals from the circuit packs in the main and function unit slots. It selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 24G-U OLIU provides selectors for timing signals from the TG circuit packs, monitors these inputs, and autonomously selects either TG circuit pack. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 24G-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 24G-U OLIU has provisionable VT signal degrade and STS signal degrade BER threshold capabilities for path protection switching.

Performance Monitoring

The 24G-U OLIU provides PM circuitry for the following performance parameters:

- Section SEFS count for the OC-12 input
- Line coding violation counts for the OC-12 input
- STS-1 path coding violation counts for up to three STS-1s that are VT1.5 cross-connected.

Power Circuitry

Power for the 24G-U OLIU circuit pack is provided by two DC-to-DC converters located on the 24G-U OLIU circuit pack. The converters supply both +5 and +3.3 volts. Both A and B –48 volt backplane busses supply power to the converters through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or converters causes the red FAULT LED to light.

24G-U OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 24G-U OLIU circuit pack are as follows:

- Selects STS-1 inputs from MXRVO, DS3, STS1E, or other OLIU circuit packs
- Provides VT1.5/STS-1 signal cross-connections
- Adds SONET transport overhead and, for up to three VT1.5 cross-connected STS-1s, adds STS-1 path overhead
- Byte-interleaves and scrambles up to three selected STS-1 signals plus the other nine to twelve STS-1s on the ring to produce an STS-12 signal
- Uses a laser transmitter to produce a SONET standard OC-12 optical signal from an STS-12 electrical signal.

Receive Functions

The following are major receive functions of the 24G-U OLIU circuit pack:

- Receives a SONET standard OC-12 optical signal and converts it to an electrical STS-12 signal
- Extracts STS-12 clock and retimes the received data
- Demultiplexes the STS-12 signal into twelve STS-1 signals
- Extracts transport overhead and, for up to three STS-1s (if VT1.5 cross-connected), extracts path overhead
- Processes the STS-1 or STS-3c pointers and frame-synchronizes the STS-1/STS-3c signals
- Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal, if VT1.5 cross-connected, for up to three STS-1s
- Provides VT1.5/STS-1 signal cross-connections for up to three STS-1s
- Provides STS-1/STS-3c pass-through cross-connections for remaining STS-1s

- Processes the received clock and provides a reference clock to the TG circuit packs
- Provides express processing for VT AIS for VT cross-connected STS-1s.

Control Functions

The major control functions are as follows:

- Switches protection for DS3, MXRVO, STS1E, other OLIU, and TG circuit packs
- Processes transport and path overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.)
- Supports VT and STS signal degrade unidirectional path protection switching for up to three STS-1s
- Supports STS-1 BER signal fail (10^{-3} or 10^{-6}) path protection switching for up to three STS-1s
- Supports path protection switching based on STS-1 unequipped, STS-1 AIS, STS-1 LOP, VT AIS, VT unequipped, and VT LOP for up to three STS-1s.

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS
- inserts and detects VT1.5 path AIS for up to three STS-1s
- Inserts and detects OC-12 line AIS
- Inserts and detects STS-1 path unequipped signal for up to three STS-1s
- Inserts and detects VT path unequipped signal for up to three STS-1
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow for up to three STS-1s if VT1.5 cross-connected
- Detects OC-12 line failures (LOS, LOF, AIS, and BER)
- Detects OC-12 line signal degrade BER, STS-1 path and VT1.5 path signal degrade, and signal fail for up to three STS-1s.

26G2-U Circuit Pack Description

Purpose of Circuit

The 26G2-U OLIU circuit pack interfaces with a 1310 nm optical line in the transmit and receive directions. It provides an interface between the OC-1 optical line and the electrical STS-1 and VT-G signals. The 26G2-U OLIU circuit pack also has the following functions:

- — Active VT timeslot interchanging in the function slot
- — Access to low speed slots and main slots from the function slot

The 26G2-U OLIU may be used in the main slots of the DDM-2000 FiberReach wideband shelf or the function unit slots of the DDM-2000 OC-3 shelf (Group 4 or later). The fiber is accessed via a pair of universal optical connectors on the 26G2-U faceplate that supports *ST*®, SC, and FC type optical connectors. Both single mode and multi mode facilities are supported.

26G2-U OLIU Faceplate Indicators

The 26G2-U OLIU circuit pack faceplate indicators are shown in Figure 7-47. The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming OC-1 signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

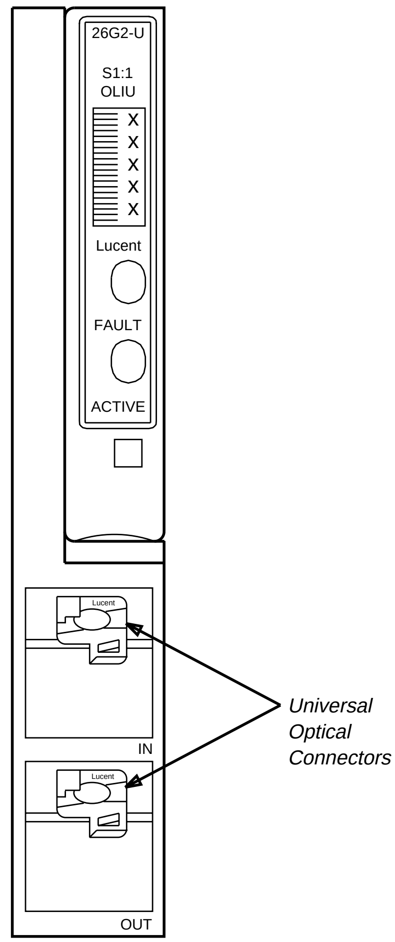


Figure 7-47. 26G2-U OLIU Circuit Packs

A faceplate-mounted universal optical connector allows the 26G2-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. The 26G2-U OLIU comes with a 0 dB *ST* buildout. A 10 dB attenuator is required for loopback testing. Various combinations of buildout attenuators and connectors are also available. See Chapter 10, "Technical Specifications" for a list of universal buildout attenuators.

General Description of Operation

The 26G2-U circuit pack accepts eight VT-G signals from the DS1 circuit packs, performs protection switch selections, combines the selected signals to form an STS-1 signal, inserts STS-1 path overhead, inserts SONET transport overhead bytes (line and section) and STS path overhead bytes, and scrambles the resulting signal which drives a separate laser transmitter to create an OC-1 output.

The 26G2-U circuit pack converts a received OC-1 signal back to an electrical STS-1, descrambles and demultiplexes it, and processes the transport overhead. It sends some of the overhead (for example, section data communications channel) via serial data links to the control packs, and processes other bytes (for example framing, parity check) on board. It performs STS-1 pointer processing to guarantee STS-1 frame alignment to the local system clock and STS-1 path overhead and VT1.5 pointer processing. The 26G2-U then performs VT1.5 TSI, multiplexes four VT1.5 signals to VT-Gs, and sends the VT-Gs to the low-speed slots.

The 26G2-U provides an interface of eight VT-G signals in both the wideband shelf and the OC-3 shelf. These groups are multiplexed into an STS-1 signal. A VT1.5 cross-connect allows VT1.5 switching as required.

Detailed Description of Operation

Figure 7-48 is a block diagram of the 26G2-U OLIU circuit pack.

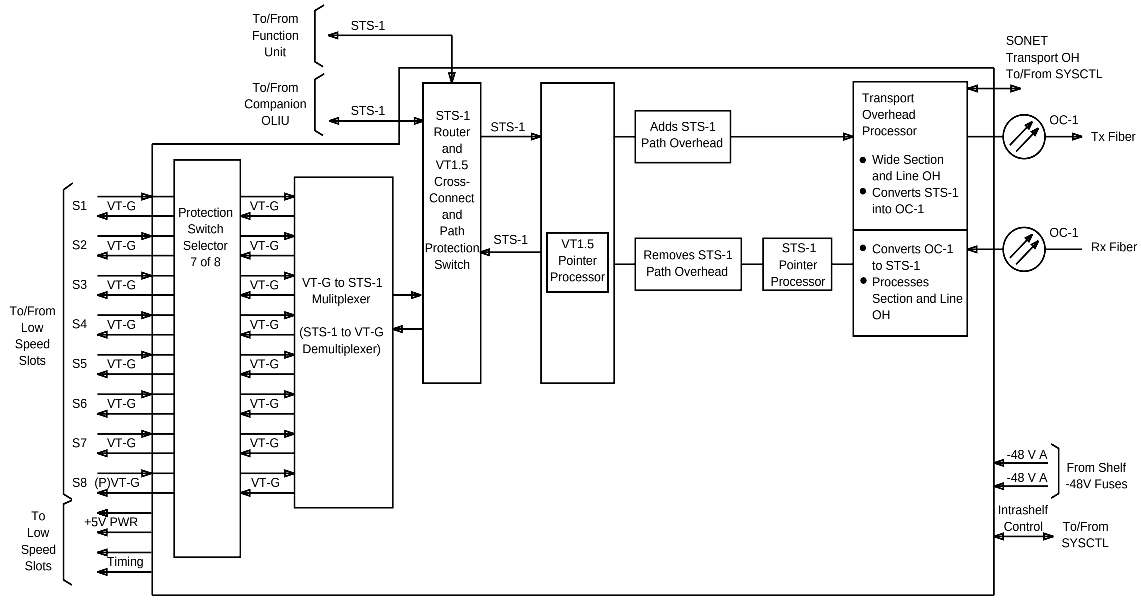


Figure 7-48. 26G2-U OLIU Circuit Pack Block Diagram

Transmission Circuitry

STS-1 Router and VT1.5 Cross-Connect . The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the VT1.5 cross-connect. The outgoing STS-1 may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

Transmit Direction . In the transmit direction (from the low-speed slots toward the optical interface), the VT-G signals from the low-speed slots are combined into an STS-1 signal. SONET path overhead is then added to STS-1 sourced by the VT1.5 cross-connect before the signals are sent to the transport overhead processor. The transport overhead processor takes the STS-1 signal, adds SONET transport overhead, then scrambles the signal with a frame synchronous scrambler. The output from the transport overhead processor is in the SONET STS-1 format and is used to modulate the amplitude of the laser transmitter, converting the electrical signal to an NRZ-encoded SONET compatible OC-1 optical signal.

In the OC-3 shelf, the 26G2-U OLIU provides an interface between the STS-1 optical signal and electrical VT-G signals. Three STS-1 paths will be brought out to the backplane for STS-1 routing throughout the OC-3 shelf. The 26G2-U also provides an STS-1 electrical interface to a companion 26G2-U OLIU which allows the two OLIUs to be cross coupled.

Receive Direction . In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-1 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock and uses it to retime the received data. The transport overhead processor circuit accepts the retimed STS-1 bit stream, frames on the incoming signal, descrambles it, and processes OC-1 transport overhead. The overhead information is sent to the SYSCTL circuit pack.

The STS-1 output from the transport overhead processor is sent to the STS-1 pointer processor which performs pointer interpretation and generation. The output of the STS-1 pointer processor is sent to the VT1.5 pointer processor. STS-1 path overhead and VT1.5 pointer processing is performed. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends two STS-1 signals to the appropriate main or function unit slots and up to 8 VT-Gs to the low-speed slots.

The 26G2-U terminates an STS-1 optical signal, converts it to an electrical signal, frames on and descrambles the signal, and processes the transport overhead.

Control Circuitry

The 26G2-U OLIU circuit pack interfaces with the BBG8 system controller (SYSCTL) via the intershelf control interface. The 26G2-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 26G2-U OLIU responds to control signals from the SYSCTL such as STS-1 routing, VT1.5 routing, protection switching, and LED control commands.

The 26G2-U OLIU accesses the SONET transport overhead and routes it to and from the SYSCTL circuit pack.

Timing Circuitry

The 26G2-U OLIU recovers timing from the incoming OC-1 signal.

Protection Circuitry

STS-1 and VT1.5 path protection switching, compliant with SONET specifications, is provided. The 26G2-U OLIU is protection switched by the SYSCTL in response to an external command, incoming optical signal failure, or internal equipment fault. The 26G2-U OLIU circuit pack is protection switched by the SYSCTL when the SYSCTL detects a fault on the active 26G2-U OLIU, and the companion 26G2-U OLIU is good.

The 26G2-U OLIU interfaces via VT-G signals with circuit packs in the low-speed slots. It selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

Fault Detection Circuitry

The 26G2-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous, and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 26G2-U OLIU has STS-1 and VT1.5 signal degrade protection switching and STS signal degrade protection switching capabilities.

Performance Monitoring

The 26G2-U OLIU provides PM circuitry for the following performance parameters:

- STS-1 section severely errored frame seconds (SEFS)
- Line coding violations (B2 parity)
- Line errored seconds
- STS-1 path coding violations (B3 parity)
- STS-1 path errored seconds

Power Circuitry

Power for the 26G2-U OLIU circuit pack is provided by two DC-to-DC converters located on the 26G2-U OLIU circuit pack. The converters supply +5 volts. Both A and B –48 volt backplane busses supply power to the converters through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. The 26G2-U provides +5V power to the low-speed slots. Failure of the fuse or converters causes the red FAULT LED to light.

26G2-U OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 26G2-U OLIU circuit pack are as follows:

a. Selects and multiplexes VT-Gs into one STS-1 synchronous payload envelope (SPE).
b. Adds SONET and STS-1 path transport overhead
c. Scrambles the STS-1 signal to prepare for optical conversion
d. Uses a laser transmitter to produce a SONET standard OC-1 optical signal.

Receive Functions

The following are major receive functions of the 26G2-U OLIU circuit pack:

a. Receives one SONET standard OC-1 optical signal and converts it to an electrical STS-1 signal
b. Extracts transport and STS-1 path overhead
c. Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
d. Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal
e. Provides path protection switching
f. Provides VT1.5/STS-1 signal cross-connections
g. Sends VT-Gs to the DS1 circuit packs

Control Functions

The major control functions are as follows:

a. Processes transport and path overhead
b. Stores inventory information (*CLEI* code, date of manufacture, etc.)
c. Supports VT and OC-1 signal degrade protection switching.
d. Supports protection switching of circuit packs in the low-speed slots.

Maintenance Signal Functions

The major maintenance signal functions are as follows:

a. Inserts and detects OC-1 line and STS-1 and VT1.5 path AIS
b. Inserts STS-1 and VT1.5 path unequipped signal
c. Inserts and detects line far-end-receive failure (FERF)
d. Inserts and detects STS-1 path yellow.

27G-U/27G2-U OLIU Circuit Pack Description

Purpose of Circuit

The 27G-U/27G2-U OLIU circuit pack provides the transmit and receive line termination functions for two OC-1 signals. The 27G-U/27G2-U OLIU performs the optical/electrical conversion between two optical carrier level 1 (OC-1) and STS-1 signals and provides SONET transport overhead access. The 27G-U/27G2-U OLIU also provides routing of the STS-1s between the OC-1 interfaces and other main and function unit slots in the shelf as well as VT1.5/STS-1 add/drop and ring capabilities. When used to perform VT1.5 add/drop or ring capabilities, STS-1 path overhead access is also provided.

27G-U/27G2-U OLIU Faceplate Indicators

The 27G-U/27G2-U OLIU circuit pack faceplate indicators are shown in Figure 7-49.

The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming OC-1 signal failure, this LED will flash on and off.

The green ACTIVE LED lights when the circuit pack is active (carrying service).

A faceplate-mounted universal optical connector allows the 27G-U/27G2-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. The 27G-U/27G2-U OLIU comes with a 0 dB *ST* buildout. A 10 dB attenuator is required for loopback testing. The 27G-U/27G2-U OLIU operates over single mode fiber. Various combinations of buildout attenuators and connectors are also available. See Section 10, "Technical Specifications," for a list of universal buildout attenuators.

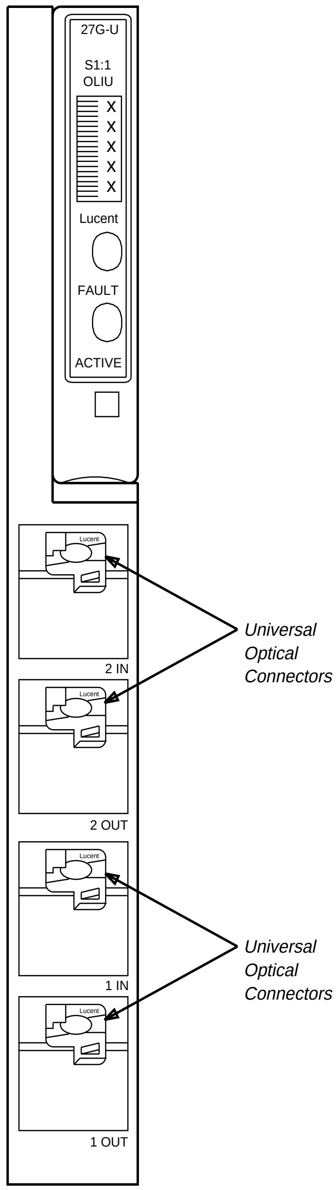


Figure 7-49. 27G-U/27G2-U OLIU Circuit Pack

General Description of Operation

The 27G-U/27G2-U OLIU, for each STS-1, inserts SONET transport overhead bytes (line and section), and for VT1.5 applications, inserts STS path overhead bytes and scrambles the resulting signal. Each STS-1 signal drives a separate laser transmitter to create the two OC-1 outputs.

A received OC-1 signal is converted back to an electrical STS-1. This STS-1 is descrambled and demultiplexed and transport/path overhead is accessed. Some of the overhead (for example, section DCC) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a VT1.5 cross-connection.

Each 27G-U/27G2-U OLIU provides timing signals to and receives timing signals from the TG circuit packs.

Detailed Description of Operation

Figure 7-50 is a block diagram of the 27G-U/27G2-U OLIU.

Transmission Circuitry

STS-1 Router and VT1.5 Cross-Connect. The STS-1 router is used to select STS-1s for both the transmit and receive directions. All incoming STS-1s are fed to the VT1.5 cross-connect. Outgoing STS-1s may be sourced by this VT1.5 cross-connect or sourced directly by an STS-1 input.

Transmit Direction. The STS-1 router selects two of the STS-1 signals directly from the other main and function unit slots or from the VT1.5 cross-connect. SONET path overhead is then added to STS-1s sourced by the VT1.5 cross-connect before the signals are sent to the transport overhead processor. The transport overhead processor takes the two STS-1 signals, adds SONET transport overhead, then scrambles the signal with a frame synchronous scrambler. The output from the transport overhead processor is in the SONET STS-1 format and is used to amplitude modulate the laser transmitter, converting the electrical signal to an NRZ-encoded SONET compatible OC-1 optical signal.

Receive Direction. In the receive direction for each OC-1, the optical receiver converts the light pulses from an NRZ-encoded OC-1 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock and uses it to retime the received data. The transport overhead processor circuit accepts the retimed STS-1 bit stream, frames on the incoming signal, descrambles it, and processes OC-1 transport overhead. The overhead information is sent to the SYSCTL circuit pack via the intra-shelf control bus and to the OHCTL circuit pack by the transport overhead channel interface.

The STS-1 outputs from the transport overhead processor are sent to the STS-1 pointer processor which performs pointer interpretation and generation on each received STS-1, using the local timing signals. The output of the STS-1 pointer processor is two STS-1 signals, frame synchronous to each other, which are sent to the VT1.5 pointer processor. VT1.5 pointer processing is performed on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends the two STS-1 signals to the appropriate main or function unit slots.

Control Circuitry

The 27G-U/27G2-U OLIU circuit pack interfaces with the BBG8/BBG8B SYSCTL and with the BBG9 OHCTL circuit packs.

The 27G-U/27G2-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 27G-U/27G2-U OLIU responds to control signals from the SYSCTL, such as STS-1 routing, VT1.5 routing, protection switching, and LED control commands.

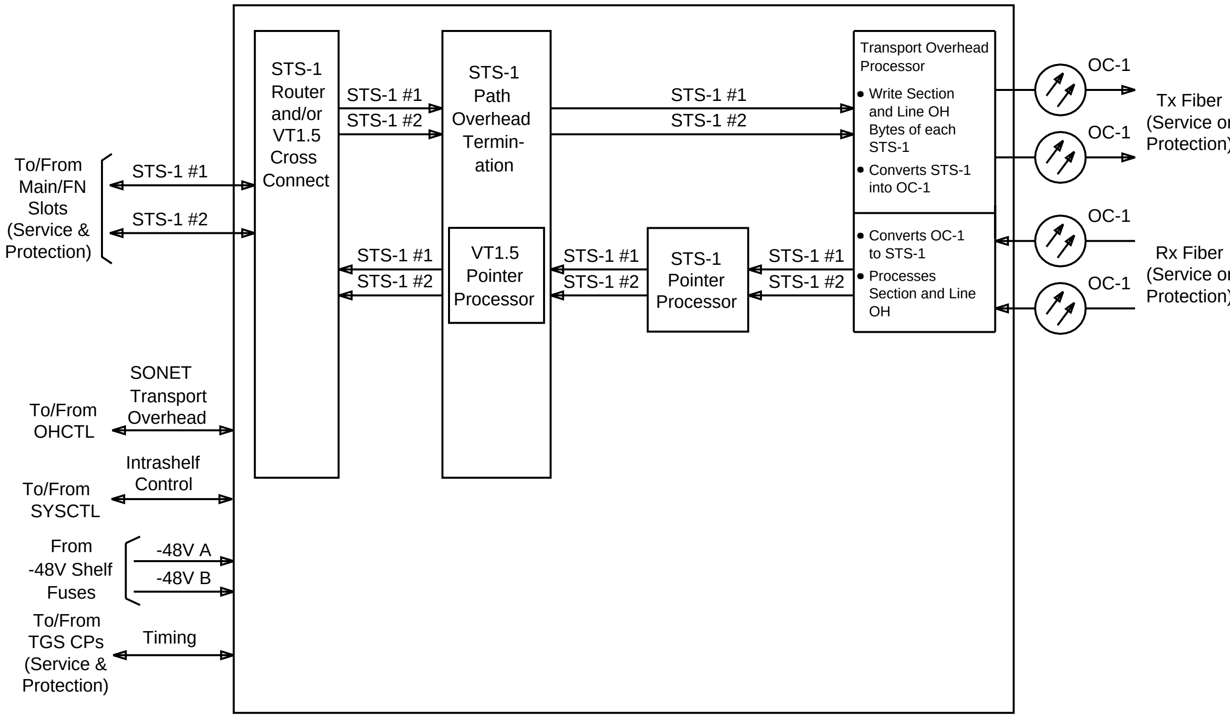


Figure 7-50. **27G-U/27G2-U OLIU Circuit Pack Block Diagram**

The 27G-U/27G2-U OLIU accesses the SONET transport overhead and routes it via the transport overhead channel interface to the OHCTL. The 27G-U/27G2-U OLIU accesses the STS-1 path overhead and routes it via the intra-shelf control bus to the SYSCTL circuit pack.

Timing Circuitry

Each TG circuit pack sends timing signals to each 27G-U/27G2-U OLIU. Each 27G-U/27G2-U OLIU monitors the timing inputs from both TG circuit packs. The 27G-U/27G2-U OLIU normally selects the timing signals from the TG selected by the SYSCTL. When inserted in main or function unit C slots, each 27G-U/27G2-U OLIU provides timing signals derived from the incoming optical signal to both TG circuit packs for line timing and DS1 output (BITS).

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 27G-U/27G2-U OLIU is protection switched by the SYSCTL in response to an external command, incoming optical signal failure, or internal equipment fault. The 27G-U/27G2-U OLIU circuit pack is protection switched by the SYSCTL when the SYSCTL detects a fault on the active 27G-U/27G2-U OLIU and the companion 27G-U/27G2-U OLIU is good.

The 27G-U/27G2-U OLIU interfaces with STS-1 signals from the circuit packs in the main and function unit slots. It selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 27G-U/27G2-U OLIU provides selectors for timing signals from the TG circuit packs, monitors these inputs, and autonomously selects either TG circuit pack. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 27G-U/27G2-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the OLIU circuit pack is inserted or recovers from a transient failure.

The 27G-U/27G2-U OLIU has provisionable VT signal degrade and STS signal degrade BER threshold capabilities for path protection switching.

Performance Monitoring

The 27G-U/27G2-U OLIU provides PM circuitry for the following performance parameters:

- STS-1 section SEFS count
- Line coding violation counts (B2 parity)
- Line errored seconds
- STS-1 path coding violation counts (B3 parity)
- STS-1 path errored seconds
- VT path coding violation counts (V5 parity)
- VT path errored seconds.

Power Circuitry

Power for the 27G-U/27G2-U OLIU circuit pack is provided by a DC-to-DC converter located on the 27G-U/27G2-U OLIU circuit pack. The converter supplies +5 volts. Both A and B –48 volt backplane busses supply power to the converter through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or converter causes the red FAULT LED to light.

27G-U/27G2-U OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 27G-U/27G2-U OLIU circuit pack are as follows:

- Selects STS-1 inputs from MXRVO, STS1E, or other OLIU circuit packs
- Provides VT1.5/STS-1 signal cross-connections
- Adds SONET transport overhead and, if VT1.5 cross-connected, adds STS-1 path overhead
- Scrambles the two selected STS-1 signals to prepare for optical conversion
- Uses a laser transmitter to produce a SONET compatible OC-1 optical signal from each STS-1 electrical signal.

Receive Functions

The following are major receive functions of the 27G-U/27G2-U OLIU circuit pack:

- Receives two SONET compatible OC-1 optical signals and converts each to an electrical STS-1 signals
- Extracts STS-1 rate clock and retimes the received data
- Extracts transport overhead and, if VT1.5 cross-connected, extracts STS-1 path overhead from each STS-1
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the VT1.5 pointers and frame-synchronizes the VT1.5 signal, if VT1.5 cross-connected
- Provides VT1.5/STS-1 signal cross-connections
- Processes the received clock and provides a reference clock to the TG circuit packs
- Provides express processing for VT AIS.

Control Functions

The major control functions are as follows:

- Switches protection for OC-1 line and STS1E, MXRVO, other OLIU, and TG circuit packs
- Processes transport and path overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.)
- Supports VT, STS, and OC-1 signal degrade protection switching
- Supports STS-1 BER signal fail (10^{-3} or 10^{-6}) path protection switching
- Supports path protection switching based on STS-1 unequipped, STS-1 AIS, STS-1 LOP, VT AIS, VT unequipped, and VT LOP.

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS or inserts and detects VT1.5 path AIS
- Inserts and detects OC-1 line AIS
- Inserts and detects STS-1 path unequipped signal
- Inserts and detects VT path unequipped signal
- Inserts and detects line FERF
- Inserts and detects STS-1 path yellow, if VT1.5 cross-connected
- Detects OC-1 line failures (LOS, LOF, AIS, and BER)
- Detects OC-1 line signal degrade BER.

Long Reach OC-12 Interface (29G-U/29H-U)

- Optical/Copper Specifications

  For direct optical loopbacks, at least 10 dB of optical attenuation is needed for the 29G-U optical line. The distributed feedback laser supplies a NRZ-coded signal. The 29G-U OLIU long reach OC-12 interface supports span lengths up to 51 km, assuming 0.45 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 7-4 Transmit and receive powers are referenced to points S and R as shown in Figure 7-51. Table 7-3 and Table 7-4 provide detailed specifications and link budget information for the 29G-U OLIU. Note that the 29G-U OLIU is not specified to operate over multimode fiber.

  For direct optical loopbacks, at least 10 dB of optical attenuation is needed for the 29H-U line. The distributed feedback laser supplies a NRZ-coded signal. The 29H-U OLIU long reach OC-12 interface supports span lengths up to 96 km, assuming 0.25 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 7-4 Transmit and receive powers are referenced to points S and R as shown in Figure 7-51. Table 7-3 and Table 7-4 provide detailed specifications and link budget information for the 29H-U OLIU. Note that the 29H-U OLIU is not specified to operate over multimode fiber.

- Alarm Thresholding

  The following parameters are monitored at the OC-12 interface.

  - Loss of signal (LOS)
  - Loss of frame (LOF)
  - Loss of pointer (LOP)
  - Line AIS
  - B2 thresholding signal fail
  - B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 7-5)

  - Section SEFS
  - Line parameter B2.
  - STS pointer justifications (Release 15.0 and later).

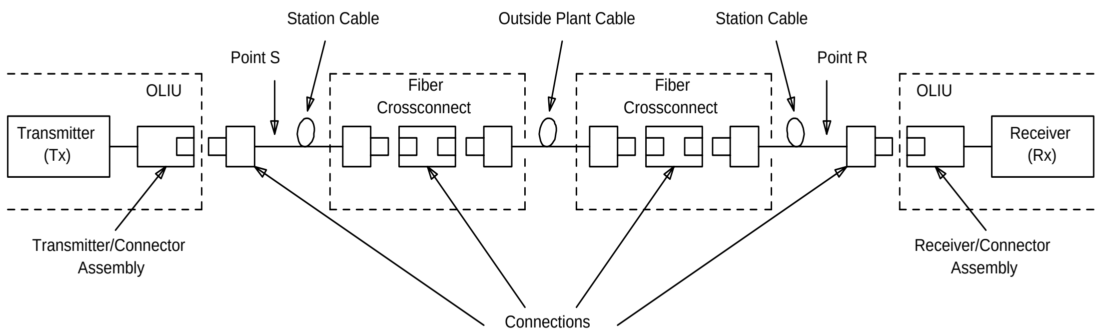


Figure 7-51. Optical System Interfaces (Points S and R)

Table 7-3. 29G-U/29H-U OLIU Specifications

System Information:		
Terminal Equipment Identification	29G-U OLIU	29H-U OLIU
Optical Line Rate (Mb/s)	622.080 Mb/s	622.080 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength (nm)	1310 nm	1550 nm
Performance	SONET LR-1 DFB (Long Reach)	SONET LR-1 DFB (Long Reach)
Transmitter Information:		
Optical Device Temperature Controller	None	None
FDA Classification	Class I	Class I
Optical Source	InGaAsP Laser, SLM Structure	InGaAsP Laser, SLM Structure
Faceplate Optical Connector	UOC Buildout Assembly (single-mode) *	UOC Buildout Assembly (single-mode) *
Receiver Information:		
Optical Device Temperature Controller	None	None
Optical Detector	InGaAs PIN	InGaAs PIN
Faceplate Optical Connector	UOC Buildout Assembly (multi-mode) *	UOC Buildout Assembly (multi-mode) *

***** The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 7-4. 29G-U/29H-U OLIU Link Budgets (Notes)

Parameter	29G-U	29H-U
Minimum Wavelength (λ_{Tmin})	1280 nm	1530 nm
Maximum Wavelength (λ_{Tmax})	1335 nm	1570 nm
Spectral Width ($\delta\lambda_{20}$)	1.0 nm	1.0 nm
Maximum Transmitter Power ∗(P_{Tmax})	+1.9 dBm	+2.0 dBm
Minimum Transmitter Power (P_{Tmin})	–2.5 dBm	–2.5 dBm
Maximum Received Power (P_{Rmax})	–8.0 dBm	–8.0 dBm
Minimum Received Power (P_{Rmin})	–30.5 dBm	–31.0 dBm
Minimum System Gain (S-R) †	28.0 dB	28.5 dB
Optical Path Penalty (P_O) ‡	1.0 dB	1.0 dB
Connector Loss §	1.5 dB	1.5 dB
Unallocated Margin ¶	1.5 dB	2.0 dB
Minimum Loss Budget ∗∗	8.0 dB	10.0 dB
Maximum Loss Budget ††	**24.0 dB**	**24.0 dB**
Maximum Span Length ‡‡	51 km	96 km

Notes:

1. All terminology is consistent with TR-253, Iss. 2. All values are worst-case end of life.
2. All specifications for the 29G-U/29H-U meet or exceed long reach (LR) values described in TR-253, Iss. 2.

∗ Transmit and receive powers are referenced to points S and R as shown in Figure 7-51.

† The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

‡ Optical path penalty includes effects of dispersion, reflection and jitter that occur on the optical path. The 29G-U has 4.0 dB of total margin. Optical path penalty is normally 1.0 dB. The 29H-U has 4.5 dB of total margin. Optical path penalty is normally 1.0 dB, which implies 1800 psec/nm total dispersion. Typical nondispersion fiber has 10 psec/nm km dispersion in the 1550 nm wavelength range.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

** The 29G-U/29H-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 10 dB.

†† Budget available for both station and transmission cable and splices.

‡‡ Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1310 nm wavelength range is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber in the 1310 nm range.

For the 29G-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 29G-U is 51 km.

Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1550 nm wavelength range is 0.25 dB/km, including cable and splice loss.

For the 29H-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 29H-U is 96 km.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

Table 7-5. Performance Monitoring Parameters Provisionable via the CIT

Parameter Definition		**Threshold Range (Default)**		**Command**
Facility	**Measure**	**Current Quarter Hour**	**Current Day**	**set-pmthres-**
OC-3 Optics	Optical Transmit Power* (21G/21G-U only) Laser Bias Current* (21G/21G-U only)	-1 dB, -2 dB enable/disable	-1 dB, -2 dB enable/disable	**sect** **sect**
OC-12 Section §§	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**sect**
OC-3 Section	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**sect**
OC-1 Section	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**sect**
OC-12 Line §§	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC)	1-55365 [5537] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-5315040 [531504] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**line** **line** **line** **line** **line** **line** **line**
OC-3 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L) STS Pointer Justification (PJC) ¶¶	1-13841[1384] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-63 [2] 1-65535 [60]	1-1328736 [132874] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-255 [4] 1-9999999 [5760]	**line** **line** **line** **line** **line** **line** **line** **line**
OC-1 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC) ¶¶	1-4613 [461] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-442848 [44285] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**line** **line** **line** **line** **line** **line** **line**
EC-1 Line §	B2 Coding Violations (CV) EC-1 B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC) ¶¶	1-4613 [461] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-442848 [44285] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**line** **line** **line** **line** **line** **line** **line**

Table 7-5. Performance Monitoring Parameters Provisionable via the CIT (Contd)

Parameter Definition		Threshold Range (Default)		Command
Facility	**Measure**	**Current Quarter Hour**	**Current Day**	**set-pmthres-**
STS-1 Path	B3 Coding Violations (CV) B3 Errored Seconds (ES) B3 Errored Seconds Type A (ESA) B3 Errored Seconds Type B (ESB) B3 Severely Errored Seconds (SES) B3 Unavailable Seconds (UAS)	1-4510 [451] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30]	1-432960 [43296] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90]	**sts1** **sts1** **sts1** **sts1** **sts1** **sts1**
DS3 Path ¶	P-Bit Error Counts SE Frame Seconds (SEFS)	1-4026 [403] 1-63 [10]	1-386500 [38650] 1-4095 [30]	**t3** **t3**
Enhanced DS3 Path for P-Bits, F&M Bits, and C-Bits from Fiber and DSX**	CV-P Coding Violations ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds SEFS	1-16383 [40] 1-900 [25] 1-63 [4] 1-63 [10] 1-63 [2]	1-1048575 [3820] 1-65535 [250] 1-4095 [40] 1-4095 [10] 1-4095 [8]	**t3** **t3** **t3** **t3** **t3**
DS3 Line ††	CV-L Coding Violations Errored Seconds, Line (ES-L) Severely Errored Seconds, Line (SES-L)	1-16383 [40] 1-900 [25] 1-63 [4]	1-1048575 [3865] 1-65535 [250] 1-4095 [40]	**t3** **t3** **t3**
VT1.5 Path †	V5 Errored Seconds (ES) V5 Severely Errored Seconds (SES) V5 Unavailable Seconds (UAS)	1-900 [40] 1-63 [20] 1-63 [30]	1-65535 [900] 1-4095 [60] 1-4095 [90]	**vt1** **vt1** **vt1**
DS1 Path ‡, ‡‡	ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds ES-PFE Errored Seconds SES-PFE Severely Errored Seconds UAS-PFE Unavailable Seconds CV-P (SF) Coding Violations †† CV-P (ESF) Coding Violations †† CV-PFE Coding Violations ††	1-900 [65] 1-63 [10] 1-63 [10] 1-900 [65] 1-63 [10] 1-63 [10] 1-16383 [72] 1-16383 [13296] 1-16383 [13296]	1-65535 [648] 1-4095 [100] 1-4095 [10] 1-65535 [648] 1-4095 [100] 1-4095 [10] 1-1048575 [691] 1-1048575 [132960] 1-1048575 [132960]	**t1** **t1** **t1** **t1** **t1** **t1** **t1** **t1** **t1**
DS1 Line ††, ‡‡	ES-L Line Errored Seconds	1-900 [65]	1-65535 [648]	**t1**

Table 7-5. Performance Monitoring Parameters Provisionable via the CIT (Contd)

Parameter Definition		Threshold Range (Default)		Command
Facility	**Measure**	**Current Quarter Hour**	**Current Day**	**set-pmthres-**
VT1.5 Path †	V5 Errored Seconds (ES)	1-900 [40]	1-65535 [900]	**vt1**
	V5 Severely Errored Seconds (SES)	1-63 [20]	1-4095 [60]	**vt1**
	V5 Unavailable Seconds (UAS)	1-63 [30]	1-4095 [90]	**vt1**
DS1 Path ‡, ‡‡	ES-P Errored Seconds	1-900 [65]	1-65535 [648]	**t1**
	SES-P Severely Errored Seconds	1-63 [10]	1-4095 [100]	**t1**
	UAS-P Unavailable Seconds	1-63 [10]	1-4095 [10]	**t1**
	ES-PFE Errored Seconds	1-900 [65]	1-65535 [648]	**t1**
	SES-PFE Severely Errored Seconds	1-63 [10]	1-4095 [100]	**t1**
	UAS-PFE Unavailable Seconds	1-63 [10]	1-4095 [10]	**t1**
	CV-P (SF) Coding Violations ††	1-16383 [72]	1-1048575 [691]	**t1**
	CV-P (ESF) Coding Violations ††	1-16383 [13296]	1-1048575 [132960]	**t1**
	CV-PFE Coding Violations ††	1-16383 [13296]	1-1048575 [132960]	**t1**
DS1 Line ††, ‡‡	ES-L Line Errored Seconds	1-900 [65]	1-65535 [648]	*

* Threshold is set once for both current quarter hour and current day.

† Release 6.0 and later linear releases, Release 7.0 and later ring releases (feature package option).

‡ Release 5.1 and later ring releases and Release 6.0 and later linear releases (feature package option).

§ Release 5.1 and later ring releases and Release 6.0 and later linear releases.

¶ Prior to Release 7.1.

** From the fiber Release 7.1 and later; from the fiber and DSX Release 7.2 and later. C-Bit option is Release 8.0 and later releases.

†† Release 7.2 and later releases.

‡‡ Release 9.1 and later in OC-3 systems support current quarter-hour thresholding and reporting of DS1 PM.

§§ Applicable only when using the 24G-U/24H-U/29G-U/29H-U OLIU in main slot.

¶¶ Release 11.0 and later.

Administration and Provisioning

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Administration and Provisioning

8

Overview

This section describes the administration and provisioning features of the DDM-2000 OC-3 Multiplexer. The following topics are described in addition to the administration and provisioning features:

- Multiplexing and mapping
- Cross-connection provisioning for linear and ring networks
- Listing of provisionable parameters with their ranges and default values.

Administration

Version Recognition

The DDM-2000 OC-3 Multiplexer provides automatic version recognition of all hardware, firmware, and software installed in the system. Each circuit pack *Common Language** code, equipment catalog item (ECI) code, apparatus code and series number, and serial number is stored on the circuit pack and is accessible by the system controller (SYSCTL) via the craft interface terminal (CIT). Circuit packs with socketed devices also report those devices and program identification (PID) codes. The SYSCTL also reports the software version for the system. Refer to the **`rtrv-eqpt`** command in Section 11, "Commands and Reports."

* Common Language is a registered trademark, and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

Security

DDM-2000 OC-3 Multiplexers provide security capabilities to protect against unauthorized access to the system through the CIT, data communications channel (DCC), and TL1/X.25 interfaces. When security is enabled (default is disabled for the CIT and DCC and always enabled for TL1/X.25), four types of users are allowed access to the system with a valid login and password:

- Privileged users can execute all commands
- General users can execute any commands not restricted to privileged users
- Maintenance users can execute some of the general level and all “reports-only” commands that are not restricted to privileged users
- Reports-only users can only execute commands that retrieve reports from the system.

When the system is first initialized, three default logins and passwords are provided which must be changed by a privileged user before security is enabled. At initialization, privileged users are those users who use the default logins and passwords. Replacement of the SYSCTL circuit pack causes the system to default back to the default logins and passwords. Up to 100 logins and passwords can be added, deleted, and changed by three authorized privileged users. Login and password security can be enabled or disabled. Timeouts can be provisioned independently for front and rear access CIT interfaces and the synchronous optical network (SONET) section DCC. Timeout is disabled on the TL1/X.25 interface. For more information on provisioning, see “System Turnup/Circuit Order,” in the TOP section of this manual (Volume II).

Authorized privileged users can establish general user and reports-only user logins using the **`set-lgn`** command. Authorized privileged users can also "lockout" access by general and reports-only users without deleting the login and password file.

The following commands are restricted to privileged users over the CIT and DCC interfaces. See 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide* for TL1/X.25 command access privileges.

- **`init-sys`** — Initialize System
- **`rstr-passwd`** — Restore login and password file
- **`rtrv-lgn`** — Retrieve Login
- **`rtrv-passwd`** — Retrieve login and password file
- **`set-feat`** — Set Features
- **`set-fecom`** — Set Far-End Communications

- **set-lgn** — Set Login
- **set-secu** — Set Security
- **set-sync** — Set Synchronization characteristics.

When security is enabled (default is “disable”), the following additional commands become restricted to privileged users only:

- **apply** — Locally Overwrite Executing Software
- **cpy-prog** — Copy Program
- **dlt-osacmap** — Delete OS application context ID map
- **ent-osacmap** — Enter OS application context ID map
- **ent-tl1msgmap** — Enter TL1 message map for OS
- **ent-ulsdcc-l3** — Enter Upper Layer Section DCC - Layer 3
- **ent-ulsdcc-l4** — Enter Upper Layer Section DCC - Layer 4
- **dlt-ulsdcc-l4** — Delete Upper Layer Section DCC - Layer 4
- **init-pm** — Initialize Performance Monitoring
- **ins-prog** — Install Program
- **reset** — System Reset
- **set-date** — Set network element (NE) Date and time
- **set-ne** — Set NE name.
- **set-x25** — Set X.25 baud rate for OS.

Reports-only users can execute the following commands: **?** (help), **logout**, **rlgn**, **set-passwd** (their own), **toggle**, and all **rtrv** commands **except**, **rtrv-lgn**, and **rtrv-passwd**.

For details on these and other commands, see Section 11, "Commands and Reports."

Software Upgrades

The DDM-2000 OC-3 Multiplexer provides an in-service software installation capability to update the generic program in local and remote systems. Upgrades are distributed on *MS-DOS* * formatted diskettes containing the new software and an installation program. Beginning with the upgrade from Release 9.1 to 11.0, an enhanced software download feature allows the source NE to download compressed copies of the new generic to all the other nodes in the network. This downloaded software will remain inactive until the **`apply`** command is issued to overwrite the current software. This feature allows wide flexibility in scheduling upgrades throughout the network. These software upgrades are the primary mechanism to add new feature enhancements to the in-service DDM-2000 OC-3 network.

The **`ins-prog`** command supports software installation from a personal computer (PC) and the **`cpy-prog`** command supports software installation from one shelf to another shelf. For details on these and other commands, see Section 11, "Commands and Reports."

Remote Software Download and Copy

System software can be downloaded using a PC through the EIA-232-D interface on the user panel to another system connected to the local system via the SONET DCC. The DDM-2000 OC-3 and OC-12 Multiplexers can upgrade the system software while in-service. DDM-2000 OC-3 and OC-12 Multiplexers use flash erasable programmable read-only memory (flash EPROM) chips to provide this capability. Software can be downloaded from a PC to a remote NE even when the local shelf is a different member of the DDM-2000 product family or *SLC*-2000 from the remote shelf (for example, a DDM-2000 OC-12 at the CO and a DDM-2000 FiberReach at the RT site). Remote software download and copy is also supported in multi-vendor subnetworks, but only between DDM-2000 Multiplexers. The remote software download and copy capabilities enable the network service providers to avoid costly craft dispatches for software upgrade.

DDM-2000 can also accept software downloads from Lucent’s ITM SNC R5.0 when upgrading from DDM-2000 OC-3 R13.0 and OC-12 R7.0 to subsequent releases.

Software Compatibility

NOTE:
DDM-2000 OC-3 TARP Releases 13.0 and 15.0 are NOT compatible with previous non-TARP releases of DDM-2000 OC-3. Therefore, when upgrading a subnetwork, care should be taken to avoid isolating NEs that have not yet been upgraded to Release 13.0 and later.

* Registered trademark of Microsoft Corporation.

DDM-2000 Multiplexers connected in the same subnetwork must be running compatible software. For more information on software compatibility, refer to Table 8-3 in this chapter.

Controller Maintenance and Memory Administration

Controller Maintenance

The controller for the DDM-2000 OC-3 Multiplexer consists of the SYSCTL and OHCTL circuit packs. The SYSCTL circuit pack provides CIT interfaces and coordinates protection switching, as well as all shelf maintenance and provisioning activities. The OHCTL circuit pack provides an X.25 interface and a communications channel to remote shelves via the DCC bytes in the OC-N section overhead. Both circuit packs have a processor and both have volatile random access memory (RAM) and nonvolatile memory.

The DDM-2000 OC-3 Multiplexer is designed so that SYSCTL failures do not affect transmission. That is, no hits or errors will occur on any traffic as a result of a SYSCTL circuit pack failure. A SYSCTL failure does result in the loss of automatic protection switching. However, if a transmission circuit pack fails before a SYSCTL failure, the protection switch will remain effective during the SYSCTL failure and service is preserved. This means that if an active transmission circuit pack should fail while the SYSCTL is failed, a protection switch cannot be done and service carried by the failed circuit pack will be affected.

Memory Administration

All transmission affecting parameters that are set by software, such as bipolar 8-zero substitution/alternate mark inversion (B8ZS/AMI) encoding on DS1 interfaces and STS-1/VT cross-connect assignments, are stored in nonvolatile memory on the SYSCTL circuit pack and on the appropriate transmission circuit packs. When the shelf is powered up or the SYSCTL circuit pack is replaced, the shelf's transmission values are automatically uploaded to the SYSCTL. When a transmission circuit pack is replaced, provisioning data stored on the SYSCTL is automatically downloaded to the replacement circuit pack. Manual action is not required to maintain system provisioning after a circuit pack is replaced.

Certain non-service-affecting provisioned data, such as alarm delay, is stored only on the SYSCTL circuit pack. This means that when a SYSCTL circuit pack is replaced, the new SYSTCL circuit pack should be initialized by pressing the INIT button during the 10-second interval while the CR alarm LED is flashing after the SYSCTL circuit pack is inserted. This action is the same as entering the **`init-sys:sysctl`** command which sets the SYSCTL circuit pack parameters to their default values. Refer to the **`init-sys`** command in Section 11, "Commands and Reports," and to "Install or Replace SYSCTL" in the TOP section of this manual (Volume II). If parameters other than the default values are needed, the values must be entered using the CIT. If the INIT function is not performed, whatever values that are stored in nonvolatile memory on the new SYSCTL circuit pack are used. Failure to follow the proper procedure may not cause transmission errors or loss of service but could affect maintenance. For example, an invalid TID could produce confusing TL1 reports to the OS.

System Backup and Restoral

The CPro-2000 Graphical User Interface (GUI) and Provisioning Tool includes a backup and restoral feature to protect provisioning information in ring networks. This feature saves a copy of a node's provisionable parameters so they can be restored at a later date, if necessary.

The feature provides backup and restoral for all provisionable parameters including:

- Network Element (NE) provisionable parameters
- Cross-connections
- Port and line provisionable parameters
- Performance Monitoring (PM) threshold parameters

Refer to Section 6, “Operations Interfaces,” of this manual for more information on CPro-2000. See also 365-576-130, *CPro-2000 User Manual,* Release 7.0, for more information on CPro-2000.

ITM SNC

All of the above backup and restore features are also available with the Integrated Transport Management SubNetwork Controller (ITM SNC), Release 5.0. Refer to 107-564-270, *Integrated Transport Management (ITM) SubNetwork Controller (SNC), User Guide,* for additional information.

Service-Affecting Actions

Although the DDM-2000 OC-3 Multiplexer is designed to minimize loss of service due to equipment failure or human action, there are certain controller related actions that can cause a loss of provisioning data and possibly loss of service. These actions include:

- Replacing a transmission circuit pack when the SYSCTL is failed or removed can result in a loss of provisioning data and loss of service
- Replacing a transmission circuit pack in a shelf without power can result in a loss of provisioning data. Loss of service may continue on channels associated with the replaced circuit pack after the shelf is powered up.
- Executing the command **`init-sys:all`** sets all provisioning data, including cross-connect provisioning, to default values. This causes loss of service on any channel connected with non-default cross-connections.
- Failing to disable the SYSCTL circuit pack before it is removed in accordance with TOP procedures could result in unexpected events; however, no loss of service occurs. Refer to the "Install or Replace SYSCTL" procedure in the TOP section of this manual (Volume II).
- Provisioning data is maintained through a software download to the SYSCTL. Replacing the SYSCTL circuit pack with incompatible software and intentionally overriding the software check could result in a loss of service.

Multiplexing and Mapping

Table 8-1 contains a summary of DDM-2000 OC-3 multiplexing and mapping capabilities.

Table 8-1. DDM-2000 OC-3 Multiplexing and Mapping Capabilities (Note)

Interface	Cross-Connect Type	Interface					
		DS1	DS3	EC-1	OC-1	OC-3	OC-12
OC-12	VT1.5	X	—	X	X	X	X
	STS-1	X	X	X	X	X	X
	STS-3c	—	—	—	—	—	X
OC-3	VT1.5	X	—	X	X	X	
	STS-1	X	X	X	X	X	
OC-1	VT1.5	X	—	X	X		
	STS-1	X	X	X	X		
EC-1	VT1.5	X	—	X			
DS3	VT1.5	—	—				
	STS-1	—	X				
DS1	VT1.5	X					

Note: “X” indicates supported.

”—” indicates not supported.

The following paragraphs describe the multiplexing and mapping capabilities provided by the system. Note that it is possible to mix the multiplexing and mapping options within an OC-3 or OC-12 signal on an STS-1 basis. For example, one STS-1 of an OC-3 or OC-12 interface may carry DS1s in a VT1.5-structured STS-1, and another may carry a DS3 signal.

DS1 to OC-1/OC-3/OC-12

The DDM-2000 OC-3 Multiplexer uses the floating VT mode, asynchronous mapping for clear channel DS1 transport. Each DS1 signal is mapped to a VT1.5 signal; four VT1.5s are byte-interleaved to form a VT-G signal; and seven VT-Gs are byte-interleaved to form a VT-structured STS-1 signal. The STS-1 signals are byte-interleaved to create STS-3 and STS-12 signals respectively.

In the opposite direction, a received OC-1, OC-3, or OC-12 is converted back to an electrical signal and, for OC-3 and OC-12, demultiplexed to STS-1 signals.

Each STS-1 is demultiplexed to seven VT-Gs; each VT-G is separated into four VT1.5s; and a DS1 signal is extracted from each VT1.5.

Table 8-2 shows the default mapping of DS1s to VT1.5s in the OC-3 signal on the DDM-2000 OC-3 Multiplexer. In default mapping there is a direct relationship between physical low-speed slot and port on that slot and the VT1.5 time slot within the OC-3. For point-to-point networks, this default mapping allows straightforward network administration because a circuit entering on a slot and port on one shelf, for example a-1-1, will always exit at the same slot and port position, a-1-1, at the far-end shelf. Default mapping can be overridden using the **`ent-crs-vt1`** and **`ent-crs-sts1`** commands. See Section 11, "Commands and Reports," for more information on these commands.

With this default mapping, each DS-1 port is associated with a specific timeslot — a VT-G in an STS-1 and a specific VT1.5 in a VT-G.

All "a" location ports are associated with STS-1 number 1, "b" location ports are associated with STS-1 number 2, and "c" location ports are associated with STS-1 number 3. The mapping of a DS-1 to an OC-3 signal requires the port address being connected with a time slot in the optical line interface unit (OLIU) circuit pack. Optical time slots identify the location; STS-1 in the OC-1, OC-3, or OC-12; VT-G in the STS-1; VT1.5 in the VT-G. Some examples of time slot identifications are:

m-1-1-1, m-2-1-3
a-1-1-3, b-3-1-4

Some examples of DS1 port to OC-3 timeslot using default VT1.5 cross-connections are:

a-1-1 to m-1-1-1
b-5-3 to m-2-5-3
c-4-4 to m-3-4-4

Table 8-2. Default DS1 to VT1.5 Mapping

DS1 Port Address	VT1.5 within STS-1	VT1.5 within VT-G	VT-G within STS-1	STS-1 within OC-3
a-1-1	1	1	1	1
a-1-2	8	2	1	1
a-1-3	15	3	1	1
a-1-4	22	4	1	1
a-2-1	2	1	2	1
a-2-2	9	2	2	1
a-2-3	16	3	2	1
a-2-4	23	4	2	1
a-3-1	3	1	3	1
a-3-2	10	2	3	1
a-3-3	17	3	3	1
a-3-4	24	4	3	1
a-4-1	4	1	4	1
a-4-2	11	2	4	1
a-4-3	18	3	4	1
a-4-4	25	4	4	1
a-5-1	5	1	5	1
a-5-2	12	2	5	1
a-5-3	19	3	5	1
a-5-4	26	4	5	1
a-6-1	6	1	6	1
a-6-2	13	2	6	1
a-6-3	20	3	6	1
a-6-4	27	4	6	1
a-7-1	7	1	7	1
a-7-2	14	2	7	1
a-7-3	21	3	7	1
a-7-4	28	4	7	1
b-1-1	1	1	1	2
b-1-2	8	2	1	2
b-1-3	15	3	1	2
b-1-4	22	4	1	2
b-2-1	2	1	2	2
b-2-2	9	2	2	2
b-2-3	16	3	2	2
b-2-4	23	4	2	2
b-3-1	3	1	3	2
b-3-2	10	2	3	2
b-3-3	17	3	3	2
b-3-4	24	4	3	2
b-4-1	4	1	4	2
b-4-2	11	2	4	2

Table 8-2. Default DS1 to VT1.5 Mapping (Contd)

DS1 Port Address	VT1.5 within STS-1	VT1.5 within VT-G	VT-G within STS-1	STS-1 within OC-3
b-4-3	18	3	4	2
b-4-4	25	4	4	2
b-5-1	5	1	5	2
b-5-2	12	2	5	2
b-5-3	19	3	5	2
b-5-4	26	4	5	2
b-6-1	6	1	6	2
b-6-2	13	2	6	2
b-6-3	20	3	6	2
b-6-4	27	4	6	2
b-7-1	7	1	7	2
b-7-2	14	2	7	2
b-7-3	21	3	7	2
b-7-4	28	4	7	2
c-1-1	1	1	1	3
c-1-2	8	2	1	3
c-1-3	15	3	1	3
c-1-4	22	4	1	3
c-2-1	2	1	2	3
c-2-2	9	2	2	3
c-2-3	16	3	2	3
c-2-4	23	4	2	3
c-3-1	3	1	3	3
c-3-2	10	2	3	3
c-3-3	17	3	3	3
c-3-4	24	4	3	3
c-4-1	4	1	4	3
c-4-2	11	2	4	3
c-4-3	18	3	4	3
c-4-4	25	4	4	3
c-5-1	5	1	5	3
c-5-2	12	2	5	3
c-5-3	19	3	5	3
c-5-4	26	4	5	3
c-6-1	6	1	6	3
c-6-2	13	2	6	3
c-6-3	20	3	6	3
c-6-4	27	4	6	3
c-7-1	7	1	7	3
c-7-2	14	2	7	3
c-7-3	21	3	7	3
c-7-4	28	4	7	3

DS3 to OC-3/OC-12

The DS3 signal maps directly to an STS-1 via the asynchronous mapping. The STS-1 signals are byte-interleaved to form an STS-3 or STS-12 signal. Finally, the STS-1, STS-3, or STS-12 is converted to an optical OC-1, OC-3, or OC-12 signal, respectively.

In the opposite direction, a received OC-1, OC-3, or OC-12 is converted back to an electrical signal and, for OC-3 and OC-12, demultiplexed to STS-1 signals. A DS3 signal is recovered directly from its STS-1.

The DS3 signal maps directly into the STS-1 payload. The DS3 location is mapped into the STS-1 in the OC-3. For example:

a to m-1
b to m-2
c to m-3
b to c-2

EC-1 to OC-1/OC-3/OC-12

The STS1E low-speed interface receives an EC-1 signal from the backplane coaxial connector which is then routed as an internal STS-1. This signal can be STS-1 or VT1.5 cross-connected to the OC-1, OC-3, or OC-12 interface. Three internal STS-1 signals are multiplexed into an STS-3 or STS-12 and converted to an optical OC-3 or OC-12 signal.

In the opposite direction, a received OC-1, OC-3, or OC-12 is converted into an electrical STS-1, STS-3, or STS-12 and demultiplexed. After either STS-1 or VT1.5 cross-connections, the resulting STS-1 internal signal is converted to an EC-1 signal by the STS1E interface. The STS1E interface can support both STS-1 and VT1.5 cross-connections. The following are examples of STS-1 cross-connections:

a to m-1
b to m-3
c to m-2

The following are examples of VT1.5 cross-connections:

a-1-1 to m-1-1-1
a-7-4 to m-1-1-2
b-1-1 to m-2-1-1

OC-1/OC-3/OC-12 to OC-1/OC-3/OC-12

From each received OC-3 signal, an STS-3 signal is recovered. The STS-3 is demultiplexed to three STS-1s, and the STS-1s are routed to other OC-3 interfaces as provisioned. Three STS-1s are multiplexed to an STS-3, converted to an OC-3, and transmitted over the fiber.

OC-3 to OC-3 cross-connections can be done at the STS-1 level or at the individual VT-1.5 (DS1 time slots) level. Example STS-1 cross-connections are:

m-1 to c-1
m-2 to c-2
m-3 to c-3

The following are some examples of VT1.5 time slot cross-connections for OC-3 to OC-3. These are representative of "pass-through" traffic in a DS1 hub network:

m-1-1-1 to c-1-1-1
m-3-1-4 to c-3-1-4
m-1-3-2 to b-1-3-2
m-2-1-1 to a-2-1-1

OC-3 to OC-1

OC-3 ring traffic is mapped into OC-1 extensions in the same way as any VT is mapped into an OLIU. The VT tributaries are assigned to one of the two STS-1s supported by the 27-type OLIUs. Two 27-type OLIUs are installed in the function unit slots for single homing applications. In dual homing applications, each of the two OC-3 shelves terminating the OC-1 ring extension is equipped with only one 27-type OLIU in a function unit slot. Each VT is mapped from the OC-3 OLIUs (for example, m-1-1-1, m-2-1-1, m-3-1-1) into the 27-type OLIUs with two STS-1s from which to choose (a-1 or a-2).

In the dual homing application, the user must map a VT from the OC-1 ring to the same VT in the OC-3 ring at each of the two host nodes. For example, if at host node #1, c-1-1-1 (OC-1 VT) is mapped to m-2-1-1 (OC-3 VT), the X-1-1-1 (X=a,b,c) OC-1 VT must also map to m-2-1-1 (OC-3 VT) at host node #2. Another consideration in deploying the dual homing configuration is that different function unit slots on the two host shelves must be used to terminate the OC-1 ring. If function unit slot X-2 (X=a,b,c) is used on host node #1, function unit slot X-1 (X=a,b,c) must be used on host node #2.

The traffic that can be mapped from all OC-1 rings terminated on 27-type OLIUs in function unit slots, to the OC-3 ring terminated on OLIUs in the main slots, is limited by the capacity of the OC-3 ring to 84 VT (DS1s). Use of the hairpin connections (described in the next section) increases the total traffic handling capacity of the shelf since the hairpin connections do not consume bandwidth on the OC-3 ring. The total traffic handling capacity is determined by the mix of main to function unit, and function unit to function unit hairpin connections.

OC-1 to OC-1 Hairpin

Mapping between OC-1 rings homed onto 27G2-U OLIUs in function unit slots follows the normal mapping of VTs to OLIUs. The VT tributaries are assigned to specific STS-1s in the 27G2-U OLIUs. The 27G2-U OLIU has two STS-1s, and one or two 27G2-U OLIUs are installed in the function unit slots. Two OLIUs are used for single homing applications, and one OLIU is used for dual homing applications. Each VT is mapped from one 27G2-U OLIU, with two STS-1s from which to choose (for example, a-1-1-1, or a-2-1-1) to another 27G2-U OLIU. The second 27G2-U may be in the same function unit or a different function unit. If it is in the same function unit, the source and destination STS-1 numbers, which correspond to the OC-1 lines supported by the 27G2-U OLIU, must be different. If the second 27G2-U is in a different function unit, note that connections between the A and the B function units are not allowed.

The traffic handling capacity consumed by the OC-1 to OC-1 hairpin connections is independent of a shelf's main to function unit traffic handling capacity. Thus, a shelf using such connections can connect more than the previous limit of 84 VT1.5s.

The following are examples of OC-1 to OC-1 hairpin VT1.5 time slot cross-connections:

a-1-1-1 to c-1-1-1	Inter-function unit hairpin
b-2-1-1 to c-1-1-1	Inter-function unit hairpin
a-1-1-1 to a-2-1-1	Intra-function unit hairpin
b-1-1-1 to b-2-2-2	Intra-function unit hairpin

m-1 to c-1
m-2 to c-2
m-3 to c-3

DS3 to EC-1 Hairpin

A DS3 signal is mapped to an STS-1 via the asynchronous mapping. The STS-1 is mapped directly to an EC-1 signal.

EC-1 to EC-1 Hairpin

An EC-1 signal is converted to an STS-1 signal, which can be connected directly to another EC-1 signal. If the STS-1 is VT1.5-formatted, connections can be made between VT1.5 timeslots of the two EC-1 signals.

Provisioning

General

The DDM-2000 OC-3 Multiplexer allows the user to customize many system characteristics through its provisioning features. Provisioning parameters are set by a combination of on-board switches and software control.

Parameters likely to vary from installation to installation and parameters that will not change in service (for example, DS1 and DS3 line buildouts) are set with on-board switches. This allows installations to be performed without a CIT using default provisioning values and switch settings. Other parameters that require a wide range of options or in-service changes are set under software control. For example, performance monitoring (PM) thresholds can be customized for each installation using the CIT.

Default Provisioning

Installation provisioning is minimized with default values set in the factory. Each parameter is given a default. The defaults for software parameters are maintained in the SYSCTL circuit pack. All provisioning data is stored in nonvolatile memory to prevent data loss during power failures.

Remote Provisioning

Software control of many provisioning parameters allows remote provisioning of the DDM-2000 OC-3 Multiplexer. This feature is provided especially for parameters likely to change in service, in support of centralized operations practices.

Automatic Provisioning

Circuit Pack Replacement

Replacement of a failed circuit pack is simplified by automatic provisioning of the current circuit pack values. The SYSCTL circuit pack maintains a provisioning map of the entire shelf, so when a transmission or synchronization circuit pack is replaced, the SYSCTL circuit pack automatically downloads values to the new circuit pack. If the SYSCTL circuit pack is ever replaced, provisioning (transmission, for example) data except for the line buildout (LBO) settings from every other circuit pack in the shelf is automatically uploaded to the nonvolatile memory of the new SYSCTL circuit pack.

Feature Package Provisioning

Certain software features are available only through a special licensing agreement with Lucent Technologies.

- VT PM
- DS1 PM.

These features are enabled by privileged user logins according to the licensing agreement, using the **`set-feat`** command and can be reviewed using the **`rtrv-feat`** command. These features are optional and may not be active on all systems. For details on these and other commands, refer to Section 11, "Commands and Reports."

Data Communications Channel (DCC) Provisioning

The DCC is automatically provisioned in the following manner and needs no provisioning by the user. The DCC uses the SONET overhead to communicate between NEs and follows the active SONET transmission line and/or IAO LAN.

In a given subnetwork, the NEs on each side of an optical span must have their "user-side/network-side" (OSI terminology) parameters provisioned to opposite values. Local procedures should determine the "user" and "network" side of a span. For example, the CO terminal can be designated the network side and the RT site the user side. It does not matter as long as the two sides are opposite values. See the TOP section of this manual (Volume II) for OI provisioning procedures.

- In ring systems, there is one DCC assigned for the "m1" ring and another DCC for the "m2" ring. The function unit slot pairs in ring systems have one DCC each when connected to linear (1+1) OC-3 extensions.
- In OC-1 ring applications when the function unit slot pairs are equipped with 27G-U OLIUs, a DCC is assigned for each rotation of each OC-1 ring.

Operations Interworking (OI) Provisioning

OI provides the capability to access, operate, administer, maintain, and provision remote Lucent NEs from other NEs in a subnetwork or from a centralized OS.

OI is supported among systems that are connected through the DCC. Table 8-3 lists the SONET software compatibility within a subnetwork for the Lucent 2000 Product Family systems. All configurations listed support OI. The table lists all possible software combinations. Combinations not listed are not supported.

Table 8-3. OI Software Compatibility

Releases	OC-3		OC-12
	13.0	**15.0**	**7.0**
OC-3, R13.0/R15.0	X	X	X
OC-12, R7.0	X	X	X
FiberReach, R3.0/3.1	X	X	X
FT-2000, R4.0, R8.0/8.1 R9.0/9.1	X	X	X
SLC-2000, R3.3, R9.0/9.1	X	X	X
SLC-2000, R4.4	X	X	X
TITAN 5500/S, R5.0	X	X	X
ITM SNC, R5.0	X	X	X
CPro-2000, R7.0	X	X	X

OI features include the following:

- Remote OS access (via TL1/X.25 GNE)
- Remote CIT login (remote technician access)
- Remote software download and copy.

See also 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

NSAP Provisioning

The network services access point (NSAP) is a multiple part address that uniquely identifies each NE for OI purposes. The NSAP is used for subnetwork DCC communications using the OSI protocol. A unique NSAP is programmed into the SYSCTL circuit pack at the factory and does not have to be modified by the user unless subnetwork partitioning is necessary. This default NSAP value is adequate to operate typical subnetworks.

Subnetwork partitioning is accomplished by assigning NEs to different areas. An NE's area address is one of the subfields within its NSAP. The **`ent-ulsdcc-l3`** command is used to modify an NE's NSAP. See the **`ent-ulsdcc-l3`** command in Section 11, "Commands and Reports," for more information on NSAP provisioning.

TARP Provisioning

Although TARP functions automatically, using standard default values and without any user provisioning, DDM-2000 allows provisioning of the following TARP parameters. All TARP parameters are provisioned by the CIT and TL1 **`ent-ulsdcc-l4`**" command and include the following:

- Lifetime
- Manual Adjacency
- Timers
- Loop Detection Buffer (LDB) Flush Timer
- TDC Enable/Disable
- TDC TID-NSAP Entries.

It is recommended that TARP default values always be used, with the possible exceptions of Manual Adjacency and the TDC parameters. TARP Manual Adjacency may be used to propagate TARP messages beyond any non-TARP nodes in a subnetwork, if necessary. In the unlikely event the TDC contains inaccurate information, the TDC parameters may be used to update the TDC.

Eliminated Provisioning: Because DDM-2000 OC-12 Release 7.0 and OC-3 Releases 13.0 and 15.0 do not support Lucent Directory Services (LDS) or Remote NE Status features, the following OI-related provisioning is no longer necessary:

- AGNE
- Alarm Group Number
- DSNE
- DSNE DLT-TADRMAP (CIT and TL1 command)
- NE Number
- Site Number
- TBOS Number

NOTE:

Level 2 Provisioning

Subnetwork partitioning also involves the assignment of level 2 Intermediate Systems (ISs). The **`ent-ulsdcc-l3`** command is used to assign DDM-2000 to serve as a level 2 IS. See the **`ent-ulsdcc-l3`** command in Section 11, "Commands and Reports," for more information on NSAP provisioning.

Port State Provisioning

Port state provisioning is a feature provided on DDM-2000 OC-3 Multiplexers that suppresses alarm reporting and PM by supporting multiple states (automatic [AUTO], in-service [IS], and not-monitored [NMON]) for low-speed ports (DS1, DS3, and EC-1).

Ports without signals (undriven) are in the AUTO state until changed to the IS state when a signal is present. The **set-state-t1**, **set-state-t3**, and **set-state-ec1** commands allow a user to change the state of a port to the NMON state or from the NMON state to the AUTO state. The **rtrv-state-eqpt**, **rtrv-t1**, **rtrv-t3**, and **rtrv-ec1** commands allow a user to retrieve current port states. The **upd** command allows a user to change the port state of all undriven ports from IS to AUTO.

Channel State Provisioning

Channel state provisioning is a feature provided on DDM-2000 OC-3 Multiplexers that suppresses reporting of alarms and events for VT1.5 and STS-1 channels during provisioning by supporting multiple states at the OC-3 and EC-1 ports (AUTO, IS, and NMON) for these channels. The **rtrv-state-eqpt**, **rtrv-t1**, **rtrv-t3**, **rtrv-ec1**, **set-state-vt1**, and **rtrv-state-vt1** commands allow a user to retrieve current channel states.

While an end-to-end circuit is being set up, particularly during VT1.5 or STS-1 cross-connection provisioning, transient maintenance signals may result. Without automatic channel state provisioning, these are reported as alarms or events. The technicians are expected to ignore these transient alarms and initiate corrective action only if the alarms persist after the provisioning is completed. To avoid the confusion created by this, DDM-2000 OC-3 Multiplexers provide automatic channel state provisioning.

A VT1.5 or STS-1 channel stays in the default AUTO state until a valid signal (a framed non-AIS or non-LOP signal) is received on that channel. While in AUTO state, no alarms or events are reported on the channel by the DDM-2000 Multiplexer. On receiving a valid signal, which occurs when the end-to-end circuit is completely provisioned, the channel automatically changes to the IS state and normal alarm and event reporting starts. An additional state, NMON, is also supported in which alarm and event reporting is suppressed regardless of the validity of the signal being received on the channel. Like the port state provisioning capability provided for DS1, DS3, and EC-1 ports, the user can use CIT or TL1 commands to manually change a channel from IS or AUTO to NMON, and from NMON to AUTO.

A direct change from NMON to IS is not allowed. See the **set-state-sts1**, **set-state-vt1**, **rtrv-state-sts1**, **rtrv-state-vt1** and **upd** commands.

Line State Provisioning

OC-1 ring interfaces can be set manually to NMON or IS.

AIS or Unequipped Provisioning

In DDM-2000 OC-3, if a DS1, DS3, TMUX, or MXRVO circuit pack is removed, or when a cross-connection is removed, the system can be optioned to send either a "path AIS" signal or an "STS/VT-path unequipped" signal.

Remote OS Access (TL1/X.25 GNE)

A DDM-2000 subnetwork may have one or more NEs serving as TL1/X.25 GNEs. Without any user provisioning, a DDM-2000 is automatically a GNE upon connecting an X.25 link to its X.25 interface. Refer to the “TL1/X.25 Interfaces” paragraph in Section 6, “Operations Interfaces,” for more information.

Remote CIT Login

Each DDM-2000 Multiplexer can remotely log into other DDM-2000 Multiplexers in the same subnetwork. OI also allows remote logins between DDM-2000 and the *SLC*-2000 Access System and from the FT-2000 OC-48 Lightwave System to other Lucent 2000 Product Family systems in the same subnetwork. Refer to Section 6, “Operations Interfaces,” for more information.

Remote Software Download and Copy

The DDM-2000 OC-3 and OC-12 Multiplexers can upgrade the system software while in-service. Software can be downloaded locally using a PC through the EIA-232-D interface on the user panel or remotely over the SONET DCC. Refer to the “Software Upgrades” section at the beginning of this chapter for more information.

Subnetwork Size

There is no limitation on the size of the networks formed by splitting a large network into a number of smaller maintenance subnetworks by disabling the DCC between the subnetworks. Subnetwork partitioning can be done while in service without affecting traffic. Subnetwork sizes of up to 256 NEs are supported via subnetwork partitioning (50 per level 1 area, 256 per subnetwork) with multiple areas connected via level 2 Intermediate Systems (IS). Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide,* for additional information.

Cross-Connection Provisioning

The DDM-2000 OC-3 Multiplexer can be provisioned for cross-connect routing of signals. In some applications, STS-1 or VT1.5 signal cross-connections may be established to route traffic in a specific manner. All cross-connections are bidirectional. Any STS-1 or VT1.5 signal may be cross-connected to a like signal with an available time slot, with some restrictions. Any STS-1 or VT1.5 signal between the main slot and any function unit slot may be cross-connected. Any single STS-1 or any VT1.5 channel in function units A or B may be cross-connected to any available time slots in function unit C when function unit C is equipped with OLIUs. Also, STS-1 and VT1.5 signals terminating on 27G2-U OLIUs installed in function units may be hairpin connected.

STS-1 and VT1.5 signals may be cross-connected in several ways. For bidirectional drop services, the normal (default) "two-way" cross-connection is used to connect a like signal in the high-speed main slot to any available time slot in any function unit equipped with low-speed STS1E, DS3, or DS1 circuit packs. For bidirectional hub applications at a ring node, the normal (default) "two-way" cross-connection is used to connect a like signal in the high-speed main slot to any available time slot in either the A, B, or C function unit, which has been equipped with OLIU circuit packs. The bidirectional pass-through service is used to connect the high-speed signal from one side of the ring to the other side. Both rings are connected using a single "two-way" (**`ent-crs`**) command. The high-speed time slot entering must be the same leaving in pass-through connections.

The "drop and continue" service provides, in a single command (**`ent-crs`**), the proper bidirectional cross-connection to "drop" a copy of the high-speed signal in the main slot to any available time slot in any function unit and to "continue" the signal on the high-speed channel to the next node. The same command also properly drops the signal from the opposite ring direction.

The DDM-2000 OC-3 Multiplexer ring system has one cross-connect mode of operation, “manual.” Any cross-connect command may be implemented at each individual site in a network through the CIT connection or at any site via a remote login session from any other site.

Cross-Connection Types

DDM-2000 OC-3 Multiplexers have time slot interchange (TSI) features. This offers users flexibility in directing traffic in and out of these systems to support a wide variety and range of customer applications.

Cross-connections in DDM-2000 OC-3 Multiplexers are made by specifying the SONET rate (VT1.5 and STS-1), the end point addresses (access identifiers), the cross-connection type (two-way, drop and continue, etc.), and, in some cases, the ring direction (ring=m1, ring=m2, etc.). In DDM-2000 OC-3 Multiplexers, each single cross-connection command establishes a two-way cross-connection.

The basic type of cross-connection allows a low-speed port or channel to be cross-connected to a channel in the high-speed interface portion of the shelf. This is used in all linear add/drop applications where DS1, DS3, VT1.5, STS-1, and EC-1 low-speed signals are cross-connected to VT1.5 and STS-1 channels in the high-speed linear interfaces.

The next type of cross-connection allows a low-speed port or channel to be cross-connected to a channel in the high-speed ring interface. This is used in all path switched ring applications where DS1, DS3, VT1.5, STS-1, and EC-1 low-speed signals are cross-connected to VT1.5 or STS-1 channels in both rotations of the rings terminating on the high-speed interfaces. With this cross-connection, all added signals are bridged on to both rotations of the ring, and the better of the two signals received from the two rotations of the ring is dropped.

Another type of cross-connection allows a VT1.5 or STS-1 channel to be "passed-through" between two high-speed ring interfaces or between two OC-1 ring interfaces supported by 27G2-U OLIUs in function units. This is used in all path switched ring applications at nodes where traffic is not dropped. In path switched rings, pass-through grooming (passing a signal on a ring time slot that is different from the ring time slot on which it was received) is not supported.

End-to-end survivable service facilities need to cross multiple rings interconnected at multiple wire centers. To support these applications, a drop-and-continue cross-connection is provided for a signal from a high-speed channel to be dropped to a specified low-speed port or channel and continued on to the next node in the same direction while also adding a corresponding signal from the low-speed port or channel to the high-speed channel in the other rotation of the ring.

A variation of ring cross-connections, the "locked cross-connection," is supported at the VT1.5 level to lock the path selector to a specified rotation of the ring. With this cross-connection, a DS1 or VT1.5 signal from the low-speed interface is cross-connected to the specified VT1.5 channel in the high-speed interface in the specified direction; and any signal received in the same VT1.5 channel from the other ring rotation is ignored.

Locked cross-connections are a ring-to-non-ring type of cross-connection between a ring interface and a non-ring interface in which no path protection switching is provided (see Figure 8-1).

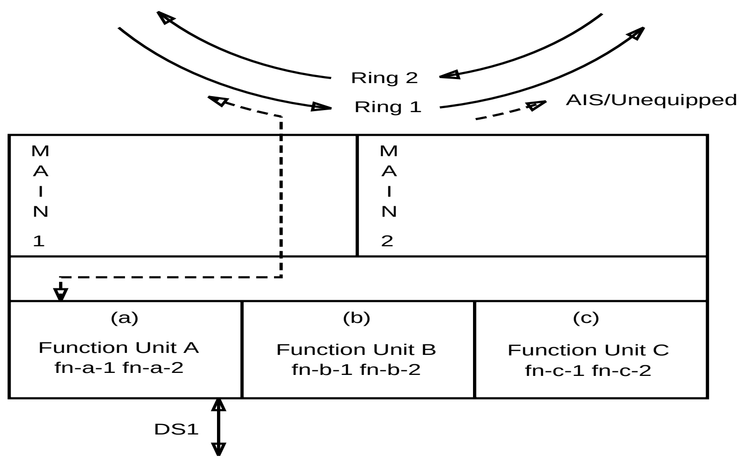

Figure 8-1. Locked Cross-Connection

A locked cross-connection configuration has the following characteristics:

- The signal received on a specified channel, for example, m-1-1-1 of the ring interface m1 from ring 1 in one direction around the ring is transmitted on a non-ring (DS1) interface.
- The signal received on the other ring interface (m2), using the other direction around the ring (ring 2), on the same channel (m-1-1-1) is ignored.
- A signal is transmitted from a non-ring interface (DS1 interface) through the specified channel (m-1-1-1) on ring 2 using ring interface m1.
- The provisioned AIS or unequipped signal is transmitted on the other direction around the ring (ring 1) using ring interface (m2). This signal will not cause any alarms at pass-through nodes and will only cause alarms at terminating nodes if cross-connections are provisioned.

"Hairpin" cross-connections allow local drop of signals, ring extensions supported by a ring host node, and allow passing traffic between two ring interfaces on a single host node. In this case, no high-speed channel is involved and the cross-connections are entirely within the interfaces in the function units.

VT1.5 signals from function units A or B can be cross-connected to VT1.5 signals in function unit C. The VT1.5 signals can be in any MXRVO, STS1E, or 22-type OLIU, with the exception that MXRVO-to-MXRVO hairpins are not allowed. Also, VT1.5 and STS-1 signals terminating on 27G2-U OC-1 OLIUs in function units may be hairpin connected. Beginning in Release 11.0, the mixing of 0x1, pass-through, and hairpin add/drop cross-connects is allowed. Beginning in Release 13.0, VT1.5 and STS-1 signals terminating on 26G2-U OC-1 OLIUs in function units may be hairpin connected. The available interfaces are:

- DS1 to EC-1/OC-3
- EC-1 to OC-3
- EC-1 to EC-1
- OC-3 to OC-3.
- OC-1 to OC-1.

Table 8-4 lists the number of available VT1.5 cross-connections including hairpin cross-connections:

Table 8-4. DDM-2000 OC-3 Available VT1.5 Cross-Connections, Including Hairpin

Slot	Main	Fn-A	Fn-B	Fn-C
Main	84	56	56	84
Fn-A	56	0	0	56∗
Fn-B	56	0	0	56∗
Fn-C	84	56∗	56∗	0

∗ Hairpin cross-connections.

Cross-Connection Provisioning Commands

Cross-connections can be entered and deleted using the following commands:

- **`ent-crs-sts1`** (Enter Cross-Connection STS-1) — This command creates STS-1 signal cross-connections.
- **`dlt-crs-sts1`** (Delete Cross-Connection STS-1) — This command deletes STS-1 signal cross-connections.
- **`ent-crs-vt1`** (Enter Cross-Connection VT1.5) — This command creates VT1.5 signal cross-connections.
- **`dlt-crs-vt1`** (Delete Cross-Connection VT1.5) — This command deletes VT1.5 signal cross-connections.
- **`ent-crs-sts3c`** (Enter Cross-Connection STS-3c) — This command creates STS-3c signal cross-connections.
- **`dlt-crs-sts3c`** (Delete Cross-Connection STS-3c) — This command deletes STS-3c signal cross-connections.
- **`cnvt-crs`** (Convert Cross-Connection)—This command converts an existing STS-1 cross-connection to 28 individual VT1.5 cross-connections with the same endpoints as the STS-1 cross-connection. VT1.5 signals carried within the original STS-1 appear in the same time slots in the upstream or downstream DDM-2000 OC-3 before and after the conversion takes place.

The **`cnvt-crs`** command has the unique ability to convert an existing STS-1 signal into its component 28 VT1.5 signals. This conversion enables an easy upgrade of existing STS-1 drop networks to DS1 add/drop networks. No inverse capability is available to convert 28 VT1.5 signals back to a single STS-1 cross-connection.

DDM-2000 OC-3 systems provide flexible routing of STS-1 and VT1.5 signals between high-speed and function unit interfaces for ring applications. These cross-connections are entered using the CIT and are shown in Table 8-8 through Table 8-19.

Allowable Cross-Connects

Table 8-5 through Table 8-7 list main and function unit circuit packs and their allowed cross-connect functionality. It also lists the earliest software release the cross-connect was available.

The following list defines the cross-connect types listed in Table 8-5 through Table 8-7.

- **Two-Way**: A two-way cross-connection is a bidirectional cross-connection between two ports. This type of cross-connection, when used to connect between function groups, is referred to as a “hairpin” cross-connection.
- **Add/Drop**: A two-way cross-connection add/drop to/from a ring interface is a bidirectional cross-connection between a channel on a path-protection switched ring and a port or channel on a non-ring interface.
- **Dual 0x1**: A two-way dual 0x1 cross-connection between two ring interfaces is a bidirectional cross-connection between channels on each of two different ring interfaces (no path switching).
- **Intra-FN Dual 0x1**: A two-way intra-FN dual 0x1 cross-connection between two ring interfaces is a bidirectional cross-connection between channels on the two different ring interfaces supported by a pair of dual-port OLIUs in the same function unit (no path switching).
- **Dual 0x1 NR**: A two-way dual 0x1 cross-connection between a ring interface and a non-ring interface is a bidirectional cross-connection between a channel on a ring interface and a port on a non-ring interface (no path switching).
- **Pass-Through**: A two-way pass-through cross-connection on a ring interface is a bidirectional cross-connection on a single ring interface.
- **Single 0x1**: A two-way single 0x1 ring to ring cross-connection is a bidirectional cross-connection between channels on each of two different ring interfaces. This type of cross-connection is used in “dual homing” network configurations (no path switching).
- **Intra-FN Single 0x1**: A two-way intra-FN single 0x1 ring to ring cross-connection is a bidirectional cross-connection between channels on the two different ring interfaces supported by a pair of dual-port OLIUs in the same function unit. This type of cross-connection is used in “dual homing” network configurations (no path switching).
- **Single 0x1 NR**: A two-way single 0x1 cross-connection between a ring interface and a non-ring interface is a bidirectional cross-connection between a channel on a ring interface and a port on a non-ring interface (no path switching).
- **Drop/Continue**: A drop and continue cross-connection is a bidirectional cross-connect between a ring and an non-ring interface which also continues on the ring.

- **Unprotected Video Broadcast**: An unprotected video broadcast source cross-connection on a ring interface is an asymmetric bidirectional cross-connection from a broadcast source onto an OC-N ring.
- **Locked VT:** A ring (0x1) VT locked cross-connection between low-speed and high-speed time slots, locking ring traffic onto a designated ring rotation.
- **STS-3c**: An STS-3c cross-connection is a main to FN-C two-way dual 0x1 cross-connect for OC-3 concatenated transmission.

Table 8-5. DDM-2000 OC-3 Ring Cross-Connect Types Allowable (Main to Main)

From MAIN		To MAIN			
Circuit Pack	**Cross-Connect Type**	**22-Type**	**24-Type**	**27-Type**	**29-Type**
22-type	Pass-Through STS	5.1			
	Pass-Through VT	5.0			
24G-U	Pass-Through STS		11.0		
	Pass-Through STS-3c		11.0		
	Pass-Through VT		11.0		
	Pass-Through STS-3c		11.0		
27-type	Pass-Through STS			9.0	
	Pass-Through VT			9.0	
*29-type	Pass-Through STS				15.0
	Pass-Through STS-3c				15.0
	Pass-Through VT				15.0
*Introduced in Release 15.0.					

Table 8-6. DDM-2000 OC-3 Ring Cross-Connect Types Allowable (Main to Function Unit)

From MAIN		To FUNCTION UNIT							
Circuit Pack	**Cross-Connect Type**	**22-type***	**26G2-U**	**27G-U**	**27G2-U**	**DS3**	**STS1E†**	**MXRVO**	**TMUX**
22-type	Add/Drop STS	7.0‡ 9.0§				5.1 ¶	5.1	5.1	13.0, 11.1
	Add/Drop VT	7.0‡ 9.0§					5.1	5.0	13.0, 11.1
	Dual 0x1 STS		13.0, 11.1 §§	9.0	9.0 ¶¶				
	Dual 0x1 VT		13.0, 11.1 §§	9.0	9.0 ¶¶				
	Dual 0x1 NR STS					11.0 **			
	Single 0x1 STS		13.0, 11.1 ††§§	9.0 ††	9.0 ††¶¶				
	Single 0x1 VT		13.0, 11.1 ††§§	9.0 ††	9.0 ††¶¶				
	Single 0x1 NR STS					11.0			
	Drop/Continue STS	7.2					7.0		
	Drop/Continue VT	7.2 ‡‡					7.0 ‡‡		
	Locked VT							9.0	13.0, 11.1
	Dual 0x1 NR STS								
27-type	Add/Drop STS	9.0				9.0 ¶	9.0	9.0	13.0, 11.1
	Add/Drop VT	9.0					9.0	9.0	13.0, 11.1
	Dual 0x1 STS		13.0, 11.1	9.0	9.0				
	Dual 0x1 VT		13.0, 11.1	9.0	9.0				
	Dual 0x1 NR STS					11.0 **			
	Single 0x1 STS		13.0, 11.1 ††	9.0 ††	9.0 ††				
	Single 0x1 VT		13.0, 11.1 ††	9.0 ††	9.0 ††				
	Single 0x1 NR STS					11.0 **			
	Drop/Continue STS	9.0				9.0 ¶	9.0		

From MAIN		To FUNCTION UNIT							
Circuit Pack	**Cross-Connect Type**	**22-type[*]**	**26G2-U**	**27G-U**	**27G2-U**	**DS3**	**STS1E[†]**	**MXRVO**	**TMUX**
27-type (cont'd)	Drop/Continue VT	9.0 ‡‡					9.0 ‡‡		
	Locked VT							9.0	13.0, 11.1
	Dual Locked STS								
24-type	Add/Drop STS	11.0				11.0	11.0	11.0	13.0, 11.1
	Add/Drop VT	11.0					11.0	11.0	13.0, 11.1
	Dual 0x1 STS		13.0, 11.1 §§	11.0	11.0 ¶¶				
	Dual 0x1 VT		13.0, 11.1 §§	11.0	11.0 ¶¶				
	Dual 0x1 NR STS					11.0			
	Single 0x1 STS		13.0, 11.1 §§	11.0	11.0 ¶¶				
	Single 0x1 VT		13.0, 11.1 §§	11.0	11.0 ¶¶				
	Single 0x1 NR STS					11.0			
	Drop/Continue STS	11.0					11.0		
	Drop/Continue VT	11.0					11.0		
	Locked VT							11.0	13.0, 11.1
	Dual Locked STS								

From MAIN		To FUNCTION UNIT							
Circuit Pack	**Cross-Connect Type**	**22-type***	**26G2-U**	**27G-U**	**27G2-U**	**DS3**	**STS1E†**	**MXRVO**	**TMUX**
29-type	Add/Drop STS	15.0				15.0	15.0	15.0	15.0
	Add/Drop VT	15.0					15.0	15.0	13.0, 11.1
	Dual 0x1 STS		15.0	15.0	15.0				
	Dual 0x1 VT		15.0	15.0	15.0				
	Dual 0x1 NR STS					15.0			
	Single 0x1 STS		15.0	15.0	15.0				
	Single 0x1 VT		15.0	15.0	15.0				
	Single 0x1 NR STS					15.0			
	Drop/Continue STS	15.0					15.0		
	Drop/Continue VT	15.0					15.0		
	Locked VT							15.0	15.0
	Dual Locked STS								
	Add/Drop STS-3c		15.0						

* A 22-type OLIU in a function unit and provisioned with STS-1 or VT1.5 cross-connects is in “linear” (unprotected or 1+1 line protected), not a ring configuration. A 22-type OLIU in function unit C and provisioned with an STS-3c cross-connect is in a dual 0x1 configuration.

† This table refers to only “low-speed” STS-1 interfaces.

‡ Only FN-B and/or FN-C can be equipped with 22-type OLIUs in this release.

§ FN-A, FN-B and/or FN-C can be equipped with 22-type OLIUs in this release.

¶ This entry valid for DS3 circuit packs except the BBG19 front-access pack.

** This entry valid for the BBG19 front-access DS3 circuit pack.

†† One of the pair of function unit slots will be empty.

‡‡ All VT1.5 drop and continue cross-connections in a system must be in the same direction, i.e. from the same ring (m1 or m2).

§§ The mixing of 0x1, Pass-Through, and local Add/Drop cross-connects is supported beginning with R13.0.

¶¶ The mixing of 0x1, Pass-Through, and local Add/Drop cross-connects is supported beginning with R11.0.

^ Introduced in Release 15.0.

Table 8-7. DDM-2000 OC-3 Ring Cross-Connect Types Allowable (Function Unit to Function Unit)

From FUNCTION UNIT		To FUNCTION UNIT						
Circuit Pack	**Cross-Connect Type**	**22-type***	**26G2-U**	**27G2-U**	**DS3**	**STS1E†**	**MXRVO**	**TMUX**
22-type	Two-Way STS	13.0, 11.1			13.0, 11.1	13.0, 11.1		
	Two-Way VT	9.0				9.0	9.0	13.0, 11.1
	Add/Drop STS		13.0, 11.1	11.0				
	Add/Drop VT		13.0, 11.1	11.0				
26G2-U	Add/Drop STS	13.0, 11.1 ‡‡				13.0, 11.1	13.0, 11.1 §‡‡	13.0, 11.1
	Add/Drop VT	13.0, 11.1 ‡‡	13.0, 11.1 ‡,‡‡			13.0, 11.1	13.0, 11.1 §‡‡	13.0, 11.1
	Dual 0x1 STS		13.0, 11.1 ¶‡‡	13.0, 11.1 ¶‡‡				
	Dual 0x1 VT		13.0, 11.1 ¶‡‡	13.0, 11.1 ¶‡‡				
	Pass-Through STS		13.0, 11.1 ‡‡					
	Pass-Through VT		13.0, 11.1 ‡‡					
	Single 0x1 STS		13.0, 11.1 ¶**‡‡	13.0, 11.1 ¶**‡‡				
	Single 0x1 VT		13.0, 11.1 ¶**‡‡	13.0, 11.1 ¶**‡‡				
27G2-U	Add/Drop STS	11.0 §§				11.0	11.0 §§	13.0, 11.1
	Add/Drop VT	11.0 §§				11.0	11.0 §§	13.0, 11.1
	Dual 0x1 STS		13.0, 11.1 ¶§§	9.1 ¶§§				
	Dual 0x1 VT		13.0, 11.1 ¶§§	9.1 ¶§§				
	Intra-FN Dual 0x1 VT			9.1 ††				
	Pass-Through STS			9.1 §§				
	Pass-Through VT			9.1 §§				
27G2-U (cont'd)	Single 0x1 STS		13.0, 11.1 ¶**§§	9.1 ¶**§§				
	Single 0x1 VT		13.0, 11.1 ¶**§§	9.1 ¶**§§				
	Intra-FN Single 0x1 VT			9.1 ††**				

From FUNCTION UNIT		To FUNCTION UNIT						
Circuit Pack	**Cross-Connect Type**	**22-type***	**26G2-U**	**27G2-U**	**DS3**	**STS1E†**	**MXRVO**	**TM**
STS1E	Two-Way VT	9.0				9.0	9.0	13 1
	Two-Way STS	13.0, 11.1			13.0, 11.1	13.0, 11.1		
	Add/Drop STS		13.0, 11.1	11.0				
	Add/Drop VT		13.0, 11.1	11.0				
MXRVO	Two-Way VT	9.0				9.0		
	Add/Drop STS		13.0, 11.1 §‡‡	11.0 §§				
	Add/Drop VT		13.0, 11.1 §‡‡	11.0 §§				
TMUX	Two-Way VT	13.0, 11.1				13.0, 11.1		
	Add/Drop STS		13.0, 11.1 §	13.0, 11.1				
	Add/Drop VT		13.0, 11.1 §	13.0, 11.1				

* A 22-type OLIU in a function unit is in “linear” (unprotected or 1+1 line protected), not a ring configuration.

† This table refers to only “low-speed” STS-1 interfaces.

‡ This entry represents the hairpin local drop cross-connection between a channel on an OC-1 ring terminating on a pair of 26G2-U OLIUs and a DS1 port in the low-speed group associated with the 26G2-U OLIUs. The MXRVO functionality on the 26G2-U OLIUs is used. Note that it is NOT possible to connect between a channe on an OC-1 ring terminating on a pair of 26G2-U OLIUs and a 26G2-U/DS1 combination in a different function unit.

§ MXRVO functionality within the 26G2-U OLIU is NOT used. Rather, a separate pair of MXRVOs in a different FN group are used.

¶ Cross-connections from one OC-1 ring to a different OC-1 ring in a different function unit.

** One of the pair of function unit slots will be empty.

†† Cross-connections from one OC-1 ring to a different OC-1 ring in the same function unit.

‡‡ The mixing of 0x1, Pass-Through, and local Add/Drop cross-connects is supported beginning with R13.0.

§§ The mixing of 0x1, Pass-Through, and local Add/Drop cross-connects is supported beginning with R11.0.

Table 8-8 through Table 8-19 lists the various types of cross-connections supported. After the tables are descriptions of applications and the types of cross-connections each application requires.

Table 8-8. Ring STS-1 Cross-Connections (Termination/Drop) (Note)

From ∗		To	"To" CP Type (Note)	CIT Command
m-{1-3}	<-->	a	MXRVO, STS1E, DS3	ent-crs-sts1:m-1,a
m-{1-3}	<-->	b	MXRVO, STS1E, DS3	ent-crs-sts1:m-2,b
m-{1-3}	<-->	c	MXRVO, STS1E, DS3	ent-crs-sts1:m-3,c
m-{1,2}†	<-->	a	MXRVO, STS1E, DS3	ent-crs-sts1:m-1,a
m-{1,2}†	<-->	b	MXRVO, STS1E, DS3	ent-crs-sts1:m-2,b
m-{1,2}†	<-->	c	MXRVO, STS1E, DS3	ent-crs-sts1:m-3,c

Note: The STS1E circuit pack hardware switch must be set to "low-speed" to support cross-connections.

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-9. Ring STS-1 Cross-Connections (Hub/Drop)

From ∗		To	"To" CP Type	CIT Command
m-{1-3}	<-->	a-{1,2}	OLIU	ent-crs-sts1:m-1,a-1
m-{1-3}	<-->	b-{1,2}	OLIU	ent-crs-sts1:m-2,b-2
m-{1-3}	<-->	c-{1,3}	OLIU	ent-crs-sts1:m-3,c-3
m-{1,2}†	<-->	{a,b}-{1-2}	22-type OLIU	ent-crs-sts1:m-1,a-1
m-{1,2}†	<-->	{c}-{1-3}	22-type OLIU	ent-crs-sts1:m-1,a-1

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-10. Ring STS-1 Cross-Connections (Pass-Through)

From ∗		To	“To” CP Type (Note)	CIT Command
m-1	<-->	m-1	OLIU	ent-crs-sts1:m-1,m-1
m-2	<-->	m-2	OLIU	ent-crs-sts1:m-2,m-2
m-3	<-->	m-3	OLIU	ent-crs-sts1:m-3,m-3
{a,b,c}-{1-2}	<-->	{a,b,c}-{1-2}	27G2-U OLIU	ent-crs-sts1:a-1,a-1
m-{1,2}†	<-->	m-{1,2}	22-type OLIU	ent-crs-sts1:m-1,m-1

Note: Address on the left side MUST BE identical to the address on the right side. There is no interchange function for “pass-through” signals.

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-11. Ring STS-1 Cross-Connections (Drop and Continue)

From ∗		To	“To” CP Type (Note)	CIT Command
m-{1-3}	<-->	a	STS1E	ent-crs-sts1:m-1,a:cct=dc,ring=m1
m-{1-3}	<-->	b	STS1E	ent-crs-sts1:m-2,b:cct=dc,ring=m1
m-{1-3}	<-->	c	STS1E	ent-crs-sts1:m-3,c:cct=dc,ring=m2
m-{1-3}	<-->	a-{1,2}	OLIU	ent-crs-sts1:m-1,a-1
m-{1-3}	<-->	b-{1,2}	OLIU	ent-crs-sts1:m-2,b-2
m-{1-3}	<-->	c-{1,3}	OLIU	ent-crs-sts1:m-3,c-3
m-{1,2}†	<-->	{a,b,c}	STS1E	ent-crs-sts1:m-1,a:cct=dc,ring=m1
m-{1,2}†	<-->	{a,b}-{1,2}	22-type OLIU	ent-crs-sts1:m-1,a-1
m-{1,2}†	<-->	c-{1-3}	22-type OLIU	ent-crs-sts1:m-1,c-3

Note: The STS1E circuit pack hardware switch must be set to “low-speed” to support cross-connections. The “ring” parameter defines the ring carrying the continue signal. This ring directly connects to the other drop and continue shelf.

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-12. Ring STS-1 Cross-Connections (Hairpin)

From	"From" CP Type		To	"To" CP Type	CIT Command
{a,b}-{1-2}	27G2-U OLIU	<-->	c-{1-2}	27G2-U OLIU	ent-crs-sts1:a-1,c-2

Table 8-13. Ring VT1.5 Cross-Connections (Termination/Drop)

From *		To	"To" CP Type (Note)	CIT Command
m-{1-3}-{1-7}-{1-4}	<-->	a-{1-7}-{1-4}	MXRVO, STS1E	ent-crs-vt1:m-1-1-1,a-1-1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1-7}-{1-4}	MXRVO, STS1E	ent-crs-vt1:m-2-3-4,b-3-4
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-7}-{1-4}	MXRVO, STS1E	ent-crs-vt1:m-3-3-3,c-3-3
m-{1,2}-{1-7}-{1-4}†	<-->	{a,b,c}-{1-7}-{1-4}	MXRVO, STS1E	ent-crs-vt1:m-1-1-1,a-1-1

Note: The STS1E circuit pack hardware switch must be set to "low-speed" to support cross-connections.

* Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

€ Ring cross-connection; 27-type OLIU in main.
†

Table 8-14. Ring VT1.5 Cross-Connections (Hub/Drop)

From *		To	"To" CP Type	CIT Command
m-{1-3}-{1-7}-{1-4}	<-->	a-{1,2}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1,2}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-2-2-2,b-2-2-2
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-3}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-3-3-3,c-3-3-3
m-{1,2}-{1-7}-{1-4}†	<-->	{a,b}-{1,2}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1
m-{1,2}-{1-7}-{1-4}†	<-->	c-{1-3}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-2-2-2,c-3-3-3

* Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-15. Ring VT1.5 Cross-Connections (OC-1 Hub/Drop)

From ∗		To	"To" CP Type	CIT Command
m-{1-3}-{1-7}-{1-4}	<-->	a-{1,2}-{1-7}-{1-4}	27G-U OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1,2}-{1-7}-{1-4}	27G-U OLIU	ent-crs-vt1:m-2-2-2,b-2-2-2
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-3}-{1-7}-{1-4}	27G-U OLIU	ent-crs-vt1:m-3-3-3,c-3-3-3
m-{1,2}-{1-7}-{1-4}†	<-->	{a,b,c}-{1,2}-{1-7}-{1-4}	27G-U OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27-type OLIU in main.

Table 8-16. Ring VT1.5 Cross-Connections (Drop and Continue)

From ∗		To	"To" CP Type (Note)	CIT Command
m-{1-3}-{1-7}-{1-4}	<-->	a-{1-7}-{1-4}	STS1E	ent-crs-vt1:m-1-1-1,a-1-1:cct=dc,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1-7}-{1-4}	STS1E	ent-crs-vt1:m-2-3-4,b-3-4:cct=dc,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-7}-{1-4}	STS1E	ent-crs-vt1:m-3-3-3,c-3-3:cct=dc,ring=m2
m-{1-3}-{1-7}-{1-4}	<-->	a-{1,2}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1:cct=dc,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1,2}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-2-2-2,b-2-2-2:cct=dc,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-3}-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-3-3-3,c-3-3-3:cct=dc,ring=m2
m-{1,2}-{1-7}-{1-4}*	<-->	{a,b,c}-{1-7}-{1-4}	STS1E	ent-crs-vt1:m-1-1-1,a-1-1:cct=dc,ring=m1
m-{1,2}-{1-7}-{1-4}†	<-->	a-{1,2}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-1-1-1,a-1-1-1:cct=dc,ring=m1
m-{1,2}-{1-7}-{1-4}†	<-->	b-{1,2}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-2-2-2,b-2-2-2:cct=dc,ring=m1
m-{1,2}-{1-7}-{1-4}†	<-->	c-{1-3}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-3-3-3,c-3-3-3:cct=dc,ring=m2

Note: The STS1E circuit pack hardware switch must be set to "low-speed" to support cross-connections. The "ring" parameter defines the ring carrying the continue signal. This ring directly connects to the other drop and continue shelf.

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27G-U OLIU in main.

Table 8-17. Ring VT1.5 Cross-Connections (Pass-Through)

From ∗		To	"To" CP Type (Note)	CIT Command
m-1-{1-7}-{1-4}	<-->	m-1-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-1-1-2,m-1-1-1
m-2-{1-7}-{1-4}	<-->	m-2-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-2-3-4,m-2-3-4
m-3-{1-7}-{1-4}	<-->	m-3-{1-7}-{1-4}	OLIU	ent-crs-vt1:m-3-5-3,m-3-5-3
{a,b,c}-{1-2}	<-->	{a,b,c}-{1-2}	27G2-U OLIU	ent-crs-vt1:a-1-1-1,a-1-1-1
m-1-{1-7}-{1-4}†	<-->	m-1-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-1-1-2,m-1-1-2
m-2-{1-7}-{1-4}†	<-->	m-2-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:m-2-3-4,m-2-3-4

Note: Address on the left side MUST BE identical to the address on the right side. There is no interchange function for "pass-through" signals.

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27G-U OLIU in main.

Table 8-18. Ring VT1.5 Cross-Connections (Locked)

From ∗		To	"To" CP Type	CIT Command
m-{1-3}-{1-7}-{1-4}	<-->	a-{1-7}-{1-4}	MXRVO	ent-crs-vt1:m-1-1,a-1-1-1:cct=locked,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	b-{1-7}-{1-4}	MXRVO	ent-crs-vt1:m-2-2,b-2-2-2:cct=locked,ring=m1
m-{1-3}-{1-7}-{1-4}	<-->	c-{1-7}-{1-4}	MXRVO	ent-crs-vt1:m-3-3,c-3-3-3:cct=locked,ring=m1
m-{1,2}-{1-7}-{1-4}†	<-->	{a,b,c}-{1-7}-{1-4}	MXRVO	ent-crs-vt1:m-1-1,a-1-1-1:cct=locked,ring=m1

∗ Whenever 24-type or 29-type OLIUs are installed in main the range of STS-1s will be from 1 to 12. Example: m-{1-12}.

† Ring cross-connection; 27G-U OLIU in main.

Table 8-19. Ring VT1.5 Cross Connections (Hairpin)

From	"From" CP Type		To	"To" CP Type	CIT Comm
{a,b}-{1-2}-{1-7}-{1-4}	27G2-U OLIU	<-->	c-{1-2}-{1-7}-{1-4}	27G2-U OLIU	ent-crs-vt1:a-1-1
a-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	<-->	a-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	ent-crs-vt1:a-1-1
b-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	<-->	b-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	ent-crs-vt1:b-1-1
c-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	<-->	c-{1-2}-{1-7}-{1-4}*	27G2-U OLIU	ent-crs-vt1:c-1-1-
{a,b}-{1-2}-{1-7}-{1-4}	22-type OLIU	<-->	c-{1-7}-{1-4}	STS1E/MXRVO	ent-crs-vt1:a-1-1
c-{1-3}-{1-7}-{1-4}	22-type OLIU	<-->	{a,b}-{1-7}-{1-4}	STS1E/MXRVO	ent-crs-vt1:c-1-1,
{a,b}-{1-2}-{1-7}-{1-4}	22-type OLIU	<-->	c-{1-3}-{1-7}-{1-4}	22-type OLIU	ent-crs-vt1:a-1-1
{a,b}-{1-7}-{1-4}	STS1E	<-->	c-{1-7}-{1-4}	STS1E	ent-crs-vt1:a-1-1
{a,b}-{1-7}-{1-4}	STS1E	<-->	c-{1-7}-{1-4}	MXRVO	ent-crs-vt1:a-1-1
c-{1-7}-{1-4}	STS1E	<-->	{a,b}-{1-7}-{1-4}	MXRVO	ent-crs-vt1:c-1-1,

* STS-1 number must be different in 'from' and 'to' addresses.

Table 8-20. Ring STS-3c Cross Connections

From	"From" CP Type	To	"To" CP Type	CIT Command
c-1	22 OLIU	m-(1, 4, 7, 10)	29 OLIU	ent-crs-sts3c:m-1, c-1

* STS-1 number must be different in 'from' and 'to' addresses.

OC-3/OC-12/OC-1 Path Protected Ring Application

This is a path protected ring application with multiple NEs in a two-fiber ring. The main optical units of each node in the ring are equipped with ring OLIU circuit packs, the 22-type, 24-type, 27-type or 29-type to transport signals to the next NE as well as drop signals at the NE. Valid mapping is provided by termination and pass-through cross-connections.

OC-3/OC-12 Path Protected Ring Drop and Continue Application

This is a path protected ring application with multiple NEs in a two-fiber ring. All but two nodes are normal ring application nodes (see previous application). Two nodes are defined to be the drop and continue nodes and are neighbors. They function to provide two copies of each service on the ring to another ring (dual ring interworking) or to wire centers (dual wire center service). Special drop and continue cross-connections are used to support this feature. The STS1E low-speed circuit pack is used to transport traffic between rings or to the wire centers. This feature provides node failure survival functionality. These two special nodes can also provide normal ring functionality at the same time.

OC-3/OC-12 Path Protected Ring Cross-Connect Restrictions

Restrictions on path-protected ring cross-connections include the following:

- All VT-1.5 cross-connections (**`ent-crs-vt1`**) are done via the OLIU circuit packs in the main slots. The OLIU circuit packs must be 22-type, 24-type, 26G2-U, 27G-U or 29-type.
- Time slots in function units A and B cannot be cross-connected to each other.
- When function units A and B are equipped with OLIUs, they can only carry two STS-1 or 56 VT1.5 signals. They cannot be cross-connected with main or function unit C to carry three STS-1, 84 VT1.5 or an STS3C signal.
- A cross-connection cannot be made to a slot that is in the unequipped state. Also, a cross-connection may not be made with any signal where a cross-connection already exists. The existing cross-connection must be deleted before a new cross-connection can be entered.
- If the system is equipped with OLIUs in function unit A and/or B, only one STS-1 signal per function unit is allowed to be connected (added) to function unit C.
- For VT1.5 cross-connections, all drop and continue cross-connections on a shelf must be entered into the same ring.
- Use the following rules to establish cross-connections in each ring:
  a. All drop connections (including DRI, if present) from the same ring must be provisioned the same, either all VT1.5 or all STS-1.
  b. If all 28 VT1.5s (DS1s) in an STS-1 are being passed through at a node in a VT1.5 path-switched ring, the cross-connection may be provisioned as either a pass-through STS-1 or VT1.5. However, if you anticipate dropping VT1.5s from the pass-through node, you should provision the pass-throughs as VT1.5 cross-connections.

Provisioning now as a VT1.5 cross-connect will avoid a hit on traffic if the STS-1 cross-connect has to be converted to 28 VT1.5 cross-connects (**`cnvt-crs`**) to drop DS1s at a later time.

c. On STS-1 path-switched rings, all nodes in the ring must be provisioned as STS-1 cross-connections.

To do a cross-connection successfully, proper addressing of cross-connect points is necessary. Figure 8-2 shows example STS-1 addresses. For a complete list of valid addresses, refer to Table 8-5 through Table 8-17.

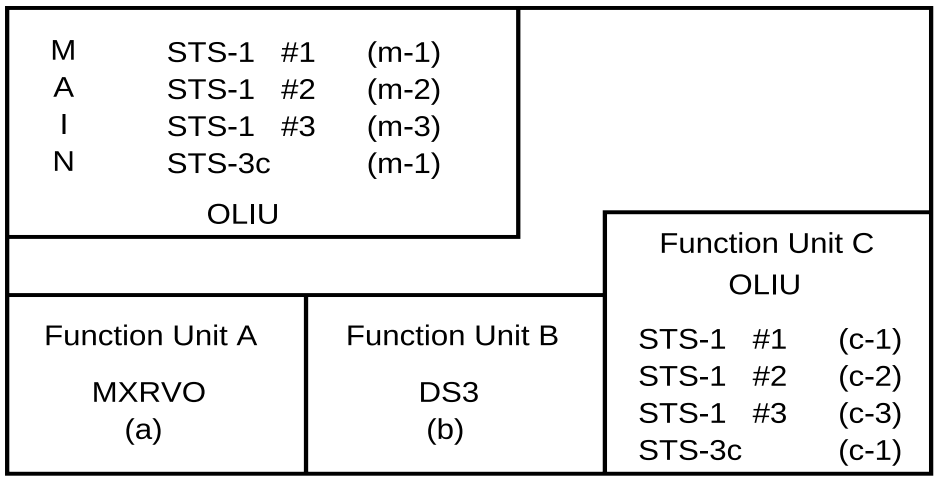

Figure 8-2. Example of STS-1 Addresses

OC-3 and OC-12 Ring Cross-Connection Provisioning

For every DS1, VT1.5, STS-1, STS-3C or DS3 transported through a ring network, a cross-connection is needed in every NE (node) on the ring. A "drop" cross-connection is needed at the nodes where service enters or exits the ring. A "pass-through" cross-connection is needed at all other nodes (intermediate nodes) on the ring.

For the DDM-2000 OC-3/12 Multiplexer, cross-connections of both ring paths are entered with a single command entry per shelf. This minimizes the possibility of provisioning a circuit without a protection channel. A DDM-2000 OC-3 ring has 84 VT1.5 channels or 3 STS-1 channels. The OC-3 ring channels are always carried within the 22-type OLIU circuit packs in the main 1 and main 2 slots. A DDM-2000 OC-12 ring has 336 VT1.5 channels or 12 STS-1 channels. The OC-12 ring channels are always carried within the 24 or 29-type OLIU circuit packs in main 1 and main 2 slots. The VT1.5 ring channels are designated **`m-{sts#}-{vtg#}-{vt#}`**. The STS-1 channels are designated **`m-{sts#}`**. In cross-connection provisioning, there is no need to identify ring channels in main 1 different from main 2 because both rings are always provisioned with the same information.

At the entry and exit points, the VT channels are cross-connected to the low-speed ports (for example, **`{ls group}-{slot#}-{port# on slot}, a-7-4)`**. These are called "drop" connections. For example, the command **`ent-crs-vt1:m-2-6-4,a-1-3`** connects the third low-speed port associated with slot 1 of low-speed group A to the fourth VT1.5 within the sixth VT group within the second STS-1 of both rings. Similarly, for STS-1 channels, the command **`ent-crs-sts1:m-2,a`** connects the DS3 or EC-1 port of function group A to the second STS-1 of both rings.

At the intermediate nodes, a pass-through cross-connection establishes a cross-connect path on both rings. Pass-through cross-connections are designated by using the same VT or STS-1 ring channel twice in the cross-connect address. For example, the single command **`ent-crs-vt1:m-2-6-4:m-2-6-4`** connects a pass-through cross-connection both to and from the fourth VT1.5 within the sixth VT group within the second STS-1 of both the service and protection ring. Also note that, unlike linear networks that require 22-type OLIUs in both main and fn-C slots to create pass-through connections, ring pass-through cross-connections are made directly between both main OLIUs.

Depending on local practice, work orders will normally identify the low-speed port designations at the entry and exit points in the network and the TIDs of the NEs at these points. The work order may also designate the VT1.5 or STS-1 ring channel which will be used for this service. If the work order does not designate a ring channel to use, use the command **`rtrv-crs-vt1;`** or **`rtrv-crs-sts1;`** to identify all the ring channels that are currently unassigned. The work order also may not designate all the other NEs on the ring that need to be provisioned with pass-through cross-connections. In this case, use the **`rtrv-map-netwrk`** command to identify the TIDs for all the NEs in a ring.

OC-3 Ring Network Cross-Connection Example

The following paragraphs describe a ring network example configuration and describe how to create manual cross-connections to establish the ring network. The example configuration is a ring network with two ring fibers and six nodes. Ring 1 carries ring traffic in the clockwise direction while Ring 2 carries ring traffic in the counterclockwise direction. For the purposes of this example, it is assumed that each shelf has recently been installed, equipped with 22-type OLIUs in the main 1 and main 2 slots, MXRVOs in the function unit slots, and DS1s in the Low-Speed Group slot; and all shelves are properly installed and provisioned. This example is for DS1 services. DS3 and EC-1 low-speed services can follow an equivalent procedure. See "System Turnup/Circuit Order," in the TOP section of this manual (Volume II). Figure 8-3 shows the six nodes with dashed lines indicating the cross-connections.

Ring configurations support manual VT1.5 or STS-1 cross-connections. Manual cross-connections must be made at **each** node in the network for each circuit being established. Drop cross-connections are made at the drop nodes where service enters or exits the node (Nodes 1 and 5) and pass-through cross-connections are made at **each** intermediate node (Nodes 2, 3, 4, and 6).

The example is for DS1 services but can be used to STS-1 services if the function units are properly equipped with DS3 and or STS1E circuit packs. The STS1E circuit pack can support 28 VT cross-connections or one STS-1 cross-connection.

Pass-through cross-connections should be established first to minimize alarms. The example assumes that the drop cross-connections are made after the pass-through cross-connections are made. This is the preferred method, since it assures that all cross-connections are associated with services.

An alternate method is also possible. Before service is established, all shelves can be defaulted to set up all pass-through cross-connections in the ring. This method has the advantage of only having to delete pass-through and establish drop cross-connections at the add/drop nodes. However, this method may introduce the possibility of affecting service when cross-connections are deleted. This is because it will not be possible to distinguish between pass-through cross-connections that are in use carrying service from those that are available. Use of this default pass-through provisioning method is only recommended if the accuracy of the cross-connection information on the work order is assured.

The following commands may be used to delete, enter, and retrieve cross-connections: **`dlt-crs-vt1`**, **`ent-crs-vt1`**, **`rtrv-crs-vt1`**, **`dlt-crs-sts1`**, **`ent-crs-sts1`**, and **`rtrv-crs-sts1`**. See Section 11, "Commands and Reports," for a description of these commands.

It is important that the pass-through signal is assigned the same channel address for all nodes in the ring including the add/drop nodes **`m-1-2-3`** in the example.

Do the following procedure:

1. Using the work order, identify the TIDs of the entry and exit points on the ring (Nodes 1 and 5 in the example).

2. Determine if the work order is specifying use of a particular ring channel (some work orders may abbreviate the **`m-1-2-3`** designation as **`m123)`**. If the work order does not designate a VT1.5 ring channel to use, use the **`rtrv-crs-vt1:all;`** to identify all unused ring channels. The output report will show a dash in the Address 2 column for all unused channels. In the example, we will cross-connect a DS1 from Node 1 through the ring and drop the DS1 at Node 5 using **`m-1-2-3`**.

3. Log in or remote log in to all the TIDs that are not entry and exit points (intermediate nodes) and enter ring "pass-through" cross-connections. At each intermediate node of the network, use the **`ent-crs-vt1:`** command to cross-connect the VT1.5 (DS1) channel time slots between main 1 and main 2. For example, to cross-connect the channel time slot associated with STS-1 #1 in VT group 2 DS1 port 3, use the **`ent-crs-vt1:m-1-2-3,m-1-2-3`**) command.

   NOTE:
   Only one command is required to establish the pass-through cross-connection on **both** rings (main 1 to main 2 for Ring 1 and main 2 to main 1 for Ring 2). Address 1 and address 2 must be the same.

4. Log in or remote log in to each drop node and enter the "drop" cross-connection. At both drop nodes of the DS1 circuit being established, use the **`ent-crs-vt1:`** command to cross-connect the VT1.5 (DS1) channel time slot to the proper group, slot and port (for example, **`ent-crs-vt1:m-1-2-3,a-2-3`**).

   NOTE:
   Only one command is required to establish the drop cross-connections on **both** rings between main and fn-A. At exit nodes, assuming normal operation, the same signal is present on both rings. The 22-type OLIU monitors the input from each ring and selects one to drop to fn-A.

5. Status and alarm conditions can be present during the provisioning operation but will clear once the last ring cross-connection for this DS1 service is completed. If they do not, the **`rtrv-alm;`** and **`rtrv-crs-vt1;`** commands can be used to isolate the problem. See the TOP section of this manual (Volume II).

6. Log in or remote log in to all the nodes and verify appropriate drop or pass-through ring cross-connections.

7. Test both paths around the ring. Since DDM-2000 OC-3 uses non-revertive path switching to minimize the number of hits on services, the initial path selection is arbitrary. Use **`rtrv-state-path`** and **`sw-path-vt1`** commands to test both ring paths around the ring network at the drop nodes of the new service. The **`sw-path-vt1`** command should be limited to the addresses that are being tested. For the example, the commands are **`sw-path-vt1:m1-1-2-3`** and **`sw-path-vt1:m2-1-2-3`**.

   The **`rtrv-state-path`** and **`sw-path-vt1`** commands use a slightly different VT1.5 ring channel designations from the cross-connect designations because these commands need to identify which of the two paths around the ring is currently active. If the ring path and selected VT1.5 channel are being received on main 1, the active ring channel designation for the **`rtrv-state-path`** and **`sw-path-vt1`** commands will be **`m1-1-2-3`**, where the **`m1`** is the path received on main 1. If the ring path and selected VT1.5 channel are being received on main 2, the ring channel designation for the **`rtrv-state-path`** and the **`sw-path-vt1`** commands will be **`m2-1-2-3`**, where the **`m2`** is the path received on main 2. The DDM-2000 OC-3 allows a per-path designation on the **`sw-path-vt`** command. This assures that only the new DS1 service being provisioned will be subject to protection switch hits. If this is not the first DS1 service being added to the ring, it is strongly recommended that the pulling of circuit packs or fibers to test the protection path not be done, since it would subject existing DS1 services to protection switch hits.

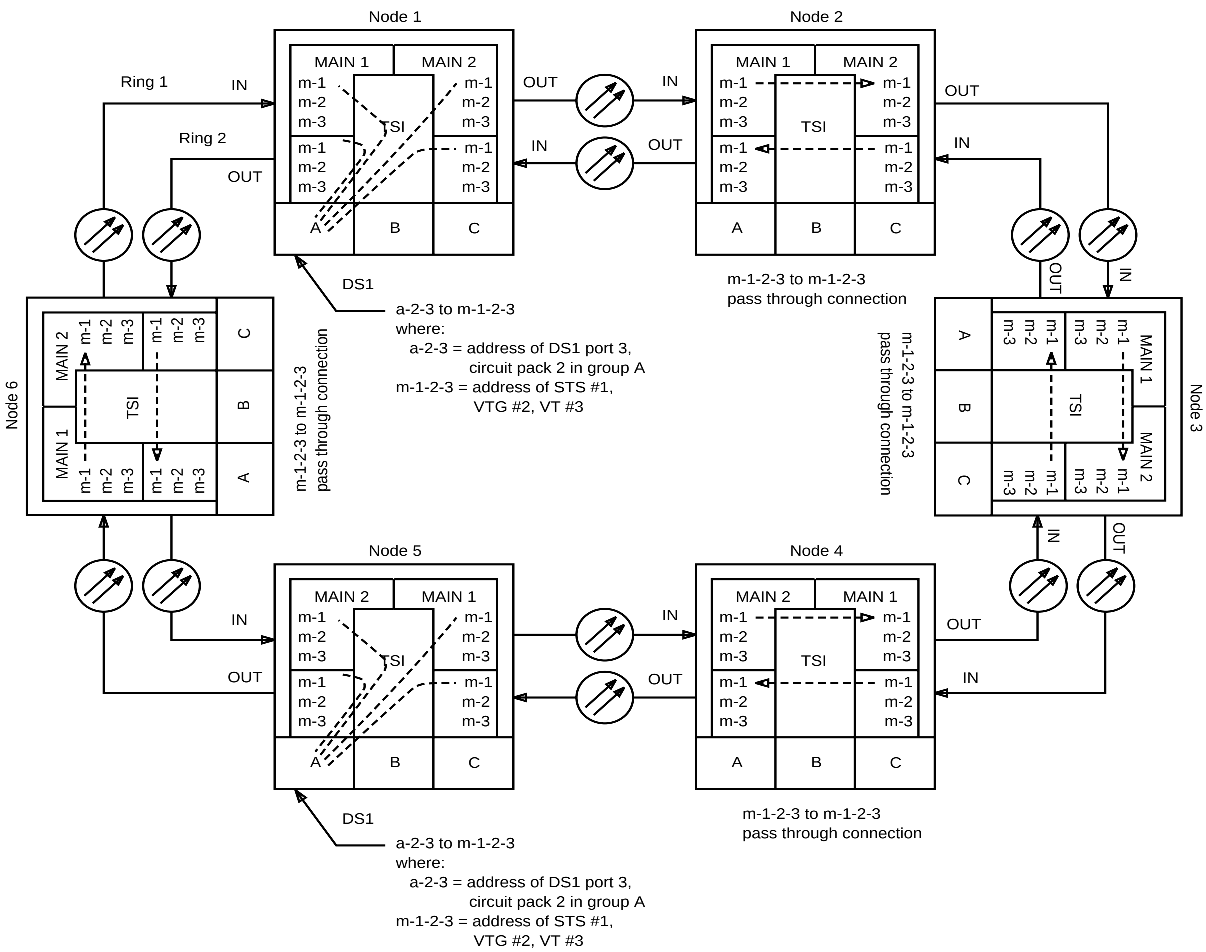

Figure 8-3. Example OC-3 Ring Configuration Cross-Connections

T1/TMUX Cross Connection and Description

Starting with OC-3 Release 15.0, the T1EXT (BBF6) (used only with the enhanced MXRVO BBG2B- circuit pack) is supported.

The dual T1EXT circuit pack terminates up to two bi-directional T1 line interfaces, supporting the transport of a DS1 signal. The T1EXT supplies 60 mA simplex DC line power for each of the two T1 lines. Signals received from the T1 interface are mapped into SONET VT1.5 signals. The resulting signals are routed to the OLIU circuit pack.

The BBF6 circuit pack offers DS1 path performance monitoring (PM) equivalent to that provided by the BBF3-type DS1 circuit pack. DS1 PM is performed to collect, store, threshold and generate PM reports on Errored Seconds (ES), daily counts for Super-Frame-NearEnd (SF-NE), Extended SuperFrame-NearEnd (ESF-NE) and Extented SuperFrame-FarEnd (ESF-FE).

Configurations Supported

OC-3 Release 15.0 adds support for T1 extensions. Each BBF6 circuit pack can support 2 T1 extensions; These can be mixed with DS1 (BBF1,BBF1B,BBF3 or BBF3B), BBF8 HDSL, or (BBF9/BBF10) IMA LAN Low Speed circuit packs.

The Low Speed slot "ls-{a,b,c}-8" position is the protection slot for all other slots equipped with packs of a kind it can protect. A shelf with BBF6s in every Low Speed slot of a certain group provides 14 T1 extensions. Furthermore, a BBF6 can only be used in an OC-3 shelf equipped with the enhanced MXRVO -BBG2B (for Group 4 shelves) circuit packs in the corresponding Function Unit group.

Cross-Connection Changes on the T1EXT BBF6 Equipped Shelves

When a Function Unit group is equipped with BBG2B MXRVO circuit packs and the corresponding Low Speed group is equipped with BBF6s in every Low Speed slot, 14 T1 extensions are addressable. Those extensions are mapped to 14 VT1.5 signals.

DS1 Alarm Processing and Alarm Reports

DS1 alarms will be created and alarm reports available for the OC-3 shelves equipped with T1EXT circuit packs in Low Speed slots Alarms for mixing packs in the Low Speed slots will be covered as well.

CIT/TL1 commands for setting and retrieving this information are given later in this document.

Provisioning Changes

The T1EXT circuit pack provisioning involves line coding, maintenance signal processing, and performance monitoring. The provisioning parameters used for provisioning these parameters is identical to that used for the BBF3/BBF3B DS1 circuit pack.

IMA LAN Cross Connection and Description

Starting with OC-3 Release 15.0, the Low Speed slots of the DDM-2000 OC-3 shelf will support the BBF9 and BBF10 LAN circuit pack 9 to be used to interconnect a Local Area Network to a Wide Area Network (WAN) through the IEEE standard 802.3 compliant interface.

The LAN circuit pack provides one 10/100BaseT (BBF9) on one 100BaseFX (BBF10) 802.3 compliant interface. The pack occupies two adjacent low-speed (DS1) slots and can use up to 8 DS1/VT1.5 channels on an OC-1/ OC-3 or OC-12 ring. Any available VT time slot can be assigned to the LAN interface. The 802.3 LAN interface performs a bridging (layer 2) function by which Protocol Data Units (MAC packets) are forwarded for transmission through the SONET network. MAC addresses are learned and aged automatically by the 802.3 device to prevent locally destined packets from traversing the network. The selected MAC packets are mapped into ATM cells using either the AAL5 IETF-RFC-1483 multi-protocol encapsulation or VC multiplexed format (one format will be pre-configured for the initial release). All user ATM cells have a single (default provisioned) VP/VC address. The ATM cells are round robin distributed over 1 to 8 DS1 channels using the ATM Forum specification for ATM inverse multiplexing (IMA) AF-PHY-0086.00 version 1. Each DS1 channel is mapped into a SONET VT1.5 channel for transmission through the SONET network. In the receive direction the circuit pack performs the reverse process to recover MAC packets for forwarding to the 802.3 LAN.

Configurations Supported

Up to three LAN circuit packs can be installed in a DDM-2000 OC-3 Low Speed group (a,b, and/or c), when the associated Function Unit is equipped with the BBG2B or BBG2 MXRVO. The following lists the different Low Speed slot combinations that this circuit pack can use:

ls-{a,b,c}-1&2, ls-{a,b,c}-2&3, ls-{a,b,c}-3&4, ls-{a,b,c}-5&6 and ls-{a,b,c}-6&7

Mixing of Low Speed Circuit Packs

Lucent will allow the mixing of LAN circuit packs with other Low Speed packs (i.e: DS1, T1EXT). The following table summarizes some mixing possibilities in the Low Speed slots (on a per Low Speed Group basis) Note that High Speed 22, 24 or 29-type OLIUs in Main can be used with any of the following combination, BBF1B, BBF3, BBF6, BBF8, BBF9/BBF10, and BBF3B:

Note that the table below does not represent all the different combinations of Low Speed circuit packs that can co-exist in the Low Speed slots at one time.

DS1/T1EXT Packs	HDSL	LAN
5*	1*	1*
5**	3**	0
3**	3**	1**
3**	1**	2**
2**	0**	3**
0**	3**	2**
0**	2**	3**

NOTES

* = Using a BBG2 (MXRVO) circuit pack in the corresponding Function Unit group

** = Using a BBG2B (Enhanced MXRVO) circuit pack in the corresponding Function Unit group

Any time T1EXT is used, BBG2B MXRVO packs must be used.

DS1/T1EXT/HDSL packs can be protected

The above table is subject to change.

General:

DS1 ===> BBF1, BBF1B, BBF3, and BBF3B

T1EXT ===> BBF6

HDSL ====> BBF8

LAN ====> BBF9/BBF10

Cross-Connection and Other Provisioning Changes Related to the Addition of LAN Low-Speed Interface on the OC-3 Shelves

The following are the allowed VT1.5 addresses:

Object	Address	Entity
VT1.5	m-{1-3}-{1-7}-{1-4,all}	22-type OLIU (high-speed interface)
VT1.5	m-{1-12}-{1-7}-{1-4,all}	24G-U/29G-U OLIU (high-sped interface)
VT1.5	{a,b,c}-{1-7}-{1-4,all}	LAN low-speed interfaces

DS3/EC-1 Ring Network Cross-Connection

DS3/EC-1 ring network provisioning follows the same procedure as the DS1 ring provisioning example except that function unit B is involved. For example, in Figure 8-3, replacing the MXRVO and DS1 circuit packs at Node 1, function unit B, and at Node 6, function unit B with DS3 or STS1E circuit packs, converts the figure to a DS3 path protected ring. The following cross-connections would then be made:

Node	Cross-Connection
2, 3, 4, and 5	ent-crs-sts1:m-2,m-2
1	ent-crs-sts1:m-2,b
6	ent-crs-sts1:m-2,b

OC-3/OC-12 Ring Drop and Continue Cross-Connection Provisioning

All the information on "Ring Cross-Connection Provisioning" applies to "Ring Drop and Continue Cross-Connection Provisioning." Please review "Ring Cross-Connection Provisioning" as that information is not repeated here. Only the new provisioning information is presented here. This information applies to both STS-1 and VT1.5 traffic. Only the cross-connection addresses are different. A mixed traffic ring of STS-1 and VT1.5 drop and continue services is supported.

Two nodes are defined to be drop and continue nodes in a ring subnetwork and are the exit points where "two" copies of the same service are available. By making two copies of the same service available at two nodes, the network is protected from failure of a node (for example, a CO) that affects all traffic on the ring. For rings that carry drop and continue services, the drop and continue nodes are neighbors and all "drop and continue" traffic must be continued on the ring connecting the two nodes.

In Figure 8-4 (one half of a drop and continue DRI application) CO 1 and CO 2 are drop and continue nodes. Traffic continued at CO 1 uses Ring 2 which is the fiber connecting CO 1 to CO 2. Likewise, continued traffic at CO 2 uses Ring 1, which is the fiber connecting CO 2 to CO 1.

When a new service is added to the ring, use the normal procedures to add service to all nodes of a ring except to the drop and continue nodes. Before a drop and continue cross-connection can be made to a low-speed function unit, the slots must be equipped with either STS1E low-speed circuit packs or OC-3 OLIUs. This circuit pack type is the interface for drop and continue applications. The cross-connection command for drop and continue at CO 1 (see Figure 8-4) has two additional parameters. They are cross-connection type (**`cct`**) and ring identification (**`ring`**). The **`cct`** is **`dc`** for drop and continue. The parameter **`ring`** for the **`ent-crs-sts1`** or **`ent-crs-vt1`** command defines the direction of the continued signal. The counterclockwise ring is called **`m2`** because it is always connected to main-2 OLIU. Similarly, the clockwise ring is called **`m1`** because it is always connected to main-1 OLIU. At CO 1 the parameter for **`ring`** is **`m2`**, which means to continue the signal on Ring 2 toward CO 2. For VT1.5 cross-connections, once the first VT drop and continue cross-connection defines the ring direction, all other VT drop and continue cross-connections at that node are forced to use that ring rotation.

Similarly at CO 2, the other drop and continue node, the cross-connection command requires the same two parameters. The **`cct`** parameter is **`dc`** and the value for **`ring`** is **`m1`**, which means to continue the signal on Ring 1 toward CO 1.

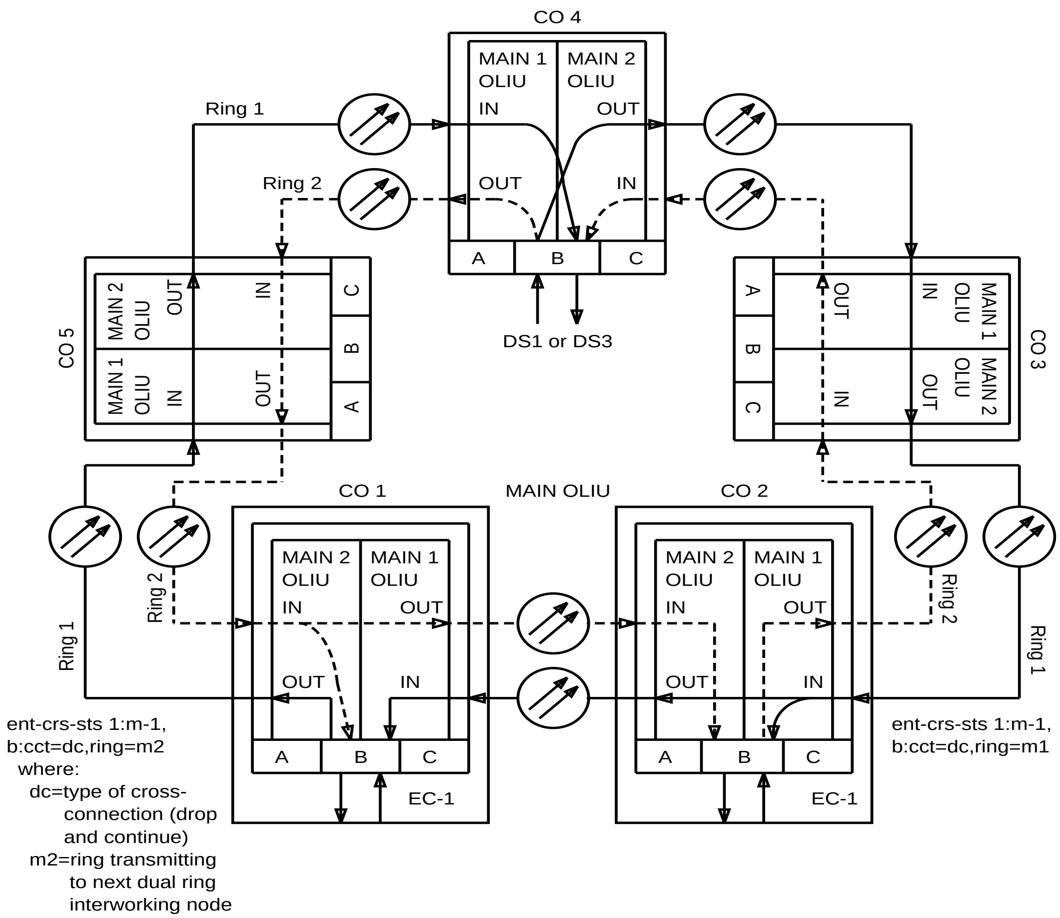

Figure 8-4. Drop and Continue Nodes

OC-3/OC-12 Ring Network Drop and Continue Cross-Connection Example

Figure 8-5 shows a DRI network.

1. The user wants to provision a fully protected service using drop and continue cross-connections in this dual ring topology. The service is a DS3 at RT2 (bottom node in figure) to CO 4 (top node in figure).
2. All nodes in both rings require 22-type or 24-type OLIUs in the main slots and all nodes require the same release of drop and continue ring software. The two terminating nodes (CO 4 and RT2) require low-speed DS3 circuit packs in a function unit as defined by the work order.
3. The site CO 1 has two NEs, one is part of the upper ring subnetwork and the other is a part of the lower subnetwork. They are connected by EC-1 signals provided by STS1E low-speed circuit packs. The figure shows these connections in function unit B of both NEs but any available function unit can be used.
4. Note in the figure the identification of Ring 1 (clockwise) and Ring 2 (counterclockwise). This identification is a key to correct provisioning and needs to be checked before cross-connections are made.
5. The work order will specify the low-speed channel of the DS3 service, the available high-speed channel on the lower ring, and the low-speed channel assigned at the drop and continue nodes. While it is not required by DDM-2000 that the low-speed channel of the drop and continue nodes be the same, it is recommended to simplify record keeping.
6. For this example, the cross-connections are:

   ent-crs-sts1:b,m-1 at RT2 (two-way drop)
   ent-crs-sts1:m-1,m-1 at RT3 and RT1 (pass-through)
   ent-crs-sts1:m-1,b:cct=dc,ring=m1 at CO 1 (lower NE)
   ent-crs-sts1:m-1,b:cct=dc,ring=m2 at CO 2 (lower NE).

   The continued signal at CO 1 must be assigned to Ring 1 ("m1"), and the continued signal at CO 2 must be assigned to Ring 2 ("m2").
7. In a similar manner, the upper ring is provisioned according to the work order. The high-speed and low-speed addresses do not have to be the same as the ones used in the lower ring, but they must follow the rules for rings, which is to assign a single high-speed channel to all nodes for this DS3 service.

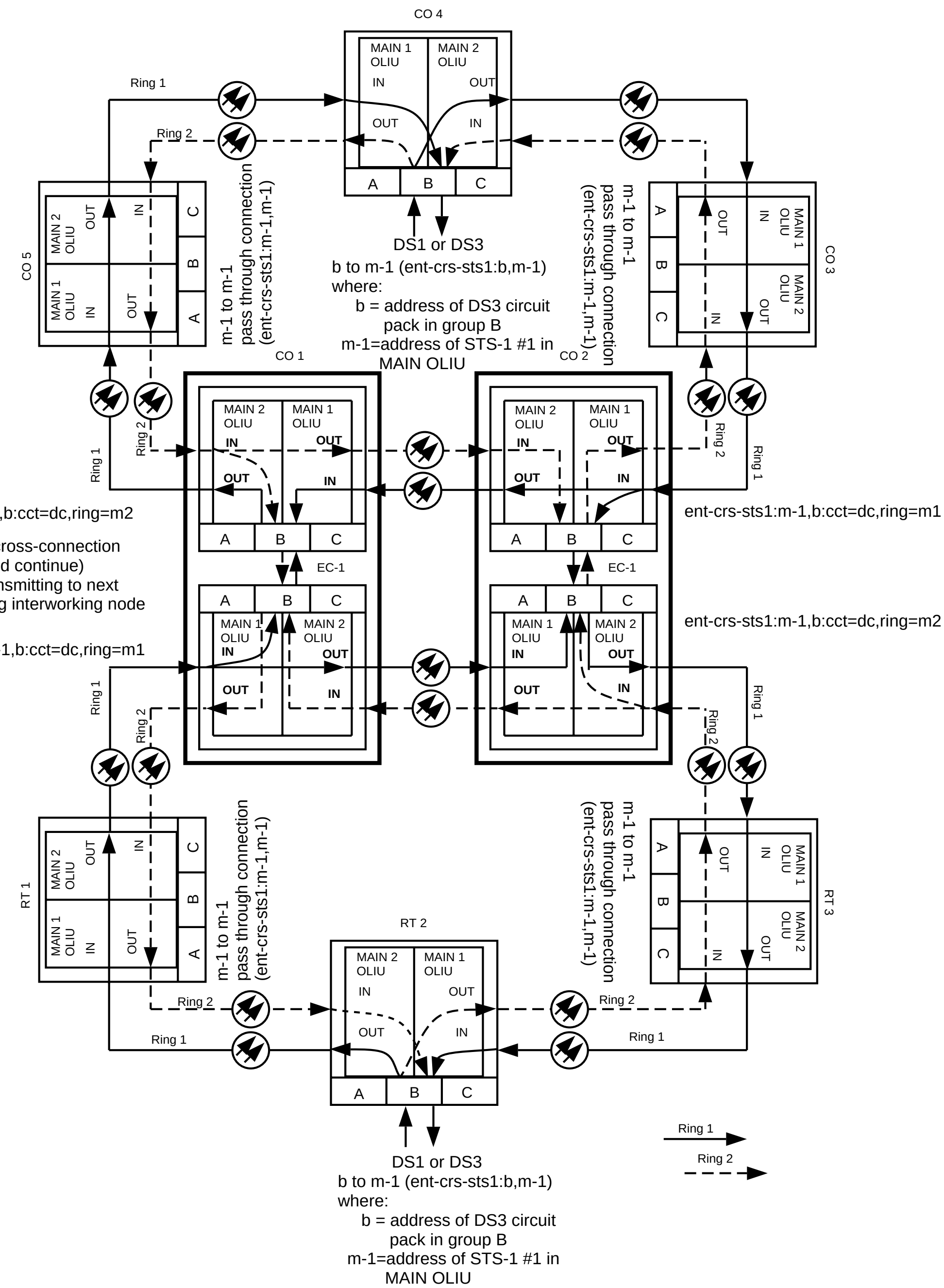

Figure 8-5. Example Dual Ring Configuration Cross-Connections

For this example, the cross-connections are:

ent-crs-sts1:m-1,b:cct=dc,ring=m2—at CO 1 (upper NE)
ent-crs-sts1:m-1,b:cct=dc,ring=m1—at CO 2 (upper NE)
ent-crs-sts1:m-1,m-1—at CO 3 and CO 5 (pass-through)
ent-crs-sts1:b,m-1—at CO 4 (two-way drop).

The continued signal at CO 1 must be assigned to Ring 2 ("m2"), and the continued signal at CO 2 must be assigned to Ring 1 ("m1").

8. Cross-connections supporting DS3 services are STS-1 cross-connections. Cross-connections supporting DS1 services may be either STS-1 or VT1.5 cross-connections. VT1.5 drop and continue services use the same procedure except that the addresses and channels used are VT. The interface between the two rings at the drop and continue nodes is still the STS1E circuit pack, which can support VT1.5 cross-connections as well as STS-1 cross-connections. See the TOP section of this manual (Volume II) for procedures.

OC-3/OC-12 VT1.5 Path Switched Ring (0x1) Single Homing

Figure 8-6 shows an example of an OC-12 VT1.5 path switched ring (0x1) single homing application. The figure is placed after the example explanation and can be removed for reference.

The DDM-2000 OC-12 ring supports 0x1 OC-3/IS-3 interfaces in its function unit slots. These interfaces must be provisioned as 0x1. Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 function unit slot FN(x)-1 is connected to OC-3 main-1, and OC-12 function unit slot FN(x)-2 is connected to OC-3 main-2. Switching is not done on the DDM-2000 OC-12 Multiplexer on these lines or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves) or the OC-12 node can provision different STS-1s at different sites. When 0x1 is used, the OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site. Since the high-speed signals from the OC-3 ring(s) are sent as two copies (one clockwise, the other counter-clockwise) on the OC-12 ring, the OC-12 ring capacity is limited to the OC-12 line rate.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring 0x1 fashion behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

Some points to note for this application are:

- 0x1 can be thought of as a "ring on ring" with many of the characteristics of a single ring.
- Pass-through cross-connections may be required at the VT and STS level.
- The OC-3 ring can be composed of any three STSs in the OC-12.
- An OC-12 STS may be the first STS in one extension, the second STS in another, and the third STS in another.

Example Cross-Connections

The OC-12 (STS level) cross-connections are:

- At CO: mb-1:a-3

  mb-1 is dropped to the third STS in the OC-3 between CO and CO-1.
- At RT1: mb-1:a-1

  mb-1 is dropped to the first STS in the OC-3 between RT1 and RT1-1.
- At RT2: mb-1:c-2

  mb-1 is dropped to the second STS in the OC-3 between RT2 and RT2-2.
- RT3 is an OC-3 shelf equipped with OC-12 optics. The 24G-U OLIUs provide the ability to drop up to any three of the 12 STS-1s at this node. The remaining STS-1s continue on the OC-12 ring.
- At RT4: mb-1:mb-1

  mb-1 is passed through RT4 at the STS level.

These cross-connections can be thought of as establishing one STS of an OC-3 ring embedded in the OC-12 system. This is sometimes referred to as a "ring on ring." In the example, the OC-3 nodes are CO-1, RT1-1, and RT2-2. The STS itself traverses all eight nodes. An "ordinary" STS (for example, one that carries a DS3 from an originating node to a terminating node) can drop at only two locations (terminate in two-way at the source and destination), and pass-through cross-connections are needed at the intermediate nodes. There can be multiple drop (ring 0x1) type cross-connections to optical extensions.

The VT cross-connections that follow drop or pass through individual VTs in the STSs. This is like an ordinary OC-3 ring, except that, the same OC-12 STS can be dropped to different STSs in the various OC-3s. In an ordinary ring, the same time slot (for example m-1-1-1) is used all the way around the ring. In a ring-on-ring application, the TSI can change in each extension. The same VTG/VT will be used but the STS can change.

The OC-3 (VT level) cross-connections are:

- At CO-1: a-1-4:m-3-2-1

  The first VT in the second VTG is assigned between CO and CO-1. This slot will be used to transport the DS1 that will terminate on port a-1-4.

- At RT1-1: b-2-1:m-1-2-1

  The above DS1 will leave the system from port b-2-1 at RT1-1. The VTG/VT slot (-2-1) is set by the cross-connection at CO-1. Because OC-12 STS mb-1 is dropped to the first STS in this OC-3 extension (m-1), port b-2-1 is cross-connected to m-1-2-1.

- At RT2-2: m-2-2-1:m-2-2-1

  At RT2, time slot mb-1 is dropped to the second STS going to RT2-2 (m-2). The VT/VTG assignment remains -2-1. A VT pass-through cross-connection is needed to enable future DS1s to be dropped at RT2-2. If drops will never be needed, STS pass-through cross-connections can be used.

- RT3 is an OC-3 shelf equipped with OC-12 optics. The 24G-U OLIUs provide the ability to drop up to any three of the 12 STS-1s at this node. The remaining STS-1s continue on the OC-12 ring.

With these cross-connections, DS1s originating at any of the three OC-3 nodes can be terminated at any one of the others with VT cross-connections at those nodes only. The STS "pipe" is in place with the OC-12 cross-connections. As was the case with the example DS1, two VT drop cross-connections and two pass-through cross-connections are needed.

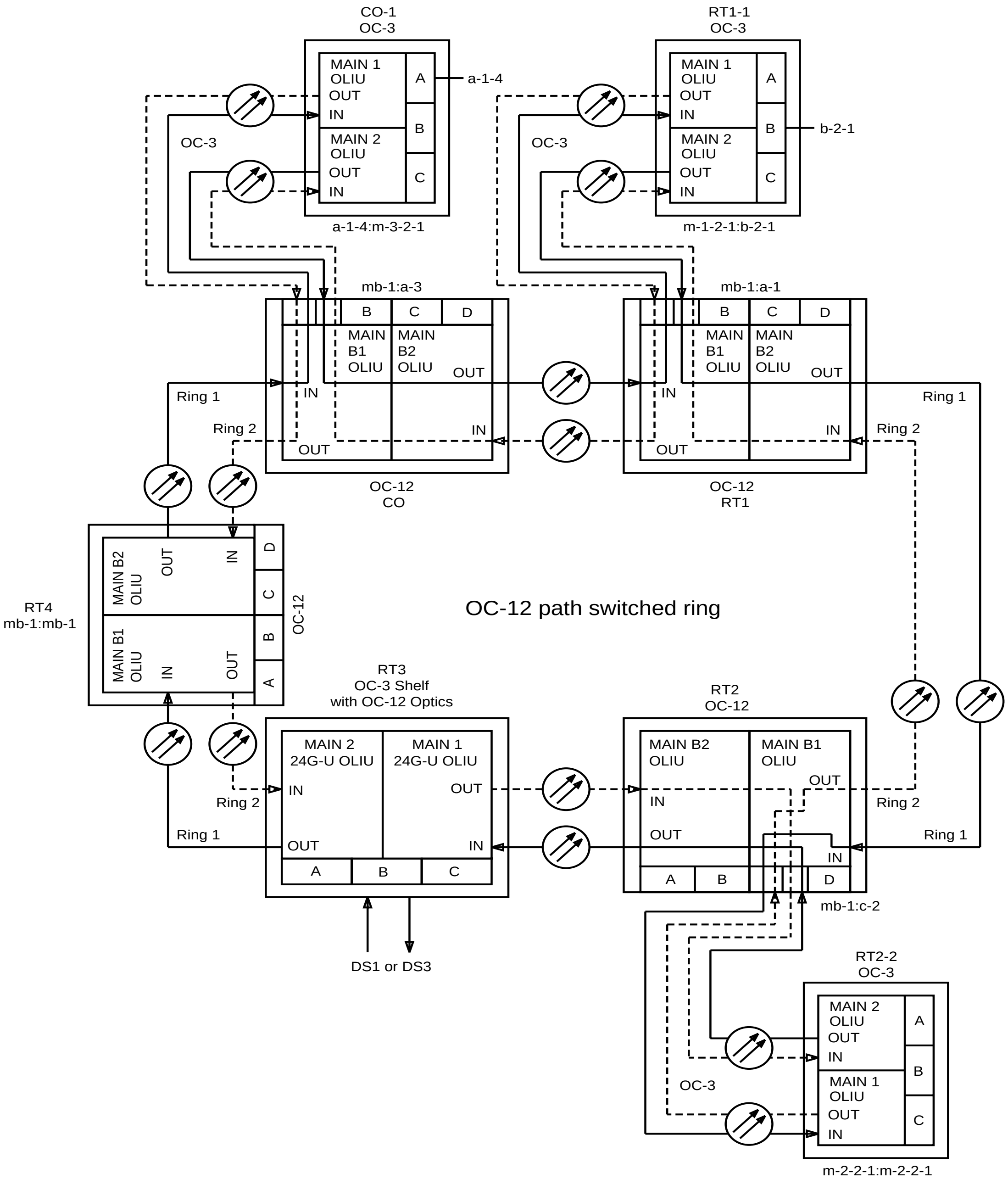

Figure 8-6. Example OC-3/OC-12 0x1 Single Homing Configuration Cross-Connections

OC-3/OC-1 Ring Cross-Connection Provisioning

For every DS1 transported through a ring network, a cross-connection is needed in every NE (node) on the ring. A "drop" cross-connection is needed at the nodes where service enters or exits the ring. A "pass-through" cross-connection is needed at all other nodes (intermediate nodes) on the ring.

For the DDM-2000 Multiplexers, cross-connections of both ring paths are entered with a single command entry per shelf. This minimizes the possibility of provisioning a circuit without a protection channel. A DDM-2000 OC-1 ring has 28 VT1.5 channels. The ring channels are always carried within the 26-type OLIU circuit packs in the main 1 and main 2 slots in FiberReach WBS nodes. There is no need to identify ring channels in main 1 different from main 2 because both rings are always provisioned with the same information.

At the entry and exit points, the VT channels are cross-connected to the low-speed ports (for example, **{ls group}-{slot#}-{port# on slot}, a-1-4)**. These are called "drop" connections. For example, the command **ent-crs-vt1:m-1-6-4,a-1-3** connects the third low-speed port associated with slot 1 of low-speed group A to the fourth VT1.5 within the sixth VT group within the first (and only) STS-1 of both OC-1 rings.

At the intermediate nodes, a pass-through cross-connection establishes a cross-connect path on both rings. Pass-through cross-connections are designated by using the same VT ring channel twice in the cross-connect address. For example, the single command **ent-crs-vt1:m-1-6-4:m-1-6-4** connects a pass-through cross-connection both to and from the fourth VT1.5 within the sixth VT group within the first STS-1 of both the service and protection ring.

Depending on local practice, work orders will normally identify the low-speed port designations at the entry and exit points in the network and the TIDs of the NEs at these points. The work order may also designate the VT1.5 ring channel which will be used for this service. If the work order does not designate a ring channel to use, use the command **rtrv-crs-vt1;** to identify all the ring channels that are currently unassigned. The work order also may not designate all the other NEs on the ring that need to be provisioned with pass-through cross-connections. In this case, use the **rtrv-map-netwk** command to identify the TIDs for all the NEs in a ring.

OC-3/OC-1 Ring Network Cross-Connection Example

The following paragraphs describe a ring network example configuration and describe how to create manual cross-connections to establish the ring network. Figure 8-7 shows the five nodes with dashed lines indicating the cross-connections.

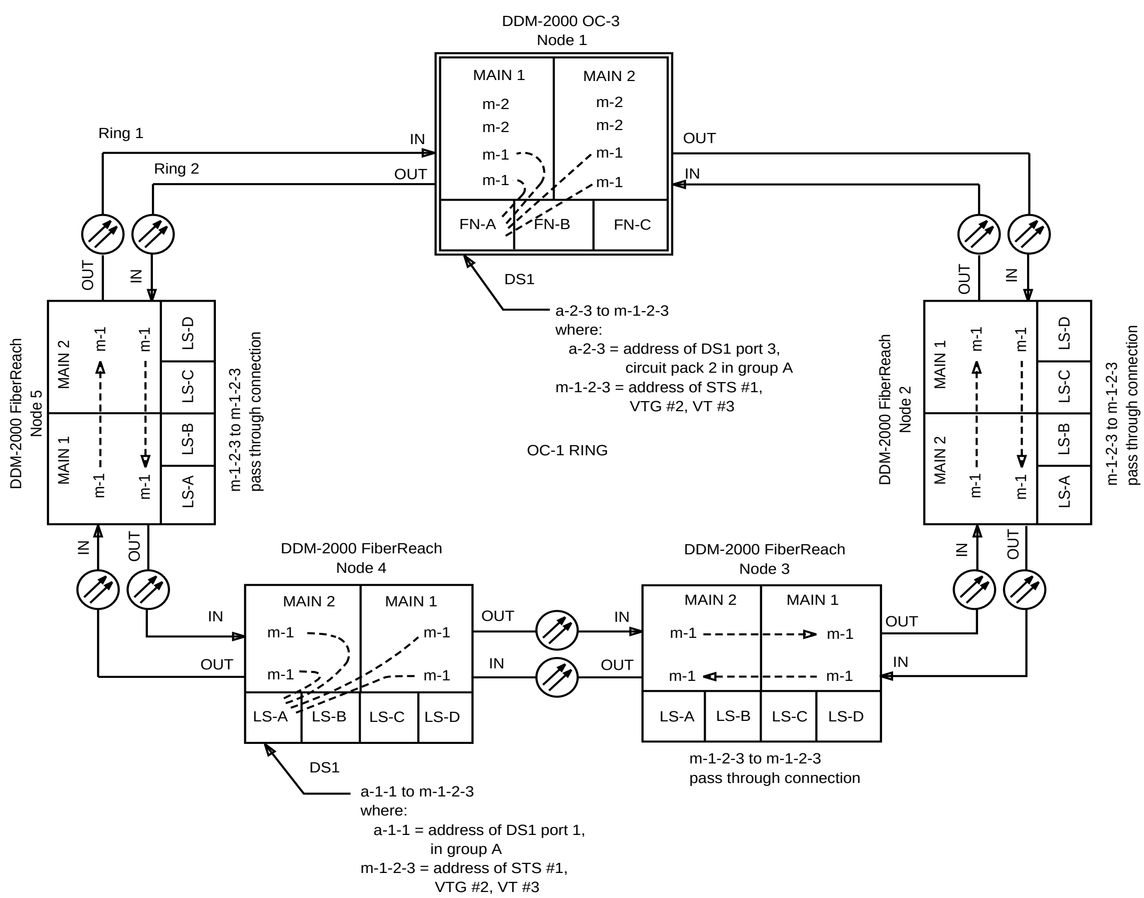

Figure 8-7. Example OC-1 Ring Configuration Cross-Connections

In Figure 8-7, the example configuration is a ring network with two ring fibers and five nodes. Ring 1 carries ring traffic in the clockwise direction while Ring 2 carries ring traffic in the counterclockwise direction. In the example configuration, Node 1 is a DDM-2000 OC-3 shelf equipped with 27-type OLIU circuit packs in the main slots, MXRVOs in function unit A, and DS1 or DS1PM circuit packs in the Low-Speed Group A slots. Nodes 2 through 5 are DDM-2000 FiberReach Multiplexer wideband shelves with 26-type OLIU circuit packs in the main slots and DS1 or DS1PM circuit packs in the low-speed Group A slots. All shelves are properly installed and provisioned. This example is for DS1 services. See "System Turnup/ Circuit Order" in the TOP section (Volume II) for actual procedures.

Ring configurations support manual VT1.5 cross-connections. Manual cross-connections must be made at **each** node in the network for each circuit being established. Drop cross-connections are made at the drop nodes where service enters or exits the node (Nodes 1 and 4) and pass-through cross-connections are made at **each** intermediate node (Nodes 2, 3, and 5).

It is recommended that pass-through cross-connections be entered first, as shown below, to avoid transient alarms during provisioning.

The following commands may be used to delete, enter, and retrieve cross-connections: **`dlt-crs-vt1`**, **`ent-crs-vt1`** and **`rtrv-crs-vt1`**. See Chapter 11, "Commands and Reports," for a description of these commands.

To establish the end-to-end DS1 circuit from Node 1 to Node 4, as shown in Figure 8-7, enter a cross-connection at each node as follows:

1. Enter the following pass-through cross-connections at Nodes 2, 3, and 5:

   `ent-crs-vt1:m-1-2-3,m-1-2-3:cct=twoway;`

2. Enter the following cross-connection to drop the VT1.5 channel from the OC-1 ring to a DS1 interface at Node 1:

   `ent-crs-vt1:m-1-2-3,a-2-3:cct=twoway;`

3. Enter the following cross-connection to drop the VT1.5 channel from the OC-1 ring to a DS1 interface at Node 4, a DDM-2000 FiberReach Wideband shelf:

   `ent-crs-vt1:m-1-2-3,a-1-1:cct=twoway;`

4. Test both paths around the ring. Since DDM-2000 uses non-revertive path switching to minimize the number of hits on services, the initial path selection is arbitrary. Use **`rtrv-state-path`** and **`sw-path-vt1`** commands to test both ring paths around the ring network at the drop nodes of the new service. The **`sw-path-vt1`** command should be limited to the addresses that are being tested. For the example, the commands to be used at Node 1 and Node 4 are:

   `sw-path-vt1:m1-1-2-3` and **`sw-path-vt1:m2-1-2-3`**.

Note that this same configuration could be set up using the second OC-1 interface on the 27G-U OLIUs in the main slots of the DDM-2000 OC-3 shelf at Node 1. To do this using the same VT1.5 timeslot on the OC-1 ring, replace the VT1.5 address **`m-1-2-3`** with **`m-2-2-3`** in Step 2, above. All other cross-connections remain the same.

Single-Homed OC-3/OC-1 Path-Switched Ring Example

Figure 8-8 shows an example of an OC-1 VT1.5 single-homed path-switched ring application. The NEs on the OC-3 ring can be either DDM-2000 OC-3 Multiplexers or *SLC*-2000 Access Systems. Refer to this figure when reviewing this example.

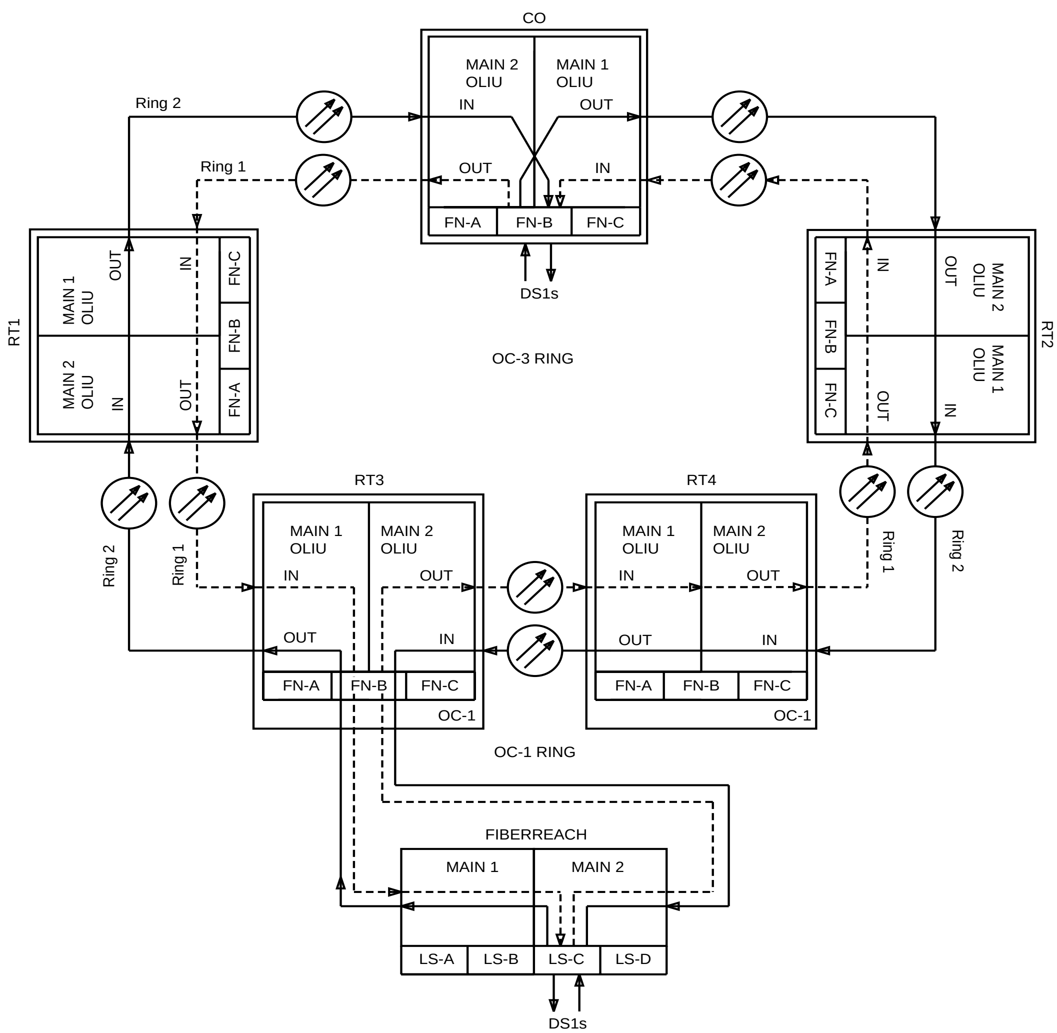

Figure 8-8. Example Single-Homed Path-Switched Ring Configuration Cross-Connections

In Figure 8-8, the DDM-2000 OC-3 shelf at RT3 supports a single-homed OC-1 interface in function unit B. Signals are connected between the OC-3 interface in main-1 and the OC-1 interface(s) in fn-B-1, and between the OC-3 interface in main-2 and the OC-1 interface(s) in fn-B-2. Switching is not done on the DDM-2000 OC-3 Multiplexer on these interfaces; rather VT1.5 level path switching is done on the DDM-2000 FiberReach Multiplexer and on the DDM-2000 OC-3 shelf at the CO node. This allows DDM-2000 FiberReach nodes to interface with DDM-2000 nodes of an OC-3 ring, providing "ring-on-ring" architecture. Each OC-1 ring so supported occupies up to 28 VT1.5 time slots on the OC-3 ring. When single-homing is used, the OC-3 system passes the VT1.5 time slots between the OC-1 interfaces and OC-3 interfaces without terminating them or performing any path protection switching on them. Up to six OC-1 rings can be supported by one DDM-2000 OC-3 shelf in this way. Since the signals from the OC-1 ring(s) are sent as two copies (one clockwise, the other counter-clockwise) on the OC-3 ring, the OC-3 ring capacity is limited to the OC-3 line rate (84 VT1.5 signals). So, although one DDM-2000 OC-3 shelf can support up to six OC-1 rings, the full capacity of all six OC-1 rings cannot be carried on the OC-3 ring.

The OC-1 lines between an OC-3 node and an OC-1 node behave like the OC-1 lines between the nodes on an OC-1 ring and do not perform line level protection switching. Instead, the DDM-2000 FiberReach shelves perform the normal path protection switching functions.

Some points to note for this application are:

- Single-homing can be thought of as a "ring on ring" with many of the characteristics of a single ring.
- Pass-through cross-connections may be required at the VT level on both the OC-1 and OC-3 rings.
- The OC-1 ring can be composed of up to 28 VT1.5 signals from the OC-3 ring.
- More DDM-2000 FiberReach wideband shelves could be added to the OC-1 ring. A cross-connection from the OC-1 interface to a DS1 interface would be required at one of the DDM-2000 FiberReach wideband shelves on the OC-1 ring, and pass-through cross-connections would be required at all other DDM-2000 FiberReach wideband shelves on the OC-1 ring.

Example Cross-Connections

To establish the end-to-end DS1 circuit from the CO to the DDM-2000 FiberReach wideband shelf as shown in Figure 8-8, enter a cross-connection at each node as follows:

- At RT1, RT2, and RT4:
  `ent-crs-vt1:m-1-2-3,m-1-2-3:cct=twoway;`

  The VT signal passes through these sites on the OC-3 ring, so two-way cross-connections with identical addresses are provisioned here.

- At RT3: **`ent-crs-vt1:m-1-2-3,b-1-5-4:cct=twoway;`**

  This single command establishes the following signal paths through the DDM-2000 OC-3 shelf at RT3:

  — from main-1, STS-1 #1, VTG #2, VT1.5 #3
  to FN-B-1, STS-1 #1, VTG #5, VT1.5 #4

  — from FN-B-1, STS-1 #1, VTG #5, VT1.5 #4
  to main-1, STS-1 #1, VTG #2, VT1.5 #3

  — from main-2, STS-1 #1, VTG #2, VT1.5 #3
  to FN-B-2, STS-1 #1, VTG #5, VT1.5 #4

  — from FN-B-2, STS-1 #1, VTG #5, VT1.5 #4
  to main-2, STS-1 #1, VTG #2, VT1.5 #3

  1. At the CO: **`ent-crs-vt1:m-1-2-3,b-7-4:cct=twoway;`**

     This is a "drop" from the OC-3 ring to a DS1 interface.

  2. At DDM-2000 FiberReach: **`ent-crs-vt1:m-1-5-4,c-1-1:cct=twoway;`**

     This is a "drop" from the OC-1 ring to a DS1 interface.

  It is recommended that the pass-through cross-connections be entered first, as shown here, to avoid transient alarms during provisioning.

Dual-Homed OC-3/OC-1 Path-Switched Ring Example

Dual-homing offers even more survivability than a single-homed network, as even the catastrophic failure of a host node can be protected. Figure 8-9 shows an example of a dual-homed OC-1 extension from two remote nodes on an OC-3 access ring. The NEs on the OC-3 ring can be either DDM-2000 OC-3 Multiplexers or *SLC*-2000 Access Systems.

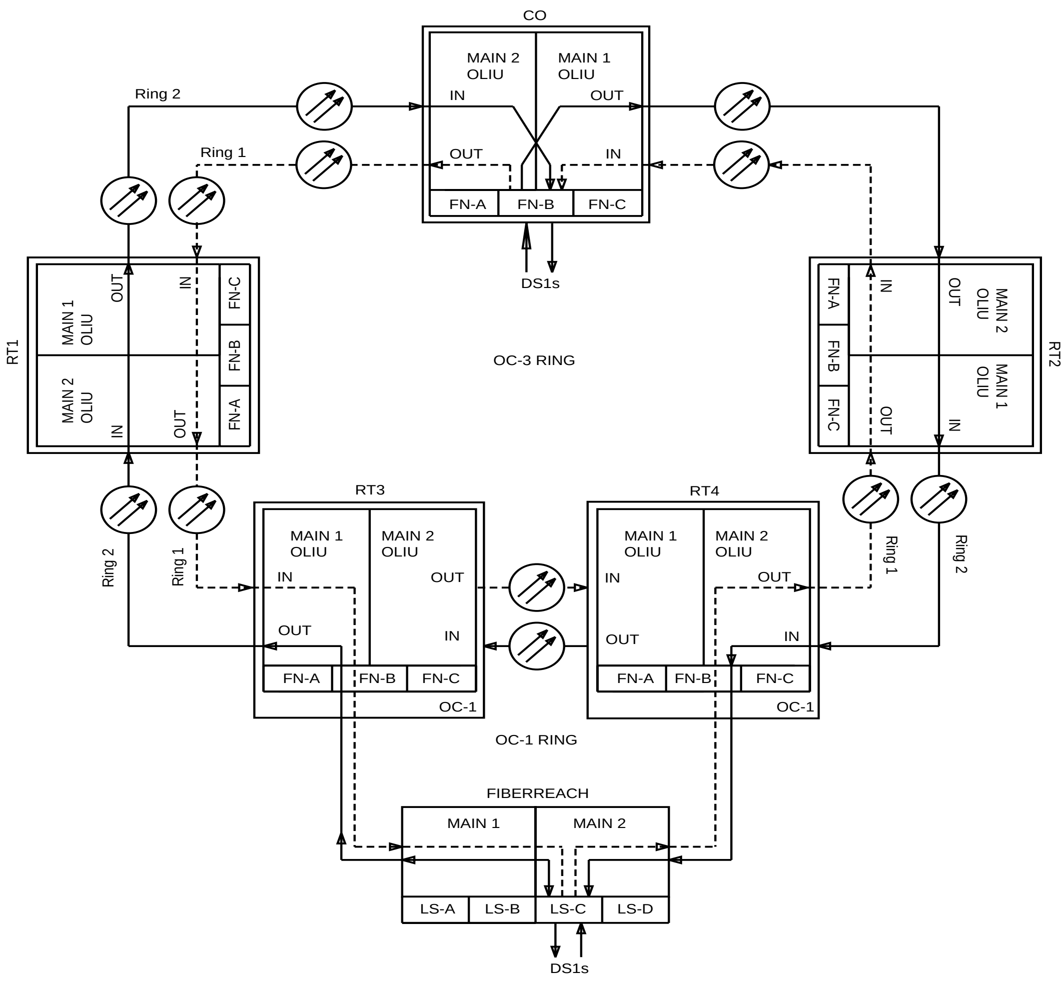

Figure 8-9. Example Dual-Homed OC-3/OC-1 Path-Switched Ring Configuration Cross-Connections

Path protection switching is employed for dual-homed applications, just like in single-homed applications. That is, path switching is supplied by the remote DDM-2000 FiberReach nodes and the DDM-2000 OC-3 systems in the wire center. However, the OC-3 host node configuration is different than for single homing. Since an OC-3 host node terminates only one leg of the OC-1 extension, it employs a 0x1 low-speed interface to the OC-1 ring extension. The dual OC-1 circuit pack can be unprotected in a dual-homed application. Dual- and single-homed extensions can also be mixed at a host node, allowing the access network to be tailored efficiently to different groups of customers.

Example Cross-Connections

The cross-connect commands at each node in Figure 8-9 are as follows:

- At RT1 and RT2: **`ent-crs-vt1:m-1-2-3,m-1-2-3:cct=twoway;`**

  The VT signal in the ring is only passing through these sites, so two-way cross-connections with identical addresses are provisioned here.

- At RT3 and RT4: **`ent-crs-vt1:m-1-2-3,b-7-4:cct=twoway;`**

  At these sites, the VT1.5 signal is routed between a timeslot on the OC-3 ring and a timeslot on the OC-1 ring.

- At the DDM-2000 FiberReach: **`ent-crs-vt1:m-1-7-4,c-1-4:cct=twoway;`**

  At this site, the signal is routed from a DS1 interface to the same timeslot on both rotations of the OC-1 ring. In the other direction, the VT1.5 signals received from both rotations of the OC-1 ring are monitored, path protection switching is provided, and the selected signal is routed to the DS1 interface.

- At CO: **`ent-crs-vt1:m-1-2-3,b-1-1:cct=twoway;`**

  At this site, the signal is routed from a DS1 interface to the same timeslot on both rotations of the OC-3 ring. In the other direction, the VT1.5 signals received from both rotations of the OC-3 ring are monitored, path protection switching is provided, and the selected signal is routed to the DS1 interface.

Locked STS-3c (0x1) Broadband Services

Beginning with Release 5.2 DDM-2000 OC-12 Multiplexer and with Release 15.0 DDM-2000 OC-3 Multiplexer when the MAIN slots are equipped with 29-type OLIU OC-12 optics, the OC-12 ring will transport STS-3c 0x1 services through OC-3/IS-3 interfaces (for OC-12) or 22-type OLIU OC-3 interfaces in its function units.

STS-3c path switching does not take place on the DDM-2000 OC-12 ring; it is executed elsewhere in the network (e.g., when the OC-12 ring transports ATM

STS-3c traffic path switching is performed through the external ATM-based router).

Figure 8-10 shows an STS-3c 0x1 application. Each OC-12 node provisions the same dropped STS-3c time slot as other nodes on the same ring. For different applications, an OC-12 node can assign the other STS-3cs to different time slots at different sites. With 0x1 applications the OC-12 ring passes the contents of these STS-3c time slots between the low-speed OC-3/IS-3 lines and the OC-12 high-speed lines without terminating them or performing path protection switching.

Since the STS-3c traffic is received by the low-speed interfaces and transmitted as two copies on the OC-12 ring (one clockwise, one counterclockwise), the ring capacity is limited to the OC-12 line rate.

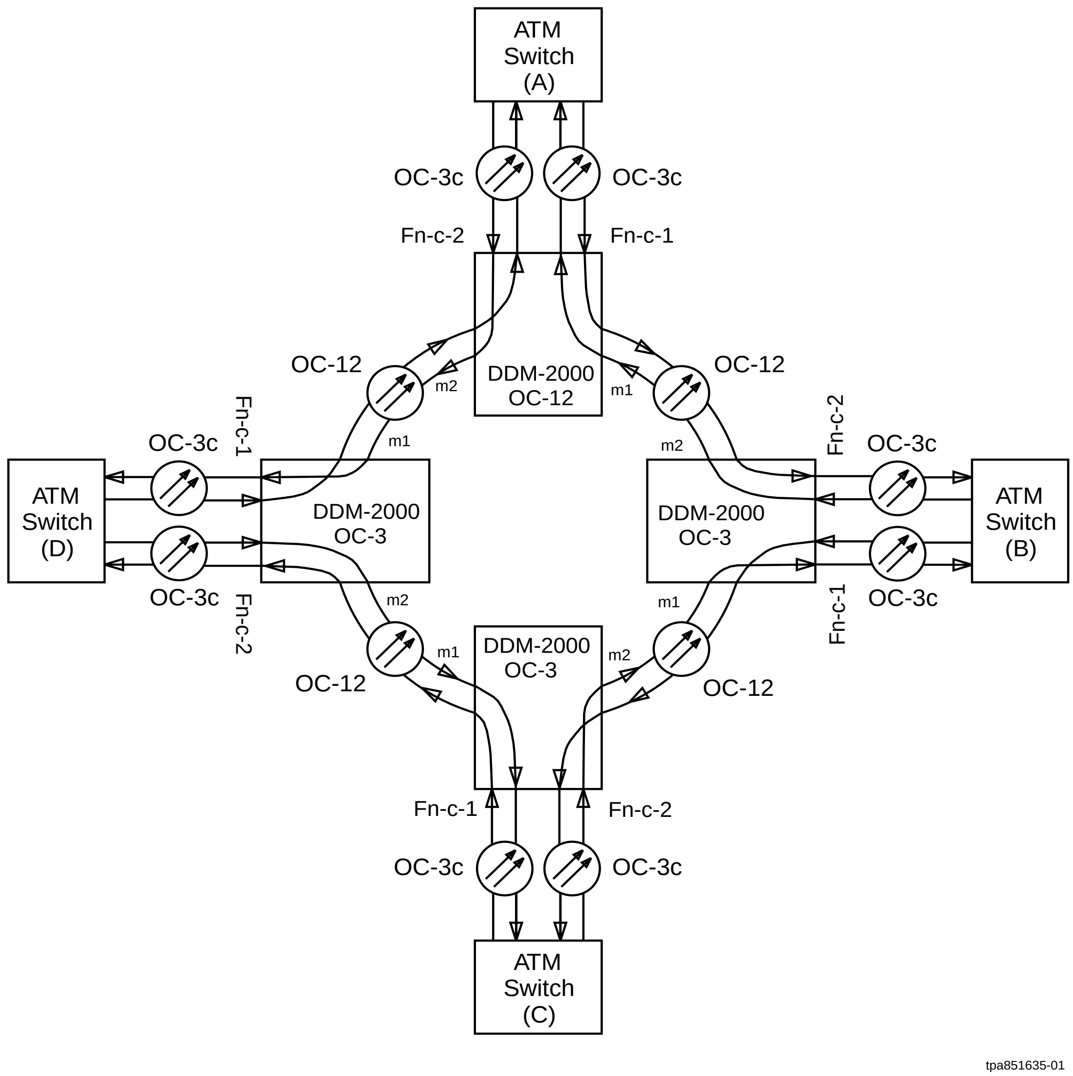

Figure 8-10. Locked (0x1) STS-3c - Broadband Services Using DDM-2000 OC-12 Multiplexer

Switch Selectable Parameters

Table 8-20 lists the parameters provisionable via hardware switches. Refer to the command pages in Section 11, "Commands and Reports," for a complete explanation of parameters.

Table 8-21. Parameters Provisionable via Hardware Switches

Parameter	Range	Pack	Command (Note)
Product ID (S1)	“Product Type”	SYSCTL	**rtrv-ne**
DS1 reference format § DS1 reference line coding § Shelf timing mode SYNC Output LBO ‡ DS1 Output	SF, ESF AMI, B8ZS free-running, external DS1, line timed 5 settings (cable dependent) MULT/SYNC OUT	TG TG TG TG TG	**rtrv-sync** **rtrv-sync** **rtrv-sync** **rtrv-sync**
DS1 line coding * DS1 LBO †	AMI, B8ZS 5 settings (cable dependent)	DS1 DS1	**rtrv-t1**
DS3 LBO †	2 settings (cable dependent)	DS3	
STS1E LBO †	2 settings (cable dependent)	STS1E	
STS1E pack type	low-speed	STS1E	**rtrv-eqpt** **rtrv-ec1**
OW type	E1-Only, Multiplexed	BBG10 OHCTL	**set-ow**
IMA LAN power settings	+5 volt or -48 volt	IMA LAN	

Note: Current switch settings except DS1 LBO, SYNC Output LBO, DS1 LBO, IMA LAN and STS1E LBO termination can be reported using CIT.

* CIT can override switch settings. (Factory default is *noOverride*.) Parameter can be set for each port.

† Parameter can be set for each circuit pack.

‡ Operational only when in SYNC OUT mode.

§ For both DS1 in and out.

CIT Selectable Parameters

Table 8-21 lists the parameters provisionable via the CIT. Refer to the command pages in Section 11, "Commands and Reports," for a complete explanation of parameters. Additional information on the ID parameters are provided in the "Identifiers" section immediately following Table 8-21.

Table 8-22. Parameters Provisionable via the CIT

Parameter	Range	Default (Note 1)	Command (Note 2)
Date †† Time ††	current value current value	70-01-01 00:00:00	**set-date** **set-date**
Target ID (system name) †† Shelf number †† CO/RT select †† STS Uneqpd./AIS insert †† VT Uneqpd./AIS insert †† Alarm bumping ††	20 characters 1-8 CO, RT Uneqpd., AIS Uneqpd., AIS enable, disable	LT-DDM-2000 1 RT AIS AIS disable	**set-ne** **set-ne** **set-ne** **set-ne** **set-ne** **set-ne**
RNE Stat Alarm Group ID (almgrp) AGNE	enabled, disabled 1-255 yes, no	disabled 255 no	**set-ne** **set-ne**
CIT page length	0 (pager off), 3-150 rows	24	**set-link**
PM thresholds	See PM Table 10-19 (Chapter 10)		**set-pmthres**
Alarm holdoff delay Alarm clear delay Power minor almn. level	0-30 sec 0-30 sec MN, MJ	2 15 MN	**set-attr-alm** **set-attr-alm** **set-attr-alm**
OC-1 degrade threshold AIS alarm level of NSA OC-1 Line AIS	10^{-5} to 10^{-9} CR, MJ, MN, NA	10^{-6} NA	**set-oc1** **set-oc1**
OC-3 degrade threshold Sync Messaging Concatenation mode AIS alarm level of NSA OC-3 Line AIS DCC Mode	10^{-5} to 10^{-9} K byte, S byte, disabled enabled, disabled CR, MJ, MN, NA identical, distinct	10^{-6} K byte enabled NA distinct	**set-oc3** **set-oc3** **set-oc3** **set-oc3** **set-oc3**
Applications for STS-3C/STS-1/VT1.5	0x1		**set-oc3**
Group ID (grpid) ATM Adaptation Layer (aal5) ATM Virtual Path identifier (VPI) Virtual Channel Identifier (VCI)	0-255 llc, vcmux 0-255 0-65535	0 llc 0 0	**set-lan** **set-lan** **set-lan** **set-lan**
IMA Frame Length (length) ATM Scrambler (scrambler) Frame Check Sequence (fcs) Alarm Level (alm) pmmd	32, 64, 128, 256 on, off enable, disable mj, mn, na off, on	128 on enable na off	**set-lan** **set-lan** **set-lan** **set-lan** **set-lan**

Table 8-22. Parameters Provisionable via the CIT—*Continued*

Parameter	Range	Default (Note 1)	Command (Note 2)
Orderwire* (E1-Only)	thru, e1dropmain,	e1dropmain (Linear)	**set-ow**
	e1dropfnc	thru (Ring)	**set-ow**
Orderwire* (Multiplexed)	thru, muxdrop	muxdrop (Linear)	**set-ow**
		thru (Ring)	**set-ow**
OC-12 degrade threshold §§§	10^{-5} to 10^{-9}	10^{-6}	**set-oc12**
Sync Messaging §§§	K byte, S byte, disabled	K byte	**set-oc12**
AIS alarm level of NSA OC-12 Line AIS §§§	CR, MJ, MN, NA	NA	**set-oc12**
STS-1 path signal degrade threshold †††	10^{-5} to 10^{-9}	0 (disabled)	**set-sts1**
NSA STS-1 path AIS alarm level	MN, NR	MN	**set-sts1**
SA STS-1 path AIS alarm level	CR, MN, NA, NR	MN	**set-sts1**
STS-1 channel state ***	NMON, AUTO ‡	AUTO	**set-state-sts1**
OC-1 line state	NMON, IS	IS	**set-state-oc1**
VT1.5 path signal degrade threshold ***†††	10^{-5} to 10^{-8}	0 (disabled)	**set-vt1**
NSA VT path AIS	MN, NR	MN	**set-vt1**
SA VT path AIS	MJ, MN, NA, NR	MJ for ring MN for linear	**set-vt1**
VT channel state ***	NMON, AUTO ‡	AUTO	**set-state-vt1**
DS3 VMR mode †	VMR, VM, clear channel	VMR	**set-t3**
Clear channel DS3 AIS insertion †	yes, no	no	**set-t3**
DS3 sig failure alarm level †	CR, MJ, MN, NA	CR	**set-t3**
DS3 failure threshold †	10^{-3}, 10^{-6} BER	10^{-3}	**set-t3**
DS3 PM mode †	off, on	on	**set-t3**
DS3 PM frame †	m13, cbit	m13	**set-t3**
DS3 PM format †	pbit, fmbit, cpbit	pbit	**set-t3**
DS3 port state †	NMON, AUTO ‡	AUTO	**set-state-t3**
DS1 line coding †	AMI, B8ZS, noOverride §	noOverride	**set-t1**
DS1 alarm level †	MJ, MN, NA	NA	**set-t1**
DS1 AIS insertion †	yes, no	yes	**set-t1**
DS1 failure threshold †	10^{-3}, 10^{-6}, 10^{-7}, 10^{-8} BER	10^{-3}	**set-t1**
DS1 BPV to LOS †	yes, no	no	**set-t1**
DS1 PM Mode †	off, on	off	**set-t1**
DS1 PM Format †	sf, esf, esfn	esf	**set-t1**
DS1 primary port state †	NMON, AUTO ‡	AUTO	**set-state-t1**
Environmental alarm level	CR, MJ, MN, NA	MN	**set-attr-env**
Environmental alarm type	10 characters		**set-attr-env**
Environmental alarm description	26 characters		**set-attr-env**
Control point description	26 characters		**set-attr-cont**

Table 8-22. Parameters Provisionable via the CIT—*Continued*

Parameter	Range	Default (Note 1)	Command (Note 2)
Far-end communication via DCC/IAO LAN ** *** DCC identity for OSI subnetworks ** ***	enabled, disabled userside, networkside	enabled see command pgs.	**set-fecom** **set-fecom**
CIT security ** CIT timeout (minutes) ** DCC security ** DCC timeout (minutes) **	enabled, disabled, lockout 0-120 enabled, disabled, lockout 0-120	disabled 15 disabled 15	**set-secu** **set-secu** **set-secu** **set-secu**
Sync Timing Source ‡‡ Sync Output Mode Sync Timing Source ‡‡ SYNC mode switching AIS Threshold Auto. sync. reconfig.	main, fn-c track¶, lock1, lock2 main-1, main-2, fn-c revertive, nonrevertive level 5, level 4, level 3, level 2 enabled, disabled	main track main-1 revertive level 5 disabled	**set-sync** **set-sync** **set-sync** **set-sync** **set-sync** **set-sync**
EC-1 alarm level † EC-1 degrade threshold † EC-1 port state †	CR, MJ, MN, NA 10^{-5} to 10^{-9} BER NMON, AUTO ‡	CR 10^{-6} AUTO	**set-ec1** **set-ec1** **set-state-ec1**
Feature package ** VT PM, DS1 PM	enabled, disabled	disabled	**set-feat**
X.25 packet size ††	128, 256	256	**set-x25**
L3org (Organization ID)†† L3res (Reserved) †† L3rd (Routing Domain) L3area (Area within routing domain)†† L3lv2is (Level 2 router) ††	Refer to command pages of ent-ulsdcc-l3 in “Section 11.”	000000 0000 0000 0000 disable	**ent-ulsdcc-l3** **ent-ulsdcc-l3** **ent-ulsdcc-l3** **ent-ulsdcc-l3** **ent-ulsdcc-l3**
L4tlif (TARP lifetime parameter) †† L4aj-(x) (Manual adjacency †† ¶¶¶ parameters) L4t(x)tm (TARP timer-parameters) †† ¶¶¶ L4lftm (TARP loop detection buffer flush timer) †† L4etdc (Enable TARP data cache) †† L4tdc(x) (TARP data cache †† ¶¶¶ parameters)	1-65535 See the command pages of ent-ulsdcc-l4 in “Section 11.” See command pgs. 1-1440 enable, disable See command pgs.	100 See command pgs. See command pgs. 5 min enable See command pgs.	**ent-ulsdcc-l4** **ent-ulsdcc-l4** **ent-ulsdcc-l4** **ent-ulsdcc-l4** **ent-ulsdcc-l4** **ent-ulsdcc-l4**

Table 8-22. Parameters Provisionable via the CIT—*Continued*

Parameter	Range	Default (Note 1)	Command (Note 2)
VC ckt. type X.25 attach. †† SNPA: LCN for PVCs or DTE address for SVC †† OS type (ACID) ††	PVC, SVC LCN 1-9, DTE(15 digits) LCN 1-9, DTE(15 digits) See command pgs.	PVC tl1CR LCN 1 (PVC) LCN 2 (PVC) tl1Maintenance LCN 3 (PVC) tl1Memory Administration tl1PeerComm	**ent-osacmap** **ent-osacmap** **ent-osacmap**
ACID (OS type) †† TL1 autonomous message type †† Action to assoc. message type to OS ††	See command pgs. See command pgs. enabled, disabled	 enabled	**ent-tl1msgmap** **ent-tl1msgmap** **ent-tl1msgmap**
Cross-connection type Ring ID for drop&continue	two-way, dc m1, m2	two-way See command pgs.	**ent-crs-sts1** **ent-crs-sts1**
Cross-connection type	two-way, dc, locked	two-way	**ent-crs-vt1**
Porttype for cit - {1,2} Porttype for x.25 Baudrate (only if porttype is TL1 or asynch) Echo (only if pottype is TL1 or asynch)	cit, TL1 asynch, synch 1200, 2400, 4800, 9600, 19200 enabled, disabled	cit synch 9600 enabled	**set-secu** **set-secu** **set-secu** **set-sync**
Address: porttype	cit-{1,2}, x.25 cit, TL1 (if address=cit1 or cit2) synch, asynch (if address=x.25)	x.25t cit synch	**ent-osacmap** **ent-osacmap** **ent-osacmap**
STS-3C cross connection	two-way	two-way	**ent-crs-sts3c**
Outgoing STS-1 path trace message	 62 characters	 See command pgs.	 **set-trace-sts1**
Expected STS-1 path trace message	 62 characters	 See command pgs.	 **set-trace-sts1**

See notes and footnotes at end of table.

Notes:

1. Default means factory default (the CIT prompts display current provisioned values).
2. To view the current values, precede these commands with **rtrv-** instead of **set-** or **ent-.**

* BBG10 required for Releases 8.1 and 9.1. *MegaStar* applications only.

† Parameter can be set for each port.

‡ AUTO means the port or channel is ready to be automatically provisioned via signal detection.

§ noOverride means read and use switch settings on circuit pack.

¶ Track means the source for timing will be selected from the active received OC-3 Line specified. It applies to linear 1+1 optical interfaces only.

** This command is available to privileged users only.

†† When security is enabled, this command is available to privileged users only (default is “disable”).

‡‡ Setting this parameter also affects DS1 output source and DS1 sync output mode. See **`set-sync`** command in Section 11, “Commands and Reports.”

*** Parameters can be set for each channel.

††† Ring releases. Requires 22D-U/22F2-U/22G-U/22G2-U OLIUs.

§§§ With 24G-U OLIU in main slots.

¶¶¶ (X) indicates multiple parameters. See the command pages of ent-ulsdcc-l4.

Identifiers

The following IDs are used for the shelf, target, CO/RT, NSAP address, GNE and AGNE (for R15.0). See also the *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*, 824-102-144 and the *DDM-2000 Operations Systems Engineering Guide*, 824-102-151.

- **Shelf ID:** The shelf ID is a parameter with values of from 1 to 8. The shelf ID provides a convenient way to log into a selected shelf in a bay using the CIT. Therefore, each shelf (OC-3 or OC-12) in a bay must be assigned a unique shelf ID. The recommended numbering is to start at the bottom of the bay and assign the bottom shelf with a shelf ID of 1 and work up to the top of the bay.
- **TID:** The TID is a 20-character parameter that is set through the CIT using the **`set-ne`** command. The TID is used in the **`rlgn`** command to identify an NE to which a CIT remote login session is being established. The TID is also used by OSs to identify NEs using the TL1 message-based communications protocol.

  After the **`init-sys:all`** command is entered, the system sets the TID to a default value of LT-DDM-2000. The TID must be unique among all NEs. The default TID may be changed using the **`set-ne`** command to a unique user-assigned value recognized by the OS.
- **CO/RT:** The CO/RT parameter for CO or RT identifies the system as having the characteristics of a CO or RT. The default is RT. The parameter controls the operation of the miscellaneous discretes and the external fan control.
- **NSAP:** The NSAP is a multiple part address that uniquely identifies each NE. The NSAP is used for subnetwork DCC communications using the OSI protocol. The NSAP is set to unique values assigned to control hardware at the factory and does not have to be modified by the user unless subnetwork partitioning is necessary. Subnetwork partitioning is accomplished by assigning NEs to different areas. An NE’s area address is one of the subfields within its NSAP. The **`ent-ulsdcc-l3`** command is used to modify an NE’s NSAP.
- **GNE:** An NE that has an active TL1/X.25 link to an OS is automatically an GNE. Subnetworks can have multiple GNEs.
- **AGNE**: In an alarm group, an NE must be designed as a AGNE by setting its AGNE parameter to “yes” using the **`set-ne`** command. An AGNE is an NE alarm group, through which members of an alarm group exchange alarm and status information. By default, all NEs are in the same alarm goup (255). For subnetworks having more than 16 NEs, the AGNE and GNE should be separate NEs. The AGNE is a “collection point” and does not have to be an NE in a CO, for example.

Performance Monitoring (PM) Parameters Provisionable via the CIT

For a list of PM parameters provisionable via the CIT, see Table 10-19 in the "Specifications" chapter of this manual.

Maintenance Description

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Maintenance Description

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Overview

This section defines the "maintenance philosophy" outlining the various features available to monitor and maintain the DDM-2000 OC-3 Multiplexer. Specific trouble clearing and maintenance procedures are provided in the operation and maintenance (TOP) section of this manual (Volume II).

Three-Tiered Operations

Figure 9-1 shows the three-tiered operations procedures for the DDM-2000 OC-3 Multiplexer. The DDM-2000 OC-3 Multiplexer operations procedures are built on three levels of system information and control, spanning operations needs from summary-level status to detailed reporting.

The first operations tier consists of light-emitting diodes (LEDs) and pushbuttons on the user panel and circuit pack faceplates. These allow routine tasks to be performed without a craft interface terminal (CIT) or any test equipment. The user panel provides system-level alarm and status information for the local terminal. The circuit pack faceplate FAULT LEDs allow fast and easy fault isolation to a particular circuit pack. The user panel and equipment indicators are described in Chapter 6, “Operations Interfaces.”

The second operations tier provides access to DDM-2000 OC-3 Multiplexer operations from a CIT over an EIA-232-D interface. System details that cannot be obtained from the first operations tier alone can be obtained over the CIT interface. A VT-100 compatible terminal or terminal emulator software running on a personal computer (PC) can be used as a CIT. Command and prompt modes are available with extensive on-line help features. The CIT interface supports operations, administration, provisioning, and maintenance (OAM&P) activities, such as performance monitoring (PM), on any and all DDM-2000 NEs in the subnetwork from a single DDM-2000.

An optional graphical user interface and provisioning (CPro-2000) tool is also available. Using CPro-2000, which runs on an *MS-DOS*[*] PC, a user can take advantage of the graphics to do many provisioning related activities. The DDM-2000 CIT and CPro-2000 are described in Chapter 6, “Operations Interfaces.”

The third operations tier consists of the remote OS interfaces. The OS interfaces include TL1/X.25 and an IAO LAN interface.

The DDM-2000 OC-3 Multiplexer supports a full-featured TL1/X.25 interface to multiple OSs. The DDM-2000 OC-3 Multiplexer supports alarm surveillance and PM with OSs, such as Telcordia's Network Monitoring and Analysis (NMA).

The DDM-2000 OC-3 Multiplexer supports automated service provisioning with memory administration OSs, such as Telcordia's Operations System Intelligent Network Element (OPS/INE) and Lucent’s ITM SNC. The DDM-2000 OC-3 Multiplexer also supports remote recovery and control functions, installation provisioning, and security over the TL1/X.25 link.

As an alternative to DDM-2000 serving as a TL1/X.25 GNE, ITM SNC R5.0 can serve as a TL1-GNE via an IAO LAN interface. DDM-2000’s TL1/X.25 and IAO LAN interfaces are described in Chapter 6, “Operations Interfaces.”

The *SLC*®-2000 Access System supports the same X.25 and IAO LAN interfaces and TL1 message set as the DDM-2000 OC-3 Multiplexer. The *SLC*-2000 Access System adds digital loop carrier (DLC) specific functionality to the existing TL1 messages (for example, for DLC related alarms) and in addition supports DLC specific TL1 commands (for example, DS0 level provisioning). See 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*, for more information.

* Registered trademark of Microsoft Corporation.

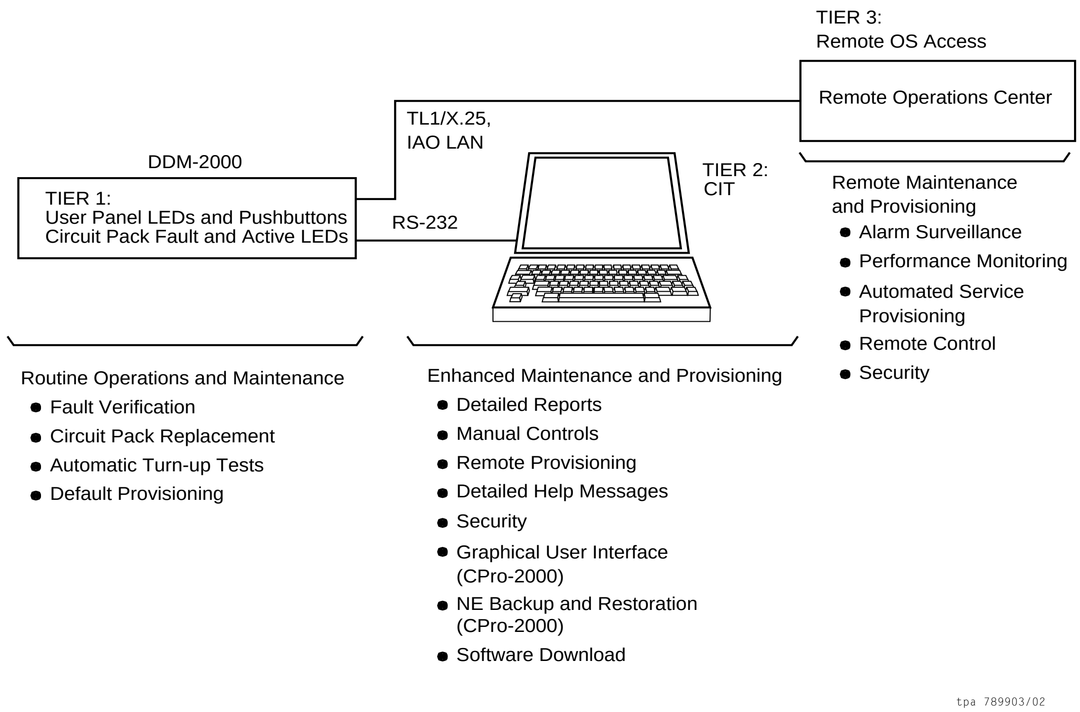


Figure 9-1. Three-Tiered Operations

Single-Ended Maintenance Philosophy

As a loop-optimized product, the DDM-2000 OC-3 Multiplexer allows operation and maintenance of all remote DDM-2000 NEs in a subnetwork from a DDM-2000 in a central office. A subnetwork consists of NEs interconnected by optical lines and/or an IAO LAN with the SONET data communications channel (DCC) enabled. Similarly, a technician working at a remote site can gain access to the central office (CO) DDM-2000 associated with that DDM-2000 OC-3 Multiplexer, as well as with other remote DDM-2000 Multiplexers in the same subnetwork. The DDM-2000 OC-3 Multiplexer uses the SONET DCC to provide CIT remote access, remote software downloads, and OS remote access. The DDM-2000 OC-3 Multiplexer uses the International Standards Organization (ISO) compliant open systems interconnection (OSI) protocol to communicate over the DCC.

Figure 9-2 shows the single-ended operations[*] (SEO) capability that provides remote access to all DDM-2000 systems in a subnetwork from a single DDM-2000 location. This minimizes technician travel because most maintenance, provisioning, and administration can be performed on all DDM-2000 Multiplexers in a subnetwork by accessing any DDM-2000 Multiplexer in the subnetwork. The SEO capability is provided by the DDM-2000 Multiplexers regardless of the subnetwork topology as long as DCC connectivity is available. The SEO (DCC) capability can be disabled between DDM-2000 shelves to create network maintenance boundaries (for example, interoffice applications) or for security reasons.

DDM-2000 OC-3 supports Lucent Technologies 2000 Product Family OI with DDM-2000 OC-12, FiberReach, *SLC*-2000, and FT-2000. It also supports multi-vendor OI in subnetworks with other-vendor NEs such as Tellabs *TITAN* 5500. See Section 2, "Applications," and Section 8, "Administration and Provisioning," for more information about OI.

* The terms single-ended maintenance and single-ended operations (SEO) are synonymous and have traditionally been used to refer to operations among DDM-2000 systems only. Now that SEO is supported among the 2000 Product Family NEs as well as in multi-vendor applications, the term operations interworking (OI) is more commonly used. OI among multi-vendor NEs will be covered later in this chapter.

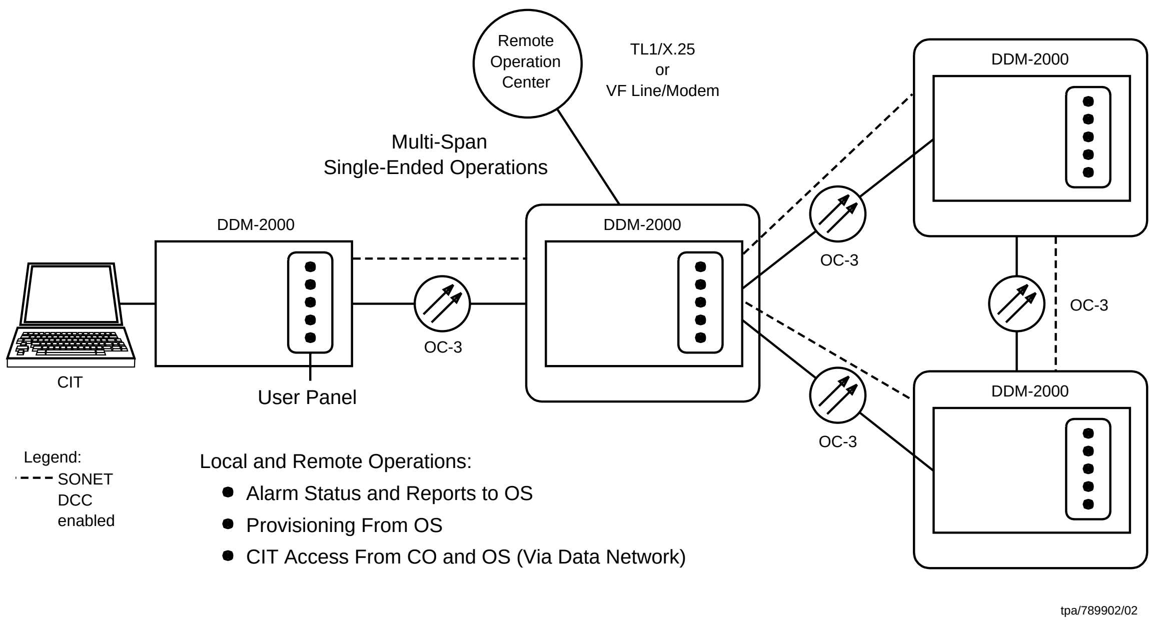


Figure 9-2. Single-Ended Operations

Multi-Vendor OI

To support multi-vendor OI, DDM-2000 OC-3 R13.0 and R15.0, and OC-12 R7.0 support Target ID Address Resolution Protocol (TARP) instead of Lucent Directory Service (LDS). DDM-2000 FiberReach R3.0, 3.1, 4.0 and FT-2000 OC-48 R8.0, 9.0 and 9.1 also support TARP. The Lucent PF-2000 Product Family is not OI compatible with Lucent TARP products. Both LDS and TARP are directory services that provide NSAP-TID translations. LDS supports additional Lucent-only features, but TARP is the established multi-vendor standard for SONET NEs that support TL1 OS interfaces. DDM-2000 supports the TARP Data Cache (TDC) function to reduce the frequency of TARP propagation throughout the subnetwork and to improve performance. No DSNE concept is used in TARP.

DDM-2000 OC-3 R13.0 and R15.0 has been developed to be compatible with any other-vendor NEs that also support TARP, OSI, IAO LAN, and TL1/X.25 as specified in Telcordia GR-253. In addition, DDM-2000's TARP Manual Adjacency feature enables DDM-2000 to operate in networks that include CMISE-based NEs which may not support TARP propagation. DDM-2000 OC-3 R13.0 and R15 support user provisioning of several OSI parameters to allow users to adjust their operations subnetwork, if necessary. For example, to support subnetwork partitioning of large subnetworks, DDM-2000 supports user provisioning of NSAP area addresses and level 2 Intermediate System (IS) functionality.

DDM-2000 OC-3 R13.0's and R15.0's compatibility with Tellabs *TITAN* * 5500 DCS R5.0, including TL1/X.25 OS access with *TITAN* 5500 DCS serving as the TL1-GNE for DDM-2000 TL1-RNEs, has been confirmed through cooperative joint testing between Lucent and Tellabs. DDM-2000's compatibility with some other-vendor NEs has also been tested by independent third-parties such as Telcordia on behalf of the SONET Interoperability Forum (SIF).

The following Remote NE Status features are not supported in R13.0:

- Remote office alarms
- Remote CIT alarm reports
- Remote user panel indications
- TBOS
- Parallel telemetry

The following Remote NE Status features are not suppored in R15.0:

- TBOS
- Parallel telemetry

* *TITAN* is a trademark of Tellabs, Inc.

All of the above features depend on the proprietary exchange of information among Lucent NEs in a subnetwork, specifically the communication of each remote NE's alarm status to other NEs. Although the Remote NE Status features were supported in previous releases of DDM-2000, such Lucent-only operations features in multi-vendor subnetworks would not include other-vendor NEs.

DDM-2000 OC-3 R13.0 and R15.0 still support the following Lucent proprietary OI applications between Lucent NEs in multi-vendor subnetworks:

- Remote Craft Interface Terminal (CIT) login
- Remote software download and copy
- Remote NE-to-NE automatic time/date synchronization at start-up.

For more information about DDM-2000 OC-3 R13.0 and R15.0 OI, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide.*

SEO Network Element Status Using Alarm Gateway NE

The Remote NE status feature is supported by OC-3 Release 15.0. It partitions a subnetwork into maintenance domains (alarm groups). In partitioned large networks, each Level 1 area can be identified as a separate Alarm Group, as long as it does not exceed the 50 NE limitation. Provisioning of one alarm gateway NE (AGNE) is required in order to support remote office alarms and summary alarm information of remote NEs in the local alarm report.

By default, the subnetwork contains a single Alarm Group of all NEs. At least one AGNE needs to be provisioned per subnetwork. A second AGNE can be provisioned as a backup. Additional AGNEs will degrade the network performance.

An Alarm group is a set of NEs that share status information between themselves. Alarm Groups can be nodes in a ring, or in any other logical grouping such as a maintenance group or a geographical group. All NEs are defaulted into an Alarm Group (number 255). Users provision NEs into Alarm Groups by assigning each member an Alarm Group number to support operations interworking, large networks, and to avoid sending unnecessary information to every NE. For example 24 NEs could be provisioned into three Alarms Groups of 8 NEs each.

Every NE broadcasts its network status (through the AGNE) to all other NEs in the same alarm group. (All members of the same Alarm Group share NE status information through their AGNEs, but do not share information with other Alarm Group members).

Depending on provisioning a member of an Alarm group can:

- Know the alarm/status of all members of the same Alarm Group and, if the NE is at the CO, activate the audible office alarms for the Alarm Group.
- List a report of the alarm or status condition of other NEs in the group.
- Display composites of other members' user panel information.
- Send/Receive ACO requests to and from members of the same Alarm Group or same Level 1 area.
- Send/Receive miscellaneous discrete alarm/status closure states to and from alarm group members at a CO.

Each Level 1 Area will be mapped to an Alarm Group with a designated Alarm Gateway Network Element (AGNE). The maximum number of NEs in an Alarm Group is 50. The position of an NE in a subnetwork determines whether an NE should be defined as AGNE.

For performance considerations, an NE defined as AGNE should not be defined as GNE.

If a Network Element cannot establish communication with the Alarm Gateway NE, or the AGNE cannot establish communication with a Network Element in the same Alarm Group, the alarm message "AGNE communication failure" will be created. Alarm Groups without an AGNE have "AGNE communication failure" alarms.

An NE is provisioned to be and AGNE through the CIT ***set-ne*** or equivalent TL1 ***ENT-SYS*** command. The AGNE broadcasts NE status information to members of its Alarm Group. Considerations for choosing an NE as AGNE include being central to the group to minimize communications links and being easily accessible for maintenance purposes. A backup AGNE can be provisioned to "shadow" the primary AGNE by sending duplicate status reports to members of the group. The disadvantage of a backup AGNE is in the cost associated with increased message traffic within the same Alarm Group.

In-Service Upgrades

Software Upgrades

Table 9-1 lists the current software releases of the DDM-2000 OC-3 Multiplexer that can be directly upgraded while in-service. Specific procedures for upgrades are provided in the TOP section of this manual (Volume II).

Table 9-1. DDM-2000 OC-3 In-Service Software Upgrade Compatibility (Note)

	Upgrade to							
Current Release	**7.2**	**8.0**	**9.0**	**8.1**	**9.1**	**11.0**	**13.0**	**15.0**
7.2 (Ring)	X	NA	C	NA	C	C	C*	C*
8.0 (Linear)	NA	X	C	X	C	C	C*	C*
9.0 (Ring)	NA	NA	X	NA	X	X	X*†	X*†
8.1 (Linear)	NA	NA	C	X	C	C	C*	C*
9.1 (Ring)	NA	NA	NA	NA	X	X	X	X
11.0 (Ring)	NA	NA	NA	NA	NA	X	X	X
13.0 (Ring)	NA	NA	NA	NA	NA	NA	X	X
15.0 (Ring)	NA	NA	NA	NA	NA	NA	NA	X

Note: All DDM-2000 OC-3 shelves in a ring should be using the same version of software.

* When a node is upgraded to R13.0 it is isolated until all nodes have been upgraded to R13.0.

† Remote software downloads to R9.0 are not supported.

X Requires local or remote software download only to upgrade the system.

C Requires an upgrade procedure with on-site equipment/fiber changes as well as software download to upgrade the system. Additional changes to software and equipment provisioning may be needed to use features of the new release. See TOP section of this manual (Volume II) for upgrade procedures.

NA Not Applicable. If an NA conversion is required, contact your local Technical Support Organization.

Software Compatibility

Table 9-2 lists the software compatibility within a subnetwork for the DDM-2000 OC-3 and OC-12 Multiplexers. All configurations listed support OI. The table lists all possible software combinations. Combinations not listed are not supported.

Table 9-2. DDM-2000 OC-3 and OC-12 Software Compatibility (Note)

OC-3 Release	OC-12 Release	Interconnection Method	Notes
13.0 *	7.0	22-type †, 24G-U § OLIU STS1E ¶	Supports OC-3/OC-12 interworking, 0x1 interfaces, and DRI
15.0	7.0	22-type †, 24G-U § OLIU, 29-type OLIU, STS1E ¶	Supports OC-3/OC-12 interworking, 0x1 interfaces, and DRI

Note: All DDM-2000 OC-3 Multiplexers in a ring, which may be part of a larger subnetwork, must be running the same software. In a subnetwork, all NEs must be running compatible software according to the table.

* 22-type OLIUs must be used in DDM-2000 OC-3 ring shelves in main and function unit slots for optical extensions.

† The 22-type OLIUs cannot be used in the DDM-2000 OC-12 shelf.

§ 24G-U OLIUs must be used in DDM-2000 OC-3 ring shelves in main only.

¶ STS1E circuit pack to be used in DRI applications.

Table 9-3 lists the DDM-2000 FiberReach software compatibility for the DDM-2000 OC-3 Multiplexers. All configurations listed support OI. The table lists all possible software combinations. Combinations not listed are not supported.

Table 9-3. DDM-2000 OC-3 and DDM-2000 FiberReach Software Compatibility

Software Release		**Interconnecting Circuit Pack**	
DDM-2000 OC-3	**DDM-2000 FiberReach**	**DDM-2000 OC-3**	**DDM-2000 FiberReach**
13.0/15.0 (Ring)	3.0 (Ring)	27G-U/27G2-U/26G2-U OLIU	26G2-U OLIU
13.0/15.0 (Ring)	3.1 (Ring)	27G-U/27G2-U/26G2-U 22G-type OLIU	26G2-U/28G-type OLIU

Table 9-4 lists the dual ring interworking (DRI) software compatibility for the DDM-2000 OC-3 Multiplexer for both EC-1 and OC-3 interfaces. The table lists all possible software combinations. Combinations not listed are not supported.

Table 9-4. DDM-2000 OC-3 Multiplexer Dual Ring Interworking Software Compatibility

DDM-2000 OC-3	**DDM-2000 OC-12 and FT-2000**
Release 13.0/15.0	OC-12 Release 7.0 and FT-2000 Releases 8.0/8.1/9.0/9.1

See 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide,* for more information on OI.

Maintenance Signaling

The DDM-2000 OC-3 Multiplexer provides maintenance signaling compliant with the SONET standard (*ANSI** T1.105).The DDM-2000 OC-3 Multiplexer generates and detects the following alarm indication signals (AISs), which notify downstream equipment that a failure has been detected and alarmed by some upstream equipment:

- SONET line AIS
- STS-1 path AIS
- Virtual tributary (VT) path AIS
- DS3 AIS
- DS1 AIS (generated, not reported).

The DDM-2000 OC-3 Multiplexer also generates and detects the following signals, which notify upstream equipment of a failure detected downstream:

- Line far-end-receive failure (FERF)
- STS-1 path yellow and VT path yellow
- An STS-1/VT AIS signal is inserted on paths that are not cross-connected; however, the user can provision a shelf to insert STS-1/VT unequipped instead of AIS on paths that are not cross-connected.

For ring interfaces, the DDM-2000 OC-3 Multiplexer detects STS-1 and VT unequipped signals. Figure 9-3 is an example of the AIS, yellow, and FERF signals generated in response to an unprotected incoming OC-3 line failure.

* Registered trademark of American National Standards Institute.

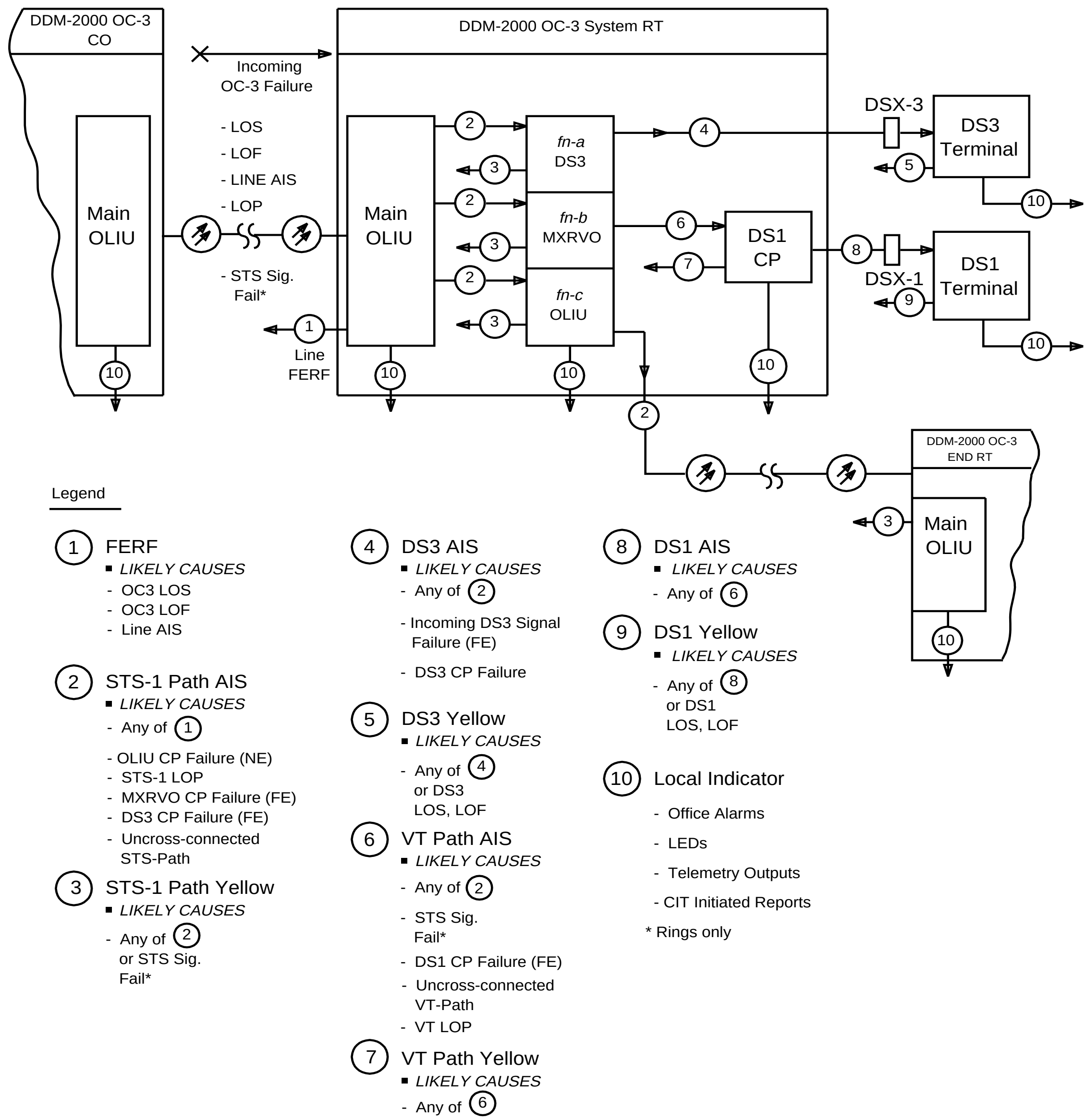


Figure 9-3. Example of Maintenance Signals as a Result of Unprotected Incoming OC-3 Failure

Non-Ring Interfaces

Figure 9-4 through Figure 9-6 are examples of the maintenance signals used by the DDM-2000 OC-3 Multiplexer. In these figures, the labels on the arrows pointing into the DDM-2000 OC-3 Multiplexer indicate the maintenance signals and failure conditions recognized by the DDM-2000 OC-3 Multiplexer. The labels on the arrows pointing out of the DDM-2000 OC-3 Multiplexer indicate the signals generated by the DDM-2000 OC-3 Multiplexer in response to the indicated incoming signals or failure conditions. The **Xs** indicate points of failure, either within the DDM-2000 OC-3 Multiplexer or in upstream equipment. Unlabeled arrows indicate normal transmission except for OC-3 line AIS; maintenance signaling is in response to unprotected failures. The DS1, DS3, EC-1, STS, and VT interfaces in Figure 9-4 though Figure 9-6 are cross-connected to function unit slots.

The DS1, DS3, EC-1, STS, and VT interfaces in ring applications, Figure 9-7 through Figure 9-9, are cross-connected to main OLIUs.

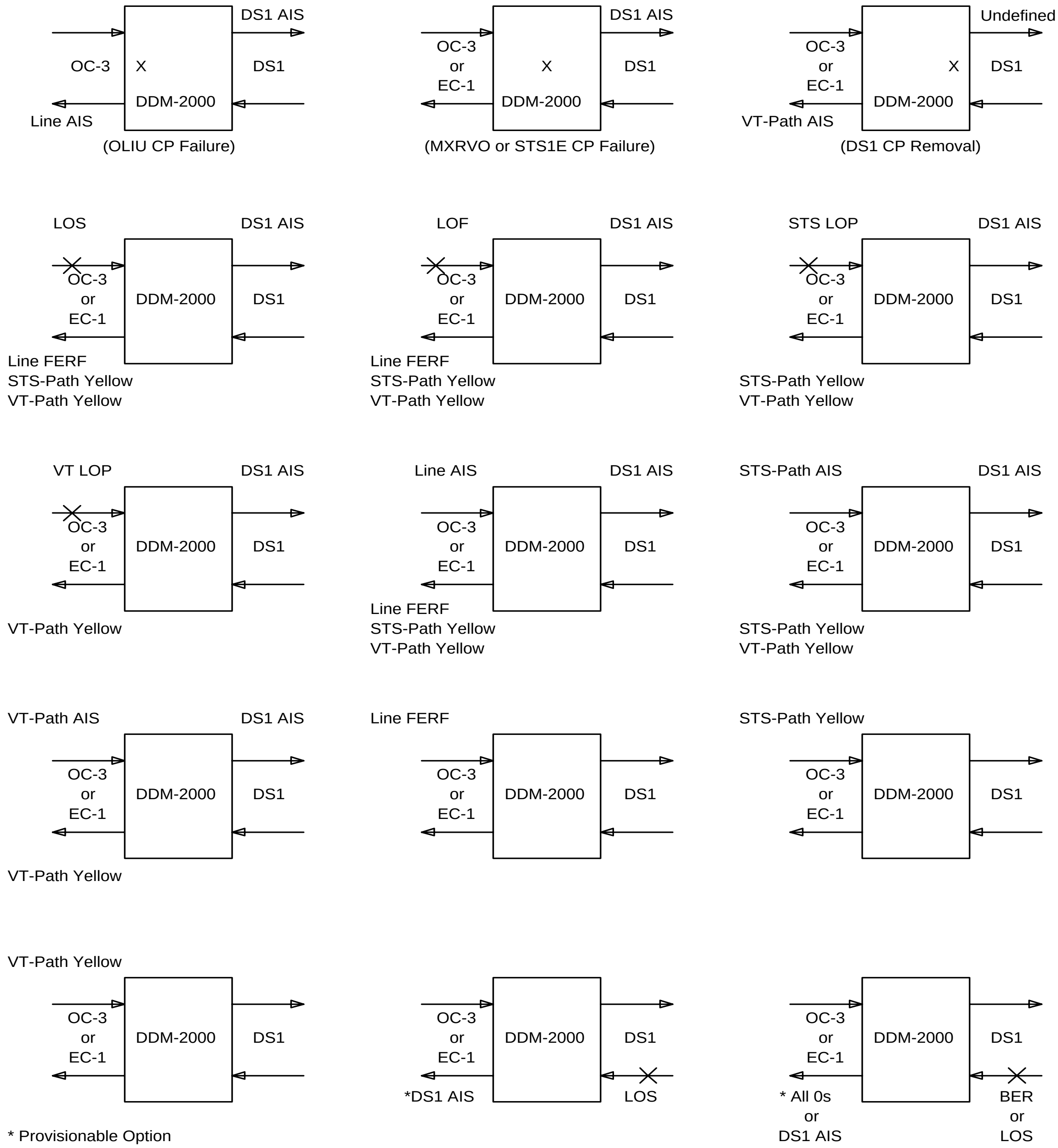


Figure 9-4. DS1 Maintenance Signaling — Non-Ring Interfaces

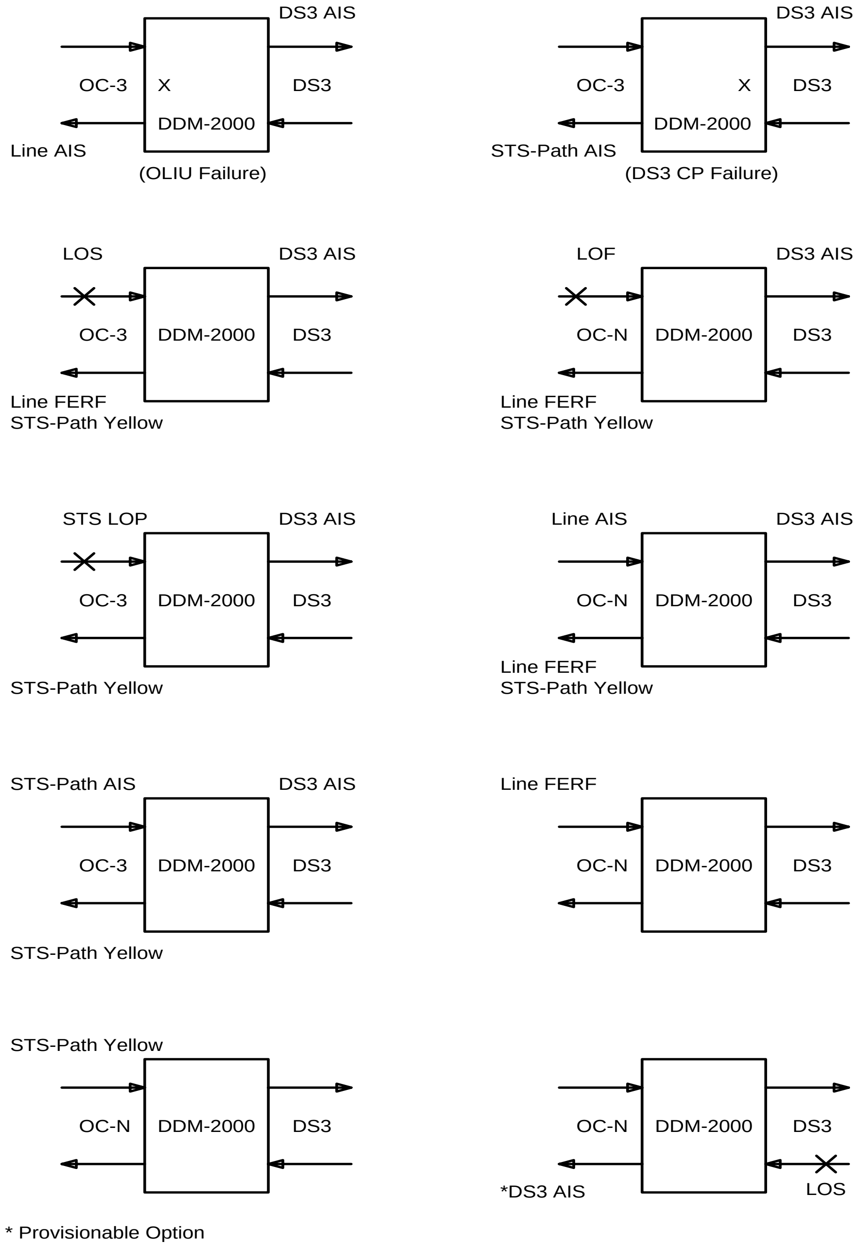


Figure 9-5. DS3 Maintenance Signaling — Non-Ring Interfaces

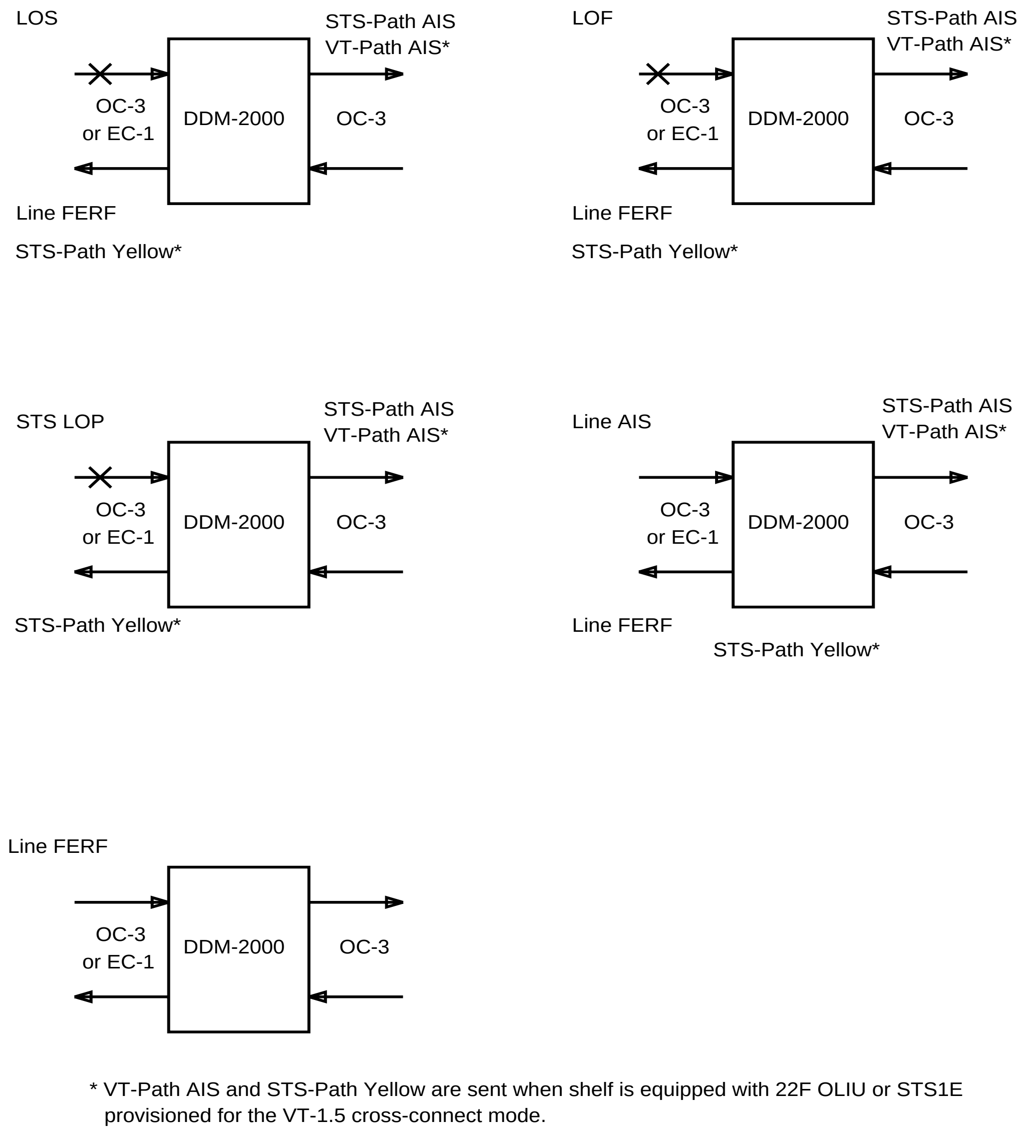


Figure 9-6. OC-3 or EC-1 Line Maintenance Signaling — Non-Ring Interfaces

Ring Applications

Figure 9-7 through Figure 9-9 are examples of the maintenance signals used by the DDM-2000 OC-3 Multiplexer in VT, VT unequipped, and TMUX circuit pack path switched ring applications.

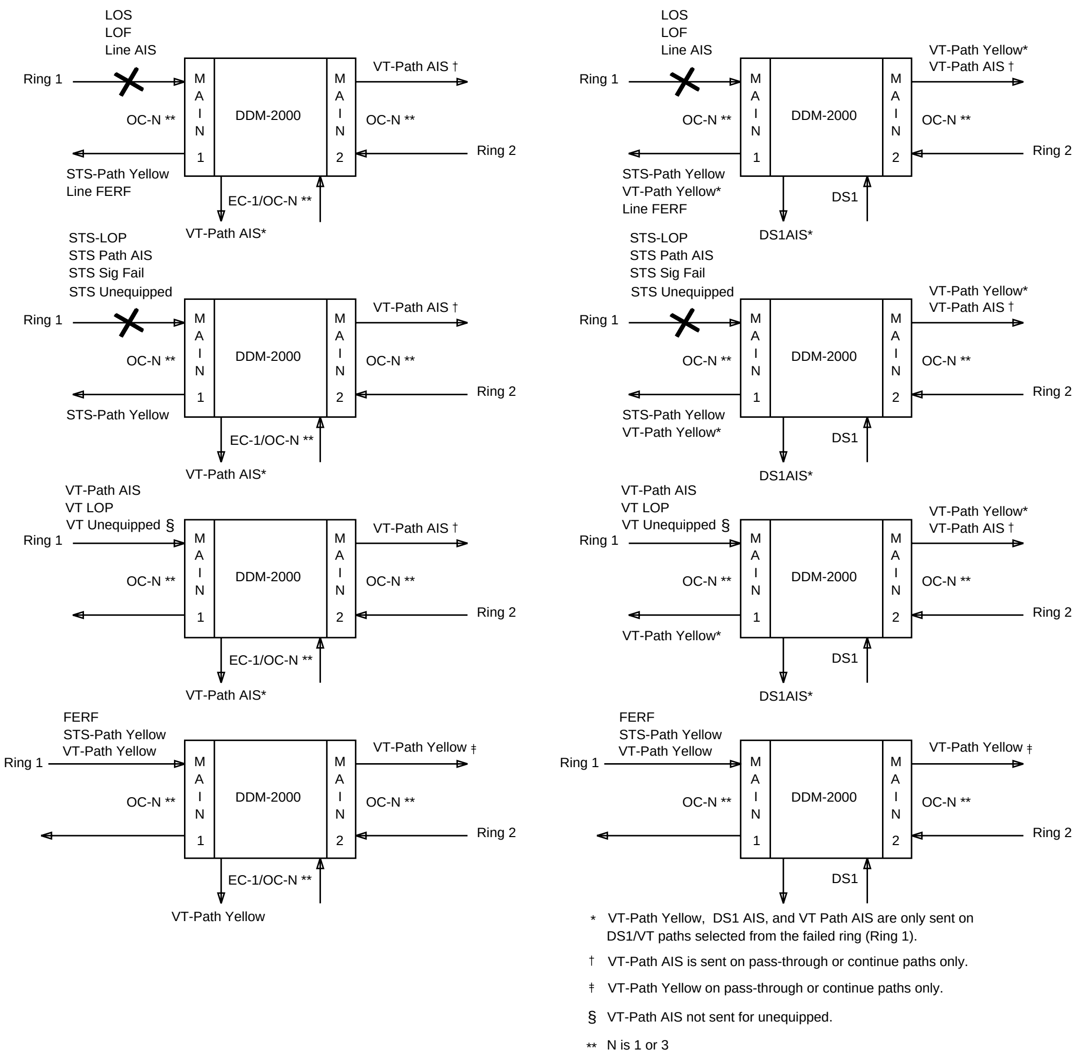


Figure 9-7. Maintenance Signaling — VT Ring Application

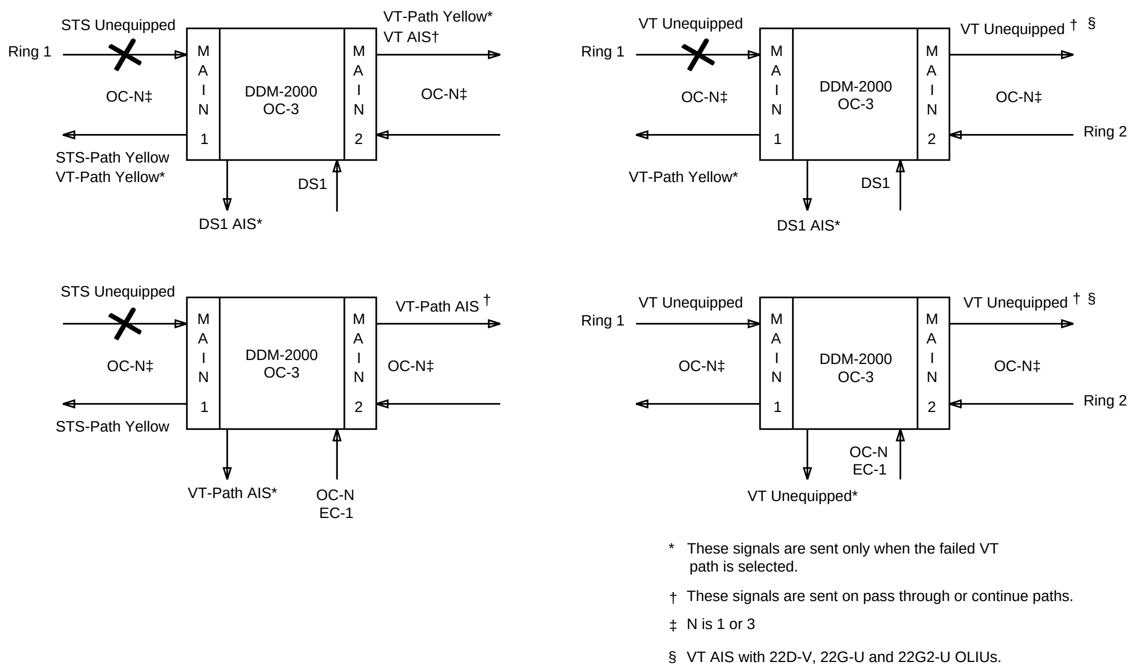


Figure 9-8. Maintenance Signaling — VT Ring Application, Unequipped

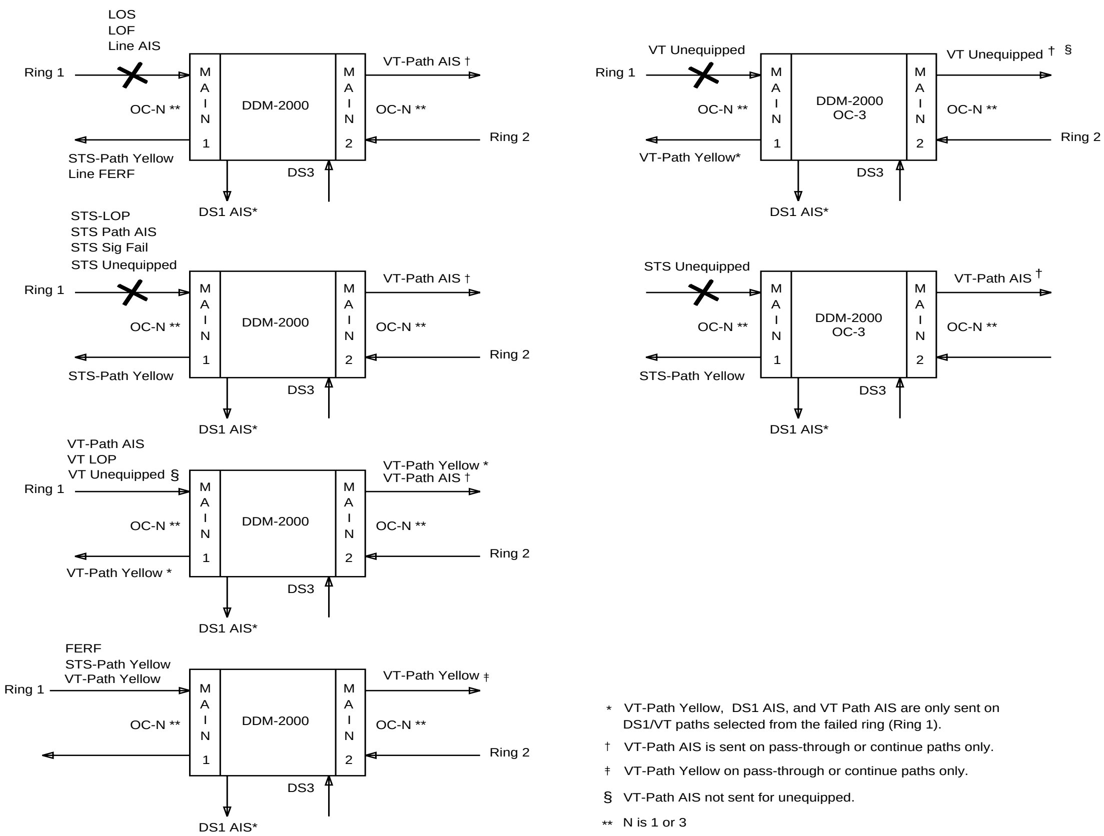
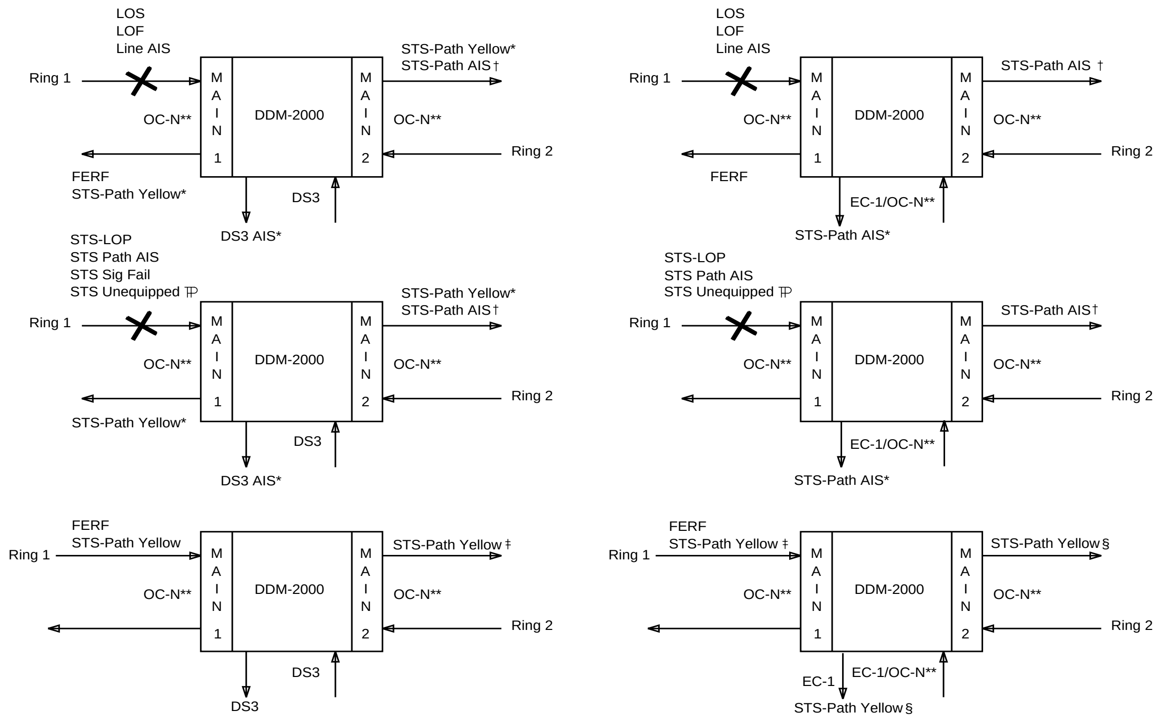


Figure 9-9. Maintenance Signaling — VT Ring Application, TMUX circuit pack

Figure 9-10 and Figure 9-11 are examples of the maintenance signals used by the DDM-2000 OC-3 Multiplexer in STS and STS unequipped, respectively, path switched ring applications.



* STS-Path Yellow, STS-Path AIS and DS3 AIS are only sent on STS-1 paths selected from the failed ring (Ring 1).

† STS-Path AIS is sent on pass-through or continue paths only.

‡ STS-Path Yellow appears on pass-through or continue paths only.

§ STS-Path Yellow is passed to the EC-1/OC-3 or OC-3 interface depending on whether the STS-1 path is a drop or pass-through connection. For drop and continue applications, the STS-Path Yellow is passed to both the EC-1/OC-3 (drop) and the OC-3 (ring) interfaces.

ℙ STS-Path AIS not sent for STS Unequipped.

** N is 1 or 3

Figure 9-10. Maintenance Signaling — STS Ring Application

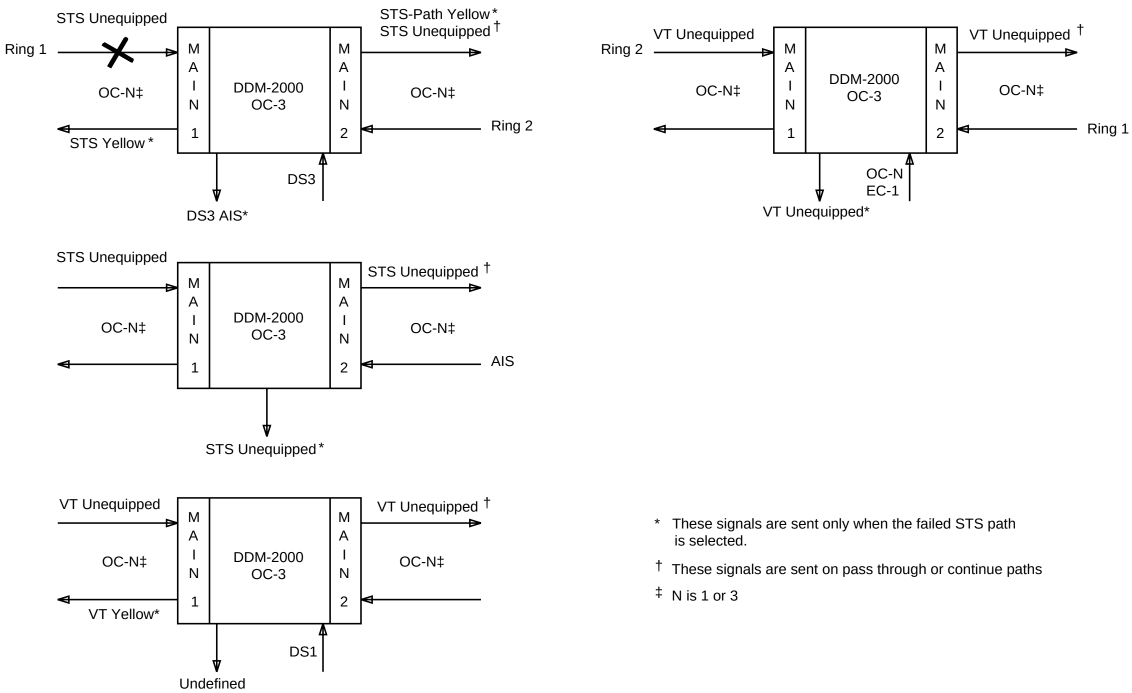


Figure 9-11. Maintenance Signaling STS Ring Application — Unequipped

Fault Detection, Isolation, and Reporting

Detection

The DDM-2000 OC-3 Multiplexer continuously monitors all circuit packs and incoming signals for faults. Incoming SONET signals are monitored for loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), and bit error ratio (BER) thresholds, and for the maintenance signals described in the preceding pages. Incoming DS1 and DS3 signals are monitored for LOS and BER thresholds. The BER thresholds for DS1 are based on bipolar 8-zero substitution (B8ZS) or alternate mark inversion (AMI) violations depending on line coding. The BER thresholds for DS3 are based on bipolar 3-zero substitution (B3ZS) coding violations. The DS3 signals received from the fiber are monitored for AIS and out-of-frame (OOF) conditions, unless they are provisioned for clear channel mode. DS1 timing references are monitored for AIS, BER, excessive out-of-frame (EOOF), LOF, LOS, and out-of-lock (OOL) conditions.

Isolation

When a fault is detected, the DDM-2000 OC-3 Multiplexer uses automatic diagnostics to isolate the fault to a particular signal or circuit pack.

Reporting

The system automatically and autonomously reports all alarm and status conditions through the appropriate user panel and equipment indicators, office alarm relays, and through the TL1/X.25 interface. The system stores a record of all fault conditions and reports them on demand through the CIT and the TL1/X.25 interface. The DDM-2000 OC-3 Multiplexer also stores a history of the past 500 alarm and status conditions and CIT events and reports them on demand through the CIT or TL1 interface. Each event is real time and date stamped.

If the diagnostic determines that a circuit pack has failed, the red FAULT LED on that circuit pack is turned on. If an incoming electrical signal from the DSX fails, the red FAULT LED on the affected circuit pack flashes on and off in one-second intervals. A failed incoming optical signal has the same effect.

The DDM-2000 OC-3 Multiplexer provides alarm holdoff and clear delays. The alarm holdoff delays prevent transient failures from causing unnecessary maintenance activity. The office alarms are not activated, and the OSs are not notified until a failure lasts at least as long as the alarm holdoff delay. Alarm clear delays prevent premature clearing of alarms. Alarm indications are not cleared until a fault condition has been clear for at least as long as the alarm clear delay. Incoming signal failure conditions, AIS, and FERF signals are subject to the provisionable holdoff delay and a fixed 15-second clear delay. Yellow signals are not subject to holdoff or clear delays. Circuit pack failures (except control circuit pack failures) are subject to the provisionable holdoff and clear delays. Refer to the **set-attr-alm** and **rtrv-attr-alm** commands in Section 11, "Commands and Reports."

The DDM-2000 Multiplexer normally declares an alarm, service affecting (SA) or non-service affecting (NSA), based on protection switch status. If the failed entity (circuit pack or signal) is in the standby (not active) state the alarm is NSA. Failure of an active entity is SA. As an option the user can provision a shelf to escalate or bump an NSA alarm on a standby entity to SA when both the active and standby entities fail. Refer to the **set-ne** command in Section 11, "Commands and Reports."

Protection Switching

The DDM-2000 OC-3 Multiplexer provides equipment protection switching of all transmission and synchronization circuit packs, and SONET standard line protection switching for OC-3 lines. Installation of protection equipment is optional. Protection switches are caused by automatically detected faults in the circuit packs or OC-3 lines and by external commands from a CIT or TL1/X.25 interface. Refer to the **switch-line**, **switch-fn**, **switch-ls**, and **switch-sync** commands in Section 11, "Commands and Reports. " The **switch-line** command is not applicable to OC-3 lines configured for path switched rings or to EC-1 interfaces. For path switched rings, path protection switching is used. Refer to "Path Protection Switching (Path Switched Rings)" paragraphs in this section and the **switch-path-vt1** or **switch-path-sts1** commands in Section 11, "Commands and Reports."

Automatic Line Protection

The DDM-2000 OC-3 Multiplexer uses optional SONET 1+1 unidirectional, nonrevertive automatic line protection switch (APS) procedures. This means that after a cut service fiber is repaired, a location **does not** switch back (revert) and select the service set as its active fiber/OLIU set. Line switching is not applicable to OC-3 lines in a path switched ring or to EC-1 interfaces.

Status of ACTIVE LED on OLIUs

Figure 9-12 illustrates examples of unidirectional and nonrevertive line protection switches. Note the squares at locations A and C. Each square represents the transmit or receive section of an OLIU. Figure 9-12(a) and Figure 9-12(b) are associated with the Service (S) OLIU and Figure 9-12(d) and Figure 9-12(e) with the Protection (P) OLIU. Four optical fibers are associated with the service and protection OLIUs that interconnect the OLIUs at locations A and C. The two fibers connecting the service OLIUs are the service fibers and the two fibers connecting the protection OLIUs are the protection fibers. Fibers and OLIUs shown in **bold** are active and carrying service.

In Figure 9-12(a), transmitted optical signals in each direction are permanently bridged to the service and protection fibers. The same signal is transmitted on both fibers. Each service and protection fiber and its associated OLIU are monitored as a set. The fiber/OLIU set selected by the receiving location is the active set and the ACTIVE LED, which in this figure is on the service OLIU circuit packs, is lit. The fiber/OLIU set not selected is the standby set, and the ACTIVE LED on its corresponding OLIU is not lit.

Contrary to other transmission circuit packs, ACTIVE LEDs on both OLIUs may be lit at the same time on the same shelf. For example, in Figure 9-12(b) the receive fiber going to location C has been cut. Location C selects the protection fiber/ OLIU set as active, resulting in the lighting of ACTIVE LEDs on both the OLIUs at location C. Location A did not switch to its protection set but continues to remain on the service set. This example illustrates the SONET standard of unidirectional APS. Since each location sends APS information to the other end, both ACTIVE LEDs on the OLIUs at location A are also lit.

After the cut service fiber is repaired, location C **does not** switch back (revert) and select the service set as its active fiber/OLIU set. This example, Figure 9-12(c), illustrates the SONET standard of nonrevertive APS.

Figure 9-12(d) and Figure 9-12(e) illustrate a second fiber failure and the resulting changes to the active OLIUs thus showing that both protection sets could be active and carrying service.

APS Initiation Criteria

The APS is initiated by signal fail and signal degrade conditions on the received optical signal. The BER of the received optical signal is calculated from violations in the SONET line overhead B2 parity bytes. Signal fail is declared for:

— OC-3 incoming LOS

— OC-3 LOF

— OC-3 line AIS

— OC-3 line BER exceeding 10^{-3}.

An OC-3 line BER exceeding a provisionable 10^{-5} to 10^{-9} threshold causes the signal degrade condition. An APS is completed within 60 milliseconds of the beginning of a hard failure such as a fiber cut. The DDM-2000 OC-3 Multiplexer APS is "span independent." In multispan applications an automatic or manual protection switch on one span does not cause a protection switch on any other span.

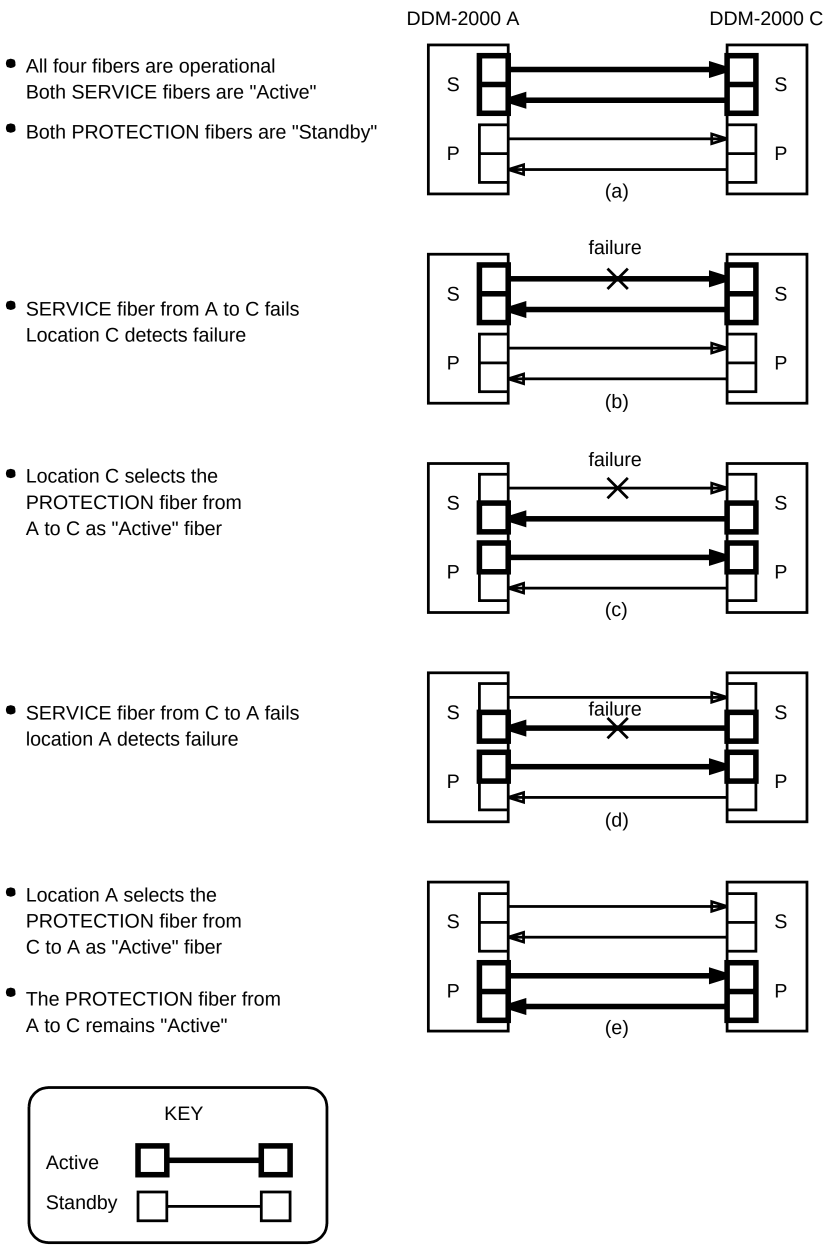


Figure 9-12. Unidirectional Line Protection Switching

Path Protection Switching (Path Switched Rings)

The path switched ring application is based on the Telcordia TR-TSY-000496/ GR-1400 path protection switching scheme. The DDM-2000 OC-3 Multiplexer must be equipped with 22-type, 24-type (OC-12) or 27-type (OC-1) OLIUs in the main slots for ring applications. The 22G-U, 22G2-U, 22F2-U, and 22D-U OLIUs support path protection switching based on STS/VT unequipped and STS/VT signal degrade, and are recommended for OC-3 ring applications.

The path protection switched ring has two single-fiber counter-rotating rings as shown in Figure 9-13. This architecture has distinct advantages over a linear architecture. Each node on the ring terminates four fibers: a transmit and receive fiber in each direction. Eight fibers are needed to connect the same NE in a nonterminal position of a linear add/drop 1+1 protected arrangement: two transmit and two receive in each direction, without providing the same level of protection that the ring provides. The architecture of the ring is designed to protect against any single point of failure, including a node failure, single fiber cut, or dual fiber cut. Node failure or dual fiber failure in a linear network affects traffic to all downstream nodes. A node failure in a ring only affects traffic dropped at the failed node.

The signal that enters the ring is protected on a SONET path basis as switching is performed independently for each path. Because of the ring's unidirectional operation, time slots must be reserved all the way around the ring for all ring traffic, limiting the capacity of the ring to the OC-N line rate. DDM-2000 OC-3 can provide both VT1.5 and/or STS-1 path protection, and DDM-2000 OC-12 can provide STS-1 path protection. A single DDM-2000 OC-3 shelf can support a mix of STS-1 and VT1.5 path switched rings. VT1.5 path protection is available at the OC-12 rate by using DDM-2000 OC-3 systems colocated with a DDM-2000 OC-12 system.

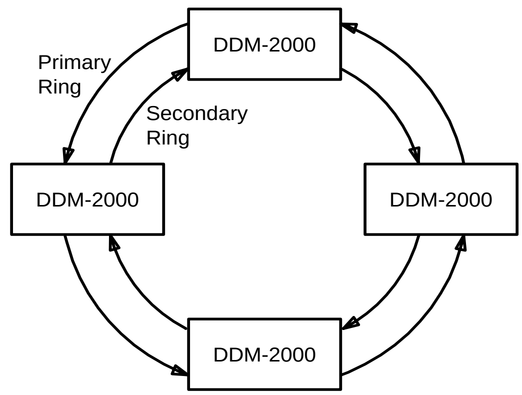


Figure 9-13. Two-Fiber Unidirectional Ring

Path Protection Scheme

Path protection rings feed a SONET payload (STS or VT) from the ring entry point, simultaneously in both rotations of the ring, to the signal's ring drop or exit point as shown by traffic AC and CA in Figure 9-14(a). This duplication of the signal that enters the ring is called a "head-end bridge." The node that drops the signal from the ring monitors both ring rotations and is responsible for selecting the signal that has the highest quality based on LOS/LOF, path AIS, LOP, STS/VT unequipped, and STS/VT path BER performance. This function at the ring exit point is called a "tail-end switch." Path switching is non-revertive. All detected hard failures (LOS, LOF, LOP, line AIS, or STS-1 path AIS) and in VT path switched rings, an STS-1 path signal failure based on BER or an STS path unequipped results in path AIS insertion in the outgoing signals. This allows the drop node to detect VT path failures and select the good path.

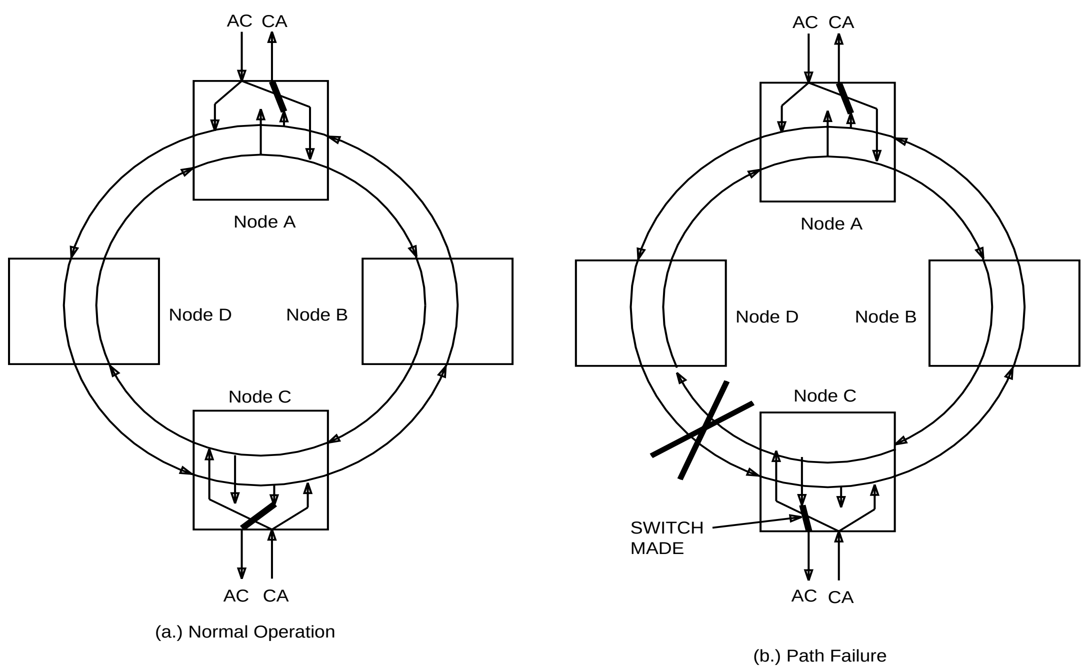


Figure 9-14. Path Protection Switching

The user can set a VT1.5 signal degrade threshold using the **`set-vt1`** and **`rtrv-vt1`** commands at a **drop** node on a VT path protected ring. Similarly, the user can set an STS-1 signal degrade threshold using the **`set-sts1`** and **`rtrv-sts1`** commands at a **drop** node on an STS path protected ring. Note that although previous equipage-based restrictions on the provisioning of these parameters have been removed, the signal degrade threshold will only be active on OLIUs that support it (22D-U, 22G-U/22G2-U, 27G-U/27G2-U, 22F2-U, 24G-U and 29G-U).

Under normal conditions, both incoming SONET path signals to the switch selection point are of high quality, and the signal can be selected from either ring. A failure or a transmission degradation on one of the rings requires that the other ring path be selected, and requirements specify that this path selection must occur within 60 milliseconds after a hard failure condition. Figure 9-14(b) shows how traffic is switched when a dual-fiber cut occurs. Ring releases provide nonrevertive switching to minimize the impact on critical customer services by giving the service provider control when, and if, the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance. Refer to the **`switch-path-vt1`** or **`switch-path-sts1`** commands in Section 11, "Commands and Reports."

Path Protection - Locked DS3 Cross-Connect

Figure 9-15(a) illustrates path-switched protection for a locked DS3 cross-connect. In this example, full multimedia data services, such as Ethernet, Token Ring, ATM, etc., are routed around the ring and through each Data Services Device on STS-1 #1. In the event of a service interruption, as indicated by the “X” in Figure 9-15(b), Data Services Device A reroutes traffic between itself and Data Services Devices B and C.

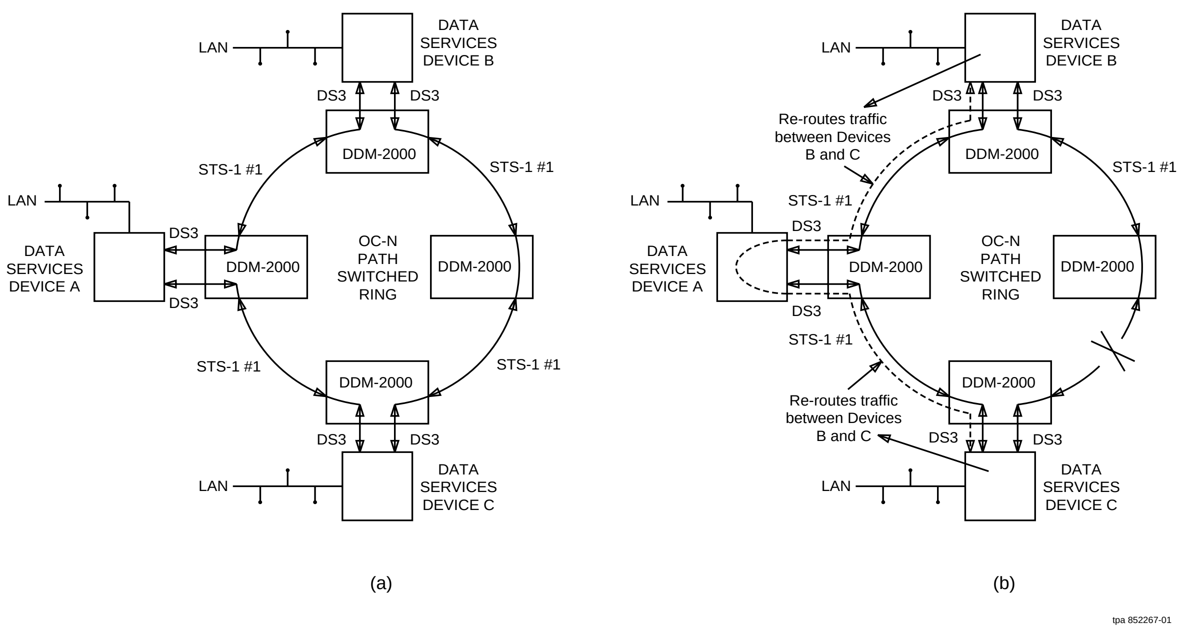


Figure 9-15. Locked DS3 Cross-Connect Path Protection Switching

Dual Ring Interworking (DRI)

The DDM-2000 OC-3 Multiplexers support DRI which provides end-to-end protection from loss of service on traffic traveling over interconnected rings. This is achieved by connecting the two rings at two dual-homing offices and by provisioning the multiplexers at these nodes to "drop and continue" all necessary paths. This provides a redundant path in case of a catastrophic failure at one of the two DRI offices or one of the nodes in each DRI office. The end nodes perform standard path protection switching on the signals from these two redundant paths.

Dual Ring Interworking (DRI) Path Protection Scheme

Figure 9-16 shows DRI path protection switching. Note that the upper ring could be an FT-2000 OC-48 Lightwave System bidirectional line switched ring. In the receive direction, a DRI node that passes a signal between rings performs two steps:

1. The VT1.5 and/or STS-1 signals to be passed between rings are "dropped and continued." This means the signal is dropped at that node and simultaneously copied into the OC-3 signal in the outgoing direction of the same ring rotation.
2. The VT1.5 and/or STS-1 signal that was dropped in Step 1 and the corresponding VT1.5 and/or STS-1 signal incoming from the other ring direction are compared, and the signal with the highest quality is selected as in single ring topologies.

In the transmit direction, a DRI node feeds VT1.5 or STS-1 signals in the direction opposite to the "continue" portion of the drop and continue signal (Step 1 previously) to only one rotation of the ring as shown in Figure 9-13. This routing is to only one rotation as distinguished from how an ordinary path switched ring bridges incoming low-speed traffic onto both rotations.

The drop and continue routing necessary for DRI is established with a cross-connection command.

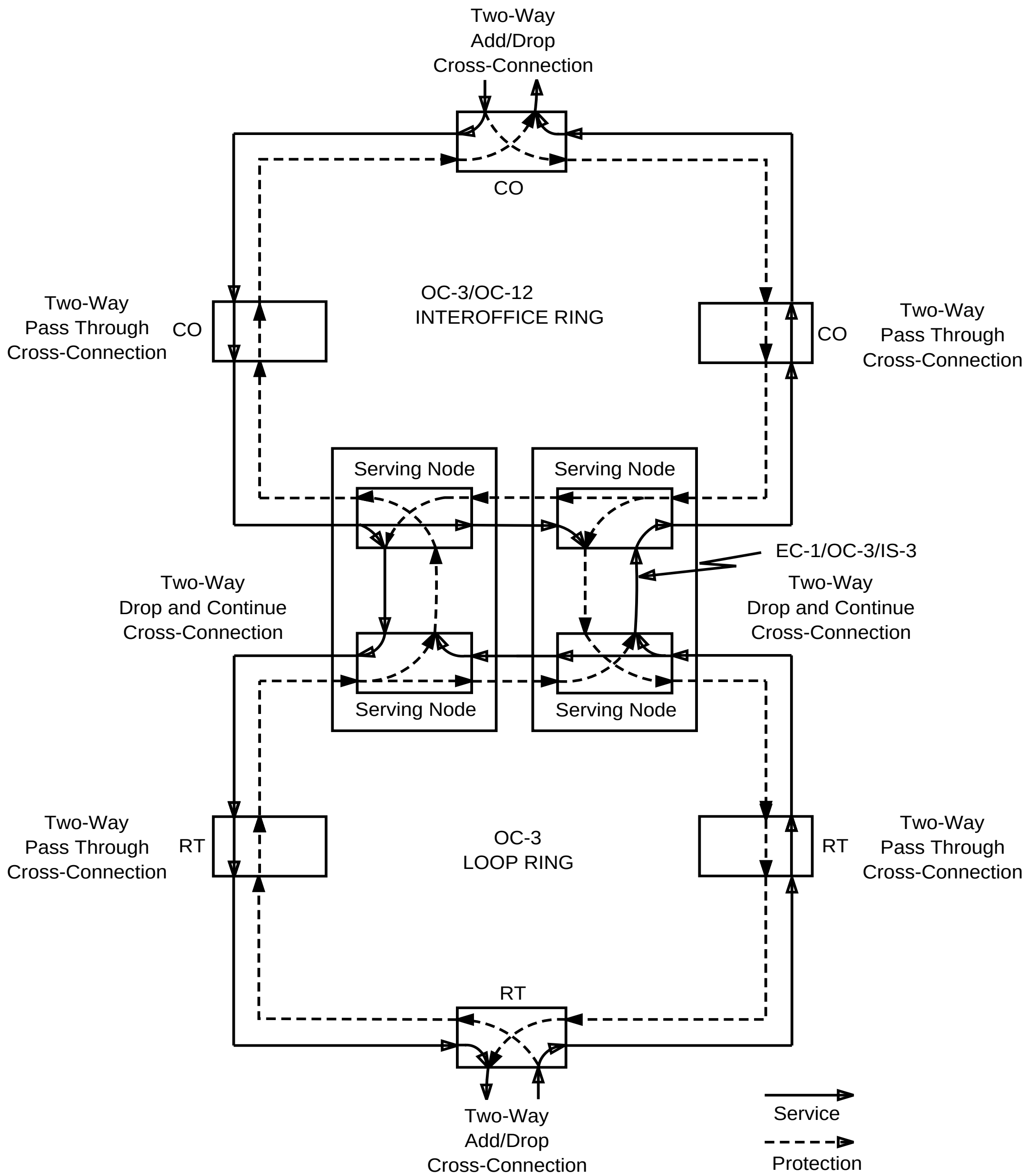


Figure 9-16. DRI Path Protection Switching

OC-3/OC-12 Path Switched Ring (0x1)

A DDM-2000 OC-3 ring shelf can function in a ring-on-ring application using the 0x1 interface capability of the OC-12 or FT-2000 OC-48 Lightwave System ring. The OC-3 shelf functions in the normal path switched ring mode. VT/STS path protection switching is done on the OC-3 shelf as previously described for an OC-3 ring.

In single homing, the OC-3 ring shelf interconnects through its main-1/main-2 ring interface either directly or through another OC-3 ring shelf to the low-speed OC-3 0x1 interface on a single OC-12 or FT-2000 OC-48 Lightwave System shelf.

In dual homing, the OC-3 ring shelf interconnects directly or through another OC-3 ring shelf with the OC-3 interfaces on two separate and normally non-colocated OC-12 or FT-2000 OC-48 Lightwave System shelves.

OC-3/OC-1 Path Switched Ring (0x1)

The OC-3/OC-1 path switched ring is similar to the OC-3/OC-12 ring-on-ring. A DDM-2000 FiberReach shelf interconnects with a DDM-2000 OC-3 ring host shelf through low-speed OC-1 interfaces on the OC-3 ring shelf. VT/STS path protection switching is done on the DDM-2000 FiberReach shelf.

In single homing, the DDM-2000 FiberReach ring interconnects through a pair of low-speed OC-1 0x1 interfaces on the OC-3 shelf.

In dual homing, the OC-1 ring interconnects through the low-speed OC-1 0x1 interfaces on two separate and normally non-colocated OC-3 shelves.

Status of ACTIVE LED on Rings

In all ring applications, ACTIVE LEDs on each main OLIU are always lit because it is not known if a signal on that OLIU is currently being selected by a far-end NE.

Equipment Protection

The DS3, MXRVO, STS1E, and TG circuit packs are 1×1 protected and use nonrevertive switching. Green ACTIVE LEDs are provided on the faceplates of these circuit packs to indicate which ones are active (carrying service).

The DS1 circuit packs are 1×7 protected and use revertive switching. To prevent frequent protection switches caused by intermittent failures of a DS1 circuit pack, the system provides an "automatic lock" feature. If four automatic protection switches are done on the same DS1 circuit pack within a 10-minute interval, traffic is automatically locked onto the protection DS1 circuit pack, and the automatic lock is reported as a minor alarm. The automatic lock can be reset manually using the **switch-ls** command. It resets automatically at midnight or if the affected DS1 circuit pack is replaced. The DDM-2000 OC-3 Multiplexer supports unprotected equipment configurations.

The DS1 protection circuit pack is automatically provisioned with the same user-settable options as the service DS1 circuit pack it protects except for the line build-out (LBO) value which is set by hardware switches (not by CIT or TL1).

Synchronization Reference Protection

In external timing and line timing modes, the synchronization references are 1×1 protected. If neither reference is available, the system automatically switches to "holdover" timing mode. When the TG is provisioned for synchronization messaging, the system can determine the quality of the line timing references by reading the synchronization messages in the OC-N transport overhead bytes. If the quality is not adequate, the TG will switch to holdover until manually switched to a good reference.

If automatic synchronization reconfiguration is enabled, the TG will automatically select the highest quality reference. See "Synchronization Messaging" in Section 5 and, "Transmission and Synchronization Interfaces" and the **set-sync** command in Section 11, "Commands and Reports."

The system can be provisioned to revertive or nonrevertive timing mode switching. The default is revertive. If provisioned for revertive mode switching, the system automatically switches from holdover mode to the provisioned timing mode (external timing or line timing) when an unprotected timing reference failure clears. If provisioned for nonrevertive mode switching, the system must be manually switched from holdover mode to the provisioned timing mode (external timing or line timing) when an unprotected timing reference failure clears. Refer to the **rtrv-sync**, **set-sync** and **switch-sync** commands in Section 11, "Commands and Reports."

Loopbacks

The DDM-2000 OC-3 Multiplexer allows technicians to set up loopbacks on all low- and high-speed interfaces. Low-speed DS1, DS3, and EC-1 electronic loopbacks, directed toward the high-speed OC-3, can be individually controlled from the CIT. Facility loopbacks can also be set up towards the DSX on all low-speed DS1, DS3, and EC-1 interfaces. DS1 facility loopbacks can only be set up in groups of four on the BBF1(B) and BBF3 circuit packs. Individual DS1 facility loopbacks are available with the BBF3B and the BBG20 (TMUX) circuit packs . Active electronic loopbacks are noted by the user panel's abnormal (ABN) indicator and in the Alarm and Status report. Refer to the **`opr-lpbk`** and **`rls-lpbk`** commands in Section 11, "Commands and Reports."

Front access to the OLIU optical connectors allows an easy manual OC-3 or OC-1 optical loopback. This loopback is set up by connecting a fiber jumper from the OLIU output to its input. An optical attenuator is required for this loopback if the 22G-U, 24G, 26G2-U, 27G2-U and 29G OLIU is used. Other types of OLIUs do not require attenuators for this loopback.

Tests

Transmission Tests

Technicians can use DDM-2000 OC-3 Multiplexer internal testing capabilities for installation and manual troubleshooting. DS1 and DS3 test signal generators and detectors are integrated in the system, eliminating the need for external test equipment to do DS1/DS3 transmission testing.

The DDM-2000 OC-3 Multiplexer lets technicians test specific signals and system components. For example, technicians can manually enable the integrated test signal generators and detectors for a DS1 or DS3 low-speed interface. These signal tests can be run selectively in the multiplex or demultiplex direction. Refer to the **`test-trmsn`** commands in Section 11, "Commands and Reports."

Automatic Turnup Tests

Automatic turnup tests are mechanisms that allow rapid turnup of DDM-2000 OC-3 systems without the use of external test equipment.

Automatic turnup tests are not currently available for path switched ring applications but software for a nonring release can be used to perform local equipment and local wiring cross-connect tests. Manual automatic turnup tests can be done using the procedures listed in the TOP section of this manual (Volume II).

The installation tests can be controlled via either the user panel or the CIT. Three different turnup procedures are provided and should be done in the order listed:

1. Local Equipment Test — The local equipment test verifies the integrity of the transmission and synchronization circuit packs and the OC-3 backplane. In the test, high-speed signals are looped back (manual optical loopback or EC-1 electrical loopback) towards the low-speed interfaces (see Figure 9-17).
2. Local Wiring Cross-Connect Test — The local wiring cross-connect test verifies the integrity of the cross-connect or wiring that is established. This assumes local equipment tests have been performed and any problems or failures have been corrected before this test is done. In the test, all low-speed signals are looped back (manual loopbacks at the STSX or DSX, see Figure 9-18).

Each of the tests described previously returns a good/fail result. If any circuit pack failures are detected during the tests, the FAULT indicator on the failed circuit packs are lit. If the wiring to the cross-connect panel is defective, the red FAULT indicators on the low-speed circuit packs that detect incoming signal failures blink for 1 minute. If the test passes, the green ACO indicator on the user panel is lit. Good/fail is also reported to the CIT at the end of the test. Refer to the **`test-auto`** command in Section 11, "Commands and Reports."

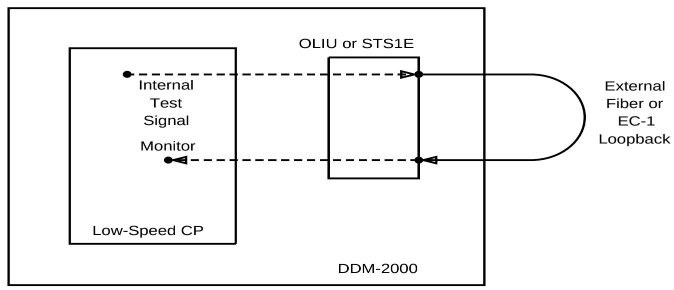


Figure 9-17. Local Equipment Test

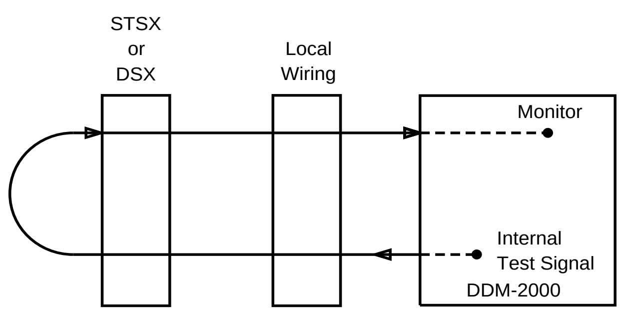


Figure 9-18. Local Wiring Cross-Connect Test

Operations Interface Tests

The DDM-2000 OC-3 Multiplexer provides tests for LED indicators, office alarms, and the system controller. Refer to the **`test-led`**, **`test-alm`**, and **`test-sysctl`** commands in Section 11, "Commands and Reports."

Performance Monitoring (PM)

The DDM-2000 OC-3 Multiplexer uses PM to support proactive maintenance of the network and tariffed service performance verification. 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. Hard and soft failures result in reactive maintenance.

Proactive maintenance consists of monitoring performance parameters associated with the SONET sections, lines, and paths within the SONET network. Table 9-5 lists the SONET performance parameters monitored by the DDM-2000 OC-3 Multiplexer. These parameters are thresholded to indicate degraded performance. When a PM threshold is crossed, it is reported to the OS as a threshold crossing alert (TCA). With TL1/X.25, all threshold crossings associated with a particular path can be correlated, and the likely source of the degradation can be identified.

Figure 9-19 shows DS1/DS3 line and path and DS3 path PM.

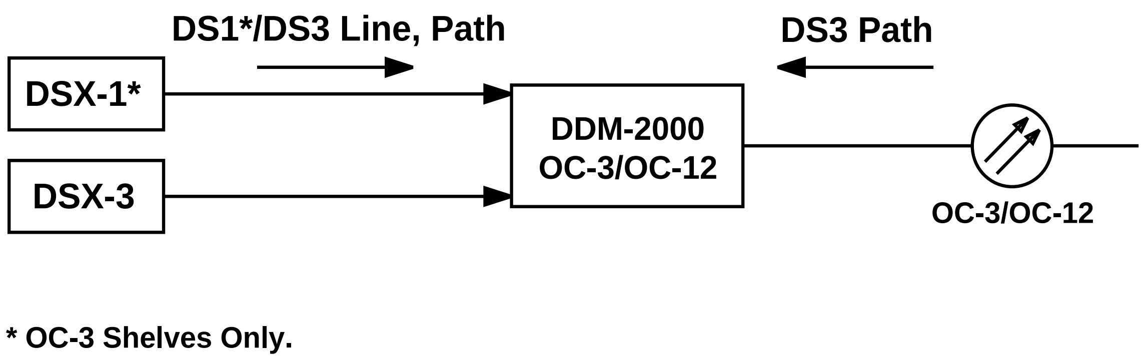


Figure 9-19. DS1/DS3 Line and Path and DS3 Path Performance Monitoring (PM)

The following are definitions and explanations for the terms used in the figure:

- Line — A line is a physical transport vehicle that provides the means of moving digital information between two points in a network. The line is characterized by a metallic transmission medium and its specific coding type. A line is bounded by its two end points, known as line terminations. A line termination is the point where the electrical, bipolar line signal is generated and transmitted, or received and decoded.
  - DS1 — DS1 line for AMI or B8ZS coding is monitored and the errored second (ES-L) data is displayed for the incoming signal from the DSX-1.
  - DS3 — DS3 line for B3ZS coding is monitored and the data is displayed in CV-L, ES-L, and SES-L registers for the incoming signal from the DSX-3.
- Path — A path is a framed digital stream between two points in a network and represents digital signal transport at a specified rate, independent of the equipment and media providing the physical means of transporting the signal. A path is defined by its two end points, called path terminations, where its frame structure is generated and decoded. A path may be carried wholly within one transport segment (line), or it may span a sequential arrangement of two or more transport segments.

- DS1 — DS1 near-end path is monitored for SF framing and both near-end and far-end paths are monitored for ESF framing. The data is displayed in ES-P, SES-P, and UAS-P categories. CV-P is also displayed.
- DS3 — DS3 path incoming from the fiber (high-speed side) is monitored for P-bit and F&M bit and the data is displayed in CV-P, ES-P, SES-P, and UAS-P registers. In addition, severely errored frame second (SEFS) is also monitored and displayed.

  DS3 path incoming from the DSX-3 (low-speed side) is also monitored, in addition to monitoring the path from the fiber, for P-bit and F&M bit. The same registers are also displayed for the data from the DSX-3. DS3 path from both the fiber and the DSX-3 are monitored for C-bit and are displayed in the same registers as above. The far-end data (FEBE bits) is monitored and displayed as well.

VT Performance Monitoring

VT PM provides performance monitoring of the V5 byte for ES, SES, and UAS. VT PM is a feature package option that requires feature package software licensed by Lucent and the use of the **`set-feat`** command to enable the feature.

The counts are retrieved using the **`rtrv-pm-vt1`** command by the message-based OS or through the CIT to determine if the service is operating within tariffed limits.

DS1 Performance Monitoring

DS1 PM is a feature package option that requires feature package software licensed by Lucent and the use of the **`set-feat`** command to enable the feature. DS1 PM measures near-end performance and ESF format far-end performance report of the incoming DS1, allowing service providers to determine the end-to-end performance of a DS1 signal. Tariffed service verification consists of monitoring performance parameters that can be associated with the customer's end-to-end service. The DDM-2000 OC-3 Multiplexer provides this capability for DS1 services with the DS1 PM feature. Based on the *ANSI* T1.403 ESF format, this capability retrieves performance report messages written into the ESF data link by the customer's terminal equipment.

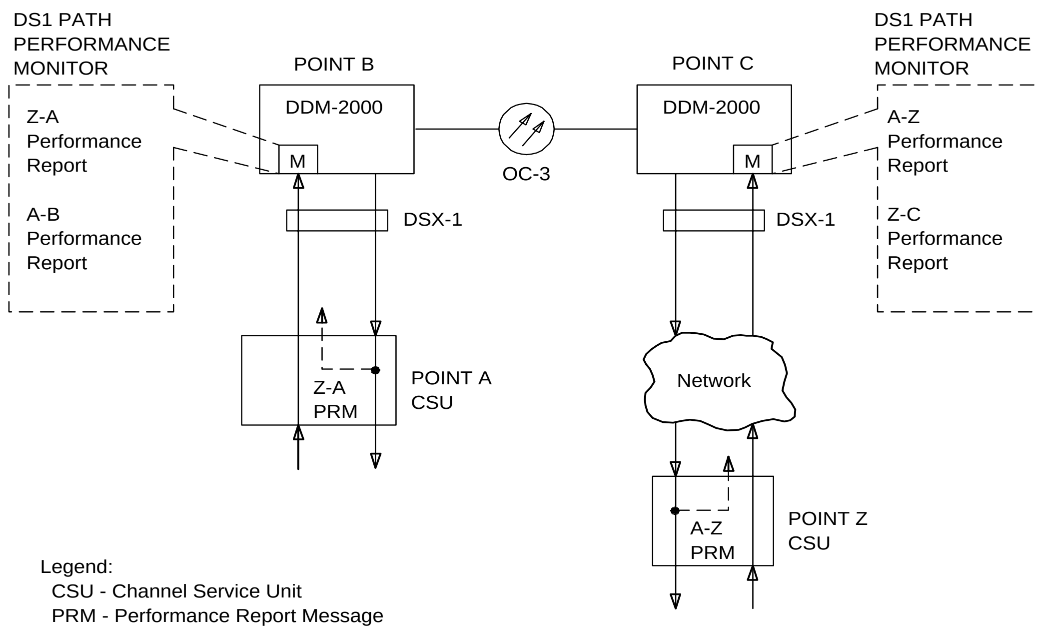


Figure 9-20. DDM-2000 OC-3 Multiplexer DS1 Path Performance Monitoring

From these messages, the DDM-2000 OC-3 Multiplexer can determine and report the end-to-end error performance of the entire DS1 link *as seen by the customer*. These parameters, listed in Table 9-5, are thresholded and reported to indicate degraded performance. The counts are retrieved using the **`rtrv-pm-t1`** command to determine if the service is operating within tariffed limits.

Application of the OC-3 DS1 PM feature for tariffed service verification is shown in Figure 9-20. Figure 9-20 shows an *ANSI* T1.403 ESF format DS1 service carried between points A and Z, using a DDM-2000 OC-3 system and terminated at the customer's premises with channel service units (CSUs). At the "A" end, the received error performance (Z-A) is detected and written by the customer's CSU onto the outgoing (A-Z) ESF data link, as shown by the dashed lines, as a performance report message (PRM). The DS1PM circuit pack interfacing the “A” end reads the incoming DS1 signal's PRM (received from the customer's premises) and reports the Z-A performance. Likewise, the OC-3 system interfacing the Z end reports the A-Z performance by reading the PRM from the customer's "Z" CSU. By reviewing the data from each OC-3 system, the service provider can determine the complete end-to-end performance (A-Z and Z-A) of the customer's service.

Additionally, each DS1PM circuit pack measures the near-end performance of the incoming DS1, allowing the service provider to determine if a good DS1 signal was received from the customer before transporting it through the network. This information can then aid in sectionalizing any reported performance problems. The DS1PM circuit pack can also provide this same near-end information for SF formatted (sometimes known as "D4 framing") DS1 services, but complete end-to-end performance verification is limited due to the lack of the PRM in the SF format.

DS3 Performance Monitoring

DS3 Path PM

With the BBG4B DS3 and BBG20 TMUX circuit packs, the DDM-2000 OC-3 Multiplexer provides three DS3 path PM options: P-bit (parity bit), adjusted F&M bit (frame and multiframe bit), and C-bit. The options are selected using a command that also sets the PM mode to "on" (default) or "off," which enables or disables the monitoring and reporting of DS3 path PM data (see Table 9-5).

P-Bit

When provisioned for P-bit, the system calculates and provides counts of DS3 CV-P, ES-P, SES-P, and UAS-P incoming from the fiber and DSX. Quarter-hour and current day registers are provided with provisionable TCAs on a per-shelf basis. SEFS are also monitored.

Because P-bits can be corrected at nodes provisioned for VMR along a DS3 path, the DS3 P-bit PM data may not provide a complete report of the end-to-end DS3 path errors.

Adjusted F&M Bit

Adjusted F&M bit PM provides an alternative method for determining and accumulating DS3 path performance data based on an error estimation technique using errors on the F&M framing bits to approximate the actual error counts in the DS3 path payload. F&M bits are not corrected at nodes provisioned for VMR along a DS3 path. When provisioned for adjusted F&M bit, the system calculates and provides estimated counts of DS3 adjusted F&M bit CVs, ESs, SESs, and UASs incoming from the fiber and DSX. Quarter-hour and current day registers are provided with provisionable TCAs on a per-shelf basis. SEFS are also monitored.

C-Bit

When the DS3 path PM C-bit option is selected, both near-end and far-end (far-end block errors — FEBE) PM data are monitored and displayed.

The system provides counts of DS3 C-bit parity coding violations (CV-P), ES-P, SES-P, and UAS-P incoming from both the DSX-3 and the fiber. The type of PM is provisioned per DS3 service by a CIT command.

For C-bit PM, the DS3 service can be provisioned in violation monitor (VM) or violation monitor and removal (VMR) modes. In VMR mode, the C-bit errors are not corrected as in the P-bit option.

Quarter-hour and day registers are provided with provisionable TCAs. The TCAs are provisionable on a per-shelf basis. SEFS counts are also provided.

DS3 Line

DS3 line parameters include line coding violations (CVL), errored seconds (ESL), and severely errored seconds (SESL). DS3 line PM provides provisionable bit error ratios (TCAs) for all DS3 line parameters. For CVL parameters, bit errors can also be provisioned in ratios such as 10^{-7}, 10^{-8} and 10^{-9}.

Optical Parameters

Performance Monitoring Enabling

Collection of optical parameters are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Laser Bias Current

The laser bias current is monitored continuously to detect degraded performance of the laser. A TCA is generated if the laser bias current exceeds a fixed threshold of 1.5 times the nominal value. Laser bias current is monitored independently for service and protection optical facilities.

Optical Transmit Power

The optical transmit power is monitored continuously to detect degraded performance of the laser. Threshold-crossing alerts (TCAs) are generated if the optical transmit power falls below fixed thresholds of –1 dB and –2 dB. Optical transmit power is monitored independently for service and protection optical facilities.

OC-3 Section Parameters

Performance Monitoring Enabling

Collection of section parameters for OC-3 interfaces are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Severely Errored Frame Seconds (SEFS)

This parameter counts the number of seconds during which an OOF, LOS, or OLIU circuit pack failure occurred. SEFSs are counted and thresholded independently for the service and the protection lines.

OC-3/EC-1 Line Parameters

Performance Monitoring Enabling

Collection of line parameters for OC-3 interfaces are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Collection of line parameters for an EC-1 high speed interface is initiated when the slot is equipped with an STS1E circuit pack set for high-speed.

Collection of line parameters for EC-1 low-speed interfaces are initiated when a slot is equipped with an STS1E circuit pack set for low-speed and the port is in the in service (IS) state. Parameters continue to be available in reports and generate appropriate TCAs until the input signal is removed and the **`update`** command or the UPD/INIT button is pressed. Alternatively, the EC-1 low-speed line parameters can be disabled by setting the EC-1 port state to not monitored (NMON) using the **`set-state-ec1`** command.

Line Coding Violations (B2 Parity)

To monitor the performance of the OC-3 (or EC-1) line, the line BIP-8 (B2 parity) is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line BIP error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. The contents of the three line B2 parity violation counters associated with the OC-3 line are added to form a composite B2 parity violation count. Coding violations are not counted during seconds that contain a line AIS, LOS, LOF, or during a UAS. The B2 parity violations are counted and thresholded independently for the service and protection lines.

Errored Seconds (ES)

An "errored second" is a second in which one or more B2 parity violations are detected. An ES "type A" is a second in which exactly one B2 parity violation is detected. An ES "type B" is a second in which more than one and less than 32 for OC-3, or 12 for EC-1, B2 parity violations are detected. Seconds that are UAS are not counted as ES. A second that contains a line AIS, LOS, LOF or is a UAS is not counted as a type A or type B ES. All three of these parameters are counted and thresholded independently for the service and protection lines.

Severely Errored Seconds (SES)

A “severely errored second” is a second in which 32 or more for OC-3 or, 12 or more for EC-1, B2 parity violations are detected or one in which a LOS, LOF or line AIS occurs. A UAS is not counted as an SES. SESs are counted and thresholded independently for the service and protection lines.

Unavailable Seconds (UAS)

An “unavailable second” is a second during which the OC-3 line is "unavailable." A line is considered unavailable from the beginning of X consecutive SESs until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the line signal failure. Y is equal to 10 seconds of no SESs or line signal failure. UAS are counted and thresholded independently for OC-3 interface service and protection lines.

Line Protection Switch Counts

Line protection switch counts is the count of the number of protection switches FROM the working OC-3 interface line. The count is independently counted and thresholded for both the service and the protection line.

STS Pointer Justification Count (PJC)

This feature provides a TCA from a DDM-2000 shelf when the STS pointer justification count in a performance bin exceeds a user provisioned threshold value. STS PJCs for each SONET line interface are accumulated in 15 minute and 24 hour performance monitoring bins. The TCA is sent via a TL1 autonomous message to the OS and is available through CIT and TL1 PM reports. PJCs are not accumulated during one second intervals in which an STS-1 is in the LOP or AIS state.

For each SONET line interface the system accumulates counts from only one STS-1 tributary during a 1 second monitoring interval. Excessive pointer justifications indicate a frequency error in the network or other potential synchronization problem. For example, a frequency error could be caused by a shelf in holdover or by a frequency offset in an external timing reference in networks with more than one shelf externally timed. The TCA can be provisioned in the frequency offset range from approximately .01 ppm to 10 ppm by setting a threshold for the PJC equivalent to the frequency offset.

STS-1 Path Parameters

Performance Monitoring Enabling

- OC-3 Interfaces

  For systems using manual STS-1 cross-connections, monitoring is initiated only when an STS-1 cross-connection is made and the channel is in the IS state. Parameters continue to be available in reports and generate appropriate TCAs until the STS-1 cross-connection is deleted. Removal of a circuit pack without removal of the cross-connection are reported as "unavailable time."

  For systems using manual VT1.5 cross-connections, monitoring is initiated only when the first VT1.5 cross-connection associated with that STS-1 signal is made and the VT channel is in the IS state. This applies to STS-1 paths on both OLIU and STS1E low-speed circuit packs. Parameters continue to be available in reports and generate appropriate TCAs until the last VT1.5 signal associated with that STS-1 cross-connection is deleted.

- EC-1 Low-Speed Interfaces

  For EC-1 low-speed interfaces, collection of STS-1 path parameters are initiated only when a slot is equipped with an STS1E circuit pack set for low-speed and an STS-1 or VT1.5 cross-connection is made.

STS-1 Path Coding Violations (B3 Parity)

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 checked for errors when the path is terminated. Beginning with R13.0, STS-1 path performance information is extended to monitor all incoming OC-n and EC-1 low-speed interfaces to an NE independent of whether the STS-1 terminates on that NE.

The B3 coding violation counter is incremented for each error detected. Up to eight errors per STS-1 frame can be detected in each STS-1 synchronous payload envelope (SPE). B3 coding violations are counted and thresholded separately for each STS-1 path terminated by the system. Coding violations are not counted during seconds that contain a line AIS, LOS, LOF, LOP, STS path AIS, or during a UAS.

Errored Seconds (ES)

An "errored second" is a second in which one or more B3 parity violations are detected. Seconds that are UAS are not counted as ES. An ES "type A" is a second in which exactly one B3 parity violation is detected. An ES "type B" is a second in which more than one and less than nine B3 parity violations are detected. All three of these parameters are counted and thresholded independently for each STS-1 path terminated by the system.

Severely Errored Seconds (SES)

An SES is a second in which nine or more B3 parity violations are detected. SES are counted and thresholded separately for each STS-1 path terminated by the system. A UAS is not counted as an SES.

Unavailable Seconds (UAS)

An STS-1 path is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the STS signal failure. Y is equal to 10 seconds of no SES or STS signal failure. If there is an unprotected STS-1 path terminating equipment failure (STS1E, MXRVO, DS3, TMUX, or OLIU), UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery.

VT1.5 Path Parameters

Performance Monitoring Enabling

- EC-1 High-Speed Interfaces

  For EC-1 high-speed, VT1.5 monitoring is initiated when a DS1 slot is equipped with a DS1 or DS1PM circuit pack (assuming an associated STS1E circuit pack set for high-speed is present). Parameters continue to be available in reports and generate appropriate TCAs until the DS1 or DS1PM circuit packs are removed and the **`update`** command or the UPD/INIT button is pressed.

- OC-3 Interfaces

  VT1.5 monitoring is initiated when the associated VT1.5 or STS-1 cross-connection is made to a DS1 or DS1PM circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the VT1.5 or STS-1 cross-connection is deleted.

Errored Seconds (ES)

An "errored second" is a second that is not an "unavailable second" in which one or more V5 parity violations or an AIS or LOP is detected. This parameter is counted and thresholded independently for each VT1.5 path terminated by the system.

Severely Errored Seconds (SES)

A "severely errored" second is a second that is not an "unavailable second" in which four or more V5 violations or an AIS or LOP is detected. SES are counted and thresholded separately for each VT1.5 path terminated by the system.

Unavailable Seconds (UAS)

A VT1.5 path is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the VT signal failure. Y is equal to 10 seconds of no SES or VT signal failure. If there is an unprotected VT path terminating equipment failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery.

DS1 Path Parameters

Performance Monitoring Enabling

Collection of DS1 path parameters are initiated only when a slot is equipped with a DS1PM circuit pack (assuming associated MXRVO or STS1E circuit packs are present), the DS1 port is in the IS or NMON state, and the DS1 port is provisioned for PM. Parameters continue to be available in reports and generate appropriate TCAs until the input signal to the DS1 interface is removed and the **`update`** command or the UPD/INIT button is pressed. Alternatively, the DS1 path parameter can be disabled by setting the DS1 port to turn off DS1PM by using the **`set-t1`** command.

DS1 path parameters are also applicable to the TMUX when the individual DS1s are provisioned for PM by the **`set-t1`** command.

Errored Seconds (ES)

An "errored second" for a DS1 SF format is a second in which one or more FEs (frame errors), or a DS1 AIS, or a DS1 OOF is detected. A near-end "errored second" for a DS1 ESF path is a second in which one or more CRC-6 violations, or a DS1 AIS, or OOF is detected. ES are not counted during "unavailable seconds." For a DS1 path with the ESF format, the far-end "errored seconds" values are obtained from the performance report message (PRM) in the DS1 ESF data link.

Severely Errored Second (SES)

For the DS1 SF format, a "severely errored second" is a second in which eight or more FEs are detected, or an OOF, or DS1 AIS is detected. For the DS1 ESF format, a near-end SES is a second in which 320 or more CRC-6 violations, or a DS1 AIS, or DS1 OOF are detected. For a DS1 path with the ESF format, the far-end "severely errored seconds" values are obtained from the PRM in the DS1 ESF data link. SES are not counted during "unavailable seconds." For a DS1 path with ESF format, the far-end "severely errored seconds" values are obtained from the PRM.

Unavailable Seconds (UAS)

A DS1 path is considered "unavailable" from the beginning of 10 consecutive SES until the beginning of 10 consecutive seconds, none of which is severely errored. If there is a DS1 pack failure, then UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded separately for each DS1 path monitored by the system.

For a DS1 path with ESF format, the far-end "unavailable second" performance is obtained from the PRM.

CV-P Coding Violations

This indicates the number of DS1 near-end path coding violations during the data collection interval. For a DS1 in SF format, this is a count of framing bit errors. For a DS1 in ESF format, this is a count of CRC-6 bit errors.

CV-PFE Coding Violations

This indicates the number of DS1 far-end path coding violations during the data collection interval. This parameter is only applicable to a DS1 signal in ESF format. This is a count of CRC-6 bit errors as reported in the G bits of the PRM.

DS1 Line Parameters

ES-L Errored Seconds

This parameter is a count of seconds containing one or more bipolar violations (for both AMI and B8ZS types of coding) or one or more LOS defects from the DSX-1.

DS3 Parameters

Performance Monitoring Enabling

Collection of DS3 path parameters are initiated when a slot is equipped with a DS3 circuit pack, the port is in the IS or NMON state, the DS3 port is provisioned for P-Bit violation monitoring (VM mode) or P-Bit violation monitoring and removal (VMR mode), and a default or manual STS-1 cross-connection is present. Parameters continue to be available in reports and generate appropriate TCAs until the input signal to the DS3 interface is removed and the **`update`** command or the UPD/INIT button is pressed (transitioning to the AUTO state). Alternatively, the DS3 path parameter can be disabled by setting the DS3 port to the clear channel mode (CC) using the **`set-t3`** command. The PM mode parameter should be set to "on" (default) using the **`set-t3`** command to start PM data monitoring and reporting.

For the TMUX circuit pack, DS3 PM is always enabled if the DS3 port is in the IS state.

DS3 Performance Monitoring (PM)

The DS3 PM is enabled as specified in Table 9-5.

Table 9-5. DS3 Performance Monitoring Enabling

	Mode		
DS3 Port State	**VMR**	**VM**	**CC**
IS (In Service)	Yes	Yes	No
AUTO	No	No	No
NMON (Not Monitored)	Yes	Yes	No

DS3 Path

CV-P Coding Violations

CV-P coding violations are a count of the number of P-bit, adjusted F&M bit, or near-end and far-end C-bit parity errors in the DS3 signal received from the fiber and the DSX-3. To detect degradation of the signal, these errors are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode. By provisioning all NEs in the DS3 path to the VM mode, CV-Ps can be used as a DS3 path performance parameter when the P-bit option is selected. When the F&M-bit or C-bit option is selected, NEs could be provisioned in VMR or VM mode (see Table 9-6).

Severely Errored Frame Seconds (SEFS)

SESF are a count of the number of seconds during which an OOF or AIS condition exists for a DS3 signal received from the fiber or the DSX-3, or during an unprotected DS3 circuit pack failure. SEFSs are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode.

Errored Seconds (ES-P)

An "errored second" is a second in which one or more DS3 P-bit, adjusted F&M-bit, or near-end and far-end C-bit coding violations are detected. ES are not counted during UAS. ES are counted and thresholded independently for each DS3 path terminated by the system.

Severely Errored Seconds (SES-P)

A "severely errored second" is a second in which 44 or more DS3 P-bit, adjusted F&M-bit, or near-end and far-end C-bit coding violations are detected. SES-P are not counted during UAS. SES are counted and thresholded independently for each DS3 path terminated by the system.

Unavailable Seconds (UAS-P)

An "unavailable second" is a second during which the DS3 path is "unavailable." A DS3 path is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the DS3 signal failure. Y is equal to 10 seconds of no SES or DS3 signal failures. If there is an unprotected DS3/TMUX circuit pack failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded independently for each DS3 path terminated by the system. This applies to P-bit, adjusted F&M bit, and near-end and far-end C-bit options.

C-Bit

When the DS3 path PM C-bit option is selected, both near-end and far-end (far-end block errors) PM data are monitored and displayed.

The system provides counts of DS3 C-bit CV-P, ES-P, SES-P, and UAS-P incoming from both the DSX-3 and the fiber. The type of PM is provisioned per DS3 service by a CIT command.

For C-bit PM, the DS3 service can be provisioned in VM or VMR modes. In VMR mode, the C-bit errors are not corrected as in the P-bit option.

Quarter-hour and day registers are provided with provisionable TCAs. The TCAs are provisionable on a per shelf basis. SEFS counts are also provided.

Table 9-6. DS3 Performance Monitoring (PM) Modes (Note)

Mode	PM Option	Monitor P-Bits	Monitor F&M Bits	Monitor C-Bits	Correct P-Bits	Correct F&M Bits	Correct C-Bits	Monitor Line PM
VMR	P-Bit	Yes	No	No	Yes	No	No	Yes
VMR	F&M-bit	No	Yes	No	Yes	No	No	Yes
VMR	C-Bit	No	No	Yes	Yes	No	No	Yes
VM	P-Bit	Yes	No	No	No	No	No	Yes
VM	F&M-bit	No	Yes	No	No	No	No	Yes
VM	C-Bit	No	No	Yes	No	No	No	Yes
CC	P-Bit	No	No	No	No	No	No	Yes
CC	F&M-bit	No	No	No	No	No	No	Yes
CC	C-Bit	No	No	No	No	No	No	Yes

***Note*:** The BBG20 TMUX circuit pack is considered to be always in the VM mode.

DS3 Line

CV-L Coding Violations

This parameter is a count of B3ZS bipolar violations (BPV) occurring over the accumulation period. BPVs that are part of the zero substitution code are excluded.

ES-L Errored Seconds

This parameter is a count of seconds containing one or more BPVs, or one or more LOS (from the DSX-3) defects.

SES-L Severely Errored Seconds

This parameter is a count of seconds during which BPVs exceed 44 or one or more LOS defects occur.

OC-1 Section Parameters

Performance Monitoring Enabling

Collection of section parameters for OC-1 interfaces are initiated when a slot is equipped with a 27G-U OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the 27G-U OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Severely Errored Frame Seconds (SEFS)

This parameter counts the number of seconds during which an OOF, LOS, or OLIU circuit pack failure occurred. SEFSs are counted and thresholded independently for each OC-1 interface.

OC-1 Line Parameters

Performance Monitoring Enabling

Collection of line parameters for OC-1 interfaces are initiated when a slot is equipped with an 27G-U OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the 27G-U OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Line Coding Violations (B2 Parity)

To monitor the performance of the OC-1 line, the line BIP-8 (B2 parity) is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line BIP error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. CV-Ls are not counted during seconds that contain a line AIS, LOS, LOF, or during a UAS. The B2 parity violations are counted and thresholded independently for each OC-1 line.

Errored Seconds (ES)

An "errored second" is a second in which one or more B2 parity violations are detected. An ES "type A" is a second in which exactly one B2 parity violation is detected. An ES "type B" is a second in which more than one and less than 12 B2 parity violations are detected. Seconds that are UAS are not counted as ES. A second that contains a line AIS, LOS, LOF or is a UAS is not counted as a type A or type B ES. All three of these parameters are counted and thresholded independently for each OC-1 line.

Severely Errored Seconds (SES)

A SES is a second in which 12 or more B2 parity violations are detected or one in which a LOS, LOF or line AIS occurs. A UAS is not counted as a SES. SES are counted and thresholded independently for each OC-1 line.

Unavailable Seconds (UAS)

A UAS is a second during which the OC-1 line is "unavailable." A line is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the line signal failure. Y is equal to 10 seconds of no SES or line signal failure. UAS are counted and thresholded independently for each OC-1 line.

STS Pointer Justification Count (PJC)

This feature provides a TCA from a DDM-2000 shelf when the STS pointer justification count in a performance bin exceeds a user provisioned threshold value. STS PJCs for each SONET line interface are accumulated in 15 minute and 24 hour performance monitoring bins. The TCA is sent via a TL1 autonomous message to the OS and is available through CIT and TL1 PM reports. PJCs are not accumulated during one second intervals in which an STS-1 is in the LOP or AIS state.

For each SONET line interface, the system accumulates counts from only one STS-1 tributary during a 1 second monitoring interval. Excessive pointer justifications indicate a frequency error in the network or other potential synchronization problem. For example, a frequency error could be caused by a shelf in holdover or by a frequency offset in an external timing reference in networks with more than one shelf externally timed. The TCA can be provisioned in the frequency offset range from approximately .01 ppm to 10 ppm by setting a threshold for the pointer justification count equivalent to the frequency offset.

OC-12 Line Parameter

Performance Monitoring Enabling

Collection of line parameters are initiated when the main slots are equipped with 24G-U and 29-type OLIU circuit packs. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **`update`** command or the UPD/INIT button is pressed.

Line Coding Violations (B2 Parity)

To monitor the performance of the OC-3 and OC-12 lines, the line BIP-8 (B2 parity) is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line BIP error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. The contents of the three or 12 line B2 parity violation counters associated with the OC-3 and OC-12 line are added to form a composite B2 parity violation count. CVs are not counted during seconds that contain a line AIS, LOS, LOF, or during a UAS. The B2 parity violations are counted and thresholded independently for the service and protection lines.

Errored Seconds (ES)

An "errored second" is a second in which one or more B2 parity violations are detected. An ES "type A" is a second in which exactly one B2 parity violation is detected. An ES "type B" is a second in which more than one and less than 32 for OC-3, or more than one and less than 124 for OC-12, B2 parity violations are detected. Seconds that are UAS are not counted as ES. A second that contains a line AIS, LOS, LOF, or is a UAS is not counted as a type A or type B ES. All three of these parameters are counted and thresholded independently for the service and protection lines.

Severely Errored Seconds (SES)

A SES is a second in which 32 or more for OC-3, or 124 or more for OC-12, B2 parity violations are detected, or one in which a loss of signal, loss of frame or line AIS occurs. A UAS is not counted as a SES. SESs are counted and thresholded independently for the service and protection lines.

Unavailable Seconds (UAS)

A UAS is a second during which the OC-3 or OC-12 line is "unavailable." A line is considered "unavailable" from the beginning of X consecutive SESs until the beginning of Y consecutive seconds, none of which is severely errored. An X is equal to 10 seconds or, in the case of a failure, the line signal failure. A Y is equal to 10 seconds of no SES or line signal failure. If there is an unprotected circuit pack failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded independently for the service and protection lines.

Line Protection Switch Counts

Line protection switch count is the count of the number of protection switches FROM the working line. The count is independently counted and thresholded for both the service and the protection line. This does not apply to main OC-N lines in ring releases.

STS Pointer Justification Count (PJC)

This feature provides a TCA from a DDM-2000 shelf when the STS pointer justification count in a performance bin exceeds a user provisioned threshold value. STS PJCs for each SONET line interface are accumulated in 15 minute and 24 hour performance monitoring bins. The TCA is sent via a TL1 autonomous message to the OS and is available through CIT and TL1 PM reports. PJCs are not accumulated during one second intervals in which an STS-1 is in the LOP or AIS state.

For each SONET line interface, the system accumulates counts from only one STS-1 tributary during a 1 second monitoring interval. Excessive pointer justifications indicate a frequency error in the network or other potential synchronization problem. For example, a frequency error could be caused by a shelf in holdover or by a frequency offset in an external timing reference in networks with more than one shelf externally timed. The TCA can be provisioned in the frequency offset range from approximately .01 ppm to 10 ppm by setting a threshold for the pointer justification count equivalent to the frequency offset.

Performance Monitoring Data Storage and Reports

The DDM-2000 OC-3 Multiplexer provides current quarter-hour and current day registers for all accumulated performance parameters. Previous day and previous quarter-hour registers for the preceding 8 hours also are provided for all accumulated performance parameters.

The DDM-2000 OC-3 Multiplexer has the capability to initialize the current registers through the CIT locally or remotely at any time, as well as to report the contents of any register at any time. Refer to the **init-pm**, **rtrv-pm-line**, **rtrv-pm-sect**, **rtrv-pm-sts1**, **rtrv-pm-t1**, **rtrv-pm-t3**, and **rtrv-pm-tca** commands in Section 11, "Commands and Reports."

Performance Monitoring During Failed Conditions

When the DDM-2000 OC-3 Multiplexer detects a trouble condition, the system stops accumulating affected performance parameters. Parameters that continue to provide useful information are accumulated during the trouble condition.

Performance Parameter Thresholds

The DDM-2000 OC-3 Multiplexer provides performance thresholds to alert maintenance staff of degraded transmission. Whenever the threshold for a parameter is exceeded, the DDM-2000 OC-3 Multiplexer generates a TCA to alert the OS to the condition. A summary of all TCAs is available in the PM TCA summary report. Current quarter-hour and current day thresholds for each parameter are provisionable, via the CIT, on a per-shelf basis. Therefore, if values other than the defaults are to be used, only one value needs to be set for each parameter. Generation of TCAs can be disabled independently for each performance parameter. Performance data is still collected if thresholding is disabled. Refer to the **rtrv-pmthres-line**, **rtrv-pmthres-sect**, **rtrv-pmthres-sts1**, **rtrv-pmthres-t3,** **set-pmthres-line**, **set-pmthres-sect**, **set-pmthres-sts1**, **set-pmthres-t3**, **rtrv-pm-tca**, **rtrv-pmthres-vt1**, **rtrv-pmthres-t1**, **set-pmthres-vt1**, and **set-pmthres-t1** commands in Section 11, "Commands and Reports."

TCA Transmission to OS

To trigger proactive maintenance activity at the OS, threshold crossing alerts (TCAs) are reported via TL1 **REPT EVT** autonomous messages.

Performance Monitoring Reports

TCA Summary Report

The TCA summary report lists the sum of the number of threshold crossings within the last 8 hours for quarter-hour thresholds and the number of threshold-crossings for the current day and current quarter hour for daily thresholds. This snapshot provides an overall view of system performance. If there are TCAs identified, it identifies which performance status report to look at for a detailed view of those parameters. See the **rtrv-pm-tca**, command in Section 11, "Commands and Reports."

Equivalent reporting information is available through TL1/X.25 commands. Refer to 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Performance Status Reports

The system provides reports that contain a snapshot of all current and previous PM registers. The time at which registers were last reinitialized is included. The option to display a specified subset of parameters (for example, line parameters only, data for only one OC-3 line or DS3 port, etc.) is also provided. See the **rtrv-pm-sect**, **rtrv-pm-line**, **rtrv-pm-sts1**, **rtrv-pm-vt1**, **rtrv-pm-t1**, and **rtrv-pm-t3** commands in Section 11, "Commands and Reports."

Equivalent reporting information is available through TL1/X.25 commands. Refer to 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Reports

This section provides information in reports available through the CIT. For reports available via TL1/X.25, refer to 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Alarm and Status Report

The system provides a report that lists all active alarm and status conditions. The identity of the condition (circuit pack failure, incoming OC-3 signal failure, etc.) is included in the report along with a time stamp indicating when the condition was detected.

See the **`rtrv-alm`** command in Section 11, "Commands and Reports," for a complete list of the alarm and status conditions that are reported by the system.

Provisioning Reports

Provisioning reports list the current state of all provisionable options in the system. See the **`rtrv-attr-alm`**, **`rtrv-attr-cont`**, **`rtrv-attr-env`**, **`rtrv-crs-sts1`**, **`rtrv-crs-vt1`**, **`rtrv-fecom`**, **`rtrv-lgn`**, **`rtrv-link`**, **`rtrv-ne`**, **`rtrv-oc3`**, **`rtrv-pmthres-line`**, **`rtrv-pmthres-sect`**, **`rtrv-pmthres-sts1`**, **`rtrv-pmthres-t1`**, **`rtrv-pmthres-t3`**, **`rtrv-pmthres-vt`**, **`rtrv-secu`**, **`rtrv-passwd`**, **`rtrv-ec1`**, **`rtrv-oc1`**, **`rtrv-sts1`**, **`rtrv-sync`**, **`rtrv-t1`**, **`rtrv-t3`**, **`rtrv-ulsdcc`**, **`rtrv-trace-sts1`** and **`rtrv-vt1`** commands in Section 11, "Commands and Reports."

Database Change Transmission to OS

All provisioning changes are automatically reported to the OS over the TL1/X.25 interface using **`REPT DBCHG`** autonomous messages.

Maintenance History Report

A maintenance history report containing the past 500 alarm, status, protection switching, and CIT (for example, provisioning, loopback request, manual protection, etc.) events is provided. This summary contains real time and date stamps indicating when each condition was detected and when it cleared; CIT events contain a time stamp indicating when the command was entered. Alarm and status entries in the retrieve history report are not subject to holdoff and clear delay. See the **`rtrv-hsty`** command in Section 11, "Commands and Reports."

State Reports

The state reports list the states of all slots, channels, low-speed ports, and OC-1 lines on the system. The **`rtrv-state-eqpt`** report includes the protection switching state ("active" or "standby") and protection switching priority of all protected lines and equipment in the system. The **`rtrv-state-path`** command includes protection status information for STS-1 paths. See the **`rtrv-state-eqpt`**, **`rtrv-state-oc1`**, **`rtrv-state-sts1`**, **`rtrv-state-path`**, and **`rtrv-state-vt1`** commands in Section 11, "Commands and Reports."

Equipment Report

This report displays the equipage and version information for one or more slots. Refer to the **`rtrv-eqpt`** command in Section 11, "Commands and Reports."

Neighbor Map Report

This report shows the Target Identifiers (TID) and Network Services Access Points (NSAP) of the NEs. The neighbor report lists the TIDs and NSAPs of all NEs that are immediate DCC and/or IAO LAN neighbors. Refer to the **`rtrv-map-neighbors`** command in Section 11, "Commands and Reports."

Network Map Report

The network report lists the TIDs and NSAPs of all reachable NEs (including level 2 ISs) in the local area only, or all reachable level 2 IS NEs in the subnetwork (if the local NE is provisioned to be a level 2 IS). Refer to the **`rtrv-map-network`** command in Section 11, "Commands and Reports."

Technical Specifications

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Technical Specifications

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Overview

This section contains the technical specifications for the DDM-2000 OC-3 Multiplexer.

DDM 2000 OC-3 Multiplexer

External Transmission Interfaces

The DDM-2000 OC-3 Multiplexer transmission interfaces adhere to industry standards as listed in Table 10-1..

Table 10-1. Transmission Interface Standards

Interface	Standard	Comments
DS1 low-speed	CB-119, *ANSI* * T1.102-1993	B8ZS/AMI option
	TR-499, Iss. 5, *ANSI* T1.403-1989	SF, ESF
DS3 low-speed	CB-119, *ANSI* T1.102-1993, TR-499, Iss. 5	VMR, VM, or clear channel
OC-1/OC-3/OC-12	*ANSI* T1.106/88, *ANSI* T1.105/91 TR-253, Iss. 2, TR-496, Iss. 3	
EC-1	*ANSI* T1.102-1993, & TR-253, Iss. 2	
10/100 BaseT and 100 BaseFX	IEEE 802.3	

* Registered trademark of American National Standards Institute.

Electrical Interfaces

The DDM-2000 OC-3 Multiplexer supports DS1 electrical, DS3 electrical, and EC-1 electrical high-speed and low-speed interfaces.

DS1 Low-Speed (BBF1B)

- Electrical Specification

  The DS1 low-speed interface transmits and receives a standard electrical DS1 signal as specified in *ANSI* * T1.102-1993, Section 2 (1.544 Mb/s nominal rate, DSX-1 interconnect specification). Line coding is provisionable to alternate mark inversion (AMI) with or without bipolar 8-zero substitution (B8ZS). Line buildout is provisionable as follows:

  — 613C (22 gauge): 30 to 655 ft.

  — 1249-C (26 gauge): 30 to 450 ft.

- Format Specification

  The DS1 low-speed interface provides clear channel transport of any DSX-1 compatible signal. There are no format constraints on this interface.

- Alarm Thresholding

  The following parameters are monitored at the DS1 interface:

  — Loss of signal (LOS)

  — Line coding violations (CV-L)

- Loopback

  — Quad DS1 facility loopback.

The alarm level for each of the monitored parameters can be provisioned to critical (CR), major (MJ), minor (MN), or status. B8ZS and AMI coding violation failure thresholds are user settable to 10^{-3} or 10^{-6} and in addition for Release 8.0 and later releases 10^{-7} or 10^{-8} BER.

DS1PM Low-Speed (BBF3/BBF3B)

- Electrical Specification

  The DS1PM low-speed interface transmits and receives a standard electrical DS1 signal as specified in *ANSI* T1.102-1993, Section 2 (1.544 Mb/s nominal rate, DSX-1 interconnect specification). Line coding is provisionable to AMI with or without B8ZS. Line buildout is provisionable as follows:

---

*

- — 613C (22 gauge): 30 to 655 ft.
- — 1249-C (26 gauge): 30 to 450 ft.

- Format Specification

  The DS1PM low-speed interface can be provisioned for the following DS1 formats: clear channel (default), superframe (SF) as specified in *ANSI* T1.403-1989, or extended superframe (ESF) as specified in *ANSI* T1.403-1989. In the case of SF or ESF format selections, DS1 performance information is collected by monitoring the associated DS1 framing format.

- Alarm Thresholding

  The following parameters are monitored at the DS1PM interface:

  - — Loss of signal (LOS)
  - — Line coding violations (CV-L).

  The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN, or status. B8ZS and AMI coding violation failure thresholds are user settable to 10^{-3} or 10^{-6} and in Release 8.0 and later releases 10^{-7} or 10^{-8} BER.

- Loopback

  - — Quad DS1 facility loopback (BBF3)
  - — Single DS1 facility loopback (BBF3B) (Release 13.0 and later).

- Performance Monitoring (see Table 10-23)

  DS1 Path Parameters:

  - — Errored Seconds (ES-P)
  - — Severely Errored Second (SES-P)
  - — Unavailable Seconds (UAS)
  - — CV-P Coding Violations (Release 7.2 and later)
  - — CV-PFE Coding Violations (Release 7.2 and later)

  DS1 Line Parameters:

  - — ES-L Errored Seconds (Release 7.2 and later)

T1 Carrier Low-Speed (BBF6 T1EXT)

■Electrical Specification

The T1 carrier low-speed interface (T1EXT) transmits and receives a standard electrical T1 carrier signal as specified in CB No. 113, Issue 2, April 1978. The T1EXT supports two interfaces. Line coding is provisionable to AMI with or without B8ZS. The following are specifications for the driver/receiver:

— Driver Output: 3 V peak pulse

— Receiver Gain: 35 dB maximum at 772 KH

— Receiver Dynamic Range: 0 to 35 dB (no pad at input).

The driver/receiver does not require any special provisioning to support up to 6,000 feet of 22-gauge copper cable (at 22 degrees Celsius) used in a T-Carrier system.

The T1EXT will support a single span of the following distances:

— In a central office: up to 3000 feet (±1500 feet)

— In an outside plant cabinet or wall DT: up to 6,000 feet.

The 60 mA constant current regulator will support a simplex loop resistance of 221 ohms.

— The T1EXT does not support fault locating using bipolar violations

— The T1EXT can interface with "looping regulator" type repeaters only

— The T1EXT does not have the capability to loop the simplex current back to a T1 line repeater

— The T1EXT does not include any components for primary or secondary lightning protection/surge protection or power cross. Primary protection (Lucent Technologies' protector unit 4B3EW or equivalent) is always required for tip/ring lines exposed to lightning and surges either in cabinet or as lines enter a building. An external secondary lightning and surge protection assembly (ED-8C783) must be collocated with the DDM-2000 shelf for all outside plant applications. Refer to Figure 10-1 for T1EXT span powering.

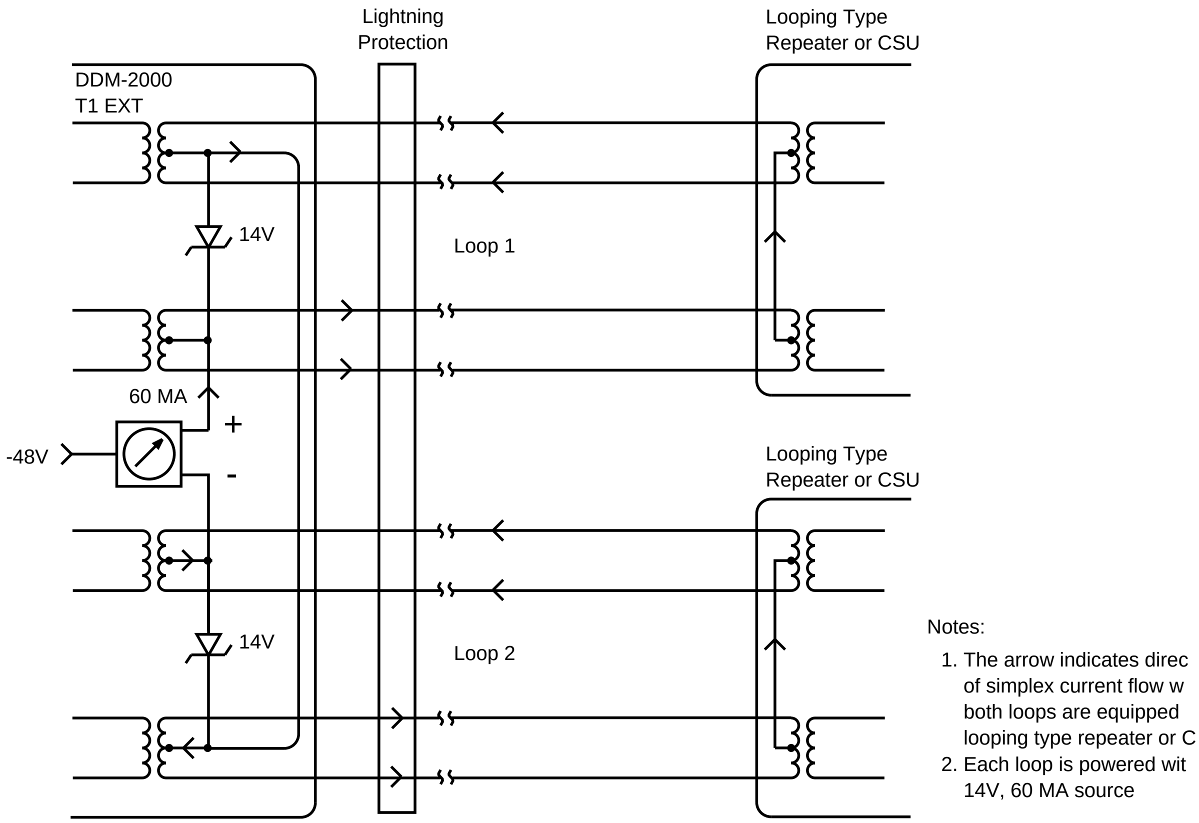

Figure 10-1. T1EXT Span Powering

■ Format Specification

The T1EXT BBF6 low-speed interface can be provisioned for the following formats: clear channel (default), SF as specified in *ANSI* T1.403-1989, or ESF as specified in *ANSI* T1.403-1989. In the case of SF or ESF format selections, T1EXT performance information is collected by monitoring the associated T1EXT framing format.

■ Alarm Thresholding

The following parameters are monitored at the T1EXT interface:

— Loss of signal

— Line coding violations.

The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN, or status. B8ZS and AMI coding violation failure thresholds are user settable to 10^{-3}, 10^{-6}, 10^{-7}, or 10^{-8} BER.

■ Performance Monitoring (PM) (see Table 10-23)

— Near-end T1EXT path parameters (ES, SES, and UAS) for SF or ESF framed signals incoming to the DSX-1

— Far-end T1EXT path parameters (ES, SES, and UAS) for ESF framed signals using performance report messages (PRM) incoming from the DSX-1.

— Coding violations (CV) for near-end and far-end

— T1EXT line PM monitoring and ES reporting

LAN Interface (BBF9)

■ Electrical Specification:

The BBF9 LAN circuit pack provides a single 10/100BaseT, IEEE 802.3 compliant interface. The LAN port performs protocol transparent filtering and bridging of incoming MAC frames. MAC frames with a destination address on the local bus are filtered by the BBF9 to prevent unnecessary transmission of frames over the wide area network (WAN). The LAN interface autonegotiates mode (full/half duplex) and speed (10/100 Mb/s) when interfacing with other 802.3 compliant devices over twisted pair media. The circuit pack occupies two adjacent low-speed slots and uses from one to 8 DS1 signals to provide native mode LAN transport through a SONET WAN.

■ LAN port:

— 10/100BaseT IEEE 802.3 compliant

— RJ-45 faceplate connector

— Cat-3 or CAT-5 UTP (unshielded twisted pair) medium

- — Buffering .5 MByte for each direction
- — See Table 10-2 for optical characteristics.

■ Format Specification:

The LAN interface converts incoming MAC frames to an ATM cell format using ATM adaptation layer 5 (AAL5) encapsulation as specified in IETF RFC-1483. ATM cells are distributed in round robin order on 1 to 8 ESF formatted DS1 signals using the ATM forum IMA Specification Version 1.1 for inverse multiplexing. The DS1 signals are mapped into asynchronous VT1.5 signals for transport through a SONET network. The circuit pack can compensate for up to 50 ms of differential delay among the 8 DS1s and uses a single IMA group with one ATM virtual channel (VC). The following provisioning options are provided:

- — AAL5 Protocol - VC multiplex or LLC encapsulation (Bridged)
- — MAC Frame Check Sequence (FCS) Preservation - enable or disable
- — ATM Virtual Path ID and Virtual Channel ID
- — IMA group ID
- — IMA Frame Length - 32, 64, 128, 256
- — ATM scrambler - on/off
- — ATM polynomial - on/off.

The IMA link IDs are assigned automatically by the system in the range 0 to 7. The IMA protocol operates in symmetric configuration with common clock.

■ Alarms:

Local LAN port failures are detected by monitoring for the presence of either MAC frames or Link Pulses per IEEE 802.3. From the SONET direction, failures are detected by monitoring for VT1.5 (AIS, LOP), DS1 LOF, Loss of IMA frame, Loss of IMA Delay Synchronization (LODS), Loss of Cell Delineation (LCD) and excessive AAL5 CRC errors. The alarm level for a local LAN port failure is user provisionable (Major, Minor, Not Alarmed).

■ Performance Monitoring:

In addition to DS1 path and VT1.5 path performance monitoring, the BBF9 circuit pack supports performance monitoring of data flow in both directions. The parameters supported are:

- — Transmit MAC packets forwarded (towards the WAN)
- — Transmit MAC packets discarded
- — Receive MAC packets forwarded (towards the LAN)

— Receive MAC packets discarded.

In addition, to monitor the efficiency of the IMA link the following parameters are supported:

— Transmit ATM cells total

— Transmit ATM idle cells

— Receive ATM cells total

— Received ATM cells Idle.

LAN Interface (BBF10)

- Electrical Specification:

  The BBF10 LAN circuit pack provides a single 100BaseFX, IEEE 802.3 compliant interface. The LAN port performs protocol transparent filtering and bridging of incoming MAC frames. MAC frames with a destination address on the local bus are filtered by the BBF10 to prevent unnecessary transmission of frames over the wide area network (WAN). The LAN interface autonegotiates mode (full/half duplex) and speed (100 Mb/s) when interfacing with other 802.3 compliant devices over twisted pair media. The circuit pack occupies two adjacent low-speed slots and converts an optical signal to from one to 8 DS1 signals to provide native mode LAN transport through a SONET WAN.

- LAN port:

  — 100BaseFX IEEE 802.3 compliant

  — SC optical connector

  — 1300 nm nominal center wavelength

  — 62.5 micron multimode fiber

  — Buffering .5 MByte for each direction

  — See Table 10-2 for optical characteristics.

- Format Specification:

  The LAN interface converts incoming MAC frames to an ATM cell format using ATM adaptation layer 5 (AAL5) encapsulation as specified in IETF RFC-1483. ATM cells are distributed in round robin order on 1 to 8 ESF formatted DS1 signals using the ATM forum IMA Specification Version 1.1 for inverse multiplexing. The DS1 signals are mapped into asynchronous VT1.5 signals for transport through a SONET network. The circuit pack can compensate for up to 50 ms of differential delay among the 8 DS1s and uses a single IMA group with one ATM virtual channel (VC). The following provisioning options are provided:

  — AAL5 Protocol - VC multiplex or LLC encapsulation (Bridged)

  — MAC Frame Check Sequence (FCS) Preservation - enable or disable

  - ATM Virtual Path ID and Virtual Channel ID
  - IMA group ID
  - IMA Frame Length - 32, 64, 128, 256
  - ATM scrambler - on/off
  - ATM polynomial - on/off.

  The IMA link IDs are assigned automatically by the system in the range 0 to 7. The IMA protocol operates in symmetric configuration with common clock.

- Alarms:

  Local LAN port failures are detected by monitoring for the presence of either MAC frames or Link Pulses per IEEE 802.3. From the SONET direction, failures are detected by monitoring for VT1.5 (AIS, LOP), DS1 LOF, Loss of IMA frame, Loss of IMA Delay Synchronization (LODS), Loss of Cell Delineation (LCD) and excessive AAL5 CRC errors. The alarm level for a local LAN port failure is user provisionable (Major, Minor, Not Alarmed).

- Performance Monitoring:

  In addition to DS1 path and VT1.5 path performance monitoring, the BBF10 circuit pack supports performance monitoring of data flow in both directions. The parameters supported are:

  - Transmit MAC packets forwarded (towards the WAN)
  - Transmit MAC packets discarded
  - Receive MAC packets forwarded (towards the LAN)
  - Receive MAC packets discarded.

  In addition, to monitor the efficiency of the IMA link the following parameters are supported:

  - Transmit ATM cells total
  - Transmit ATM idle cells
  - Receive ATM cells total
  - Received ATM cells Idle.

Table 10-2. BBF10 LAN Optical Characteristics

Receiver Parameters	Symbol	Min.	Typical	Max.	Unit
Input Optical Power (Minimum at Window Edge)	$P_{IN\ Min.}$ (W)		–33.5	–31.0	dBm avg.
Input Optical Power (Minimum at Eye Center)	$P_{IN\ Min.}$ (C)		–34.5	–31.8	dBm avg.
Input Optical Power Maximum	$P_{IN\ Max.}$	–14.0	–11.8		dBm avg.
Operating Wavelength	λ	1270		1380	nm
Signal Detect - Asserted	P_A	P_D + 1.5 dB		–33.0	dBm avg.
Signal Detect - Deasserted	P_D	–45.0			dBm avg.
Signal Detect - Hysteresis	P_A - P_D	1.5	2.4		dB
Signal Detect Assert Time (off to on)	AS_Max	0	2	100	µs
Signal Detect Deassert Time (on to off)	ANS_Max	0	5	350	µs
Transmitter Parameters	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Output Optical Power BOL 62.5/125 µm, NA=0.275 Fiber EOL	P_O	–19.0 –20.0	–15.7	–14.0	dBm avg.
Output Optical Power BOL 50/125 µm, NA=0.20 Fiber EOL	P_O	–22.5 –23.5	–20.3	–14.0	dBm avg.
Optical Extinction Ratio			0.05 –50.0	0.2 –35.0	% dB
Output Optical Power at Logic Low “0” State	P_O(“0”)			–45.0	dBm avg.
Center Wavelength	λ_C	1270	1308	1380	nm
Spectral Width - FWHM -RMS	$\Delta\lambda$		147 63		nm

HDSL Interface (BBF8)

- Electrical Specification

  The High bit rate Digital Subscriber Line (HDSL) circuit pack transmits and receives a 2B1Q signal as specified in Telcordia Technologies TA-NWT-001210.

  — Data is scrambled/descrambled with a pseudo-random sequence

  — Line buildout is automatically provisioned

  — Compensated for data inversion caused by tip-ring reversals

- Format Specification

  The HDSL allows for clear channel transport of a framed or unframed DS1. Its data stream consists of two 784 Kb/s signals transported on separate wire pairs. Together, the aggregate bi-directional bit rate is 1.544 Mb/s. The remaining 24 Kb/s is used for training and diagnostic information.

  — Compatible with PairGain™ equipment

- Alarm reporting

  — LOS

  A LOS is reported if either HDSL line experiences a synchronization failure

- Loopback

  DS1 terminal loopback for each HDSL interface

- Performance Monitoring (PM) — Available through the HDSL link management port only.

  — User-configurable alarm thresholds

  — 15-minute, 24-hour, and 7-day performance histories

  — Asynchronous serial interface for provisioning and PM

- Management

  — SONET Management

  This link is accessible via the SONET DCC and DDM-2000 CIT. It allows the HDSL circuit pack to be provisioned for DS1 facility loopbacks.

  — HDSL Link Management

  This link is accessible via a faceplate mounted RS-232 interface. It allows management of each HDSL port only (management of the DDM-2000 is not accessible through this interface). This management port supports a menu driven interface for each HDSL port; managed features include:

  — PM features listed above

  — Local and remote loopbacks

  — Programmable loopback time-out

— Alarm status.

DS3 Low-Speed (BBG4/4B)

- Electrical Specification

  The low-speed DS3 interface transmits/receives a standard electrical DS3 signal as specified in *ANSI* T1.102-1993, Section 5 [44.736 Mb/s rate, DSX-3 interconnect specification, bipolar 3-zero substitution (B3ZS) encoding]. However, the signal does not have to contain a standard DS3 frame.

  Line buildout is provisionable as follows:

  — 734A/D: 0 to 450 ft.

  — 735A: 0 to 250 ft.

- Format Specification

  The DS3 low-speed interface provides clear channel transport of any DSX-3 compatible signal (M13 mode, framed clear channel, unframed clear channel). Thus, there are no format requirements on this interface.

- Alarm Thresholding

  The following parameters are monitored at the DS3 interface to the DSX-3:

  — Loss of signal (LOS)

  — Line coding violations (CV-L).

The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN, or status. B3ZS coding violation failure threshold is user settable to 10^{-3} or 10^{-6} BER.

- Performance Monitoring (see Table 10-23)

  — DS3 parity errors (P-Bits)

  — Severely errored frame seconds (SEFS).

  If provisioned in the violation monitor and removal (VMR) or violation monitor (VM) modes (Table 10-3), DS3 P-bit violations and SESF are counted and the counts are thresholded to flag detected performance degradation of the DS3 signal incoming from the fiber.

Table 10-3. DS3 Interface Modes

	Monitor P-Bits	Correct P-Bits
VMR mode	Yes	Yes
VM mode	Yes	No
CC mode	No	No

- Enhanced DS3 Performance Monitoring (see Table 10-23)
  - — CV-P Coding Violations

    These errors are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode. When the F&M bit or C-bit option (C-bit is Release 8.0 and later releases) is selected, network elements could be provisioned in VMR or VM mode. See Table 10-4.
  - — Errored Seconds (ES-P)
  - — Severely Errored Seconds (SES-P)
  - — Unavailable Seconds (UAS-P)
  - — Severely Errored Frame Seconds (SEFS)
  - — CV-L Coding Violations Line (Release 7.2 and later)
  - — ES-L Errored Seconds (Release 7.2 and later)
  - — SES-L Severely Errored Seconds Line (Release 7.2 and later)

Table 10-4. Enhanced DS3 Performance Monitoring Modes

Mode	PM Option	Monitor P-Bits	Monitor F&M Bits	Monitor C-Bits	Correct P-Bits	Correct F&M Bits	Correct C-Bits	Monitor Line PM
VMR	P-bit	Yes	No	No	Yes	No	No	Yes
VMR	F&M-bit	No	Yes	No	Yes	No	No	Yes
VMR	C-bit	No	No	Yes	Yes	No	No	Yes
VM	P-bit	Yes	No	No	No	No	No	Yes
VM	F&M-bit	No	Yes	No	No	No	No	Yes
VM	C-bit	No	No	Yes	No	No	No	Yes
CC	P-bit	No	No	No	No	No	No	Yes
CC	F&M-bit	No	No	No	No	No	No	Yes
CC	C-bit	No	No	No	No	No	No	Yes

EC-1 High-Speed and Low-Speed (BBG6)

- Electrical Specification

  The EC-1 high-speed and low-speed interface transmits and receives a standard electrical EC-1 signal as specified in *ANSI* T1.102-1993 (51.844 Mb/s rate, STSX-1 interconnect specification, bipolar 3-zero substitution ([B3ZS] encoded and scrambled).

  Line buildout is provisionable as follows:

  — 734A/D: 0 to 450 ft.

  — 735A: 0 to 250 ft.

- Format Specification

  The EC-1 high-speed port interfaces with an EC-1 signal compatible with the electrical STS-1 interface specification in *ANSI* T1.102 and containing a VT1.5 structured STS-1 with an asynchronous DS1 mapping. The EC-1 high-speed interface provides both line and STS-1 path termination functions.

  The EC-1 low-speed interface provides clear channel transport of any STS-1 signal compatible with the electrical STS-1 interface specification in *ANSI* T1.102. The EC-1 low-speed port can be provisioned to provide the path termination functions for a VT1.5 structured STS-1 with an asynchronous DS1 mapping.

- Alarm Thresholding

  The following parameters are monitored at the EC-1 interface to the STSX-1:

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line alarm indication signal (AIS)

  — B2 thresholding signal fail

  — B2 thresholding signal degrade.

  The alarm level for each of the monitored parameters can be provisioned for CR, MJ, MN, or status. B2 signal degrade thresholds are user settable in the range from 10^{-6} to 10^{-9} BER.

- Performance Monitoring (see Table 10-23)

  — EC-1 line performance monitoring.

DS3 Data Services Interface (BBG19)

- Electrical Specification

  The low-speed DS3 interface transmits/receives a standard electrical DS3 signal as specified in *ANSI* T1.102-1993, Section 5 (44.736 Mb/s rate, DSX-3 interconnect specification, bipolar 3-zero substitution [B3ZS] encoding). However, the signal does not have to contain a standard DS3 frame.

  LBO is provisionable as follows:

  — 734A/D: 0 to 450 ft.

  — 735A: 0 to 250 ft.

- Format Specification

  The DS3 low-speed interface provides clear channel transport of any DSX-3 compatible signal (M13 mode, framed clear channel, unframed clear channel). Thus, there are no format requirements on this interface.

- Alarm Thresholding

  The following parameters are monitored at the DS3 interface to the DSX-3:

  — LOS

  — CV-L.

  The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN, or status. B3ZS coding violation failure threshold is user settable to 10^{-3} or 10^{-6} BER.

- Performance Monitoring (see Table 10-23)

  — DS3 parity errors (P-Bits)

  — SEFS.

  If provisioned in the VMR or VM modes (Table 10-3), DS3 P-bit violations and SESF are counted, and the counts are thresholded to flag detected performance degradation of the DS3 signal incoming from the fiber.

- Enhanced DS3 Performance Monitoring (see Table 10-23 and Table 10-4)

  The Enhanced DS3 PM for the BBG19 is the same as for the BBG4/BBG4B. Refer to the DS3 Low-Speed (BBG4/4B) Enhanced DS3 Performance Monitoring section for a list of parameters.

Transmultiplexer (BBG20)

- Electrical Specification

  The DS3 Transmux interface transmits/receives a standard electrical DS3 signal as specified in *ANSI* T1.102-1993, Section 5 [44.736 Mb/s rate, DSX-3 interconnect specification, bipolar 3-zero substitution (B3ZS) encoding].

  Line buildout is provisionable as follows:

  — 734A/D: 0 to 450 ft.

  — 735A: 0 to 250 ft.

- Format Specification

  The DS3 Transmux interface provides termination for DS3 signals in both M13 and C-bit parity formats.

- Alarm Thresholding

  The following parameters are monitored at the DS3 interface from the DSX-3:

  — Loss of signal (LOS)

  — Out Of Frame (OOF)

  — AIS

  — BER (based on P-bit or C-bit parity)

  The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN, or status. Coding violation failure threshold is user settable to 10^{-3} or 10^{-6} BER.

- Loopback

  — DS1 and DS3 terminal and facility loopback

- DS3 Line and Path (from DSX-3) Performance Monitoring (see Table 10-23)

  — DS3 parity errors (P-Bits, F&M Bits, C-bits) (CV-P)

  — Severely Errored Frame Seconds (SEFS)

  — Errored Seconds (ES-P)

  — Severely Errored Seconds (SES-P)

  — Unavailable Seconds (UAS-P)

  — Code Violations Line (CV-L)

  — Errored Seconds Line (ES-L)

  — Severely Errored Seconds Line (SES-L)

- DS1 Path Performance Monitoring (see Table 10-23)
  - CV-P
  - ES-P
  - SES-P
  - UAS-P
  - CV-PFE (Far-end ESF paths)
  - ES-PFE (Far-end ESF paths)
  - SES-PFE (Far-end ESF paths)
  - UAS-PFE (Far-end ESF paths)
- STS and VT Performance Monitoring (see Table 10-23)
  - All STS and VT PM is supported.

Lightguide Jumpers

The DDM-2000 Multiplexers provide Lucent's universal optical connector on all OLIUs. The universal optical connectors are receptacles on the faceplate of the OLIUs that allow a single OLIU to support either *ST*®, FC-PC, or SC connectors as needed. Both 0 dB and attenuating buildouts are supported.

The OC-1 and OC-3 lightguide interfaces use both single-mode and multimode jumpers for connecting to and from the outside plant *LGX*® panel and the DDM-2000 OC-3 Multiplexer.

When the outside plant lightguide is multimode, a single-mode or multimode jumper can be used between the *LGX* panel and the DDM-2000 OC-3 Multiplexer on the transmit (OUT) side. Multimode must be used on the receive (IN) side of all OLIUs.

When the outside plant lightguide is single-mode, a single-mode jumper must be used for the transmit side and either single-mode or multimode jumpers can be used for the receive side of all OLIUs (except the 24G-U/24H-U and 29G-U/29H-U which requires single-mode fiber on both the transmit and receive sides due to potential optical path degradations).

Regardless of the type of fiber in the outside plant, the 22D-U OLIUs, used for intershelf OC-3/OC-12 interconnection, must be used with multimode jumpers on the transmit side.

The 24G-U/24H-U and 29G-U/29H-U OLIU must be used with single mode fiber.

Lightguide jumpers can be ordered from Lucent. See the "OC-3 Ordering — Miscellaneous Equipment and Tools" section for ordering information.

Intermediate Reach OC-3 Interface (22F/22F-U/22F2-U OLIU)

- Optical Specification

  The 22F/22F-U/22F2-U OLIU photonics meet or exceed SONET intermediate reach specifications (TR 253-IR-1 MLM category). The multilongitudinal mode (MLM*) laser transmitter supplies an NRZ-coded signal. The PINFET receiver allows direct optical loopback without the use of an external attenuator.

  The 22F/22F-U/22F2-U OLIU intermediate reach OC-3 interface supports span lengths up to 33 km, assuming 0.45 dB/km single-mode fiber and the span engineering rules outlined in Table 10-8. Transmit and receive powers are referenced to Points S and R as shown in Figure 10-2. Table 10-7, Table 10-8, and Table 10-9 provide detailed specifications and link budget information for the 22F OLIU.

- Alarm Thresholding

  The following parameters are monitored at the OC-3 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2.

  — STS pointer justifications (Release 11.0 and later).

* A higher quality SLM laser may be used instead of an MLM laser.

Long Reach OC-3 Interface (22G-U/22G2-U/22G3-U/22G4-U OLIU)

- Optical Specification

  The multilongitudinal mode (MLM*) laser transmitter supplies an NRZ-coded signal. For direct optical loopbacks, at least 7.0 dB (use 10 dB attenuator, see Table 10-21) of attenuation is needed for the 22G-U. No attenuation is needed for the 22G2-U, 22G3-U, or 22G4-U.

  The 22G-U/22G2-U OLIU long reach OC-3 interface supports span lengths up to 51 km, assuming 0.45 dB/km single-mode fiber and the span engineering rules outlined in Table 10-8. Transmit and receive powers are referenced to Points S and R as shown in Figure 10-2. Table 10-7, Table 10-8, and Table 10-9 provide detailed specifications and link budget information for the 22G-U/22G2-U OLIU.

  The 22G3-U/22G4-U OLIU is a SONET compliant long reach OC-3 interface supporting span lengths up to 55 km, assuming 0.45 dB/km single-mode fiber and the span engineering rules outlined in Table 10-8. Transmit and receive powers are referenced to Points S and R as shown in Figure 10-2. Table 10-7, Table 10-8, and Table 10-9 provide detailed specifications and link budget information for the 22G3-U/22G4-U OLIU.

- Alarm Thresholding

  The following parameters are monitored at the OC-3 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2.

  — STS pointer justifications (Release 11.0 and later).

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* A higher quality SLM laser may be used instead of an MLM laser.

Long Reach OC-12 Interface (24G-U)

- Optical Specification

  The distributed feedback laser supplies a NRZ-coded signal. For direct optical loopbacks, at least 15 dB of optical attenuation is needed for the 24G-U.

  The 24G-U OLIU long reach OC-12 interface supports span lengths up to 51 km, assuming 0.45 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 10-11. Transmit and receive powers are referenced to points S and R as shown in Figure 10-2. Table 10-10 and Table 10-11 provide detailed specifications and link budget information for the 24G-U OLIU. Note that the 24G-U OLIU is not specified to operate over multimode fiber.

- Alarm Thresholding

  The following parameters are monitored at the OC-12 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2.

  — STS pointer justifications (Release 11.0 and later).

Long Reach OC-12 Interface (24H-U)

- Optical Specification

  The distributed feedback laser supplies a NRZ-coded signal. For direct optical loopbacks, at least 10 dB of optical attenuation is needed for the 24H-U.

  The 24H-U OLIU long reach OC-12 interface supports span lengths up to 96 km, assuming 0.25 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 10-11. Transmit and receive powers are referenced to points S and R as shown in Figure 10-2. Table 10-10 and Table 10-11 provide detailed specifications and link budget information for the 24H-U OLIU. Note that the 24H-U OLIU is not specified to operate over multimode fiber.

- Alarm Thresholding

  The following parameters are monitored at the OC-12 interface.

  - Loss of signal (LOS)
  - Loss of frame (LOF)
  - Loss of pointer (LOP)
  - Line AIS
  - B2 thresholding signal fail
  - B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  - Section SEFS
  - Line parameter B2.
  - STS pointer justifications (Release 11.0 and later).

Intraoffice (IS-3) OC-3 Rate Interface (22D-U OLIUs)

- Optical Specification

  The 22D-U OLIUs are short-reach optical interfaces used to interconnect between the DDM-2000 OC-3 and OC-12 Multiplexers. The nominal line rate is 155.520 Mb/s. The LED transmitter supplies an NRZ-coded signal.

  Table 10-5, Table 10-6, and Table 10-9 provide detailed specifications and link budget information for the 22D-U OLIUs.

- Alarm Thresholding

  The following parameters are monitored at the OC-3 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — B2 parameters.

  — STS pointer justifications (Release 11.0 and later)
  22-type only.

Long Reach OC-1 Interface (26G2-U/27G-U/27G2-U OLIU)

- Optical Specification

  The multilongitudinal mode (MLM*) laser transmitter supplies an NRZ-coded signal. For direct optical loopbacks, at least 13.8 dB (use 15.0 dB, attenuator, see Table 10-21) of attenuation is needed for the 26G2-U/27G-U/27G2-U.

  The 26G2-U/27G-U/27G2-U OLIU long reach OC-1 interface supports span lengths up to 44 km, assuming 0.45 dB/km single-mode fiber and the span engineering rules outlined in Table 10-13. Transmit and receive powers are referenced to Points S and R as shown in Figure 10-2. Table 10-12, Table 10-13, and Table 10-14 provide detailed specifications and link budget information for the 26G2-U/27G-U/27G2-U OLIU.

- Alarm Thresholding

  The following parameters are monitored at the OC-1 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2

  — STS pointer justifications (Release 11.0 and later).

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* A higher quality SLM laser may be used instead of an MLM laser.

Long Reach OC-12 Interface (29G-U)

- Optical Specification

  The distributed feedback laser supplies a NRZ-coded signal. For direct optical loopbacks, at least 10 dB of optical attenuation is needed for the 29G-U.

  The 29G-U OLIU long reach OC-12 interface supports span lengths up to 51 km, assuming 0.45 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 10-16 Transmit and receive powers are referenced to points S and R as shown in Figure 10-2. Table 10-15 and Table 10-16 provide detailed specifications and link budget information for the 29G-U OLIU. Note that the 29G-U OLIU is not specified to operate over multimode fiber.

- Alarm Thresholding

  The following parameters are monitored at the OC-12 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2.

  — STS pointer justifications (Release 15.0 and later).

Long Reach OC-12 Interface (29H-U)

- Optical Specification

  The distributed feedback laser supplies a NRZ-coded signal. For direct optical loopbacks, at least 10 dB of optical attenuation is needed for the 29H-U.

  The 29H-U OLIU long reach OC-12 interface supports span lengths up to 96 km, assuming 0.25 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 10-16 Transmit and receive powers are referenced to points S and R as shown in Figure 10-2. Table 10-15 and Table 10-16 provide detailed specifications and link budget information for the 29H-U OLIU. Note that the 29H-U OLIU is not specified to operate over multimode fiber.

- Alarm Thresholding

  The following parameters are monitored at the OC-12 interface.

  — Loss of signal (LOS)

  — Loss of frame (LOF)

  — Loss of pointer (LOP)

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade. (B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.)

- Performance Monitoring (see Table 10-23)

  — Section SEFS

  — Line parameter B2.

  — STS pointer justifications (Release 15.0 and later).

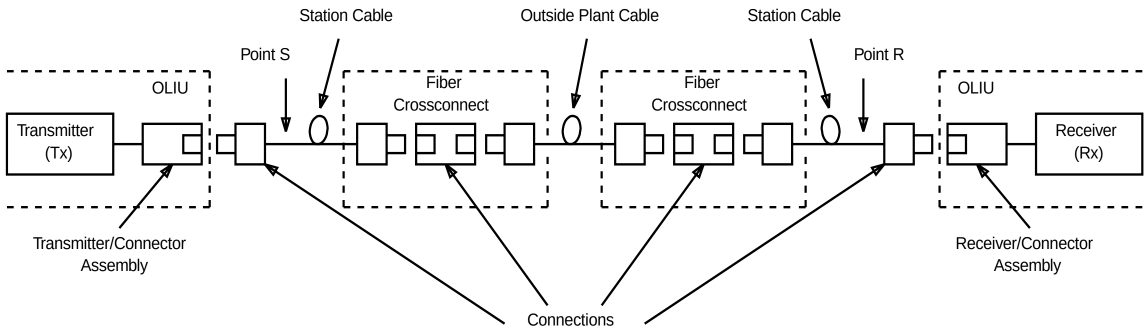

Figure 10-2. Optical System Interfaces (Points S and R)

Table 10-5 lists the 22D-U OLIU specifications.

Table 10-5. 22D-U OLIU Specifications

System Information:		
Terminal Equipment Identification Optical Line Rate (Mb/s) Optical Line Coding Optical Wavelength Performance	155.520 Mb/s Scrambled NRZ 1310 nm SONET LR-1 (Long Reach)	22D-U OLIU 155.520 Mb/s Scrambled NRZ 1310 nm Not applicable
Transmitter Information:		
Optical Device Temperature Controller FDA Classification Optical Source	Class I InGaAsP Laser, MLM* Structure	No TEC Class I LED Lucent *ST* UOC buildout assembly† (22D-U) Multimode
Receiver Information:		
Optical Device Temperature Controller Optical Detector Faceplate Optical Connector	None InGaAsP PIN	None InGaAsP PIN UOC buildout assembly †(22D-U) Multimode

* A higher quality SLM laser may be used instead of the MLM.

† The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 10-6. 22D-U OLIU Link Budgets

Parameter (Note 1)	22D-U
Minimum Wavelength (l_{Tmin})	1270/1260* nm
Maximum Wavelength (λ_{Tmax})	1380 nm
Spectral Width ($\delta\lambda_{rms}$)	170 nm ¶¶
Maximum Transmitter Power (P_{Tmax})	–14.0 dBm
Minimum Transmitter Power (P_{Tmin})	–18.8/–21.8 dBm
Maximum Received Power (P_{Rmax})	–14.0 dBm
Minimum Received Power (P_{Rmin})	–33.8/–31.8* dBm
Minimum System Gain (S-R)‡	15/10.0* dB
Optical Path Penalty (P_O)§	1.6 dB
Connector Loss¶	1.5 dB
Unallocated Margin**	2.0 dB
Minimum Loss Budget	0.0 dB
Maximum Loss Budget‡‡	9.9/4.9* dB
Maximum Span Length§§	

Notes:

1. All terminology is consistent with TR-253, Issue 2.

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* When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions.

† Transmit and receive powers are referenced to points S and R as shown in Figure 10-2.

‡ The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

§ Optical path penalty includes 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 typically specified from 0 dB to 3 dB.

†† If the loss budget is less than 6.0 dB, use low power. Includes a 1.5 dB safety margin.

‡‡ Budget available for both station and transmission cable and splices.

§§ Attenuation and dispersion can be the limiting factors in span length. For OC-3 single-mode fiber systems, dispersion is not a factor and all applications are attenuation limited. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

¶¶ Full width at half maximum (FWHM) spectral width.

*** 1.0 nm for a SLM laser.

Table 10-7 lists the 22F/22F-U/22F2-U and 22G-U/22G2-U/22G3-U/22G4-U OLIU specifications.

Table 10-7. 22F/22F-U/22F2-U and 22G-U/22G2-U/22G3-U/22G4-U OLIU Specifications

System Information:			
Terminal Equipment Identification	22F/22F-U/22F2-U OLIU	22G-U/22G2-U OLIU	22G3-U/22G4-U OLIU
Optical Line Rate (Mb/s)	155.520 Mb/s	155.520 Mb/s	155.520 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ	Scrambled NRZ
Optical Wavelength	1310 nm	1310 nm	1310 nm
Performance	SONET IR-1 MLM (Intermediate Reach)	Not applicable	SONET LR-1 (Long Reach)
Transmitter Information:			
Optical Device Temperature Controller	No TEC	No TEC	No TEC
FDA Classification	Class I	Class I	Class I
Optical Source	InGaAsP Laser, MLM* Structure	InGaAsP Laser, MLM* Structure	InGaAsP Laser, MLM* Structure
Faceplate Optical Connector	Lucent *ST* (Integral to transmitter) Single Mode	UOC buildout assembly† Single Mode	UOC buildout assembly† Single Mode
Receiver Information:			
Optical Device Temperature Controller	None	None	None
Optical Detector	InGaAsP PIN	InGaAsP PIN (22G-U)	InGaAs PIN
Faceplate Optical Connector	Lucent *ST* C2000-A-2 (22F)22F-U/22F2-U	InGaAs PIN (22G2-U) UOC buildout assembly† Multimode	UOC buildout assembly† Multimode

* A higher quality SLM laser may be used instead of the MLM. The 22G4-U OLIU uses the SLM laser.

† The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 10-8. 22F/22F-U/22F2-U, 22G-U, 22G2-U, 22G3-U, and 22G4-U OLIU Link Budgets

Parameter (Note)	22F/22F-U/ 22F2-U	22G-U	22G2-U	22G3-U	22G4-U*
Minimum Wavelength (λ_{Tmin})	1260 nm	1272 nm	1272 nm	1280 nm	1280 nm
Maximum Wavelength (λ_{Tmax})	1360 nm	1350 nm	1350 nm	1335 nm	1335 nm
Spectral Width ($\delta\lambda_{rms}$)	7.7 nm	3.0 nm	3.0 nm	4.0 nm	1.0 nm ¶¶
Maximum Transmitter Power† (P_{Tmax})	–8.0 dBm	0.0 dBm	0.0 dBm	0.0 dBm	0.0 dBm
Minimum Transmitter Power (P_{Tmin})	–15.0 dBm	–7.0 dBm	–7.0 dBm	–5.0 dBm	–5.0 dBm
Maximum Received Power (P_{Rmax})	–7.0 dBm	–7.0 dBm	0.0 dBm	0.0 dBm	0.0 dBm
Minimum Received Power (P_{Rmin})	–34.0 dBm	–34.0 dBm	–34.0 dBm	–34.0 dBm	–34.0 dBm
Minimum System Gain (S-R)‡	19.0 dB	27.0 dB	27.0 dB	29.0 dB	29.0 dB
Optical Path Penalty (P_O)§	1.0 dB	1.0 dB	1.0 dB	1.0 dB	1.0 dB
Connector Loss¶	1.5 dB	1.5 dB	1.5 dB	1.5 dB	1.5 dB
Unallocated Margin**	1.5 dB	1.5 dB	1.5 dB	1.5 dB	1.5 dB
Minimum Loss Budget	0.0 dB	7.0 dB	0.0 dB	0.0 dB	0.0 dB
Maximum Loss Budget‡‡	**15.0 dB**	**23.0 dB**	**23.0 dB**	**25.0 dB**	**25.0 dB**
Maximum Span Length§§	33 km	51 km	51 km	55 km	55 km

Note: All terminology is consistent with TR-253, Issue 2. All specifications for the 22F OLIU meet or exceeds intermediate reach (IR) values described in TR-253, Issue 2.

* The 22G4-U OLIU is fully compliant with SONET long reach applications. It is fully compatible with the 22F-type, 22G-U, 22G2-U, and 22G3-U OLIUs and will replace them.

† Transmit and receive powers are referenced to points S and R as shown in Figure 10-2.

‡ The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

§ Optical path penalty includes 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 typically specified from 0 dB to 3 dB.

‡‡ Budget available for both station and transmission cable and splices.

§§ Attenuation and dispersion can be the limiting factors in span length. For OC-3 single-mode fiber systems, dispersion is not a factor and all applications are attenuation limited. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

¶¶ 1.0 nm for a SLM laser.

Table 10-9. OC-3 OLIU Link Budget - Multimode Operation

	Maximum Span Length (km)		
Fiber Bandwidth	22F/22F-U/ 22F2-U (Note 1)	22D-U (Note 2)	22G/22G-U/ 22G2-U/22G3-U/ 22G4-U(Note 3)
1000 MHz-km	6.5	3.6/3.4	6.5
800 MHz-km	5.1	3.4/3.3	5.1
500 MHz-km	3.1	2.7	3.1
300 MHz-km	1.8	1.9	1.8

Notes:

1. Maximum 22F-type MM Link Budget (dB) for multimode operation is 12.0 dB.
2. When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions
3. The 22G4-U will replace the 22F-type and the 22G/22G-U/22G2-U and 22G3-U OLIUs.

The system is dispersion limited for all the fiber bandwidths listed in Table 10-9.

Multimode fiber operation on the DDM-2000 OC-3 Multiplexer requires a minimum exit bandwidth of 120 MHz to ensure that dispersion loss is kept below acceptable levels. If the fiber is already installed and the exit bandwidth is measured to be 120 MHz or greater, then the maximum link budget values (see Notes 1 and 2) can be used to determine if the loss budget is sufficient for that fiber.

If planning a new fiber installation, the values at the end of the table, given for a number of commercially available fiber bandwidth-distance products, can be used. Fiber distances are calculated using the 120 MHz exit bandwidth limit; however, actual exit bandwidths may be higher for these distances due to the existence of splices. This may permit longer span lengths to be achieved, for the given fiber bandwidths, than those specified in the table. In this case, however, the span length can only be increased to the point where the system is loss limited as specified by the maximum multimode link budget given in the table (1 dB/km cable is assumed).

Table 10-10. 24G-U/24H-U OLIU Specifications

System Information:		
Terminal Equipment Identification	24G-U OLIU	24H-U OLIU
Optical Line Rate (Mb/s)	622.080 Mb/s	622.080 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength (nm)	1310 nm	1550 nm
Performance	SONET LR-1 DFB (Long Reach)	SONET LR-1 DFB (Long Reach)
Transmitter Information:		
Optical Device Temperature Controller	None	None
FDA Classification	Class I	Class I
Optical Source	InGaAsP Laser, SLM Structure	InGaAsP Laser, SLM Structure
Faceplate Optical Connector	UOC Buildout Assembly (single-mode) *	UOC Buildout Assembly (single-mode) *
Receiver Information:		
Optical Device Temperature Controller	None	None
Optical Detector	InGaAs PIN	InGaAs PIN
Faceplate Optical Connector	UOC Buildout Assembly (multi-mode) *	UOC Buildout Assembly (multi-mode) *

*The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 10-11. 24G-U/24H-U OLIU Link Budgets (Notes)

Parameter	24G-U	24G-U (S1:2)	24H-U
Minimum Wavelength (λ_{Tmin})	1280 nm	1280 nm	1530 nm
Maximum Wavelength (λ_{Tmax})	1335 nm	1335 nm	1570 nm
Spectral Width ($\delta\lambda_{20}$)	1.0 nm	1.0 nm	1.0 nm
Maximum Transmitter Power ∗(P_{Tmax})	+1.9 dBm	+1.9 dBm	+2.0 dBm
Minimum Transmitter Power (P_{Tmin})	–3.0 dBm	–2.5 dBm	–2.5 dBm
Maximum Received Power (P_{Rmax})	–8.0 dBm	–8.0 dBm	–8.0 dBm
Minimum Received Power (P_{Rmin})	–30.0 dBm	–30.5 dBm	–31.0 dBm
Minimum System Gain (S-R) †	27.0 dB	28.0 dB	28.5 dB
Optical Path Penalty (P_O) ‡	1.0 dB	1.0 dB	1.0 dB
Connector Loss §	1.5 dB	1.5 dB	1.5 dB
Unallocated Margin ¶	1.5 dB	1.5 dB	2.0 dB
Minimum Loss Budget ∗∗	10.0 dB	10.0 dB	10.0 dB
Maximum Loss Budget ††	**23.0 dB**	**24.0 dB**	**24.0 dB**
Maximum Span Length ‡‡	51 km	51 km	96 km

Notes:

1. All terminology is consistent with TR-253, Iss. 2. All values are worst-case end of life.
2. All specifications for the 24G-U/24H-U meet or exceed long reach (LR) values described in TR-253, Iss. 2.

∗ Transmit and receive powers are referenced to points S and R as shown in Figure 10-2.

† The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

‡ Optical path penalty includes effects of dispersion, reflection and jitter that occur on the optical path. The 24G-U has 4.0 dB of total margin. Optical path penalty is normally 1.0 dB. The 24H-U has 4.5 dB of total margin. Optical path penalty is normally 1.0 dB, which implies 1800 psec/nm total dispersion. Typical nondispersion fiber has 10 psec/nm km dispersion in the 1550 nm wavelength range.

Notes (Continued):

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

** The 24G-U/24H-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 10 dB.

†† Budget available for both station and transmission cable and splices.

‡‡ Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1310 nm wavelength range is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber in the 1310 nm range.

For the 24G-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 24G-U is 51 km.

Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1550 nm wavelength range is 0.25 dB/km, including cable and splice loss.

For the 24H-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 24H-U is 96 km.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

Table 10-12, Table 10-13, and Table 10-14 lists the 26G2-U/27G-U/27G2-U OLIU specifications and link budgets.

Table 10-12. 26G2-U/27G-U/27G2-U OLIU Specifications

System Information:	
Terminal Equipment Identification	26G2-U/27G-U/27G2-U OLIU
Optical Line Rate (Mb/s)	51.84 Mb/s
Optical Line Coding	Scrambled NRZ
Optical Wavelength	1310 nm
Performance	Not applicable
Transmitter Information:	
Optical Device Temperature Controller	No TEC
FDA Classification	Class I
Optical Source	InGaAsP Laser, MLM* Structure
Faceplate Optical Connector	UOC buildout assemble† Single Mode
Receiver Information:	
Optical Device Temperature Controller	None
Optical Detector	InGaAsP PIN
Faceplate Optical Connector	UOC buildout assemble† Multimode

* A higher quality SLM laser may be used instead of the MLM laser.

† The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 10-13. 26G2-U/27G-U/27G2-U OLIU Link Budgets (Note)

Parameter	Value
Minimum Wavelength (λ_{Tmin})	1272 nm
Maximum Wavelength (λ_{Tmax})	1350 nm
Spectral Width ($\delta\lambda_{rms}$)	3.0 nm
Maximum Transmitter Power (P_{Tmax}) *	–0.0 dBm
Minimum Transmitter Power (P_{Tmin}) *	–7.0 dBm
Maximum Received Power (P_{Rmax})	–13.8 dBm
Minimum Input Power (P_{Rmin})	–30.8 dBm
Minimum System Gain (S-R)‡	23.8 dB
Optical Path Penalty (P_O) †	1.0 dB
Connector Loss ‡	1.5 dB
Unallocated Margin	1.5 dB
Minimum Loss Budget	13.8 dB
Maximum Loss Budget	**19.8 dB**
Maximum Span Length§	44 km
Note: All values are for both controlled and uncontrolled environmental conditions.	

* Transmit and receive powers are referenced to points S and R as shown in Figure 10-2.

† Optical path penalty includes 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.

§ The 26G2-U/27G-U/27G2-U OLIUs are dispersion limited at 44 km, due to the wider wavelength range. Assuming fiber with zero dispersion wavelength between 1300 and 1320 nm, the worst case dispersion over the transmitter wavelength range of 1272 to 1350 nm is 4.88 psec/nm km. This implies a 44 km span would have a total dispersion of about 215 psec/nm.

Table 10-14. 26G2-U/27G-U/27G2-U OLIU Link Budgets — Multimode Operation (Notes)

Fiber Bandwidth	Maximum Span Length (km)
1000 MHz-km	19.8
800 MHz-km	19.8
500 MHz-km	19.8
300 MHz-km	13.6

Notes:

1. The maximum Link Budget loss is 19.8 dB
2. Multimode fiber operation requires a minimum exit bandwidth of 44 MHz to ensure that dispersion loss is kept below acceptable levels. If the fiber is already installed and the exit bandwidth is measured to be 44 MHz or greater, then the maximum link budget values can be used to determine if the loss budget is sufficient for that fiber.
3. If planning a new fiber installation, the values given in the table (given for a number of commercially available fiber bandwidth-distance products) can be used. Fiber distances are calculated using the 44 MHz exit bandwidth limit; however, actual exit bandwidths may be higher for these distances due to the existence of splices. This may permit longer span lengths to be achieved for the given fiber bandwidths than those specified in the table. In this case, however, the span length can only be increased to the point where the system is loss limited as specified by the maximum multimode link budget given in the table (1 dB/km cable is assumed).

Table 10-15. 29G-U/29H-U OLIU Specifications

System Information:		
Terminal Equipment Identification	29G-U OLIU	29H-U OLIU
Optical Line Rate (Mb/s)	622.080 Mb/s	622.080 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength (nm)	1310 nm	1550 nm
Performance	SONET LR-1 DFB (Long Reach)	SONET LR-1 DFB (Long Reach)
Transmitter Information:		
Optical Device Temperature Controller	None	None
FDA Classification	Class I	Class I
Optical Source	InGaAsP Laser, SLM Structure	InGaAsP Laser, SLM Structure
Faceplate Optical Connector	UOC Buildout Assembly (single-mode) *	UOC Buildout Assembly (single-mode) *
Receiver Information:		
Optical Device Temperature Controller	None	None
Optical Detector	InGaAs PIN	InGaAs PIN
Faceplate Optical Connector	UOC Buildout Assembly (multi-mode) *	UOC Buildout Assembly (multi-mode) *

* The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or FC-type connectors.

Table 10-16. 29G-U/29H-U OLIU Link Budgets (Notes)

Parameter	29G-U	29H-U
Minimum Wavelength (λ_{Tmin})	1280 nm	1530 nm
Maximum Wavelength (λ_{Tmax})	1335 nm	1570 nm
Spectral Width ($\delta\lambda_{20}$)	1.0 nm	1.0 nm
Maximum Transmitter Power ∗(P_{Tmax})	+1.9 dBm	+2.0 dBm
Minimum Transmitter Power (P_{Tmin})	–2.5 dBm	–2.5 dBm
Maximum Received Power (P_{Rmax})	–8.0 dBm	–8.0 dBm
Minimum Received Power (P_{Rmin})	–30.5 dBm	–31.0 dBm
Minimum System Gain (S-R) †	28.0 dB	28.5 dB
Optical Path Penalty (P_O) ‡	1.0 dB	1.0 dB
Connector Loss §	1.5 dB	1.5 dB
Unallocated Margin ¶	1.5 dB	2.0 dB
Minimum Loss Budget ∗∗	8.0 dB	10.0 dB
Maximum Loss Budget ††	**24.0 dB**	**24.0 dB**
Maximum Span Length ‡‡	51 km	96 km

Notes:

1. All terminology is consistent with TR-253, Iss. 2. All values are worst-case end of life.
2. All specifications for the 29G-U/29H-U meet or exceed long reach (LR) values described in TR-253, Iss. 2.

∗ Transmit and receive powers are referenced to points S and R as shown in Figure 10-2.

† The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

‡ Optical path penalty includes effects of dispersion, reflection and jitter that occur on the optical path. The 29G-U has 4.0 dB of total margin. Optical path penalty is normally 1.0 dB. The 29H-U has 4.5 dB of total margin. Optical path penalty is normally 1.0 dB, which implies 1800 psec/nm total dispersion. Typical nondispersion fiber has 10 psec/nm km dispersion in the 1550 nm wavelength range.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

Table 10-16. 29G-U/29H-U OLIU Link Budgets (Notes) (Contd)

¶ Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

** The 29G-U/29H-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 10 dB.

†† Budget available for both station and transmission cable and splices.

‡‡ Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1310 nm wavelength range is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber in the 1310 nm range.

For the 29G-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 29G-U is 51 km.

Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1550 nm wavelength range is 0.25 dB/km, including cable and splice loss.

For the 29H-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 29H-U is 96 km.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

OC-3 Optical Interface Mixing

Mixing different OC-3 rate OLIUs at opposite ends of an optical link is often necessary for technical reasons or for convenience. The following information will aid in planning and engineering optical links having different types of OC-3 rate OLIUs at each end of the fiber. Table 10-17 details the minimum link budget necessary for each pairing of OC-3 rate OLIUs.

To use Table 10-17, locate the number at the intersection of the transmitter/receiver pair of interest. This number is the minimum attenuation necessary for proper operation of that transmitter/receiver pair. The link must have at least this much attenuation either from fiber loss, splice loss, connector loss, external attenuators, or a combination of these, or the receiver will be overdriven and the link will not operate properly.

Table 10-17. OC-3 Rate OLIU Mixes - Minimum Link Budgets (dB)

	Receiver				
Transmitter	**22F**	**22G-U***	**22G2-U 22G3-U 22G4-U**	**22D-U (Ctrld/ Unctrld Env.)**	**22F-U/ 22F2-U**
22F	0.0	0.0	0.0	6.0	0.0
22F-U/22F2-U	0.0	0.0	0.0	6.0	0.0
22G-U*	7.0	7.0	0.0	14.0	0.0
22G2-U	7.0	7.0	0.0	14.0	0.0
22D-U (ctrld./ unctrld. env.)	0.0	0.0	0.0	0.0	0.0

*The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and therefore should follow the same optical mixing rules.

The minimum link budget is not always symmetrical. A transmitter/receiver pair may have one minimum link budget in one direction and another in the opposite direction.

When using universal optical buildout attenuators for OLIUs equipped with Universal Optical Connectors (for example, 22G-U and 22D-U), the buildout must have the same type fiber on both sides, that is, single-mode to single-mode or multimode to multimode. The buildout must also match the mode of the fiber. Therefore, when a single-mode jumper is used, the buildout would be on the transmit side (OUT) of the OLIU and when a multimode jumper is used, the buildout would be on the receive side (IN) of the OLIU. When using in-line attenuators for non-U OLIUs, place the attenuator in the bay frame PANDUIT. Make sure that the mode type of the attenuator matches the mode of the fiber to ensure proper attenuation.

Table 10-18 details the maximum link budgets for each pairing of OC-3 rate OLIUs when operating on single-mode (SM) fiber. These numbers give the maximum attenuation acceptable for proper operation of each transmitter/receiver pair. The link must have no more than this much attenuation either from fiber loss, splice loss, connector loss, external attenuators or a combination of these or the link will not operate properly. The maximum link budgets for SM fiber were calculated using the following margins:

- Optical Path Penalty (dB) 1.0
- Connector Loss (dB) 1.5

Table 10-18. OC-3 Rate OLIU Mixes - Maximum Link Budgets for SM Fiber (dB)

	Receiver				
Transmitter	**22F**	**22G-U*/ 22G2-U**	**22D-U (Ctrld. Env.)**	**22D-U (Unctrld. Env.)**	**22G3-U 22G4-U**
22F	15.0	15.0	14.8	12.8	15.0
22G-U*/22G2-U	23.0	23.0	22.8	20.8	23.0
22D-U (ctrld. env.)	n/a	n/a	n/a	n/a	n/a
22D-U (unctrld. env.)	n/a	n/a	n/a	n/a	n/a
22G3-U/22G4-U	25.0	25.0	24.8	22.8	25.0

* The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and therefore should follow the same optical mixing rules.

The maximum link budget is not always symmetrical. A transmitter/receiver pair may have one maximum link budget in one direction and another in the opposite direction.

Table 10-19 details the maximum link budgets for each pairing of OC-3 rate OLIUs when operating on multimode (MM) fiber. These numbers give the maximum attenuation acceptable for proper operation of each transmitter/receiver pair. The link must have no more than this much attenuation either from fiber loss, splice loss, connector loss, external attenuators or a combination of these or the link will not operate properly. The maximum link budgets for MM fiber were calculated using the following margins. The first column of margins applies to any link where there is at least one OC-3 OLIU (22F or 22G-U/22G2-U). The second column of margins applies to links having two IS-3 (22D-U) OLIUs.

	At Least One OC-3 OLIU	**IS-3 OLIUs Only**
MM Optical Path Penalty (dB)	4.0	1.6
Connector Loss (dB)	1.5	1.5
Unallocated Margin (dB)	1.5	2.0

The maximum link budget is not always symmetrical. A transmitter/receiver pair may have one maximum link budget in one direction and another in the opposite direction.

Table 10-19. OC-3 Rate OLIU Mixes—Maximum Link Budgets for MM Fiber (dB)

	Receiver			
Transmitter	**22F**	**22G-U∗/ 22G2-U 22G3-U 22G4-U**	**22D-U (Ctrld. Env.)**	**22D-U (Unctrld. Env.)**
22G4-U	22.0	22.0	21.8	19.8
22F	12.0	12.0	11.8	9.8
22G-U∗/22G2-U	20.0	20.0	19.8	17.8
22D-U (ctrld. env.)	8.2	8.2	9.9	7.9
22D-U (unctrld. env.)	5.2	5.2	6.9	4.9

* The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and, therefore, should follow the same optical mixing rules.

Plug-In Maintenance Sparing Guidelines

Table 10-20 provides a guideline for determining the number of DDM-2000 OC-3 plug-in spares needed for a given number of plug-ins in the field. The sparing guide serves as an initial estimate and is calculated with the following assumptions:

- The method for calculating spares follows the procedure described in Telcordia Technologies TR-TSY-000385, Issue 1.
- The steady-state failure rate is assumed. Failure rates are based on the reliability prediction procedure (RPP) method described in TR-TSY-000332, Issue 4.
- The spare availability objective (SAO) is 99 percent. The SAO is the long-term probability that a spare plug-in is available when it is needed.
- A no-trouble-found (NTF) factor of 1.67 is multiplied to the failure rate. This accounts for replacements of plug-ins when actually no failure has occurred. The NTF factor is expected to approach 1.25 as the product matures. The likelihood of an NTF decreases as the product matures, and sparing needs will therefore diminish over time.
- Turnaround time of a returned plug-in is two weeks.

Table 10-20 shows how many plug-ins in the field can be supported by a given number of spares (NS).

Table 10-20. Sparing Guidelines

Plug-In Code	Number of Spares					
	NS=1	**NS=2**	**NS=3**	**NS=4**	**NS=5**	**NS=6**
BBF1 (DS1)	335	1029	1962	3038	4258	5502
BBF1B (DS1)	290	892	1701	2635	3693	4772
BBF2 (TGS)	91	280	534	826	1158	1497
BBF2B (TGS)	108	332	632	979	1373	1774
BBF2C (TGS)	106	327	623	965	1353	1748
BBF3 (DS1PM)	190	585	1116	1728	2472	3129
BBF3B (DS1PM)	202	621	1183	1833	2569	3319
BBF4 (TG3)	106	327	623	965	1353	1748
BBF5 (JUMPER)	—	—	—	—	—	—
BBF6 (T1EXT)	175	537	1024	1586	2223	2872
BBF8 (HDSL)	48	147	280	434	608	786
BBF9 (LAN)	122	376	717	1111	1557	2012
BBF10 (LAN)	110	337	642	994	1393	1800
BBG2 (MXRVO)	277	850	1620	2509	3517	4544
BBG2B (MXRVO)	304	935	1782	2760	3869	4999
BBG4 (DS3)	277	850	1620	2509	3517	4544
BBG4B (DS3)	236	726	1384	2143	3004	3882
BBG5 (SYSCTL)	47	145	277	428	600	776
BBG6 (STS1E EC-1)	114	349	666	1032	1447	1869
BBG7 (OHCTL)	73	223	426	659	924	1194
BBG8 (SYSCTL)	55	170	324	502	704	910
BBG8B (SYSCTL)	56	173	329	510	714	923
BBG9 (OHCTL)	61	188	358	554	777	1004
BBG10 (OHCTL)	57	174	331	513	719	930
BBG19 (DS3)	342	1051	2005	3105	4351	5623
BBG20 (TMUX)	38	117	223	346	484	626
22F (OLIU)	75	231	441	682	956	1236
22F2-U (OLIU)	123	377	719	1113	1560	2016
22D-U (OLIU)	127	391	746	1155	1619	2092

Table 10-20. Sparing Guidelines

Plug-In Code	Number of Spares					
	NS=1	**NS=2**	**NS=3**	**NS=4**	**NS=5**	**NS=6**
22G-U (OLIU)	87	266	507	786	1101	1423
22G2-U (OLIU)	80	245	467	724	1014	1311
22G3-U (OLIU)	61	188	358	555	778	1005
22G4-U (OLIU)	175	537	1025	1587	2225	2874
24G-U (OLIU)	120	368	703	1088	1525	1971
24H-U (OLIU)	104	321	612	948	1328	1716
26G-U (OLIU)	120	368	703	1088	1525	1971
26G2-U (OLIU)	99	303	579	896	1256	1623
27G-U (Dual OC-1 OLIU)	78	241	460	712	998	1289
27G2-U (Dual OC-1 OLIU)	88	271	518	802	1124	1452
29G-U (OLIU)	76	235	448	693	972	1256
29H-U (OLIU)	82	251	479	742	1040	1344
Fan Shelf	25	78	148	229	321	415
Fan Pack	125	383	731	1132	1586	2049

Universal Optical Connector Attenuators

The DDM-2000 OC-3 and OC-12 Multiplexers provide Lucent Technologies' universal optical connector (Figure 10-3) on all OLIUs. This connector is a two-part connector consisting of a faceplate-mounted block and an optical buildout. The faceplate block optionally supports an *ST*, SC, or FC-type optical buildout.

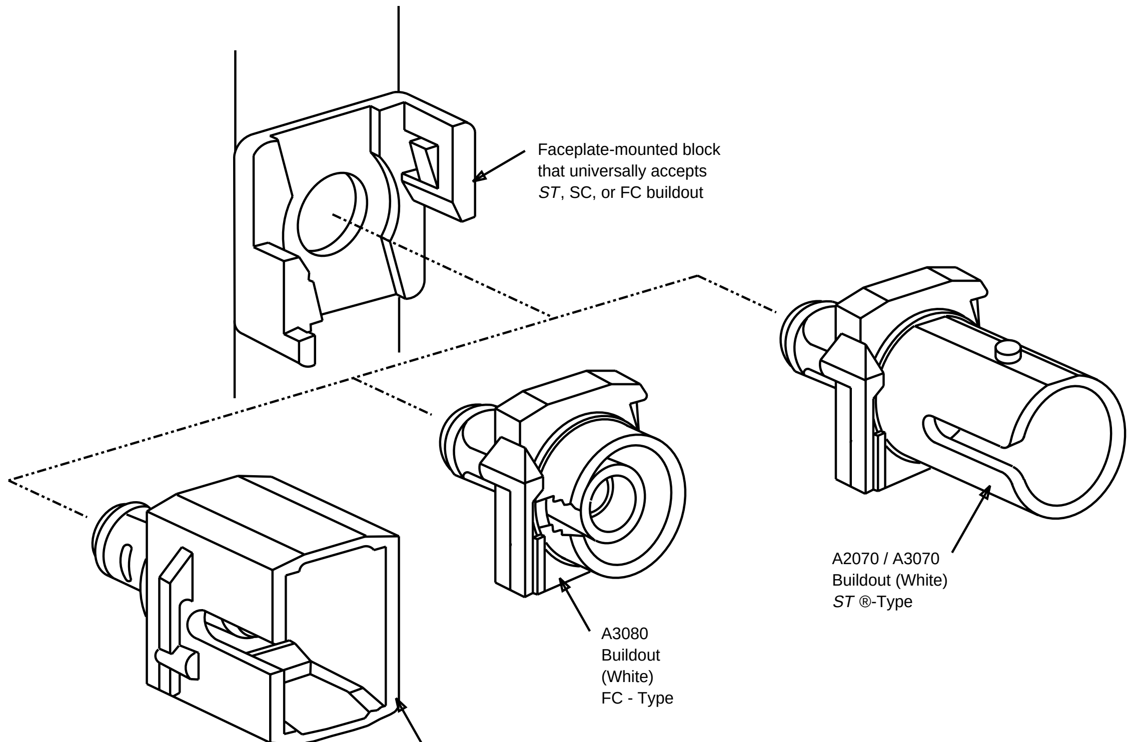

Figure 10-3. Universal Optical Connector

The 22G-U OLIU needs a 10 dB attenuator for loopback testing. The 26G2-U/27G-U/27G2-U OLIUs require a 15 dB attenuator for loopback testing.

A 0 dB SC-type connector is shipped installed on each OLIU. A 0 dB *ST*-type connector is shipped loose in the packaging with each OLIU. Optional SC, *ST*, or FC 0 dB or attenuated buildouts can be ordered separately as listed in Table 10-21. Table 10-21 lists single-mode (SM) and multimode (MM) attenuated buildouts.

Table 10-21. Universal Buildout Attenuators

Description	Connection	Loss (dB)	Comcode
A3010A *ST*® 0 dB buildout *	SM-SM	0	106312523
A3010B *ST* 5 dB buildout *	SM-SM	5	106312556
A3010C *ST* 10 dB buildout *	SM-SM	10	106312572
A3010D *ST* 15 dB buildout *	SM-SM	15	106312598
A3010E *ST* 20 dB buildout *	SM-SM	20	106312630
A3060 SC 0 dB buildout	SM-SM & MM-MM	0	106708951
A3060B1 SC 5 dB buildout	SM-SM	5	107406142
A3060D1 SC 10 dB buildout	SM-SM	10	107406159
A3060F1 SC 15 dB buildout	SM-SM	15	107406167
A3070 *ST*® 0 dB buildout	SM-SM & MM-MM	0	106795354
A3070B1 *ST* 5 dB buildout	SM-SM	5	107406183
A3070D1 *ST* 10 dB buildout	SM-SM	10	107406191
A3070F1 *ST* 15 dB buildout	SM-SM	15	107406209
A3080 FC 0 dB buildout	SM-SM & MM-MM	0	106795404
A3080B1 FC 5 dB buildout	SM-SM	5	107406225
A3080D1 FC 10 dB buildout	SM-SM	10	107406233
A3080F1 FC 15 dB buildout	SM-SM	15	107406241
A2060B SC 5 dB buildout	MM-MM	5	106795271
A2060D SC 10 dB buildout	MM-MM	10	106795289
A2060F SC 15 dB buildout	MM-MM	15	106795297
A2070B *ST* 5 dB buildout	MM-MM	5	106795313
A2070D *ST* 10 dB buildout	MM-MM	10	106795321
A2070F *ST* 15 dB buildout	MM-MM	15	106795339

* 23G and 23H only.

SONET Overhead Bytes

The DDM-2000 OC-3 Multiplexer currently uses the K2 byte in the SONET format for synchronization signaling. The reserved V4 byte in the VT1.5 superframe is used for internal fault detection in a DDM-2000 OC-3 Multiplexer shelf. This internal usage of the V4 byte may cause the value of the transmitted V4 byte to vary.

The DDM-2000 OC-3 Multiplexer does not depend on, and always ignores, the value of the V4 byte received from another DDM-2000 or other shelf with an OC-3 interface.

Performance

Wander/Jitter

- The OC-3 interface accommodates at least 10 microseconds of wander per 24-hour period without buffer overflow or depletion.
- For SONET optical interfaces, the maximum time interval error (MTIE) does not exceed 60 nanoseconds phase variation when timed with a wander-free reference
- Jitter transfer, tolerance, and generation requirements are met as specified in TR-253 and TR-499
- The SONET interfaces meet the T1.101 OC-N output short-term stability mask.

Signal Performance

The following specifications apply given the standard networks defined in TR-499, Issue 5.

- For systems interfacing at the DS1 rate, the number of errored seconds, during a 2-hour, one-way loopback test, is less than 10.
- For systems interfacing at the DS3 rate, the number of errored seconds, during a 2-hour, one-way loopback test, is less than 72.
- The BER is less than 10^{-9} for both the DS1 and DS3 rates. Burst-errored seconds are excluded.
- The frequency of burst-errored seconds, other than those caused by protection switching induced by hard equipment failures, averages less than 4 per day.

Synchronization

BBF2/BBF2B Synchronous Timing Generator (TGS)

The TGS circuit pack meets the specifications of GR-253-CORE, SONET Transport Systems Generic Criteria. The TGS circuit pack supports three timing modes:

- External timing: Locked to external Stratum 3 (±4.6 ppm) or better DS1 reference.
- Line-timing: Locked to recovered clock from an OC-N signal.
- Free-running: Timing derived from high-stability temperature-compensated voltage-controlled crystal oscillator (TCVCXO) with a long-term accuracy of ±15 ppm and temperature stability of ±8.8 ppm (–40°C to +75°C).

Holdover mode is entered on failure of external timing or line-timing reference, providing a temperature stability of ±8.8 ppm (–40°C to +75°C). Holdover capability for 24 hours will be better than ±4.6 ppm.

The DS1 timing output used for network synchronization (BBF2B only) provides long-term accuracy traceable to the OC-N signal.

SONET synchronization messaging is used to output DS1 AIS when clock traceability is lost (Release 5 and later). Jitter on the DS1 output is less than 0.06 unit interval peak-to-peak.

BBF4 Synchronous Timing Generator 3 (TG3)

The TG3 Stratum 3 circuit pack meets the specifications of GR-253-CORE, SONET Transport Systems Generic Criteria. The TG3 circuit pack supports three timing modes:

- External timing: Locked to external Stratum 3 (±4.6 ppm) or better DS1 reference.
- Line-timing: Locked to recovered clock from an OC-N signal.
- Free-running: Timing derived from high-stability temperature-compensated voltage-controlled crystal oscillator (TCVCXO) with a long-term accuracy of ±4.6 ppm and temperature stability of ±2 ppm.

Holdover mode is entered on failure of external timing or line-timing reference, providing a temperature stability of ±2 ppm (–40°C to +75°C) or ± .3 ppm (0°C to +70°C). Holdover capability for 24 hours will be better than ±.37 ppm.

The DS1 timing output used for network synchronization (BBF2B or BBF4) provides long-term accuracy traceable to the OC-N signal.

Protection Switching

Linear Networks

Automatic line switches are initiated by signal fail and signal degrade conditions on the received OC-3 signal and are completed within 50 milliseconds of a signal failure. This signal's BER is calculated from violations of the SONET line overhead B2 parity bytes. Signal fail is declared for incoming LOS, LOF, line AIS, or a BER exceeding 10^{-3}, while a BER exceeding a provisionable threshold between 10^{-5} and 10^{-9} causes a signal degrade to be declared.

Ring Networks

Path protection rings feed a SONET payload (STS or virtual tributary [VT]) from the ring entry point, simultaneously in both rotations of the ring, to the signal's ring exit point. The node that terminates the signal from the ring monitors both ring rotations and is responsible for selecting the signal that has the highest quality based on LOS, path AIS, and path BER performance. On pass-through paths, all detected hard failures (LOS, LOF, LOP, line AIS, STS-1 path AIS, or STS-1 path signal failure based on BER) result in VT AIS insertion in the outgoing signals. This allows the terminating node to be aware of the failure and to switch to protection. Protection switching is completed within 50 milliseconds of failure detection.

Under normal conditions, both incoming SONET path signals to the switch selection point are of high quality, and the signal can be selected from either ring. A failure or a transmission degradation on one of the rings requires that the other ring path be selected. Release 5.1 provides nonrevertive switching to minimize the impact on critical customer services by giving the service provider control, when and if, the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance.

Transient Performance

Power Loss Restart

After system shutdown due to power loss, the system will exhibit a 2-second error free transmission interval which begins within 1 minute of restoration of power.

Transmission Start-Up on Signal Application

The system, after having no signal applied for greater than 1 minute at the DSX-n interface, will exhibit a 2-second error free transmission interval which begins within 5 seconds of the reapplication of a signal.

Delay

Table 10-22 lists the worst-case measured one-way transmission delay within a DDM-2000 OC-3 Multiplexer.

Table 10-22. DDM-2000 OC-3/OC-1 Transmission Delay in Microseconds

	Low-Speed Interface					
Mode (High-Speed)	**OC-3/EC-1 (STS-1)***	**OC-3/EC-1 (VT)***	**DS3**	**DS1**	**OC-1 STS**	**OC-1 VT**
Terminal (OC-3)	7	27	7	40		
EC-1				40		
ADM (OC-3)	7	27	7	100		
Ring (OC-3/OC-12) †	7 †	27 †	7	100	7	27
Ring (OC-1)				100	7	27

* STS-1 or EC-1 cross-connected.

† Ring delay is based on high-speed and low-speed or between main-1 and main-2.

Performance Monitoring

Table 10-23 shows the provisionable range of the thresholds for monitored parameters and, in brackets, the default thresholds. Thresholding of any parameter(s) can be disabled.

Table 10-23. Performance Monitoring Parameters Provisionable via the CIT

Parameter Definition		**Threshold Range (Default)**		**Command**
Facility	**Measure**	**Current Quarter Hour**	**Current Day**	**`set-pmthres-`**
OC-12 Section †	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**`sect`**
OC-3 Section	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**`sect`**
OC-1 Section	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]	**`sect`**
OC-12 Line †	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC)	1-55365 [5537] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-5315040 [531504] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**`line`** **`line`** **`line`** **`line`** **`line`** **`line`** **`line`**
OC-3 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L) STS Pointer Justification (PJC)	1-13841[1384] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-63 [2] 1-65535 [60]	1-1328736 [132874] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-255 [4] 1-9999999 [5760]	**`line`** **`line`** **`line`** **`line`** **`line`** **`line`** **`line`** **`line`**
OC-1 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC)	1-4613 [461] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-442848 [44285] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**`line`** **`line`** **`line`** **`line`** **`line`** **`line`** **`line`**
EC-1 Line	B2 Coding Violations (CV) EC-1 B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) STS Pointer Justification (PJC)	1-4613 [461] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-65535 [60]	1-442848 [44285] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-9999999 [5760]	**`line`** **`line`** **`line`** **`line`** **`line`** **`line`** **`line`**

Parameter Definition		Threshold Range (Default)		Command
Facility	**Measure**	**Current Quarter Hour**	**Current Day**	**set-pmthres-**
STS-1 Path	B3 Coding Violations (CV) B3 Errored Seconds (ES) B3 Errored Seconds Type A (ESA) B3 Errored Seconds Type B (ESB) B3 Severely Errored Seconds (SES) B3 Unavailable Seconds (UAS)	1-4510 [451] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30]	1-432960 [43296] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90]	**sts1** **sts1** **sts1** **sts1** **sts1** **sts1**
Enhanced DS3 Path for P-Bits, F&M Bits, and C-Bits from Fiber and DSX	CV-P Coding Violations ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds SEFS	1-16383 [40] 1-900 [25] 1-63 [4] 1-63 [10] 1-63 [2]	1-1048575 [3820] 1-65535 [250] 1-4095 [40] 1-4095 [10] 1-4095 [8]	**t3** **t3** **t3** **t3** **t3**
DS3 Line	CV-L Coding Violations Errored Seconds, Line (ES-L) Severely Errored Seconds, Line (SES-L)	1-16383 [40] 1-900 [25] 1-63 [4]	1-1048575 [3865] 1-65535 [250] 1-4095 [40]	**t3** **t3** **t3**
VT1.5 Path	V5 Errored Seconds (ES) V5 Severely Errored Seconds (SES) V5 Unavailable Seconds (UAS)	1-900 [40] 1-63 [20] 1-63 [30]	1-65535 [900] 1-4095 [60] 1-4095 [90]	**vt1** **vt1** **vt1**
DS1 Path	ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds ES-PFE Errored Seconds SES-PFE Severely Errored Seconds UAS-PFE Unavailable Seconds CV-P (SF) Coding Violations CV-P (ESF) Coding Violations CV-PFE Coding Violations	1-900 [65] 1-63 [10] 1-63 [10] 1-900 [65] 1-63 [10] 1-63 [10] 1-16383 [72] 1-16383 [13296] 1-16383 [13296]	1-65535 [648] 1-4095 [100] 1-4095 [10] 1-65535 [648] 1-4095 [100] 1-4095 [10] 1-1048575 [691] 1-1048575 [132960] 1-1048575 [132960]	**t1** **t1** **t1** **t1** **t1** **t1** **t1** **t1** **t1**
DS1 Line	ES-L Line Errored Seconds	1-900 [65]	1-65535 [648]	**t1**

* Threshold is set once for both current quarter hour and current day.

† Applicable only when using the 24G-U OLIU in main slot.

Operations Interfaces

This section presents the operation interfaces that are required to support technician access to the system and allow alarms and status information generated by the system to be reported. The local operation interfaces include the CIT interface, the user panel, and the equipment indicators. The DDM-2000 OC-3 Multiplexer supports office alarms, parallel telemetry, user-definable miscellaneous discretes, serial (TBOS) telemetry interfaces, and TL1/X.25.

Craft Interface Terminal (CIT)

The system provides two EIA-232-D compatible CIT interfaces — a front access interface, configured as data communications equipment (DCE), and a rear access CIT interface, configured as data terminal equipment (DTE), to allow a permanent modem connection without requiring a null modem. A null modem is required to connect an ASCII terminal to the DTE interface or a modem to the DCE interface. The CIT interfaces provide data rates of 300, 1200, 2400, 4800, 9600, and 19,200 baud.

Both CIT interfaces operate full duplex using 1 start bit, 8 data bits, and 1 stop bit. Table 10-24 describes the pins supported on the CIT interfaces.

Table 10-24. CIT Interface Pin Connections

EIA-232-D Pin	Front Access CIT (DCE)	Rear Access CIT (DTE)
Pin 2 — Circuit BA Transmitted Data	carries data from terminal to DDM-2000 OC-3	carries data from DDM-2000 OC-3 to modem or terminal
Pin 3 — Circuit BB Received Data	carries data from DDM-2000 OC-3 to terminal	carries data from modem or terminal to DDM-2000 OC-3
Pin 7 — Circuit AB Signal Ground	signal ground	signal ground
Pin 8 — Circuit CF Received Line Signal Detector	not used	indicates to DDM-2000 OC-3 that modem or terminal is connected
Pin 20 — Circuit CD DTE Ready	indicates to DDM-2000 OC-3 that modem or terminal is connected	indicates to modem or terminal that DDM-2000 OC-3 is connected (always ON when SYSCTL is powered)

A CIT is recommended for installation, maintenance and administrative activities. A personal computer (PC) is required for software download and to run the CPro-2000 software. The DDM-2000 OC-3 Multiplexer CIT port (mounted on the user panel) is a standard EIA-232-D (supersedes RS-232C specification) interface configured as DCE for direct connection to a CIT. The CIT port will support rates of 300, 1200, 2400, 4800, 9600, and 19,200 baud and should be compatible with most *ANSI* 3.64 ASCII terminals; however, it is optimized for standard screens with display areas of 24 lines by 72 (or more) columns. A pager function is included in the DDM-2000 OC-3 Multiplexer to accommodate screen lengths from 3 lines to 150 lines.

Those CITs compatible with DDM-1000 (see 363-206-100 for a list of DDM-1000 compatible terminals) should be directly compatible with the DDM-2000 OC-3 Multiplexer, although some may not be as convenient to use with the DDM-2000 OC-3 Multiplexer.

If the multishelf bus cables (ED-8C724-20, G354 or G356) are connected between shelves in a bay, a CIT may then be connected to the user panel CIT port on any shelf and may address any other shelf in that bay (as well as the remote terminal shelves associated with that shelf in the bay). Any terminal compatible with the *ANSI* 3.64 standard should be compatible with the DDM-2000 OC-3 Multiplexer.

Personal Computer (PC) Specifications for Software Download

The PC used for software download should have:

- A minimum of 640K of random access memory (RAM)
- *MS-DOS** version 2.0 or newer
- Hard disk
- At least one floppy disk drive of 360K or larger capacity. Although the disk drive may accommodate either floppy or hard disk, a hard disk is preferred for its better performance. The disk requirement is met with most portable *MS-DOS* PCs with a single 3.5-inch disk. An *MS-DOS* PC with a hard disk and either a 3.5-inch 1.44M floppy disk may also be used.
- Windows NT* available to work with the OC-3 releases 7.2 and earlier and 13.0 and later and OC-12 releases 7.0 and later.

* Registered trademark of Microsoft Corporation.

Compatible Modems

A compatible modem must meet the following minimum requirements:

- 300, 1200, 2400, 4800, 9600, or 19,200 baud
- Full duplex
- 8 data bits
- No parity bits
- 1 start bit
- 1 stop bit
- No flow control.

The following stand-alone modems meet the modem requirements and can be used with the DDM-2000 system. *Western Electric*® 103-compatible and 212A-compatible modems are also suitable for use with the DDM-2000 system. This is not an exhaustive list of compatible modems:

- *Paradyne* *2224-CEO modem (at 1200 and 2400 baud)
- *Paradyne* 2224 modem (at 1200 and 2400 baud)
- *Paradyne* 4024 modem (at 1200 and 2400 baud)
- *Paradyne* 2296 modem (at 4800 and 9600 baud)
- Hayes *V-series*† Smartmodems
- *Penril*‡ Alliance V.32 modem.

The *NCR* 3170 computer and the AT&T *Safari*® computer have a built-in modem and meet the modem requirements.

* Trademark of Paradyne Corporation.
† Trademark of Hayes Microcomputer Products, Inc.
‡ Registered trademark of Penril Corporation.

CPro-2000 Graphical User Interface and Provisioning Tool

The CPro-2000 Graphical User Interface and Provisioning Tool is a *Microsoft*[*] *Windows* based user interface that can optionally be used with the DDM-2000 OC-3 Multiplexer. The tool simplifies and mechanizes administration, maintenance, and provisioning operations. CPro-2000 supports DDM-2000 OC-3 Multiplexers, DDM-2000 OC-12 Multiplexers, and FT-2000 OC-48 Lightwave Systems. A minimum platform configuration is:

- 486 DX *IBM*[†] compatible desktop or laptop PC
- Disk drive — one 1.44 Megabyte (3.5 inch)
- Hard disk with at least 40 Megabytes of available space
- 16 Megabyte RAM
- *MS-DOS* operating system version 5.0 or later
- *Windows* NT or *Windows* 95, *Windows* 98
- Serial port (EIA-232-D) — configured as COM1 or COM2
- Mouse
- VGA color monitor.

CPro-2000 has been tested with AT&T, *NCR*, *IBM*, *NEC*[‡], and *Gateway*-2000[§] personal computers.

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* Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.
† IBM is a registered trademark of International Business Machines Corporation.
‡ NEC is a registered trademark of NEC Corporation.
§ Gateway 2000 is a trademark of Gateway 2000, Inc.

User Panel

The user panel contains red LEDs for CR and MJ alarms, yellow LEDs for MN and PMN alarms, and for abnormal (ABN), far-end activity (FE-ACTY), and near end activity
(NE-ACTY) status. These LEDs are used in conjunction with the far-end identification (FE-ID) 7-segment display on the front panel of the adjacent SYSCTL circuit pack to provide CIT-less single-ended operations.

A green PWR ON LED is lighted when the shelf is receiving –48 V power. A green ACO LED is lighted when the ACO function is active.

The FE SEL test, ACO/TEST, and UPD/INIT push-buttons are provided to control system operation.

Equipment Indicators

A red LED FAULT indicator is provided on all circuit packs. A green LED ACTIVE indicator is provided on all 1x1 protected circuit packs to indicate which circuit packs are actively carrying traffic.

Office Alarms

The office alarms interface is a set of discrete relays that control office audible and visual alarms. Separate relays handle CR, MJ, and MN alarms. Each contact closure is rated at 1 A, 60 V maximum. The CR and MJ alarms can be wire-ORed. The CR alarm relays are fail safe against unprotected power failures.

User-Definable Miscellaneous Discrete Environmental Alarms and Controls

The user-definable miscellaneous discrete environmental alarm and control interface allows the DDM-2000 OC-3 Multiplexer to monitor and control co-located equipment at the remote site. At the remote terminal (RT) site, 21 alarm or status environmental inputs can monitor environmental conditions (for example, open door, high temp); these inputs are activated by contact closures. The 15th environmental alarm or status input is provided to monitor the condition of the power shelf and fans at the RT site; this closure is activated by –48 V DC. Prior to Release 8.0, only 15 discretes are available. Four environmental control outputs are provided to control external equipment (for example, pumps or generators). The miscellaneous discrete outputs (control outputs at an RT, alarm/status outputs at a CO) tolerate –60 V maximum open circuit voltage and 35 mA maximum current. Transient voltages up to –135 V are tolerated for up to 1 ms. The miscellaneous discrete inputs (control inputs at a CO, alarm/status inputs in an RT) provide –48 V nominal (–60 V maximum) open circuit voltage and 2 mA maximum current. The miscellaneous discrete output closures generated by the optoisolator require external voltage and ground to operate.

The 21 alarm or status inputs can be reported through a TL1/X.25 interface. The first 10 of these can also be reported through discrete telemetry outputs at the CO end. The first 15 of these inputs can also be reported through TBOS scan points.

Order Wire

The DDM-2000 OC-3 Multiplexer uses the E1 byte in the SONET overhead and provides a 64 kb/s complementary metal oxide semiconductor (CMOS) or transistor-transistor logic (TTL) compatible interface to an external order wire shelf to provide point-to-point voice communication between DDM-2000 OC-3 systems.

If the DDM-2000 OC-3 Multiplexer is using R8.1 or R9.1, a proprietary MUX order wire capability is available for use in *MegaStar* 2000. The MUX order wire mode provides access to the E1, E2, and F1 SONET overhead bytes in a proprietary 1.544 Mb/s data stream for use with the Harris-Farinon mini-CSU equipment.

The DDM-2000 OC-3 Multiplexer system has been tested with the *DANTEL*[*] Order wire Assembly A18-04588-02.

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* DANTEL is a registered trademark of Dantel, Inc.

TL1/X.25 Interface

The DDM-2000 Multiplexer supports a TL1/X.25 interface for communication between local and remote DDM-2000s and alarm surveillance and provisioning operations systems (OS) such as Telcordia Technologies' Network Monitoring and Analysis (NMA) and Operations Systems/Intelligent Network Element (OPS/INE) OSs. The DDM-2000 OC-3 Multiplexer TL1/X.25 interface is based on Telcordia Technologies TR-TSY-000833, Issue 5. In Releases 8.0, 9.0 and later, the DDM-2000 OC-3 Multiplexer supports up to nine X.25 permanent virtual circuits (PVCs) and up to nine switched virtual circuits (SVCs) assigned by default as shown in Table 10-25. The user may assign a maximum of nine VCs using any combination of PVCs and SVCs.

Table 10-25. TL1/X.25 Interface — Default VC Assignments

PVC ID	SVC ID	Logical Group #	Logical Channel #	Use
1		0	1	User Definable ‡
2		0	2	Autonomous Maintenance Messages, (User Definable ‡)
3*		0	3	Autonomous Provisioning Messages (REPT DBCHG), (User Definable ‡)
	1†	0	16	Autonomous Maintenance and Provisioning Messages §, (User Definable ‡)
	2 ‡	0	17	User Definable ‡
	3 ‡	0	18	User Definable ‡
	4 ‡	0	19	User Definable ‡
	5 ‡	0	20	User Definable ‡
	6 ‡	0	21	User Definable ‡

* Release 6.1 (linear), 5.1 (rings), and later

† Release 6.2 (linear), 7.1 (rings), and later

‡ Release 8.0 (linear), 9.0 (rings), and later

§ Release 6.2 (linear), 7.1 and 7.2 (rings) only.

All VCs support command/response messages (except PVC #2 prior to Release 6.0, is limited to autonomous maintenance messages only). The autonomous maintenance messages are all TL1 autonomous messages except REPT DBCHG.

If the default assignments in Table 10-25 do not meet the user's OS needs, Releases 8.0, 9.0 and later of DDM-2000 OC-3 allows users to specify the routing of TL1 autonomous message types to VCs. This is done in two steps:

1. Each TL1 autonomous message type (for example, `REPT ALM, REPT DBCHG, REPT PM`, etc.) can be mapped to any OS type (using the ent-tl1msgmap command at every NE in the subnetwork). The OS types are tl1Maintenance, tl1MemoryAdministration, tl1test, tl1PeerComm, tl1Other1 and tl1Other2.
2. Each OS type can be mapped to any of the VCs (using the ent-osacmap command at the TL1 GNE). The combination of Step #1 (mapping TL1 autonomous message types to OS types) and Step #2 (mapping OS types to VCs) accomplishes the desired mapping of TL1 autonomous message types to VCs.

At the packet layer, the DDM-2000 OC-3 Multiplexer is configured as a passive DTE with the following parameters as shown in Table 10-26.

Table 10-26. TL1/X.25 Interface — X.25 Packet Layer Parameters

Parameter	Value
Packet Size	128 bytes* or 256 bytes
Window Size	2 packets
D bit support	NO
M bit support	YES

* Release 8.0 (linear), 7.2 (rings) and later

At the link layer, the DDM-2000 OC-3 Multiplexer uses the standard link access procedure "B" (LAPB) protocol with the following parameters as shown in Table 10-27.

Table 10-27. TL1/X.25 Interface — LAPB Link Layer Parameters

Parameter	Value
Maximum Frame Size	2104 bits
Module	8
Window Size	7 frames
n2	7 retries
T1	3 seconds
T3*	20 seconds

* Release 3.2 and later.

The DDM-2000 OC-3 Multiplexer uses synchronous, full duplex, continuous carrier communication. Data rates of 1200, 2400, 4800, 9600, and 19,200 baud are supported. The EIA-232-D interface is configured as DTE, using the pin connections specified in Table 10-28.

Table 10-28. TL1/X.25 Interface — EIA-232-D Pin Connections

Pin	Description
2	Transmitted Data
3	Received Data
4	Request to Send
5	Clear to Send
6	DCE Ready
7	Signal Ground
8	Received Line Signal Detector
15	Transmitter Signal Element Timing (DCE to DTE)
17	Receiver Signal Element Timing (DCE to DTE)
20	DTE Ready*

* DTE is always on when the DDM-2000 OC-3 Multiplexer is powered.

Physical Specifications

Shelf Physical Characteristics

- Dimensions: 8.5 in. H x 21.25 in. W x 12 in. D (Group 1 or Group 3)
  Dimensions: 8.5 in. H x 21.25 in. W x 13.25 in. D (Group 4)
- Weight (Max.): 44 lb. (20 kg)
- Appearance: Coordinated with other equipment in the Lucent 2000 Product Family.

Network Bay and Cabinet Mounting

The DDM-2000 OC-3 Multiplexer can be mounted in both ED-8C500 and ED-8C501 network bay frames. A maximum of six shelves may be mounted in a 7-foot bay. In addition to bay mounting, the DDM-2000 OC-3 Multiplexer can be packaged with other equipment in 80A, 80D, and 80E cabinets, 51A cabinets, 90-type business remote terminals, controlled environment vaults (CEVs), or huts.

NOTE:
The mounting brackets on the DDM-2000 OC-3, OC-12, heat baffle, and fan shelf are designed to allow for mounting in standard 23-inch wide network bay frames and 23-inch wide EIA-type bay frames.

Environmental Specifications

Temperature and Humidity

A DDM-2000 OC-3 Multiplexer shelf meets Telcordia Technologies Network Equipment Building System (NEBS*) requirements for use in CO environments without fans.

A fan shelf is required in uncontrolled environments or cabinet applications either above or below any DDM-2000 OC-3 shelf. Refer to ED-8C724-10, "Typical Bay Arrangements," for detailed information on placement of fans and heat baffles in typical bay arrangements.

The DDM-2000 OC-3 Multiplexer operates in uncontrolled environments at temperatures of –40°C to +75°C and humidity of 5 to 95 percent (noncondensing). Forced convection cooling (fans) is required when the air inlet temperature is above 50°C. The DDM-2000 OC-3 Multiplexer provides optional control and alarming of the 2-type fan units used in Lucent cabinets and alarming of the DDM-2000 fan shelf.

EMC Requirements

The DDM-2000 OC-3 Multiplexer has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residence is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

* "*NEBS Generic Equipment Requirements*," TR-NWT-000063, Issue 4.

Earthquake Requirements

The DDM-2000 OC-3 Multiplexer meets the earthquake requirements defined in Telcordia Technologies TR-NWT-000063, Issue 4, and Pacific Bell Standard PBS-000-102PT. Installations in Zone 4 regions require the ED-8C800-50 or ED-8C801-50 bay frame. Drawing ED-8C800-70 provides ordering and engineering application information for these frames.

Fire Resistance

The DDM-2000 OC-3 Multiplexer meets the ignitability requirements specified in ANSI T1.307-1997. In addition, the DDM-2000 OC-3 Multiplexer meets the fire resistance requirements of *UL* 1459, 2nd Edition.

Underwriters Laboratories

The DDM-2000 OC-3 Multiplexer is *UL* recognized for restricted access installations in business and customer premises applications installed in accordance with Articles 110-16 and 110-17 of the *National Electric Code*[*], *ANSI*/NFPA Number 70-87. Other installations exempt from the requirements of the *National Electric Code* may be engineered according to the accepted practices of the local telecommunications utility.

Canadian Standards Association

The DDM-2000 OC-3 Multiplexer has been certified by the Canadian Standards Association per standard C22.2 Number 225-M90.

* Registered trademark of the National Fire Protection Association, Inc.

Power Requirements

Shelf Fuses

The two –48 V feeders (A and B) are required for each DDM-2000 OC-3 shelf. Shelf power is protected by 5-amp fuses provided with the shelf.

It is recommended that a supply of spare fuses be provided at DDM-2000 OC-3 Multiplexer locations. Fuses for the Group 1 shelf may be ordered through Lucent using COMCODE 405697442 or through Littlefuse, Inc., 800 East Northwest Highway, Des Plaines, IL 60016, or call 708-824-1188. Order:

Fuse, 5-amp, Part No. 334005.

Fuses and a fuse extraction tool for the Group 3 or Group 4 shelf may be ordered through Lucent using COMCODE 406203976 for fuses and COMCODE 406420273 for the extraction tool or through SAN-O Industrial Corporation, 91-3 Colin Drive, Sherwood Corporation Center, Holbrook, NY 11741 or by calling 516-472-6666 and ordering.

Fuse, 5-amp, Part No. AX-1-5A or
Fuse Extraction Tool, Part No. F-0431.

Power Dissipation

Table 10-29 lists the power dissipation and current drains for the listed configurations.

Table 10-29. Power Dissipation and Current Drains

Configuration	Power Dissipation (Watts)	DC Current Drains (Amps)	
		List 1 (-48 V DC)	List 2 (-40 V DC)
OC-3 terminating shelf with 24 DS1 circuit packs (84 DS1s)	66	1.4	1.7
OC-3 terminating shelf with 24 DS1PM circuit packs (84 DS1s)	79	1.6	2.0
OC-3 terminating shelf with 6 DS3 circuit packs (3 DS3s)	58	1.2	1.5
OC-3 STS-1 add/drop shelf with 16 DS1 circuit packs (56 DS1s)	80	1.7	2.0
OC-3 DS1 add/drop shelf with 16 DS1PM circuit packs (56 DS1s)	87	1.8	2.2
OC-3 DS1 add/drop shelf with 8 22F OLIU circuit packs	114	2.4	2.9
EC-1 electrical multiplexer shelf with 24 DS1 circuit packs (84 DS1s)	66	1.4	1.7
EC-1 electrical multiplexer shelf with 24 DS1PM circuit packs (84 DS1s)	73	1.5	1.8
OC-3 terminating shelf with 6 STS1E circuit packs (3 EC-1s)	60	1.3	1.5
OC-3 DS1 self-healing ring shelf with 24 DS1 circuit packs (84 DS1s)	73	1.5	1.8
OC-3 DS1 self-healing ring shelf with 24 DS1PM circuit packs (84 DS1s)	80	1.7	2.0
OC-3 DS1 self-healing ring shelf with 24G-U/ 24H-U OLIU and 24 DS1 circuit packs (84 DS1s)	73	1.5	1.8
OC-3 DS1 self-healing ring shelf with 24G-U/ 24H-U OLIU and 24 DS1PM circuit packs (84 DS1s)	88	1.8	2.25
OC-3 self-healing ring shelf with 6 STS1E circuit packs (3 EC-1s)	63	1.3	1.6

Table 10-29. Power Dissipation and Current Drains—*Continued*

Configuration	Power Dissipation (Watts)	DC Current Drains (Amps)	
		List 1 (-48 V DC)	List 2 (-40 V DC)
OC-3 terminating shelf with 24 DS1 circuit packs (84 DS1s)	66	1.4	1.7
OC-3 self-healing ring shelf with 2 OC-3 optical extensions (22G-U/22G2-U) and 8 DS1PM circuit packs (28 DS1s)	102	2.1	2.5
OC-3 self-healing ring shelf with 6 27G-U/27G2-U dual OC1 OLIUs	111	2.3	2.8
OC-3 DS1 self-healing ring shelf with 29G-U/ 29H-U OLIU and 24 DS1 circuit packs (84 DS1s)	78	1.6	1.9*
OC-3 DS1 self-healing ring shelf with 29G-U/ 29H-U OLIU and 24 DS1PM circuit packs (84 DS1s)	93	1.9	2.3
DDM-2000 Fan shelf	53	1.1	1.3

The following items should be noted:

- The DDM-2000 OC-3 shelf accommodates two –48 V power feeders ("A" and "B" office power feeders).
- Loss of one power feeder does not cause a loss of service.
- All supply voltages other than –48V required by DDM-2000 OC-3 Multiplexer are generated by DC-to-DC converters within the DDM-2000 OC-3 shelf.
- The DDM-2000 OC-3 Multiplexer meets all performance requirements when the DC input voltage varies between –40.0 V and –60.0 V.
- The DDM-2000 OC-3 Multiplexer tolerates DC input voltages between 0 V and –60 V without damage.
- The DDM-2000 OC-3 Multiplexer complies with electrical noise tolerance requirements in Section 13.2 of TR-TSY-000499.

CAUTION:
This information is for a typical application only. Consult 801-525-168, DDM-2000 Floor Plan Data Sheets, and T82046-30, Power Systems DC Distribution Circuit for Digital Transmission System, for proper engineering of battery plant and feeders.

DDM-2000 OC-3 Reliability

Summary

This section describes the Telcordia Technologies reliability requirements that apply to the DDM-2000 OC-3 Multiplexer and the calculations used to predict how the DDM-2000 OC-3 Multiplexer meets those standards.

The DDM-2000 OC-3 Multiplexer meets all the applicable Telcordia Technologies reliability requirements that cover transmission availability, OS availability, optical module maintenance, and infant mortality. A summary of the reliability predictions and requirements is shown in Table 10-30. The applicable Telcordia Technologies requirements and objectives were clarified through interactions with Telcordia Technologies during their audit of the DDM-2000 OC-3 Multiplexer. The basis for these requirements comes from TA-TSY-000418, "*Generic Reliability Assurance Requirements for Fiber Optic Transport Systems*." The method and assumptions used to calculate DDM-2000 OC-3 Multiplexer reliability predictions are described in the following paragraphs. Each paragraph is devoted to one of the reliability parameters which must meet a Telcordia Technologies requirement or objective.

Transmission Availability

Telcordia Technologies *requirements* state that the probability of a hardware caused outage on a two-way channel within a SONET multiplexer should be less than 1.75 minutes per year in a CO environment[*] and 5.25 minutes per year in a RT environment.[†] Telcordia Technologies *objectives* for outages are 0.25 minutes per year for the CO[‡] and 0.75 minutes per year for RT environments.[§]

The outage requirements and objectives apply to any part of the product needed to process an incoming high-speed or low-speed signal (DS1 to OC-3 or OC-3 to DS1). An outage is defined, for this and all other outage requirements, as any 1-second interval with a bit error rate of 10^{-3} or worse.[¶] The predicted hardware outages for various configurations of the DDM-2000 OC-3 system are given in Table 10-30.

* TA-NWT-000418, Issue 3, November 1991, p. 17.
† TA-NWT-000418, Issue 3, November 1991, p. 28.
‡ TA-NWT-000418, Issue 3, November 1991, p. 18.
§ TA-NWT-000418, Issue 3, November 1991, p. 28.
¶ TR-TSY-000009, Issue 1, May 1986, p. 4-11.

A Markov model was used to calculate the predicted system outage. The model assumes a mean time to repair of 2 hours for the CO environment and 4 hours for the RT environment. Individual circuit pack failure rates used in the model were calculated using the method described in TR-TSY-000332, Issue 4, "*Reliability Prediction Procedure for Electronic Equipment (RPP)*." A summary of the circuit pack and fan shelf failure rates is shown in Table and Table 10-32, respectively.

Operation System Interface Availability

The Telcordia Technologies objective states that the OS outage should be less than 28 minutes per year (50 percent hardware, 50 percent software).[*] Therefore, the objective applies to the TBOS and TL1/X.25 interfaces. This objective applies to circuitry needed to maintain communication from the DDM-2000 OC-3 Multiplexer to the CO's telemetry equipment for access by an OS. Since the OS interface is used in the CO, the reliability model assumes the mean time to repair is 2 hours and the environmental factor is 1.0. Table 10-30 lists the predicted outages for the TBOS and TL1/X.25 interfaces.

Optical Module Maintenance Objective

According to Telcordia Technologies, the objective for mean time between failure (MTBF) of a one-way regenerator is a minimum of four years[†]. A regenerator is defined as any circuit pack that performs the electrical-to-optical and optical-to-electrical conversion. Table lists the failure rate and MTBFs of the OLIU circuit packs. All OLIU circuit packs meet Telcordia Technologies objectives.

* TA-NWT-000418, Issue 3, November 1991, p. 36.

† TA-NWT-000418, Issue 3, November 1991, p. 37.

Infant Mortality

Telcordia Technologies requires that the number of circuit pack failures in the first year of operation should not exceed 2.5 times the number of failures per year beyond the first year. The ratio of first year failures to failures in subsequent years is known as the infant mortality factor (IMF). The requirement is to have an IMF of less than 2.5*.

DDM-2000 OC-3 Multiplexer circuit packs are subjected to an environmental stress testing (EST) program. The purpose of the program is to eliminate early life failures, conduct failure mode analysis on defective circuit packs, and use corrective action to make the product more reliable. All new circuit pack codes in manufacturing are subjected to EST. However, based on field return data, when the early life failures for any circuit pack codes have been minimal and the infant mortality factor is below 2.5, these circuit pack codes may be subjected only to sampling EST.

* TA-NWT-000418, Issue 3, November 1991, p. 40.

DDM-2000 OC-3 System Reliability Predictions

Table 10-30. DDM-2000 OC-3 System Reliability Prediction (Note 1)

Application	Environment (Note 2)	Telcordia Criteria (Note 3)		Prediction (Outage, min/yr)	MTBF Years (Note 4)
		Requirement	Objective		
DS1 to OC-3	CO	1.75	0.25	0.0464	2587
DS1 to OC-3	RT	5.25	0.75	0.1395	1716
DS3 to OC-3	CO	1.75	0.25	0.0219	5474
DS3 to OC-3	RT	5.25	0.75	0.0662	3608
OC-3 to OC-3	CO	1.75	0.25	0.00013	706329
OC-3 to OC-3	RT	5.25	0.75	0.00115	16,120
EC-1 to OC-3	CO	1.75	0.25	0.0220	5452
EC-1 to OC-3	RT	5.25	0.75	0.0665	3589
DS1 to EC-1	CO	1.75	0.25	0.0647	1853
DS1 to EC-1	RT	5.25	0.75	0.1944	1233
DS1 to OC-1	CO	1.75	0.25	0.0464	2585
DS1 to OC-1	RT	5.25	0.75	0.1396	1714
OC-1 to OC-3	CO	1.75	0.25	0.00015	617467
OC-1 to OC-3	RT	5.25	0.75	0.00131	137227
DS1 to OC-12	CO	1.75	0.25	0.0464	2587
DS1 to OC-12	RT	5.25	0.75	0.1395	1717
OC-12 to OC-12	CO			4.373	27
OC-12 to OC-12	RT			13.118	18
OS Interface TBOS	CO		14.00	8.97	13
OS Interface TL1/X.25	CO		14.00	8.97	13

Example:
The unavailability of one 2-way DS3 channel within one DDM-2000 OC-3 system configured to multiplex DS3 to OC-3, located in an uncontrolled environment, is 0.0662 minutes per year (that is, fraction of time per year when the DS3 channel is unavailable). The mean time between outage of the DS3 channel is 3608 years (that is, average length of time until a DS3 outage occurs).

Notes:

1. Hardware failure rates are calculated per the RPP method, TR-NWT-000332, Issue 6, "Reliability Prediction Procedure."
2. The environmental factor for the CO = 1.0 and for the RT = 1.5, per TR-NWT-000332, Issue 4, "Reliability Prediction Procedure."

3. Telcordia Technologies criteria (Outage Requirements and Objectives) is based on TA-TSY-000418,
Issue 3, "Generic Reliability Assurance Requirements for Fiber Optic Transport Systems." Outage is in minutes per year.
4. Mean time to repair is assumed to be 2 hours for the CO and 4 hours for RT environments.

Table 10-31. DDM-2000 OC-3 Circuit Pack Reliability (Note 1)

	CO		RT	
Circuit Pack	**FITS (Note 2)**	**MTBF (Years)**	**FITS (Note 2)**	**MTBF (Years)**
BBF1B (DS1)	859	132.8	88.5	93
BBF2B (TGS)	1935	59.0	2903	39.3
BBF2C (TGS)	2345	48.68	3518	32.45
BBF3 (DS1PM)	1310	87.1	1965	58.1
BBF3B (DS1PM)	1235	92.4	1853	61.6
BBF4 (TG3)	2311	49.40	3467	32.93
BBF6 (T1EXT)	1427	80.0	2138	53.39
BBF9 (IMA-LAN)	2037	56.04	3056	37.35
BBF10 (IMA-LAN)	2277	50.13	3416	33.42
BBF8 (HDSL)	5216	21.9	7824	14.6
BBG2 (MXRVO)	570	200.1	855	133.4
BBG2B (MXRVO)	820	139.21	1230	92.81
BBG4 (DS3)	902	126.5	1353	84.3
BBG4B (DS3)	1056	108.0	1584	72.0
BBG5 (SYSCTL)	3032	37.6	4548	25.1
BBG6 (STS1E)	1422	80.2	2133	53.5
BBG7 (OHCTL)	2001	57.0	3002	38.0
BBG8 (SYSCTL)	4505	25.3	6758	16.9
BBG8B (SYSCTL)	4442	25.7	6663	17.1
BBG9 (OHCTL)	4084	27.9	6126	18.6
BBG10 (OHCTL)	4409	25.9	6614	17.2
BBG19 (DS3)	729	156.5	1094	104.3
BBG20 (TMUX)	3088	36.9	4632	24.6
22D-U (IS-3 OLIU)	1959	58.2	2939	38.8

Table 10-31. DDM-2000 OC-3 Circuit Pack Reliability (Note 1)—*Continued*

	CO		RT	
Circuit Pack	**FITS (Note 2)**	**MTBF (Years)**	**FITS (Note 2)**	**MTBF (Years)**
22F (OLIU)	2441	46.7	3662	31.2
22F-U (OLIU)	2519	45.3	3779	30.2
22F2-U (OLIU)	2033	56.1	3050	37.4
22G-U (OLIU)	2439	46.8	3659	31.2
22G2-U (OLIU)	2197	51.9	3296	34.6
22G3-U (OLIU)	3533	32.8	5300	21.5
22G4-U (OLIU)	1426	80.05	2139	53.37
24G-U (OLIU)	2080	54.8	3120	36.6
24H-U (OLIU)	2388	47.80	3582	31.87
26G2-U (OLIU)	2575	44.3	3863	29.5
27G-U (Dual OC-1 OLIU)	2857	39.9	4286	26.6
27G2-U (Dual OC-1 OLIU)	2823	40.4	4235	26.9
29G-U (OLIU)	3264	34.9	4896	23.3
29H-U (OLIU)	3049	37.4	4574	24.9

Notes:

1. Calculations are based on Telcordia Technologies RPP Issue 6 data. All KS and Lucent components considered as quality level III. All components evaluated at 40°C ambient and 50 percent electrical stress.
2. FITS is the number of failures per billion hours of operation (10^9).

Table 10-32. DDM-2000 Fan Shelf Steady State Failure Rates (Based on Telcordia Technologies RPP, Issue 6, Data)

DDM-2000 Fan Shelf	Failures /10^9 hrs. RPP Prediction	MTBF (years)
ED-8C733-30,G7 Fan Shelf	9879 *	11.56
ED-8C733-30,G6 Fan Unit	2000	57.08

* Includes failure rates for individual fan units.

Commands and Reports

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11

Overview

This chapter describes the command and report features of the American Standard Code for Information Interchange (ASCII) terminal interface to a DDM-2000 OC-3 Multiplexer. It provides detailed information about each command, as well as system report outputs and explanations.

Reason for Ressue

This chapter has been updated toprovide the details of software commands for OC-3 Release 15. This release features Target ID Address Resolution Protocol (TARP) which provides for multi-vendor interworking. For additional information on TARP, please refer to the “About This Document” sections.

The following new commands are available in OC-3 Release 15:

— rtrv-lan

— rtrv-pm-lan

— set-lan

Please note that the 29G-U OLIU circuit pack must be present in the Main slots of the DDM-2000 OC-3 shelves for these new commands to properly execute. Please refer to the TOP section of this document for instructions on properly installing these circuit packs in a shelf.

Command Page Format

This chapter includes DDM-2000 commands that are presented as one- or multiple-page entires in alphabetical order. The name of each command appears at the top of each page.

Each entry is presented in a common format:

— The **NAME** part gives the name of the command and summarizes its funtion.

— The **INPUT FORMAT** provides the syntax for each command. Each command starts with a command name followed by a colon. Parameters follow the colon. Optional parameters are enclosed in square brackets [ ].

— The **DESCRIPTION** part provides detailed information about each command.

— The **RELATED COMMANDS** part identifies commands that affect or are affected by the named command or sets the conditions displayed by a report. Some commands are not affected by any other command and will not have this part included on the command page.

Entries which are to be typed exactly as shown are printed in **`bold`** type. System repsonses are printed in `courier` type. Descriptive names entry values are shown in *italic* type.

Input Format

All commands have a common input format:

`command name`[:Address][:parameters]

`Address` identifies a slot, channel, or operations interface within the shelf. In commands which require an address, it must appear immediately after the command name.

`Parameters` identifies a variable name assigned to some provisionable attribute of the command. The value of the parameter is defined on each command page.

Parameters are separated with commas (,). The parameters may be entered in *any* order, but they must be entered in the *`name=value`* format.

Brackets ([ ]) are not part of the command line. Parameters enclosed in brackets are optional. Default values are provided for these parameters.

Any command can be entered on a single line.

DDM-2000 is case sensitive. Commands may be entered in upper- and lower-case letters. Entries other than commands may be case sensitive (for example, passwords). DDM-2000 addresses and logins are sensitive to white space (that is, blanks between characters). For example, the address parameters "**`m1-all`**" and "**`m1- all`**" may be interpreted differently by DDM-2000. As a general rule, white space should not be included in commands.

Addresses

Table 11-1 specifies the valid addresses for slots, lines, ports, channels, paths, cross-connections, and operations interfaces. Where lists of items appear in braces { }, and one (and only one) of these items may be used to form the address.

Each address is made up of several components that are combined to indicate a specific location on the DDM-2000. The following list shows the potential values for each address component. Refer to this list when reviewing Table 11-1:

slot type: Possible values are: `main, m, fn, ls, tg, sysctl, auxctl, tsi, userpanel,` and `all`.

group: Possible values are: `m, a, b, c,` and `all`.

Note carefully in Table 11-1 when this value is followed by a dash (-) and when it is not.

slot within a group (abbreviated as slot):

Possible values are: `1-8,` and `all`.

line: Possible values are: `1, 2` and `all`.

This identifies a line within a slot. For optical interfaces, it is only used to identify OC-1 lines on the 27-type OLIU. Note carefully in Table 11-1 when `all` is not allowed.

STS-1: Possible values are: `1-12`, and `all`.

VTG: Possible values are: `1-7`, and `all`.

VT1.5: Possible values are: `1-4`, and `all`.

special: Possible values are: `cit, dcc, tbos, partlm, x25, env, cont, and ref.`

environmental alarm or control point (abbreviated as alm/cont point):

Possible values are: `1-21,` and `all`.

Table 11-1. DDM-2000 OC-3 Address Table

Object	Entity	Address	Example
	Entire System	all	all
	Main slot	main-{1,2,all}	main-all
	Function unit slot	fn-all	fn-all
		fn-{a,b,c}-{1,2,all}	fn-b-all
			fn-c-all
Slots	Function unit pair	fn-{a,b,c}	fn-a
	Low speed slot	ls-all	ls-all
		ls-{a,b,c}-{1-8,all}	ls-b-2
	Timing slot	tg-{1,2,all}	tg-all
	Sys. control slot	sysctl	sysctl
	Aux. control slot	auxctl	auxctl
	OC-3 line pair	all	all
		main, fn-{a,b,c,all}	main-1
	OC-3 line	all	all
		main-{1,2,all}, fn-{a,b,c,all}-{1,2,all}	main-1
			fn-c-2
		fn-all	fn-all
	OC-1 line pair	all	all
	(27-type OLIU)	main-all	main-all
		main-{1,2,all}	main-2
		fn-all	fn-all
		fn-{a,b,c}-{1,2,all}	fn-a-all
Lines			fn-b-2
	OC-1 line	all	all
	(27-type OLIU)	main-all	main-all
		main-{1,2}-{1,2}	main-2-2
		fn-all	fn-all
		fn-{a,b,c}-all	fn-b-all
		fn-{a,b,c}-{1,2}-{1,2}*	fn-a-2-2
	OC-12 line pair	all	all
		main	main
	OC-12 line	all	all
		main-{1,2,all}	main-2
	EC-1 line	a,b,c,all	c

* For OC-1 line addresses, the address is configured as {func. unit}-[slot]-{line in slot}.

(Table continues on the following page)

Table 11-1. DDM-2000 OC-3 Address Table

Object	Entity	Address	Example
Ports	DS-3 (BBG4 or BBG4B only), EC-1 port, or TMUX (BBG20) port	a,b,c,all	a
	Front-Access DS3 (BBG19) Port	{a,b,c,all*}-{1-2,all}	a-1
	DS1 port (including TMUX)	{a,b,c,all*}-{1-7,all}-{1-4,all}	all b-all b-2-all c-1-4
	DS1 sync. ref. port	ref-{1,2}	ref-1
Channels	STS-1 channel (within OC-3)	{m,c,all*}-{1-3,all}, {a,b}-{1,2,all} m{1,2}-{1-3,all} (Rings Only)	c-3 a-2 m2-3
	STS-1 channel (within OC-12 using 24G-U or 29G-U OLIUs in Main)	m{1,2}-{1-12,all} (Rings Only)	m2-7
	STS-1 channel (within OC-1 using 27-type OLIUs)	all {m,a,b,c}{1,2}-{1-2,all}	all m2-2
	STS-1 channel for DS3, MXRVO, STS1E, TMUX	a,b,c,all	a
	STS-3c channel (within OC-12 using 24G-U or 29G-U OLIUs in Main)	m{1,2}-{1,4,7,10,all} (Rings)	m1-1
	VT1.5 channel (within OC-3)	{m,c,all*}-{1-3,all*}-{1-7,all*}-{1-4,all} {a,b,all*}-{1,2,all*}-{1-7,all*}-{1-4,all} m{1,2}-{1-3,all*}-{1-7,all*}-{1-4,all} (RingsOnly)	c-1-2-1 b-2-7-4 m1-3-2-3
	VT1.5 channel (within OC-12 using 24G-U OLIUs)	m{1,2}-{1-12,all*}-{1-7,all*}-{1-4,all} (Rings)	m1-7-4-3
	VT1.5 channel for DS1, STS1E, or TMUX	{a,b,c,all*}-{1-7,all*}-{1-4,all}	a-1-2 b-7-4
	VT1.5 channel (within OC-1 using 27-type OLIUs)	all {m,a,b,c}{1,2}-all {m,a,b,c}{1,2}-{1,2}-all {m,a,b,c}{1,2}-{1,2}-{1-7}-{1-4,all}	all b1-all c2-2-all c2-1-7-4

* If *all* is chosen as any part of an address, no subsequent address fields should be defined.

(Table continues on the following page)

Table 11-1. DDM-2000 OC-3 Address Table

Object	Entity	Address	Example
STS-1 Cross-connections	Main port	m-{1-3,all} m-{1-12,all} (For 24G-U/29G-U OLIUs in Rings) m-{1-2,all} (For 27-type OLIUs)	m-3 m-2 m-2
	STS-3c channel (within OC-12 using 24G-U OLIUs)	m-{1-4-7-10,all} (Rings)	m-1
	Function unit (OC-3 OLIU)	{a,b}-{1-2,all} c-{1-3,all}	a-2 c-3
	Function unit (27-type OLIU)	{a,b,c}-{1,2}	b-2
	Function unit (DS3, STS1E, MXRVO, or TMUX)	{a,b,c}	b
VT1.5 Cross-connections	Main port	m-{1-3,all*}-{1-7,all*}-{1-4,all} m-{1,2,all*}-{1-7,all*}-{1-4,all} (For 27-type OLIUs) m-{1-12,all*}-{1-7,all*}-{1-4,all} (For 24G-U/29G-U OLIU)	m-3-4-4 m-2-4-4 m-1-2-1
	DS1 low speed port (including TMUX)	{a,b,c}-{1-7,all*}-{1-4,all}	b-2-4
	Function unit (OC-3 OLIU)	{a,b}-{1-2,all*}-{1-7,all*}-{1-4,all) {c}-{1-3,all*}-{1-7,all*}-{1-4,all)	b-1-1-4 c-3-7-1
	Function unit (27-type OLIU)	{a,b,c}-{1,2,}-all {a,b,c}-{1,2,}-{1-7}-{1-4,all}	b-1-all b-1-6-4

* If *all* is chosen as any part of an address, no subsequent address fields should be defined.

(Table continues on the following page)

Table 11-1. DDM-2000 OC-3 Address Table

Object	Entity	Address	Example
Operation Interfaces	User Panel	userpanel	userpanel
	CIT	cit-{1,2,all}	cit1
	Section Data Comm Channel	dcc-{m,a,b,c,all} (OC-3 linear fecom) dcc-all (OC-3 linear/rings security only) dcc-{m1,m2,a,b,c,all} (OC-3 Rings only fecom) dcc-all (OC-1 rings security only) dcc-{m,a,b,c,all*}{1,2} -{1,2} (OC-1 interfaces fecom using 27-type OLIUs)	
	TBOS	tbos-1	tbos-1
	Parallel Telemetry	partlm	partlm
	X.25 link	x25	x25
	IAO LAN interface	lan	lan
	Environmental Alarm Input	env-{1-21,all}	env-2
	Environmental Control Input	cont-{1-4,all}	cont-1
Other	Faceplate Connector on 24G-U or 29G-U OLIUs	fac-main	fca-main

* If *all* is chosen as any part of an address, no subsequent address fields should be defined.

The 2000 Product Family includes many SONET products that are capable of interworking with each other. At times, references to other SONET products may appear in DDM-2000 reports. The following list shows standard abbreviations for the various members of the 2000 family.

Complete Product Name	Abbreviated Product Name
unknown	unknown*
DDM-2000 OC-3	DDM-OC3
DDM-2000 OC-12	DDM-OC12
DACS IV-2000	DACS-IV
FT-2000	FT-2000
SLC-2000 Access System	SLC-2000
DDM-2000 FiberReach	FbrRch
Foreign	Foreign**

* Indicates the type of product is unknown.

** Indicates that the product is not compatible with other SONET products.

Command Mode and Prompt Mode

There are two entry modes: command mode (no prompts) and prompt mode. In the command mode (the default), the command line and any user responses are terminated by the semicolon (;) or carriage return (`<cr>`).

The prompt mode is designed for users that are not familiar with DDM-2000. To enter the prompt mode, terminate any line with a carriage return (ENTER or RETURN key) or question mark (?). Prompts generally appear in the form:

```
Prompt Message [Default value]=
```

with the default value enclosed in square brackets ([..]). There are two types of default values:

Static default values, which assume the same value each time the command is invoked.

Current default values, which reflect the mode recent value entered into the system. In the case of an address containing the value “all”, the prompt will display the value [CurrentValues]. When “Current Values” is selected, the current setting of that parameter is not changed.

To reenter the command mode from the prompt mode, answer the current prompt, then continue entering input on the same line after typing a comma (,). When the input is completed, terminating the command with a semicolon (;) will return the session to the command mode. If a command is terminated with a semicolon (;), the system will use default values for all optional parameters for which a value has not been given.

The **help** command provides in-context help during a dialog with DDM-2000. Help is provided automatically when an invalid input is entered and can also be requested anytime by typing a question mark (?).

Special Control Characters

— Backspace characters control H (^H), BACKSPACE key is used to erase character input.

— At sign (@) is used to erase an entire line of input.

— Question mark (?) is used to get help and to enter prompt mode at any time.

— Comma (,) is used to separate parameters from each other.

— Equal sign (=) is used to separate parameter names from parameter values.

— Control T (^T) is the **toggle** command. See the **toggle** command page for additional details.

— Carriage return (ENTER or RETURN key) or exclamation point (!) are used to end a line of input.

— Semicolon (;) is used to end a command. The system will use default values for all optional parameters for which a value has not been given.

— CANcel, DELete, and CTRL-x are used to abort a command which has been entered but has not yet started to execute. All commands can be aborted anytime before the “In Progress...” message is printed. Test commands (except **test-sysctl**) can be aborted at any time during execution using these keys. Reports may be aborted at any time using these keys.

— Colon (:) is used to separate the command name, address, and parameters.

Paged Reports

Reports are paged. When the end of the page has been reached, the prompt “`more? [yes]=`” is displayed if more report text remains. Page length can be set with the **set-link** command.

Confirmation Requests

NOTE: Some commands can be service-affecting if their default parameters are ignored.

After all parameters have been entered, a caution message followed by the command name, the selected values of parameters, and the prompt “`Execute? (y/n or CANcel/DELete to quit)=` is printed. To execute the command, enter “y” and carriage return. To change the value of any of the parameters, enter “n” and carriage return and you will be reprompted for all parameters. To abort the command, enter CANcel or DELete.

Output Descriptions

The output for most commands is described on the following manual pages. Refer to the “Detailed Alarm and History Reports” part of this section for more complete examples and explanations of the alarm and status report (**`rtrv-alm`**) and the history report (**`rtrv-hsty`**).

Alarm Level Prompt

When the system is ready to accept a new command, it prints the system prompt “<“. If there is an active alarm or status condition, the level of the highest level active alarm in the system is printed before the “<“. For example, the system prompt is “MN<“ when a minor alarm condition exists in the system.

Security

The option of system security is provided for DDM-2000 systems. Three privileged user logins and a maximum of 100 nonprivileged user logins, consisting of general users, maintenance users, and Reports-Only users, are available. Privileged users may set system security on all data communication channels (DCC) and each craft interface terminal (CIT) interface (using the **`set-secu`** command) and assign login and password pairs to general users (using the **`set-lgn`** command). General users may execute commands that are not restricted to privileged users and obtain reports. Maintenance users may only execute commands that access the system, extract reports, and execute maintenance functions. Reports-Only users may only obtain reports and ececute several basic commands.

When system security is enabled, all users are then required to enter a valid login and password pair to access the system.

The following comands are always restricted to privileged users only:

— **init-sys** (initialize system)

— **rstr-passwd** (restore password)

— **rtrv-lgn** (retrieve login)

— **rtrv-passwd** (retrieve password)

— **set-fecom** (set far-end communication)

— **set-lgn** (set login)

— **set-secu** (set security)

— **set-feat** (set feature)

— **set-sync** (set synchronization)

When security is enabled on a system, the following commands become restricted to priviliged users only:

— **cpy-prog** (copy program)

— **dlt-osacmap** (delete OS application context ID map entry)

— **ent-osacmap** (enter OC application context ID map entry)

— **ent-ulsdcc** (enter upper layer section DCC)

— **ent-tl1msgmap** (enter TL1 message map for Operations Systems)

— **init-pm** (initialize performance montoring)

— **ins-prog** (install program)

— **reset** (reset system software)

— **set-date** (set date)

— **set-ne** (set network element)

— **set-x25** (set X.25 link)

When security is enabled on a system, only the following commands may be executed by Reports-Only users:

— **?** (help)

— **logout** (log out)

— **rlgn** (remote login)

— **set-link** (set link)

— **set-passwd** (set password)

— **T** (toggle)

— all **rtrv** commands except **rtrv-lgn** and **rtrv-passwd**

Refer to the **set-secu** command for more details on system security.

DDM-2000 OC-3 Command Menu

Table 11-2 lists the DDM-2000 OC-3 commands by category and indicates what type of user is able to execute each command.

Table 11-2. DDM-2000 OC-3 Command Menu

Command Category	Verb	Modifier	Security Level
CONFIGURATION	rtv-	alm	Privileged, General, Maintenance, Reports only
		state-eqpt	Privileged, General, Maintenance, Reports only
		state-path	Privileged, General, Maintenance, Reports only
		state-sts1	Privileged, General, Maintenance, Reports only
		state-vt1	Privileged, General, Maintenance, Reports only
		state-oc1	Privileged, General, Maintenance, Reports only
		eqpt	Privileged, General, Maintenance, Reports only
		feat	Privileged, General, Maintenance, Reports only
		fecom	Privileged, General, Maintenance, Reports only
		hsty	Privileged, General, Maintenance, Reports only
		lan	Privileged, General, Maintenance, Reports only
		oc1	Privileged, General, Maintenance, Reports only
		oc3	Privileged, General, Maintenance, Reports only
		oc12	Privileged, General, Maintenance, Reports only
		t1	Privileged, General, Maintenance, Reports only
		t3	Privileged, General, Maintenance, Reports only
		ec1	Privileged, General, Maintenance, Reports only
		sync	Privileged, General, Maintenance, Reports only
		link	Privileged, General, Maintenance, Reports only

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
CONFIGURATION (Continued)	rtv-	attr-alm	Privileged, General, Maintenance, Reports only
		attr-cont	Privileged, General, Maintenance, Reports only
		attr-env	Privileged, General, Maintenance, Reports only
		ne	Privileged, General, Maintenance, Reports only
		map-neighbor	Privileged, General, Maintenance, Reports only
		map-network	Privileged, General, Maintenance, Reports only
		osacmap	Privileged, General, Maintenance, Reports only
		ow	Privileged, General, Maintenance, Reports only
		crs-sts1	Privileged, General, Maintenance, Reports only
		crs-sts3c	Privileged, General, Maintenance, Reports only
		crs-vt1	Privileged, General, Maintenance, Reports only
		ulsdcc	Privileged, General, Maintenance, Reports only
		sts1	Privileged, General, Maintenance, Reports only
		sts3c	Privileged, General, Maintenance, Reports only
		tl1msgmap	Privileged, General, Maintenance, Reports only
		trace-sts1	Privileged, General, Maintenance, Reports only
		vt1	Privileged, General, Maintenance, Reports only
		x25	Privileged, General, Maintenance, Reports only
	set-	oc1	Privileged, General
		oc3	Privileged, General
		oc12	Privileged, General
		t1	Privileged, General

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
CONFIGURATION (Continued)	set-	t3	Privileged, General
		ec1	Privileged, General
		sync	Privileged
		date	Privileged only if Security enabled. Privileged, General if Security disabled.
		link	Privileged, General, Maintenance, Reports only
		attr-alm	Privileged, General
		attr-cont	Privileged, General
		attr-env	Privileged, General
		ne	Privileged only if Security enabled. Privileged, General if Security disabled.
		ow	Privileged, General, Maintenance,
		lan	Privileged, General
		state-t1	Privileged, General
		state-t3	Privileged, General
		state-ec1	Privileged, General
		state-oc1	Privileged, General
		state-oc3	Privileged, General
		state-sts1	Privileged, General
		state-vt1	Privileged, General
		fecom	Privileged
		feat	Privileged
		sts1	Privileged, General
		sts3c	Privileged, General
		trace-sts1	Privileged, General
		vt1	Privileged, General
		x25	Privileged only if Security enabled. Privileged, General if Security disabled.
	upd		Privileged, General
	init-	sys	Privileged
	switch-	line	Privileged, General, Mainenance
		ls	Privileged, General, Mainenance
		fn	Privileged, General, Mainenance
		sync	Privileged, General, Mainenance

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
	switch-	path-vt1	Privileged, General, Mainenance
		path-sts1	Privileged, General, Mainenance
		path-sts3c	Privileged, General, Mainenance
CONFIGURATION (Continued)	opr-	lpbk-t1	Privileged, General, Mainenance
		lpbk-t3	Privileged, General, Mainenance
		lpbk-ec1	Privileged, General, Mainenance
	rls-	lpbk-t1	Privileged, General, Mainenance
		lpbk-t3	Privileged, General, Mainenance
		lpbk-ec1	Privileged, General, Mainenance
	test-	auto	Privileged, General, Mainenance
		iao-lan	Privileged, General, Mainenance
		trmsn-t1	Privileged, General, Mainenance
		trmsn-t3	Privileged, General, Mainenance
		alm	Privileged, General, Mainenance
		led	Privileged, General, Mainenance
		sysctl	Privileged, General, Mainenance
	ins-	prog	Privileged only if Security enabled. Privileged, General if Security disabled.
	ent-	crs-sts1	Privileged, General
		crs-sts3c	Privileged, General
		crs-vt1	Privileged, General
		usldcc	Privileged only if Security enabled. Privileged, General if Security disabled.
		tl1msgmap	Privileged only if Security enabled. Privileged, General if Security disabled.
		osacmap	Privileged only if Security enabled. Privileged, General if Security disabled.
	dlt	crs-sts1	Privileged, General
		crs-sts3c	Privileged, General
		crs-vt1	Privileged, General
		osacmap	Privileged only if Security enabled. Privileged, General if Security disabled.

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
Configuration	cnvt-	crs	Privileged, General
(Continued)	cpy-	prog	Privileged only if Security enabled. Privileged, General if Security disabled.
FAULT	rtrv-	alm	Privileged, General, Mainenance, Reports-Only
		state-eqpt	Privileged, General, Mainenance, Reports-Only
		state-path	Privileged, General, Mainenance, Reports-Only
		eqpt	Privileged, General, Mainenance, Reports-Only
		hsty	Privileged, General, Mainenance, Reports-Only
	opr-	aco	Privileged, General, Mainenance, Reports-Only
	reset		Privileged, General, Mainenance, Reports-Only
PERFORMANCE	rtrv-	pm-tca	Privileged, General, Mainenance, Reports-Only
		pm-sect	Privileged, General, Mainenance, Reports-Only
		pm-lan	Privileged, General, Mainenance, Reports-Only
		pm-line	Privileged, General, Mainenance, Reports-Only
		pm-t1	Privileged, General, Mainenance, Reports-Only
		pm-t3	Privileged, General, Mainenance, Reports-Only
		pm-sts1	Privileged, General, Mainenance, Reports-Only
		pm-vt1	Privileged, General, Mainenance, Reports-Only.
		pmthres-sect	Privileged, General, Mainenance, Reports-Only.
		pmthres-line	Privileged, General, Mainenance, Reports-Only.

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
PERFORMANCE (Continued)	rtrv-	pmthres-sts1	Privileged, General, Mainenance, Reports-Only.
		pmthres-vt1	Privileged, General, Mainenance, Reports-Only.
		pmthres-t3	Privileged, General, Mainenance, Reports-Only.
		pmthres-t1	Privileged, General, Mainenance, Reports-Only.
		alm	Privileged, General, Mainenance, Reports-Only.
		state-eqpt	Privileged, General, Mainenance, Reports-Only.
		state-path	Privileged, General, Mainenance, Reports-Only.
		eqpt	Privileged, General, Mainenance, Reports-Only.
		hsty	Privileged, General, Mainenance, Reports-Only.
	set-	pmthres-sect	Privileged, General, Mainenance, Reports-Only.
		pmthres-line	Privileged, General, Mainenance, Reports-Only.
		pmthres-sts1	Privileged, General, Mainenance, Reports-Only.
		pmthres-vt1	Privileged, General, Mainenance, Reports-Only.
		pmthres-t3	Privileged, General, Mainenance, Reports-Only.
		pmthres-t1	Privileged, General, Mainenance, Reports-Only.
	init-	pm	Privileged only if Security enabled. Privileged, General if Security disabled.

Table 11-2. DDM-2000 OC-3 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
SECURITY	rtrv-	lgn	Privileged
		secu	Privileged, General, Mainenance, Reports-Only.
		passwd	Privileged
	set-	lgn	Privileged
		secu	Privileged
		passwd	Privileged, General, Mainenance, Reports-Only.
	rstr-	passwd	Privileged
MISCELLANEOUS	apply-		Privileged
	help		Privileged, General, Mainenance, Reports-Only.
	logout		Privileged, General, Mainenance, Reports-Only.
	rlgn		Privileged, General, Mainenance, Reports-Only.
	toggle		Privileged, General, Mainenance, Reports-Only.

Starting a CIT Session

Procedures in the “Operation and Maintenance” section of this manual describe how to “Connect a CIT and Establish a Session” with the DDM-2000.

CPro-2000

CPro-2000 is a software package from Lucent Technologies to help users of DDM-2000 Multiplexer systems set up and use an advanced, yet simple, craft operations environment on a personal computer using *Microsoft* Windows**3.1 in the enhanced mode. CPro-2000 provides the user with the normal CIT access to DDM-2000 as well as a mouse-driven graphical user interface (GUI). The user may issue commands to DDM-2000 by using the mouse to select items from a menu and/or objects from the graphics display.

CPro-2000 Release 3.0 and later supports DDM-2000 OC-3,OC-12 and FiberReach Multiplexers, as well as FT-2000 OC-48 Systems. For complete information on CPro-2000, refer to the *CPro-2000 User Manual*, 190-253-101 (for CPro-2000 Release 3.0) or 365-576-1xx (for CPro-2000 Release 4.0 and later).

Commands

The following pages provide detailed information about the user interface commands supported by DDM-2000. Detailed report information is located at the end of this chapter.

* Registered trademark of Microsoft Corporation.

NAME

apply: Locally Overwrite the Executing Software Generic with a New Software Generic

INPUT FORMAT

`apply`[:[`date=`*`date`*][,[`time=`*`time`*][,`action=`*`action`*]]];

`apply`[:[,`pgmtype=`*`ProgramType`*[,`Address=`*`AID`*]
[`date=`*`date`*][,[`time=`*`time`*]] [,`action=`*`action`*]];
(For OC-3 Release 15.0 and later)

DESCRIPTION

This command can be issued by the user to initiate the installation of a dormant copy of a software generic stored in the network element's flash memory; therefore replacing the currently executing software generic.

Once the **`apply`** command completes, the software in flash memory is left undisturbed, so that it can be copied to other like network elements.

CAUTION:
Normal alarming and protection switching are disabled for the DDM-2000 system while this command is used to copy the Network Element's dormant program.

CAUTION:
Do not attempt any command that causes shelf reset while an apply command is in progress.

Starting with OC-3 Release 15.0, this command can also be issued by the user to initiate the installation of a dormant copy of an IMA LAN software generic stored in the network element's flash memory; therefore replacing the currently executing software generic on the addressed IMA LAN circuit pack(s).

Once the **`apply`** command completes, the software in flash memory is left undisturbed, so that it can be copied to other like network elements (if needed).

NOTE:
This command is available to privileged users only for all CIT or DCC ports on the system.

Users can schedule a date and time for this command to be executed for non-IMA LAN related upgrades. If no date and time is supplied, the command will execute 15 minutes after it is received.

Authorized users can remotely apply the dormant software generic (whether Network Element or IMA LAN's software generic) to be the executing one by first remotely logging into the target network element and then initiating this command.

The input parameters are:

ProgramType

This parameter is used starting with OC-3 Release 15.0. ProgramType specifies whether the software to be applied is the Network Element or IMA LAN software generic. This parameter can have one of the following values:

lansw The software to be applied is the IMA LAN generic.

nesw The software to be applied is the Network Element generic (default).

Address Address of the Low Speed slot(s) equipped with the IMA LAN pack. This parameter is prompted for only if **pgmtype** has the value of **lansw**.

Valid Addresses: **ls-{a, b, c}-{1-7,all},all**

NOTE:
Knowing that the IMA LAN pack occupies two consecutive Low Speed slots, the following guidelines should be used:

The IMA LAN pack address is the address of either slot number of the two occupied by the pack. For example: if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the Address used in this case can be either *ls-a-1* or *ls-a-2*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and/or 7), the following are the allowed Address combinations:

ls-{a,b,c}-{3 and 4} is allowed
ls-{a,b,c}-{6 and 7} is allowed

date Date is entered as six digits YYMMDD, where YY represents the last two digits of the year, MM is the month, and DD is the day. Default is the current system day. If no *date* parameter is entered, and *action* has the value of **install** or is **NULL**, and the entered value for *time* has already passed the 24-hour interval in the current system's date, *date* will default to the next system's day (current system's day + 1). (As an example, if the current time is 23:46 but the provisioned time is set for 21:00, the execution of the command will occur at 21:00 the next system's day.)

This parameter is not prompted for if **pgmtype** has the value of **lansw**(for IMA LAN).

time The time parameter is supplied in order to identify the time at which the software is to be installed on the network element. If no *time* parameter is entered, and the *action* parameter has the value of **install** or is **NULL**, then the software will be scheduled for installation 15 minutes after receiving the **apply** command. The fifteen-minute interval is designed to give the user a chance to cancel the command and/or to issue similar command(s) to other network element(s) in the subnetwork.

This parameter is entered as six digits **HHMM[SS]**. **HH** expresses the hour on a 24-hour clock basis and the allowed values range from **00** to **23**, with leading zeros required. **MM** expresses the minutes and the allowed values range from **00** to **59** with leading zeros required. **SS** expresses the seconds and the allowed values are **NULL** or a value ranging from **00** to **59** with leading zeros required.

This parameter is not prompted for if **pgmtype** has the value of **lansw**(for IMA LAN).

action The action parameter enables the execution of this command to be either confirmed, or canceled. The allowed values are:

install This action causes the installation of software at the time and date supplied in the *time* and *date* parameters. The installation will take place in 15 minutes if *time* and *date* are not provisioned.

cancel Cancel the scheduled installation.

NULL No value. When no value is entered, the default value is **install**.

If a software installation was already scheduled, and a **cancel** value was received, the software installation is canceled.

For IMA LAN, **install** action causes the immediate software installation (no delay is involved).

CAUTION:
*If this command is scheduled for execution (`action`=**`install`**),* the **`set-date`** command should never be issued before program installation is invoked and completed. In this case, the user is advised to wait until program installation is completed, and the system is reset.

NOTE:
If this command is issued with (*`action`*=**`install`**), while there is an outstanding apply command, the newly issued command will replace the old request with the newly entered values of **`date`** and **`time`**.

If this command is entered by a non-privileged user, the following denial message is displayed:

```
PICC
/* Privileged, Illegal Command Code. */
```

If the command syntax is correct, the following message will be displayed:

```
/* Testing for NE program copy ... */
```

When applying the IMA LAN software generic; if the command syntax is correct, the following message will be displayed:

```
/* Testing for IMA LAN program copy ... */
```

If the user issues an **apply** command for IMA LAN software generic, but the dormant area contains NE software generic, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Mismatch between Dormant SW and requested operation. */
```

The above denial also applies to the opposite case (the user issues an **apply** command for NE software, but the dormant area contains IMA LAN software) as well.

If an **apply** command is issued to schedule (install or NULL) a software installation but *time* is entered with invalid syntax, the user will be reprompted to enter a valid *time* value.

If an **apply** command is issued to schedule (install or NULL) a software installation but *date* is entered with invalid syntax, the user will be reprompted to enter a valid *date* value.

If the time specified is unknown to the local system, the following denial message will be displayed:

```
IDNV
/* Input Data Not Valid */
/* Unknown time specified. */
```

If the date specified is unknown to the local system, the following denial message will be displayed:

```
IDNV
/* Input Data Not Valid */
/* Unknown date specified. */
```

If this command is issued and the dormant copy of software generic is either missing (does not reside in the flash memory) or is determined to have been corrupted, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Dormant file corrupted or missing. */
```

If an otherwise valid command with action equal to **`cancel`** is initiated, but with no outstanding apply command, the request will be denied and the following message displayed:

```
SROF
/* Status, Requested Operation Failed */
/* No apply command to cancel. */
```

After testing for program apply, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will erase the current
   generic n.n.n at Target Identifier and replace it with
   generic m.m.m.  If this fails prior to completion,
   the control system will likely become inoperable
   until another install program attempt is successful.
   This command will terminate any active CIT and TL1 sessions.
   This command will take time to install the new program.  Check
   the Software Release Description for the time estimates. */


   You have selected the apply command with these parameters:

   date = date
   time = time
   action = action


Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, after testing for NE program apply, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will erase the current
   generic n.n.n at Target Identifier and replace it with
   generic m.m.m.  If this fails prior to completion,
   the control system will likely become inoperable
   until another install program attempt is successful.
   This command will terminate any active CIT and TL1 sessions.
   This command will take time to install the new program.  Check
   the Software Release Description for the time estimates. */


   You have selected the apply command with these parameters:

   ProgramType = nesw
   date = date
   time = time
   action = action

Execute? (y/n or CANcel/DELete to quit) =
```

After testing for IMA LAN program apply, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will erase the current
   IMA LAN generic at listed Address(es) below and
   replace it with IMA LAN generic m.m.m.  If this fails prior
   to completion, this will result in continued operation of the
   original IMA LAN generic on the addressed circuit pack(s).
   If this download completes successfully and the addressed
   IMA LAN starts to reboot to the new IMA LAN generic, then
   IMA LAN operations may be affected.
   This command will take time to install the new program.  Check
   the Software Release Description for the time estimates. */


   You have selected the apply command with these parameters:

   ProgramType = lansw
   Address = x
   action = action

Execute? (y/n or CANcel/DELete to quit) =
```

Failed or canceled transfers (apply) of the new IMA LAN software will result in continued operation of the original IMA LAN generic on the addressed circuit pack(s).

When this command is used to install a new NE release of program that is significantly different from the program currently running on the system, the following confirmation message will be displayed after testing for program apply:

```
/* Caution! Execution of this command will erase the current
   generic n.n.n at Target Identifier and replace it with
   generic m.m.m.  If this fails prior to completion,
   the control system will likely become inoperable
   until another install program attempt is successful.
   This command will terminate any active CIT and TL1 sessions.
   Check the Software Release Description for the time estimates. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and program
   compatibility information for additional information or actions
   needed. */


   You have selected the apply command with these parameters:

   date = date
   time = time
   action = action


Execute? (y/n or CANcel/DELete to quit) =
```

See "Install New Generic Program" in the TOP section (Volume 2) of this manual for complete instructions before using this command. Use the **`rtrv-map-network`** command to obtain the exact TID for the target system. The current program version may also be obtained from the initial screen when logged into the system with a craft interface terminal (CIT).

When the user gives a positive response to the confirmation message, the following message is displayed:

```
In progress; Program installation will start on <date>, at
<time>.
System will Reset when program installation is complete.
```

After displaying the above message, the NE program apply will begin at the provisioned **`date`** and **`time`**.

When the user gives a positive response to the IMA LAN confirmation message, the following message is displayed:

```
IMA LAN Program installation is starting.
Pack(s) will Reset when program installation is complete.
```

IMA LAN program apply begins immediately after displaying the above message.

When applying IMA LAN software to a specific address; if the addressed Low Speed slot is not equipped, or equipped with a non-IMA LAN pack, the following denial is displayed:

```
ENEQ
/* Equipage, Not EQuipped */
/* Addressed Low Speed slot is not equipped,
   or not equipped with the correct pack. */
```

When applying IMA LAN software to multiple addresses; if some of the addressed Low Speed slots are not equipped, equipped with a non-IMA LAN pack, or the corresponding IMA LAN program apply fails for some reason, the command will complete, but the following message is displayed for each exception:

```
/* Address; SW download denied  */
```

If the IMA LAN program apply fails at one or more of the addressed packs, the command will complete, and the apply failure(s) will be recorded in the history log.

All NE or IMA LAN software apply commands that fail or succeed will be reported in the History log (rtrv-hsty report).

If this command is issued with action equal to **`cancel`**, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will cancel the scheduled
   software installation at Target Identifier.


   You have selected the apply command with this parameter:

   action = cancel


Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, if an apply for NE generic is issued with action equal to **`install`**, and then an action equal to **`cancel`** is issued, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will cancel the scheduled
   software installation at Target Identifier.


   You have selected the apply command with these parameters:

   ProgramType = nesw
   action = cancel


Execute? (y/n or CANcel/DELete to quit) =
```

If an apply for IMA LAN generic is issued with action equal to **`install`**, and then an action equal to **`cancel`** is issued, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will cancel the scheduled
   IMA LAN software installation at the listed Address(es).


   You have selected the apply command with these parameters:

   ProgramType = lansw
   Address = x
   action = cancel


Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
When the value **`cancel`** is entered for Action, the user will not be prompted for the (date and time) parameters. As soon as the scheduled program installation is canceled as a result of this option, the Date and Time are initialized to zero (0) values.

When the user gives a positive response to the confirmation message, the following message is displayed:

```
Program installation is being canceled.
```

For IMA LAN, when the user gives a positive response to the confirmation message, the following message is displayed:

```
IMA LAN Program installation is being canceled.
```

Once the program installation is canceled, the following message is displayed:

```
COMPLD
```

RELATED COMMANDS

cpy-prog

ins-prog

rtrv-ne

NAME

cnvt-crs: Convert Cross-Connection

INPUT FORMAT

`cnvt-crs`:*`Address1`*,*`Address2`*;

DESCRIPTION

CAUTION:
Execution of this command will affect service. This command should only be executed when existing STS-1 cross-connections are supporting either no services or DS1 services. Executing this command will cause a service interruption of approximately 25 milliseconds on associated DS1 services. Refer also to the note on the next page.

This command converts an existing STS-1 cross-connection to 28 individual VT1.5 cross-connections with the same endpoints. VT1.5 signals carried within the original STS-1 will appear in the same time slots in the upstream or downstream DDM-2000 multiplexers before and after the conversion takes place. This conversion enables an easy upgrade of existing STS-1 networks to DS1 networks. This command will reconfigure all hardware.

This command is available with OC-3 linear and ring releases. For ring releases where the cross-connection type (CrsType) is defined, the CrsType of all converted VT1.5 cross-connections will be the same as the CrsType of the STS-1 cross-connection before conversion. That is, if `CrsType=`*dc* for the STS-1 cross-connection, all VT1.5 cross-connections will be `CrsType=`*dc* also. The 22-type, 24-type, 29-type, 26-type, or 27-type OLIU circuit packs must be used to convert cross-connections. The 24-type OLIU is available in OC-3 Release 11.0 and later OC-3 ring releases. The 29-type OLIU is available in OC-3 Release 15.0 and later OC-3 ring releases.

The input parameters are:

Address1 and *Address2*	These are the addresses of the two STS-1 channels that are currently cross-connected and will be converted to 28 VT1.5 cross-connections. Valid STS-1 Addresses: **{a,b,c}, {m,c}-{1-3}, {a,b}-{1-2}** If the shelf is equipped with 24- or 29-type OLIU in its Main units, the valid STS-1 addresses are: **m-{1-12}, {a,b,c}, {a,b}-{1,2}, c-{1-3}**

NOTE:
No inverse capability is available to convert 28 VT1.5 cross-connections back to a single STS-1 cross-connection. In order to achieve this, the user must delete each of the 28 VT1.5 cross-connections using the **dlt-crs-vt1** command and then enter the STS-1 cross-connection using the **ent-crs-sts1** command.

In linear systems, if the cross-connect mode, set by the **set-ne** command, has a value of default, execution of this command will be denied with the following denial message:

```
SNVS
/*  Status, Not in Valid State  */
/*  System provisioned for default cross-connections. */
```

Address1 and *Address2* must match an existing STS-1 cross-connection or execution of the command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  The specified STS-1 cross-connection does not exist. */
```

The 22-type, 24-type, 29-type, 26-type, or 27-type OLIU circuit packs must be used in the Main slots of the shelf to convert cross-connections, and function units must have circuit packs that support VT1.5 cross-connections (for example, the 22-type OLIU, MXRVO, TMUX, or STS1E circuit packs). If a user executes this command with 21-type OLIUs in the main slots, or if DS3s or 21-type OLIUs exist in the function unit addressed, the command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  <address> is not equipped for VT connections. */
```

If the convert cross-connection request is for a drop-and-continue connection and the ring identification of the STS-1 cross-connection does not agree with the assigned value for VT1.5 cross-connections (defined by the first VT1.5 drop and continue connection), the request is denied with the following message:

```
SNVS
/*  Status, Not in Valid State */
/*  Ring Identification already provisioned to be ring <value>. */
```

If a user executes this command on an EC-1 port that is in the NMON state, the command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  EC-1 port is in NMON state. */
```

If a user executes this command on an OC-1 line that is in the NMON state, the following warning will be displayed:

```
/*  Cross-connects may use an OC-1 line that is in the NMON state */
```

When using 24-type OLIUs in Main, if the maximum number of STS-1s (3) has already been reached and the user attempts to convert one or more addtional STS-1s (which would exceed the allowed STS-1 bandwidth) the request will be denied and the following denial message displayed:

```
SNVS
/*  Status, Not in Valid State  */
/*  Cross connect capacity is not available. */
```

NOTE:
The above case does not apply when using the 29G-U OLIU in Main.

An attempt to convert any of the following types of cross-connections will be denied.

- STS-1 pass-through in a function unit
- STS-1 function unit to function unit 0x1
- STS-1 path-protection-switched local drop from a function unit
- STS-1 0x1 DS3
- STS-1 dual locked

The denial message is as follows:

```
SNVS
/*  Status, Not in Valid State  */
/*  Cross connect cannot be converted. */
```

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

If an attempt is made to execute this command when using an addres of **`3a-3`** or **`b-3`** (even in a shelf with 29-type OLIUs in Main), the request will be denied and the following message displayed:

```
SNVS
/*  Status, Not in Valid State  */
/*  STS-1 in A-3 or B-3 cannot be converted. */
```

After entering this command, the following confirmation is displayed. If fewer than 28 cross-connections are created, only the equipped slots will be shown in the **`rtrv-crs-vt1`** report.

```
/* CAUTION!  Execution of this command may affect service.
   This command will convert an existing STS-1 cross-connection into
   28 new VT1.5 cross-connections.  Proceed with EXTREME CAUTION!
   You have selected the cnvt-crs command with these parameters:

   Address1 = address
   Address2 = address         */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-vt1

ent-crs-vt1

rtrv-crs-vt1

NAME

cpy-prog: Copy Program

INPUT FORMAT

`cpy-prog:``TID;`

`cpy-prog:``TID`[,**`pgmtype=`**`ProgramType`];
(OC-3 Release 15.0 and later)

DESCRIPTION

This command is used to copy a software program from one DDM-2000 network element to another. The software to be copied may be a non-executing, dormant copy of a software generic. When executing this command (to copy the Network Element's software generic), the local network element will internally check whether the currently executing software generic or a dormant software generic should be copied into the memory of the target network element; if the dormant software generic is copied into the memory of the target network element, then it would reside as a dormant copy in the target network element also. If the executing software generic is copied into the target network element, then it would override the target network element's executing generic. The **`apply`** command is used later to overwrite the currently executing generic with a copy of the generic included in the dormant software.

Starting with OC-3 Release 15.0, this command will be used to copy either the Network Element's software generic or the IMA LAN software generic from one DDM-2000 Network Element to another. When executing this command (to copy the IMA LAN's software generic), the local Network Element will always copy the dormant IMA LAN software gneneric into the memory of the target Network Element, where it would reside as a dormant copy also. The **`apply`** command is used later to overwrite the currently executing IMA LAN generic (on the IMA LAN circuit pack(s)) with a copy of the generic included in the dormant software.

NOTE:
If security is enabled on any CIT or DCC port on a system, then this command is available to privileged users only for all CIT or DCC ports on the system. If security is not enabled on *some* systems in the network, users on unsecured systems will be able to copy either executing or dormant program onto systems with security enabled.

The input parameter(s) are:

TID The Target Identifier (system name) of the system into which the program will be loaded. TIDs are case insensitive.

ProgramType
Program Type specifies whether the software to be copied is the Network Element or IMA LAN software generic. This parameter can have one of the following values;

lansw The software to be copied is the IMA LAN generic.

nesw The software to be copied is the Network Element generic (Default).

If the command syntax is correct, the following message will be displayed:

```
/* Testing for program copy ... */
```

When copying the IMA LAN software generic; if the command syntax is correct, the following message will be displayed:

```
/* Testing for IMA LAN program copy ... */
```

If the user issues a cpy-prog command for IMA LAN software generic, but the dormant area contains NE software generic, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Mismatch between Dormant SW and requested operation. */
```

The above denial applies to the opposite case (the user issues a cpy-prog command for NE software, but the dormant area contains IMA LAN software) as well.

If the system name specified is the name of the local system instead of the remote system, the following error message will be displayed and the user will be asked to reenter the TID:

```
/* Invalid Target Identifier (TID) */
/* Enter the name (TID) of the far end system. */
TID=
```

If a user attempts to copy program from one product type to a different product type (for example, DDM-2000 OC-12 program into an FT-2000 system), the following denial message will be displayed:

```
IITA
/* Input, Invalid TArget identifier (TID) */
/* <TID> is a different product type;
   Incompatible software. */
```

The above message is displayed before any association is established between the local and target network elements (NEs).

If a user attempts to copy an IMA LAN program to a network element that does not support this feature (for example, copy the IMA LAN SW into an OC-3 shelf running Release 13.0), the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* Target NE does not support this feature. */
```

If a user attempts to copy an IMA LAN program to a target network element that has either an **`apply`** command in progress or **`apply`** is already scheduled, the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* Apply command is either IP or scheduled
   in Target NE. */
```

The above denial message is applicable also if the user attempts to copy an NE program to a target network element that has either an **`apply`** command in progress or **`apply`** is already scheduled.

If a user attempts to copy an IMA LAN program to a target network element that has a **`cpy-prog`** command in progress, the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* A cpy-prog command is already IP
   in Target NE. */
```

The above denial message is applicable also if the user attempts to copy an NE program to a Target network element that has a cpy-prog command in progress.

If the remote system has a communication failure or a "P" is displayed in the SYSCTL 7-segment LED display, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication failure. */
```

If a Network Element (NE) receives this command, but is unable to determine a TID-NSAP translation for the entered TID (TID could not be found), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the remote NE's TID does not match the entered TID (only the NSAP matched in this case), this command will be denied and the following message displayed :

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX */
```

In the above message, NSAP represents the remote NE's NSAP.

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

If the dormant copy is corrupted or not found, and it is the only software generic that can be copied, the executing generic will be copied in this case.

A user should not attempt to copy program from an OC-3 shelf using Release 9.1 or later (a release capable of receiving, storing, or sending compressed files) into a remote OC-3 shelf using Release 9.0 or earlier (a release that is not capable of receiving compressed files). The currently executing software generic cannot be copied to the destination network element because it has a different release number from the dormant copy. The copy request will be denied and the following message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Execute APPLY command locally first and then try again. */
```

The above request is denied because no copy from the source NE to the destination NE is possible until the executing software release number matches the dormant software release number. To correct this problem, the **apply** command must be issued in the source NE first before trying again.

The following confirmation message will be displayed when this command is entered:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, the following confirmation message will be displayed when this command is entered:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier.
   You have selected the cpy-prog command with these parameters: */

   TID = TargetId
   ProgramType = lansw|nesw

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is used to copy a new NE release of program (into the dormant memory of remote system) that is significantly different from the program currently running on the system, the following confirmation message will be displayed after testing for program copy:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and program
   compatibility information for additional information or actions
   needed. */

Execute? (y/n or CANcel/DELete to quit) =
```

See "Install New Generic Program" in the TOP section (Volume 2) of this manual for complete instructions before using this command. Use the **`rtrv-map-network`** command to obtain the exact TID for the target system. The current program version may also be obtained from the initial screen when logged into the system with a craft interface terminal (CIT).

When the user gives a positive response to the confirmation message, the program copy begins and the following message is displayed:

```
In progress ................................................
```

The number of dots and how fast they are displayed depend on the size of the program to be copied, number of DCC spans between the local and remote systems, and DCC traffic.

If the program copy fails, the following failure message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Program copy failed to Target Identifier
   Before attempting another copy, check the User’s Manual
   to review a list of possible problems and their solutions. */
```

If the IMA LAN program copy fails, the following failure message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* IMA LAN Program copy failed to Target Identifier
   Before attempting another copy, check the User’s Manual
   to review a list of possible problems and their solutions. */
```

When the program has successfully been copied to the remote system, the following message is displayed:

```
/* NE Generic program m.m.m is installed. */
```

When the IMA LAN program has successfully been copied to the remote system, the following message is displayed:

```
/* IMA LAN Generic program n.n.n is installed. */
```

If this command experiences memory space problems at the target network element (that is, the software will not fit in the space allocated in flash memory reserved for it), the currently executing software generic will be overwritten.

RELATED COMMANDS

rtrv-map-network

rtrv-ne

ins-prog

NAME

dlt-crs-sts1: Delete Cross-Connection STS-1

INPUT FORMAT

`dlt-crs-sts1`:*`Address1`*,*`Address2`*[:*`cct`*=`CrsType`];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command deletes STS-1 cross-connections.

NOTE:
In linear systems, this command can only be executed if the cross-connect mode is set to manual (**`crs=`***`manual`*) as provisioned by the **`set-ne`** command.

The input parameters are:

`Address1` and *`Address2`*
These are the addresses of the two STS-1 channels, or one STS-1 channel and one DS3/EC-1/OC-3/MXRVO/TMUX (in Release 13.0) port or OC-1 line where the existing STS-1 cross-connection is to be deleted. In ring applications, pass-through connections are deleted by using the same address for *`Address1`* and *`Address2`*.
Valid OC-3 STS-1 Addresses:
`{m,c}-{1-3}, {a,b,c}, {a,b}-{1-2}`

If the shelf is equipped with 24-type OLIUs in its Main units, the valid STS-1 Addresses are:
`m-{1-12}, c-{1-3}, {a,b,c}, {a,b}-{1,2}`

If the shelf is equipped with 29-type OLIUs in its Main units, the valid STS-1 Addresses are:
`m-{1-12},`
`c-{1-3}, {a,b,c}, {a,b}-{1,2}`

`cct` CrsType specifies the cross-connection type. This parameter is available with all OC-3 ring releases. The valid values are:

`twoway` Two-way (default) cross-connections apply to terminating, hubbing, add/drop, pass-through, hairpin, 0x1 DS3 and 0x1 ring. configurations. This is the default value. In 0x1 ring configurations, two-way cross-connections support dual- and single-homed OC-1 and, beginning with Release 15.0, OC-3 ring applications. For more information, refer to **`ent-crs-sts1`** command documentation.

NOTE:
For 24G-U OLIU circuit packs, STS-1 pass-through cross-connections will be deleted *only* if the STS-1 contains STS-1 AIS in both directions. Adjacent shelves should have `idle` set to **`ais`** (via the **`set-ne`** command) to insure AIS is inserted on STS-1 channels that are not cross-connected.

dc Drop and continue connections support dual ring applications. Drop and continue connections are only allowed if the function unit address is equipped with the STS1E or 22-type OLIU low-speed circuit packs.

NOTE:
The *`cct`* parameter is an optional parameter if the cross-connection type to be deleted is **`twoway`**. The *`cct`* parameter is required for other CrsType values.

`Address1`, *`Address2`*, and *`CrsType`* must match an existing STS-1 cross-connection or execution of the command will complete with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  The specified STS-1 cross-connection does not exist. */
```

In linear systems, if the cross-connect mode is set to default (**crs=***default*), as provisioned by the **set-ne** command, this command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State */
/*  System provisioned for default cross-connections
    by the CrsMode parameter in the set-ne command. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

Users may not delete an STS-1 pass-through cross-connect through a 24G-U OLIU containing traffic VT1.5 traffic. To remove the pass-through cross-connect, users should first delete the associated VT1.5 or STS-3 cross-connect at the ring drop nodes. Otherwise, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path must be in the AIS state
   to delete the cross-connect. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the dlt-crs-sts1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-crs-sts1

rtrv-crs-sts1

rtrv-ne

set-ne

NAME

dlt-crs-sts3c: Delete Cross-Connection STS-3c

INPUT FORMAT

`dlt-crs-sts3c:Address1,Address2[:cct=CrsType];`

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command deletes STS-3c cross-connections. STS-3c signals are identified by the first STS-1 address in the STS-3c signal. The following chart shows the mapping for STS-3c addresses to the internal STS-1 signal structure:

STS-3c Mapping

Interface	Address	Internal STS-1 #s
Main	m-1	1,2,3
	m-4	4,5,6
	m-7	7,8,9
	m-10	10,11,12
FN-C	c-1	1,2,3 (29-type in Main)

This command can be used in an OC-3 shelf if it is equipped with 24-type OLIU circuit packs in its Main unit slots. The only valid cross-connect type for this equipage is **`Twoway`** for pass-through cross-connections. Starting with OC-3 Release 15.0, if the shelf is equipped with 29-type OLIU circuit packs in its Main unit slots, the valid cross-connect type is **`Twoway`**, which supports pass-through or add-drop for 0X1 (depending on the shelf's equipage).

The input parameters are:

Address1 and *Address2*

These are the addresses of the two STS-3c channels that are to be deleted. Valid connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

m-{1,4,7,10} to m-{1,4,7,10}

Allowed if the OC-3 shelf is equipped with 24-type or 29-type OLIU circuit packs in its Main unit slots.

m-{1,4,7,10} to c-1

Allowed with 29G-U in Main and 22-type in functio slots.

For pass through signals, Address1 and Address2 must be the identical time slot.

cct CrsType specifies whether the cross-connection is two-way The valid values are:

twoway Two-way applies to add-drop (in OC-3 applicable to 0X1 application only) and pass through cross-connections. Twoway is the default value.

The *cct* parameter is an optional parameter if the cross-connection type to be deleted is **twoway**.

Address1, *Address2*, and *CrsType* must match an existing STS-3c cross-connection, or execution of the command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  The specified STS-3c cross-connection does not exist. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the dlt-crs-sts3c command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-crs-sts3c

rtrv-crs-sts3c

NAME

dlt-crs-vt1: Delete Cross-Connection VT1.5

INPUT FORMAT

dlt-crs-vt1:*Address1*,*Address2*[:**cct=**CrsType];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command deletes VT1.5 signal cross-connections within a DDM-2000 OC-3 system.

NOTE:
In linear systems, this command can only be executed if the cross-connect mode is set to manual (**crs=***manual*) as set by the **set-ne** command.

The input parameters are:

Address1 and *Address2*

These are the addresses of the two VT1.5 channels, or one VT1.5 channel and one DS1 or "internal" DS1 (within the BBG20 TMUX circuit pack in OC-3 Release 13.0 and later) port, where existing cross-connections are to be deleted. In ring applications, pass-through connections are deleted by using the same address for *Address1* and *Address2*.

Valid Linear Addresses:
{m,c}-{1-3,all}-{1-7,all}-{1-4,all},
{a,b}-{1-2}-{1-7,all}-{1-4,all},
{a,b,c}-{1-7,all}-{1-4,all}

Valid Ring Addresses:
m-{1-3,all}-{1-7,all}-{1-4,all},
{a,b,c}-{1-7,all}-{1-4,all},

a-{1,2,all}-{1-7,all}-{1-4,all},
b-{1,2,all}-{1-7,all}-{1-4,all},
c-{1-3,all}-{1-7,all}-{1-4,all}

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying all selects ports 1 and 2 only.

If the shelf is equipped with 24-type or 29-type OLIUs in Main unit slots, valid OC-12 Main unit Addresses are:
`m-{1-12}-{1-7,all}-{1-4,all}`

`cct` CrsType specifies cross-connection type. The valid values are:

`twoway` Two-way cross-connections apply to add/drop, hairpin, and 0x1 ring configurations. Two-way is the default value.

`dc` Drop and continue connections support dual ring applications.

`locked` Locked cross-connections support nonpath-switched DS1 drop applications. Locked cross-connections are only allowed if the function unit address is equipped with the MXRVO or BBG20 TMUX (in Release 13.0 and later) interface.

If the address includes the value `all`, the value for *`cct`* applies to every cross-connection within the range of the addresses.

The *`Address1`*, *`Address2`*, and *`CrsType`* parameters must match an existing VT1.5 cross-connection or execution of the command will complete with the following message:

```
/* The specified VT1.5 cross-connection does not exist
   and can not be deleted. */
```

In linear systems, if the cross-connect mode is set to default (**`crs=`***`default`*) as provisioned by the **`set-ne`** command, this command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State */
/*  System provisioned for default cross-connections
    by the CrsMode parameter in the set-ne command. */
```

If the cross-connection request address includes the value **all** and the addresses do not have a one-to-one relationship, this command will be denied with the following denial message:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

If this command is entered with several addresses or an address of **all** is used and one or more of these addresses cannot be processed, the command will complete but the following message will be displayed:

```
/* The following cross-connections not processed.
   Cross-connect exists with different address:
   Address1  Address2
   Address1  Address2
      .         .
      .         .
      .         .    */
```

When *CrsType* is used and the command is entered with one or more addresses that cannot be processed or an address of **all** that cannot be processed, the command will complete but the following message will be displayed:

```
/* The following cross-connections were not processed
   because the address or cross-connection type did not match.
   Address1  Address2  CrsType
   Address1  Address2  CrsType
      .         .         .
      .         .         .      */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the dlt-crs-vt1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is entered with `all` as part of the address, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   Multiple cross-connections may be affected.
   You have selected the dlt-crs-vt1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-crs-vt1

rtrv-crs-vt1

rtrv-ne

set-ne

NAME

dlt-osacmap: delete OS application context ID map entry

INPUT FORMAT

`dlt-osacmap:vc=`*`VCType`*,**`snpa=`***`SNPA`*;

DESCRIPTION

This command deletes data terminal equipment (DTE) calling addresses of operations systems (OS) that are assigned to the switched virtual circuit (SVC) and/or the permanent virtual circuit (PVC) in the X.25 subnetwork application context map. This map lists both the PVCs and the DTE calling addresses for the SVC available in the X.25 channel and maps them to OS application contexts. The DTE entries of both SVC and the PVC can be deleted. The PVC entries can be deleted and replaced by SVC entries, or can be changed using the **`ent-osacmap`** command.

NOTE 1:
If security is enabled on any craft interface terminal (CIT) or data communication channel (DCC) port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 2:
While this command is allowed at all network elements in the subnetwork, only the table at the active gateway network element (GNE) node is active.

The input parameters are:

vc VCType is the virtual circuit type X.25 attachment for the OS and may be one of the following values:

- *PVC* permanent virtual circuit (default value)
- *SVC* switched virtual circuit.

snpa SNPA is the X.25 subnetwork point of attachment for the OS. It is either the logical channel number (LCN) corresponding to the PVC or the DTE calling address corresponding to the SVC entries in the table. SNPA is 1 to 15 digits and must match an existing entry in the table.

If the **vc** or **snpa** entered is not known by the NE, the command will be denied with the following message:

```
IDNV
 /* Input, Data Not Valid, invalid data entered. */
 /* The corresponding VCType/SNPA value is not found in OSACMAP. */
```

When this command is entered at an active GNE, the following confirmation message will be displayed:

```
/* Caution! Operations System access is affected by this command.

   Caution!  When executed, this command causes the NE's affected
   VC to be reset. This action will drop all currently active
   logins on the affected VC.

   You have selected the dlt-osacmap command with these parameters:

    VCType = x
    SNPA = x */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is entered at a network element that is not an active GNE, the following confirmation message will be displayed:

```
/* Caution!  This NE is not an active GNE.  Entries in this table are
   not active.  Only the information at an active GNE is valid.

   You have selected the dlt-osacmap command with these parameters:

    VCType = x
    SNPA = x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

ent-osacmap

rtrv-osacmap

NAME

dlt-ulsdcc-l4: Delete Upper Layer Section DCC

INPUT FORMAT

`dlt-ulsdcc-l4`:[**`L4ajsys=`***`AJSystemId`*][**`L4tdctid=`***`TDCTID`*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **`dlt-ulsdcc-l4`** command in OC-3 Release 13.0 and all later TARP releases.

This command is used to delete provisionable parameters of Layers 3 through 7 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

This command is used to delete a row of data in buffers which hold user-settable parameters in Layer 4 of the OSI stack. These buffers are the TARP Manually Adjacent NE buffer and the TARP Data Cache (TDC).

NOTE:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameters are:

`L4ajsys` This parameter specifies the NSAP System Identifier field of the TARP adjacent NE to be deleted from the TARP Manual Adjacency list of local NE. This is a 6 byte (12 hex digit) field of the TARP adjacent NE. Since the System ID is unique for each NE, the System ID is sufficient to identify a specific Manual Adjacency.

The format of this parameter is **`L4ajsys=`***`AJSystemId`*, where *`AJSystemId`* is the 6 byte (12-digit hex) System ID field of the NSAP address of the Adjacent NE in the list.

This parameter deletes a single Manual Adjacent NE. Multiple Manual Adjacent NEs are deleted using multiple occurrences of the **`dlt-ulsdcc-l4`** command.

The parameter **`L4tdctid`** is used to specify an entry in the TARP Data Cache (TDC) to delete.

Specifying this parameter causes the deletion of a single row of data in the TDC. Multiple rows of data are deleted using multiple occurrences of this command.

The TDC stores three parameters for each entry; the NSAP, TID and the address type. The address type is not user provisionable and is set to its default value ('FE' hex) in the TDC. Specifying the TID field of the NSAP is sufficient to identify the complete TDC entry.

`L4tdctid` This parameter specifies the TID of the Network Element for which the row of data is to be deleted from the TDC.

While entering **`L4ajsys`**, if an incorrect number of digits is entered for a specific parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number. */
```

The `<num>` specifies the number of digits required.

If an invalid *`L4TDCTID`* value is entered (wrong syntax), the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4TDCTID value entered. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Network Element access is affected by this command.

   You have selected the dlt-ulsdcc-l4 command with these parameters:

   L4ajsys   = AJSystemId
   L4tdctid  = TDCTID */

Execute?  (y/n or CANcel/DELete to quit) =
```

If no entries in the TDC match the Target Identifier (TID) specified in the **L4tdctid**, then no action is taken and the following denial message is displayed:

```
IDNV
/* Input, Data Not Valid */
/* Invalid L4tdctid value was entered. */
```

If no entries in the Manual Adjacency table match the SYS ID specified in the **L4ajsys**, then no action is taken and the following denial message is displayed:

```
IDNV
/* Input, Data Not Valid */
/* Invalid L4ajsys value was entered. */
```

RELATED COMMANDS

ent-ulsdcc-l4

ent-ulsdcc-l3

rtrv-ulsdcc-l4

NAME

ent-crs-sts1: Enter Cross-Connection STS-1

INPUT FORMAT

ent-crs-sts1:*Address1*,*Address2*[:*cct*=CrsType][,*ring*=RingId];

DESCRIPTION

This command sets bidirectional STS-1 cross-connections between Main and function unit slots and may be applied to OC-3 systems with various arrangements, including hubbing, add/drop, terminating STS-1, and rings.

All cross-connections require the presence of OLIU circuit packs in the Main slots. In ring applications, 22-type, 24-type, 29-type or 27-type OLIU circuit packs must be present in order to establish STS-1 cross-connections. The 27-type OLIU is available in OC-3 Release 9.0 and later ring releases. The 24-type OLIU is available in OC-3 Release 11.0 and later ring releases for Main units only.
The 29-type OLIU is available in OC-3 Release 15.0 and later ring releases for Main units only.

The 27G2-U or 26G2-U OLIU circuit packs are required in order to establish OC-1 pass-through cross-connections within a function unit and OC-1 0x1 cross-connections between function units and OC-1 hairpin local drop cross-connections and 26G2-U OLIU hairpin support (in Release 13.0 and later).

In linear applications, 22-type, 21G, or 21D OLIU circuit packs may be used to establish STS-1 cross-connections. Additionally, in linear applications, cross-connections may only be entered if **crs=***manual*, as set by the **set-ne** command.

NOTE 1:
The 24G-U OC-12 interface circuit pack will allow up to three STS-1s to be STS or VT cross-connected. The remaining STS-1 channels (if any) will have to continue as STS-1 ring pass-through cross-connects, otherwise the request will be denied as specified later in this document.

NOTE 2:
Any of the 12 STS-1s on the OC-12 (29G-U) interface circuit pack can be selected for STS-1 cross-connection to Function Units or Pass-Through STS-1 cross-connections.

Up to 7 STS-1 channels can be cross-connected on the OC-12 ring.

Figures 11-1, 11-2, 11-3, 11-4, 11-5, and 11-6 show sample cross-connections.

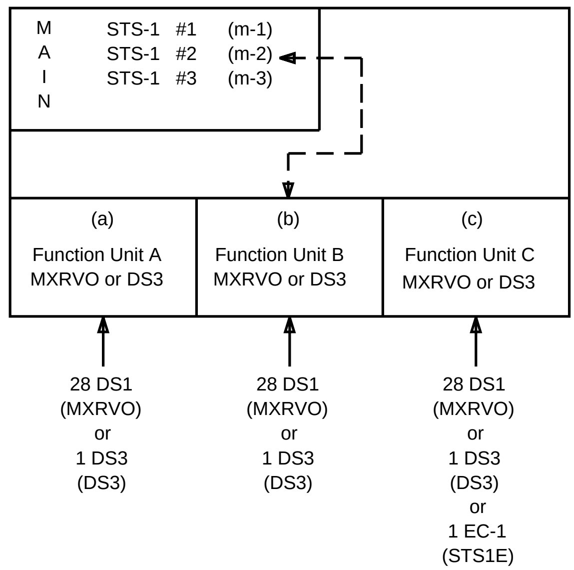


Figure 11-1. Terminating STS-1 m-2 to b

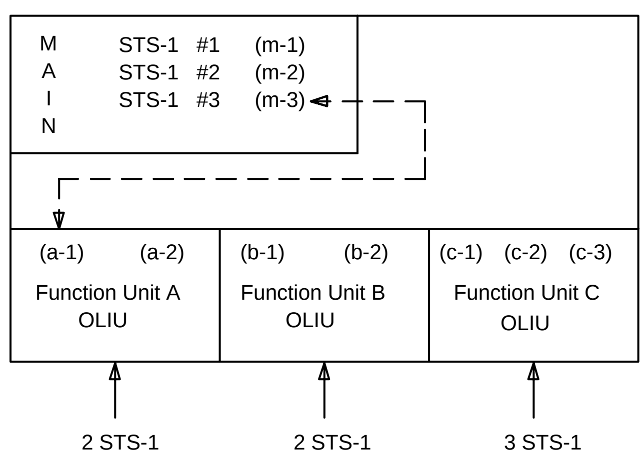


Figure 11-2. Hub Application m-3 to a-1

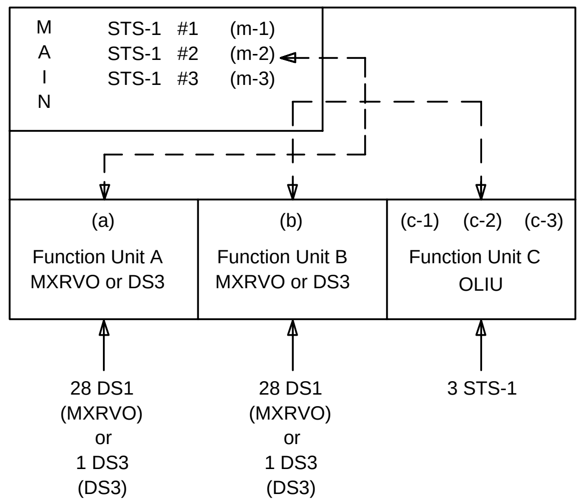


Figure 11-3. Linear Add/Drop Application m-2 to a, c-2 to b

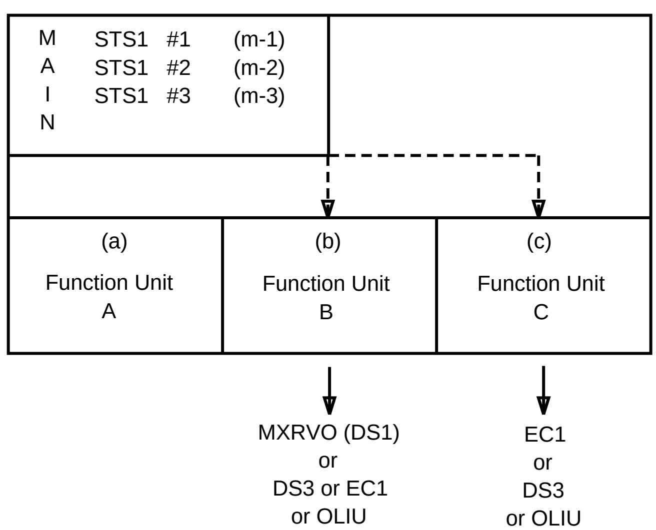


Figure 11-4. Ring Hairpin Application b to c

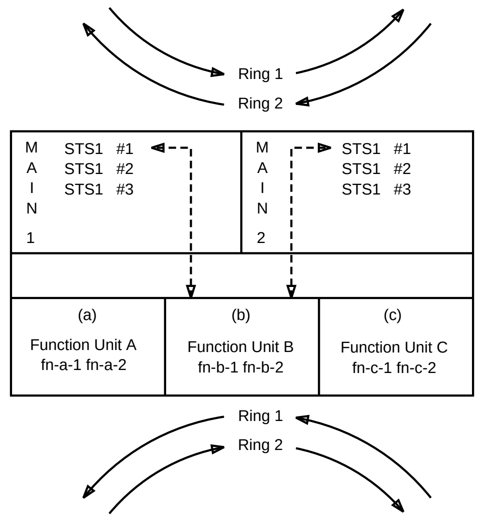


Figure 11-5. 0x1 Ring Configuration, Single-Homed Application m-1 to b-1

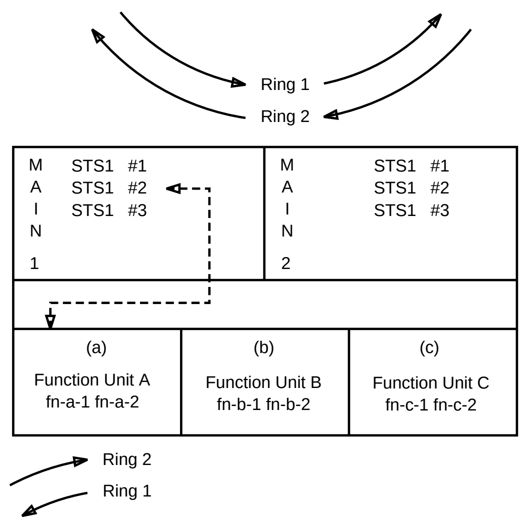


Figure 11-6. 0x1 Ring Configuration, Dual-Homed Application m-2 to a-1

The input parameters are:

Address1 and *Address2*

These are the addresses of the two STS-1 channels or one STS-1 channel and one DS3/EC-1/OC-3/OC-1/MXRVO or TMUX (in Release 13.0 and later) For STS-1 ring pass-through traffic, *Address1* and *Address2* must be the same time slot. Valid addresses are listed on the following pages.

NOTE:
All cross-connections are bidirectional.

cct CrsType specifies the cross-connection type. The valid values are:

twoway Twoway cross-connections apply to terminating, hubbing, add/drop, pass-through, hairpin, 0x1 DS3 configurations and 0x1 ring Twoway is the default value. The 0x1 ring configurations support both dual and single homed OC-1 and, begining with Release 15.0, OC-3 applications.

Starting with Release 9.1, 0x1 ring configurations include main-to-function unit, and function unit-to-function unit interconnections. See the following pages for detailed listings of allowed equipage combinations and corresponding valid addresses. Also starting with Release 9.1, pass-through cross-connections within function units equipped with 27G2-U OLIUs may be established.

Starting with Release 11.0, hairpin local drop cross-connections may be used to drop path-protected traffic from an OC-1 ring terminating on a pair of 27G2-U OLIU circuit packs in a function unit to DS1 ports or to STS-1 channels on an OC-3/IS-3 or STS1E facility. The pair of 27G2-U OLIUs in a single function unit can support a mix of hairpin local drop cross-connections and main-to-FN 0x1 or FN-to-FN 0x1 cross-connections.

Starting with Release 13.0, hairpin local drop cross-connections may be used to drop path-protected traffic from an OC-1 ring terminating on a pair of 26G2-U OLIU circuit packs in a function unit slot to DS1 ports in a different function unit or to STS-1 channels on an OC-3/IS-3 or STS1E facility.

Also, starting with OC-3 Release 13.0, a two-way STS-1 hairpin cross-connect is available between a function unit with a linear OC-3 interface or EC-1 port and another function unit with an EC-1/DS3 or OC-3 linear port.

A 0x1 DS3 cross-connection is established when the addressed function unit contains one or two BBG19 circuit packs. In this case, the addressed STS-1 channel received by the OLIU in Main-1 is connected to the DS3 port in slot 1 of the addressed function unit and the addressed STS-1 received by the OLIU in Main-2 is connected to the DS3 port in slot 2 of the addressed function unit. One of the function slots may be unequipped. Also starting with OC-3 Release 15.0 and when using 22-type OLIUs in Fn slots, if a 0X1 application is desired, this requires provisioning the OC-3 interface(s) with 0X1 application type using the **set-oc3** command.

dc Drop and continue cross-connections support dual ring interworking applications. Drop and continue connections are only allowed if the function unit address is equipped with the STS1E or 22-type OLIU low-speed circuit packs.

If the addresses indicate a pass-through cross-connection, the CrsType is not prompted for but is automatically set to **twoway**. The confirmation message indicates that a CrsType of **twoway** has been selected for the user. If a CrsType other than **twoway** is entered on the command line when the addresses indicate a pass-through cross-connection, the request is rejected. If the CrsType is not **locked** or **dc**, the RingId is not requested and is not displayed in confirmation messages. If the CrsType is not **locked** or **dc**, and RingId is entered, the system will ignore any value entered for RingId.

ring This parameter is available with all ring releases. RingId is the ring identification for drop and continue or locked connections.

For **dc** type connections, it specifies which ring rotation will be continued as well as dropped at this network element. The valid values are:

m1 Ring **m1** is the ring that is received on the Main-1 OLIU and is transmitted on the Main-2 OLIU.

m2 Ring **m2** is the ring that is received on the Main-2 OLIU and is transmitted on the Main-1 OLIU.

In linear releases, shelves may be placed into the default or manual cross-connect mode using the **set-ne** command. If no cross-connect mode is specified, each shelf will be in default mode, which provides a fixed mapping between STS-1 signals embedded in the OC-3 line signal and the STS-1s associated with signals terminating on the shelf. When the manual cross-connect mode is selected, the cross-connect map may be changed by the user. All cross-connections must be entered by the user with this **ent-crs-sts1** command.

For STS-1 cross-connections, there is a one-to-one correspondence between the VT Group number and the low-speed slot number. There is also a one-to-one correspondence between the VT number and the low speed port number.

Valid default and manual cross-connection addresses are listed on the following pages. To successfully perform any cross-connection, the user *must* equip the Main slots with 22-type, 21D, 21G, or 27-type OLIU circuit packs. For additional examples and restrictions on cross-connections, refer to the "Cross-Connection Provisioning" information located in Chapter 8.

Default Linear Release Cross-Connect Addresses:

`m-1 to a`	Default when function group A is equipped with DS3, STS1E, or MXRVO circuit packs
`m-2 to b`	Default when function group B is equipped with DS3, STS1E, or MXRVO circuit packs
`m-3 to c`	Default when function group C is equipped with DS3, STS1E, or MXRVO circuit packs
`m-1 to a-1`	Default when function group A is equipped with OLIU circuit packs
`m-2 to b-2`	Default when function group B is equipped with OLIU circuit packs
`m-3 to c-3`	Default when function group C is equipped with OLIU circuit packs

For DDM-2000 OC-3, manual cross-connections may be entered if the cross-connect mode is set to manual (**`crs=`***`manual`*), as provisioned by the **`set-ne`** command. Valid manual cross-connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

Manual Linear Release Cross-Connect Addresses:

`m-{1-3} to {a,b,c}`
: Allowed when function groups A and/or B and/or C are equipped with DS3, STS1E, or MXRVO circuit packs

`{a,b} to c-{1-3}`
: Allowed when function groups A and/or B are equipped with DS3, STS1E, or MXRVO and when function group C is equipped with OLIU circuit packs.

`m-{1-3} to {a,b}-{1,2}`
: Allowed when function groups A and/or B are equipped with OLIU circuit packs

`{a,b}-{1,2} to c-{1-3}`
: Allowed when function groups A or B and C are equipped with OLIU circuit packs. No more than 1 STS-1 channel may be routed between function groups A and C, and no more than 1 STS-1 channel may be routed between function groups B and C.

`m-{1-3} to c-{1-3}`
: Allowed when function group C is equipped with OLIU circuit packs

In DDM-2000 OC-3 ring releases, the cross-connect mode is always manual (**`crs=`***`manual`*). Valid manual cross-connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

Ring Release Cross-Connect Addresses:

`m-{1-3} to {a,b,c}`
: Allowed when Main slots are equipped with 22-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with DS3 (BBG4, BBG4B, and BBG19), STS1E, MXRVO, or TMUX circuit packs

`m-{1,2} to {a,b,c}`
: Allowed when Main slots are equipped with 27-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with DS3 (BBG4, BBG4B, and BBG19), STS1E, MXRVO, or TMUX circuit packs

`m-{1-12} to {a,b,c}`
: Allowed when Main slots are equipped with 24-type or 29-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with DS3 (BBG4, BBG4B, and BBG19), STS1E, MXRVO, or TMUX circuit packs

m-{1-3} to a-{1,2}
For rings Release 9.0 and later, allowed when Main slots are equipped with 22-type OLIU circuit packs, and function group A is equipped with 22-type circuit packs

m-{1-3} to b-{1,2}
Allowed when Main slots are equipped with 22-type OLIU circuit packs, and function group B is equipped with 22-type circuit packs

m-{1-12} to {a,b}-{1,2}
Allowed when Main slots are equipped with 24-type OLIU circuit packs, and function groups A and/or B are equipped with 22-type circuit packs

m-{1-12} to c-{1-3}
Allowed when Main slots are equipped with 24-type OLIU circuit packs, and function group C is equipped with 22-type circuit packs

m-{1-12} to {a,b}-{1,2}
Allowed when Main slots are equipped with 29-type OLIU circuit packs, and function groups A and/or B are equipped with 22-type circuit packs (Group 4 shelves or earlier)

m-{1-3} to c-{1-3}
Allowed when Main slots are equipped with 22-type circuit packs, and function group C is equipped with 22-type circuit packs

m-{1-3} to m-{1-3}
Allowed to cross-connect pass-through signals when Main slots are equipped with 22-type circuit packs. `Address1` and `Address2` must be the identical time slot.

m-{1,2} to m-{1,2}
Allowed to cross-connect pass-through signals when Main slots are equipped with 27-type OLIU circuit packs. `Address1` and `Address2` must be the identical time slot.

{a,b,c}-{1,2} to {a,b,c}-{1,2}
Allowed to cross-connect pass-through signals when function unit slots are equipped with 27G2-U OLIU circuit packs. `Address1` and `Address2` must be the identical time slot.

m-{1,12} to m-{1,12}
Allowed to cross-connect pass-through signals when Main slots are equipped with 24-type or 29-type OLIU circuit packs. `Address1` and `Address2` must be the identical time slot.

m-{1-3} to {a,b,c}-{1,2}
Allowed when Main slots are equipped with 22-type circuit packs, and function groups A and/or B and/or C are equipped with 27-type OLIU circuit packs.

m-{1-12} to {a,b,c}-{1,2}
Allowed when Main slots are equipped with 24-type or 29-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with 27-type OLIU circuit packs.

m-{1,2} to {a,b,c}-{1,2}
Allowed when Main slots are equipped with 27-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with 27-type OLIU circuit packs.

m-{1-3} to {a,b,c}-1
Allowed when Main slots are equipped with 22-type circuit packs, and function groups A and/or B and/or C are equipped with 26-type OLIU circuit packs.

m-{1-12} to {a,b,c}-1
Allowed when Main slots are equipped with 24-type or 29-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with 26-type OLIU circuit packs.

m-{1,2} to {a,b,c}-1
Allowed when Main slots are equipped with 27-type OLIU circuit packs, and function groups A and/or B and/or C are equipped with 26-type OLIU circuit packs.

m-{1,2} to {a,b}-{1,2}
Allowed when Main slots are equipped with 27-type OLIU circuit packs, and function groups A and/or B are equipped with 22-type OLIU circuit packs.

m-{1,2} to c-{1-3}
Allowed when Main slots are equipped with 27-type OLIU circuit packs, and function group C is equipped with 22-type OLIU circuit packs.

{a,b}-{1,2} to c-{1,2}
Allowed when both addressed function unit slots are equipped with 27G2-U OLIU circuit packs. In this situation, a function unit to function unit OC-1 0x1 cross-connection is established.

{a,b}-{1,2} to c-{1-3}
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B is equipped with 27G2-U OLIU circuit packs and when function group C is equipped with 22-type OLIU circuit packs.

{a,b}-{1,2} to c-{1,2}
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B is equipped with 22-type OLIU circuit packs and when function group C is equipped with 27G2-U OLIU circuit packs.

{a,b}-{1,2} to c
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B is equipped with 27G2-U OLIU circuit packs and when function group C is equipped with MXRVO, TMUX (in release 13.0), or STS1E low-speed circuit packs.

{a,b} to c-{1,2}
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO, TMUX (in release 13.0), or STS1E low-speed circuit packs and when function group C is equipped with 27G2-U OLIU circuit packs.

{a,b}-1 to c-{1-3}
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B is equipped with 26G2-U OLIU circuit packs and when function group C is equipped with 22-type OLIU circuit packs.

{a,b}-{1,2} to c-1
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with 22-type OLIU circuit packs and when function group C is equipped with 26G2-U OLIU circuit packs.

{a,b}-1 to c Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B is equipped with 26G2-U OLIU circuit packs and when function group C is equipped with MXRVO, TMUX, or STS1E low-speed circuit packs.

{a,b} to c-1 Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO, TMUX, or STS1E low-speed circuit packs and when function group C is equipped with 26G2-U OLIU circuit packs.

{a,b} to c-{1-3}
Starting with Release 13.0 allowed when function groups A and/or B are equipped with DS3, STS1E, and when function group C is equipped with 22-type OLIU circuit packs.

{a,b}-{1,2} to c-{1-3}
Starting with Release 13.0 allowed when function groups A or B and C are equipped with 22-type OLIU circuit packs. No more than 1 STS-1 channel may be routed between function groups A and C, and no more than 1 STS-1 channel may be routed between function groups B and C.

{a,b} to c Starting with Release 13.0 allowed when function groups A and/or B are equipped with DS3, STS1E, and when function group C is equipped with STS1E circuit packs.

{a,b}-{1,2} to c
Starting with Release 13.0 allowed when function groups A or B are equipped with 22-type OLIU circuit packs and function group C is equipped with DS3 or STS1E circuit packs.

If this command is invoked using addresses where active cross-connections already exist, the following denial message will be displayed:

```
SACC
/* Status, Already Cross-Connected */
/* Establishing new cross-connections requires that
   existing cross-connections associated with these
   addresses be deleted. */
```

If the cross-connection request includes an invalid circuit pack type, invalid port address, or specifies a cross-connection not supported by the system, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

If the cross-connection request is to an STS1E low-speed interface, the EC-1 port state *cannot* be set to NMON or the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* The addressed port is in NMON state. */
```

In ring systems, if this command is issued and one of the Main slots is not equipped, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped */
```

Starting with Release 11.0, when setting up a path-protected hairpin local drop cross-connection, both slots of the function unit to which the OC-1 ring is terminated must be equipped with 27G2-U OLIU circuit packs. Otherwise the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both FN slots terminating the OC-1 ring must be
   equipped with 27G2-U OLIU circuit packs.  */
```

Starting with Release 13.0, when setting up a path-protected hairpin local drop cross-connection, both slots of the function unit to which the OC-1 ring is terminated must be equipped with 27G2-U or 26G2-U OLIU circuit packs. Otherwise the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both FN slots terminating the OC-1 ring must be
   equipped with 27G2-U or 26G2-U OLIU circuit packs.  */
```

If the addresses indicate a pass-through cross-connection and the CrsType is not **`twoway`**, the request is denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request */
```

In linear systems, if the cross-connect mode is set to default (**`crs=`***`default`*), as provisioned by the **`set-ne`** command, this command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State */
/*  System provisioned for default cross-connections
    by the CrsMode parameter in the set-ne command. */
```

If the maximum number of STS-1s (3) has already been reached when the user attempts to provision an additional STS-1 cross-connect to be dropped; which would exceed the allowed STS-1 bandwidth, the request will be denied and the following denial message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Cross connect capacity is not available. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed. The `RingId` parameter is displayed in the confirmation message only if the `CrsType` parameter is set to **`dc`** or **`locked`**.

```
/* Caution!  Network cross-connections are affected by this command.
   You have selected the ent-crs-sts1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-sts1

rtrv-crs-sts1

rtrv-ne

set-ne

NAME

ent-crs-sts3c: Enter Cross-Connection STS-3c

INPUT FORMAT

`ent-crs-sts3c`:*`Address1`*,*`Address2`*[:*`cct`*=`CrsType`];

DESCRIPTION

This command sets bidirectional STS-3c cross-connections between main-1 and main-2 (using the 24-type or 29-type OLIU circuit packs), or between main and function unit slots (using the 29-type OLIUs in main unit slots and 22-type OLIUs in the function unit slots) to support the STS-3c 0X1 application.

NOTE 1:
In linear OC-3 releases, the STS-3c cross-connection is an optional feature that requires a special license from Lucent Technologies. This feature must first be enabled via the **`set-feat`** command before the cross-connection request takes place.

NOTE 2:
This command can be used in an OC-3 shelf ONLY if the shelf is equipped with 24-type or 29-type OLIU circuit packs in its Main units. The only allowed cross-connect types are `Twoway`.

When using the 24-type OLIU in Main, the only `Twoway` cross-connect allowed is Pass-Through. When using the 29-type OLIU in Main, the only `Twoway` cross-connects allowed are Pass-Through and Add-Drop (for 0X1). All other cross-connect types are not valid at this time.

NOTE:
Special licensing is not required for STS-3c cross-connects in OC-3 ring shelves that are equipped with 24G-U or 29-type type OLIUs in their Main unit slots.

The STS-3c signals are identified (addressed) by using the first STS-1 address contained in each STS-3c signal. The following chart shows the mapping of STS-3c addresses to the internal STS-1 structure:

STS-3c Mapping Table

Interface	Address	Internal STS-1 #s
Main	m-1	1,2,3
	m-4	4,5,6
	m-7	7,8,9
	m-10	10,11,12
FN-C	c-1	1,2,3 (29G-U in Main)

The input parameters are:

`Address1` and `Address2`

These are the addresses of the two STS-3c channels that are to be cross-connected. Valid manual cross-connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

`m-{1,4,7,10} to m-{1,4,7,10}`

Allowed to cross-connect Twoway (pass-through) signals if the OC-3 shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots. Address1 and Address2 must be the identical time-slot.

`m-{1,4,7,10} to c-1`

(Group 4 shelf or earlier, with 29G-U in Main). Allowed for STS-3c 0X1 application ONLY.

`cct` CrsType specifies the cross-connection type. The only valid value is:

`twoway` Two-way cross-connections apply to add-drop (for 0X1 applications, using the 29G-U OLIU in Main and 22-type OLIU in Function) and pass through cross-connections, using the 29-type OLIUs in Main. Twoway is the default value.

Starting with OC-3 Release 15.0, if this command is issued with a *`cct`* parameter equal to **`twoway`** for add-drop (Address1 is different from Address2), and if the application parameter in the **`set-oc3`** command is set to **`1+1`**: The following denial message will be displayed

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

When using 29-type OLIUs in Main and 22-type OLIUs in Fn slots, if a 0X1 application is desired, this requires provisioning the OC-3 interface(s) with 0X1 application type using the **set-oc3** command.

If this command is invoked using addresses where active STS-3c cross-connections or active STS-1 cross-connections within the STS-3c address already exist, the following denial message will be displayed:

```
SACC
/* Status, Already Cross-Connected */
/* Establishing new cross-connections requires that
   existing cross-connections associated with these
   addresses be deleted. */
```

If the cross-connection request includes an invalid circuit pack type, invalid address, or specifies a cross-connection not supported by the system, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

The following denial message will be displayed If both MAIN slots are not equipped:

```
   SNVS
   /* Status, Not in Valid State */
   /* Both main slots must be equipped */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed.

```
/* Caution!   Network cross-connections are affected by this command.
   You have selected the ent-crs-sts3c command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

set-feat

rtrv-feat

set-oc3

rtrv-oc3

dlt-crs-sts3c

rtrv-crs-sts3c

rtrv-crs-sts1

NAME

ent-crs-vt1: Enter Cross-Connection VT1.5

INPUT FORMAT

`ent-crs-vt1`:*`Address1`*,*`Address2`*[:*`cct`*=`CrsType`][,*`ring`*=`RingId`];

DESCRIPTION

This command sets bidirectional VT1.5 cross-connections among Main and function unit slots and may be applied to OC-3 systems with various arrangements.

All cross-connections require the presence of OLIU circuit packs in the Main slots. The 22-type, 24-type, 29-type or 27-type OLIU circuit packs must be present in order to establish VT1.5 cross-connections. Additionally, in linear systems, cross-connections may only be entered if **`crs=`***`manual`*, as set by the **`set-ne`** command.

The 27-type OLIU circuit pack is available with OC-3 Release 9 software, and later ring releases. The 24-type OLIU circuit pack is available with OC-3 Release 11.0 software and later ring releases. The 29-type OLIU circuit pack is available with OC-3 Release 15.0 software and later ring releases.

NOTE 1:
The 24G-U OC-12 interface circuit pack will allow up to three STS-1s to be VT cross-connected; the remaining STS-1 channels (if any) will have to continue as STS-1 ring pass-through cross-connects.

NOTE 2:
Any of the 12 STS-1s on the 29-type OC-12 interface can be selected for VT cross- connection to Function Units or for Pass-Through cross-connections. Up to 196 VT1.5 channels can be add-drop cross-connected from the OC-12 ring to Fn Unit groups on the OC-12 ring.

VT1.5 cross-connects to a-3-x-y and b-3-x-y cannot be established.

27G2-U or 26G2-U OLIU circuit packs must be used to establish OC-1 pass-through cross connections within a function unit, OC-1 0x1 cross connections within and between function unit slots, and OC-1 hairpin local drop cross-connections. (26G2-U support is available in Release 13.0 and later.)

Starting with Release 15.0, the IMA LAN (BBF9) circuit pack will be supported and allowed in the Low Speed slots of an OC-3 shelf.

NOTE:
Each IMA LAN circuit pack occupies 2 adjacent Low-Speed DS1 slots; the pack can use up to 8 VT1.5 channels and will be addressed as two Quad-DS1 circuit packs.

Up to three IMA LAN circuit packs can be installed in a DDM-2000 OC-3 Low Speed group (a, b, and/or c) when the associated Function Unit is equipped with the BBG2B MXRVO. Only one IMA LAN circuit pack is allowed in a Low Speed group if the associated Function Unit is equipped with a BBG2 MXRVO pack.

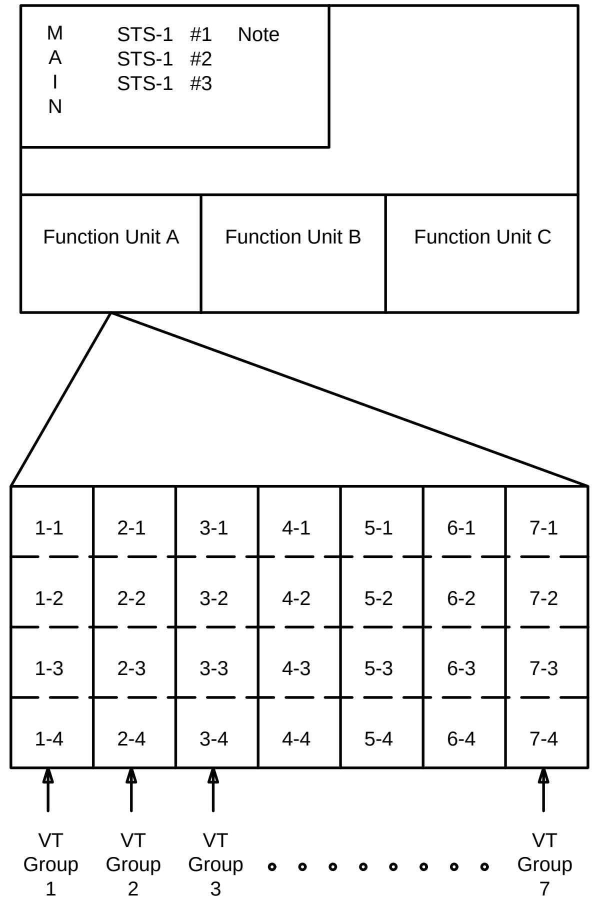
The following lists the different Low Speed slot combinations that this circuit pack can use:

- ls-{a,b,c}-{1 & 2}
- ls-{a,b,c}-{2 & 3}
- ls-{a,b,c}-{3 & 4}
- ls-{a,b,c}-{5 & 6}
- ls-{a,b,c}-{6 & 7}

Mixing of the IMA LAN circuit pack with other Low Speed packs is allowed.

High Speed OLIUs (such as 22-, 24-, or 29-type) can be used with the IMA LAN circuit pack.

Figure 11-7 shows a DDM-2000 OC-3 shelf and highlights a function unit with 28 VT1.5 signals.



Note: Each STS-1 signal contains 28 VT1.5 signals.

Figure 11-7. DDM-2000 Shelf with VT1.5 Signals

As highlighted in Figure 11-8, each OC-3 signal contains three STS-1 signals. Each STS-1 signal contains seven VT Groups of signals. Each VT Group contains four VT1.5 signals, and each VT1.5 signal corresponds to an individual DS1 or T1 port.

In a 27-type OLIU pack, each of the two OC-1 signals contains 1 STS-1 signal.

The input parameters are:

Address1 and *Address2*

These are the addresses of the two VT1.5 channels, or one VT1.5 channel and one DS1 or "internal" DS1 (within the BBG20 TMUX circuit pack) port that are to be cross-connected. For VT1.5 ring pass-through traffic, *Address1* and *Address2* must be the same. Valid addresses are listed on the following pages.

NOTE:
All cross-connections are bidirectional.

cct CrsType specifies the cross-connection type. This parameter is available with all OC-3 ring releases. The valid values are:

twoway Two-way applies to add/drop, hairpin and 0x1 ring configurations. In linear configurations, Twoway applies to add/drop, hairpin, point-to-point and pass-through cross-connections.

0x1 ring configurations support both dual and single homed OC-1.

Starting with Release 9.1, OC-1 0x1 ring configurations include Main-to-function unit, function unit-to-function unit, and intra-function unit interconnections. See the following pages for detailed listings of allowed equipage combinations and corresponding valid addresses.

Starting with Release 9.1, pass-through cross-connections within function units equipped with 27G2-U OLIU circuit packs may be established.

Starting with Release 11.0, hairpin local drop cross-connections may be used to drop path protection switched traffic from an OC-1 ring terminating on a pair of 27G2-U OLIUs in a function unit slot to DS1 ports or to VT1.5 channels on an OC-3/IS-3 or STS1E facility. The pair of 27G2-U OLIUs in a single function unit can support a mix of hairpin local drop cross-connections and Main-to-FN 0x1 or FN-to-FN 0x1 cross-connections.

Starting with Release 13.0, hairpin local drop cross-connections may be used to drop path protection switched traffic from an OC-1 ring terminating on a pair of 26G2-U OLIUs in a function unit slot to DS1 ports in the same or a different function unit or to VT1.5 channels on an OC-3/IS-3 or STS1E facility.

Starting with Release 13.0, the TMUX (BBG20) circuit pack will be allowed in the function unit slots of an OC-3 system. All types of VT1.5 cross-connections that are supported for the MXRVO interface will also be supported for the TMUX interface.

Starting with Release 13.0, VT1.5 cross-connects 3 and 4 will not be allowed for the HDSL (BBF8) circuit pack.

Starting with OC-3 with Release 15.0, 0X1 ring configurations support dual homed OC-3 ring applications.

Also starting with Release 15.0, the IMA LAN (BBF9) circuit pack will be supported and allowed in the Low Speed slots of an OC-3 shelf. VT1.5 cross-connections between main and low-speed ports will be supported. Hairpin cross-connections between IMA LAN ports and other low-speed or function unit ports are not supported.

`Twoway` is the default value for *`cct`*. Starting with OC-3 Release 15.0 and when using 22-type OLIUs in Fn slots, if a 0X1 application is desired, this requires provisioning the OC-3 interface(s) with 0X1 application type using the **set-oc3** command.

`dc` Drop and continue connections are allowed only from Main to function unit. Drop and continue connections support dual ring applications. Drop and continue connections are only allowed if the function unit address is equipped with the STS1E or OC-3 OLIU low-speed interface.

`locked` Locked cross-connections support nonpath-switched DS1 drop applications. Locked cross-connections are only allowed if the function unit address is equipped with the MXRVO or TMUX interfaces. Locked cross-connections are applicable to the IMA LAN interfaces as well.

If the addresses indicate a pass-through cross-connection, the CrsType is not prompted for but is automatically set to **`twoway`**. The confirmation message indicates that a CrsType of **`twoway`** has been selected for the user. If a CrsType other than **`twoway`** is entered on the command line when the addresses indicate a pass-through cross-connection, the request is rejected. If the value `all` is used in the address, the *`cct`* applies to every cross-connection within the range of the addresses.

ring RingId is the ring identification for drop and continue and locked cross-connections. For **dc** type connections this parameter specifies which ring rotation will be continued as well as dropped at this network element. The valid values are:

m1 Ring **m1** is the ring that is received on the Main-1 OLIU and is transmitted on the Main-2 OLIU.

m2 Ring **m2** is the ring that is received on the Main-2 OLIU and is transmitted on the Main-1 OLIU.

All VT drop and continue cross-connections in a network element must be assigned to the same ring. The assigned value will be set to the ring specified in the first completed drop and continue cross-connection. If *cct* is set to **dc**, this parameter is only prompted for if this is the first assignment. The user may continue to enter the RingId value for other drop and continue connections but the value must agree with the value set by the first drop and continue connection. If the CrsType is **locked**, the RingId is always prompted for and is displayed in confirmation messages. If the CrsType is not **dc** or **locked**, the RingId is not prompted for and it is not displayed in confirmation messages. If the CrsType is not **dc** or **locked**, and RingId is entered anyway, the value entered for RingId is ignored.

The following is a list of valid cross-connections. To successfully perform any cross-connection, the user *must* equip the Main slots with 22-type, 24-type, 29-type or 27-type OLIU circuit packs. For linear systems, cross-connections may be entered if **crs=***manual*, as set by the **set-ne** command. Where items appear in braces { }, any one (and only one) of these items may be used to form the address. The value **all** may be used as part of an address (allowed as indicated below) to cross-connect entire groups of signals. When **all** is used, no subsequent address fields should be defined.

Ring Release Cross-Connection Addresses:

`m-{1-3}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a DS1 or STS1E low-speed, or TMUX circuit pack and the Main slots are equipped with 22-type OLIU circuit packs. This address is also applicable for HDSL circuit packs, although only 2 DS1 interfaces may be specified in the address.

`m-{1-3}-{1-7,all}-{1-4,all} to {a,b,c}-{1,2}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a 27-type OLIU, and the Main slots are equipped with 22-type OLIU circuit packs.

`m-{1-12}-{1-7,all}-{1-4,all} to {a,b,c}-{1,2}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a 27-type OLIU, and the Main slots are equipped with 24-type or 29-type OLIU circuit packs.

`m-{1,2}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a DS1 or STS1E low-speed, or TMUX circuit pack and the Main slots are equipped with 27-type OLIU circuit packs.

`m-{1-12}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a DS1 or STS1E low-speed, or TMUX circuit pack and the Main slots are equipped with 24-type or 29-type OLIU circuit packs.

`m-{1,2}-{1-7,all}-{1-4,all} to {a,b,c}-{1,2}-{1-7,all}-{1-4,all}`
: Allowed when the addressed low-speed (LS) port is equipped with a 27-type OLIU circuit pack and the Main slots are equipped with 27-type OLIU circuit packs.

`m-{1-3,all}-{1-7,all}-{1-4,all} to m-{1-3,all}-{1-7,all}-{1-4,all}`
: For ring releases, when the Main slots are equipped with 22-type OLIUs, these addresses provide pass-through cross-connections. The two VT1.5 channel addresses must be the same.

`m-{1,2}-{1-7,all}-{1-4,all} to m-{1,2}-{1-7,all}-{1-4,all}`
: For ring releases, when the Main slots are equipped with 27-type OLIUs, these addresses provide pass-through cross-connections. The two VT1.5 channel addresses must be the same.

{a,b,c}-{1,2}-{1-7,all}-{1-4,all} to {a,b,c}-{1,2}-{1-7,all}-{1-4,all}

For ring releases, when the addressed function unit slots are equipped with 27G2-U OLIU circuit packs, these addresses provide either pass-through or intra-function unit 0x1 cross-connections. Pass-through cross-connections are established when the two VT1.5 channel addresses are the same. Intra-function unit 0x1 cross-connections are established when the function unit portion of the addresses are the same but the STS-1 numbers are different.

m-{1-12}-{1-7,all}-{1-4,all} to m-{1-12}-{1-7,all}-{1-4,all}

For ring releases, when the Main slots are equipped with 24-type or 29-type OLIUs, these addresses provide pass-through cross-connections. The two VT1.5 channel addresses must be the same.

m-{1-3}-{1-7,all}-{1-4,all} to a-{1,2}-{1-7,all}-{1-4,all}

For rings Release 9.0 and later, allowed when function group A is equipped with 22-type OLIU circuit packs.

m-{1-3}-{1-7,all}-{1-4,all} to b-{1,2}-{1-7,all}-{1-4,all}

Allowed when function group B is equipped with 22-type OLIU circuit packs.

m-{1-12}-{1-7,all}-{1-4,all} to {a,b}-{1,2}-{1-7,all}-{1-4,all}

Allowed when function groups A and/or B is equipped with 22-type OLIU circuit packs and Main slots are equipped with 24-type or 29-type OLIUs.

m-{1-3,all}-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}

Allowed when function group C is equipped with 22-type OLIU circuit packs.

m-{1-12}-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}

Allowed when function group C is equipped with 22-type OLIU circuit packs and Main slots are equipped with 24-type or 29-type OLIUs.

{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}

Allowed when the addressed low-speed port in function groups A or B are equipped with 22-type OLIU circuit pack and when function group C is equipped with 22-type OLIU circuit pack.

{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}

Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B are equipped with 27G2-U OLIU circuit packs and when function group C is equipped with 22-type OLIU circuit packs.

`{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1,2}-{1-7,all}-{1-4,all}`
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B are equipped with 22-type OLIU circuit packs and when function group C is equipped with 27G2-U OLIU circuit packs.

`{a,b}-1-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}`
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with 26G2-U OLIU circuit packs and when function group C is equipped with 22-type OLIU circuit packs.

`{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-1-{1-7,all}-{1-4,all}`
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with 22-type OLIU circuit packs and when function group C is equipped with 26G2-U OLIU circuit packs.

`{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1,2}-{1-7,all}-{1-4,all}`
Allowed when the addressed low-speed port in function groups A or B are equipped with 27G2-U OLIU circuit pack and when function group C is equipped with 27G2-U OLIU circuit pack. In this situation, function unit to function unit OC-1 0x1 cross-connections are established.

`{a,b}-{1-7,all}-{1-4,all} to c-{1-3}-{1-7,all}-{1-4,all}`
Allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO or STS1E low-speed, or TMUX circuit packs and when function group C is equipped with 22-type OLIU circuit pack.

`{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1-7,all}-{1-4,all}`
Allowed when the addressed low-speed port in function groups A or B are equipped with 22-type OLIU circuit pack and when function group C is equipped with MXRVO or STS1E low-speed, or TMUX circuit packs.

`{a,b}-{1-7,all}-{1-4,all} to c-{1-7,all}-{1-4,all}`
Allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO or STS1E low-speed, or TMUX circuit packs and when function group C is equipped with STS1E circuit pack.

`{a,b}-{1-7,all}-{1-4,all} to c-{1-7,all}-{1-4,all}`
Allowed when the addressed low-speed port in function groups A or B are equipped with STS1E low-speed circuit packs and when function group C is equipped with MXRVO, STS1E low-speed, or TMUX circuit packs.

`{a,b}-{1,2}-{1-7,all}-{1-4,all} to c-{1-7,all}-{1-4,all}`
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B are equipped with 27G2-U OLIU circuit packs and when function group C is equipped with MXRVO, STS1E low-speed, or TMUX circuit packs.

`{a,b}-{1-7,all}-{1-4,all} to c-{1,2}-{1-7,all}-{1-4,all}`
Starting with Release 11.0, allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO or STS1E low-speed or TMUX (in Release 13.0) circuit packs and when function group C is equipped with 27G2-U OLIU circuit packs.

`{a,b}-1-{1-7,all}-{1-4,all} to c-{1-7,all}-{1-4,all}`
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with 26G2-U OLIU circuit packs and when function group C is equipped with MXRVO, STS1E low-speed, or TMUX circuit packs.

`{a,b}-{1-7,all}-{1-4,all} to c-1-{1-7,all}-{1-4,all}`
Starting with Release 13.0, allowed when the addressed low-speed port in function groups A or B are equipped with MXRVO, STS1E low-speed, or TMUX circuit packs and when function group C is equipped with 26G2-U OLIU circuit packs.

`{a,b,c}-1-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}`
Starting with Release 13.0, allowed when the addressed 'from' port in function group A, B, or C is equipped with 26G2-U OLIU circuit packs and when the corresponding low-speed slots are equipped with DS1 or DS1PM circuit packs. This case is distinguished by having the same function group in both the source and destination addresses. A path-protected hairpin local drop connection is established between the ring terminating on the 26G2-U OLIU circuit packs and DS1/DS1PM ports in the same fn group, using the MXRVO functionality on the 26G2-U OLIU circuit packs.

`m-{1-3}-{1-7,all}-{1-2,all} to {a,b,c}-{1-7,all}-{1-2,all}`
Starting with Release 13.0, when addressing ports on a BBF8, only port numbers 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

`m-{1-3}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}`
Allowed when equipped with 22-type OLIUs in Main Unit slots, and the addressed Low Speed slots are equipped with IMA LAN (BBF9) circuit packs.

m-{1-12}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}
Allowed when equipped with 24/29-type OLIUs in Main Unit slots, and the addressed Low Speed slots are equipped with IMA LAN (BBF9) circuit packs.

m-{1,2}-{1-7,all}-{1-4,all} to {a,b,c}-{1-7,all}-{1-4,all}
Allowed when equipped with 27-type OLIUs in Main Unit slots, and the addressed Low Speed slots are equipped with IMA LAN (BBF9) circuit packs.

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0 and later) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

If the cross-connection request includes an invalid circuit pack type, invalid port address, or specifies a cross-connection not supported by the system, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

If the cross-connection request includes **all** in the addresses and the addresses do not have a one-to-one relationship, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

In linear releases, if the cross-connect mode is set to default (**`crs=`***`default`*), as provisioned by the **`set-ne`** command, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* System provisioned for default cross-connections
   by the CrsMode parameter in the set-ne command. */
```

In ring systems, if this command is issued and one of the Main slots is not equipped, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped. */
```

When setting up a path-protected hairpin local drop cross-connection, both slots of the function unit to which the OC-1 ring is terminated must be equipped with 27G2-U OLIU circuit packs. Otherwise the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both FN slots terminating the OC-1 ring must be
   equipped with 27G2-U OLIU circuit packs.  */
```

When setting up a path-protected hairpin local drop cross-connection, both slots of the function unit to which the OC-1 ring is terminated must be equipped with 27G2-U or 26G2-U OLIU circuit packs. Otherwise the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Both FN slots terminating the OC-1 ring must be
   equipped with 27G2-U or 26G2-U OLIU circuit packs.  */
```

If this command is invoked using addresses where active cross-connections already exist, the following denial message will be displayed:

```
SACC
/* Status, Already Cross-Connected */
/* Establishing new cross-connections requires that existing
   cross-connections associated with these addresses must
   be deleted first. */
```

If the cross-connect request is to a 27-type interface, and either OC-1 line at the specified address is in the NMON state, the following warning will be displayed:

```
/* Cross-connect may use an OC-1 line that is in the NMON state */
```

If the cross-connect request is to an STS1E low-speed interface, the EC-1 port state cannot be set to NMON or the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* EC-1 port is in NMON state. */
```

If this command is entered with several addresses (for example, when an address of **all** is used) and one or more of these addresses are already cross-connected, the command will complete but send the following message indicating the requested cross-connections that could not be completed because of previously existing cross-connections:

```
/* The following cross-connections not processed.
   Cross-connect exists with different address:
   Address1  Address2
   Address1  Address2
      .         .
      .         .    */
```

When the command is entered with several addresses (for example, when an address of **all** is used), but one or more of these addresses is already cross-connected, the following response message will be displayed:

```
/* The following cross-connections were not processed
   because the address or cross-connection type did not match
   Address1  Address2  CrsType
   Address1  Address2  CrsType
      .         .         .
      .         .         .
```

If the addresses indicate a pass-through cross-connection and the CrsType is not **`twoway`**, the request is denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request */
```

If the cross-connect request is for a drop and continue connection and the Ring Identification does not agree with the assigned value (defined by the first drop and continue connection), the request is denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Ring Identification already provisioned to be ring <value> */
```

If the shelf is equipped with 24G-U OLIU packs in both Main slots and the maximum number of STS-1s has already been reached (that is, 3 STS-1s already have VT cross-connects) when the user attempts to provision VT-1.5 cross connects within an additional STS-1, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Cross connect capacity is not available. */
```

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed. If CrsType is not **dc** or **locked**, RingId is not displayed in the following confirmation message:

```
/* Caution!  Network Cross-connections are affected by this command.
   You have selected the ent-crs-vt1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is entered with the parameter *all* as part of the address, the following confirmation message is displayed. If CrsType is not **dc** or **locked**, RingId is not displayed in the confirmation message.

```
/* Caution! Execution of this command may affect service.
   Multiple cross-connections may be affected.
   You have selected the ent-crs-vt1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-vt1

rtrv-crs-vt1

rtrv-ne

set-ne

NAME

ent-osacmap: enter OS application context ID map

INPUT FORMAT

ent-osacmap:vc=*VCType*,**snpa=***SNPA*,**acid=***ACID*;

ent-osacmap:[Address][:[**porttype=***porttype*][,**vc=***VCType*]
[,**snpa=***SNPA*][,]**acid=***ACID*];

(For OC-3 Release 15.0 and later)

DESCRIPTION

This command creates entries in the X.25 subnetwork application context map. This map lists the permanent virtual circuits (PVCs) and switched virtual circuit (SVC) available in the X.25 channel and maps them to operation systems (OS) application context Ids. For the SVC, this command lists the data terminal equipment (DTE) calling addresses used by the various OS application contexts. Defaults for the PVCs are provided, which should apply to most situations.

Starting with OC-3 Release 15.0, this command will map the CIT port (provisioned for TL1), or the X.25 port (when provisioned as Asynchronous) to operations systems (OS) application contexts.

NOTE 1:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 2:
While this command is allowed at all network elements in the subnetwork, only the table at the active GNE node is active.

The input parameters are:

address Address is the address of a CIT or an Asynchronous X.25 (DTE port) port. The default address is **x25**:

Valid Addresses: **cit-{1,2}, x25**

porttype Specifies whether the provisioned Address **cit-1** (DCE port - front access) or **cit-2** (DTE port - rear access) is used for *CIT* or *TL1* application. If the value of Address is **cit-1 or cit-2**, this parameter can have two possible values: **cit** or **tl1**. Default value is **cit**.

If the value of Address is **x25**, this parameter can have two possible values: **synch**, or **asynch**. Default value is **synch**.

NOTE:
If the (Address) parameter is equal to **`cit-1, cit-2`**, and Port Type is equal to **`tl1`** or **`cit`**, the user will only be prompted for the (ACID) parameter.

If the Address parameter is equal to **`x25`**, and Port Type is equal to **`asynch`**, the user will ONLY be prompted for the ACID parameter.

If the Address parameter is equal to **`x25`**, and Port Type is equal to **`synch`**, the user will be prompted for the VC, SNPA, and ACID parameters.

`vc` This parameter is the virtual circuit type X.25 attachment for the OS.

PVC permanent virtual circuit (default value).

SVC switched virtual circuit.

NOTE:
This parameter is not prompted for if Port Type is **`tl1, or asynch`**.

`snpa` SNPA is the X.25 subnetwork point of attachment address for the OS. It is either logical channel number (LCN) 1, 2, 3, 4, 5, 6, 7, 8, or 9 if VCType is *PVC* or it is the Data Terminal Equipment (DTE) calling address, which is 1 to 15 digits if VCType is *SVC*. Up to nine VCs can be mapped to any combination of PVCs and SVCs (that is, PVCs could be removed and replaced by SVCs).

NOTE:
This parameter is not prompted for if Port Type is **`tl1, or asynch`**.

`acid` ACID is a string of up to 23 alphanumeric characters, which is the application context ID to be assigned to a particular SNPA address. Each OS has a value of ACID assigned. Default values exist for OS applications supported by DDM-2000.

Starting with OC-3 Release 15.0, this parameter can also be the application context ID to be assigned to a particular CIT (**`used for TL1`**) or X.25 (**`in Asynchronous mode`**) port. Supported values are:

`tl1PeerComm`
(Assigned to PVC "1" as default value)

tl1Maintenance
(Assigned to PVC "2" as default value)

tl1MemoryAdministration
(Assigned to PVC "3" as default value)

NOTE:
The values *tl1CR*, *tl1Other1*, *tl1Test*, and *tl1Other2* are provided as additional ACID values for the OS application that are supported by DDM-2000.

Note that *tl1CR* will never report TL1 autonomous messages.

NOTE:
If a CIT port is provisioned for TL1, or the X.25 port is used as Asynchronous; (Port Type is equal to **tl1, or asynch**), the default ACID in this event is **tl1PeerComm**. A CIT port Type of **cit** causes the provisioning of ACID to default value **tl1PeerComm** as well.

If a user attempts to enter an additional SNPA (LCN/DTE calling address), when the maximum supported number already exists, the following denial message will appear:

```
SLEM
/* Status, List Exceeds Maximum */
/* Maximum number of SNPA entries (LCN/DTE address)
   already exists. */
```

When this command is entered at an active GNE (Address=x25 and Porttype=synch), the following confirmation message will be displayed:

```
/* Caution! Operations System access is affected by this command.

   Caution!  When executed, this command causes the NE's affected
   VC to be reset.  This action will also drop all currently
   active logins on the affected VC.

   You have selected the ent-osacmap command with these parameters:

    Address = address
    Porttype = porttype
    VCType = x
    SNPA = x
    ACID = x */

Execute? (y/n or CANcel/DELete to quit) =
```

If executing this command results in changing the ACID value, any active login session on the specified port will be terminated.

When this command is entered to assign an ACID value for an Address of **`cit-1/2`** with a port type of tl1, or **`x25`** with an asynchronous port type, the following confirmation message will be displayed:

```
/* Caution!  When executed, this command causes the NE's affected
   address to be reset (if cit1/2 is running in TL1 or X.25 is
   running in Asynchronous mode).
   This action will also drop all currently active logins on the
   affected address.

   You have selected the ent-osacmap command with these parameters:

    Address = address
    Porttype = porttype
    ACID = x */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is entered to assign an ACID value for an Address of **`cit-1`** or **`cit-2`** with a port type of cit, no confirmation message is displayed and the command will complete without terminating any login session on that port.

When this command is entered at a network element that is not an active GNE, the following confirmation message will be displayed:

```
/* Caution!  This NE is not an active GNE.  Entries in this table are
   not active.  Only the information at an active GNE is valid.

   You have selected the ent-osacmap command with these parameters:

    Address = address
    Porttype = porttype
    VCType = x
    SNPA = x
    ACID = x */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE 1:
The same ACID can appear more than once in the table.

NOTE 2:
If the shelf is operating in a Synchronous X.25 mode, the shelf is automatically assumed to be the Gateway Network Element between the Operation Systems and the subtending network that includes the local shelf.

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

dlt-osacmap

rtrv-osacmap

NAME

ent-tl1msgmap: Enter Tl1 Message Map for Operation Systems

INPUT FORMAT

ent-tl1msgmap:acid=*ACID*,**msgtype=***MessageType*,**action=***Action*;

DESCRIPTION

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

This command maps the DDM-2000 TL1 message types to the operations systems (OS) for this network element in the subnetwork. This command provides a filter for TL1 messages by specifying TL1 message classes (known as *MessageTypes*) and allowing the user to determine which message classes should be received at each type of OS (specified in the *ACID* parameter).

There are default message classes that exist for the ACIDs supported by DDM-2000. The following table shows the default mappings supported by DDM-2000. Most users should be able to use these mappings as defined. However, users may change the default mapping by using this command. Users may check the current provisioning by using the **rtrv-tl1msgmap** command.

The following table displays the default mappings:

```
/* DDM-2000 TL1 Autonomous Message Map
=====================================================
    ACID                     ALM ENV CON DB  EVT PM  SW
=====================================================
tl1Maintenance          | x | x | x |   | x | x | x |
tl1MemoryAdministration |   |   |   | x |   |   |   |
tl1Test                 |   |   |   |   |   |   |   |
tl1PeerComm             |   |   |   |   |   |   |   |
tl1Other1               | x | x | x | x | x |   | x |
tl1Other2               |   |   |   |   |   |   |   |

      x - enabled
<blank> - disabled
*/
```

Each message type can be assigned to more than one ACID. However, if more than one assignment is made, a 9600 or higher baud x.25 link is recommended.

The input parameters are:

ACID Application Context ID (ACID) is a string of up to 23 alphanumeric characters, which is the OS function. The valid ACID values are:

tl1Maintenance
(This identifies the *maintenance* OS type).

tl1MemoryAdministration
(This identifies the *memory~administration* OS type).

tl1Test (This identifies the *testing* OS type).

tl1PeerComm
(This identifies the OS type for peer TL1 communications. This ACID is also used for incoming X.25 SVC DTE calling addresses that do not match any of the user-provisioned X.25 SVC DTE calling addresses).

tl1Other1
(This identifies the *RIDES* OS type).

tl1Other2
(This identifies an OS type for future use).

msgtype MessageType is one of the supported classes of TL1 messages that the system generates. These message types are *not* sent to the OS unless they are enabled and associated with an ACID. The supported message types are:

ALM To report the occurrence of an event that requires immediate attention by the craft at the OS. Report is sent via the `REPT ALM` message.

ENV To report the occurrence of an environmental alarm to the OS. Report is sent via the `REPT ALM ENV` message.

CON To report the active status conditions at the network element. Report is sent via the `REPT COND` message.

DB To report database changes that have occurred as a result of line termination and cross-connection provisioning commands and changes due to external events such as circuit pack insertion or removal. Report is sent via the `REPT DBCHG` message.

EVT To report events that do not require alarmed notifications or to report a status change of the network element. Report is sent via the `REPT EVT` message.

PM To report performance monitoring data from the network element. Report is sent via the `REPT PM` message.

SW To report equipment protection switches at the network element. Report is sent via the `REPT SW` message.

action Action is either **enabled** or **disabled** and associates the MessageType to the OS.

When this command is entered, the following confirmation message will be displayed:

```
/* Caution!  Operations Systems Autonomous message mapping is
   affected by this command.

   You have selected the ent-tl1msgmap command with these parameters:

    ACID = x
    MessageType = x
    Action = x           */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-osacmap

dlt-osacmap

rtrv-osacmap

rtrv-tl1msgmap

NAME

ent-ulsdcc-l3: Enter Upper Layer Section DCC - Layer 3

INPUT FORMAT

ent-ulsdcc-l3:[**L3org=***OrganizationId*][,**L3res=***Reserved*]
[,**L3rd=***RoutingDomain*][,**L3rarea=***RoutingArea*]
[,**L3lv2is=***Level2Router*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **ent-ulsdcc-l3** command in OC-3 Release 13.0 and all later TARP releases.

CAUTION:
Errors in provisioning this command to change the NSAP address of the target Network Element (NE) could result in silent failures. Command parameters should only be changed by users who intend and are authorized to provision the SONET subnetwork and partition DCC communications.

This command provisions parameters of Layers 3 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

If this command is used to change the value of at least one of the fields of Layer 3 NSAP address, it will cause the NE to reset. this action will erase all of the performance monitoring data and the history file. If possible, the NE will reinitialize the date and time. Otherwise, the date and time will assume default values.

This command is used to provision the user-settable fields in Layers 3 of the OSI stack. Layer 3 parameters include user-settable fields of the network service access point (NSAP) address and the enabling of the Level-2 Routing. The NSAP address is a 20-byte (40 hex digit) address required by OSI to provide unique identification within the OSI network. Some of the fields within the NSAP are pre-defined and some others are user-settable. Each DDM-2000 is programmed with a unique NSAP address at the factory.

All Layer 3 parameters that can be provisioned using this command, and that are needed for the operation of the NE, have original values. Hence, it is not necessary to provision these parameters for the NE to operate properly in a network.

NOTE:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The structure of the NSAP is shown in the following display. The field names are shown on the first row, and the size (in bytes) of each field is listed on the second row.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Org. ID	RES	RD	Area	Sys. Ident.	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

The AFI, IDI and DFI (DSP Format Identifier) fields are not user provisionable. They are always set to "39" hex, "840" hex, "F" hex and "80" hex respectively to indicate that the ISO DCC syntax shall be used.

The Organization ID, Reserved (RES), Routing Domain (RD) and Area fields are user provisionable when setting the NSAP of the target NE.

The Organization ID field is a three byte field that identifies the Network Service Provider and is assigned by the ANSI. The Reserved field is currently not used and has a default value of hex "0000". The Routing Domain and Area fields, each of which are 2 bytes (4 hex digits), area is used in applications where there are multiple Level-1 areas to identify the different areas.

Each NE is programmed with a unique System Identifier at the factory. This six byte (12 hex digit) field of the NSAP guarantees that the NSAP for each NE is unique.

The Select (SEL) field is currently not user provisionable and is normally set to a default value of "0". Its purpose is to differentiate between multiple NSAP addresses associated with the same End system. Its value is not fixed but is set in a PDU according to its usage. It is set to "af" hex when TARP is run over CLNP. It has a value of "1d" hex when TP4 is run over CLNP. it may be set to "00" hex for other uses. When retrieved and displayed, it will always be shown as "00" hex.

For additional information on provisioning, refer to 824-102-144, *2000 Product Family Operation Interworking Guide for TARP Releases*.

The input parameters are:

`L3org` Organization Id is a 6-digit hexadecimal field used to provision into the NSAP address the allocated company code assigned by the *ANSI**-administered USA Registration Authority for OSI Organization Names. The original value for this parameter is 000000.

`L3res` Reserved is a 4-digit hexadecimal field that currently has not been assigned a specific purpose by the SONET standards. Users may populate this field to further uniquely identify the NSAP address. The original value for this parameter is 0000.

`L3rd` This field identifies a unique routing domain within an administrative domain.

The format of this parameter is **`L3rd=`**`*RoutingDomain*`, where *`RoutingDomain`* is the 2 byte (4-digit hex) NSAP Routing Domain field of the local NE. The original value for this parameter is 0000.

`L3area` This field identifies the area within the routing domain to which the NSAP address belongs.

The format of this parameter is **`L3area=`***`RoutingArea`*, where *`RoutingArea`* is the 2 byte (4-digit hex) NSAP Area field of the local NE. The original value for this parameter is 0000.

`L3lv2is` Enable or Disable the level 2 IS-IS routing. This parameter is used to specify that the local NE is a Level 2 IS (router).

Possible values of this parameter are: **`enable`** or **`disable`**. The default value is **`disable`**.

If an incorrect number of digits is entered for a specific NSAP parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number */
```

The `<num>` specifies the number of digits required.

* Registered trademark of the American National Standards Institute, Inc.

After entering this command the following confirmation message is displayed:

```
/* Caution!  Network Element access is affected by this command.

   Caution! When executed, this command will cause the NE to
   restart the program.  This action will erase all of the
   performance monitoring data and the history file.  If possible,
   it will reinitialize the date and time with the far end via the DCC.
   Otherwise, the date and time will assume default values.

   You have selected the ent-ulsdcc-l3 command with these parameters:

   L3org     = OrganizationId
   L3res     = Reserved
   L3rd      = RoutingDomain
   L3area    = RoutingArea
   L3lv2is   = Level2Router

Execute?  (y/n or CANcel/DELete to quit) =
```

NOTE:
This command executes immediately upon entering it; however the changes may not be refected in the **`rtrv-map-neighbor`** report for up to 20 minutes after this command is executed.

If the user enters the same parameter values as currently defined for the "L3" parameters, the system does not reset.

RELATED COMMANDS

dlt-ulsdcc-l4

ent-ulsdcc-l4

rtrv-ulsdcc-l3

rtrv-ulsdcc-l4

NAME

ent-ulsdcc-l4: Enter Upper Layer Section DCC - Layer 4

INPUT FORMAT

ent-ulsdcc-l4:[**L4tlif=***LifeTime*][[[,**L4ajsys=***AJSystemId*]
[[,**L4ajorg=***AJOrganizationId*] [,**L4ajres=***AJReserved*]
[,**L4ajrd=***AJRoutingDomain*][,**L4ajarea=***AJRoutingArea*]]]]
[[,**L4t1tm=***TimerT1*][,**L4t2tm=***TimerT2*] [,**L4t3tm=***TimerT3*]
[,**L4t4tm=***TimerT4*][,**L4lftm=***LDBFlushTimer*]]
[[,**L4etdc=***L4etdc*][[,**L4tdcsys=***L4tdcSystemId*][[,**L4tdctid=***L4tdctid*]
[,**L4tdcorg=***L4tdcOrganizationId*][,**L4tdcres=***L4tdcReserved*]
[,**L4tdcrd=***L4tdcRoutingDomain*][,**L4tdcarea=***L4tdcRoutingArea*]]]];

DESCRIPTION

NOTE:
This command page describes the functionality of the **ent-ulsdcc-l4** command in OC-3 Release 13.0 and all later TARP releases.

CAUTION:
Errors in provisioning this command to change the NSAP address of the target Network Element (NE) could result in silent failures. Command parameters should only be changed by users who intend and are authorized to provision the SONET subnetwork and partition DCC communications.

This command provisions parameters of Layers 4 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

This command is used to provision the user-settable fields in Layer 4 of the OSI stack. The NSAP address is a 20-byte address required by OSI to provide unique identification within the OSI network. Some of the fields within the NSAP are pre-defined and some others are user-settable. Each DDM-2000 is programmed with a unique NSAP address at the factory.

User-settable Layer 4 parameters are used to enter TARP Manual Adjacencies. Manually specifying a NE to be logically adjacent to local NE, for TARP propagation purposes requires the specification of the adjacent NEs NSAP address. The NSAP, which is 20 bytes long (40 hex digit), is composed of separate fields, most of which have default values. Thus, to simplify the entry of the NSAP address, the NSAP is entered via a number of separate TARP Manual Adjacency NSAP parameters; those parameters are covered in a later section of this command page.

Multiple TARP Manual Adjacent NE values are entered using multiple occurrences of this command.

All Layer 4 parameters that can be provisioned using this command, and that are needed for the operation of the NE, have original values. Hence, it is not necessary to provision these parameters for the NE to operate properly in a network.

NOTE 1:
A maximum of two Manual Adjacencies can be initiated from a Network Element.

NOTE 2:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The structure of the NSAP is shown in the following display. The field names are shown on the first row, and the size (in bytes) of each field is listed on the second row.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Org. ID	RES	RD	Area	Sys. Ident.	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

The AFI, IDI and DSI (DSP Format Identifier) fields are not user provisionable. They are always set to "39" hex, "840" hex, "F" hex and "80" hex respectively to indicate that the ISO DCC syntax shall be used.

The Organization ID, Reserved (RES), Routing Domain (RD) and Area fields are user provisionable when entering a TARP Manual Adjacency NSAP and when entering an NSAP into the TARP Data Cache (TDC).

The Organization ID field is a three byte field that identifies the Network Service Provider and is assigned by the ANSI. The Reserved field is currently not used and has a default value of hex "0000". The Routing Domain and Area fields, each of which are 2 bytes (4 hex digits), area used in applications where there are multiple Level-1 areas to identify the different areas.

Each NE is programmed with a unique System Identifier at the factory. This six byte (12 hex digit) field of the NSAP guarantees that the NSAP for each NE is unique.

The Select (SEL) field is currently not user provisionable and is normally set to a default value of "0". Its purpose is to differentiate between multiple NSAP addresses associated with the same End system. Its value is not fixed but is set in a PDU according to its usage. It is set to "af" hex when TARP is run over CLNP. It has a value of "1d" hex when TP4 is run over CLNP. It may be set to "00" hex for other uses. When retrieved and displayed, it will always be shown as "00" hex.

For additional information on provisioning, refer to 824-102-144 *2000 Product Family Operation Interworking Guide for TARP Releases*.

The user-settable input parameters are:

L4tlif This parameter sets the TARP lifetime parameter in TARP PDUs originated by the local NE. The TARP lifetime specifies the maximum number of hops allowed for a TARP PDU. When this number of hops is exceeded, the TARP PDU will not be forwarded. This parameter may have a value in the range from 1 to 65535. An error message will be returned if a value of 0 is entered. The default value for this parameter is 100 in decimal.

L4ajsys This parameter is used to provision the NSAP System Identifier field of the TARP adjacent NE. This is a 6 byte (12 hex digit) field of the TARP adjacent NE. No default value is assumed for this parameter.

> **NOTE:**
> The NSAP System Id field, **L4ajsys**, which is unique for each NE, is the only parameter that is required to enter a manual adjacency.
>
> If this parameter is specified, then any of the other user settable NSAP field parameters that are not specified and NSAP fields that are not settable by the user (IDP, DFI and SEL fields) are set to their default values in the TARP Manual Adjacency list. These default values shall be the equivalent NSAP fields of the local NE. If no value is specified for **L4ajsys** parameter, the user will not be prompted for the rest of the **L4aj** parameters.

L4ajorg This parameter is used to provision the NSAP Organization Id field of the TARP adjacent NE. This is a 3 byte (6-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Organization Id field of the local NE.

L4ajres This parameter is used to provision the NSAP Reserved field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Reserved field of the local NE.

L4ajrd This parameter is used to provision the NSAP Routing Domain field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Routing Domain field of the local NE.

`L4ajarea` This parameter is used to provision the NSAP Area field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Area field of the local NE.

`L4t1tm` This parameter is used to provision the TARP Timer T1. T1 is the maximum time waiting for response to TARP Type 1 request PDU (search level 1 routing area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 15 seconds.

`L4t2tm` This parameter is used to provision the TARP Timer T2. T2 is the maximum time waiting for response to TARP Type 2 request PDU (search outside of level 1 area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 25 seconds.

`L4t3tm` This parameter is used to provision the TARP Timer T3. T3 is the maximum time waiting for response to Address resolution request (type 5, for example, requesting the TID when the NSAP address is known). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 40 seconds.

`L4t4tm` This parameter is used to provision the TARP Timer T4. T4 starts when T2 expires. It is used for error recovery. This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 20 seconds.

`L4lftm` This parameter is used to provision the TARP Loop Detection Buffer Flush Timer. It sets the time period for flushing the TARP Loop Detection Buffer. This parameter may have a value in the range from 1 to 1440 minutes. Its default value is 5 minutes.

`L4etdc` This parameter is used to Enable or Disable the TARP Data Cache. Possible values are either **`enable`** or **`disable`**. The default value is **`enable`**.

The following set of parameters are used to enter data manually into the TARP Data Cache. An entry in a TARP Data Cache consists of three parameters: The NSAP address, the Target Identifier (TID) and the address type of an NE. The NSAP, which is 20 bytes long (40 hex digit), is composed of separate fields, most of which have default value. To simplify the entry of the NSAP address, the NSAP is entered via a number of separate TDC NSAP parameters as follows:

`L4tdcsys` This parameter is used to provision the NSAP System Identifier field of the NE to be manually entered into the TARP Data Cache. If this parameter is specified, then **`L4tdctid`** must also be specified for the entry to be made in the TARP Data Cache.

This is a 6 byte (12 hex digit) field of the NE to be manually entered into the TARP Data Cache. There is no default value for this parameter.

NOTE:
The NSAP System ID field, **`L4tdcsys`**, which is unique for each NE, is the only parameter that is required to enter a TARP data cache entry.

If this parameter is specified, then any of the other user settable NSAP field parameters that are not specified and NSAP fields that are not settable by the user (IDP, DFI and SEL fields) are set to their default values in creating the NSAP portion of the TARP Data Cache entry. Those default values will be the equivalent NSAP fields of the local NE.

If no value is specified for **`L4tdcsys`** parameter, the user will not be prompted for the rest of the **`L4tdc`** parameters.

`L4tdctid` This parameter is used to provision the Target Identifier (TID) portion of TARP Data Cache entry for manually entering data into the TARP Data Cache (TDC). It indicates the TID of the NE associated with the TDC NSAP address parameters that are specified. This parameter has a maximum of 20 characters and it has no default value.

If L4tdctid is specified, then L4tdcsys must have also been specified for the entry to be made in TARP Data Cache.

Along with the TDC NSAP, this parameter is required to enter a set of data into the TDC. Both the NSAP parameters and L4tdctid need to be specified for the transaction to be complete. This will enter a single row of data into the TDC. Multiple rows of data are entered using multiple occurrences of **`ent-ulsdcc-l4`**.

NOTE:
If the set of specified NSAP and TID does not already exist in the TDC, then the data is added to the TDC. If the NSAP-TID pair already exists in the TDC, then no action is taken.

`L4tdcorg` This parameter is used to provision the NSAP's Organization Id field of the NE that is to be manually entered into the TDC. It specifies the allocated Network

Services Provider Code assigned by the ANSI-administered USA Registration Authority for OSI Organization Names. The default value for this parameter is the NSAP's Organization ID field of local NE.

`L4tdcres` This parameter is used to provision the NSAP Reserved field of the NE to be manually entered into the TDC. This is a two byte (4-digit hex) NSAP Reserved field of the NE that is to be manually entered into the TDC. The default value for this parameter is the NSAP's Reserved field of local NE.

`L4tdcrd` This parameter is used to provision the NSAP Routing Domain field of the NE to be manually entered into the TDC. This is a 2 byte (4-digit hex) NSAP Routing Domain field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Routing Domain field of local NE.

`L4tdcarea`
This parameter is used to provision the NSAP Area field of the NE to be manually entered into the TDC. It identifies the Area within the Routing Domain to which the NSAP address belongs. This is a 2 byte (4-digit hex) NSAP Area field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Area field of local NE.

If an incorrect number of digits is entered for a specific NSAP parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number */
```

The `<num>` specifies the number of digits required.

If an invalid *L4tlif* value is entered (that is, a value equal to or less than 0, or a value greater than 65535), the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4tlif value entered. */
```

If an invalid *L4t1tm*, *L4t2tm*, *L4t3tm*, *L4t4tm* or *L4lftm* value is entered (for example, a value equal to or less than 0), the following message is displayed and the user is reprompted:

```
/* Invalid data entry. */
```

If an invalid *L4TDCTID* value, or no *L4TDCTID* value is entered, the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4TDCTID value entered. */
```

After entering this command the following confirmation message is displayed:

```
/* You have selected the ent-ulsdcc-l4 command with these parameters:

   L4tlif    = LifeTime
   L4ajsys   = AJSystemId
   L4ajorg   = AJOrganizationId
   L4ajres   = AJRserved
   L4ajrd    = AJRoutingDomain
   L4ajarea  = AJRoutingArea
   L4t1tm    = TimerT1
   L4t2tm    = TimerT2
   L4t3tm    = TimerT3
   L4t4tm    = TimerT4
   L4lftm    = LDBFlushTimer
   L4etdc    = L4etdc
   L4tdcsys  = L4tdcSystemId
   L4tdctid  = L4tdctid
   L4tdcorg  = L4tdcOrganizationId
   L4tdcres  = L4tdcReserved
   L4tdcrd   = L4tdcRoutingDomain
   L4tdcarea = L4tdcRoutingArea

Execute?  (y/n or CANcel/DELete to quit) =
```

If the user changes the value of any "L4" parameter or enters the same parameter values as currently defined for the "L3" parameters, the system does not reset.

RELATED COMMANDS

ent-ulsdcc-l3

rtrv-ulsdcc-l3

rtr-vulsdcc-l4

dlt-ulsdcc-l4

NAME

help: Provide In-context Help

INPUT FORMAT

?

DESCRIPTION

Help (**?**) provides help within a craft dialog on the CIT. Help is provided automatically when an invalid input is entered and can also be requested at any time by typing "**?**". The "**?**" displays a help message and then displays another prompt.

The help message is either a description of format of the required entry or a menu of choices.

NAME

init-pm: Initialize Performance Monitoring (PM)

INPUT FORMAT

`init-pm:reg=`*`Register`*;

DESCRIPTION

This command initializes all *current* day and/or all *current* quarter-hour performance-monitoring storage registers. Registers for previous day and previous quarter-hours are not affected.

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameter is:

`reg` Register is the class of registers to be initialized and may be one of the following:

`day`	Day registers
`qh`	Quarter-hour registers
`all`	Day and quarter-hour registers

RELATED COMMANDS

`rtrv-pm-line`

`rtrv-pm-sect`

`rtrv-pm-sts1`

`rtrv-pm-t3`

`rtrv-pm-tca`

`rtrv-pm-t1`

`rtrv-pm-vt1`

NAME

init-sys: Initialize System

INPUT FORMAT

`init-sys`:*`Address`*;

DESCRIPTION

CAUTION:
Execution of this command may affect service. The command **`init-sys:all`** *should NOT be used on an in-service system. This command should only be used at the end of installation before system turnup.*

This command initializes provisionable parameters to their default values. The time and date parameters are reset from the far end.

NOTE:
After entering the **`init-sys`** command, the system will show transient DCC failures that are recorded in the Alarm and History reports. This is a normal, expected system response.

The command **`init-sys:all`** should be used only at the end of installation before system turnup. The command **`init-sys:sysctl`** should only be used after a SYSCTL is replaced. To clear a system problem, the **`reset`** command should be used, since it resets the system software without changing the provisioned parameters except for the page parameter in **`set-link`**, which is reset to default value in this case.

NOTE:
This command is available to privileged users only.

The input parameter is:

`Address` Address determines whether just system controller parameters are initialized or whether all parameters on the entire system are initialized. Address may have the following values:

`sysctl` The address **`sysctl`** can be used after a system controller is replaced on an in-service system. It is the equivalent of pressing the UPD/INIT button within 10 seconds of the processor start-up sequence (while the CR LED on the user panel is flashing). This command restores the following list of parameters to their default values:

NOTE:
Parameters can be provisioned using the following commands listed below the parameters.

Alarm delays
set-attr-alm

NSAP

Starting with OC-3 13.0 and later TARP releases, the following additional parameters will be affected as well:
L4ajorg, L4ajres, L4ajrd, L4ajarea, L4ajsys
L3lv2is
L4tlif
L4t1tm, L4t2tm, L4t3tm, L4t4tm, L4lftm
L4etdc
ent-ulsdcc-l3
ent-ulsdcc-l4

Security
set-lgn
set-passwd
set-secu

CIT link configuration
set-link

Protection Switching
(inhibit, forced, lockout, manual)
switch-fn
switch-line
switch-ls
switch-sync

Performance monitoring thresholds
set-pmthres-sect
set-pmthres-line
set-pmthres-t3
set-pmthres-sts1
set-pmthres-t1
set-pmthres-vt1

Environmental alarm names and alarm levels
set-attr-env

Environmental control names
set-attr-cont

Far-end communications enabled/disabled
set-fecom

STS-1 Trace Value
`set-trace-sts1`

Idle value, Alarm Group and AGNE
`set-ne`

In OC-3 Release 13.0 and later TARP releases, the Alarm Group and AGNE parameter will not be part of the **`set-ne`** provisioning parameters, and therefore will not be affected by this command.

Starting with OC-3 Release 15.0, the almgrp (Alarm Group), AGNE, and RneStat (Remote NE Status) will be valid **set-ne** parameters and therefore will be affected by this command.

ACID, VCType, SNPA
`ent-osacmap`
`ent-tl1msgmap`

`all` The address **`all`** is used only at the end of an installation before turning over the system. This ensures that all parameters in the system have the proper default values before any system-specific provisioning is done.

CAUTION:
*The address **`all`** should NOT be used on an in-service system.*

NOTE:
The **`init-sys:all`** command is available to privileged users only.

This parameter initializes all the parameters listed under **`sysctl`** PLUS the following:

Loopbacks
- **`opr-lpbk-ec1`**
- **`opr-lpbk-t1`**
- **`opr-lpbk-t3`**

Cross-connections
- **`dlt-crs-sts1`**
- **`dlt-crs-vt1`**
- **`ent-crs-sts1`**
- **`ent-crs-vt1`**

OC-3 signal degrade threshold
- **`set-oc3`**
- **`set-ec1`**
- **`set-sts1`** (all rings releases)
- **`set-vt1`** (all rings releases)
- **`set-oc1`** (all rings releases)
- **`set-ne`**

Signal failure thresholds
- **`set-ec1`**
- **`set-state-ec1`**
- **`set-t1`**
- **`set-t3`**

Protection Switching (`manual`)
- **`switch-fn`**
- **`switch-line`**
- **`switch-ls`**
- **`switch-sync`**

Feature Options
- **`set-feat`**

System name (TID)
set-ne

PMN
set-attr-alm

Site Id, NE Id and Shelf Id — In OC-3 Release 13.0 and later TARP releases, the Site Id and NE Id parameters will not be available, and therefore are not affected by this command.

set-ne

TBOS and CO/RT selection — In OC-3 Release 13.0 later TARP releases, the TBOS parameter will not be available, and therefore it will not be affected by this command.
set-ne

UserSide/NetworkSide settings on DCC
DCC Channel IAO LAN
set-fecom

In addition to initializing parameters, entering the address **all** will clear all performance monitoring data and alarms. For failure conditions that still exist after parameters are initialized, the alarms will be redeclared. Time and date parameters are not affected by this command.

Executing an **init-sys:sysctl** with no TGS packs equipped will set the following parameters to default values:

Feature Options

Directory Services Network Element (DSNE) — In OC-3 Release 13.0 and later TARP releases, the DSNE parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

System name (TID)

PMN

Site Id, NE Id and Shelf Id — In OC-3 Release 13.0 and later TARP releases, the Site Id and NE Id parameters will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS Address — In OC-3 Release 13.0 and later TARP releases, the TBOS Address parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS Enabled — In OC-3 Release 13.0 and later TARP releases, the TBOS Enabled parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS link — In OC-3 Release 13.0 and later TARP releases, the TBOS link parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

CO/RT selection

UserSide/NetworkSide settings on DCC

DCC channel enable/disable

IAO LAN enable/disable

When the command **init-sys:sysctl** is entered, the following confirmation message will be displayed:

```
/* CAUTION!
   Execution of this command will set ALL parameters on the
   controller to their original default values.
   This may disrupt this system’s operations interfaces.
   Refer to the DDM-2000 User/Service Manual before executing
   this command.

   Caution!  When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file,
   and reinitialize the date and time with the far end
   system.

   Proceed with EXTREME CAUTION!

   You have selected the init-sys command with these parameters:

   Address = sysctl */
Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
Executing **init-sys:sysctl** may cause the system to respond with the following message: `Parameters set to default values.` This means that the circuit pack in a specified slot has failed or has been removed, and the parameters for ports associated with that slot have been set to their default values.

Entering the command **`init-sys:all`** will cause the following confirmation message to be displayed:

```
/* CAUTION!

   THIS COMMAND SHOULD NEVER BE EXECUTED ON AN IN-SERVICE SYSTEM!

   This command will set ALL parameters in the whole system
   to their original default values.
   This may result in a lengthy service outage and may disrupt
   this system's operations interfaces.

   Caution!  When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file,
   and reinitialize the date and time with the far end
   system.

   PROCEED WITH EXTREME CAUTION!

   You have selected the init-sys command with these parameters:

   Address = all */
Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

reset

upd

NAME

ins-prog: Install Program

INPUT FORMAT

`ins-prog:``TID;`

`ins-prog:``TID`[,**`pgmtype=`**`ProgramType`];

(for OC-3 Release 15.0 and later)

DESCRIPTION

This command installs a new program into the system controller. This command supports a local program installation to a network element from a personal computer (PC) connected to the CIT port of the target system. The command **`cpy-prog`** is used to copy the system controller program from a local network element to a remote network element.

The software to be installed may be a non-executing dormant copy of a software generic. When executing this command, the local network element will support local or remote program installation into the memory of the target network element where it will reside as a dormant copy.

The **`apply`** command is used later to overwrite the currently executing generic with a copy of the generic included in the dormant software.

Starting with OC-3 Release 15.0 this command will be used to install, either the Network Element's software generic or the IMA LAN software generic. When executing this command (to install the IMA LAN's software generic), the installed software will always be a non-executing dormant copy.

The **`apply`** command is used later to overwrite the currently executing IMA LAN generic (on the IMA LAN circuit pack(s)) with a copy of the generic included in the dormant software.

NOTE:
This command cannot be executed during a remote login session.

This command also supports a remote program installation to flash memory as standby copy from a PC connected to the CIT port of another DDM-2000 system.

NOTE 1:
This command must be executed from a PC with the program to be installed in its hard disk or on a set of floppy disks.

NOTE 2:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf. If security is not enabled on *all* shelves in the network, users on

unsecured shelves will be able to install software into the dormant memory of shelves with security enabled.

The input parameters are:

TID The Target Identifier (system name) of the shelf into which the program will be loaded. TIDs are case insensitive.

ProgramType
Program Type specifies whether the software to be installed is the Network Element or IMA LAN software generic. This parameter can have one of the following values;

lansw	The software to be installed is the IMA LAN generic.
nesw	The software to be installed is the Network Element generic (Default).

If the command syntax is correct, the following message will be displayed:

```
/* Testing for program installation ... */
```

When installing the IMA LAN software generic, if the command syntax is correct, the following message will be displayed:

```
/* Testing for IMA LAN program installation ... */
```

If the user issues a ins-prog command for IMA LAN software generic, but the PC contains NE software generic, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Mismatch between PC files and requested operation. */
```

The above denial applies to the opposite case (the user issues a ins-prog command for NE software, but the PC contains IMA LAN software) as well.

This command can only be completed successfully if it is executed from a CIT or modem port but not if it is received over the DCC. This command cannot be executed during a remote login session. If this command is executed during a remote login session, the following message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* This command cannot be executed from within a rlgn session. */
```

If this command is not executed from a PC, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* PC communication link could not be established.
   Please connect PC with program to be installed and start again. */
```

If this command is used to install a program for a certain product type while the TID of the shelf into which the program will be loaded identifies a different product type (for example, a program to be installed is for DDM-2000 OC-3 product type, while the target product type is FT-2000), the request will be denied and the following message is displayed:

```
IITA
/* Input, Invalid TArget identifier (TID) */
/* <TID> is a different product type;
   Incompatible software. */
```

If a user attempts to remotely install an IMA LAN program into a network element that does not support this feature (for example, installing the IMA LAN SW into an OC-3 shelf running Release 13.0), the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* Target NE does not support this feature. */
```

If a user attempts to remotely install an IMA LAN program into a Target network element that has either an Apply command in progress or Apply is already scheduled, the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* Apply command is either IP or scheduled
   in Target NE. */
```

The above denial message is applicable also if the user attempts to remotely install an NE program into a Target network element that has either an Apply command in progress or Apply is already scheduled.

If a user attempts to remotely install an IMA LAN program into a Target network element that has a **cpy-prog** command in progress, the following denial message is displayed:

```
SSTP
/* Status, execution SToPped */
/* A cpy-prog command is already IP
   in Target NE. */
```

The above denial message is applicable also if the user attempts to remotely install an NE program to a Target network element that has a cpy-prog command in progress.

If this command is used to install a program locally to a DDM-2000 but the PC contains DLC Subsystem program, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Incompatible program. */
```

If the communication link between the PC and the system that it connects to fails, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* PC communication link failure. */
```

To support remote program installation from a PC, the PC, the local system that the PC connects to, and the target system must be running compatible programs. To support local program installation from a PC, the PC, and the local (target) system that the PC connects to must be running compatible programs. If the programs are not compatible, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication protocol failure. */
```

For remote program installation, if the target system has a communication failure, has a "P" displayed in its SYSCTL 7-segment LED display, or does not support remote program installation from a PC, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication failure. */
```

If a Network Element (NE) receives this command, but is unable to determine a TID-NSAP translation for the entered TID (TID could not be found), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the entered TID does not match the remote NE's TID (only the NSAP matched in this case), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the remote NE's NSAP.

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

If communication cannot be established when attempting to download software to a local site from a PC, the following message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication link cannot be established.
   Please connect PC with DDM-2000 upgrade
   program and start again. */
```

If a user attempts to download software that is incompatible with the shelf type (for example, DDM-2000 OC-12 software into a DDM-2000 OC-3 system), or controller type for OC-3 shelves equipped with BBG8/BBG9 controllers, the following denial message will be displayed:

```
SCSN
/* Status, invalid Command SequenCe */
/* Incompatible Software */
```

When upgrading software, the following confirmation message will be displayed after testing for program installation:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, the following confirmation message will be displayed after testing for program installation:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */
   You have selected the ins-prog command with these parameters: */

   TID = TargetId
   ProgramType = lansw|nesw

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is used to download a new release of NE software (into the dormant memory of remote system) that is significantly different from the NE software currently running on the remote system, or to download NE software into the dormant memory of a local system from a PC where the software to be downloaded is significantly different from the NE software currently running on the local system, the following confirmation message is displayed:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and software
   compatibility information for additional information or actions
   needed. */

Execute? (y/n or CANcel/DELete to quit) =
```

When a user gives a positive response to the confirmation message, the following message is displayed:

```
In progress ................................................
```

The number of dots and how fast they are displayed depend on the size of the program to be installed, baud rate, and for remote program installation, number of DCC spans between the local and remote systems, and DCC traffic.

See "Install New Generic Program" in the TOP section (Volume 2) of this manual for complete instructions before using this command. Use the **rtrv-ne** or **rtrv-map-network** commands to obtain the exact TID for the system. The command **rtrv-eqpt** provides the current program version. The current program version may also be obtained from the initial screen and every report header line when logged into the system with a craft interface terminal (CIT). The current program version is also available on the user panel.

Each time a carriage return is entered, the system will also print a header line containing the TID and program version.

When the IMA LAN program has successfully been installed to the remote system, the following message is displayed:

```
/* IMA LAN Generic program m.m.m is installed. */
```

RELATED COMMANDS

rtrv-eqpt

rtrv-ne

NAME

logout: Terminate CIT Session

INPUT FORMAT

logout;

DESCRIPTION

This command terminates a user CIT session.

If this command is entered during a local session, it will terminate all sessions established by the user. If entered during a remote session, this command will terminate the remote session and return the user to the local session.

RELATED COMMANDS

rlgn

toggle

NAME

opr-aco: Operate Alarm Cutoff

INPUT FORMAT

`opr-aco;`

DESCRIPTION

This command silences the audible office alarms. Alarms remain silent until a new alarm condition arises.

If this command is executed while there is an active alarm condition in the system, it will:

- Silence active audible office alarms
- Light the alarm cut-off (ACO) LED on the user panel
- Set the parallel telemetry ACO output point
- Clear all parallel telemetry outputs (Not Applicable to all TARP releases) except the system ID and ACO outputs.

This command is equivalent to pushing the ACO button on the user panel, activating the TBOS ACO control point or activating the parallel telemetry ACO input.

For any DDM-2000 Multiplexer shelf in a network that has co-located DDM-2000 shelves (same *`site`* parameter settings), any one of the following actions will silence audible office alarms on all shelves at the same site:

- Pressing the ACO button
- Executing the **`opr-aco`** command
- Activating the parallel telemetry ACO input
- Setting the TBOS ACO control point

NOTE:
For all TARP releases, **only** the *`Local ACO`* parameter (obtained by either pressing the ACO button or executing **`opr-aco`** command) is allowed. The *`TBOS ACO control points`*, *`parallel telemetry ACO`*, *`remote ACO`*, and the *`site`* parameter are not applicable.

NAME

opr-lpbk-ec1: Operate-Loopback-EC1

INPUT FORMAT

`opr-lpbk-ec1:`*`Address`*[:**`lpbktype=`***`LoopbackType`*];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command executes a loopback on a low-speed STS1E interface towards the optical fiber (terminal) or DSX (facility), as shown in Figure 11-8.

Both the terminal and facility loopback can be set at the same time. The loopback remains in place until it is released by the **`rls-lpbk-ec1`** command.

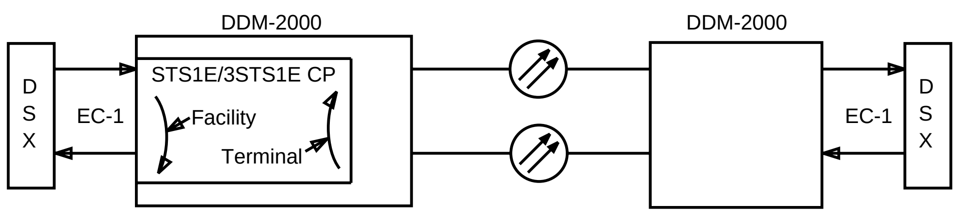


Figure 11-8. EC1 Loopback

The input parameters are:

Address Address of EC-1 port(s) to be looped back.
Valid EC-1 Port Address: **{a, b, c, all}**

lpbktype loopbacktype specifies whether the loopback is terminal or facility

- *terminal* Terminal loopback directed towards the high-speed facility. This is a default value.
- *facility* Facility loopback directed towards the DSX.

If a slot is determined to have the wrong circuit pack type for the command, the following message is displayed:

```
/*  Address not equipped for STS1E  */
/*  Enter low-speed EC-1 port address:  {a, b, c, all}  */
```

If the command cannot be completed due to hardware problems on the SYSCTL, the following message is displayed:

```
/*  SYSCTL failed - no loopback established */
```

If an invalid address is entered, the following message is displayed:

```
/*  Invalid Address */
/*  Enter EC1 port address:  {a, b, c, all} */
```

When input, this command will cause the following confirmation message to be displayed:

```
/* Caution!  Execution of this command may affect service. You
   have selected the opr-lpbk-ec1 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute?  (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rls-lpbk-ec1

NAME

opr-lpbk-t1: Operate-Loopback-T1

INPUT FORMAT

`opr-lpbk-t1:``Address`[:**`lpbktype=`**`LoopbackType`];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command executes a loopback on a DS1 port. Also, beginning with OC-3 Release 13.0 and later, this command executes a loopback on an "internal" DS1 port within a BBG20 TMUX circuit pack towards the optical fiber (terminal) or the DSX (facility) as shown in Figures 11-9 and 11-10. The loopback remains in place until released by the **`rls-lpbk-t1`** command.

Only **terminal** type loopbacks are allowed if applied to the IMA LAN circuit pack.

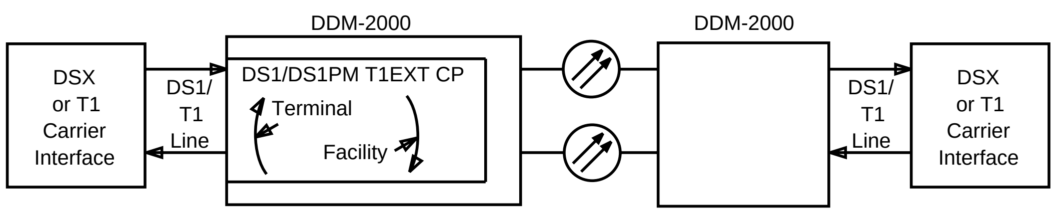


Figure 11-9. DS1 Loopback

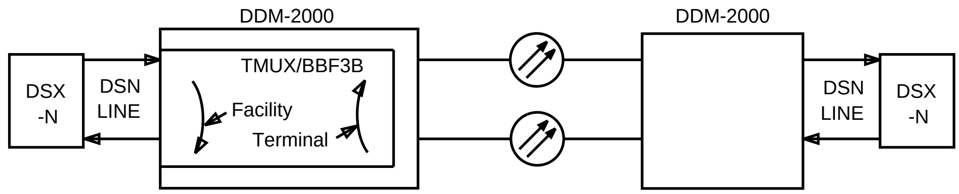


Figure 11-10. TMUX Loopback

The input parameters are:

Address Address of DS1 port(s) to be looped back.
For a terminal loopback, valid addresses are:
all, {a,b,c}-all, {a,b,c}-{1-7}-{1-4,all}

For a facility loopback, valid addresses are:
all, {a,b,c}-all, {a,b,c}-{1-7}-{all}
or
all, {a,b,c}-all, {a,b,c}-{1-7}-{1-4,all}
(For the BBG20 TMUX or BBF3B circuit pack)

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only ports number 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

`lpbktype` Loopbacktype specifies whether the loopback is terminal or facility. The valid values for this parameter are:

`terminal` Terminal loopback directed towards the high-speed facility. This is a default value.

`facility` Facility loopback directed towards the DSX. For the BBF1, BBF1B, and BBF3 circuit packs, operation of the loopback causes all four incoming DS1 signals to be looped back towards the DSX.

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only ports number 1 and 2 are valid. Specifying *`all`* selects ports 1 and 2 only.

In Release 13.0 and later, individual DS1 facility loopback is supported for each one of the 28 DS1 signals on the BBG20 TMUX circuit pack or for each of the four DS1 on a BBF3B (DS1PM) circuit pack.

If the loopback type is not consistent with the address, the following denial message is displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* loopback type is not consistent with the address. */
```

If the command cannot be completed due to hardware problems on the circuit pack, the following message is displayed:

```
/* Address CPname CP failed */
```

`Address` and *`CPname`* refer to the slot address and provisioned circuit pack type for the slot, respectively.

If a slot is in AUTO state or determined to have the wrong circuit pack type for the command, the following message is displayed:

```
/* Slot is in AUTO state or Address is not equipped  - no
   loopback established */
/* Enter DS1 port Address:   */
```

If the command cannot be completed due to hardware problems on the SYSCTL, the following message is displayed:

```
/* SYSCTL failed - no loopback established */
```

If this command is invoked to establish other than an existing loopback type (that is, if a facility loopback is requested when a terminal loopback already exists or vice versa) for the same address, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Establishing new loopback type (facility/terminal) requires that
existing loopback type (terminal/facility) associated with this
address must be released. */
```

NOTE:
The above denial message is not applicable to the BBG20 TMUX circuit pack. Both types of loopbacks can be active on the same DS1 address on this pack simultaneously. However, if the address "all" is used but one loopback of the opposite type exists, the command will be denied.

When input for a terminal loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS1
performance monitoring data and may affect service.
You have selected the opr-lpbk-t1 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

When input for a facility loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS1 and VT
performance monitoring data and may affect service.
You have selected the opr-lpbk-t1 command with these parameters:

Loopbacktype=loopbacktype
Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rls-lpbk-t1

NAME

opr-lpbk-t3: Operate-Loopback-T3

INPUT FORMAT

`opr-lpbk-t3:`*`Address`*[:**`lpbktype=`***`LoopbackType`*];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command executes a loopback on a DS3 port towards the optical fiber (terminal) or DSX (facility), as shown in Figure 11-11. For OC-3 Release 13.0 and later, a TMUX loopback is also available, as shown in Figure 11-12.

The terminal and facility loopbacks cannot be set at the same time. The loopback remains in place until released by the **`rls-lpbk-t3`** command.

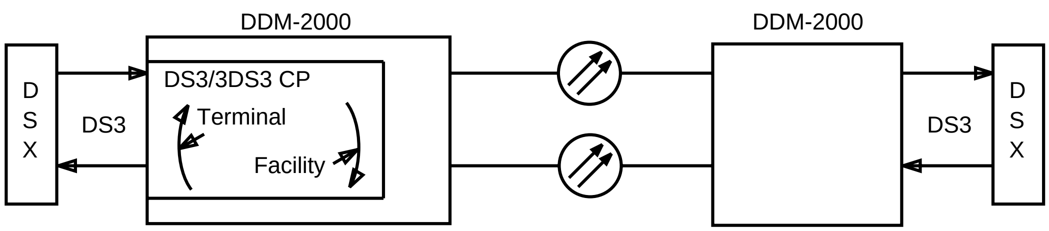


Figure 11-11. DS3 Loopback

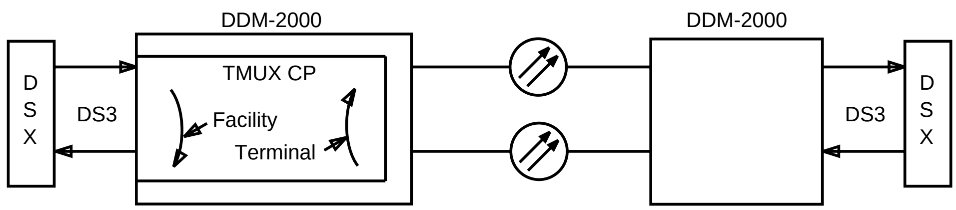


Figure 11-12. TMUX Loopback

The input parameters are:

Address Address of DS3 port(s) to be looped back.
Valid DS3 Port Addresses (BBG4, BBG4B, BBG20 TMUX):
{a,b,c,all}

Valid DS3 Port Addresses (BBG19): **all, {a,b,c}-{1-2,all}**

lpbktype loopbacktype specifies whether the loopback is terminal or facility

- *terminal* terminal loopback directed towards the high-speed facility. This is a default value.
- *facility* facility loopback directed towards the DSX.

If the command cannot be completed due to hardware problems on the circuit pack, the following message is displayed:

```
/*  Address CPname CP failed  */
```

Address and *CPname* refer to the slot address and provisioned circuit pack type for the slot, respectively.

If a slot is in AUTO state or is determined to have the wrong circuit pack type for the command, the following message is displayed:

```
/* Slot is in AUTO state or Address is not equipped - no
   loopback established */
/*  Enter DS3 port Address:  */
```

If the command cannot be completed due to hardware problems on the SYSCTL, the following message is displayed:

```
/*  SYSCTL failed - no loopback established */
```

If it is determined that a slot has the wrong pack type for the command, one of the following messages will be printed on the CIT:

```
/* address is not equipped for DS3 */
/*  Enter DS3 port address:  all, {a, b, c}-{1,2,all}  */
```

Where *address* is a slot AID:

```
/* address not properly equipped */
/*  Enter DS3 port address:  all, {a, b, c}, {a, b, c}-{1,2,all}
```

If this command is invoked to establish other than an existing loopback type (that is, if a facility loopback is requested when a terminal loopback already exists or vice versa) for the same address, the following denial message will be displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* Establishing new loopback type (facility/terminal) requires that
      existing loopback type (terminal/facility) associated with this
      address must be released. */
```

NOTE:
The above denial message is not applicable to the BBG20 TMUX circuit pack. Both types of loopbacks can be active on the same DS3 address on this pack simultaneously.

When input for terminal loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS3
   performance monitoring data and may affect service.
   You have selected the opr-lpbk-t3 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

When input for facility loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS3
   performance monitoring data and may affect service.
   You have selected the opr-lpbk-t3 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rls-lpbk-t3

NAME

reset: Reset the System Software Program

INPUT FORMAT

`reset`;

DESCRIPTION

CAUTION:
Execution of this command may affect performance-monitoring data.

This command resets the system software program. All history and performance-monitoring data is lost. All alarm information is lost and "rediscovered." The date and time are lost and "rediscovered" from the far end or set to default (**`70-01-01`** for date and **`00:00:00`** for time). No provisioning information is lost or changed, except for the page length parameter in **`set-link`**, which is reset to the default value.

An automatic date and time recovery process takes place by reading the date and time from the remote shelf connected to the main interface of the local shelf (in linear applications). In ring applications, the date and time data is recovered from the remote shelf connected to main-1 the local shelf.

NOTE 1:
Unlike other commands, an abbreviated version of this command name may not be entered. The user must type the complete command name when entering this command or the command request will be denied.

NOTE 2:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 3:
If a reset is done on any shelf, all adjacent shelves (shelves at the other ends of the optical interfaces that terminate on the shelf being reset) may show transient "section DCC channel failed" alarms. This is a normal system response.

When input, this command displays the following confirmation message:

```
/* Caution! When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file.
   If possible, it will reinitialize the date and time with
   the far end system.
   You have selected the reset command. */

Execute? (y/n or CANcel/DELete to quit) =
```

During system start-up after reset or other initialization, the user who is connected to a CIT port cannot log in. When the user presses RETURN, the following message is issued:

```
/*  System Initialization is in progress.
    Try to log in again later. */
```

NAME

rlgn: Remote Login

INPUT FORMAT

rlgn:*TID;*

DESCRIPTION

This command establishes a remote login session via the SONET data communications channel (DCC). Any network element (NE) which is part of the same maintenance subnetwork and has a compatible product type may be accessed with this command.

The alarm and status report for the far end system is printed automatically when this command is executed.

The input parameter is:

TID TID is the target identifier (system name) of the desired remote shelf.

If the command is successfully completed and security is enabled the user will be prompted for login and password (similar to a local login session).

NOTE:
A remote login session may be terminated unexpectedly if a user elsewhere in the network enables or disables the DCC.

If a user attempts to login to a remote shelf where another remote session is already established, the following denial message will be displayed:

```
RNBY
/* Resource, Ne is BusY */
/* A remote session is not allowed.
   Try again later. */
```

If a user is logged into a shelf and then tries to remotely login to the same shelf, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Local session already established.
   A remoted login to this TID is not allowed. */
```

If a user has toggled back to the local NE after establishing a remote session and tries to return to the remote session using this command, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session already established.
   A second remote session is not allowed. */
```

If the user attempts to log into a system whose product type does not support remote logins from the local NE, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   A remoted login to this product type is not allowed. */
```

If a nonprivileged user remotely logs into a remote NE through a DCC in **`lockout`** state, the following denial message will be displayed:

```
PIPW
/* Privilege, Illegal PassWord */
/* Access Blocked. */
```

If an unknown TID (or TID could not be found) is entered, the following message will be displayed and the user will be reprompted for the TID:

```
/* TID entered is not found. */
```

If an unknown TID (NE is unable to determine TID-NSAP translation for the entered TID and TID could not be found) is entered, this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the entered TID does not match the remote NE's TID, (only the NSAP matched in this case), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the remote NE's NSAP.

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed) or for any other reason, the remote NE is simply not reachable, this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

RELATED COMMANDS

logout

toggle

rtrv-map-neighbor

rtrv-map-network

NAME

rls-lpbk-ec1: Release-Loopback-EC1

INPUT FORMAT

`rls-lpbk-ec1:`*`Address`*[:`lpbktype=`*`LoopbackType`*];

DESCRIPTION

This command releases a previously established loopback on a low-speed STS1E interface.

The input parameters are:

`Address` Address of EC-1 port(s) where a loopback is to be released.
Valid EC-1 Port Addresses: **`{a,b,c,all}`**

`lpbktype` loopbacktype specifies whether the loopback is terminal or facility

`terminal` terminal loopback directed towards the high speed facility. This is a default value.

`facility` facility loopback directed towards the DSX.

If the user attempts to release a **`facility`** loopback type at a valid address when only a **`terminal`** loopback type has been established, or attempts to release a **`terminal`** loopback type at a valid address when only a **`facility`** loopback type has been established, the attempt will be denied and the following denial message displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Specified loopback does not exist. */
```

RELATED COMMANDS

opr-lpbk-ec1

NAME

rls-lpbk-t1: Release-Loopback-T1

INPUT FORMAT

`rls-lpbk-t1:`*`Address`*[:**`lpbktype=`***`LoopbackType`*];

DESCRIPTION

This command releases a previously established loopback on a DS1 port or an "internal" DS1 port in a BBG20 TMUX circuit pack in OC-3 Release 13.0 and later. Since establishing both types of loopbacks on the same address is allowed for the TMUX circuit pack, this command has been enhanced to include the type of loopback to be released. When using the IMA LAN interfaces, the only allowed loopback type is **terminal**.

The input parameters are:

`Address` Address of DS1 port(s) where a loopback is to be released. For a terminal loopback, valid addresses are:

`all, {a,b,c}-all, {a,b,c}-{1-7}-{1-4,all}`

For a facility Loopback, valid addresses are:

`all, {a,b,c}-all, {a,b,c}-{1-7}-{all}`

For a facility loopback on the BBF3B in R13.0 and later valid addresses are:

`all, {a,b,c}-all, {a,b,c}-{1-7}-{1-4,all}`

For a facility lookback for DS1 ports on DS1 packs other than BBF3B, valid addresses are:

`all, {a,b,c}-all, {a,b,c}-{1-7}-all`

For the BBG20 TMUX pack in OC-13 Release 13.0 later, valid addresses are:

`all, {a,b,c}-all, {a,b,c}-{1-7}-{1-4,all}`

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only ports number 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

`lpbktype` Loopbacktype specifies whether the loopback is terminal or facility. This parameter is only applicable to the BBG20 TMUX circuit pack in DDM-2000 OC-3 R13.0 and later releases. Since only one type of loopback is allowed at a time on DS1 or T1EXT circuit packs, this parameter is not used for these circuit packs.

terminal terminal loopback is directed towards the high speed facility. This is the default value.

Terminal is the only loopback type allowed when using the IMA LAN interfaces.

facility facility loopback is directed towards the DSX.

For the BBG20 TMUX circuit pack, if the user attempts to release a **facility** loopback type at a valid address when only a **terminal** loopback type has been established, or attempts to release a **terminal** loopback type at a valid address when only a **facility** loopback type has been established, the attempt will be denied and the following denial message will be displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Specified loopback does not exist. */
```

If the command is issued with an incorrect address for the specified loopback, the following denial message is displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* loopback type is not consistent with the address. */
```

NOTE:
If the address **all** is used, the command will be denied of the loopback type is inconsistent with any existing loopback.

RELATED COMMANDS

opr-lpbk-t1

NAME

rls-lpbk-t3: Release-Loopback-T3

INPUT FORMAT

`rls-lpbk-t3:`*`Address`*[:**`lpbktype=`***`LoopbackType`*];

DESCRIPTION

This command releases a loopback on a DS3 port previously established by an **`opr-lpbk-t3`** command. Since establishing both types of loopbacks on the same address is allowed for the BBG20 TMUX circuit pack in DDM-2000 OC-3 R13.0 and later releases, this command has been enhanced to include the type of loopback to be released.

The input parameter is:

`Address` Address of DS3 port(s) where a loopback is to be released.
Valid DS3 Port Addresses (BBG4, BBG4B): **`{a,b,c,all}`**

Valid DS3 Port Addresses (BBG4, BBG4B, and BBG20): **`{a,b,c,all}`**

Valid DS3 Port Addresses (BBG19): **`all, {a,b,c}-{1-2,all}`**

`lpbktype` Loopbacktype specifies whether the loopback is terminal or facility. This parameter is only applicable to the BBG20 TMUX circuit pack in DDM-2000 OC-3 R13.0 and later releases. For BBG4/BBG4B/BBG19 circuit packs, only one type of loopback at a time is allowed on a given address. Valid values are:

`terminal` terminal loopback is directed towards the high speed facility. This is the default value.

`facility` facility loopback is directed towards the DSX-3.

For the BBG20 TMUX circuit pack, if the user attempts to release a **`facility`** loopback type at a valid address when only a **`terminal`** loopback type has been established, or attempts to release a **`terminal`** loopback type at a valid address when only a **`facility`** loopback type has been established, the attempt will be denied and the following denial message will be displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Specified loopback does not exist. */
```

RELATED COMMANDS

opr-lpbk-t3

NAME

rstr-passwd: Restore Logins, Passwords, and User Types

INPUT FORMAT

`rstr-passwd`:*`login`*,*`passwd`*,*`user_type`*,*`clr`*;

DESCRIPTION

NOTE:
This command is available to privileged users only.

This command is *only* used to restore the login, password (in encrypted and encoded form), and user type information from an external workstation into the network element (NE). The restored information is information that would have been previously loaded from the NE into the external workstation through the **`rtrv-passwd`** command.

This command is intended to be used *only* in expert mode by an external personal computer or workstation and not at a CIT.

The input parameters are:

`login` This is the login name that was established by the security administrator on the NE before the **`rtrv-passwd`** command was executed.

`passwd` This is the current encrypted and encoded password selected by the owner of the login before the **`rtrv-passwd`** command was executed.

`user_type` This is the user access class assigned to this login by the security administrator before the **`rtrv-passwd`** command was executed. This parameter may have one of the following values:

`privileged`
The privileged user may execute any commands including restricted commands.

`general` The general user may execute any commands that are not restricted to privileged users.

`maintenance`
The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. No privileged commands are allowed to be executed by maintenance users.

`reports-only`
The reports-only user may only execute basic commands that extract reports from the system.

clr This parameter indicates whether the login data existing on the NE should be deleted before the login, password, and user type information can be restored. This parameter may have one of the following values:

- `clear` Clear the NE login file before restoring the login information (used only when *user_type* is privileged).
- `noclear` Append the restored login information to the network element login file.

If this command is executed with the parameter *clr* set to `clear`, all login information in the NE login file will be cleared. Then the new login information is restored from the external workstation. However, all active login sessions will not be terminated.

Attempts to input invalid parameter(s) data will result in the user being denied execution of this command. The following denial message is displayed:

```
IDNV
/* Input Data Not Valid, invalid data entered. */
```

An invalid parameter indicates that either a login does not match the valid login definition, the length of the encrypted password (after decoding it into encrypted form) is invalid, a *user_type* is invalid (for example, a misspelled *user_type*), or a *clr* value is invalid (that is, other than clear or noclear).

If this command attempts to restore another login line when the NE's maximum number of supported logins is reached, the following denial message will appear:

```
SLEM
/* Status, List, Exceeds Maximum */
/* Maximum number of logins already exists.
   Cannot enter another login. */
```

If the user attempts to restore another `privileged` user when the maximum number of `privileged` users has already been reached, this attempt will be denied and the following message will be displayed:

```
SLOM
/* Status, List, Over Maximum allowed */
/*  Maximum number of privileged users already exists. */
```

If an attempt is made to restore an already existing `privileged` user's login/password information with a *`user_type`* of either `general`, `maintenance`, or `reports-only`, this attempt is denied and the following message is displayed:

```
SDNC
/* Status, Data Not Consistent */
/* Privileged user logins cannot be restored as
   General, maintenance or Reports-only. */
```

If an attempt is made to restore a user's login/password information, with a *`user_type`* of either `general, maintenance` or `reports-only` and *`clr`*=**`clear`**, the attempt will be denied and the following message is displayed:

```
SDNC
/* Status, Data Not Consistent */
/* for clr=clear, user_type must be set to privileged. */
```

RELATED COMMANDS

rtrv-passwd

set-lgn

set-passwd

NAME

rtrv-alm: Retrieve Alarm and Status

INPUT FORMAT

`rtrv-alm[:alm=``AlarmLevel`];

DESCRIPTION

This command displays a report of active alarm and status conditions at the local network element. The report includes the source address of the alarm as well as date and time of the alarm, whether or not the condition is service-affecting, and a short description of the condition.

The input parameter is:

`alm` AlarmLevel for which a report is desired. This parameter may have one of the following values:

```
all (default)
cr
mj
mn
pmn
other (abnormal, ne-acty, status conditions)
```

Alarms are listed from greatest to least severity. Within a severity level, newer alarms are listed first.

NOTE:
Due to the large number of conditions reported, the RTRV-ALM report pages have been located at the end of this section for easier reference. Please refer to the RTRV-ALM table (Table 11-3) for a complete description of report outputs.

RELATED COMMANDS

rtrv-hsty

NAME

rtrv-attr-alm: Retrieve Attribute Alarm

INPUT FORMAT

`rtrv-attr-alm;`

DESCRIPTION

This command displays current alarm attributes, as provisioned by the **`set-attr-alm`** command.

The output report appears as follows:

```
/* System Alarm Attributes Report
======================================================================
Alarm Delay (almdel)=almdel, Clear Delay (clrdel)=clrdel, PMN=pmn
*/
```

The output parameters are:

`Alarm Delay`	This shows the alarm holdoff delay in seconds for incoming signal and equipment failures. This parameter is an integer with a range of 0 through 30.
`Clear Delay`	This shows the alarm clear delay in seconds for equipment failures. This parameter is an integer with a range of 0 through 30.
`PMN`	PMN is the office alarm level to be raised during a power minor alarm condition. This parameter has the values MJ (major) or MN (minor) indicating the alarm level.

NOTE:
Incoming signal failure conditions, AIS, and FERF signals are subject to the provisionable alarm holdoff delay and a fixed 15-second clear delay. Yellow signals are not subject to holdoff or clear delays. Circuit pack failures (except control circuit pack failures) are subject to the provisionable alarm holdoff and clear delays.

RELATED COMMANDS

set-attr-alm

NAME

rtrv-attr-cont: Retrieve Attribute Control

INPUT FORMAT

`rtrv-attr-cont`[:*`Address`*];

DESCRIPTION

This command displays the provisioned name of miscellaneous discrete environmental control points, as set by the **`set-attr-cont`** command.

The input parameter is:

`Address` Address of the environmental control point. The default address is **`cont-all`**.
Valid Addresses: **`cont-{1-4,all}`**

The output report appears as follows:

```
/* Control Point Provisioning Report
============================================================
Address  Description
============================================================
cont-1   StartGenerator
cont-2   StartPump
cont-3   control3
cont-4   control4
*/
```

The output parameters are:

`Address` This is the address of the control point.

`Description` This is the provisioned description of the environmental control point.

NOTE:
This command will be denied if it is entered in a system whose SYSCTL CO/RT parameter is set to CO (via the **`set-ne`** command). Use the **`rtrv-ne`** command to determine the switch setting. The following denial message will be displayed:

```
ENRI
/* Equipage, Not equipped for Retrieving specified Information */
/* Environmental controls can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-env

rtrv-ne

set-attr-cont

set-attr-env

NAME

rtrv-attr-env: Retrieve Attribute Environment

INPUT FORMAT

`rtrv-attr-env`[:*`Address`*];

DESCRIPTION

This command displays the provisioned alarm and provisioned name and provisioned alarm type of miscellaneous discrete environmental alarm/status points, as set by the **`set-attr-env`** command.

The input parameter is:

`Address` The address of the environmental input point.
Valid Addresses: **`env-{1-21}`**, **`env-{all}`** (default)

The output report appears as follows:

```
/* Environmental Alarm Provisioning Report
============================================================
Address  Alarm  Alarm Type      Description
============================================================
env-1     CR    MISC            Fire
env-2     NA    Power           OpenDoor
env-3     MN    code-7          environment3
 .        .       .              .   .   .
 .        .       .              .   .   .
 .        .       .              .   .   .
env-15    MN    Misc            externalMinor
env-21    MN    Misc            generatorOn
*/
```

The output parameters are:

`Address` The address of the environmental alarm/status point.

`Alarm`	Alarm is the provisioned alarm level of the environmental input and has the following values: `CR` Critical alarm `MJ` Major alarm `MN` Minor alarm `NA` Not alarmed, but reported
`Alarm Type`	This is the user-defined classification of the environmental alarm/status point.
`Description`	Provisioned description of the environmental alarm/status point.

NOTE:
This command will be denied if it is entered in a system whose SYSCTL CO/RT parameter is set to CO (via the **`set-ne`** command). Use the **`rtrv-ne`** command to determine the switch setting. The following denial message will be displayed:

```
ENRI
/* Equipage, Not equipped for Retrieving specified Information */
/* Environmental alarms can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

rtrv-ne

set-attr-cont

set-attr-env

NAME

rtrv-crs-sts1: Retrieve Cross-Connection STS-1

INPUT FORMAT

`rtrv-crs-sts1`[:*`Address`*];

DESCRIPTION

This command retrieves STS-1 cross-connections within the DDM-2000 system. Cross-connections are entered using the **`ent-crs-sts1`** command.

For OC-3 linear releases, STS-3c cross-connections are possible between Main slots and FN-C slots, and will also be displayed in this report. The STS-3c mode must be set to **`enabled`** using the **`set-oc3`** command.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

STS-3c cross-connections are an optional feature that requires a special license from Lucent Technologies. See Chapter 8, "Administration and Provisioning," for additional information.

This report also indicates if any VT1.5 cross-connections exist. A VT1.5 cross-connection map report, obtained by using the **`rtrv-crs-vt1`** command, will show the specific VT1.5 cross-connections.

The input parameter is:

`Address` The address of one or more STS-1 channels for which cross-connections are to be reported. The default address is **`all`** STS-1 channels in the system.
Valid Linear Addresses: **`all, {a,b,c}, {m,c}-{1-3,all}, {a,b}-{1-2,all}`**

Valid Ring Addresses: **`all, {m,c}-{1-3,all}, b-{1,2,all}, a-{1,2,all}`**

If the shelf is equipped with 24-type OLIUs in its Main units, the valid addresses are: **`m-{1-12,all}`**

If the shelf is equipped with 29-type (starting with OC-3 Release 15.0) OLIUs in its Main units, the valid addresses are: **`m-{1-12,all}, c-{1-3,all}, {a,b}-{1,2,all}`**

The output report appears as follows:

```
   /* Cross-Connection Map Report
   =================================================================
   Address  Address                Cross Connect  Ring Id
      1        2                       Type
   =================================================================
   -----------------------------STS-3C-----------------------------
   m-10     m-10                      twoway         -
   -----------------------------STS-1------------------------------
   m-1      a                         twoway         m1
   m-2      b-1                       twoway         -
   m-3      VT1.5 Cross-Connection
   a        c-1                       twoway         -
*/
```

NOTE:
Starting with OC-3 Release 13.0 each cross-connection is reported only once (not once in each direction).

The above report lists both STS-1 and STS-3c cross connections (if applicable) in separate sections. The output report shows the channels in an order that reflects the physical layout of the system (for example, the high-speed slots are shown first, followed by those associated with the function unit).

Also the STS-3c section within the OC-3 report is applicable if the main unit slots are equipped with OC-12 interfaces (24G-U or 29G-U OLIU circuit packs).

The output parameters are:

`Address 1` Address 1 is the address of an STS-1 channel.

`Address 2` Address 2 is the address of an STS-1 channel.

`Cross Connect Type`
This parameter is available with all ring releases.

This column specifies whether the cross-connection is two-way (**`twoway`**) or drop and continue (**`dc`**). - Two-way cross-connections apply to terminating, hub, add/drop, pass-through hairpin, 0x1 DS3 and 0X1 ring configurations. For detailed information on the mentioned cross-connection types, refer to **`ent-crs-sts1`** command page.

`Ring Id` This parameter is available with all ring releases. This column identifies the ring for drop and continue connections, specifying which ring will be continued as well as dropped at the network element. The valid values are **`m1`** and **`m2`**.

This report indicates if any VT1.5 or STS-3c cross-connections exist. A VT1.5 cross-connection map report, obtained by using the **`rtrv-crs-vt1`** command, will show the specific VT1.5 cross-connections.

RELATED COMMANDS

dlt-crs-sts1

ent-crs-sts1

rtrv-crs-vt1

NAME

rtrv-crs-sts3c: Retrieve Cross-Connection STS-3c

INPUT FORMAT

`rtrv-crs-sts3c[``:`*`Address`***`]`**`;`

DESCRIPTION

This command retrieves STS-3c cross-connections within the DDM-2000 system. Cross-connections are entered using the **`ent-crs-sts3c`** command.

This command can be used in an OC-3 shelf if it is equipped with 24-type OLIU circuit packs in its Main unit slots. The only valid cross-connect type for this equipage is **`Twoway`** for pass-through cross-connections. Starting with OC-3 Release 15.0, if the shelf is equipped with 29-type OLIU circuit packs in its Main unit slots, the valid cross-connect type is **`Twoway`**, which supports pass-through or add-drop for 0X1 (depending on the shelf's equipage).

NOTE:
If Slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` The address of one or more STS-3c channels for which cross-connections are to be reported. The default address is **`all`** STS-3c channels in the system.

If the OC-3 shelf is equipped with 24-type OLIU circuit packs in its Main unit slots, the valid Main Unit Addresses are:
`m-{1,4,7,10,all}`,

If the OC-3 shelf is equipped with 29-type OLIU circuit packs in its Main unit slots, the valid Main and Function Unit Addresses are:
`m-{1,4,7,10,all}`,

The valid Function Unit Addresses are: **`c-1`**

The output report appears on the following page.

```
     /* Cross-Connection Map Report
     ================================================================
     Address  Address                 Cross Connect  Ring for
        1        2                        Type       Drop&Cont
     ================================================================
     -------------------------------STS-3C---------------------------
      m-1     m-1                        twoway         -
      m-4     m-4                        twoway         -
     -------------------------------STS-1----------------------------
      m-7     VT1.5 Cross-Connection
      m-10    c-1                        twoway         -
      m-11    c-2                        twoway         -
      m-12    c-3                        dc             m1
  */
```

The output report shows the STS-3c channels in an order that reflects the physical layout of the system (for example, the high-speed slots are shown first, followed by those associated with function unit A, function unit B, etc.). The output report also shows the STS-1 channels (if applicable) in a separate section. The STS-1 channels are listed in the same order as described for the STS-3c channels.

The output parameters are:

`Address 1` Address 1 is the address of an STS-3c channel.

`Address 2` Address 2 is the address of an STS-3c channel.

`Cross Connect Type`
This column specifies whether the cross-connection is two-way (**`twoway`**)

RELATED COMMANDS

ent-crs-sts3c

dlt-crs-sts3c

NAME

rtrv-crs-vt1: Retrieve Cross-Connection VT1.5

INPUT FORMAT

`rtrv-crs-vt1`[:*`Address`*];

DESCRIPTION

This command retrieves VT1.5 signal cross-connections within a DDM-2000 OC-3 system, as set by the **`ent-crs-vt1`** command.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Following is the list of valid addresses:

Valid Linear Addresses:
`{m,c}-{1-3,all}-{1-7,all}-{1-4,all},`
`{a,b}-{1,2}-{1-7,all}-{1-4,all},`
`{a,b,c}-{1-7,all}-{1-4,all}`

Valid Ring Addresses:
`m-{1-3,all}-{1-7,all}-{1-4,all},`
`{a,b,c}-{1-7,all}-{1-4,all},`
`a-{1,2,all}-{1-7,all}-{1-4,all}`
`c-{1-3,all}-{1-7,all}-{1-4,all},`
`b-{1,2,all}-{1-7,all}-{1-4,all}`

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying **`all`** selects ports 1 and 2 only.

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in its Main units, valid VT1.5 Addresses are:
`m-{1-12,all}-{1-7,all}-{1-4,all}`

The output report appears as follows. Only existing ports or channels that are cross-connected will be displayed in the report.

```
/* VT1 Cross Connect Report
=================================================================
Address     Address    Cross Connect   Ring Id
   1           2          Type
=================================================================
m-1-7-4     c-2-7-1      twoway         -
m-2-1-2     c-1-1-2      twoway         m1
m-2-6-1     b-6-1        dc             m2
m-2-6-3     b-6-3        dc             m2
m-3-2-4     c-2-4-1      twoway         -
  .           .          .              .
  .           .          .              .
*/
```

NOTE:
Starting with OC-3 Release 13.0 each cross-connection is reported only once (not once in each direction).

The output parameters are:

`Address 1` Address1 is the address of a VT1.5 channel or DS1 port.

`Address 2` Address2 is the address of a VT1.5 channel or DS1 port.

`Cross Connect Type`
This parameter specifies the cross connection type. It also specifies whether the cross-connection is two-way, drop and continue **`(dc)`**, or locked. Two-way applies to add/drop, hairpin and 0x1 ring configurations. In linear configurations, Twoway applies to hubbing, add/drop, point-to-point and pass-through cross-connections.

`Ring Id` This column identifies the ring for drop and continue, and locked connections.

The report shows the current state of VT1.5 cross-connections in the NE. When the address of multiple VT1.5 channels or DS1 ports are specified in the execution of this command, the report will show the addresses in the first column in numerical order reflecting the physical layout of the shelf.

The report will also indicate if any STS-1 cross-connections exist. An STS-1 cross-connection map report, obtained by using the **`rtrv-crs-sts1`** command, shows the specific STS-1 cross-connections.

RELATED COMMANDS

dlt-crs-vt1

ent-crs-vt1

rtrv-crs-sts1

rtrv-state-path

NAME

rtrv-ec1: Retrieve EC-1

INPUT FORMAT

`rtrv-ec1`[:*`Address`*];

DESCRIPTION

This command retrieves information about each EC-1 port. This information includes attributes set by the **`set-ec1`** command, as well as parameters set by switches on the circuit pack.

The input parameter is:

`Address` This is the address of one or more EC-1 ports. The default address is **`all`** EC-1 ports in the system.

Valid Addresses: **`{a,b,c,all}`**

The output report appears as follows:

```
/* EC1 Port Provisioning Report
======================================================================
 Port      CP Transmission    Alarm  Signal Degrade  State
Address        Mode (hw)      Level    Threshold
======================================================================
address        mode           alarm       nn         state
address        mode           alarm       nn         state
     .           .              .          .           .
     .           .              .          .           .
     .           .              .          .           .
     .           .              .          .           .
*/
```

The output parameters are:

`Port Address` This column lists the address of one or more EC-1 ports.

`CP Transmission Mode (hw)`
This column reports the hardware provisioned transmission mode of the circuit pack that provides the EC-1 interface. The valid values are **`High Speed`** and **`Low Speed`**.

`Alarm Level`	This column shows the alarm level for an incoming EC-1 signal failure and may have one of the following values: `CR` Critical `MJ` Major `MN` Minor `NA` Not Alarmed
`Signal Degrade`	This column shows a signal degrade threshold for the EC-1 port as a BER in terms of a logarithm to the base 10. The value may be an integer ranging from -9 through -5.
`State`	This column shows the memory administrative state of the port. When the mode is set for **`High Speed`**, the state is always `is` (in-service). When the mode is set for **`Low Speed`**, the state may be one of the following values: `is` In-service `auto` Automatic `nmon` Not Monitored

RELATED COMMANDS

set-ec1

NAME

rtrv-eqpt: Retrieve Equipment

INPUT FORMAT

`rtrv-eqpt`[:*`Address`*];

DESCRIPTION

This command displays the circuit pack type and version information for one or more slots on a network element (NE).

The input parameter is:

`Address` Address identifies one or more slot(s). The default is **`all`** slots. Valid Slot Addresses: **`all, main-{1,2,all}, fn-all, fn-{a,b,c}-{1,2,all}, ls-all, tg-{1,2,all}, ls-{a,b,c}-{1-8,all}, sysctl, auxctl, shelf`**

A sample output report appears on the following page.

```
/* Equipage and Version Report
=====================================================================
   Slot     Circuit  Apparatus  Series     CLEI       ECI     Serial
   Address   Pack       Code    Number     Code       Code    Number
   ====================================================================
   tg-1     TGS      BBF2B      S1:1     SNPQAJCAAA  680153  93MV01616399
                                         PID=AEKCG
   tg-2     TGS      BBF2B?     S1:1?    SNPQAJCAAA? 680153? 92MV09625399
                                         PID=AGAEC
   --------------------------------------------------------------------
   main-1   OLIU     22G-U      S1:1     SNTRFBXDAA  200320  94MV11057853
   main-2   OLIU     22G-U      S1:1     SNTRFBXDAA  200320  94MV11057867
   --------------------------------------------------------------------
   fn-a-1   MXRVO    BBG2       S2:2     SNCMAA2AAA  670744  92MV08488635
   fn-a-2   MXRVO    BBG2       S1:1     SNCMAAOAAA  663642  90MV08461815
   fn-b-1   MXRVO                        SNCMAA2AAA  670?
   fn-b-2   MXRVO                        SNCMAA2AAA  670Y
   fn-c-1   DS3      BBG4       S1:1     SNCLBBBAAA  663938  90MV11065997
   fn-c-2   DS3                          SNCLBBBAAC  681?
   --------------------------------------------------------------------
   ls-a-1   DS1      BBF1B      S3:4     SNCLAA1AAB  682891  92MV09578358
   ls-a-2   DS1      BBF1B      S3:4     SNCLAA1AAB  682891  92MV09578358
   ls-a-3   DS1      BBF1B      S3:4     SNCLAA1AAB  682891  92MV07648136
   ls-a-4   -        -          -        -           -       -
   ls-a-5   -        -          -        -           -       -
   ls-a-6   -        -          -        -           -       -
   ls-a-7   -        -          -        -           -       -
   ls-a-8   DS1PM    BBF3       S1:1     SNPQAM4AAA  682269  92MV11637497
   ls-b-1   LAN      BBF9       S1:1     SNCBF05DAA  240159  ????????????
   ls-b-2   LAN      BBF9       S1:1     SNCBF05DAA  240159  ????????????
   ls-b-3   -        -          -        -           -       -
   ls-b-4   -        -          -        -           -       -
   ls-b-5   -        -          -        -           -       -
   ls-b-6   -        -          -        -           -       -
   ls-b-7   -        -          -        -           -       -
   ls-b-8   -        -          -        -           -       -
   ls-c-1   -        -          -        -           -       -
   ls-c-2   -        -          -        -           -       -
   ls-c-3   -        -          -        -           -       -
   ls-c-4   -        -          -        -           -       -
   ls-c-5   -        -          -        -           -       -
   ls-c-6   -        -          -        -           -       -
   ls-c-7   -        -          -        -           -       -
   ls-c-8   -        -          -        -           -       -
   --------------------------------------------------------------------
   sysctl   SYSCTL   bbg8       S1:1     SNC11WOAAA  205700  94MV00000075
   --------------------------------------------------------------------
   auxctl   OHCTL    bbg9       S1:1     SNC11VLAAA  205701  94MV00000049
   shelf             ED-8C724-30,G3 or earlier

            Program version X.X.X
   */
```

Starting with OC-3 Release 15.0, the Low Speed slots of the DDM-2000 OC-3 shelf will support the IMA LAN circuit pack.

When an OC-3 shelf is equipped with the IMA LAN pack, which occupies two consecutive Low Speed slots, this report lists the LAN pack in 2 consecutive lines as shown in the sample report.

Also starting with OC-3 Release 15.0, the Low Speed slots of the DDM-2000 OC-3 shelf will support the T1EXT circuit pack.

NOTE:
When using the T1EXT (BBF6) circuit pack(s) in OC-3 shelves, the function unit must be equipped with the BBG2B enhanced MXRVO circuit packs (in both Function slots).

The output parameters are:

`Address`	This is the address of the slot. An address of `shelf` requests information about the group id for the shelf.
`Circuit Pack`	Circuit pack is the mnemonic name that identifies the general type function provided by a circuit pack. For example, Optical Line Interface Units are all named OLIU; SYStem ConTroLlers are named SYSCTL.
`Apparatus Code`	Apparatus code uniquely identifies the specific function provided by a circuit pack. Circuit packs with different apparatus codes are not interchangeable even if they have the same name.
`Series Number`	This is used to indicate interchangeability among circuit packs with the same circuit pack name and apparatus code but different manufacturing versions. In general, a circuit pack can be replaced by another circuit pack that has the same apparatus code and the same or later series number.
`CLEI Code`	*CLEI** code is the 10-character code identifying each circuit pack.
`ECI Code`	Equipment catalog item (ECI) code is a 6-character code identifying each circuit pack. This code corresponds to the bar-coded label on the faceplate of the circuit pack, and is uniquely equivalent to the *CLEI* code.

* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

`Serial Number`	This is a 12-character code uniquely identifying each circuit pack and indicating the date and place of manufacture.
`Program Version`	Program version is the version of software that is currently stored on the circuit pack.
`PID`	Program identification code identifies the version of firmware on one or more socketed devices on the circuit pack.

The report always contains a line for every slot included in the range of the address whether or not the slot is equipped.

Hyphens (`-`) indicate information in that field is not applicable (that is, type and version information for slots that are not equipped).

Question marks (`?`) indicate that the information is unknown (for example, an unrecognized circuit pack, because the system is unable to read version information from a circuit pack inserted into a slot in the AUTO state)

If an incorrect circuit pack is inserted in a slot, the report will show the expected circuit pack name for that slot and indicate that the current circuit pack does not match inventory.

If an unpowered circuit pack is placed in a slot, the report will indicate that the circuit pack is unpowered and version information is unavailable.

If the system cannot report complete and correct version information for a circuit pack because of a field upgrade, then the information that may be incorrect (apparatus code, series, *CLEI* code, and ECI code) is followed by a "?".

RELATED COMMANDS

rtrv-state

NAME

rtrv-feat: Retrieve Feature

INPUT FORMAT

`rtrv-feat`;

DESCRIPTION

This command retrieves a list of active feature options enabled by the **`set-feat`** command.

The output report appears as follows:

```
/* Feature Options Enabled Report
===================================================================
 Feature Option     Description
===================================================================
     feature        description
     feature        description
      .                 .
      .                 .
      .                 .
      .                 .
*/
```

The output parameters are:

`Feature Option`	This is the name of the feature currently enabled.
`Description`	Description of the feature.

RELATED COMMANDS

set-feat

NAME

rtrv-fecom: Retrieve Far-end Communications

INPUT FORMAT

`rtrv-fecom:[``Address`];

DESCRIPTION

This command displays the provisioned state of a network element's (NE's) section data communication channels (DCC), and of the IAO LAN interface, as set by the **`set-fecom`** command.

The DCC is an embedded overhead communications channel in the SONET line used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between NEs.

The input parameter is:

Address — Address is the address of the DCC or IAO LAN. The default value is **`dcc-all`**

Valid Linear Addresses: **`dcc-{m,a,b,c,all}`**
These addresses also apply to OC-3 R15.0 or later ring releases when the main ring interface is provisioned for the "identical" DCC mode.

Valid Ring Addresses: **`dcc-{m1,m2,a,b,c,all}`**

Valid OC-1 Ring Addresses (for 27-type OLIU):
`dcc-{m,a,b,c}{1,2}-{1,2}`

Valid OC-1 Ring Addresses (for 26G2-U OLIU):
`dcc-{a,b,c}{1,2}-1`

Valid IAO LAN Address: **`lan`**

The far-end communication output report appears as follows:

```
/* Far End Communication Configuration Report
=================================================================
 DCC/LAN       Communications   DCC
 Address                       NS/US
=================================================================
 dcc-m1           enabled      us
 dcc-m2           enabled      ns
 dcc-m%           enabled      us

 lan               enabled
 dcc-c             disabled     ns
 dcc-a             disabled     ns
 dcc-b             disabled     ns

*/
```

% This Address is applicable to Release 15.0 and later ring releases if the DccMode parameter is set to"identical" using the set-oc3 or set-oc12 command.

The output parameters for this report are:

`DCC/LAN Address`	This column displays the address of a DCC or IAO LAN.
`Communication`	This column shows whether communication over the DCC or IAO LAN is enabled or disabled.
`DCC NS/US`	DCC network side/user side (NS/US) parameter settings are available with the BBG8 controller to identify the setting of each end of the DCC in the network element. This identification is needed for OSI communications and is required for all nodes in the subnetwork. To avoid alarms, only one end of a span may be designated as the user side and only one end of a span may be designated as the network side.

RELATED COMMANDS

rtrv-map-neighbor

rtrv-map-network

rtrv-x25

set-fecom

NAME

rtrv-hsty: Retrieve History

INPUT FORMAT

`rtrv-hsty`;

DESCRIPTION

This command displays an event-history report. This report contains a list of the most recent system events. This report will contain up to 500 events. The events are listed in last-in, first-out order, and are date- and time-stamped.

NOTE:
Due to the large number of conditions reported, the RTRV-HSTY report pages have been located at the end of this section for easier reference. Please refer to the RTRV-HSTY table (Table 11-4) for a complete description of report outputs.

RELATED COMMANDS

rtrv-alm

NAME

rtrv-lan: Retrieve IMA LAN internal parameters' settings

INPUT FORMAT

`rtrv-lan`:*`Address`*;

DESCRIPTION

This command displays the data associated with the IMA LAN circuit pack for a specific address, as set by the **`set-lan`** command.

This command is available starting with OC-3 Release 15.0, and it is applicable only to the IMA LAN (BBF9 or BBF10) circuit pack.

The input parameter is:

`Address` Address is the address of the IMA LAN port on the IMA LAN circuit pack.

Valid Addresses: **`{a,b,c}-{1-7,all}, all`**

NOTE:
Since that the IMA LAN pack occupies **two consecutive** Low Speed slots, following guidelines should be used:

The IMA LAN pack address can be derived from either slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *`a-1`* and *`a-2`*, the address used in this case can be either *`a-1`* or *`a-2`*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed address combinations:
`{a,b,c}-{3 and 4}` is allowed.
`{a,b,c}-{6 and 7}` is allowed

The output report appears as follows:

```
/* IMA LAN Provisioning report
=======================================================================
Address  Grp Id  aal5   vp_id  vc_id  frm_lgth  scrambler  polynom  fcs
                 almlvl pmmd   dsx_st sonet_st
=========================================================================
IMALAN_Release=sw_release
address   grpid  aal5   vpi    vci    length    scrambler  polynom  fcs
                 alm    pmmode dsxst  sonetst

IMALAN_Release=sw_release
address   grpid  aal5   vpi    vci    length    scrambler  polynom  fcs
                 alm    pmmode dsxst  sonetst

IMALAN_Release=sw_release
   .       .     .      .      .      .         .          .        .
                 .      .      .      .

IMALAN_Release=sw_release
   .       .     .      .      .      .         .          .        .
                 .      .      .      .

IMALAN_Release=sw_release
   .       .     .      .      .      .         .          .        .
                 .      .      .      .

---------------------------------------------------------------------------
Apply:Action=action    Address=x

Apply:Action=action    Address=x

Apply:Action=action    Address=x
```

The output parameters are:

`IMALAN_Release`

This parameter reports on the software release number that is currently running on the addressed IMA LAN pack.

The IMA LAN Sofware Release will be listed in the form XX.XX.XX

NOTE:
There will be an IMA LAN software release number listed for each one of the addressed IMA LAN pack(s).

`Address` Address of the LAN port on the IMA LAN pack

Valid Addresses: **`{a,b,c}-{1-7,all}`**

NOTE:
Since that the IMA LAN pack occupies **two consecutive** Low Speed slots, following guidelines should be used:

The LAN port address is derived from the lowest slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the LAN port address used in this case is *a-1*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed combinations:
Addresses **{a,b,c}-{3 and 4} combination is allowed**
Addresses **{a,b,c}-{6 and 7} combination is allowed**

grpid IMA Group Identifier. This is an integer value used to identify an IMA Group of 1 to 8 DS1s. This integer ranges between **0** and **255**. **0** is the default value.

aal5 ATM Adaptation Layer 5. This is a method of encapsulating or adapting LAN packets in ATM format. This parameter can have one of the following values:

llc (Default value)

vcmux

vp_id ATM Virtual Path Identifier. This parameter is used to assign an ATM virtual path identifier to the ATM cells in the IMA group for transmission of LAN packets. This is an 8-bit integer of range **0-255**. Default value is **0**.

vc_id Virtual Channel Identifier. This parameter is used to assign an ATM virtual channel identifier to the ATM cells in the IMA group for transmission of LAN packets. This is a 16-bit integer value of range **0 - 65535**. Default value is **0**.

frm_lgth IMA Frame Length. This is a set of integer values ranging from **32**, **64**, **128** (default), to **256**. The frame length is measured by the number of ATM cells.

scrambler	ATM Scrambler. This parameter can have either one of two values:	
	on	ATM scrambler is ON (default)
	off	ATM scrambler is OFF
polynom	ATM Polynomial. This parameter is used to activate/disactivate the checksum for header error check on the ATM cells. This parameter can have either one of the following two values:	
	on	ATM polynomial is ON
	off	ATM polynomial is OFF (default).
fcs	Frame Check Sequence Preserved. This parameter is used to enable/disable the preservation of the frame check seq uence (FCS) contained in MAC frames sent to the BBF9 or BBF10 circuit pack from the LAN i nterface. When frame check sequence preservation is disabled, the FCS bytes are stripped from the MAC frame prior to conversion to ATM cell format for transmission over the IMA LAN connection. In the opposite direction the FCS is recalculated and added back to the MAC frame before forewarding to the LAN interface. Default value is **enable**.	
almlvl	Alarm Level. This parameter sets the alarm level for an incoming DS1 Signal Failure and may be one of the following:	
	mj	Major Alarm
	mn	Minor Alarm
	na	No Alarm (default value)
pmmd	This parameter sets the PM mode for the IMA LAN circuit pack. **Pmmd** is only used for performance-monitoring. Setting this parameter does not affect the transmitted or received signal. This parameter may be one of the following values:	
	off	PM turned off (default value)
	on	PM turned on.

`dsx_state` This parameter indicates the management state of the incoming LAN signal interface from the DSX or customer interface direction. The values are NMON (Not MONitored), AUTO, IS (In Service). The state is controlled through the "upd" command and the "set-state-t1" command.

`sonet_state` This parameter indicates the management state of the incoming LAN signal interface from the SONET or high speed direction. The values are NMON (Not MONitored), AUTO, IS (In Service). The state is controlled through the **`upd`** command and the **`set-state-t1`** command.

`Apply`

`Action` This parameter is reported ONLY if a dormant IMA LAN software generic is currently stored by the network element, and the **`apply`** command is issued for program installation with `Action=`**`install`**

NOTE:
This parameter is not reported if an apply command to a specific address has been completed. Only apply commands that are In Progress (still running) and apply commands queued for execution are listed in this report).

For each IMA LAN circuit pack, this parameter is NOT reported if no IMA LAN program apply is issued yet.

If an IMA LAN dormant software generic is currently stored by the network element, and the **`apply`** command is issued with `Action=`**`cancel`**, a blank " " is reported for Action.

NOTE:
This parameter is not reported if an apply command with Action=cancel to a specific address.

`Address` Address of the Low Speed slot(s) equipped with the IMA LAN pack

This command may only be executed if the shelf is equipped with IMA LAN circuit packs in the addressed Low Speed slots, otherwise the following denial message is displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* Specified AID slot(s) are not equipped with proper hardware. */
```

RELATED COMMANDS

set-lan

NAME

rtrv-lgn: Retrieve Login

INPUT FORMAT

rtrv-lgn;

DESCRIPTION

This command retrieves login authorization information. This report lists each user's login and privileges. The report does not contain passwords.

NOTE:
This command is available to privileged users only.

The output report appears as follows:

```
/* Login Provisioning Report
===================================================================
  Login           User Type
===================================================================
  name            privileged
  name            privileged
  name            privileged
-------------------------------------------------------------------
  name            general
   .                 .
   .                 .
-------------------------------------------------------------------
  name            maintenance
   .                 .
   .                 .
-------------------------------------------------------------------
  name            reports-only
   .                 .
   .                 .
*/
```

Privileged logins are listed first in the report, followed by general logins, maintenance logins, and then reports-only logins. Each category of logins is separated by a row of hyphens.

NOTE:
There are always three (and only three) privileged logins on the DDM-2000 system.

The output parameters are:

`Login`	This column lists the login names.
`User Type`	This column indicates the type of authorization each user is assigned. The valid values are **`privileged`**, **`general`**, **`maintenance`**, and **`reports-only`**.

RELATED COMMANDS

set-lgn

set-secu

rtrv-secu

NAME

rtrv-link: Retrieve CIT Link Configuration

INPUT FORMAT

`rtrv-link;`

DESCRIPTION

This command displays the currently-provisioned parameters for the user's craft interface link, as set by the **`set-link`** command. This includes the link which the user is logged into, the baud rate, and the page length of reports.

The baud rate is set by autobaud and is not a provisionable parameter.

The output report appears as follows:

```
/* Interface Link Configuration Report
==============================================================
Link=link, PageLength (pg)=pg, Baud=baud (auto)
*/
```

The output parameters are:

`Link` Link identifies the CIT link from which the command was executed and may have the following values:

- `cit-1` This indicates the front-access port.
- `cit-2` The rear-access port.
- `dcc-`*x* A SONET DCC port used for remote access (**`dcc-m`**, **`dcc-a`**, **`dcc-b`**, or **`dcc-c`**).

`PageLength` This is the number of lines displayed in one page of a report. Reports with a number of lines greater than one page will be paged.

`Baud` Baud identifies the data rate for this link. For the BBG8 SYSCTL, the CIT data rate is automatically set to agree with the terminal or workstation connected to the link. The (`auto`) after the data rate indicates that the data rate is set by the autobaud routine on the SYSCTL circuit pack. After connecting to the CIT port, press <enter><enter> or <CR><CR> (double carriage return) or "AA" or "aa" to allow the system to automatically set its baud rate to the rate of the terminal or workstation attached to the port.

RELATED COMMANDS

set-link

rtrv-ne

NAME

rtrv-map-neighbor: Retrieve Neighbor Map

INPUT FORMAT

`rtrv-map-neighbor`;

DESCRIPTION

NOTE:
This command page describes the functionality of the **`rtrv-map-neighbor`** command in OC-3 Release 13.0 and later OC-3 TARP releases.

This command displays the immediate DCC and/or IAO LAN neighbors that are reachable by the local Network Element (NE).

The TIDs included in this report are always determined by real-time TARP NSAP-to-TID queries, even if TARP Data Cache is enabled.

If this command is issued to a NE provisioned as a Level 2 IS, the report will list the default neighboring NEs provisioned as Level 2 (if any) and/or Level 1 ISs within the same Area, as well as other Level 2 neighboring ISs included in other Areas.

NOTE 1:
If the local NE is a Level 2 IS, this will be indicated in the report. The only other Level 2 IS that can be identified in the report is the default Level 2 IS (if local NE is not the default Level 2 IS).

NOTE 2:
Network Elements provisioned as neighbors through TARP Manual Adjacency are not listed as neighbors in this report. This information can be obtained through the **`rtrv-ulsdcc`** report.

NOTE 3:
Adjacent NEs provisioned as Level 1 ISs across multiple Level 1 areas will not be listed as neighbors in this report.

For more explanation on the Level 1 and Level 2 routing and the IS/ES terminology, refer to 824-102-144, *Lucent Technologies 2000 Product Family Operations Interworking Guide for TARP Releases*.

The following is an example report under normal conditions and it is applicable to OC-3 Release 13.0 and later:

```
/* Neighbor Map for local_system
======================================================================
TID                   Connected Thru    Product Type        Level 2 IS
 NSAP
======================================================================
local_system                            DDM-2000 OC-3       Y
 39 840 80 000000 0000 0000 0000 08006alad06e 00
R5                    lan
 39 840F 80 000000 0000 0000 0000 00000e3a0273 00
R6                    lan                                 Y
 39 840F 80 000000 0000 0000 0001 08006alad07f 00
R7                    lan                                 Y
 39 840F 80 000000 0000 0000 0002 00000e3a0732 00
Site7NE1              main-1
 39 840F 80 000000 0000 0000 0000 08006alad06f 00
Site3NE1              main-2
 39 840F 80 000000 0000 0000 0000 00000e3a0372 00
*/
```

Note that the NSAP value is part of the same line as the other reported information, but it is wrapped around based on an 80-column screen width.

NOTE 1:
If Multiple Area Addresses have been provisioned at any other NE in the local NE's area, and a TARP NSAP-to-TID translation for a remote NE is successfully completed, this report will only list the information corresponding to the primary NSAP of the remote NE. A remote NE's primary NSAP is the NSAP for which the remote NE responds successfully to an NSAP-to-TID TARP query.

NOTE 2:
In the event Multiple Area Addresses are used for an NE in the local NE's area, and none of the TARP NSAP-to-TID queries were successful, this report will list each of the possible NSAPs (each NSAP corresponding to one of the multiple Area Addresses) for the remote NE, along with a "?" displayed in the TID column.

The local NE is listed first in the report. The rest of the entries are sorted by channel number or `Connected Through` Address.

The output report contains two lines for each neighbor system with which the local NE is communicating via SONET section DCC and/or IAO LAN

Starting with OC-3 Release 13.1, a new output parameter, **`DCC`**, is added to the report. This parameter is used to indicate whether DCC communication between two neighboring network elements (in two neighboring Level 1 areas) is functional or not. This parameter is populated also, if at least one of those two neighboring ISs is not a Level 2 IS.

Also when the local NE is a Level 1 IS and its neighbor is in a different area, the value of "?" is expected for **`Level 2 IS`** output parameter.

As a result, the output report will look as the following:

```
/* Neighbor Map for local_system
======================================================================
TID                   Connected Thru    Product Type   Level 2 IS  DCC
 NSAP
======================================================================
local_system                            DDM-2000 OC-3  Y
 39 840 80 000000 0000 0000 0000 08006a1ad06e 00
R5                    lan
 39 840F 80 000000 0000 0000 0000 00000e3a0273 00
R6                    lan                                        N
 39 840F 80 000000 0000 0000 0001 08006a1ad07f 00
R7                    lan                              Y
 39 840F 80 000000 0000 0000 0002 00000e3a0732 00
Site7NE1              main-1
 39 840F 80 000000 0000 0000 0000 08006a1ad06f 00
Site3NE1              main-2
 39 840F 80 000000 0000 0000 0000 00000e3a0372 00
*/
```

Note that the NSAP value is part of the same line as the other reported information, but it is wrapped around based on an 80-column screen width.

The output report parameters are:

`TID` This column contains the TID of the local NE and its direct DCC and/or IAO LAN neighbors.

Any time the local NE is unable to determine the TID for its neighbor's NSAP, this report will indicate this by showing a "?" in the TID column.

`Connected Through`

This column contains the address of the optical lines and/or IAO LAN through which the local NE is directly connected to the NE identified in the `TID` column. When the main ring interface is provisioned for the *identical* DCC mode using the **`set-oc3`** or **`set-oc12`** command the `Connected Through` Address is **main**.

NOTE:
In the event of a DCC or IAO LAN link failure between the local NE and its immediate neighbor occurs, the line corresponding to this NE will be removed from the report.

`Product Type` This is the product type of the local NE.

`Level 2 IS` This column identifies whether the listed Network Element is provisioned as a Level 2 IS. Possible values are: "Y" or " ". FiberReach Release 3.0 NEs cannot be provisioned as Level 2 ISs.

Starting with OC-3 Release 13.1, this parameter can have the value of "?" in cases where the local NE is a Level 1 IS and its neighbor is in a different area; as a result, the output value "?" would be expected for this parameter (i.e., the neighbor's Level in such cases cannot be determined).

NOTE:
If the local NE is a Level 2 IS and its neighbor is in a different area, the local NE is expected to know if its neighbor is a Level 2 IS, otherwise the local NE can deduce that the neighbor is a Level 1 IS.

`DCC` This output parameter is available starting with OC-3 Release 13.1 and it is used to indicate whether DCC communication between two neighboring network elements (in two neighboring Level 1 areas) is functional or not. This parameter can have either of two values: "NO" indicating that DCC communications is not really functional. A blank " " indicates that DCC communications is functioning properly.

NOTE:
This new parameter can highlight potential provisioning errors, and reporting the neighbor's NSAP can help identify the needed corrections (e.g, when the local NE is a Level 1 IS and its neighbor is in a different Level 1 area, **DCC** will be equal to "NO").

`NSAP` The NSAP address is a 20-byte (40-character) address required by OSI to provide unique identification within the OSI network and consists of a number of fields, some of which are pre-defined and some of which are user-settable. The structure of the NSAP is shown in the following display.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	Sys. Ident.	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

The different fields that make up the NSAP address are separated by a single space in the report. For more information on the NSAP's individual fields, refer to the **`ent-ulsdcc`** command page.

When the OC-3 shelf serves as a host to the DDM-2000 FiberReach Multiplexer, this will be reflected in the report. For example, If within the OC-1 host (OC-3 shelf), slot 1 in fn-a and slot 2 in fn-b were equipped with 27-type OLIU packs to be used in a dual-homed 0X1 ring application (where each one of the 27-type packs is being used to connect local host to a different DDM-2000 FiberReach wideband shelf node through fn-a-1-2 and fn-b-2-2 respectively), the report from the OC-1 host NE will appear as follows:

```
/* Neighbor Map for NE1
======================================================================
TID                   Connected Thru    Product Type        Level 2 IS
 NSAP
======================================================================
NE1                                     DDM-2000 OC-3
39 0840 80 000000 0000 0000 0000 08006alad06e 00
R2                    fn-a-1-2
39 0840 80 000000 0000 0000 0000 08006alad07f 00
R4                    fn-b-2-2
39 0840 80 000000 0000 0000 0000 00000e3a0273 00
Site7NE1              main-1
39 0840 80 000000 0000 0000 0000 08006alad06f 00
Site3NE1              main-2
39 0840 80 000000 0000 0000 0000 00000e3a0372 00
*/
```

RELATED COMMANDS

rtrv-map-network

NAME

rtrv-map-network: Retrieve Network Map

INPUT FORMAT

rtrv-map-network[:Level2=*level2***]**;

DESCRIPTION

NOTE:
This command page describes the functionality of the **rtrv-map-network** command in OC-3 Release 13.0 and later OC-3 TARP releases.

This command displays all Network Elements (NEs) in the same Level 1 area that are reachable by the local NE through the DCC or IAO LAN.

The TIDs included in this report are always determined by real-time TARP NSAP-to-TID queries, even if TARP Data Cache is enabled.

For more explanations on the Level 1 and Level 2 routing and the IS/ES terminology, refer to 824-102-144, *Lucent Technologies 2000 Product Family Operations Interworking Guide for TARP Releases*.

The input parameter is:

level2 This parameter is available starting from OC-3 Release 13.0. Level 2 indicates whether the report should list all reachable NEs provisioned as Level 2 ISs across multiple areas within a subnetwork. Possible values are either "Y" or "N" with a default value of "N". This parameter is only supported if the local NE is provisioned to be a Level2 IS.

This is an optional parameter. By default, the report lists all reachable NEs, and the Level 2 IS(s) (if any) that are included in the local NE's area only.

NOTE:
If the local NE is a Level 2 IS, this will be indicated in the report also.

To list all Level 2 ISs across all areas, this command must be submitted to a NE provisioned as a Level 2 IS, and the value of **level2** parameter must be set to "Y".

If this command is issued to an NE that is not provisioned as a Level 2 IS and the value of **`level2`** is set to "Y", the command will be denied and the following message displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Network Element must be a Level 2 IS. */
```

The following is an example output report:

```
/* Network Map for local_system
=========================================================
TID                     Product Type         Level 2 IS
NSAP
=========================================================
local_system            DDM-2000 OC-3
 39 840F 80 000000 0000 0000 0000 08006a1ad06e 00
R5
 39 840F 80 000000 0000 0000 0000 00000e3a0273 00
R6
 39 840F 80 000000 0000 0000 0000 08006a1ad07f 00
R7
 39 840F 80 000000 0000 0000 0000 00000e3a0732 00
Site3NE1                                      Y
 39 840F 80 000000 0000 0000 0000 00000e3a0372 00
Site7NE1
 39 840F 80 000000 0000 0000 0000 08006a1ad06f 00
*/
```

Note that the NSAP value is part of the same line as the other information, but is wrapped around based on an 80-column screen width.

The local NE is listed first in the report. The rest of the entries are sorted by TID.

The output report parameters are:

`TID` This column contains the TID of the local and remote NEs in the subnetwork.

Any time the local NE is unable to determine a TID for a reachable NSAP, the network map report indicates this by showing a "?" in the TID column.

NOTE:
When "?" is displayed in the report, it will always appear, along with the related information at the end of the report.

`Product Type` This is the product type of the local NE (for example, DDM-2000 OC-3).

`Level 2 IS` This column identifies whether the listed NE is the default Level 2 IS. If local NE is a Level 2 IS, this will be indicated by "Y" under this column. Possible values are: "Y" or " ". The blank indicates a non-Level 2 IS (Level 1 NE). FiberReach Release 3.0 NEs cannot be provisioned as Level 2 ISs.

`NSAP` The NSAP address is a 20-byte (40-character) address required by OSI to provide unique identification within the OSI network and consists of a number of fields, some of which are pre-defined and some of which are user-settable. The structure of the NSAP is shown in the following display.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	Sys. Ident.	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

For more information on the NSAP's individual fields, refer to the **`ent-ulsdcc`** command page.

The report lists the different fields that make up the NSAP address separated by a single space.

If some NEs that have duplicate TIDs were found in the same subnetwork, they will both be reported in the report.

If an NE becomes isolated, and if the user were to run this report while this condition still exists, the isolated NE would no longer be listed in the report; only NEs that are reachable by the local NE are listed.

NOTE 1:
If Multiple Area Addresses have been provisioned at any other NE in the local NE's area, and a TARP NSAP-to-TID translation for a remote NE is successfully completed, this report will only list the information corresponding to the primary NSAP of the remote NE. A remote NE's primary NSAP is the NSAP for which the remote NE responds to an NSAP-to-TID TARP query.

NOTE 2:
In the event Multiple OSI Network Layer Area Addresses have been provisioned at any other NE in the local NE's area, and none of the TARP NSAP-to-TID queries were successful, this report will list each of the possible NSAPs (each NSAP corresponding to one of the multiple Area Addresses) for the remote NE, along with a "?" displayed in the TID column.

RELATED COMMANDS

rtrv-map-neighbor

NAME

rtrv-ne: Retrieve Network Element

INPUT FORMAT

rtrv-ne;

DESCRIPTION

NOTE:
This command page describes the functionality of the **rtrv-ne** command in OC-3 Release 13.0 and later OC-3 TARP releases.

This command displays the information that is provisioned by the **set-ne** command and set by switches on the SYSCTL pack.

The output report appears as follows:

```
/* System Provisioning Report
===========================================================
TID=system_name
GNE=active|not active
Crs Mode=default|manual
IDLE=ais|unequipped
Shelf=number
CO/RT Selector=location
Product=value  (hw)
Dormant_Release=dormant_release
Apply:Action=action    Schedule:Date=date Time:time
macaddress=macaddress
*/
```

Starting with OC-3 Release 15.0, the output report appears as follows:

```
/* System Provisioning Report
===========================================================
TID=system_name
GNE=active|not active|limited
RneStat=enabled|disabled
Alarm Group=number
AGNE=yes|no
AGNE Address=TID1
AGNE Address=TID2   ****entry if more AGNEs exist****
Crs Mode=default|manual
IDLE=ais|unequipped
Shelf=number
CO/RT Selector=location
Product=value  (hw)
Dormant_Release=dormant_release(nesw|lansw)
Apply:Action=action    Schedule:Date=date Time:time
macaddress=macaddress
*/
```

The (hw) after a parameter value indicates that the parameter is set by hardware switches on the BBG8 SYSTCL.

The output parameters are:

`TID` This is the system name, indicated by a string of up to 20 alphanumeric characters. The default value for `TID` is "LT-DDM-2000". The `TID` must be unique for each element in a subnetwork.

`GNE` The GNE field is used to identify whether this system is the gateway network element (GNE), providing TL1 interface. It has a value of either `active` or `not active`. Starting with OC-3 Release 15.0, a new value is added to this parameter; `limited`.

A Network Element is considered an "active" GNE if there is an active exchange between the OS and the DDM-2000 NE on the synchronous X.25 port. Once this exchange stops (i.e: the X.25 cable is unplugged off the DDM-2000 X.25 port), the GNE is set to "not active".

A Network Element is considered a "limited" GNE if it is not an "active" GNE and any of the following is/are true:

- CIT-1 is provisioned with porttype of tl1
- CIT-2 is provisioned with porttype of tl1
- X.25 port is provisioned with porttype of asynch.

If neither is true, the Network Element is considered to be a "not active" GNE.

`RneStat`	This parameter is valid starting with OC-3 Release 15.0. Remote NE Status (feature) can have a value of `enabled` or `disabled`. If this parameter has a value of `enabled`, the **`Alarm Group`** and **`AGNE`** will be displayed, as well as the other parameters; otherwise the **`Alarm Group`** and **`AGNE`** are not displayed.
`Alarm Group`	This parameter is valid starting with OC-3 Release 15.0. Alarm Group (AG) has a numeric value of `1` through `255`. All NEs in the subnetwork, whether nearby or not, that have the same AG number are members of the same group. All members of the AG will share NE Status information with each other but not with NEs of different alarm Groups. The default AG number for DDM-2000 is `255` and may not have to be changed if a single AG is desired.
`AGNE`	This parameter is valid starting with OC-3 Release 15.0. AGNE (Alarm Gateway NE) has a value of `yes` or `no`, which indicates whether this system is an alarm gateway network element. The default value for this parameter is *no*. One AGNE is needed for each alarm group to support the message communications for NE Status features (FE activity, office alarms, miscellaneous discretes, local ACO, and FE user panel status). Any member of the alarm group can be an AGNE but some may be preferred because of their position in the subnetwork or location near a maintenance center. Other NEs of the same alarm group may be provisioned as backup AGNEs if required. At least one NE in each alarm group must be designated as an **agne**. NEs without an AGNE would raise "AGNE communication failure" alarms (if Remote NE Status feature is enabled).
`AGNE Address`	This parameter is valid starting with OC-3 Release 15.0. The AGNE Address is the target identifier (TID) of the AGNE for this alarm group. It can be the TID of this NE or any other NE in the alarm group. More than one NE can be an AGNE for backup reasons. If more than one AGNE exists for this alarm group, it is also listed here. AGNE Addresses for NEs in other alarm groups are not listed here. If an AGNE is not defined, this parameter is left blank.
`IDLE`	If value is `ais`, the system will insert an Alarm Indication Signal toward the SONET line when channels are not cross-connected or not equipped with path terminating equipment. If value is `unequipped`, the system will insert the unequipped signal toward the SONET line when channels are not cross-connected or not equipped with path terminating equipment.
`Shelf`	Shelf is the shelf address (`1-8`). It identifies the physical position of the shelf in a bay.

`CO/RT Selector`

The CO/RT Selector identifies either a central office (CO) shelf or a remote terminal (RT) shelf to control the operation of the miscellaneous discrete points and fan control relays.

`Product` Product is a keyword that is set by switches on the BBG8 SYSCTL and the value of the SHELFID pin (DDM shelf or ARM shelf) of the backplane to identify the product to be supported.

`DDM-2000 OC-3`

The shelf is part of a DDM-2000 network. The software also checked for the OHCTL and determined that the product is OC-3 (BBG9 or BBG10).

`DDM-2000 OC-12`

The shelf is part of a DDM-2000 network. The software also checked for the OHCTL and determined that the product is OC-12 (BCP4).

`SLC-2000 ARM`

The shelf is part of a *SLC*®-2000 Access System ARM network. The software also checked for the OHCTL and determined that the product is OC-3 (BBG9 or BBG10).

`DDM-2000 FiberReach`

The shelf is part of a FiberReach network. The OHCTL is not a part of the shelf.

`MegaStar 2000`

The shelf is part of a *MegaStar** 2000 network. The software also checked for the OHCTL and determined that the product is OC-3 (BBG10).

`Dormant_Release`

This parameter is reported starting with OC-3 Release 11.0. If a dormant software generic or release is currently stored by the network element, this parameter will report the release number in the form XX.XX.XX.

Starting with OC-3 Release 15.0, the release number will be followed by either **`nesw`** (to designate that the dormant software is the NE generic), or **`lansw`** (to designate that the dormant software is the IMA LAN generic). The value of this parameter can be either one of the following:

---

* Registered trademark of Harris Corporation.

`XX.XX.XX` A dormant NE software generic exists locally.

Starting with OC-3 Release 15.0,

`XX.XX.XX(nesw)` - For dormant NE generic
`XX.XX.XX(lansw)` - For dormant IMA LAN generic

`none` No dormant software generic exists locally or the dormant software is corrupted.

`Apply`

`Action` This parameter is reported starting with OC-3 Release 11.0. If a dormant software generic is currently stored by the network element, and the **`apply`** command is scheduled for program installation with `Action=`**`install`** on `Date=`**`date`** and `Time=`**`time`**, the date is reported as a 6 digit YYMMDD, and time as HH:MM:SS

If no program installation is scheduled yet, a blank " " is reported under Action. Date and time will report blank " " values also (example: Date= Time=)

If a dormant software generic is currently stored by the network element, and the **`apply`** command is scheduled with `Action=`**`cancel`**, a blank " " is reported for Action. Date and time will report blank " " values also (example: Date= Time=)

Starting with OC-3 Release 15.0, if a dormant IMA LAN software generic is currently stored by the network element, in this event `Action=`**`IMALAN`** and `Date=`**`000000`** and `Time=`**`00:00:00`**. The date is always reported as "000000" for the 6 digit YYMMDD (because Date is NA to IMA LAN), and Time always reported as 00:00:00 (because Time is NA to IMA LAN).

This indicates that the user has to run the **`rtrv-lan`** command in order to find out what actions are planned on the different IMA LAN circuit packs.

`Schedule`

`Date` This parameter is reported starting with OC-3 Release 11.0. If the **`apply`** command is scheduled for program installation with `Action=`**`install`** on `Date=`**`date`**. This parameter is reported as a 6 digit YYMMDD.

For IMA LAN software, this parameter will always have the value"000000" (because it is NA to IMA LAN).

`Time` This parameter is reported starting with OC-3 Release 11.0 if the **`apply`** command is scheduled for program installation with `Action=`**`install`**. This parameter is reported as HH:MM:SS

For IMA LAN, this parameter will always have the value"00:00:00" (because it is NA to IMA LAN).

`macaddress` This parameter is applicable to only OC-3 Release 13.0 and later OC-3 TARP releases. This is the Media Access Control (MAC) address of the IAO LAN. This address is stored (burned) on the OHCTL circuit pack's EEPROM by the factory and it is unique.

The 6 bytes of the MAC address are displayed as 12 hexadecimal digits. The following is an example of a MAC address: "08006alad06e".

RELATED COMMANDS

rtrv-map-network

set-ne

NAME

rtrv-oc1: Retrieve OC1

INPUT FORMAT

`rtrv-oc1`[:*`Address`*];

DESCRIPTION

This command displays the configuration of OC-1 line(s), as set by the `set-oc1` command.

The input parameter is as follows:

`Address` Address identifies the OC-1 line(s). The default is **`all`**.

Valid OC-1 Addresses (for 27-type OLIU): **`all, main-all, main-{1,2}-{1,2}, fn-all, fn-{a,b,c}-{1,2}-{1,2}, fn-{a,b,c}-all`**

Valid OC-1 Addresses (for 26G2-U OLIU): **`fn-all, fn-{a,b,c}-{1,2}-1, fn-{a,b,c}-all`**

The output report appears as follows:

```
/* OC-1 Line Provisioning Report
=================================================================
 Line      Signal Degrade    AIS
Address      Threshold      Alarm
=================================================================
address          n           alm
address          n           alm
  .              .            .
*/
```

The output parameters are:

`Line Address` Address of the OC-1 line.

`Signal Degrade Threshold`
This is the bit error rate (BER) threshold shown as a logarithm to the base 10. The value of *n* is an integer with a range of -5 through -9 corresponding to BERs of 10^{-5} through 10^{-9}, respectively.

`aisalm` This parameter indicates the the provisioned alarm level of the NSA OC-1 line AIS and has the following values:

- **`cr`** Critical alarm
- **`mj`** Major alarm
- **`mn`** Minor alarm
- **`na`** Not alarmed, but reported (default).

RELATED COMMANDS

set-oc1

NAME

rtrv-oc3: Retrieve OC3

INPUT FORMAT

`rtrv-oc3`[:*`Address`*];

DESCRIPTION

This command displays the configuration of OC-3 lines, as set by the **`set-oc3`** command.

The input parameter is as follows:

`Address` Address identifies the OC-3 line(s). The default is **`all`**.
Valid Addresses: **`all, main-{1,2,all}, fn-{a,b,c}-{1,2,all}, fn-all`**

For OC-3 shelves, the output report appears as follows:

```
/* OC-3 Line Provisioning Report
================================================================
 Line     Signal Degrade       Optical      Sync        AIS
Address     Threshold         Power (hw)   Message     Alarm
================================================================
address        n                 x           message      alm
address        n                 x           message      alm
  .            .                 .             .          .
  .            .                 .             .          .
*/
```

For OC-3 Release 15.0 and later ring releases, the output report appears as follows:

```
/* OC-3 Line Provisioning Report
=================================================================
 Line     Signal Degrade  Sync    AIS     DCC
Address     Threshold    Message  Alarm    Mode
=================================================================
address        n         message  alm   dccmode
address        n         message  alm   dccmode
  .            .            .     .     .
  .            .            .     .     .
*/
```

If this command is executed from a *MegaStar* 2000 shelf, the output report appears as follows:

```
/* OC-3 Line Provisioning Report
====================================================================
 Line    Signal Degrade   Optical    Kbyte    Concat      AIS
Address    Threshold     Power (hw)  Message   Mode      Alarm Radio
====================================================================
1234567  12345678911234  1234567891  12345678  123456789  12345  123
address        n             x       message    mode      alm   yes
address        n             x       message    mode      alm   no
  .            .             .          .         .         .
  .            .             .          .         .         .
*/
```

The `Radio` parameter is visible only in *MegaStar* 2000 applications and with OC-3 linear releases. The `Concat` mode is only visible in linear DDM-2000 releases where the STS-3c mode has been enabled with the **`set-feat`** command.

The output parameters are:

`Line Address` Address of the OC-3 line.

`Signal Degrade Threshold`
This is the bit error rate (BER) threshold shown as a logarithm to the base 10. The value of *n* is an integer with a range of -5 through -9 corresponding to BERs of 10^{-5} through 10^{-9}, respectively.

`Optical Power` This is the current setting of the optical power switch on the OLIU circuit pack carrying the specified OC-3 signal. The (hw) after `Optical Power` indicates that the optical power setting is determined by a hardware switch on the OLIU circuit pack. This parameter may have the following values:

- `high` High optical power
- `low` Low optical power
- — A hyphen indicates that optical power is not settable by switches on the OLIU circuit pack.

`Kbyte Message` The valid values for this parameter are `enabled`, indicating that proprietary Sync messages are used, and `disabled`, indicating that proprietary Sync messages are not used. The Sync messages use the K2 byte in the SONET overhead to determine synchronization quality. These values are set by the **`set-oc3`** command.

`Sync Message` Starting with OC-3 Releases 8.1 and 9.1, This parameter indicates the type of synchronization messaging that has been provisioned for that OC-3 optical interface by the **`set-oc3`** command. The valid values for this parameter are `Kbyte` (default value), `Sbyte`, and `disabled`. The sync messages use the K2 byte or the S1 byte in the SONET line overhead to determine synchronization quality.

`Concat Mode`	This parameter is used in linear releases only. This report parameter is visible only if the STS3c mode is enabled via the **`set-feat`** command. This indicates if the addressed line is concatenated or not. The valid values are `enabled` and `disabled`. For OC-3, only function unit C slots can report concatenated values.
`Radio`	This parameter is avaliable with linear releases only and is reported if this a *MegaStar* 2000 system. It has a value of **`yes`** or **`no`**, and it indicates whether there is a Radio Frequency Unit (RFU) connected to the SONET subsystem through an IS-3 interface.
`Application`	This parameter is available in OC-3 starting with Release 15.0. This report parameter defines additional behavior assigned to this function unit. If this parameter is set to `0x1` (there is no protection switching between the packs in a function unit pair), or `1+1` (the function unit is an optical extension of a path switched ring. The automatic protection switching and alarms will follow the rules for optical extension applications). A **-** in this column indicates that Application is not settable for the specified Address.
`AIS Alarm`	This parameter specifies the alarm level of a non-service-affecting OC-3 line AIS failure condition. The valid values are: **`cr`** Critical alarm **`mj`** Major alarm **`mn`** Minor alarm **`na`** Not alarmed, but reported (default).

`DccMode`	This parameter specifies whether the OC-3 interface is configured for interworking with a ring or 1+1 interface. There are two valid values for this parameter, **`distinct`** (default) or **`identical`**. When configured for **`distinct`** a separate DCC data link (SONET embedded over head channel) is assigned to each OC-3 line in the pair. This is the configuration that supports ring interworking. To allow the OC-3 ring interface to interconnect to a 1+1 OC-3 interface at the far-end, the DccMode should be set to **`identical`**. In this configuration the same DCC channel is transmitted on both OC-3 lines, and the K-bytes are configured for the 1+1 protection mode to prevent the far-end from initiating an APS channel alarm. The DccMode parameter is only applicable to the Main OC-3 interface in R15.0 and later. Assignment of this parameter always affects both OC-3 lines. A **"-"** in this column indicates that DccMode is not settable for the specified Address.

RELATED COMMANDS

rtrv-sync

NAME

rtrv-oc12: Retrieve OC12

INPUT FORMAT

`rtrv-oc12`[:*`Address`*];

DESCRIPTION

This command displays the configuration of OC-12 lines provisioned by the **`set-oc12`** command.

The input parameter is as follows:

`Address` Address identifies the OC-12 line(s). The default is **`all`**.

If the OC-3 shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots (in a ring application), the valid addresses are: **`all`** (default)**`, main-{1,2,all}`**

NOTE:
If slot 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

For OC-3 Release 11.0 and later ring releases, The output report appears as follows:

```
/* OC-12 Line Provisioning Report
==============================================================
 Line    Signal Degrade   Sync      AIS     DCC
Address    Threshold     Message   Alarm    Mode
==============================================================
address         -n       message    alm   dccmode
address         -n       message    alm   dccmode
  .             .           .        .
  .             .           .        .
  .             .           .        .

*/
```

The DCC Mode parameter is applicable to OC-3 Release 15.0 and later ring releases.

The output parameters are:

`Line Address` Address of the OC-12 line.

`Signal Degrade Threshold`
This is the bit error rate (BER) threshold as a logarithm to the base 10. The value of *n* is an integer with a range of -5 through -9 corresponding to BERs of 10^{-5} through 10^{-9}. If a slot is empty or equipped with something other than an OC-12 optical unit, a hyphen (-) will appear in this column.

`Sync Message` For OC-3 Release 11.0 and later ring releases, this parameter indicates the type of synchronization messaging that has been provisioned for that OC-12 optical interface by the **`set-oc12`** command. The valid values for this parameter are `Kbyte` (default value), `Sbyte`, and `disabled`. The sync messages use the K2 byte or the S1 byte in the SONET line overhead to determine synchronization quality.

`AIS Alarm` This parameter specifies the alarm level of a non-service-affecting OC-12 line AIS failure condition. The valid values are

`cr` Critical alarm

`mj` Major alarm

`mn` Minor alarm

`na` Not alarmed, but reported (default)

`DccMode` This parameter specifies whether the OC-12 interface is configured to interwork with a ring or 1+1 application. There are two valid values for this parameter, **`distinct`** (default) or **`identical`**. When configured for **`distinct`** a separate DCC data link (SONET embedded over head channel) is assigned to each OC-12 line in the pair. This is the configuration that supports ring interworking. To allow the OC-12 interface to interconnect to a 1+1 OC-12 interface at the far-end, the DccMode should be set to **`identical`**. In this configuration the same DCC channel is transmitted on both OC-12 lines, and the K-bytes are configured for the 1+1 protection mode to prevent the far-end from initiating an APS channel alarm. The DccMode parameter is only applicable to the Main OC-12 interface in Release 4.0 and later. Assignment of this parameter always affects both OC-12 lines.

RELATED COMMANDS

set-oc3

set-oc12

NAME

rtrv-osacmap: Retrieve Operation Systems Application Context Map

INPUT FORMAT

`rtrv-osacmap;`

DESCRIPTION

This command displays the Operation Systems Application Context Map information that is created by the **`ent-osacmap`** command. This information provides association information between OS application contexts and X.25 channel assignments.

Starting with OC-3 Release 15.0 this command will report also on the association between OS Application Contexts and the CIT port used for TL1, or the X.25 port defined as Asynchronous

NOTE:
While this command is allowed at all network elements in the subnetwork, only the table at a GNE node is active.

The output report appears as follows:

```
/* OS Application Context Map Report
===========================================================
VC Type  SNPA Address      ACID
===========================================================
pvc      1                 tl1_application_context
pvc      2                 tl1_application_context
pvc      3                 tl1_application_context
svc      address           tl1_application_context
svc      address           tl1_application_context
svc      address           tl1_application_context
*/
```

The above report shows allocation of PVCs for LCNs 1, 2, and 3. The other SNPA addresses contain some allocated SVCs.

NOTE:
The above report is sorted by the VC Type, and then by SNPA within the VC Type parameters.

Starting with OC-3 Release 15.0 the output report appears as follows:

```
/* OS Application Context Map Report
===========================================================
VC Type  SNPA Address      ACID
===========================================================
pvc      1                 tl1_application_context
pvc      2                 tl1_application_context
pvc      3                 tl1_application_context
svc      address           tl1_application_context
svc      address           tl1_application_context
svc      address           tl1_application_context
-----------------------------------------------------------
Address:cit-1              tl1_application_context
Address:cit-2              tl1_application_context
Address:x25                tl1_application_context
*/
```

NOTE 1:
The top section of the report is first sorted by the VC Type, and then by SNPA within the VC Type parameters. The lower section of the report lists first the CIT addresses followed by the Asynchronous X.25 address (along with the ACID information).

The output parameters are:

`VC Type` VCType is the X.25 SubNetwork Virtual Channel Type. The valid values are:

PVC Permanent Virtual Circuit

SVC Switched Virtual Circuit.

VC Type information does not apply to the Asynchronous X.25, CIT-1 or CIT-2.

`SNPA Address`

SNPA Address is the X.25 SubNetwork Point of Attachment address for the OS. It is either the Logical Channel Number (LCN) if VCType is *PVC*, or it is the Data Terminal Equipment (DTE) calling address (which is 1 to 15) digits if VCType is *SVC*.

NOTE:
Up to nine VCs can be mapped to any combination of PVCs and/or SVCs (that is, the allocation of PVCs can be removed and replaced by SVCs).

SNPA Address information does not apply to the Asynchronous X.25, CIT-1 or CIT-2.

`ACID` ACID is a string of up to 23 alphanumeric characters, which is the Application Context ID to be assigned to a particular SNPA Address. Each OS has a value of ACID assigned. Default values exist for OS applications supported by DDM-2000. The supported applications types are:

tl1Maintenance

tl1MemoryAdministration

tl1PeerComm

tl1Test

tl1CR

tl1Other1

tl1Other2.

`Address` Applicable to OC-3 Release 15.0 and later releases.

This is the address of a CIT port, Asynchronous X.25 port, or an Synchronous X.25 port.

Valid Addresses: **cit-{1,2}, x25**

NOTE:
The Address parameter is not listed as a separate column in this report, but rather as the string "Address:" followed by its value.

When this command is entered at a node that is not an active GNE, and not an active *limited* GNE (OC-3 Release 15.0), the following caution message will be displayed before the report is printed:

```
/* Caution! This OS Application Context Map Report is not active.
            Only the map at a GNE is active. */
```

NOTE:
A network element is considered a *limited* GNE if it has been provisioned to run TL1 over a CIT port or over the Asynchronous X.25 port.

A limited GNE can only support up to fifty (50) remote TL1 associations on the CIT port.

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

ent-osacmap

dlt-osacmap

NAME

rtrv-passwd: Retrieve Passwords

INPUT FORMAT

rtrv-passwd;

DESCRIPTION

This command displays the logins, passwords (in encrypted form), and user type for all logins in the system. This command should *only* be used to back up this information to an external workstation.

Additional workstation software and the **rstr-passwd** command will be used to re-create this information on the network element when a new controller is installed.

NOTE:
This command is available to privileged users only.

The output report appears as follows:

```
/* Password Provisioning Report
============================================================
Login : Password : User Type :
============================================================
ATT01:08:sdfsdt-g:privileged:
ATT02:08:67&&8#1g:privileged:
ATT03:08:57s&8#1g:privileged:
DDM-2000:07:kdsm5:-:general:
george:09:RVoc6*bQ1:maintenance:
pete:08:RTnu8*bB:reports-only:
*/
```

The output parameters are:

`Login`	The login name established by the security administrator.
`Password`	The length and current encrypted password selected by the user of the login.
`User Type`	The access class assigned to this login by the security administrator.

RELATED COMMANDS

rstr-passwd

rtrv-lgn

set-lgn

set-passwd

NAME

rtrv-pm-lan: Retrieve Performance Monitoring data for the IMA LAN pack

INPUT FORMAT

rtrv-pm-lan:*Address*;

DESCRIPTION

This command displays the performance monitoring data associated with the IMA LAN circuit pack.

This command is available starting with OC-3 Release 15.0, and it is applicable only to the IMA LAN (BBF9 or BBF10) circuit pack.

NOTE:
If the PM Mode (pmmd) parameter is set to **on** by the **set-lan** command, this report will display the performance data associated with the IMA LAN pack; otherwise no data will be displayed in the report.

This command may only be executed if the shelf is equipped with IMA LAN circuit packs in the Low Speed slots, otherwise the following denial message is displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* Low Speed slot(s) not equipped with proper hardware. */
```

The input parameter is:

Address Address of the LAN port on the IMA LAN pack

Valid Addresses: **{a,b,c}-{1-7,all}**

NOTE:
Since that the IMA LAN pack occupies **two consecutive** Low Speed slots, following guidelines should be used:

The IMA LAN pack address can be derived from either slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the address used in this case can be either *a-1* or *a-2*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed address combinations:
{a,b,c}-{3 and 4} is allowed.
{a,b,c}-{6 and 7} is allowed

The output report appears as follows:

```
/* IMA LAN Performance Monitoring Status Report
======================================================================
Address  Start  Direction        Pkt              Count
         Time                    Type
======================================================================
address  time   lan         mac_Pkt_Forward   nnnnnnnnnnnn
                lan         mac_Pkt_Discard   nnnnnnnnnnnn
                lan         atm_cell_util     nnnnnnnnnnnn
                lan         atm_cell_idle     nnnnnnnnnnnn
                sonet       mac_Pkt_Discard   nnnnnnnnnnnn
                sonet       mac_Pkt_Forward   nnnnnnnnnnnn
                sonet       atm_cell_util     nnnnnnnnnnnn
                sonet       atm_cell_idle     nnnnnnnnnnnn

address  time   lan         mac_Pkt_Forward   nnnnnnnnnnnn
                lan         mac_Pkt_Discard   nnnnnnnnnnnn
                lan         atm_cell_total    nnnnnnnnnnnn
                lan         atm_cell_idle     nnnnnnnnnnnn
                sonet       mac_Pkt_Discard   nnnnnnnnnnnn
                sonet       mac_Pkt_Forward   nnnnnnnnnnnn
                sonet       atm_cell_total    nnnnnnnnnnnn
                sonet       atm_cell_idle     nnnnnnnnnnnn
```

The output parameters are:

`Address` Address of the LAN port on the IMA LAN pack

Valid Addresses: **`{a,b,c}-{1-7,all}`**

NOTE:
Since that the IMA LAN pack occupies **two consecutive** Low Speed slots, following guidelines should be used:

The LAN port address is derived from the lowest slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the LAN port address used in this case is *a-1*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed combinations:
Addresses **`{a,b,c}-{3 and 4} combination is allowed`**
Addresses **`{a,b,c}-{6 and 7} combination is allowed`**

`Start Time` This indicates the time on the system clock when the data collection started.

`Direction` This indicates the direction from which the data packets are received. This parameter can have one of the following values:

- `lan` This indicates that data shown resulted from monitoring the MAC Packets incoming from the IMA LAN side.
- `sonet` This indicates that data shown resulted from monitoring the MAC Packets incoming from the High Speed (SONET) side.

`pkttype` This column includes four different parameters (Packet or cell Types) listed as follows:

`mac_Pkt_Discard`
This parameter indicates the number of 802.3 MAC frames discarded. In the transmit direction towards the wide area network (WAN) or SONET facility, discards are the result of buffer overflow and may indicate the need for additional DS1 capacity. In the receive direction discards may result from errored packets caused by faulty DS1 or SONET facilities or from buffer overflow when the LAN is operating in half-duplex mode.

`mac_Pkt_Forward`
In the transmit direction this parameter indicates the number of incoming MAC packets from the LAN that have been forwarded to the WAN. In the receive direction this parameter indicates the number of MAC packets received from the WAN (from SONET) and forwarded to the LAN.

`atm_cell_total`
In the transmit direction, this parameter indicates the total number of ATM cells, both traffic carrying and idle cells, sent towards the WAN (SONET). In the receive direction, this parameter indicates the total number of ATM cells received from the WAN.

`atm_cell_idle`
In the transmit direction this parameter indicates the number of idle ATM cells sent to the WAN. In the receive direction, this parameter indicates the number of idle ATM cells received from the WAN. A low number of idle cells relative to the total number of cells indicates that the WAN connection is operating near full utilization and that additional capacity (additional DS1s) may be needed or that there is a

facility failure affecting one or more DS1s in the IMA group.

`Count`	This column indicates the accumulated day or previous day count for the corresponding packet or cell parameter.

Rows that are all zeros are not printed except for current quarter-hour and current day, which are always printed. Any rows containing partial counts will always be printed as well.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the IMA LAN circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

RELATED COMMANDS

set-lan

NAME

rtrv-pm-line: Retrieve Performance Monitoring Line

INPUT FORMAT

`rtrv-pm-line`:*`Address`*;

DESCRIPTION

This command displays performance-monitoring data associated with the OC-1, OC-3, OC-12 (with 24-type or 29-type OLIUs in Main units), or EC-1 lines terminated on the system.

The 29G-U OLIU circuit pack is available starting with OC-3 Release 15.0

NOTE:
If Main slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The input parameters are:

`Address` Address of the OC-1, OC-3, OC-12, or EC-1 lines.
Valid OC-3 Line Addresses: **`all, main-{1,2,all}, fn-{a,b,c,all}-{1,2,all}`**

Valid EC-1 Line Addresses: **`a,b,c,all`**

Valid OC-1 Line Addresses (for 27-type OLIU): **`all, main-all main-{1,2}-{1,2}, fn-all, fn-{a,b,c}-all, fn-{a,b,c}-{1,2}-{1,2}`**

Valid OC-1 Line Addresses (for 26G2-U OLIU): **`fn-all, fn-{a,b,c}-all, fn-{a,b,c}-{1,2}-1`**

If the shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots (in a ring configuration), the valid addresses are: **`main-{1,2,all}`**

The output report appears as follows:

```
/* Line Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
=========================================================================
Address  Start   B2 CV   B2 ES   B2 ESA   B2 UAS    PSC-L    PJC
         Time            B2 SES  B2 ESB
=========================================================================
address   time    nn...   nn...   nn...     nn...    nn...    nn...
                          nn...   nn...
   .       .       .       .        .        .        .        .
                           .        .
--------------------------------------------------------------------------
address   time    nn...   nn...   nn...     nn...    nn...    nn...
                          nn.     nn .
   .       .       .       .        .        .        .        .
                           .        .
   .       .       .       .        .        .        .        .
*/
```

The output parameters are:

`Address`	This column shows the address of the monitored signal.
`Start Time`	This column indicates the time on the system clock when the data collection started.
`B2 CV`	This parameter shows the number of coding violations for the data collection interval that started at the time reported in the previous column.
`B2 ES`	This parameter shows the number of errored seconds in the data collection interval.
`B2 SES`	This parameter shows the number of severely errored seconds.
`B2 ESA`	This parameter shows the number of Type A errored seconds in the data collection interval. A Type A errored second is a second with a single error.
`B2 ESB`	This parameter shows the number of Type B errored seconds in the data collection interval. A Type B errored second is a second with more than one error but less than the number of errors in a severely errored second. An OC-1 severely errored second contains 12 or more errors. An OC-3 severely errored second contains 32 or more errors. An OC-12 severely errored second contains 124 or more errors.

`B2 UAS`	This parameter shows the number of unavailable seconds.
`PSC-L`	This parameter shows the number of protection switches from this line. This parameter does not apply to EC-1 lines.
`PJC`	This parameter shows the number of outgoing STS pointer justifications not caused by incoming STS pointer justifications. An accumulation of outgoing STS pointer justifications indicates a possible frequency error on the incoming line or a frequency error in the timing reference selected by the shelf. If the number of incoming pointer justifications exceeds the number of outgoing pointer justifcations during the count interval the count is followed by the percent symbol (%). Excessive incoming pointer justifications (greater than 100 per day) may indicate an upstream synchronization problem other than a frequency error.

NOTE:
Rows that are all zeros are not printed, except for the current day and current quarter, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the OLIU/EC-1 circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

If the count is not overflowed or incomplete, a percent mark (%) will follow the PJC count if the number of incoming pointer justifications exceeds the number of outgoing pointer justiifications for the count interval.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

rtrv-pmthres-line

set-pmthres-line

NAME

rtrv-pm-sect: Retrieve Performance Monitoring Section

INPUT FORMAT

`rtrv-pm-sect:`*`Address`***`;`**

DESCRIPTION

This command displays performance-monitoring data associated with the following:

- OC-3 optics
- OC-12 optics (if shelf is equipped with 24-type or 29-type OLIUs in Main unit slots)
- STS-1 section (within an OC-1 line only)
- STS-3 section
- STS-12 section (if shelf is equipped with 24-type or 29-type OLIUs in Main unit slots)

The 29G-U OLIU is available starting with Release 15.0.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address of the OC-1 or OC-3 or OC-12 (if shelf is equipped with 24-type or 29-type OLIUs in Main unit slots) line(s). The address **`all`** may be used to retrieve all performance-monitoring information.

Valid OC-3 Line Addresses: **`all, main-{1,2,all}, fn-{a,b,c,all}-{1,2,all}`**

Valid OC-1 Line Addresses (for 27-type OLIU): **`all, main-{1,2}-{1,2}, main-all, fn-{a,b,c}-all, fn-{a,b,c}-{1,2}-{1,2}, fn-all`**

Valid OC-1 Line Addresses (for 26G2-U OLIU): **`fn-{a,b,c}-all, fn-{a,b,c}-{1,2}-1, fn-all`**

If the shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots, the valid addresses are: **`main-{1,2,all}`**.

The output report appears as follows:

```
/* Optics and Section Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
==================================================================
Address  Start  Transmit  Transmit  Laser   SEFS
         Time   Pwr -1dB  Pwr -2dB  Bias
                  TCA       TCA      TCA
==================================================================
address  time     aaa       aaa     aaa     nnn
   .       .       .         .       .       .
   .       .       .         .       .       .
------------------------------------------------------------------
address  time     aaa       aaa     aaa     nnn
   .       .       .         .       .       .
   .       .       .         .       .       .
   */
```

The output parameters are:

`Address`	This indicates the address of the OC-1, OC-3, or OC-12 line (if equipped with 24-type or 29-type OLIUs in both Main unit slots).
`Start Time`	This indicates the time on the system clock when the data collection started.
`Transmit Power -1dB`	This column shows whether a -1 dB transmit power threshold crossing has occurred in the data collection interval starting at the time reported in the previous column. This parameter applies only to the 21G OLIU circuit pack, and has a value of **yes** or **no**.
`Transmit Power -2dB`	This column shows whether a -2 dB transmit power threshold crossing has occurred in the data collection interval starting at the time reported in the previous column. This parameter applies only to the 21G OLIU circuit pack, and has a value of **yes** or **no**.
`Laser Bias`	This column indicates the TCA of the OLIU laser bias threshold setting. This parameter applies only to the 21G circuit packs.
`SEFS`	This column displays the number of severely errored frame seconds.

NOTE:
Rows that are all zeros or "no's" are not printed except for current day and current quarter hour, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition or the parameter is not applicable for current equipage.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the OLIU circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

rtrv-pmthres-sect

set-pmthres-sect

NAME

rtrv-pm-sts1: Retrieve Performance Monitoring STS-1

INPUT FORMAT

`rtrv-pm-sts1:`_`Address`_;

DESCRIPTION

This command reports path performance-monitoring data associated with STS-1 signals terminating on the network element. For STS-1 cross-connections to non-ring interfaces, data is collected on the active path of the signals and only the active path is reported. For STS-1 cross-connections, path termination exists if one of the interfaces is not SONET (for example, a BBG4B DS3 interface). Data is collected on both STS-1 ring paths connected to BBG19 DS3 circuit packs, and both paths are reported.

Starting with Release 13.0, all non-terminated STS cross-connected services at both ring OLIU, non-ring OLIU, and EC-1 interfaces will be monitored and reported. For the ring OLIU interfaces, data is collected and reported on both ring paths. For the non-ring OLIU and EC-1 interfaces, data is collected and reported on the active interface only. For terminated STS-1 cross-connections, data is collected on both the active and standby ring interfaces.

For all VT1.5 cross-connections, there is an STS-1 path that is terminated. For OC-1, OC-3 and OC-12 ring interfaces, data is collected on *both* STS-1 ring paths and both paths are reported.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` This parameter identifies the address of STS-1 channels. It is the address of the incoming STS-1 signal before it is cross-connected.

Valid Non-Ring Interface Addresses:

`all, {m}-{1-3,all}, {a,b}-{1-2,all}, c-{1-3,all}`
(to OLIU from DS3, MXRVO, or TMUX)

`all, {a,b,c}`
(to STS1E with VT1.5 cross-connections *or*
to STS1E from DS3, TMUX, or MXRVO)

Valid Ring Interface Addresses:

`all, {m1,m2}-{1-3,all}`
(to OC-3 in Main with VT1.5 cross-connects).

`all, m-{1-3,all}`
(to OC-3 in Main from DS3 or MXRVO with STS-1 cross-connects).

If the shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots, the valid addresses are:
`all, {m1,m2}-{1-12,all}`
(to OC-12 in Main with VT1.5 cross-connects. Also applicable to the BBG19 packs in Function Unit slots with Locked DS3 cross-connects).

`all, m-{1-12,all}`
(to OC-12 in Main from DS3 or MXRVO with STS-1 cross-connects).

If the shelf is equipped with 27-type OLIUs in the Main unit slots, the valid addresses are:
`{m1,m2}-{1,2}`

If the shelf is equipped with 27-type OLIUs in the FN slots, the valid addresses are:
`{a,b,c}{1,2}-{1,2}`

If the shelf is equipped with 26G2-U OLIUs in the FN slots, the valid addresses are:
`{a,b,c}{1,2}-1`

NOTE:
If this command is directed at an address not equipped with a SONET interface (for example, DS3), the command will be executed but the report field is left blank.

The output report appears as follows:

```
/* STS-1 Path Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
====================================================================
Address  Start   B3 CV    B3 ES  B3 ES   B3 ES   B3 SES  B3 UAS
         Time                    Type A  Type B
====================================================================
address   time   nn...   nn...   nn...    nn...    nn...   nn...
   .       .       .       .       .        .        .       .
   .       .       .       .       .        .        .       .
--------------------------------------------------------------------
address   time   nn...   nn...   nn...    nn...    nn...   nn...
   .       .       .       .       .        .        .       .
   .       .       .       .       .        .        .       .
*/
```

The output parameters are:

`Address`	This column shows the address of the monitored signal.
`Start Time`	This column indicates the time on the system clock when the data collection started.
`B3 CV`	This column shows the number of coding violations.
`B3 ES`	This column shows the number of errored seconds.
`B3 ES Type A`	This column shows the number of Type A errored seconds. A Type A errored second is a second with a single error.
`B3 ES Type B`	This column shows the number of Type B errored seconds. A Type B errored second is a second with more than one error but less than the number of errors in a severely errored second.
`B3 SES`	This column shows the number of severely errored seconds. A severely errored second contains 9 or more errors.
`B3 UAS`	This column shows the number of unavailable seconds of service. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.

NOTE:
Rows that are all zeros are not printed except for current day and current quarter hour, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS3, EC1, OLIU MXRVO or TMUX circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-tca

rtrv-pmthres-sts1

set-pmthres-sts1

NAME

rtrv-pm-t1: Retrieve Performance Monitoring T1

INPUT FORMAT

rtrv-pm-t1:*Address*;

DESCRIPTION

This command displays the parameter data associated with one or more DS1 signals passing through the system and is available only if the DS1 performance monitoring feature is set via the **set-feat** command.

Quarter-hour registers are available for DS1 PM, in addition to daily registers.

In OC-3 Release 13.0 and later releases, this command will also apply to the DS1 path performance monitoring on the BBG20 TMUX circuit pack. Starting with OC-3 Release 15.0, this command also applies to the DS1 path performance monitoring on the T1EXT and IMA LAN circuit pack.

The two consecutive Low Speed slots occupied by the IMA LAN are addressed as if they had two separate Quad-DS1 IMA LAN circuit packs inserted in them. For instance, if an IMA LAN circuit pack is inserted into slot ls-a-1 and ls-a-2, the DS1s will be addressed as follows: a-1-{1-4,all}, a-2-{1-4,all}.

The input parameter is:

Address Address is the address of DS1 ports.
Valid Addresses:
all, {a,b,c}-{1-7,all}-{1-4,all}

The BBF6 circuit pack supports 2 T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying **all** selects ports 1 and 2 only.

The output report appears as follows:

```
/* DS1 Path Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
=====================================================================
Address  Start     ES-L        CV-P       ES-P     SES-P      UAS-P
         Time                 CV-PFE     ES-PFE    SES-PFE    UAS-PFE
=====================================================================
address  time         n           n          n          n          n
                                  n          n          n          n
address  time         n           n          n          n          n
                                  n          n          n          n
  .       .           .           .          .          .          .
  .       .           .           .          .          .          .
  .       .           .           .          .          .          .
```

Starting with OC-3 Release 15.0, the output report appears as follows:

```
/* DS1 Path Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
=====================================================================
Address  Start  Direc-  ES-L      CV-P      ES-P     SES-P     UAS-P
         Time   tion             CV-PFE    ES-PFE   SES-PFE   UAS-PFE
=====================================================================
address  time    dsx       n         n         n         n         n
                                     n         n         n         n
address  time    sonet     -         n         n         n         n
                                     n         n         n         n
  .       .                .         .         .         .         .
  .       .                .         .         .         .         .
  .       .                .         .         .         .         .
```

The output parameters are:

`Address` This shows the address of the DS1 signal.

`Start Time` This indicates the time on the system clock when the data collection started.

`Direction` This parameter is applicable starting with OC-3 Release 15.0. This indicates the direction from which the signal is received (**`dsx`** or **`sonet`**). If the value is **`dsx`**, it indicates that data shown resulted from monitoring the signals incoming from the Low Speed side If the value is **`sonet`**, it indicates that data shown resulted from monitoring the signals incoming from the High Speed side (Applicable to the IMA LAN)

`ES-L` This indicates the number of errored second line (ES-L) counts during the data collection interval that started at the time reported in the second column. This column does not apply to the BBG20 TMUX circuit packs in OC-3 Release 13.0 and later releases. For the DS1 ports on this pack, this column will be blank. This column does not apply to the IMA LAN circuit packs. For the DS1 ports on this pack, this column will include "-".

`CV-P`	This indicates the number of path coding violations (CV-P) during the data collection interval that started at the time reported in the second column.
`ES-P`	This indicates the number of errored second path (ES-P) counts during the data collection interval that started at the time reported in the second column.
`SES-P`	This indicates the number of severely errored second path (SES-P) counts during the data collection interval that started at the time reported in the second column.
`UAS-P`	This indicates the number of unavailable second path (UAS-P) counts during the data collection interval that started at the time reported in the second column.
`CV-PFE`	This indicates the number of far-end path coding violations (CV-PFE) during the data collection interval that started at the time reported in the second column.
`ES-PFE`	This indicates the number of errored second path far-end (ES-PFE) counts during the the data collection interval that started at the time reported in the second column.
`SES-PFE`	This indicates the number of severely errored second path far-end (SES-PFE) counts during the data collection interval that started at the time reported in the second column.
`UAS-PFE`	This indicates the number of unavailable second path far-end (UAS-PFE) counts during the data collection interval that started at the time reported in the second column.

NOTE 1:
There are two rows of output for each address. The first row reports ES-L and near-end parameters. The second row reports far-end parameters.

NOTE 2:
Rows that are all zeros are not printed except for current day, which is always printed.

NOTE 3:
Rows that are all zeros are not printed except for current quarter-hour and current day, which are always printed. Any rows containing partial counts will always be printed as well.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS1, T1EXT or IMA LAN circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

This command may only be used if the `ds1pm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

init-pm

rtrv-feat

rtrv-pmthres-vt1

set-feat

NAME

rtrv-pm-t3: Retrieve Performance Monitoring T3

INPUT FORMAT

`rtrv-pm-t3:``*Address*`;

DESCRIPTION

This command displays performance-monitoring data associated with one or more DS3 signals passing through the system. This report is enhanced to display the performance monitoring data for the DS3 line and path incoming from the DSX-3, in addition to the previously displayed data for the DS3 path incoming from the fiber.

The line and path PM data from the DSX-3, as well as all near-end and far-end C-bit parity PM data are available ONLY when a BBG4/BBG4B, BBG19, or BBG20 TMUX (in Release 13.0 and later) pack is active (in-service) in a function unit slot. When a function unit slot is equipped with one of these new circuit packs, the DS3 line performance monitoring data will always be displayed regardless of what type of mode the DS3 service has been provisioned for. If the *`clear channel (cc)`* mode is selected, the report will display the DS3 line PM data and dash lines (-) for both directions of all DS3 path PM data.

NOTE:
When using the BBG4B or BBG19 circuit pack, this report will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber and the DSX-3. The TCAs associated with DS3 line performance monitoring parameters are reported also for the BBG4B. Finally, C-bit parity for Near End or Far End are reported for the BBG4B as well.

When using the BBG4 circuit pack, this report will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber only.

NOTE:
For the TMUX (BBG20) circuit pack in OC-3 Release 13.0 and later, only the line and path on the incoming signal from the DSX-3 is monitored. The `mode` parameter of the **`set-t3`** command is NOT applicable to this circuit pack. The report will always display blank lines for the DS3 data incoming from the fiber for this pack.

The input parameters are:

`Address` Address of the DS3 signal(s).
Valid DS3 Port Addresses (BBG4, BBG4B, BBG20):
`{a,b,c,all}`

Valid DS3 Port Addresses (BBG19):
`all, {a,b,c}-{1-2,all}`

The output report appears as follows:

```
/* DS3 Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
=====================================================================
Address  Type       Start   SEFS        CV       ES      SES      UAS
         Direction  Time
=====================================================================
address  line       time                n        n       n
         dsx-p                 n        n        n       n        n
         dsx-pfe               n        n        n       n        n
address  fiber-p               n        n        n       n        n
         fiber-pfe             n        n        n       n        n
   */
```

The output parameters are:

`Address` This shows the address of the DS3 signal incoming from the DSX-3 or the fiber.

`Type Direction`
This shows the type of the PM data (line, path, path far-end) and the direction from which the signal is received (dsx-3 or fiber). For the TMUX (BBG20) circuit pack in OC-3 release 13.0 and later, only the dsx-3 direction will be applicable.

`Start Time` This indicates the time on the system clock when the data collection started. The parameters are reported as a combination of their type and direction from which they are received. For *`line`* parameters, refer to CV-L, ES-L, and SES-L definitions. For *`dsx-p`* and *`fiber-p`* parameters, see SEFS, CV-P, ES-P, SES-P, and UAS-P definitions. For far-end *`dsx-pfe`* and *`fiber-pfe`* path parameters, refer to SEFS, CV-PFE, ES-PFE, SES-PFE, and UAS-PFE definitions.

`CV-L` This indicates the number of B3ZS coding violations occurring over the accumulation period for the DS3 signal incoming from the DSX-3.

`ES-L` This indicates the number of seconds with at least one B3ZS coding violation or LOS for the DS3 signal incoming from the DSX-3.

`SES-L` This indicates the number of seconds with greater than 44 B3ZS coding violations or LOS for the DS3 signal incoming from the DSX-3.

`SEFS` This indicates the number of out of frame seconds or AIS seconds for the DS3 signal incoming from the DSX-3 or the fiber.

`CV-P` This shows the number of P-bit, adjusted F&M bit, or C-bit parity coding violations for the DS3 signal incoming from the DSX-3 or the fiber.

`ES-P` This shows the number of path errored seconds for the DS3 signal incoming from the DSX-3 or the fiber.

`SES-P` This shows the number of path severely errored seconds for the DS3 signal incoming from the DSX-3 or the fiber. A severely errored second contains 44 or more errors.

`UAS-P` This shows the number of path unavailable seconds of service for the DS3 signal incoming from the DSX-3 or the fiber. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.

`CV-PFE` This shows the number of FEBE bits path coding violations at the far-end for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **`set-t3`** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber.

`ES-PFE` This shows the number of far-end path errored seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **`set-t3`** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber.

`SES-PFE` This shows the number of far-end path severely errored seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **`set-t3`** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber. A severely errored second contains 44 or more errors.

`UAS-PFE` This shows the number of far-end path unavailable seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **`set-t3`** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.

NOTE:
Rows that are all zeros are not printed except for current day and current quarter, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS3 and/or TMUX circuit pack is inserted or removed, or a terminal or a facility loopback is established. (For the TMUX, establishing a DS3 facility loopback will not interrupt the collection of the line and path PMON data). If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-tca

rtrv-pmthres-t3

set-pmthres-t3

set-t3

NAME

rtrv-pm-tca: Retrieve Performance Monitoring TCA

INPUT FORMAT

`rtrv-pm-tca`;

DESCRIPTION

This command displays the number of threshold crossing alerts (TCAs) associated with signals terminating in or passing through the system. A TCA occurs when a performance-monitoring counter exceeds a user-selected threshold.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The output report appears as follows:

```
/* TCA Performance Monitoring Summary Report
====================================================================
Address   Optics  Section   Line   STS-1    DS3    DS3
                                   Path     Path   Line
====================================================================
address     n        n       n
address     n        n       n
address                              n
address                              n        n      n
address                              n        n
```

If the **ds1pm** feature is enabled (via the **set-feat** command), the following additional lines will appear in the TCA report:

```
=====================================================================
DS1       TCA   DS1       TCA   DS1       TCA   DS1       TCA
Address  Count  Address  Count  Address  Count  Address  Count
=====================================================================
address  count  address  count  address  count  address  count
  .        .       .       .       .       .       .       .
  .        .       .       .       .       .       .       .
```

If the **vtpm** feature is enabled (via the **set-feat** command), the following additional lines will appear in the TCA report:

```
=====================================================================
VT1.5     TCA   VT1.5     TCA   VT1.5     TCA   VT1.5     TCA
Address  Count  Address  Count  Address  Count  Address  Count
=====================================================================
address  count  address  count  address  count  address  count
  .        .       .       .       .       .       .       .
  .        .       .       .       .       .       .       .
```

The output report shows the address and type of parameters that are generating TCAs. Blanks in the report indicate that the output parameter does not apply for the specified address.

The output parameters are:

`Address` — Address of the monitored signal. This can be the address of an OC-1, OC-3, or OC-12 (24G-U or 29G-U (OC-3 Release 15.0) in main unit slots) line, STS-1 channel, EC-1 port or DS3 port.

`Optics` — This shows the total number of TCAs associated with optical performance-monitoring parameters (Transmit Pwr -1dB, Transmit Pwr -2dB, Laser Bias).

`Section` — This shows the total number of TCAs associated with section performance monitoring parameters (severely errored frame seconds).

`Line`	This shows the total number of TCAs associated with line performance monitoring parameters (B2 CV, B2 ES, B2 ES Type A, B2 ES Type B, B2 SES, B2 UAS, PSC, or PJC).
`STS-1 Path`	This shows the total number of TCAs associated with STS-1 path performance monitoring parameters (B3 CV, B3 ES, B3 ES Type A, B3 ES Type B, B3 SES, or B3 UAS). Independent TCA counts are reported for each of the two STS-1 channels, one from each ring, cross-connected to the BBG19 DS3 circuit packs in a function unit with addresses m1-x and m2-x. Also starting with this release, all non-terminated STS cross-connected services at both ring OLIU, non-ring OLIU, and EC-1 interfaces will be monitored and reported. For the ring OLIU interfaces, independent TCA counts are reported for each of the two STS-1 channels, one from each ring. For the non-ring OLIU and EC-1 interfaces, only TCA counts of the active interface is reported.
`DS3`	This shows the total number of TCAs associated with **DS3 path** performance monitoring parameters (severely errored frame seconds, P-bit, adjusted F&M bit, or C-bit parity CV-P, ES-P, SES-P, UAS-P) incoming from the fiber and the DSX-3.

The report will also show the total number of TCAs for **DS3 line** performance monitoring parameters (CV-L, ES-L, SES-L).

NOTE:
When using the BBG4B circuit pack, this parameter will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber and the DSX-3. The TCAs associated with DS3 line performance monitoring parameters are reported also for the BBG4B. Finally, C-bit parity for Near End or Far End are reported for the BBG4B as well.

When using the BBG4 circuit pack, this parameter will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber only.

For ports on the BBG4B or TMUX circuit packs, path and line TCAs for the DS3 signal incoming from the DSX-3 will be displayed with a port address (a,b-3,...).
Path TCAs for the DS3 signal incoming from the fiber, will be displayed with a channel address; e.g, m-1 (OC-3 or FiberReach)

Independent TCA counts are reported for each of the two DS3 ports (a-1, a-2, ...) in a function unit equipped with BBG19 DS3 circuit packs, and for each channel connected to the ports (m1-1, m2-1, ...).

Starting with OC-3 Release 13.0, only the TCAs for the DS3 signal incoming from the DSX-3 are applicable to the TMUX (BBG20) circuit packs.

`DS1 Address`	This column shows the address of the DS1 signal.
`VT1.5 Address`	This column shows the address of the VT1.5 signal.
`TCA Count`	This column indicates the total number of TCAs associated with the addressed signal.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-sect

rtrv-pm-t3

set-pmthres-line

set-pmthres-sect

set-pmthres-t3

NAME

rtrv-pm-vt1: Retrieve Performance Monitoring VT1.5

INPUT FORMAT

`rtrv-pm-vt1`:*`Address`*;

DESCRIPTION

This command displays the parameter data associated with one or more VT1.5 channels terminating on a DS1, DS1PM, BBG20 TMUX, T1EXT (OC-3 Release 15.0), or IMA LAN (OC-3 Release 15.0) circuit pack. This command is available only if the VT1.5 performance monitoring feature is set via the **`set-feat`** command.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address`

Address is the address of VT1.5 channels.

Valid Addresses: **`all`**

`m-{1-3,all}-{1-7,all}-{1-4,all}`
(For 22-type OLIUs in main slots)

`{a,b}-{1,2,all}-{1-7,all}-{1-4,all}`
(For 22-type OLIUs in FN-a or FN-b slots)

`c-{1-3,all}-{1-7,all}-{1-4,all}`
(For 22-type OLIUs in FN-c slot)

`m-{1,2,all}-{1-7,all}-{1-4,all}`
(For 27-type OLIUs in MAIN slots)

`{a,b,c}-{1,2,all}-{1-7,all}-{1-4,all}`
(For 27G2-U OLIUs in FN slots, Release 11.0 and later)
`{a,b,c}-1-{1-7,all}-{1-4,all}`
(26G2-U OLIU in FN slots, Release 13.0 and later)

`{a,b,c}-{1-7,all}-{1-4,all}`
(For low-speed STS-1E in FN slots to MXRVO/TMUX)

`m-{1-12,all}-{1-7,all}-{1-4,all}`
(For 24-type or 29-type OLIUs in MAIN slots, Release 15.0 and later).

The output report appears as follows:

```
/* VT1.5 Path Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
===================================================================
Address  Start   V5 ES   V5 SES   V5 UAS
         Time
===================================================================
address  time     n        n        n
address  time     n        n        n
  .       .       .        .        .
  .       .       .        .        .
```

The output parameters are:

`Address`	This shows the address of the VT1.5 signal.
`Start Time`	This indicates the time on the system clock when the data collection started.
`V5 ES`	This indicates the number of VT1.5 errored seconds (ES) during the data collection interval that started at the time reported in the previous column.
`V5 SES`	This indicates the number of VT1.5 severely errored seconds (SES) during the data collection interval that started at the time reported in the previous column.
`V5 UAS`	This indicates the number of VT1.5 unavailable seconds (UAS) during the data collection interval that started at the time reported in the previous column.

NOTE:
Rows that are all zeros are not printed except for current day and current quarter, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS1, DS1PM, TMUX, T1EXT or IMA LAN circuit pack is inserted or removed. A question mark may also follow a facility loopback (not applicable to the IMA LAN) established on a TMUX circuit pack. Establishing a DS1 facility loopback will not interrupt the VT1.5

performance monitoring. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

This command may only be used if the `vtpm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 system loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

init-pm

rtrv-pmthres-vt1

NAME

rtrv-pmthres-line: Retrieve Performance Monitoring Threshold Line

INPUT FORMAT

`rtrv-pmthres-line`;

DESCRIPTION

This command displays the system's current OC-1, OC-3, and OC-12 OLIUs line performance parameter thresholds, as set by the **`set-pmthres-line`** command.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The output report appears as follows:

```
  /* Line Performance Monitoring Thresholds Report
============================================================
  Parameter                                    Thresholds
                                            Quarter    Day
                                             Hour
============================================================
  B2 Coding Violations OC12 (B2CVOC12)        n         n
  B2 Coding Violations OC3 (B2CVOC3)          n         n
  B2 Coding Violations OC1 (B2CVOC1)          n         n
  B2 Coding Violations EC1 (B2CVEC1)          n         n
  B2 Errored Seconds (B2ES)                   n         n
  B2 Errored Seconds Type A (B2ESA)           n         n
  B2 Errored Seconds Type B (B2ESB)           n         n
  B2 Severely Errored Seconds (B2SES)         n         n
  B2 Unavailable Seconds (B2UAS)              n         n
  Line Protection Switch Counts (PSCL)        n         n
  STS Pointer Justification Counts (PJC)      n         n
  */
```

The first column of the report contains the names of the line performance monitoring parameters. The second and third columns contain the quarter hour and day thresholds for each parameter. The output parameters are:

`B2 Coding Violations OC12`	This parameter displays the threshold values for the B2 coding violation counts for OC-12 lines.
`B2 Coding Violations OC3`	This parameter displays the threshold values for the B2 coding violation counts for OC-3 lines.

`B2 Coding Violations OC1`	This parameter displays the threshold values for the B2 coding violation counts for OC-1 lines. This parameter is available with Release 9 and later.
`B2 Coding Violations EC1`	This parameter displays the threshold values for the B2 coding violation counts for EC-1 lines.
`B2 Errored Seconds`	This parameter displays the threshold values for the B2ES count.
`B2 Errored Seconds Type A`	This parameter displays the threshold values for the B2ESA count.
`B2 Errored Seconds Type B`	This parameter displays the threshold values for the B2ESB count.
`B2 Severely Errored Seconds`	This parameter displays the threshold values for the B2SES count.
`B2 Unavailable Seconds`	This parameter displays the threshold values for the B2UAS count.
`Line Protection Switch Count`	This parameter displays the threshold values for the line protection switch count.
`STS Pointer Justification Count`	This parameter displays the threshold values for the STS pointer justification count. This parameter is available with Release 11.0 and later.

A parameter threshold of zero indicates that thresholding is disabled.

A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^{-n}.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

set-pmthres-line

NAME

rtrv-pmthres-sect: Retrieve Performance Monitoring Threshold Section

INPUT FORMAT

rtrv-pmthres-sect;

DESCRIPTION

This command displays the system's current section performance parameter thresholds, as set by the **set-pmthres-sect** command.

The output report appears as follows:

```
/* Optics & Section Performance Monitoring Thresholds Report
============================================================
Transmit Power 1dB (TxPwr1dB) = x
Transmit Power 2dB (TxPwr2dB) = x
Laser Bias = x
============================================================
Parameter                                  Thresholds
                                        Quarter    Day
                                         Hour
============================================================
Severely Errored Frame Seconds (SEFS)    n         n
*/
```

Values for the first three output parameters are **enabled** and **disabled**. The output parameters are:

`Transmit Power 1dB` OLIU transmit power threshold setting. This parameter applies only to the 21G OLIU circuit pack.

`Transmit Power 2dB` OLIU transmit power threshold setting. This parameter applies only to the 21G OLIU circuit pack.

`Laser Bias` OLIU laser bias threshold setting. This parameter applies only to the 21G circuit pack.

`Severely Errored Frame Seconds`
This parameter displays the threshold values for the SEFS count. A parameter threshold of zero indicates that the thresholding is disabled.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

set-pmthres-sect

NAME

rtrv-pmthres-sts1: Retrieve Performance Monitoring Threshold STS-1

INPUT FORMAT

`rtrv-pmthres-sts1`;

DESCRIPTION

This command retrieves the system's STS-1 path performance monitoring thresholds, as set by the **`set-pmthres-sts1`** command.

The output report appears as follows:

```
/* STS-1 Path Performance Monitoring Thresholds Report
================================================================
Parameter                                  Thresholds
                                      Quarter        Day
                                       Hour
================================================================
B3 Code Violations (B3CV)                n            n
B3 Errored Seconds (B3ES)                n            n
B3 Errored Seconds Type A (B3ESA)        n            n
B3 Errored Seconds Type B (B3ESB)        n            n
B3 Severely Errored Seconds (B3SES)      n            n
B3 Unavailable Seconds (B3UAS)           n            n
*/
```

The first column of the report contains the names of the path performance monitoring parameters. The second and third columns contain the quarter-hour and day thresholds for each parameter. The output parameters are:

`Quarter Hour`	This column contains the quarter-hour thresholds for each performance monitoring parameter.
`Day`	This column contains the day thresholds for each performance-monitoring parameter.
`B3CV`	This parameter shows the threshold for coding violations. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent Bit Error Ratio (BER) of 10^{n}. A threshold of zero indicates that the thresholding is disabled.
`B3ES`	This parameter shows the threshold for errored seconds.
`B3ESA`	This parameter shows the threshold for type A errored seconds.
`B3ESB`	This parameter shows the threshold for type B errored seconds.

B3SES	This parameter shows the threshold for the number of severely errored seconds.
B3UAS	This parameter shows the threshold for unavailable seconds of service.

RELATED COMMANDS

init-pm

set-pmthres-sts1

rtrv-pm-sts1

rtrv-pm-tca

NAME

rtrv-pmthres-t1: Retrieve Performance Monitoring Threshold T1

INPUT FORMAT

rtrv-pmthres-t1;

DESCRIPTION

This command displays the current DS1 path and line performance parameter thresholds set for a shelf by the **set-pmthres-t1** command, and it is available only if the DS1 performance monitoring feature is set via the **set-feat** command.
This command will also display the current DS1 path PM thresholds on a BBG20 TMUX circuit pack in OC-3 Release 13.0 and later releases.

The output report appears as follows:

```
/* DS1 Path Performance Monitoring Thresholds Report
=====================================================================
Parameter                                             Thresholds
                                                 Quarter      Day
                                                  Hour
=====================================================================
Errored Seconds-Line (ESL)                          n          n
Code Violations-Path SF (CVPSF)                     n          n
Code Violations-Path ESF (CVPESF)                   n          n
Errored Seconds-Path (ESP)                          n          n
Severely Errored Seconds-Path (SESP)                n          n
Unavailable Seconds-Path (UASP)                     n          n
Code Violations-Path Far End (CVPFE)                n          n
Errored Seconds-Path Far End (ESPFE)                n          n
Severely Errored Seconds-Path Far End (SESPFE)      n          n
Unavailable Seconds-Path Far End (UASPFE)           n          n
*/
```

The output parameters are:

`Errored Seconds-Line` This parameter shows the daily threshold for DS1 line errored seconds. Beginning with OC-3 Release 9.1, this parameter will also show the quarter-hour threshold value.
This parameter is not applicable to the BBG20 TMUX circuit pack in OC-3 Release 13.0 and later releases.

`Code Violations-Path SF`
This parameter shows the daily threshold for DS1 path code violations for SF encoded paths. This parameter will also show the quarter-hour threshold value. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^n.

`Code Violations-Path ESF`
This parameter shows the daily threshold for DS1 path code violations for ESF encoded paths. This parameter will also show the quarter-hour threshold value. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^n.

`Errored Seconds-Path` This parameter shows the daily threshold for DS1 path errored seconds. This parameter will also show the quarter-hour threshold value.

`Severely Errored Seconds-Path`
This parameter shows the daily threshold for DS1 path severely errored seconds. This parameter will also show the quarter-hour threshold value.

`Unavailable Seconds-Path`
This parameter shows the daily threshold for DS1 path unavailable seconds. This parameter will also show the quarter-hour threshold value.

`Code Violations-Path Far End`
: This parameter shows the daily threshold for DS1 path code violations at the far end. This parameter will also show the quarter-hour threshold value. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^{n}.

`Errored Seconds-Path Far End`
: This parameter shows the daily threshold for DS1 path errored seconds at the far end. This parameter will also show the quarter-hour threshold value.

`Severely Errored Seconds-Path Far End`
: This parameter shows the daily threshold for DS1 path severely errored seconds at the far end. This parameter will also show the quarter-hour threshold value.

`Unavailable Seconds-Path Far End`
: This parameter shows the daily threshold for DS1 path unavailable seconds at the far end. This parameter will also show the quarter-hour threshold value.

A threshold of zero indicates that thresholding is disabled.

A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent Bit Error Ratio (BER) of 10^{n}.

This command may only be used if the `ds1pm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 system loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

rtrv-feat

set-feat

set-pmthres-t1

NAME

rtrv-pmthres-t3: Retrieve Performance Monitoring Threshold T3

INPUT FORMAT

`rtrv-pmthres-t3`;

DESCRIPTION

This command displays the system's current DS3 performance parameter thresholds, as set by the **`set-pmthres-t3`** command.

NOTE:
When using the BBG4B or BBG19 circuit pack, this command will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber and the DSX-3. The TCAs associated with DS3 line performance monitoring parameters are reported also for the BBG4B. Finally, C-bit parity for Near End or Far End are reported for the BBG4B as well.

When using the BBG4 circuit pack, this command will show the total number of TCAs associated with DS3 path performance monitoring parameters incoming from the fiber only.

The output report appears as follows:

NOTE:
All DS3 line parameters, in addition to DS3 C-bit parity and all other path parameters for the incoming signal from the DSX-3, are only applicable when a BBG4/BBG4B, BBG19 or BBG20 TMUX (Release 13.0 and later) packs is active (in-service) in a function unit slot.

```
/* DS3 Performance Monitoring Thresholds Report
=====================================================================
   Parameter                                              Thresholds
                                                       Quarter      Day
                                                         Hour
=====================================================================
 Coding Violations-Line (CVL)                             n          n
 Errored Seconds-Line (ESL)                               n          n
 Severely Errored Seconds-Line (SESL)                     n          n
 Severely Errored Frame Seconds (SEFS)                    n          n
 P-bit Coding Violations-Path (PCV)                       n          n
 F&M bit Coding Violations-Path (FMCV)                    n          n
 C-bit Coding Violations-Path (CP)                        n          n
 Errored Seconds-Path (ESP)                               n          n
 Severely Errored Seconds-Path (SESP)                     n          n
 Unavailable Seconds-Path (UASP)                          n          n
 Severely Errored Frame Seconds-Far End (SEFSFE)          n          n
 C-bit Coding Violations-Path Far End (CPFE)              n          n
 Errored Seconds-Path Far End (ESPFE)                     n          n
 Severely Errored Seconds-Path Far End (SESPFE)           n          n
 Unavailable Seconds-Path Far End (UASPFE)                n          n
 */
```

A threshold of zero indicates that thresholding is disabled.

The output parameters are:

`CVL` These parameters display the threshold for the coding violations count of the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent bit error ratio (BER) of 10^{n}.

`ESL` These parameters display the threshold for the errored seconds count of the DS3 line with at least one B3ZS coding violation.

`SESL` These parameters display the threshold for the severely errored seconds count of the DS3 line with greater than 44 B3ZS coding violations.

`SEFS` These parameters display the threshold values for severely errored frame seconds. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

PCV	These parameters display the threshold for the DS3 P-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^{n}.
FMCV	These parameters display the threshold for the DS3 F&M bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^{n}.
CP	These parameters display the threshold for the DS3 C-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^{n}.
ESP	These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
SESP	These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit severely errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
UASP	These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit unavailable seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
SEFSFE	These parameters display the threshold values for the far-end DS3 C-bit severely errored frame seconds. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
CPFE	These parameters display the threshold for the DS3 far-end C-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^{n}.

ESPFE	These parameters display the threshold for the DS3 far-end C-bit errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
SESPFE	These parameters display the threshold for the DS3 far-end C-bit severely errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.
UASPFE	These parameters display the threshold for the DS3 far-end C-bit unavailable seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

RELATED COMMANDS

init-pm

rtrv-pm-t3

rtrv-pm-tca

set-pmthres-t3

set-t3

NAME

rtrv-pmthres-vt1: Retrieve Performance Monitoring Threshold VT1.5

INPUT FORMAT

`rtrv-pmthres-vt1`;

DESCRIPTION

This command displays the current VT1.5 path performance parameter thresholds set for a shelf by the **`set-pmthres-vt1`** command, and it is available only if the VT1.5 performance monitoring feature is enabled via the **`set-feat`** command.

The output report appears as follows:

```
/* VT1.5 Path Performance Monitoring Thresholds Report
=====================================================================
Parameter                                      Thresholds
                                              Quarter  Day
                                               Hour
=====================================================================
V5 Errored Seconds (V5ES)                      nnnn     nnn
V5 Severely Errored Seconds (V5SES)            nnnn     nnn
V5 Unavailable Seconds (V5UAS)                 nnnn     nnn
*/
```

In the report, a threshold of zero indicates that thresholding is disabled. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^{n}.

The output parameters are:

`V5 Errored Seconds`	This parameter shows the quarter hour and daily threshold for VT1.5 errored seconds.
`V5 Severely Errored Seconds`	This parameter shows the quarter hour and daily threshold for VT1.5 severely errored seconds.
`V5 Unavailable Seconds`	This parameter shows the quarter hour and daily threshold for VT1.5 unavailable seconds of service.

This command may only be used if the `vtpm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

rtrv-feat

set-feat

set-pmthres-vt1

NAME

rtrv-secu: Retrieve Security

INPUT FORMAT

`rtrv-secu`;

DESCRIPTION

This command retrieves CIT and DCC ports security and timeout information.

Starting with OC-3 Release 13.0, this command will also report on the users who are currently logged into the Network Element via the CIT and DCC ports, as well as the users logged in to the NE via the X.25 PVCs and/or SVCs (**only** if local NE is a GNE). This X.25 section of the report will be displayed (in the TL1 section of the report) after the CIT and DCC information.

Starting with OC-3 Release 15.0, this command will report on the **`porttype`** of the addressed CIT port (whether used for TL1 or CIT access). Also the X.25 **`porttype`** will be reported (whether used as an Asynchronous or Synchronous port). **`baudrate`** and **`3echo`** (whether enabled or disabled) are reported as well.

For OC-3 Release 13.0, the output report appears as follows:

```
/* Port Security Configuration Report
==================================================================
Access        Security       Timeout,       Active
Link                         minutes        User
==================================================================
cit-1         lockout         0             LUC01
cit-2         enabled        60
dcc           disabled       15
-------------------------------------------------------------------
TL1
___
Access        SNPA                          Active
Link                                        User
-------------------------------------------------------------------
dcc                                         user1
x25(PVC)      1                             user7
x25(PVC)      2                             user8
x25(PVC)      3                             user9
x25(SVC)      146782229996                  user10
*/
```

For OC-3 Release 15.0 and later releases, the output report appears as follows:

```
/* Port Security Configuration Report
==================================================================
Access       Port      Baud  Echo      Active    Security  Timeout
Link         Type      Rate            User
==================================================================
cit-1        tl1       9600  enabled   user11    enabled   0
cit-2        cit                       LUC01     lockout   0
dcc                                              disabled  15
x25          asynch    9600  disabled  user12    enabled   0
-------------------------------------------------------------------

dcc                                     user1
-------------------------------------------------------------------
*/
```

NOTE:
The top section of the report (CIT/DCC, TL1 over CIT and/or Synchronous/Asynchronous X.25 information), and the bottom section (TL1 DCC and/or X.25 SVC/PVC information) are separated by a dotted line.

In the above report no data is listed for X.25(PVC/SVC) in the bottom section, because Access Link is listed as **x25** and Port Type is **asynch**.

The report below shows X.25(PVC/SVC) information, because Access Link is listed as **x25** and Port Type is **synch**.

```
/* Port Security Configuration Report
==================================================================
Access       Port      Baud  Echo      Active    Security  Timeout
Link         Type      Rate            User
==================================================================
cit-1        tl1       9600  enabled   user11    enabled   0
cit-2        cit                       LUC01     lockout   0
dcc                                              disabled  15
x25          synch
-------------------------------------------------------------------

dcc                                    user1
x25(PVC)-SNPA:1                        user7
x25(PVC)-SNPA:2                        user8
x25(PVC)-SNPA:3                        user9
x25(SVC)-SNPA:146782229996             user10
-------------------------------------------------------------------
*/
```

The output parameters are:

`Access Link`	Access link is the address of a CIT or DCC interface. Valid OC-3 Addresses: **dcc**, **cit-{1,2}** Valid OC-1 Interface Addresses: **dcc** Valid X.25/TL1 DCC Addresses (Starting with OC-3 Release 13.0): **x25(PVC) and x25(SVC)** (only if local NE is a GNE), **dcc** (when used for TL1 remote access to a non-GNE) Valid X.25 Synchronous/Asynchronous Address: (Starting with OC-3 Release 15.0): **x25**
`Port Type`	This parameter is available starting with OC-3 Release 15.0. It specifies whether the provisioned Address (**cit-1** or **cit-2**) is being used for **tl1** or **cit** application. If the value reported under Access Link is **cit-1 or cit-2**, the reported value for this parameter can be **tl1** or **cit**. If the value reported under Access Link is **x25**, the reported value for this parameter can be **synch** or **asynch**. If the value reported under Port Type is **synch**, then the second section of the report will include **x25(PVC/SVC)** information; **dcc** information might be included as well. If the value reported under Port Type is **asynch**, then the only information that might be reported in the second section of the report is for TL1 **dcc**. No *porttype* parameter value is reported when the Access Link is **dcc**; this will be designated by a " " (blank).
`baudrate`	This parameter is available starting with OC-3 Release 15.0. It specifies the baudrate in which TL1 messages are received/transmitted. The values for this parameter are: **1200**, **2400**, **4800**, **9600** (Default), and 19200. This parameter is reported, only if Port Type is either **tl1** or **asynch**; otherwise a " " (blank) is reported.
`echo`	This parameter is available starting with OC-3 Release 15.0. It specifies whether the character entered needs to be echoed back. The reported values are: **enabled** (default) or **disabled**. This parameter is reported only if Port Type is either **tl1** or **asynch**; otherwise a " " (blank) is reported.
`Active User`	This parameter is available starting with OC-3 Release 13.0. This parameter reports on the user's login id that is currently logged into the NE via the communication port identified by

the Access Link column. If no user is currently logged in at the time of the report, this parameter is reported as a dash ("-").

If Access Link is **`x25`** and Port Type is **`synch`**, then no Active User is reported in the top section for the Active User column. The Active Users will be reported in the bottom section of the report.

`Security` — Security shows whether security is enabled, disabled, or in lockout state on the listed CIT or DCC port. The valid values are `enabled`, `disabled`, or `lockout`. When security is enabled, a user must enter a valid login and password to begin a session. When security is in `lockout` state, only a `privileged` user is permitted to access the system through the locked out CIT/DCC ports.

`Timeout` — This parameter shows the time duration, in minutes, before an inactive session is terminated on a specified CIT or DCC interface. If timeout is zero (0), then there is no timeout.

`TL1` — This section is available starting with OC-3 Release 13.0. This section of the report will list the users logged in to the NE via the X.25 PVCs and/or SVCs (**`only if local NE is a GNE`**) or TL1 dcc and it is sorted by TL1 dcc first, the VC type (PVC and then SVC) and then by SNPA. This X.25 section of the report is displayed after the CIT, DCC and TL1 DCC information.

Starting with OC-3 Release 15.0, this section of the report will be displayed in the second (bottom) section underneath the dotted line (------), and it will include information on the addressed X.25 (SVC/PVC) "Access Link, SNPA, and Active User". The TL1 DCC information on the "Active User" will still be reported as well.

The "TL1" title for this section will be eliminated starting with this release.

NOTE:
The top section of the report includes (CIT/DCC, TL1 over CIT and/or Synchronous/Asynchronous X.25) information, and the bottom section includes (TL1 DCC and/or X.25 SVC/PVC). Both sections of the report are separated by a dotted line.

This section of the report will display the following columns:

`Access Link`
: See earlier description.

`SNPA`
: This parameter is available starting with OC-3 Release 13.0 and it contains the X.25 Subnetwork Point of Attachment address for the OS. It is either the PVC Logical Channel Number (LCN) or the SVC Data Terminal Equipment (DTE) calling address, which is 1 to 15 digits. Up to nine VCs can be mapped to any combination of PVCs and SVCs.

> **NOTE:**
> Starting with OC-3 Release 15.0, this parameter will not have its own column, but rather it will be listed as part of the Access Link address (as mentioned in the OC-3 R15.0 report).

`Active User`
: This parameter is available starting with OC-3 Release 13.0. This parameter reports the login id for a user that is currently logged into the NE via the communication port identified by the *`Address`* column. If no user is currently logged in at the time of the report, this parameter is reported as a blank.

RELATED COMMANDS

rtrv-lgn

set-secu

NAME

rtrv-state-eqpt: Retrieve State Equipment

INPUT FORMAT

`rtrv-state-eqpt`[:*`Address`*];

DESCRIPTION

This command displays slot, port, and protection switching state information for the network element (NE).

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

This command is used with all ring releases and should be used instead of the **`rtrv-state`** command with all later linear releases.

The input parameter is:

`Address`	Address identifies one or more slots. The default is **`all`** for all slots in the system. Valid OC-3 Addresses: **`all, main-{1,2,all}, fn-all, fn-{a,b,c}-{1,2,all}, ls-all, ls-{a,b,c}-{1-8,all}, tg-{1,2,all}`** If the shelf is equipped with IMA LAN (BBF9) circuit packs, the valid Low Speed Addresses are: **`ls-{a,b,c}-{1-7,all}`**

The output report appears on the following page.

```
/* Equipment State Report
   ===========================================================
   Address   Circuit    Port     Switch     Switch
             Pack     State(s)   State     Priority
   ===========================================================
   address   pack       p          s       priority
   address   pack       p          s       priority
     .         .        .          .          .
     .         .        .          .          .
   -----------------------------------------------------------
   address   pack       p          s       priority
     .         .        .          .          .
     .         .        .          .          .
   address   pack       p          s       priority
*/
```

In the output report, slot types are separated by a row of dashes. Within each slot type, slots are listed in order of their addresses, with protection slots listed last. Slots for control circuit packs (SYSCTL, AUXCTL) are not listed in this report.

The output parameters are:

`Address` Address is the address of a slot.

`Circuit Pack`

Circuit pack is the circuit pack name. A hyphen (-) means not applicable or not equipped.

If the shelf is equipped with the IMA LAN pack and knowing that this pack occupies two consecutive Low Speed slots, this report lists the LAN pack in 2 consecutive lines.

For the IMA LAN circuit pack, **LAN** will be printed in this column.

`Port State(s)`

The state of the signal, from the DSX for DS-1, LAN, DS-3, or EC-1 signals is reported.

Port State (p) may be blank or have one of the following values:

`i` (In-Service) In this state, the port is monitored for failures, and the appropriate alarm is generated if a failure is detected. To retire the alarm and transition the associated port to the `auto` state, the update function must be performed after the input signal is removed.

a (Automatic) In this state, the port will automatically be put `in-service` if a good signal is detected. This state is not allowed for OC-N signals.

n (Not Monitored)

In this state, the signal is not monitored or alarmed. The port will not automatically go to the `in-service` state when a signal is detected.

— Not applicable (not equipped).

The port state is always blank for timing circuits, for protection slots for 1x1 and 1xn protected circuit packs, and for OLIU circuit packs. Note that the BBG19 DS3 circuit pack is 0x1 protected and thus has independent port states for the service and protection slots. The port state is always a hyphen (`-`) for low-speed slots in the `auto` state.

`Switch State`

This indicates whether the circuit pack is active or standby, corresponding to the state of the protection switching relays. Switch state(s) may be one of the following:

`active` For OC-N lines in a 1+1 line-protected configuration, active means the signal being received on this line is selected by the near end protection switch and the signal being transmitted on this line is selected by the far end. For ring applications, each OLIU in the main slots is feeding its ring channels incoming from the fiber to the other side for pass-through connections and is sending drop channels to the function units. Some or all of the received ring channels incoming from this OLIU may be active. This can be determined using the **`rtrv-state-path`** command on this system. Some or all of the transmitted ring channels outgoing to the fiber may also be active. This can be determined by using the **`rtrv-state-path`** command on *all* remote systems.

With the addition of pass-through cross-connections in function units and path-protected hairpin local drop cross-connections, the above discussion applies to OLIUs in function unit slots supporting such cross-connections. For IMA LAN, the *Switch State* is always **`active`**.

`active-fn` For a main OLIU slot in ring applications, this means that the ring path protection switching is currently being done on this pack, and this pack is choosing each active ring channel from either ring and sending it to the function units.

For other pack types, active means the signal is being transmitted and received from this pack. Even if the pack is removed, the slot will remain active unless there is a protection circuit pack that service can be switched to.

`active-tx` For the function unit's OC-3 lines, the signal being transmitted is selected by the far end, but the received signal is not selected by the near end protection switch.

`active-rx` For the function unit's OC-3 lines, the signal being received on this line is selected by the near end protection switch, but the signal being transmitted is not selected by the far end.

`active-?` For the function unit's OC-3 lines, the protection line is failed in the receive direction. The state of the protection line in the transmit direction is unknown; the signal transmitted on the protection line *might* be selected by the far end.

`standby` The circuit pack or optical line is not currently active.

— Not applicable or not equipped.

For ring applications because of pass-through connections, the switch state will always be active for both main OLIUs. For function units provisioned for pass-through, path-protected hairpin local drop, or 0x1 ring applications, the switch state will always be active for both OLIUs.

`Switch Priority`

Switch priority is the currently active protection switch request. Only a higher priority protection switch request can cause a protection switch to be done. For ring applications, the switch priority in this report applies only to the equipment switching of the main to function unit signals. See the **`rtrv-state-path`** command for path protection switching information.

NOTE:
For 1X1 or 1+1 protected packs, the Switch Priority is displayed for both packs; The Switch Priority displayed for one pack is displayed for the other.

Switch priority may be one of the following:

`inhibit` No protection switches will be done until the switch is reset.

`lockout of protection`
This prevents access to the protection pack for the group.

`lockout of service`
This prevents access to the protection circuit pack for the specified service slot.

`forced` No automatic or manual switches will be done until the forced switch is reset.

`K1/K2 byte failure`
: This occurs when the system cannot determine the protection switching state of the far end due to a failure of the automatic protection switching channel (K1/K2 bytes of the SONET line overhead on the protection line).

`APS-protection line signal failure`
: Automatic protection switching has occurred due to a protection line signal failure.

`APS-service line signal failure`
: Automatic protection switching has occurred due to a service line signal failure.

`APS-signal failure`
: Automatic protection switching has occurred due to a signal failure.

`APS-signal degrade`
: Automatic protection switching has occurred due to a signal degrade.

`APS-pack failure`
: Automatic protection switching has occurred due to a circuit pack failure.

`APS-Fn failure`
: Automatic protection switching has occurred in Main-x because of a failure in Fn-x, where there was at least one local drop cross-connect between Fn-x and Fn-y (Main-x did not fail in this case).

NOTE:
This switch priority may be the result of failing or removing a 27G2-U OLIU in Fn-X-1/2, where a a local Hairpin Add-Drop cross-connect is established between Fn-X and Fn-Y. For example, if Main-1 had a 0X1 cross-connect with Fn-a-1, and one or more local Hairpin Add-Drop cross-connects were established between Fn-a and Fn-c; and Fn-a-1 CP fails, resulting in a Path Protection switch from Fn-a-1 to Fn-a-2. Also a switch from Main-1 to Main-2 for the Add-Drop cross-connect into Fn-c is caused. Running the "rtrv-state-eqpt" in this event will result in displaying Main-1 as "-" and Main-2 as "active-fn" for "Switch State". "Switch Priority" will list "APS-Fn failed" for Main-1 and "-" for Main-2. For Fn-a-1, "Switch State" will list "-", while "Switch Priority" will list "APS-pack failed".

The output report for the case above appears as follows:

```
/* Equipment State Report
   ============================================================
   Address   Circuit    Port     Switch     Switch
              Pack    State(s)   State     Priority
   ============================================================
   tg-1      TGS                 active     -
   tg-2      TGS                 standby
   ------------------------------------------------------------
   main-1    OLIU                active     APS - Fn failure
   main-2    OLIU                active-fn  APS - Fn failure
   ------------------------------------------------------------
   fn-a-1    OLIU                active     APS - pack failed
   fn-a-2    OLIU                active-fn  APS - pack failed
   fn-b-1    MXRVO               active
   fn-b-2    MXRVO               standby
   fn-c-1    MXRVO               active
   fn-c-2    MXRVO               standby
   ------------------------------------------------------------
   ls-b-1    LAN       iiii      active     -
   ls-b-2    LAN       iaaa      active     -
   ls-c-1    DS1       iiii      active     -
   ls-c-2    DS1       aaaa      active     -
   ls-c-3    DS1       aiia      active     -
   ls-c-4    DS1       aaaa      active     -
   ls-c-5    DS1       iani      active     -
   ls-c-6    DS1       iiii      active     -
   ls-c-7    -         -         -          -
   ls-c-8    DS1                 standby    -
*/
```

The above example assumes that the shelf's Low Speed slots "b-1" and "b-2" are equipped with the IMA LAN circuit pack and some of the DS1 ports are In Service.

`APS-automatic lock`
: Traffic is forced and held onto the protection pack, unable to revert to the service pack until midnight. This occurs following four automatic switches from service to protection during a 10-minute interval.

`APS-wait to restore`
: Automatic protection switching has occurred, but the service line is now good and service will revert back to its original source after a specified period of time.

`manual`
: Traffic has been manually switched to protection.

— No manual or automatic switch requests are active.

For the IMA LAN circuit pack, *Switch Priority* is always **-**

For ring applications, the switch priority in this report applies only to the equipment switching of the main OLIUs to function unit signals. See the **`rtrv-state-path`** command for path protection switching information.

The switch priority is always blank for protection slots, with one exception. For 1xn protected slots, the protected slot may have a switch priority of `lockout of protection`.

The state of the timing reference is reported in the **`rtrv-sync`** command.

RELATED COMMANDS

rtrv-alm

rtrv-state-path (Rings only)

rtrv-sync

set-state-t1

set-state-t3

switch-fn

switch-line

switch-ls

switch-sync

upd

NAME

rtrv-state-oc1: Retrieve State of OC-1 Lines

INPUT FORMAT

rtrv-state-oc1[:*Address*];

DESCRIPTION

This command retrieves OC-1 line states.

The input parameter is:

Address Address is the address of the OC-1 lines whose state is to be reported. The default is **all** OC-1 lines. Other valid addresses are:

main-all, main-{1,2}-{1,2}, fn-{a,b,c}-all, fn-all, fn-{a,b,c}-{1,2}-{1,2}
(For 27-type OLIUs)

fn-{a,b,c}-all, fn-all, fn-{a,b,c}-{1,2}-1
(For 26G2-U OLIUs)

The output report appears as follows. Only lines that are cross-connected will be displayed in the output report.

```
/* OC-1 Line State Report
=====================================================================
Address    Line State
=====================================================================
main-1-1   is
main-2-1   is
main-2-2   nmon
fn-a-1-1   is
fn-c-2-2   nmon
 .         .
 .         .
 .         .
*/
```

The output parameters are:

`Address` — Address is the address of an OC-1 line.

`Line State` — Line state is the state of the OC-1 line identified in the address field. It may have one of the following values:

- `is` — In-service. The line is monitored. Alarm and status conditions are reported normally.
- `nmon` — Not Monitored. The line is not being monitored. Alarm and status conditions are not reported for this line. Performance monitoring is not done for the line. The line will remain in this state until the state is changed (with the **`set-state-oc1`** command) or until the cross-connection involving this line is deleted.

RELATED COMMANDS

set-state-oc1

upd

NAME

rtrv-state-path: Retrieve State Path

INPUT FORMAT

`rtrv-state-path`[:*`Address`*];

DESCRIPTION

This command displays signal path state information for path-protected signals dropped at the network element (NE). To determine which of the transmitted ring channels outgoing to the fiber are active, it may be necessary to also use the **`rtrv-state-eqpt`** command on all remote systems.

Any application that is path protected is reported.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

Any application that is path protected is reported.

The input parameter is:

`Address` The *`address`* is any connected VT1.5 or STS-1 path. The default is **`all`** for all paths in the system.

Valid OC-3 VT1.5 Addresses:
`all, {m1,m2}-{1-3,all}-{1-7,all}-{1-4,all}`

Valid STS-1 Addresses for OC-3 OLIUs:
`all, {m1,m2}-{1-3,all}`

Valid VT1.5 Addresses for 27-type OLIUs:
`{m}{1,2}-{1,2}-{1-7,all}-{1-4,all}`
`{a,b,c}{1,2}-{1,2}-{1-7,all}-{1-4,all}`
(27G2-U OLIUs only)

Valid STS-1 Addresses for 27-type OLIUs:
`{m}{1,2}-{1,2}`
`{a,b,c}{1,2}-{1,2}`
(27G2-U OLIUs only)

Valid VT1.5 Addresses for 26G2-U OLIUs:
`{a,b,c}{1,2}-1-{1-7,all}-{1-4,all}`
(Release 13.0 and later)

Valid STS-1 Addresses for 26G2-U OLIUs:
`{a,b,c}{1,2}-1` (Release 13.0 and later)

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in its Main unit slots, the valid VT1.5 Main addresses are:
m{1,2}-{1-12,all}-{1-7,all}-{1-4,all}

The valid STS-1 Main addresses are:
m{1,2}-{1-12,all}

The output report appears as follows:

```
/* Path Protection Switch State Report
   ==============================================================
   ---------- Ring 1 -----------  ---------- Ring 2 -----------
   Address  Act   APS Condition   Address  Act   APS Condition
   ==============================================================
   address   x     condition      address   x    condition
   address   x     condition      address   x    condition
      .      .        .              .      .        .
      .      .        .              .      .        .
      .      .        .              .      .        .
   */
```

The output parameters are:

`Address` The `address` could be an STS-1, STS3c (if Main slots are equipped with 24G-U or 29G-U OLIUs), or VT1.5 path. The report always displays both the Ring 1 and Ring 2 addresses.

`Act` This column indicates whether the associated Ring 1 path (receive into local main-1) [receive into local main-1or fn-{a,b,c}-1 (Release 11.0 and later)] or Ring 2 path (receive into local main-2) Ring 2 path [receive into local main-2 or fn-{a,b,c}-2 (Release 11.0 and later)] is active.

This column may contain one of the following:

Y The path is provisioned as drop, or drop and continue, and this side is active (path protection switching is allowed).

`(blank)` The path is provisioned as drop, or drop and continue, and this side is in standby.

`APS Condition` This column lists the condition that caused the automatic protection switch to occur and appears on the path where the condition was detected. (The manual protection switch request is not shown because the system is nonrevertive.) The condition may be one of the following:

`signal failure`

`pack removal`

`pack failure`

`signal degrade`

Only manual or automatic protection switch (APS) requests that are higher priority than the currently active requests will cause a protection switch to occur. Currently, only the `manual` protection switch request is allowed, and because it is a lower priority than the APS requests, only APS requests will appear in the report. The APS conditions will remain active while the condition that caused the switch still exists. When that failure clears, the APS condition is changed to blank if no other APS requests exist.

NOTE:
Whenever a VT1.5 cross-connection is made, the STS-1 path is actually terminated. When an STS-1 address is entered, this command does not report any STS-1 signals because individual VT1.5s within that STS-1 can be active on different rings. In general both rings are normally active.

To really know the state of VT cross-connected STS-1 signals, it is necessary to look at the states of all the constituent VT1.5 signals.

RELATED COMMANDS

rtrv-state-eqpt

switch-path-vt1

switch-path-sts1

NAME

rtrv-state-sts1: Retrieve State of STS-1 Channels

INPUT FORMAT

`rtrv-state-sts1`[:*`Address`*];

DESCRIPTION

This command retrieves STS-1 channel states.

NOTE 1:
The channel state will be reported when the path of the channel can be either switched or terminated.

NOTE 2:
If slots 1 and 2 are equipped with different pack types (for example, during and upgrade), the report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address is the address of the STS-1 channels whose state is to be reported. The default is **`all`** STS-1 channels. Other valid addresses are:
`{m,c}-{1-3,all}, {a,b}-{1-2,all} {a,b,c}`
(For EC-1s)

`{m,a,b,c}-{1,2,all}` (For 27-type OLIUs)

`{a,b,c}-1` (For 26G2-U OLIUs)

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in both Main unit slots, the valid addresses are: **`m-{1-12,all}`**

The output report appears as follows. An example of a VT1.5 cross-connected hairpin between an OLIU in slot C (aid=c-3) and an MXRVO in slot B (aid=b-1) is shown. Only channels that are cross-connected and subject to monitoring will be displayed in the output report.

```
/* STS-1 Channel State Report
=================================================================
Address     Channel State
=================================================================
m-1         AUTO
m-2         IS
a-1         AUTO
b-2         IS
c-3         NMON
 .          .
 .          .
*/
```

NOTE:
An empty report is displayed if there are no cross-connections or if no channels are monitored (for example, pass-through cross-connections).

The output parameters are:

`Address` Address is the address of an STS-1 channel.

`Channel State` Channel State is the state of the STS-1 channel identified in the address field. It may have one of the following values:

- `auto` Automatic. There is not a good signal on this channel. (STS-1 AIS or STS-1 loss of pointer [LOP] condition may be present.) Alarm or status conditions associated with this channel are not reported. Performance monitoring is not done for the channel. If a good signal is detected on this channel, then the channel will be put in the `in-service` state automatically.
- `is` In-service. The channel is monitored. Alarm and status conditions are reported normally.
- `nmon` Not Monitored. The channel is not being monitored. Alarm and status conditions are not reported for this channel. Performance monitoring is not done for the channel. The channel will remain in this state until the state is changed (with the **`set-state-sts1`** command) or until the cross-connection involving this channel is deleted.

RELATED COMMANDS

dlt-crs-sts1

ent-crs-sts1

rtrv-crs-sts1

rtrv-state-vt1

set-state-sts1

upd

NAME

rtrv-state-vt1: Retrieve State of VT1.5 Channels

INPUT FORMAT

`rtrv-state-vt1`[:*`Address`*];

DESCRIPTION

This command retrieves VT1.5 channel states.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address is the address of VT1.5 channels whose state is to be reported. The default address is **`all`**.

Valid VT1.5 channel(s) addresses are:
`{m,a,b,c}-all, {m,c}-{1-3}-all`,
`{a,b}-{1,2,all}-{1-7,all}-{1-4,all}`,
`{m,c}-{1-3}-{1-7}-{1-4,all}`

Valid VT1.5 channel(s) addresses within EC-1 are:
`{a,b,c}-{1-7,all}-{1-4,all}`

Valid VT1.5 channel(s) addresses for 27-type OLIUs are:
`m-all, m-{1,2}-all, m-{1,2}-{1-7,all}-{1-4,all}`,
`{a,b,c}-all, {a,b,c}-{1,2}-all, all`,
`{a,b,c}-{1,2}-{1-7}-{1-4,all}`
(Requires 27G2-U OLIUs, Release 11.0 and later)

Valid VT1.5 channel(s) addresses for 26G2-U OLIUs are:
`{a,b,c}-all, {a,b,c}-1-all, all`,
`{a,b,c}-1-{1-7}-{1-4,all}`
(Release 13.0 and later)

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in its Main unit slots, the valid VT1.5 channel addresses are:
`main-{1-12,all}-{1-7,all}-{1-4,all}`.

The output report appears as follows. Only channels that are cross-connected will be displayed in the output report. (This includes VT1.5 channels that are implicitly cross-connected as part of an STS-1 cross-connection.) An example of a VT cross-connected hairpin between an OLIU in slot C (aid=c-1-1-2) and a MXRVO in slot B (aid=b-1-1-1) is shown.

```
/* VT1.5 Channel State Report
=================================================================
Address      Channel State
=================================================================
m-1-1-1      auto
m-1-1-2      is
m-1-1-3      nmon
m-1-1-4      auto
c-1-1-2      is
*/
```

The output parameters are:

`Address` Address is the address of a VT1.5 channel.

`Channel State` Channel State is the state of the VT1.5 channel identified in the address field. It may have one of the following values:

- `auto` Automatic. There is not a good signal on this channel. (The VT AIS or a VT loss of pointer condition may be present.) Alarm or status conditions associated with this channel are not reported. Also, performance monitoring is not reported. If a good signal is detected on this channel, then the channel will be put in the `in-service` state automatically.
- `is` In-service. The channel is monitored. Alarm and status conditions are reported normally.
- `nmon` Not Monitored. The channel is not being monitored. Alarm and status conditions are not reported for this channel. Performance monitoring is not done for the channel. The channel will remain in this state until the state is changed (with the **`set-state-vt1`** command) or until the cross-connection involving this channel is deleted.

RELATED COMMANDS

dlt-crs-sts1

dlt-crs-vt1

ent-crs-sts1

ent-crs-vt1

rtrv-crs-sts1

rtrv-crs-vt1

rtrv-state-sts1

set-state-vt1

upd

NAME

rtrv-sts1: Retrieve STS1

INPUT FORMAT

rtrv-sts1[:*Address*];

DESCRIPTION

This command retrieves three types of provisioned parameters for STS-1 channels. The parameter types are:

- signal degrade alarm threshold
- signal fail alarm threshold
- alarm level for sa/nsa STS path AIS condition

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

Address Address is the address of the STS-1 channels whose parameters are to be reported. The default is **all** STS-1 channels.
Other valid addresses are:
{m,c}-{1-3,all}, {a,b}-{1-2,all}

{a,b,c} (EC-1 addresses)

{m,a,b,c}-{1,2,all} (27-type OLIU addresses)

{a,b,c}-1 (26G2-U OLIU addresses)

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in its Main unit slots, the valid addresses are:
m-{1-12,all}

Only STS-1 channels that are cross-connected will be displayed in the output report.

When the default address is entered, the output report appears as follows:

```
/* STS1 Channel Provisioning Report
======================================================
SignalDegrade = value
SignalFailure = value

STS-1 AIS Alarm Information
Address      AIS Alarm            AIS Alarm
           Service Affecting  Non Service Affecting
======================================================
address         sa                nsa
address         sa                nsa
  .             .                 .
  .             .                 .
*/
```

If the address is anything but **all**, then the report appears as follows:

```
/* STS-1 Channel Provisioning Report
=====================================================
Address        AIS Alarm           AIS Alarm
           Service Affecting  Non Service Affecting
=====================================================
address        sa                    nsa
address        sa                    nsa
  .             .                     .
  .             .                     .
  .             .                     .
*/
```

If the **nsa** parameter is not valid for the application, for example a non-ring application, then the report appears as:

```
/* STS-1 Channel Provisioning Report
==============================================
Address        AIS Alarm
           Service Affecting
==============================================
address        sa
address        sa
  .             .
  .             .
  .             .
*/
```

The output parameters are:

`SignalDegrade` This is the signal degrade threshold value.

`SignalFailure` This is the signal failure threshold value.

`address` This is the address of the provisioned channel.

`AIS Alarm` One or more columns of information will show the AIS alarm values for service affecting (SA) and non-service affecting (NSA) alarms. SA alarms may have one of the following values:

- **cr** Critical alarm (default for ring channels)
- **mn** Minor alarm (non-ring channels only, default)
- **na** Not alarmed, but reported
- **nr** not alarmed and not reported (non-ring channels only).

NSA alarms may have one of the following values:

- **mn** Minor alarm (default)
- **nr** Not alarmed and not reported.

RELATED COMMANDS

set-sts1

NAME

rtrv-sync: Retrieve Synchronization

INPUT FORMAT

`rtrv-sync`;

DESCRIPTION

This command displays the provisioning and operational information on the synchronization attributes of the DDM-2000, as set by the **`set-sync`** command.

NOTE 1:
Synchronization provisioning is the same, whether the OC-3 shelf is equipped with OC-3 (22-type) or OC-12 (24-type or 29-type, starting with OC-3 Release 15.0) OLIU circuit packs in its Main unit slots.

NOTE 2:
Line timing from OC-1 line #1 on 27-type OLIU circuit packs in Main slots is supported.

NOTE 3:
Beginning with DDM-2000 OC-3 Release 13.0 and later, this command will also be used with the new Stratum 3 timing circuit pack, TG3 (BBF4). This pack can not be used in combination with either of the two TGS circuit packs (BBF2/BBF2B) in the same network element. The BBF4 circuit pack can be used in any BBF2B application. Care must be taken to ensure that a system equipped with these new BBF4 circuit packs will not receive its sync source for line-timing from another system that is equipped with either BBF2 or BBF2B TGS packs.

The following pages show output reports for this command and explain the various fields on the reports. Output reports will vary according to the provisioned timing mode and the software release.

The `(hw)` after a parameter value on the following reports indicate that the parameter is set by hardware switches on the TGS or TG3 circuit pack.

The synchronization output report on the following page is the general format for a system equipped with TGS or TG3 circuit packs that include DS1 timing outputs in the sync mode.

The following report is for OC-3 Releases:

```
/* Synchronization Report
 ===================================================================
 Parameter                    Value(s)
 ===================================================================
 Sync Source (src)            address  timing_message

 DS1 Line Code/Format         tg-1=xxxx/xxx (hw)  tg-2=xxxx/xxx (hw)

 Shelf Timing
   Provisioned Mode           mode (hw)
   Active Timing Mode         mode (hw)
   DS1 Reference Input State ref-1=mode       ref-2=mode
   Active Circuit Pack        pack
   Active Reference/Line      ref
   Mode Switching (mdsw)      mode
   Last Reference Switch      YY-MM-DD HH:MM:SS

DS1 Outputs
   Provisioned Mode           mode (hw)
   DS1 Output Mode (omd)      mode
   AIS Threshold (aisthres)   thres (Message)
   DS1 Output State           refout-1=state   refout-2=state
   Active Reference           ref

Sync Message Information
   OC-N Line      Input Message     Output Message     Type
---------------------------------------------------------------------
   address          Message            Message         Type
   address          Message            Message         Type
   address          Message            Message         Type

Sync Autoreconfiguration    mode
*/
```

The output parameters for the reports are as follows. Some parameters may not apply to all the reports. The output parameters are:

`Sync Source` The sync source is the optical line provisioned from which shelf (and optionally, DS1 sync output) timing is derived. If the shelf timing mode is set for `LineTimed` and DS1 sync output timing is also selected, `Sync Source` is both the source for shelf timing and DS-1 sync outputs. If the shelf timing mode is set for `External` and DS1 sync output timing is also selected, `Sync Source` is only the source for DS-1 sync outputs. The valid values for this parameter are:

`main`	OC-3 Linear Releases (default).
`main-1`	OC-3 Ring Releases (default). If Main-1 contains a 27-type OLIU, this value indicates timing derived from OC-1 line #1.
`main-2`	Applicable to OC-3 ring releases. if Main-2 contains a 27-type OLIU, this value indicates timing derived from OC-1 line #1.
`fn-c`	Linear Releases and Rings optical extensions

NOTE:
Shelf timing cannot be sourced from `fn-c`, if it is equipped with 27-type OLIU circuit packs.

— (dash)	Timing mode is hardware provisioned to be FreeRunning or External without DS1 sync outputs (`mult`).

The choices for Sync Source (except the dash) are followed by one of these messages:

`for Shelf only` Sync Source is set for LineTimed shelf.

`for Shelf and DS1 Outputs`
Sync Source is set for LineTimed shelf/Sync Out.

`for DS1 Outputs only`
Sync Source is set for External shelf timing/Sync Out.

`DS1 Line Code/Format`
This refers to the signal format and line coding of the DS1 `External` timing references (as set with option switches on the TGS or TG3 circuit pack). The valid values are:

`DS1 Line Code`

`ami`	Alternate Mark Inversion
`b8zs`	Bipolar with 8 Zeros Substitution
— (dash)	Unequipped
?	Unreadable

`DS1 Line Format`

`sf`	Super Frame format (D4)
`esf`	Extended Super Frame format
— (dash)	Unequipped
?	Unreadable

`Provisioned Mode`

Provisioned Mode is the provisioned synchronization mode of the timing generator circuit packs, as set with option switches on the TGS or TG3 circuit pack. The valid values are:

`External`	Timing derived from DS1 External reference.
`FreeRunning`	Timing derived from internal oscillator.
`LineTimed`	Timing derived from the OC-3 payload-carrying signal in the Main or FN-C slots. Starting with Release 9.1, timing can be derived from OC-1 line #1 on 27-type OLIU circuit packs in Main slots.

`Active Timing Mode`

Active timing mode is the active timing synchronization mode of the system. The value may be any of the values listed previously in `Provisioned Mode` or one of the following:

`Holdover`	Timing generator is operating in holdover mode because the provisioned references are not available or because the system has been manually switched to holdover mode.
`No Timing`	Timing circuit packs have been removed.
`?`	Timing mode is unreadable.

`DS1 Reference Input State`

Input State refers to the primary state of the DS1 `External` timing reference ports, with values as follows:

`is`	in-service
`auto`	automatic

`Active Circuit Pack`

Active Circuit Pack indicates which timing generator circuit pack is currently active. The value is `tg-1`, `tg-2`, or `-` (empty slot).

`Active Reference/Line`

Active Reference is the active external reference for the timing generator. When Active Reference is reported, Active Line is not reported. When the Provisioned Mode is `External`, Active Reference has the following values:

`ref-1`	The active timing reference is set to the timing reference "one".
`ref-2`	The active timing reference is set to the timing reference "two".
—	Not applicable, DS1 references are in auto input state.

Active Line is the active LineTimed reference for the timing generator. When Active Line is reported, Active Reference is not reported. When Provisioned Mode is `LineTimed`, Active Line has the following values:

`main-1`

`main-2`

`fn-c-1`

`fn-c-2`

`NA` Neither timing reference is active.

When the active timing mode is `Holdover`, Active Reference/Line is the timing reference that will provide timing if the system switches out of holdover mode.

When the Provisioned Mode is `FreeRunning` , Active Reference and Active Line are not reported.

`Mode Switching`

Mode Switching indicates whether the mode switching for the timing generator is revertive or nonrevertive.

`Revertive`	Revertive mode switching. If the system is provisioned for revertive mode switching, it will automatically switch from holdover mode to the provisioned mode (`LineTimed` or `External` timing) when a good reference becomes available.

`Nonrevertive`	Nonrevertive mode switching. If the system is provisioned for nonrevertive mode, it will switch to holdover mode (as a result of a timing reference failure) and remain in this mode until it is manually switched back to the provisioned timing mode by the **`switch-sync`** command.
— (dash)	Not applicable. Provisioned mode is `FreeRunning`.

`Last Reference Switch`

Last Reference Switch Time is the date and time of the last switch of the `External` timing reference. It has an initial power-up value of "NA" which is retained until a reference switch occurs. The value of Switch Time (the instant a switch occurs) is obtained from the system clock. This parameter is reported only when the Provisioned Mode is `External`.

`DS1 Outputs`

DS1 Outputs is the DS1 timing outputs and can be provisioned by hardware switches on the circuit pack. If the DS1 outputs are mult, then only Provisioned Mode is reported for this section.

`Provisioned Mode`

`mult` In the `External` timing mode, the `mult` is used to distribute the incoming DS1 reference to other shelves in the bay.

`sync out`

This mode indicates that timing is derived from a terminating OC-1, OC-3 or OC-12 (if Main slots equipped with 24G-U or 29G-U OLIU circuit packs) line and is used for network synchronization. (This mode is only available with the BBF2B or BBF4 circuit pack.)

`DS1 Output Mode`

Output Mode identifies whether the DS1 timing output derivation will track transmission or lock on a particular line (1 or 2) with values:

`track`

`lock1`

`lock2`

DS1 Output Mode is not reported for ring releases unless the `src` parameter is set to `fn-c` and the DS1 synchronization output is provisioned for `SYNC OUT` mode.

In addition to the condition mentioned above, in OC-3 Release 9.1 and future ring releases, DS1 Output Mode will not be reported when `Sync Autoreconfiguration` parameter is enabled. This will prevent any confusion in reading the report when the autoreconfiguration forces the `Active Reference/Line` parameter to switch to a better source.

`AIS Threshold`

This parameter indicates the provisioned sync message quality level and its equivalent sync message phrase for the active reference at which, or greater incoming quality level numbers, DS1 AIS will be transmitted on the sync output of the BBF2B TGS or BBF4 TG3 circuit pack. If the `syncmsg` parameter within the **`set-oc3`** or **`set-oc12`** command is set to `disabled`, then the word `disabled` will be reported with the provisioned value of this parameter. It may be set to one of the following options:

`level5`	default value. (K2: Internal Clock, S1: Traceable SONET Clk, or disabled)
`level4`	(K2: Stratum 3, S1: Traceable Stratum 3, or disabled)
`level3`	(K2: Stratum 2, S1: Traceable Stratum 2, or disabled)
`level2`	(K2: Sync Quality Unknown, S1: Sync Trace Unknown, or disabled)

For a definition of quality levels, refer to the Sync Message Information section of this command pages.

`DS1 Output State`

The output state is the status of the DS1 output when in the *`sync out`* mode, and may be one of the following:

`good`	This status indicates that the DS1 output is traceable to the incoming OC-1, OC-3 signal, or OC-12 (if Main unit slots are equipped with 24G-U or 29G-U OLIU packs).
`AIS`	DS1 AIS is inserted if a failure exists that prohibits tracing of the DS1 output to the incoming optical line. It is also inserted due to certain incoming synchronization message

quality levels on the active timing source.

— Indicates the slot is in the auto state.

? The circuit pack is unreadable, or slot is equipped and empty.

`Active Reference`

This shows the actual line that the DS1 timing output is being derived from, with the following values:

`main-1`

`main-2`

`fn-c-1`

`fn-c-2`

`Sync Message Information`

This heading identifies the section of the report where input and output messages used to determine the timing source quality are listed.

this section of the report is available only if any of the optical interfaces has been provisioned for `kbyte` (default) or `Sbyte` sync messaging (using the **`set-oc3`** command) or the **`set-oc3/set-oc12`** (when Main has 24-type or 29-type OLIUs).

`OC-N Line`

This parameter identifies the addresses of optical interfaces that can carry sync messages.

`Input Message`

`disabled` Indicates that the field is not applicable (for example, if synchronization messaging is disabled).

? Indicates that the message is not readable (for example, due to a line failure).

This column identifies the `Kbyte` input message received on each optical interface line, and may have one of the following values:

`Don't Use` The interface is not suitable for synchronization timing (Quality Level 7).

`Timing Looped Back`
The network element connected to this interface is line-timed from it (Quality Level 7).

`Stratum 4` The interface is receiving timing from a Stratum 4 clock source (Quality Level 6).

`Internal Clock`
This interface is receiving timing from a system in holdover or free running (Quality Level 5). This is applicable to the DDM-2000 systems equipped with TGS (BBF2 or BBF2B) circuit packs.

`Stratum 3` The interface is receiving timing from a Stratum 3 clock source (Quality Level 4) or from a DDM-2000 system equipped with TG3 (BBF4) circuit packs that is either in holdover or free running.

`Stratum 2` The interface is receiving timing from a Stratum 2 clock source (Quality Level 3).

`Sync Quality Unknown`
This interface is receiving timing from a good quality clock source (Quality Level 2).

`Stratum 1` The interface is receiving timing from a Stratum 1 clock source (Quality Level 1).

The type of sync messaging can be provisioned to `Kbyte` or `Sbyte` using the **`set-oc3`** command. In these releases, both versions of sync messages could appear in the report if the optical interfaces have been provisioned for the two types of messages. If `Sbyte` is selected, the following input messages will be applicable for the optical interface:

`Don't Use` The interface is not suitable for synchronization timing (Quality Level 7). This message is equivalent to **`Don't Use`** in Kbyte messaging. There is no message equivalent to **`Timing Looped Back`** in Sbyte messaging.

`Reserved` The interface is receiving the Reserved message on S1 byte (Quality Level 7). Upon receiving this message, the system treats it the same as **`Don’t Use`** message.

`Undefined` The interface is receiving a message on S1 byte that is not defined by the standards (Quality Level 7). Upon receiving this message, the system treats it the same as **`Don’t Use`** message.

`Traceable SONET Clk`
The interface is receiving timing from a system in holdover or free running (Quality Level 5). This message is equivalent to **`Internal Clock`** in Kbyte messaging. This is applicable to the DDM-2000 systems equipped with TGS (BBF2 or BBF2B) circuit packs.

`Traceable Stratum 3`
The interface is receiving timing from a Stratum 3 clock source (Quality Level 4) or from a DDM-2000 system equipped with TG3 (BBF4) circuit packs that is either in holdover or free running. This message is equivalent to **`Stratum 3`** in Kbyte messaging.

`Traceable Stratum 2`
The interface is receiving timing from a Stratum 2 clock source (Quality Level 3). This message is equivalent to **`Stratum 2`** in Kbyte messaging.

`Sync Trace Unknown`
This interface is receiving timing from a good quality clock source (Quality Level 2). This message is equivalent to **`Sync Quality Unknown`** in Kbyte messaging.

`PRS Traceable`
The interface is receiving timing from a Stratum 1 clock source (Quality Level 1). This message is equivalent to **`Stratum 1`** in Kbyte messaging.

`Output Message`
This identifies the output message sent out on each OC-N interface line. The valid values for this parameter are the same as those listed for `Input Message`. For

systems provisioned in line timing, in addition to the above Input Messages, if the sync source is provisioned for Sbyte type of sync messaging and is receiving `Traceable Stratum 3`, `Traceable Stratum 2`, or `PRS Traceable` messages, then the output messages on any of the optical interfaces provisioned for Kbyte will be `Stratum 3`, `Stratum 2`, or `Stratum 1`, respectively.

`Type` This column identifies the type of sync messaging the optical interface was provisioned for using the **`set-oc3`** and/or **`set-oc12`** command. The valid values are:

`Kbyte`

`Sbyte`

`disabled`

NOTE:
For OC-1 interfaces, this column will only display `Kbyte`.

`Sync Autoreconfiguration`
This capability allows the system to choose the best timing source to use when it is provisioned for line timing. The valid values are **`enabled`** and **`disabled`**.

Sync Autoreconfig is **`disabled`** by default.

RELATED COMMANDS

rtrv-oc3

rtrv-state

set-sync

set-oc3

switch-sync

NAME

rtrv-tl1msgmap: Retrieve Message Map for Operation Systems

INPUT FORMAT

`rtrv-tl1msgmap;`

DESCRIPTION

This command displays the table that associates the OS Application Context Identifier (ACID) to TL1 autonomous message types. This allows the DDM-2000 network element to direct messages to the proper OS destination.

The output report appears as follows:

```
/* TL1 Autonomous Message Map
=====================================================================
    ACID                 ALM ENV CON DB  EVT PM  SW
=====================================================================
tl1Maintenance          | x | x | x |   | x | x | x |
tl1MemoryAdministration |   |   |   | x |   |   |   |
tl1Test                 |   |   |   |   |   |   |   |
tl1PeerComm             |   |   |   |   |   |   |   |
tl1Other1               | x | x | x | x | x |   | x |
tl1Other2               |   |   |   |   |   |   |   |

      x - enabled
<blank> - disabled
*/
```

The output parameters are:

ACID ACID is the Application Context ID to be assigned to a particular SNPA or SubNetwork Point of Attachment on the x.25 channel. Each ACID defines the type of TL1 messages to be sent by the network element. Default MessageType mappings exist for ACIDs supported by DDM-2000. Supported ACID values are:

tl1Maintenance

tl1MemoryAdministration

tl1Other1

tl1Test

tl1PeerComm

tl1Other2.

msgtype MessageType is one of the supported classes of TL1 messages that the system generates. These message types are not sent to the OS unless they are enabled and associated to an ACID. The supported message types are:

ALM - REPT ALM

ENV - REPT ALM ENV

CON - REPT COND

DB - REPT DBCHG

EVT - REPT EVT

PM - REPT PM

SW - REPT SW

RELATED COMMANDS

ent-osacmap

dlt-osacmap

rtrv-osacmap

ent-tl1msgmap

NAME

rtrv-trace-sts1: Retrieve Path Trace Characteristics

INPUT FORMAT

`rtrv-trace-sts1`:*`Address`*;

DESCRIPTION

This command retrieves the provisioned transmit and receive path traces for the STS cross-connected STS-1 channel. The command also outputs the actual receive path trace, and the status of the path trace.

NOTE:
For OC-3 and OC-12, this feature is only applicable to the STS path terminated to a BBG4B circuit pack.

The input parameter is:

`Address` This is a STS-1 channel address of the SONET path terminating signal for which the path trace is assigned.

Valid Addresses (within OC-3):
`{m,c,all}-{1-3,all}, {a,b}-{1,2}`

Valid Rings Only Addresses: **`m-{1-3,all}`**

Valid 27-type OLIU Addresses: **`m-{1,2}`**

Valid 24-type or 29-type (OC-3 Release 15.0) OLIU Addresses:
`m-{1-12,all}`

The output report appears as follows:

```
/* STS-1 Path Trace Report
===========================================================================
Address
Parameter Value
===========================================================================
m-1
Status: MISMATCH
INCTRC: ActualReceiveTraceWhichDoesNotMatchProvisionedReceiveTrace789123
EXPTRC: ProvisionedTransmitTraceyzabcdefghijklmnopqrstuvwxyz1234567891
TRC   : ProvisionedReceiveTracexyzabcdefghijklmnopqrstuvwxyz1234567891
---------------------------------------------------------------------------
m-2
Status: GOOD
INCTRC: AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
---------------------------------------------------------------------------
m-3
Status: MISMATCH
INCTRC:
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz1234567891
---------------------------------------------------------------------------
*/
```

The output parameters are:

Address This is a channel address of the SONET path terminating signal for which the path trace is assigned.

Status STS path trace status. This is a status report of the incoming trace. For **rtrv-trace-sts1** messages, *status* may have one of the following values:

- *GOOD* Good. This indicates that the *INCTRC* and the *EXPTRC* match.
- *MISMATCH* Mismatch. This indicates that the *INCTRC* and the *EXPTRC* do not match.
- *UNAVAILABLE* Unavailable. This indicates that there is no *INCTRC* because there has been a path interruption. This is also true for the STS path terminating to other than a BBG4B or BBG11B circut pack for which the path trace is unavailable.

INCTRC	Incoming Path trace message. This indicates the incoming Path Trace (J1) content.
EXPTRC	Expected incoming Path trace message. This indicates the expected Path Trace (J1) content.
TRC	Outgoing Path trace message. This identifies the path trace message to be transmitted.

If the STS-1 channel for which the **`rtrv-trace-sts1`** command was issued is not available, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Address points to a non-existent channel. */
```

RELATED COMMANDS

set-pthtrc-sts1

NAME

rtrv-t1: Retrieve T1

INPUT FORMAT

`rtrv-t1`[:*`Address`*];

DESCRIPTION

This command displays the configuration information and attributes of one or more DS1 or "internal" DS1 (within the BBG20 TMUX circuit pack) ports, as set by the **`set-t1`** command.

When this command is used in OC-3 Release 13.0 and later on a DS1 port that is associated with a BBG20 TMUX circuit pack, dashes (-) will be displayed for all parameters except the PM Mode and Format.

When this command is used in OC-3 Release 15.0 and later on a DS1 port that is associated with an IMA LAN circuit pack, dashes (-) will be displayed for all parameters except the Port Address, Alarm Level, Port State, PM Mode and Format.

The input parameter is:

`Address` Address identifies the DS1 or "internal" DS1 (within the TMUX (BBG20) circuit pack) port(s). One or more ports may be specified. The default address is **`all`**.

Valid Addresses: **`all, {a,b,c}-{1-7,all}-{1-4,all}`**

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

The output report appears on the following page.

```
/* T1 Port Provisioning Report
====================================================================
 Port    Line Coding    Alarm  AIS Failure  BPV   State  PM  Format
Address                 Level      Thrshld  to LOS       Mode
====================================================================
a-1-1    ami (hw)        na   yes   -3       no     is   off   none
a-1-2    ami (hw)        na   yes   -3       no    auto  off   none
a-1-3    ami (hw)        na   yes   -3       no    auto  off   none
a-1-4    ami (hw)        na   yes   -3       no    auto  off   none
  .         .            .     .     .       .      .     .     .
  .         .            .     .     .       .      .     .     .
  .         .            .     .     .       .      .     .     .
*/
```

The output parameters are:

`Port Address` Port Address is the address of the DS1 or "internal" DS1 (within the BBG20 TMUX circuit pack) port.

`Line Coding` Line Coding is the DS1 line coding which may have the value `ami` (alternate mark inversion) or `b8zs` (AMI with bipolar 8-zero substitution). If a previous **`set-t1`** command has set this parameter to a value that overrides the circuit pack switch setting, either of these values will be followed with the string "`override`." Otherwise, it will be followed by the string "`(hw)`" to indicate that the line coding for the port is determined by the hardware switches.

This column does not apply to the IMA LAN circuit packs. For the DS1 ports on this pack, this column will display "-".

`Alarm Level` Alarm Level describes the alarm level for an incoming DS1 signal failure and may have one of the following values:

`MJ` Major alarm

`MN` Minor alarm

`NA` No alarm

If the system is provisioned for and reporting no alarm but an alarm exists, the NE ACTY LED on the user panel will be illuminated and the fault LED on the circuit pack will flash (flashing LED is applicable to regular DS1s; it is not applicable to the DS1s associated with the IMA LAN circuit pack). The condition will be reported in the alarm and status report as a near-end activity.

`AIS`	Alarm Indication Signal indicates whether an AIS is to be inserted toward the fiber when a loss of an incoming DS1 signal is detected. The values are `yes` and `no`. This column does not apply to the IMA LAN circuit packs. For the DS1 ports on this pack, this column will display "-". **NOTE:** When the "BPV to LOS" DLC parameter is set to `yes`, the AIS parameter is ignored. (An all zeros signal, not AIS, is transmitted to the far end even if the `AIS` parameter is set to `yes`.)
`Failure Thrshld`	Failure threshold is the BER threshold in terms of a logarithm to the base 10. The value may be -8, -7, -6, or -3, corresponding to BERs of 10^{-8}, 10^{-7}, 10^{-6}, and 10^{-3}, respectively. This column does not apply to the IMA LAN circuit packs. For the DS1 ports on this pack, this column will display "-".
`BPVtoLOS`	This column indicates whether an incoming DS1 signal failure (a bit error ratio above the threshold set by the failure threshold parameter) will be translated into an outgoing all-zeros signal at the far end. The values are `yes` and `no`. This column does not apply to the IMA LAN circuit packs. For the DS1 ports on this pack, this column will display "-".
`State`	State is the state of the port. It may be one of the following: `is` — In-service. A valid T1 signal from the DSX-1 that is being monitored. `auto` — Automatic. The system is waiting for a valid T1 signal from the DSX-1. `nmon` — Not Monitored

`PM Mode`	This column indicated the performance-monitoring (PM) mode of the DS1 interface and may be one of the following values:	
	`on`	DS1 PM enabled on this port
	`off`	DS1 PM disabled on this port
`Format`	This column indicates the PM format of the DS1 interface and may be one of the following values:	
	`none`	No DS1 PM possible on this port due to equipage (PM Mode always `off`.)
	`sf`	Superframe
	`esf`	Extended superframe, near-end and far-end
		The PM format of the DS1 interfaces on the IMA LAN circuit pack always has the value of `esf`.
	`esfn`	Extended superframe, near-end only

RELATED COMMANDS

set-state-t1

set-t1

NAME

rtrv-t3: Retrieve T3

INPUT FORMAT

rtrv-t3[:*Address*];

DESCRIPTION

This command displays a port provisioning report for one or all DS3 ports, as set by the **set-t3** command.

The input parameter is:

Address Address identifies the DS3 ports. One port or all ports may be specified. The default address is **all**.

Valid DS3 Port Addresses (for BBG4, BBG4B, and BBG20):
{a,b,c,all}

Valid DS3 Port Addresses (for BBG19):
all, {a,b,c}-{1-2,all}

The output report appears as follows:

```
/* T3 Port Provisioning Report
=====================================================================
 Port    Mode   AIS   Alarm   Failure   State   PM     PM      PM
Address                Level  Threshold         Mode   Frame  Format
=====================================================================
address  mode   ais   alarm     fth     state   pmmd   frame    fmt
   .       .     .      .        .        .      .       .        .
   .       .     .      .        .        .      .       .        .
   .       .     .      .        .        .      .       .        .
   .       .     .      .        .        .      .       .        .
```

For OC-3 Release 13.0 and later, the report appears as follows:

```
===================================================================
 Port    Mode  AIS  Alarm  AIS   Failure  State   PM   PM   PM   Xbit
Address              Level  Alarm Thresh          Mode Frame Fmt
===================================================================
address  mode  ais  alarm  alarm   fth    state  pmmd frame fmt  xbit
   .       .    .     .      .      .       .      .    .    .    .
   .       .    .     .      .      .       .      .    .    .    .
   .       .    .     .      .      .       .      .    .    .    .
   .       .    .     .      .      .       .      .    .    .    .
*/
```

The output parameters are:

`Port Address` — Port Address is the address of the DS3 port

`Mode` — Mode is the violation monitor removal mode of the DS3 signal. It may have one of the following values:

- `vmr` — Monitor and remove DS3 P-bit errors (default value).
- `vm` — Monitor but do not remove DS3 P-bit errors.
- `cc` — Clear channel. Do not monitor or remove DS3 P-bit errors.
- — — This parameter does not apply to the BBG20 TMUX circuit pack.

`AIS` — AIS indicates whether or not a DS3 alarm indication signal (AIS) should be inserted. The value may be `yes` or `no`. This parameter is not applicable to the BBG20 TMUX circuit packs, therefore, a dash (—) will be displayed. When AIS is set to `yes`:

- — DS3 AIS is inserted towards the DSX-3 upon detection of an OC-N loss of signal or STS path AIS incoming from the fiber.
- — DS3 AIS is inserted towards the fiber upon detection of DS3 LOS incoming from the DSX-3.

NOTE:
AIS is always inserted if the violation monitor removal mode is provisioned for `vmr` or `vm`.

`Alarm Level`	Alarm describes the alarm level for an incoming DS3 signal failure and has the following values: `CR` Critical alarm `MJ` Major alarm `MN` Minor alarm `NA` No alarm If the system is provisioned for and reporting no alarm but an alarm exists, the NE ACTY LED on the user panel will be illuminated, and the fault LED on the circuit pack will flash. The condition will be reported in the alarm and status report as a near-end activity. For TMUX circuit packs in OC-3 Release 13.0 and later, this parameter refers to the alarm level for the following incoming DS3 (from DSX) alarms: LOS, Signal Failure BER, and
`AIS Alarm Level`	This is only applicable to the BBG20 TMUX circuit packs in OC-3 Release 13.0 and later. It describes the alarm level for an incoming DS3 (from DSX) AIS and has the following values: `CR` Critical alarm `MJ` Major alarm `MN` Minor alarm `NA` No alarm level `-` This parameter is not applicable to any other non-TMUX DS3 ports.
`Failure Threshold`	Failure threshold is the BER threshold in terms of a logarithm to the base 10. The value may be either -6 or -3, corresponding to BERs of 10^{-6} and 10^{-3}, respectively. For the BBG20 TMUX circuit pack, the DS3 BER threshold for the TMUX circuit pack is based on p-bit or c-

bit parity violations; a failure threshold value of 10^{-3} will cause a "BER signal fail" alarm if the DS3 BER exceeds 10^{-4}.

`State` — State is the state of the port with the values:

- `is` — In-service. A valid T3 signal from the DSX-3 is being monitored.
- `auto` — Automatic. The system is waiting for a valid T3 signal from the DSX-3.
- `nmon` — Not Monitored

`PM Mode` — This column shows the performance monitoring (PM) mode of the DS3 interface, and may be one of the following values:

- `on` — DS3 PM enabled on this port (default value).
- `off` — DS3 PM disabled on this port (PM data is not monitored or reported).
- — — Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG4B or BBG19 pack is active (in-service) in a function unit slot.

`PM Frame` — This parameter indicates the type of framing for the incoming DS3 signal from both the fiber and the DSX-3. For the BBG20 TMUX circuit pack, this parameter will indicate the type of DS3 signal that is received from the DSX-3 only and is transmitted towards the DSX-3. It may have one of the following values:

- `m13` — The incoming DS3 signal is in M13 framing type (default value).

`cbit`	The incoming DS3 signal is in C-bit framing type.
—	Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG4B or BBG19 pack is active (in-service) in a function unit slot.

`PM Format`

This parameter indicates the type of path PMON that will appear in the DS3 PM report. This parameter will appear only if the `vmr` or `vm` mode has already been selected. For the BBG20 TMUX circuit pack, this parameter will always appear. This parameter may have one of the following values:

`pbit`	When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 P-bit CV, ES, SES, and UAS (default value).
`fmbit`	When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 adjusted F&M bit CV, ES, SES, and UAS.
`cpbit`	When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 CP-bit parity near-end and far-end CV, ES, SES, and UAS.
—	Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG4B or BBG19 pack is active (in-service) in a function unit slot.

`Xbit`	This is only applicable to the BBG20 TMUX circuit packs in OC-3 Release 13.0 and later. It displays the values for both X-bits in the outgoing (towards DSX) DS3 signal. This parameter is valid only if the Frame has been set to "m13". The value may be one (default), zero, or - (for when the TMUX circuit pack has been provisioned for "cbit" framing or any other non-TMUX DS3 ports).

RELATED COMMANDS

set-state-t3

set-t3

NAME

rtrv-ulsdcc-l3: Retrieve Upper Layer Section DCC - Layer 3

INPUT FORMAT

`rtrv-ulsdcc-l3`;

DESCRIPTION

NOTE:
This command page describes the functionality of the **`rtrv-ulsdcc-l3`** command in OC-3 Release 13.0 and all later TARP releases.

This command is currently used to retrieve the parameters in Layers 3 through 7 of the OSI stack, many of which are provisioned by the **`ent-ulsdcc-l3`** command. Layer 3 parameters include the fields of the network service access point (NSAP) address and the enable/disable state of Level-2 IS-IS Routing.

The NSAP is a 20-byte address that provides unique identification for each network element. Only certain portions of this address are user-settable.

The output report appears as follows:

```
/* Upper Layer Section DCC Provisioning Report
=====================================================================
L3 NSAP address:
 idp    dfi org    res  rd   area  sys          sel   lv2is
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx    e/d

*/
```

The output parameters are:

`L3 NSAP Address`

This is the 20-byte address assigned to a network element. This is only a string. Under this string, the following seven parameters that make up the NSAP address are identified:

`idp` Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the local NE NSAP. This part of the NSAP address is assigned according to the International Standards Organization (ISO) standards. For

SONET systems, the value is set to `39840F` to indicate that U.S. American National Standards Institute (ANSI) is the registration authority responsible for the assignment of the NSAP address.

`dfi` Where "xx" indicates the 2-digit hexadecimal DFI field value of the local NE's NSAP. This part of the NSAP address specifies the format for the rest of the NSAP address. For SONET systems, the value is set to hex `0X80`. This is to specify that a format in alignment with GOSIP version 2 is to be used.

`org` Where "xxxxxx" indicates the 6-digit hexadecimal Organization Id field value of the local NE's NSAP. This part of the NSAP address contains the allocated hexadecimal company code assigned by the ANSI-administered USA Registration Authority for OSI Organization Ids.

`res` Where "xxxx" indicates the 4-digit hexadecimal Reserved field value of the local NE's NSAP. This part of the NSAP address currently has not been assigned a specific purpose by the SONET standards.

`rd` Where "xxxx" indicates the 4-digit hexadecimal Routing Domain field value of the local NE's NSAP. This field is user provisionable. However, until the standard use of this field is defined, this parameter should not be provisioned to a value other than its default value.

`area` Where "xxxx" indicates the 4-digit hexadecimal Routing Area field value of the local NE's NSAP. It is used to identify NEs in the same area. Where multiple areas are defined, IS-IS Level-2 Routing needs to be enabled to allow addressing across areas. This field is user provisionable.

`sys` Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal System Id field value of the local NE's NSAP. This part of the NSAP address is assigned by IEEE administrators to U.S.-manufactured systems to guarantee a globally-unique NSAP.

sel Where "xx" indicates the 2-digit hexadecimal Selector Id field value of the local NE's NSAP. This part of the NSAP address is used to differentiate multiple NSAP addresses within a system. The value of this field is not fixed, but is set in a PDU according to its usage; it is set to "AF" in hex when TARP is run over CLNP. IT has a value of "1D" in hex when TP4 is run over CLNP. IT may be set to "00" in hex for other uses. When retrieved and displayed, it will always be shown as "00" in hex.

lv2is This parameter indicates if the local NE is enabled as an IS-IS Level2 Router. Possible values are either e for enable or d for disable.

RELATED COMMANDS

dlt-ulsdcc-l4

ent-ulsdcc-l3

ent-ulsdcc-l4

NAME

rtrv-ulsdcc-l4: Retrieve Upper Layer Section DCC - Layer 4

INPUT FORMAT

rtrv-ulsdcc-l4[:**tdc_rpt=***tdc_rpt*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **rtrv-ulsdcc-l4** command in OC-3 Release 13.0 and all later TARP releases.

This command is used to retrieve the parameters in Layer 4 of the OSI stack, many of which are provisioned by the **ent-ulsdcc-l4** command. Layer 4 parameters include the TARP timers and TARP Data Cache provisioned parameters and the TARP Manual Adjacencies. the TARP TARP Data Cache information may be retrieved if its retrieval is enabled through the *tdc_rpt* parameter. The input parameter is:

`tdc_rpt` TARP Data Cache reporting; This parameter enables the retrieval of TARP Data Cache. Specifying this parameter will result in the TID, the NSAP address and the protocol address type to be retrieved and output for every entry in the TARP Data Cache for local NE.

This is an optional parameter and it can have the value of either *yes* or *no*. If a value of NULL (no value) is enetered, a value of *no* is assumed and the TARP Data Cache is not retrieved. The default value of this parameter is *no*.

After entering this command, the output report appears as follows:

```
/* Upper Layer Section DCC Provisioning Report
==================================================================
==================================================================
L4TM data:
 L4tlif  L4t1tm L4t2tm  L4t3tm  L4t4tm L4lftm
 xxxx    xxxx   xxxx    xxxx    xxxx   xxxx
------------------------------------------------------------------
L4AJ NSAP data:
 idp    dfi org    res  rd  area  sys          sel
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx

L4TDC data: L4etdc=enable
 L4tdctid=LT-DDM-2000
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2001
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2002
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2003
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
  .
  .
  .
  .
  .
  .
  .
  .
*/
```

The output parameters are:

`L4TM data` This is only a string and under this string, the following parameters are identified:

`L4tlif` This parameter reports on the TARP lifetime parameter in TARP PDUs originated by the local NE. The TARP lifetime specifies the maximum number of hops allowed for a TARP PDU. When this number of hops is exceeded, the TARP PDU will not be forwarded. This parameter may have a value in the range from 1 to 65535. The default value for this parameter is 100.

`L4t1tm` This parameter indicates the TARP Timer T1. T1 is the maximum time waiting for response to TARP Type 1 request PDU (search level 1 routing area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 15 seconds.

`L4t2tm` This parameter indicates the TARP Timer T2. T2 is the maximum time waiting for response to TARP Type 2 request PDU (search outside of level 1 area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 25 seconds.

`L4t3tm` This parameter indicates the TARP Timer T3. T3 is the maximum time waiting for response to Address resolution request (type 5, example: requesting the TID when the NSAP address is known). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 40 seconds.

`L4t4tm` This parameter indicates the TARP Timer T4. T4 starts when T2 expires. It is used for error recovery. This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 20 seconds.

`L4lftm` This parameter indicates the TARP Loop Detection Buffer Flush Timer. It sets the time period for flushing the TARP Loop Detection Buffer. This parameter may have a value in the range from 1 to 1440 minutes. Its default value is 5 minutes.

`L4AJ NSAP` This header indicates that what follows is the 20-byte (40-digit hex) NSAP address of an entry in the TARP Manually Adjacent NE list. A maximum of two Manually Adjacent NEs can be assigned to an NE.

ajidp Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the Manually Adjacent NE.

ajdfi Where "xx" indicates the 2-digit hexadecimal DFI field value of the Manually Adjacent NE.

ajorg Where "xxxxxx" indicates the 6-digit hexadecimal Organization field value of the Manually Adjacent NE.

ajres Where "xxxx" indicates the 4-digit hexadecimal Reserved field value of the Manually Adjacent NE.

ajrd Where "xxxx" indicates the 4-digit hexadecimal Routing Domain field value of the Manually Adjacent NE.

ajarea Where "xxxx" indicates the 4-digit hexadecimal Area field value of the Manually Adjacent NE.

ajsys Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal System ID field value of the Manually Adjacent NE.

ajsel Where "xx" indicates the 2-digit hexadecimal Selector field value of the Manually Adjacent NE, which is currently reported as "00".

`L4TDC data` This is only a string and under this string, the following parameters are identified:

L4etdc This parameter is used to Enable or Disable the TARP Data Cache. Possible values are either **enable** or **disable**. The default value is **enable**.

L4tdctid

This parameter indicates the Target Identifier (TID) portion of entry in the TARP Data Cache (TDC). This parameter has a maximum of 20 characters and it has no default value.

tdcidp Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the NE that was manually entered into the TDC.

`tdcdfi` Where "xx" indicates the 2-digit hexadecimal DFI field value of the NE that was manually entered into the TDC.

`tdcorg` Where "xxxxxx" indicates the 6-digit hexadecimal NSAP's Organization Id field value of the NE that was manually entered into the TARP Data Cache. It specifies the allocated Network Services Provider Code assigned by the ANSI-administered USA Registration Authority for OSI Organization Names. The default value for this parameter is "000000" hex.

`tdcres` Where "xxxx" indicates the 4-digit hexadecimal NSAP's Reserved field value of the NE that was manually entered into the TARP Data Cache. This is a two byte (4-digit hex) NSAP Reserved field of the NE that is to be manually entered into the TDC. The default value for this parameter is the NSAP's Reserved field of local NE.

`tdcrd` Where "xxxx" indicates the 4-digit hexadecimal NSAP's Routing Domain field value of the NE that was manually entered into the TARP Data Cache. This is a 2 byte (4-digit hex) NSAP Routing Domain field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Routing Domain field of local NE.

`tdcarea` Where "xxxx" indicates the 4-digit hexadecimal NSAP's Routing Area field value of the NE that was manually entered into the TARP Data Cache. It identifies the Area within the Routing Domain to which the NSAP address belongs. This is a 2 byte (4-digit hex) NSAP Area field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Area field of local NE.

`tdcsys` Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal NSAP's System Id field value of the NE that was manually entered into the TARP Data Cache.

The default value for this parameter is the value of the System Identifier Area field of the local NE.

`tdcsel` Where "xx" indicates the 2-digit hexadecimal NSAP’s Selector Id field value of the NE that was manually entered into the TARP Data Cache. This parameter is currently being reported as "00".

RELATED COMMANDS

ent-ulsdcc-l4

ent-ulsdcc-l3

dlt-ulsdcc-l3

dlt-ulsdcc-l4

NAME

rtrv-vt1: Retrieve VT1.5

INPUT FORMAT

`rtrv-vt1`[:*`Address`*];

DESCRIPTION

This command retrieves two types of provisioned parameters for VT1.5 channels. The parameter types are:

- Signal degrade alarm threshold
- Alarm level for sa/nsa VT1.5 path AIS condition

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address is the address of VT1.5 channels whose state is to be reported. The default is **`all`** addresses. Other valid ring and linear addresses are:
`m-{1-3,all}-{1-7,all}-{1-4,all},`
`c-{1-3,all}-{1-7,all}-{1-4,all},`
`{a,b}-{1-2,all}-{1-7,all}-{1-4,all}, all`

Valid EC-1 Addresses: **`{a,b,c}-{1-7,all}-{1-4,all}, all`**

Valid 27-type OLIU Addresses:
`{m,a,b,c}-{1,2,all}-{1-7,all}-{1-4,all}, all`

Valid 26G2-U OLIU Addresses:
`{a,b,c}-1-{1-7,all}-{1-4,all}, all`

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIUs in its Main unit slots, the valid Main unit addresses are:
`m-{1-12,all}-{1-7,all}-{1-4,all}`

Only VT1.5 channels that are cross-connected will appear in the output report.

The output report appears as follows:

```
/* VT1.5 Channel Provisioning Report
=============================================================
SignalDegrade = value

VT AIS Alarm Information
Address      AIS Alarm            AIS Alarm
           Service Affecting  Non Service Affecting
=============================================================
address         sa                nsa
address         sa                nsa
  .             .                  .
  .             .                  .
  .             .                  .
*/
```

For Release 9.1 and later, a signal degrade value of zero (0) cannot be provisioned and thus will not appear in the report.

If the signal degrade parameter and non-service affecting AIS parameters are not valid for the application, for example a non-ring application, then the report appears as follows:

```
/* VT1.5 Channel Provisioning Report
=============================================================
Address      AIS Alarm
           Service Affecting
=============================================================
address         sa
address         sa
  .             .
  .             .
  .             .
*/
```

The output parameters are:

`SignalDegrade`	This is the signal degrade threshold value.
`address`	This is the VT1.5 address of the provisioned channel.
`AIS Alarm`	One or more columns of information will show the AIS alarm values for service affecting (SA) and non-service affecting (NSA) alarms. SA alarms may have one of the following values:

`mj` Major alarm (default for ring channels)

`mn` Minor alarm (non-ring channels only, default)

`na` Not alarmed, but reported

`nr` not alarmed and not reported (non-ring channels only)

NSA alarms may have one of the following values:

`mn` Minor alarm (default)

`nr` not alarmed and not reported

RELATED COMMANDS

set-vt1

NAME

rtrv-x25: Retrieve X.25 link

INPUT FORMAT

`rtrv-x25;`

DESCRIPTION

Three output reports are displayed when this command is entered. The first report displays the X.25 link packet size information provisioned by the **`set-x25`** command, and the second report shows the status of the X.25 communication. The third report provides an X.25 event history.

The X.25 link packet size output report appears as follows:

```
/* X.25 Link Provisioning Report
===========================================================
TID=system_name
GNE=x

------------------------------------------------------------
PKT=pkt
*/
```

The output parameters are:

`TID` This is the system name, indicated by a string of up to 20 alphanumeric characters. The default value for `TID` is that set by the site and NE values and is a string of the form `"SitemNEn"`. The `TID` must be unique for each element in a subnetwork.

`GNE` This parameter indicates whether this system is a gateway network element (GNE), providing a TL1 interface. It has a value of `active` or `not active`. a new value is added to this parameter; `limited`.

A Network Element is considered an "active" GNE if there is an active exchange between the OS and the DDM-2000 NE on the synchronous X.25 port. Once this exchange stops (i.e: the X.25 cable is unplugged off the DDM-2000 X.25 port), the GNE is set to "not active".

A Network Element is considered a "limited" GNE if it is not an "active" GNE and any of the following is/are true:

- CIT-1 is provisioned with porttype of tl1
- CIT-2 is provisioned with porttype of tl1
- X.25 port is provisioned with porttype of asynch.

If neither is true, the Network Element is considered to be a "not active" GNE.

`PKT` `Pkt` is a string with possible values of 128 or 256 (default value). The X.25 packet size is active only if this system is a GNE, otherwise it is inactive.

The second report shows the state of various X.25 communication entities. The output report appears as follows:

```
/* X.25 Communication Report
=====================================================================
Entity                 State    DTE Calling Address    Code (hex)
=====================================================================
X.25 lcn  1 (pvc)      up                              06
X.25 lcn  2 (pvc)      up                              06
X.25 lcn  3 (pvc)      up                              06
X.25 lcn 16 (svc)      up       5086901234             06
X.25 lcn 17 (svc)      down                            00
X.25 lcn 18 (svc)      down                            00
X.25 lcn 19 (svc)      down                            00
X.25 lcn 20 (svc)      down                            00
X.25 lcn 21 (svc)      down                            00
X.25 interface         down                            01
lapb                   down                            00
physical line          down                            00
*/
```

The output parameters for this report are:

`Entity` This column shows the various X.25 communication entities. The entities are:

`X.25 lcn 1 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 2 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 3 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 16 (svc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the CALL_REQ_IND packet with a CALL_ACC_CONN packet. This does *not* imply that TL1 communication is active.

`X.25 interface`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESTART_PACKET packet and the RESTART_CONFRM packet. This means that layer 3 is active and ready to establish the pvc or svc communication channel.

`lapb` When this communication channel is **up**, layer 2 is active and ready to send or receive a RESTART_PACKET.

`physical line`
This X.25 physical line is up only if the `lapb` is up. A **down** physical line does not necessarily mean that the physical connection (for example, a cable) is broken but that the interfacing equipment does not acknowledge the communication with the DDM-2000.

`State` This parameter is explained in each one of the above entities.

`DTE Calling Address`
SVCs are defined by their X.25 DTE Calling Address. The allowed values for this parameter are defined as 1 to 15 Binary Coded Decimal (BCD) digits. Furthermore, this parameter would only be displayed when the SVC `State` is **up** and would not be shown when the SVC `State` is **down** or if the X.25 Communication `Entity` is a PVC, X.25 interface, `lapb`, or a physical line. (no default value)

`Code (hex)` This column shows a hexadecimal output of the protocol states in the DDM-2000 software. This is used by technicians for diagnostic purposes.

A third output report lists an X.25 event history. The output report appears as follows:

```
/* X.25 Event History
=================================================================
Date    Time       Entity   Event                  Data (hex)
=================================================================
01-01  00:18:48    lcn 16   xmt   CLR_CONFRM       10 10 17
01-01  00:18:47    lcn 16   rcv   CLR_REQ_IND      10 10 13 00 00
01-01  00:18:03    lcn 16   xmt   CALL_ACC_CONN    10 10 0f
01-01  00:00:21    lcn  2   rcv   RESET_CONFRM     10 03 1f
01-01  00:00:21    lcn  3   rcv   RESET_CONFRM     10 03 1f
01-01  00:00:21    lcn  1   xmt   RESET_REQ_IND    10 01 1b 00 00
01-01  00:00:21    lcn  2   xmt   RESET_REQ_IND    10 02 1b 00 00
*/
```

The output parameters for this report are:

`Date` This column shows the date the X.25 event occurred.

`Time` This column shows the time the X.25 event occurred.

`Entity` This column shows the X.25 communication entity where the event occurred.

`Event` This column lists the event and whether it was transmitted (**`xmt`**) or received (**`rcv`**) by the DDM-2000.

`Data` This column shows a hexadecimal representation of frame or packet information related to the event. This is used by RTAC personnel for diagnostic purposes.

RELATED COMMANDS

set-x25

NAME

set-attr-alm: Set Alarm Attribute

INPUT FORMAT

set-attr-alm[:**almdel=***AlarmDelay*][**,clrdel=***ClearDelay*][**,pmn=***PMN*];

DESCRIPTION

This command sets the alarm holdoff and clear delays.

The input parameters are:

almdel AlarmDelay is the delay for incoming signal and equipment failures. It sets an interval of time that a fault condition is present before an alarm is declared. The delay is in seconds, between 0 and 30, with a default value of 2.

> **NOTE:**
> If a signal degrade threshold is exceeded, the recovery interval for the signal degrade condition may be longer than the provisioned holdoff delay, and an alarm will result. For example, suppose an OC-3 interface with an alarm delay of 20 seconds and a signal degrade threshold of 10^{-6} has a signal degrade failure of 10 seconds. Since the recovery interval for a 10^{-6} error rate threshold is 15 seconds, the total length of the alarm condition (10 seconds of failure plus 15 seconds of recovery) will exceed the provisioned alarm delay of 20 seconds, and an alarm will be declared.

clrdel ClearDelay is the delay in time before an alarm can be declared to be clear. For equipment failures and signal failures (including AIS and FERF), the clear delay time interval begins when the alarm failure clears. For equipment failures, the delay is between 0 and 30 seconds, with a default value of 15 seconds. For signal failures, clear delay is fixed at 15 seconds.

pmn PMN is the Power Minor alarm level, which can be either minor (**MN**) or major (**MJ**). The default is Minor.

When input, this command will cause the following confirmation message to be displayed:

```
/* Caution! Alarm or maint. thresholds are affected by this command.
   You have selected the set-attr-alm command with these parameters:

   AlarmDelay = nn
   ClearDelay = nn */
   PMN = nn */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-attr-alm

NAME

set-attr-cont: Set Attribute Control

INPUT FORMAT

set-attr-cont:*Address*:**desc=***Description*;

DESCRIPTION

This command is used to provision (define) the name of the environmental control points.

The input parameters are:

Address — Address identifies the control point to be provisioned. There is no default for this parameter.

Valid Addresses: **cont-{1-4}**

desc — Description is a descriptive name for the control point. The description may be an alphanumeric string, upper- and lower-case with no spaces, up to 26 characters long. Symbolic characters may be included in the descriptive name of the control point.

The following symbolic characters have special meanings either for the CIT interface or for the X.25 TL1 interface and cannot be included in the description:

;	semicolon	?	question mark
@	at sign		space
\	back slash	!	exclamation point
:	colon	=	equal sign
"	double quote	,	comma

All control characters and special keys cannot be included in the description.

NOTE:
This command will be denied if entered in a system whose CO/RT parameter is set to CO (via the **`set-ne`** command). The following denial message will be displayed:

```
ENSI
/* Equipage, Not equipped for Setting specified Information */
/* Environmental controls can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

NAME

set-attr-env: Set Attribute Environment

INPUT FORMAT

set-attr-env:*Address*[:**alm=***Alarm*][,**almtype=***AlarmType*][,**desc=***Description*];

DESCRIPTION

This command is used to provision (set) the alarm level of the environmental input points. Active inputs appear as entries in the alarm and history reports of the local network element (NE) and generate autonomous TL1 messages through the gateway network element (GNE).

The input parameters are:

Address Address identifies the environmental point to be provisioned. There is no default value for this parameter.

Valid Addresses: **env-{1-21}**, **env-{all}**

NOTE:
The address **env-{all}** is allowed only when **alm** is the only parameter used for this command. The address **env-{all}** is not allowed when the **almtype** and/or **desc** parameters are used.

alm Alarm is the provisioned alarm level of the environmental input and has the following values:

cr Critical alarm

mj Major alarm

mn Minor alarm (default)

na Not alarmed, but reported.

almtype AlarmType. This parameter is used to classify the type of alarm. The description may be an alphanumeric string, upper- and lowercase with no spaces, up to 10 characters long. The original value of AlarmType is "Misc."

desc Description is a descriptive name for the point. The description may be an alphanumeric string, upper- and lowercase with no spaces, up to 26 characters long.

The following symbolic characters have special meanings either for the CIT interface or for the X.25/TL1 interface and cannot be included in the description:

;	semicolon	?	question mark
@	at sign		space
\	back slash	!	exclamation point
:	colon	=	equal sign
"	double quote	,	comma

All control characters and special keys cannot be included in the description.

NOTE:
This command will be denied if entered in a system that has the lO/RT parameter is set to CO (via the **set-ne** command). The following denial message will be displayed:

```
ENSI

/* Equipage, Not equipped for Setting specified Information */
/* Environmental alarms can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

rtrv-attr-env

rtrv-ne

set-attr-cont

NAME

set-date: Set Date and Time

INPUT FORMAT

set-date:[**date=***Date*][,**time=***Time*];

DESCRIPTION

This command sets the date and time. Executing this command will corrupt the current quarter hour and day performance-monitoring (PM) bins.

CAUTION:
If an **apply** *command is scheduled for execution (action=***install***), the* **set-date** *command should NOT be issued before program installation is invoked and completed. The user is advised to wait until program installation is completed and the system is reset.*

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE:
In both linear and ring applications, if the automatic recovery fails, both date and time are set to default (**70-01-01** for date and **00:00:00** for time).

The input parameters are:

date Date is entered as six digits YYMMDD, where YY is the last two digits of the year, MM is the month, and DD is the day. Default is the current system day.

time Time is entered as six digits HHMMSS, where HH is hours (00-23), MM is minutes (00-59), and SS is seconds (00-59). Default is the current system time.

When input, this command will cause the following confirmation message to be displayed:

```
/* Caution!  Execution of this command will corrupt the
   current quarterhour and current day performance monitoring
   data.  You have selected the set-date command with these
   parameters:

   Date = YYMMDD
   Time = HHMMSS */

Execute?  (y/n or CANcel/DELete to quit) =
```

If a user does not have the valid permissions for the **`set-date`** command, the following denial message will be displayed:

```
M set-date:  DENY
   PICC
/* Privilege, Illegal Command Code */
/* You are not authorized to execute this command  /*
```

RELATED COMMANDS

`apply`

NAME

set-ec1: Set EC-1

INPUT FORMAT

set-ec1:*Address*:[**alm=***AlarmLevel*][**,dgr=***SignalDegradeThreshold*];

DESCRIPTION

This sets the characteristics of an EC-1 port.

The input parameters are:

address Address is the address of one or more EC-1 ports. For OC-12, the alarm and signal degrade thresholds are set for all three ports.

Valid Addresses: **{a,b,c,all}**

alm AlarmLevel describes the alarm level for an incoming EC-1 signal failure, and has the following values:

- **cr** Critical alarm (default value)
- **mj** Major alarm
- **mn** Minor alarm
- **na** Not alarmed

dgr SignalDegradeThreshold specifies the bit error rate (BER) threshold for the EC-1 port in terms of a logarithm to the base 10 as an integer with values from -9 to -5, with a default of -6. When this threshold is crossed, an alarm will be raised and automatic protection switching of the service line will be initiated.

Entering this command will cause the following confirmation message to be displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the set-ec1 command with these parameters:
   Address = address
   AlarmLevel = alarmlevel
   SignalDegrade= signaldegradethreshold */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-ec1

NAME

set-feat: Set Feature

INPUT FORMAT

`set-feat`:**`feat=`***`Feature`*,**`act=`***`Action`*;

DESCRIPTION

This command enables a user to configure the network element for feature options that are licensed for use.

NOTE:
This command is available to privileged users only.

The input parameters are:

`feat` Feature is the feature option available to the user, and it may have one of the following values:

- `sts3c` This feature allows STS-3c service (concatenated signals) to be supported. The 21-type OLIU circuit packs must be in the Main and FN-C slots to support this feature.
- `vtpm` This feature provides performance-monitoring of cross-connected VT1.5 services.
- `ds1pm` This feature provides performance-monitoring of cross-connected (dropped) DS1 services in ring systems.

`act` Action is the action the user wants to perform on the listed feature, and it may have one of the following values:

- `enabled` This enables a feature option. This action will also unblock the use of commands needed by this feature.
- `disabled` This disables a feature option. This action will also block the use of commands needed by this feature. The user may be required to reprovision the shelf before disabling a feature.

If a user fails to remove all equipment or reprovision parameters associated with a feature before disabling that feature, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* System must be reprovisioned to disable <Feature>. */
```

If this command is entered and no TGS (timing) packs are equipped, there is no place to store a backup copy of the feature options. Thus, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* No change in provisioning - both timing slots are unequipped */
```

This case is not applicable to the "banner" feature" Enabling a feature will cause the following confirmation message to be displayed:

```
/* ACCESS TO, AND USE OF THIS <feature> FEATURE IS PERMITTED
   ONLY IF SPECIFICALLY AND EXPRESSLY AUTHORIZED UNDER THE
   RELEVANT DDM-2000 SOFTWARE AGREEMENT BETWEEN
   LUCENT TECHNOLOGIES AND CUSTOMER.

   You have selected the set-feat command with the parameters:
   Feature = feature
   Action = action  */

Execute? (y/n or CANcel/DELete to quit) =
```

In the MegaStar 2000 SONET Subsystem, enabling a feature will cause the following confirmation message to be displayed:

```
/* Access to, and use of this feature is permitted only
   if specifically and expressly authorized under the relevant
   MegaStar 2000 software agreement between AT&T and/or HARRIS
   CORPORATION and customer.

   You have selected the set-feat command with the parameters:
   Feature = feature
   Action = action  */

Execute? (y/n or CANcel/DELete to quit) =
```

Disabling a feature will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command will disable all of the
   system capabilities associated with the <feature> feature
   and circuit packs which support that feature will no longer
   provide access to that feature.

   You have selected the set-feat command with these parameters:
   Feature = feature
   Action = action  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-feat

NAME

set-fecom: Set Far-End Communications

INPUT FORMAT

set-fecom:*Address*[:**com=***Communications*][,**nsus=***NS/US*]
[,**lanreset=***lanreset*];

DESCRIPTION

This command enables or disables communication over the section data communication channels (DCC) or IAO LAN. A DCC is an embedded overhead communications channel in the SONET line used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between network elements (NEs).

NOTE:
This command is available to privileged users only.

Starting with Release 13.0, this command will complete successfully if it is executed during a remote login session.

The input parameters are:

Address Address identifies the address of the DCC or IAO LAN.

Valid Linear DCC Addresses: **dcc-{m,a,b,c,all}**
These addresses also apply to OC-3 R15.0 and later ring releases when the main ring interface is provisioned for the "identical" DCC mode.

Valid Ring DCC Addresses: **dcc-{m1,m2,a,b,c,all}**

Valid OC-1 DCC Addresses (for 27-type OLIU): **dcc-all, dcc-{m,a,b,c}{1,2}-{1,2}**

Valid IAO LAN Address: **lan** (Release 13.0 and later)

com This parameter indicates whether communication over a specified DCC or IAO LAN interface (for OC-3 Release 13.0 and later TARP releases) is enabled or disabled. The valid values are **enabled** or **disabled**. The default value is **enabled**.

Starting with OC-3 Release 15.0, the IAO LAN port's (address=*lan*) default value for *com* is **disabled**.

Communication must be enabled/disabled per DCC-all, specific DCC, or IAO LAN. or specific DCC. As an example, at some point, communication over some DCC channels and the IAO LAN might have to be enabled at the same time. In order to enable communication over both a DCC channel and IAO LAN interface, this command will have to be executed twice; once to enable communication over a DCC, and the other time to enable communication over the IAO LAN interface.

nsus NetworkSide/UserSide (NS/US) is the identification of the DCC identity for the NE. Each DCC on the NE must define its NS/US identity in the OSI network. When the NS/US parameter is the same at both ends, an alarm is active. *nsus* is not prompted for, if the parameter *Address* is set to **lan**, NetworkSide/UserSide may have the following parameter values:

ns Network Side (NS) defines this end of the DCC to be a network site. For DDM-2000 networks either termination of the DCC can be this value as long as the other termination is different. Default values are listed on the following page.

us User Side (US) defines this end of the DCC to be a user site. For DDM-2000 networks, either termination of the DCC can be this value as long as the other termination is different. Default values are listed on the following page.

The following chart shows default settings for the NS/US parameter:

Linear Appl.	**dcc-m**		**dcc-a**		**dcc-b**		**dcc-c**	
21-type/ 22-type+ 24/29-type+ OLIUs	us		ns		ns		ns	
Rings Appl.	**dcc-m1**	**dcc-m2**	**dcc-a**		**dcc-b**		**dcc-c**	
OC-3/OC-12 OLIUs	us	ns	ns		ns		ns	
Ring Appl.	dcc- **m1-1 m1-2**	dcc- **m2-1 m2-2**	dcc- **a1-1 a1-2**	dcc- **a2-1 a2-2**	dcc- **b1-1 b1-2**	dcc- **b2-1 b2-2**	dcc- **c1-1 c1-2**	dcc- **c2-1 c2-2**
27-type OLIUs	us	ns	ns	us	ns	us	ns	us
Ring Appl.			**dcc-a1-1**	**dcc-a2-1**	**dcc-b1-1**	**dcc-b2-1**	**dcc-c1-1**	**dcc-c2-1**
26G2-U OLIUs			ns	us	ns	us	ns	us

+ For OC-3 R15.0 and later ring releases this default configuration is applicable to a main ring interface when the DCC is provisioned for the "identical" mode using the set-oc3 or set-oc12 command. The 24/29-type OLIU is only applicable to the ring interface.

`lanreset` This paramater is available with OC-3 Release 13.0 and later TARP releases. This parameter is prompted for, only if *`Address`* is set to **`lan`**; it can only have the value of either "y" or "n", with a default value of "n".

If this parameter is set to "y", this will cause the resetting of the Network Element's LAN interface.

CAUTION:
Resetting an IAO LAN interface will disrupt the transactions that are in progress (for example, transmitting or receiving over LAN).

When this command is input, the following confirmation message will be displayed:

```
 /* Caution!  Network element access is affected by this command.
    You have selected the set-fecom command with these parameters:

    Address = address
    Communications = enabled
    NS/US = value */

Execute? (y/n or CANcel/DELete to quit) =
```

If the **nsus** parameter is changed, no NE reset will be caused and the following confirmation message will be displayed:

```
/* Caution!  Network Element access is affected by this command.
   You have selected the set-fecom command with these parameters:

   Address = address
   Communications = enabled
   NS/US = value */
```

If *Address* is set to **lan**, the following confirmation message will be displayed:

```
 /* Caution!  Network element access is affected by this command.
    Resetting an IAO LAN interface will disrupt the transactions
    that are in progress (i.e: transmitting or receiving over LAN).

    You have selected the set-fecom command with these parameters:

    Address = lan
    Communications = value
    LanReset = value */

Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, if *`Address`* is set to **`lan`**, the following **warning** will be displayed, followed by the Caution message:

```
 /* WARNING - Completing this command without provisioning the
    appropriate NSAP address might cause routing traffic to the
    wrong address(es).

    Caution!  Network element access is affected by this command.
    Resetting an IAO LAN interface will disrupt the transactions
    that are in progress (i.e: transmitting or receiving over LAN).

    You have selected the set-fecom command with these parameters:

    Address = lan
    Communications = value
    LanReset = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-fecom

rtrv-map-neighbor

rtrv-map-network

NAME

set-lan: Set the IMA LAN internal parameters

INPUT FORMAT

set-lan:*Address*:**grpid=***imagroupid*,**aal5=***aal5fmt*,
vpi=*virtualpathid*,**vci=***virtualchannelid*,**scrambler=***atmscrambler*,
polynom=*atmpolynomial*,**length=***framelength*,**fcs=***framecheckseq*,
alm=*alarmlevel*,**pmmd=***pmmode*;

DESCRIPTION

This command is available starting with OC-3 Release 15.0, and it is applicable only to the IMA LAN (BBF9 or BBF10) circuit pack.

This command controls the settings of the IMA LAN internal parameters.

The input parameters for this command are:

Address Address of the Low Speed slot(s) equipped with the IMA LAN pack

Valid Addresses: **{a,b,c}-{1-7,all}**

NOTE:
Since that the IMA LAN pack occupies **two consecutive** Low Speed slots, following guidelines should be used:

The IMA LAN pack address can be derived from either slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the address used in this case can be either *a-1* or *a-2*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed address combinations:
{a,b,c}-{3 and 4} is allowed
{a,b,c}-{6 and 7} is allowed.

grpid IMA Group Identifier. This is an integer value used to identify an IMA Group of 1 to 8 DS1s. This integer ranges between **0** and **255**. **0** is the default value.

NOTE:
The value of *grpid* cannot be changed unless the IMA LAN link is down.

aal5 ATM Adaptation Layer 5. This is a method of encapsulating or adapting LAN packets in ATM format. This parameter can have one of the following values:

llc	Default value
vcmux	

vpi ATM Virtual Path Identifier. This parameter is used to assign an ATM virtual path identifier to the ATM cells in the IMA group for transmission of LAN packets. This is an 8-bit integer of range **0-255**. Default value is **0**.

vci Virtual Channel Identifier. This parameter is used to assign an ATM virtual channel identifier to the ATM cells in the IMA group for transmission of LAN packets. This is a 16-bit integer value of range **0 - 65535**. Default value is **0**.

length IMA Frame Length. This is a set of integers with multiple values: **32**, **64**, **128** (default), or **256**. The Frame Length is measured in number of ATM cells.

NOTE:
The value of *length* cannot be changed unless the IMA LAN link is down.

scrambler
ATM Scrambler. This parameter can have either one of two values:

on	ATM scrambler is ON (default).
off	ATM scrambler is OFF.

polynom ATM Polynomial. This parameter is used to activate/disactivate the checksum for header error check on the ATM cells. This parameter can have either one of the following two values:

on	ATM polynomial is ON
off	ATM polynomial is OFF (default).

fcs Frame Check Sequence Preservation Disable. This parameter is used to enable/disable the preservation of the frame check sequence (FCS) contained in MAC frames sent to the BBF9 or BBF10 circuit pack from the LAN interface. When frame check sequence preservation is disabled, the FCS bytes are stripped from the MAC frame prior to conversion to ATM cell format for transmission over the IMA LAN connection. In the opposite direction the FCS is recalculated and added back to the MAC frame before forewarding to the LAN interface. Default value is **enable**.

alm Alarm Level. This parameter sets the alarm level for an incoming DS1 Signal Failure and may be one of the following:

mj	Major Alarm
mn	Minor Alarm
na	No Alarm (default value)

pmmd This parameter sets the performance monitoring mode for the IMA LAN circuit pack. **Pmmd** is only used for performance-monitoring. Setting this parameter does not affect the transmitted or received signal. This parameter may be one of the following values:

off	PM turned off (default value)
on	PM turned on.

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command will affect the settings of
   the addressed IMA LAN circuit pack, and will affect service on
   the IMA LAN link.
   You have selected the set-lan command with these parameters:

   Address = x
   imagroupid = x
   aal5fmt = x
   virtualpathid = x
   virtualchannelid = x
   framelength = x */
   atmscrambler = x
   atmpolynomial = x
   framecheckseq = x
   alarmlevel = x
   pmmode = x

Execute? (y/n or CANcel/DELete to quit) =
```

Execution of this command will cause an IMA group resynch, and as a result will affect service on the IMA LAN link.

This command may only be executed if the shelf is equipped with IMA LAN circuit packs in the addressed Low Speed slots, otherwise the following denial message is displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* Specified AID slot(s) are not equipped with proper hardware. */
```

The value of *grpid* and/or *length* cannot be changed unless the IMA LAN link is down (no active cross-connects). If the user attempts to change the value of *grpid* and/or *length* while the IMA LAN link is active, the command will complete with either or both of the following messages displayed:

```
/* IMA Group Id (imagrpid) was not changed. */
/* IMA Frame Length (framelength) was not changed. */
```

RELATED COMMANDS

rtrv-lan

rtrv-pm-lan

NAME

set-lgn: Set Login

INPUT FORMAT

`set-lgn[:act=`*Action*`];`

DESCRIPTION

This command enters, edits, and deletes logins and passwords. Prior to the first use of this command, the 3 default logins are `LUC01`, `LUC02`, and `LUC03`. The default password is `DDM-2000`.

NOTE 1:
Some situations (for example, a software upgrade or a new circuit pack installation) may cause the default login to change. Users who may no longer gain system access with the `ATT`*XX* login should try `LUC`*XX*.

NOTE 2:
This command is available to privileged users only.

NOTE 3:
To enable security, a privileged user must execute the **`set-secu`** command. Creating logins and passwords does *not* automatically enable security.

A maximum of 100 (general, maintenance and reports-only user) logins is supported. When security is enabled, the following four types of users are permitted to access the system with a valid login and password:

`privileged user`	The privileged user may execute any commands, including restricted commands.
`general user`	The general user may execute any commands that are not restricted to privileged users.
`maintenance`	The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. No privileged commands are allowed to be executed by maintenance users.
`reports-only`	The reports-only user may only execute commands that access the system and extract reports.

All users may use the **`set-passwd`** command to modify their own passwords.

The input parameters are:

act Action has one of the following values:

enter Enter a new login and password pair (default value). Login is a case-sensitive alphanumeric string consisting of a minimum of five and a maximum of ten alphabetic characters and/or numbers. When entering a new login, the type of user (`privileged user`, `general user`, `maintenance` or `reports-only`) must be specified and a password should also be assigned to the new user. A user may then use the **set-passwd** command to modify his/her own password after the login has been activated.

Password is a case-sensitive string of alphanumeric and symbolic characters. Password may have a minimum of six and a maximum of ten characters. Additionally, the password must include at least two numeric characters and one symbolic (non-alphabetic and non-numeric) character. The following symbolic characters have special meanings either for the User Interface or for the X.25 TL1 interface and cannot be included in a password:

;	semicolon		space
@	at sign	*?*	question mark
\	back slash	*!*	exclamation point
:	colon	=	equal sign
"	double quote	*,*	comma

Additionally, the following control characters and special keys CANNOT be included in a password:

<CR>	carriage return	*<tab>*	tab key
<bksp>	backspace key	*<esc>*	escape key
<del>	delete key		

edit Change an existing login and/or password

delete Delete an existing login.

The **set-lgn** command executes in prompt mode. Based on the action selected, there are three different dialogs shown on the following pages. In these dialogs, the user input is indicated with bold type.

The following screen shows the dialog to enter a login:

```
set-lgn:act=enter;
enter the new login = new_login
enter password for new login = new_password
reenter password for new login = new_password
enter user type for this login = user_type

/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = enter
   Login = new_login
   User Type = user_type */

Execute? (y/n or CANcel/DELete to quit) =
;
```

NOTE:
Passwords will not be displayed when they are entered.

The following screen shows the dialog to edit a login:

```
set-lgn:act=edit;
enter the login to be changed = old_login
enter the new login = new_login
enter password for new login = new_password
reenter password for new login = new_password
enter user type for this login = user_type

/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = edit
   Old Login = old_login
   New Login = new_login
   Old User Type = user_type
   New User Type = user_type  */

Execute? (y/n or CANcel/DELete to quit) =
;
```

The following screen shows the dialog to delete a login:

```
set-lgn:act=delete;
enter the login to be deleted = user_login
/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = delete
   Login = user_login  */

Execute? (y/n or CANcel/DELete to quit) =
;
```

If the login value does not match the valid login definition (syntactically incorrect), the following message will appear:

```
/* Entry does not follow rules for logins. */
/* Logins must be 5 to 10 alphabetic characters and/or numbers;
   characters allowed are A..Z, a..z and/or 0..9 */
```

The user may try once again to enter a login. If the user enters a login that does not match the valid login definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

If the entered password value does not match the valid password definition (syntactically incorrect), the following message will appear:

```
/* Entry does not follow rules for passwords. */
/* Passwords must be 6 to 10 characters, with at least 2
   non alphabetic characters and additionally, at least 1
   symbolic Characters allowed are:  A..Z or a..z, 0..9,
   all symbolic characters, EXCEPT the following:

     ;   semicolon        ?   question mark
     @   at sign              space
     :   colon            =   equal sign
     "   double quote     ,   comma
     \   back slash       !   exclamation point

*/
```

The user may try once again to enter a password. If the user enters a password that does not match the valid password definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

Privileged user logins can be edited to change the login name, password, or both. However, privileged logins cannot be deleted. If an attempt is made to delete a privileged user login, the following denial message will be displayed:

```
SDNC
/* Status, Data Not Consistent */
/* Privileged user logins cannot be deleted. */
```

If an attempt is made to add a privileged user login, the following message will keep displaying until a valid user type (general, maintenance, or reports-only) is entered:

```
/* Not a valid response */
/* Select from: */
   1. general
   2. maintenance
   3. reports-only
enter user type for this login [general] =
```

When a user selects the `edit` or `delete` option for a login but the login entered does not exist, the following message will be displayed:

```
IIUS
/* Input, Invalid USer identifier */
/* login <value> is unknown. */
```

If a user invokes this command with **`Action`**`=enter` and the entered login matches the login definition (syntactically correct) but *also* matches an already existing valid login, the attempt will be denied and the following denial message will be displayed:

```
IIUS
/* Input, Invalid USer identifier */
/* login <value> is unknown. */
```

If a user attempts to enter another login when the maximum supported logins already exists, the following denial message will appear:

```
SLEM
/* Status, List, Exceeds Maximum */
/* Maximum number of logins already exists.
   Cannot enter another login. */
```

RELATED COMMANDS

rtrv-lgn

set-passwd

set-secu

NAME

set-link: Set CIT Link Configuration

INPUT FORMAT

`set-link:pg=`*`pagelength`*;

DESCRIPTION

This command sets the configuration of the current user's craft interface terminal (CIT) link.

The input parameter is:

pg PageLength is the vertical size of the displayed page in lines. The value may be an integer between 3 and 150 with a default of 24. If the page length is set to zero, no pager is used and system output is sent directly to the screen. The page length is set to the default value each time a new CIT session is started.

RELATED COMMANDS

rtrv-link

NAME

set-ne: Set Network Element

INPUT FORMAT

`set-ne:tid=`*`TID`*[,**`shelf=`***`Shelf`*][,**`cort=`***`CO/RT`*]
[,**`idle=`***`IdleChannelSignal`*]; (Ring Releases)

`set-ne:tid=`*`TID`*[,**`rnestat=`***`RneStat`*]
[,**`almgrp=`***`AlarmGroup`*][,**`agne=`***`AGNE`*]
[,**`shelf=`***`Shelf`*][,**`idleChannelSignal=`***`IdleChannelSignal`*][,**`cort=`***`CO/RT`*];
(Ring Releases, OC-3 Release 15.0 and later)

DESCRIPTION

NOTE:
This command page describes the functionality of the **`set-ne`** command in OC-3 Release 13.0 and later OC-3 TARP releases.

This command sets the network element (NE) characteristics (parameters) of a DDM-2000.

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameters are:

`tid` TID is a string of up to 20 characters, and may include upper- and lowercase letters, numbers, and the following characters: "-", "+", "%", "#", ".". Prior to the first use of this command, the initial value is **`LT-DDM-2000`**. The *`TID`* will be printed at the beginning of the output for all commands. For proper operation of TL1/X.25 OS interfaces, the *`TID`* must be unique for each NE.

NOTE 1:
Changing the `TID` (system name) does not change the network address, which is determined by the NSAP but does affect proper TL1 message reporting.

NOTE 2:
It is strongly recommended to change the default TIDs of all NEs in the subnetwork at systems startup.

CAUTION:
Changing the `TID` will cause all active TL1 logins to this NE to be dropped. New TL1 logins to this NE will have to be activated using the new TID value.

`rnestat` This parameter is valid starting with OC-3 Release 15.0. Remote NE Status (feature) can have a value of `enabled` or `disabled`. If this parameter has a value of `enabled`, the user will be prompted for **`almgrp`** and **`agne`**, as well as the other parameters; otherwise the user will not be prompted for **`almgrp`** and **`agne`**.

`almgrp` This parameter is valid starting with OC-3 Release 15.0. Alarm Group (AG) has a numeric value of `1` through `255`. All NEs in the subnetwork, whether nearby or not, that have the same AG number are members of the same group. All members of the AG will share NE Status information with each other but not with NEs of different alarm Groups. The default AG number for DDM-2000 is 255 and may not have to be changed if a single AG is desired.

`agne` This parameter is valid starting with OC-3 Release 15.0. AGNE (Alarm Gateway NE) has a value of `yes` or `no`, which indicates whether this system is an alarm gateway network element. The default value for this parameter is *no*. At least one AGNE is needed for each alarm group to support the message communications for NE Status features (FE activity, office alarms, miscellaneous discretes, local ACO and FE user panel status). Any member of the alarm group can be an AGNE but some may be preferred because of their position in the subnetwork or location near a maintenance center. Other NEs of the same alarm group may be provisioned as backup AGNEs if required. At least one NE in each alarm group must be designated as an **`agne`**. Network Elements without an AGNE can raise "AGNE communication failure" alarms (If the remote NE status feature is enabled).

`shelf` Shelf is the numeric identification (1-8) of the system in a bay arrangement at a site. The Shelf parameter is used by the local CIT interface to identify which system to connect to the CIT. The default value is 1.

`idle` IdleChannelSignal determines whether or not an AIS or Unequipped signal should be inserted toward the SONET line in VT1.5 and STS-1 channels that are not cross-connected. The value may be one of the following:

`ais` STS-1 or VT1.5 AIS is inserted towards the SONET line from SONET interfaces (OLIUs and STS1Es) if the channel is not cross-connected or if a low-speed slot is not equipped but the function unit is STS-1 cross-connected.

`unequipped`

The STS-1 or VT1.5 Unequipped signal is inserted towards the SONET line from SONET interfaces (OLIUs and STS1Es) if the channel is not cross-connected or if a low-speed slot is not equipped but the function unit is STS-1 cross-connected.

NOTE:
It is recommended that the user choose the `ais` option for this parameter, since all SONET equipment is capable of detecting and performing path protection switching when receiving a VT/STS AIS signal.

`cort` The CO/RT parameter for CO (Central Office) or RT (Remote Terminal) identifies the system as having characteristics of a CO or an RT. The values for CO/RT are `co` and `rt` with `rt` as the default value. The value of CO/RT controls the operation of the miscellaneous discretes, and the external fan control.

NOTE:
When the Remote NE Status fearture is enabled; to optimize the performance of your network and simplify provisioning, it is stronly recommended that the following guidelines/rules are followed:

- If network partitioning is implemented, an Alarm Group should be restricted to a Level1 area (Multiple Alarm Groups are allowed within the same Level1 area).
- Multiple AGNEs can be defined in an Alarm Group.
- It is recommended to define a maximum of 2 AGNEs per Alarm Group.
- It is good practice to not define the same Alarm Group Id across different level1 areas.

Some of the command parameters are backed up on the TGS packs (tid, shelf, cort). Any attempt to provision any of these parameters with no TGS packs equipped will be denied with the following message:

```
SNVS
 /* Status, Not in Valid State */
 /* System must be equipped with at least one TGS circuit
    pack to provision selected parameters.  */
```

When this command is entered, the following confirmation message will be displayed:

```
/* Caution! Network Element access is affected by this command.

   You have selected the set-ne command with these parameters:

    TID = LT-DDM-2000
    IDLE = ais|unequipped
    Shelf = shelf
    idle = ais|unequipped
    CO/RT = co|rt

Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, when this command is entered and the `rnestat` feature is **`enabled`**, the following confirmation message will be displayed:

```
/* Caution! Network Element access is affected by this command.

   You have selected the set-ne command with these parameters:

    TID = LT-DDM-2000
    RneStat = enabled
    AlarmGroup = number
    AGNE = yes|no
    Shelf = shelf
    idleChannelSignal = ais|unequipped
    CO/RT = co|rt

Execute? (y/n or CANcel/DELete to quit) =
```

Changing the **`cort`** or **`shelf`** parameters will cause the network element to reset. Before these parameters are changed, the following caution message will be displayed prior to the confirmation message:

```
/* Caution!  Network Element access is affected by this command.

   Caution! When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file.
   If possible, it will reinitialize the date and time with
   the far end via the DCC.  Otherwise, the
   date and time will assume default values.
   You have selected the set-ne command with these parameters:
```

RELATED COMMANDS

reset

rlgn

rtrv-ne

rtrv-map-network

NAME

set-oc1: Set OC-1 Characteristics

INPUT FORMAT

set-oc1:*Address*[:**dgr=***SignalDegradeThreshold*]
[,**aisalm=***Alarm*];

DESCRIPTION

This command sets the characteristics (parameters) of a specified OC-1 line.

The input parameters are:

Address Address identifies the OC-1 line(s).

Valid OC-1 Addresses (for 27-type OLIUs): **all, main-all, main-{1,2}-{1,2}, fn-all, fn-{a,b,c}-{1,2}-{1,2}, fn-{a,b,c}-all**

Valid OC-1 Addresses (for 26G2-U OLIUs): **fn-all, fn-{a,b,c}-{1,2}-1, fn-{a,b,c}-all**

dgr SignalDegradeThreshold specifies the signal degrade threshold as a BER in terms of a logarithm to the base 10. When this threshold is crossed, an alarm will be raised. The value of this parameter has a range of -9 to -5. The default value is -6.

NOTE:
The signal degrade value for both addresses of each OC-1 line pair *must* be the same. Therefore, any change to signal degrade for one address will automatically be made to the other by the software.

aisalm Alarm is the provisioned alarm level of the nonservice affecting (NSA) OC-1 line AIS and has the following values:

cr Critical alarm

mj Major alarm

mn Minor alarm

na Not alarmed, but reported (default).

When input, this command will cause the following confirmation request to be displayed:

```
/* Caution! Alarm or maint. thresholds and sync messages
   are affected by this command.
   You have selected the set-oc1 command with these parameters:

   Address = x
   SignalDegradeThreshold = -n
   NonServiceAffectingAis=value

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-oc1

NAME

set-oc3: Set OC-3 Characteristics

INPUT FORMAT

set-oc3:*Address*[:**dgr=***SignalDegradeThreshold*]
[,**syncmsg=***SynchronizationMessaging*][,**aisalm=***Alarm*];

set-oc3:*Address*[:**dgr=***SignalDegradeThreshold*]
[,**syncmsg=***SynchronizationMessaging*][,**aisalm=***Alarm*,
dcc=*DccMode*][,**app=***Application*];
(OC-3 Release 15.0 and later)

DESCRIPTION

This command sets several characteristics (parameters) of a specified OC-3 line or line pair. If the address refers to an OC-3 shelf in a linear topology, the address is expressed as a line pair for Main and FN slots.

If the address refers to an OC-3 shelf in a ring topology, the address for Main is expressed as line (main-1 or main-2), and for FN slots it is expressed as a line pair.

The input parameters are:

Address Address identifies the OC-3 line(s) or line pair(s).

Valid OC-3 Linear Addresses: **main, fn-{a,b,c,all}**
Valid OC-3 Ring Addresses: **main-{1,2,all}, fn-{a,b,c,all}, all** (not valid for Release 15.0 and later)

NOTE:
If the shelf is equipped with 24-type or 29G-U (starting with OC-3 Release 15.0) OLIU circuit packs in both slots of its Main unit, the only OC-3 valid addresses will belong to function units.

dgr SignalDegradeThreshold specifies the signal degrade threshold as a BER in terms of a logarithm to the base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching of the service line will be initiated. The value of this parameter has a range of -9 to -5. The default value is -6.
For ring releases, the signal degrade value for addresses of main-1 and main-2 *must* be the same. Therefore, any change to signal degrade for one address will automatically be made to the other by the software.

syncmsg Synchronization messaging allows timing to be reconfigured in a network upon a node or fiber failure. This parameter has one of the following values:

`Kbyte` This is the default value. When this option is selected, both K2 and S1 byte sync messages are transmitted, but only K2 byte is received and interpreted for sync messaging.

`Sbyte` When this option is selected, only the S1 byte is sent and received for sync messaging. K2 byte will always send a "Don’t Use" message.

NOTE:
To minimize the amount of time that DDM-2000 is in holdover mode when upgrading a ring network from **`Kbyte`** to **`Sbyte`** messages, it is recommended that the user first upgrade the nodes farthest away from the external timing source, and then proceed to nodes closer to the timing source.

`disabled` When this option is selected, interpretation of both K2 and S1 bytes will be disabled and hence a "Don’t Use" message will be transmitted on both bytes at all times.

`app` Application is a keyword that further characterizes the behavior of the function unit in complex networks. This parameter cannot be changed if any cross-connection exists to this function slot. Parameter value is one of the following:

`0x1` The function unit is part of an OC-12 STS-3c /STS-1/VT1.5 0X1 ring application, or OC-3 STS-1/VT1.5 0x1 ring application. The automatic protection switching and alarms will follow the rules for the dual or single-homed 0x1 ring applications (no automatic protection switching). For single-homed 0x1 ring applications, both **`fn`** slots must be equipped with a 22-type OLIU. For dual-homed 0x1 ring applications, one **`fn`** slot must be empty. For the single homed 0x1 application both OC-3 function unit interfaces must connect to the same remote OC-3 shelf.

`1+1` The function unit is an optical extension of a path switched ring. The automatic protection switching and alarms will follow the rules for optical extension applications. **`1+1`** is the default value.

This parameter is not prompted for if the user enters a Main Address value.

aisalm Alarm is the provisioned alarm level of the NSA OC-3 line AIS and has the following values:

- `cr` Critical alarm
- `mj` Major alarm
- `mn` Minor alarm
- `na` Not alarmed, but reported (default).

dcc DccMode is a parameter that configures an OC-3 ring interface to interwork with either a ring or 1+1 application. There are two valid values for this parameter, **"distinct"** (default) or **"identical"**. When configured for **"distinct"** a separate DCC data link (SONET embedded overhead channel) is assigned to each OC-3 line in the pair. This is the configuration that supports ring interworking. To allow the OC-3 interface to interconnect to a 1+1 OC-3 interface at the far-end, the DccMode should be set to **"identical"**. In this mode the transmit DCC bytes are copied or bridged on both OC-3 lines, and the K-bytes are configured for the 1+1 protection mode. In the receive direction only the DCC bytes from the active line are processed. This parameter is only applicable to the Main OC-3 interface in R15.0 and later.

Assignment of this parameter always affects both OC-3 lines.

This parameter is not prompted for if the user enters a Function unit Address value.

The ConcatenationMode parameter requires that the Main slots be equipped. If they are not equipped the request will be denied with the following message:

```
ENEQ
/* Equipage, Not EQuipped */
/* Main slots must be equipped also. */
```

The application parameter requires that no cross-connection exist to the addressed function unit if the application type is to be changed. If the port is cross-connected, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Cross-connection exists.  Application cannot be changed. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

The ConcatenationMode parameter requires cross-connections from Main to FN-C to be m-1 <-> c-1, m-2 <-> c-2, m-3 <-> c-3. If these cross-connects do not exist the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Required cross-connects not established. */
```

If this is a *MegaStar* 2000 application and the specified AID slot(s) are incorrectly equipped, the command will be denied and the following message displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* specified AID slot(s) are not equipped with proper hardware. */
```

The parameter enabling the concat function is allowed only when 21-type OLIUs are installed in both Main and FN-C. If this is violated the following message is output.

```
EQWT
/* EQuipage, Wrong Type */
/* address is not equipped with proper hardware. */
```

The DccMode parameter is only valid for a Main address and the Application parameter is only valid for a function unit address. If either condition is violated the operation is denied and the following message is output.

```
IDNC
/* Input, Data Not Consistent */
/* Address is not valid for input parameter */
```

In OC-3 Release 15.0, when this command is entered, the following confirmation request to be displayed:

```
/* Caution! Alarm or maint. thresholds and sync messages
   are affected by this command.
   You have selected the set-oc3 command with these parameters:

   Address = x
   SignalDegradeThreshold = -n
   SynchronizationMessaging = value
   NonServiceAffectingAIS= value
   DccMode = value
   Application = value */

Execute? (y/n or CANcel/DELete to quit) =
```

The **DccMode** and **Application** parameters appear in R15.0 and later ring releases.

The **DccMode** parameter confirmation only applies to Main slots and the **Application** parameter confirmation only applies to Function unit slots.

RELATED COMMANDS

rtrv-oc3

rtrv-sync

NAME

set-oc12: Set OC-12 Characteristics

INPUT FORMAT

`set-oc12`:*`Address`*[:**`dgr=`***`SignalDegrade`*][,**`syncmsg=`***`SynchronizationMessaging`*]
[,**`aisalm=`***`Alarm`*] [,**`dcc=`***`DccMode`*];

DESCRIPTION

This command sets the Signal Degrade (DGR) threshold, the line AIS alarm level and the Synch messaging status of the specified OC-12 line pair.

The input parameters are:

`Address` Address identifies the OC-12 line or line pair.

When the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIU circuit packs in its Main unit slots, the valid Main unit addresses for OC-3 are:
`main-{1,2,all},all`

`dgr` SignalDegrade specifies the signal degrade threshold as a BER in terms of a logarithm to the base 10. The value of this parameter has a range of -5 to -9. The default value is -6. For ring releases, When using the 24-type or 29-type OLIU circuit packs in the OC-3 shelf’s Main unit slots, the degrade values for main-1 and main-2 must be the same. Any change to one address will also be made automatically to the other by the software.

`syncmsg` Synchronization messaging allows timing to be reconfigured in a network upon a node or fiber failure. Parameter value is one of the following:

`Kbyte` This is the default value. When this option is selected, both K2 and S1 byte sync messages are transmitted, but only K2 byte is received and interpreted for sync messaging.

`Sbyte` When this option is selected, only the S1 byte is sent and received for sync messaging. K2 byte will always send a "Don’t Use" message.

`disabled` When this option is selected, interpretation of both K2 and S1 bytes will be disabled and hence a "Don’t Use" message will be transmitted on both bytes at all times.

`aisalm` For ring releases, the AIS alarm values for Main-1 and Main-2 (when using the 24-type or 29-type OLIU circuit packs in the Main unit slots) must be the same. Any change to one address will also be made automatically to the other by the software. Alarm is the provisioned alarm level of the non-service affecting (NSA) OC-12 line AIS and has the following values:

`cr` Critical alarm

`mj` Major alarm

`mn` Minor alarm

`na` Not alarmed, but reported (default)

`dcc` DccMode is a parameter that configures an OC-12 ring interface for interworking with either a ring or 1+1 application. There are two valid values for this parameter, **`"distinct"`** (default) or **`"identical"`**. When configured for **`"distinct"`** a separate DCC data link (SONET embedded overhead channel) is assigned to each OC-12 line in the pair. This is the configuration that supports ring interworking. To allow the OC-12 interface to interconnect to a 1+1 OC-12 interface at the far-end, the DccMode should be set to **`"identical"`**. In this mode the transmit DCC bytes are copied or bridged on both OC-12 lines, and the K-bytes are configured for the 1+1 protection mode. In the receive direction only the DCC bytes from the active line are processed. This parameter is only applicable to the Main OC-12 interface in R15.0 and later.

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

This command will cause the following confirmation request to be displayed:

```
/* Caution! Alarm or maint. thresholds are affected by this command.
   You have selected the set-oc12 command with these parameters:

     Address = x
     SignalDegradeThreshold = -n
     SynchronizationMessaging = x
     NonServiceAffectingAIS= value */
     DccMode = value

Execute? (y/n or CANcel/DELete to quit) =
```

The **`DccMode`** parameter appear in R15.0 and later ring releases.

RELATED COMMANDS

rtrv-oc12

rtrv-sync

NAME

set-passwd: Set Password

INPUT FORMAT

set-passwd;

DESCRIPTION

This command changes a user's password. All users can change their own passwords. Privileged users can change other users' passwords by using the **set-lgn** command.

The following screen shows the dialog to change a password. In the dialog, the user input is shown in bold type.

NOTE:
Passwords will not be displayed when they are entered.

```
   <set-passwd;

enter your old password = old_password
enter your new password = new_password
reenter your new password = new_password
;
```

There are no default values for the old and new passwords.

A valid password is a case-sensitive ASCII string containing a minimum of six and a maximum of ten characters. The password must also include at least two numeric characters and one symbolic (non-alphabetic and non-numeric) character. The following symbolic characters have special meanings either for the User Interface or for the x.25 TL1 interface and cannot be included in a password:

;	semicolon	*?*	question mark
@	at sign		space
:	colon	=	equal sign
"	double quote	*,*	comma
\	back slash	*!*	exclamation point

Additionally, the following control characters and special keys CANNOT be included in a password:

<CR>	carriage return	*<tab>*	tab key
<bksp>	backspace key	*<esc>*	escape key
<del>	delete key		

If the entered password value does not match the valid password definition (syntactically incorrect), the following message will be displayed:

```
/* Entry does not follow rules for passwords. */
/* Passwords must be 6 to 10 characters, with at least 2 non
   alphabetic characters and additionally, at least 1 symbolic.
   Characters allowed are:  A..Z or a..z, 0..9, all symbolic
   characters, EXCEPT the following:

         ;   semicolon        ?   question mark
         @   at sign              space
         :   colon            =   equal sign
         "   double quote     ,   comma
         \   back slash       !   exclamation point

*/

enter your new password:
```

The user may try once again to enter a password. If the user tries again to enter a password that does not match the valid password definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

If a user is changing a password and the password entered does not match the present valid password, it will be rejected and the user will be prompted to try again. The user is allowed only one retry. If the user attempts and fails a second time, the entry will be denied with the following message and the old password will remain in effect:

```
PIPW
/* Privilege, Illegal PassWord. */
/* The old password remains in effect. */
```

If the new password that a user enters when changing a password meets the password definition requirements (syntactically correct), but does not match on its two entries (`enter your new password`; `reenter your new password`), the following message will be displayed:

```
/* The first and second entries of new password did not match. */
```

The user may try once again to change the password. If the user fails a second time to match the two entries, the following denial message will be displayed and the old password will remain in effect:

```
IDNC
/* Input, Data Not Consistent */
/* First and second entries of new password did not match.
   The old password remains in effect. */
```

RELATED COMMANDS

rtrv-lgn

set-lgn

set-secu

NAME

set-pmthres-line: Set Performance Monitoring Threshold Line

INPUT FORMAT

`set-pmthres-line`:
[**QHB2CVOC12=***nnnnn*][,**DayB2CVOC12=***nnnnnn*]
[**QHB2CVOC3=***nnnnn*][,**DayB2CVOC3=***nnnnn*]
[,**QHB2CVOC1=***nnnnn*][,**DayB2CVOC1=***nnnnn*]
[,**QHB2CVEC1=***nnnn*][,**DayB2CVEC1=***nnnnn*]
[,**QHB2ES=***nnn*][,**DayB2ES=***nnnnn*]
[,**QHB2ESA=***nnn*][,**DayB2ESA=***nnnnn*]
[,**QHB2ESB=***nnn*][,**DayB2ESB=***nnnnn*]
[,**QHB2SES=***nn*][,**DayB2SES=***nnnn*]
[,**QHB2UAS=***nn*][,**DayB2UAS=***nnnn*]
[,**QHPSCL=***nn*][,**DayPSCL=***nn*]
[,**QHPJC=***nnnnn*][,**DayPJC=***nnnnnnn*]**;**

where *nnn....* is a numerical value in the range given in the following parameter descriptions.

NOTE:
Parameters are shown in uppercase letters for readability. Parameters may be entered in either upper- or lowercase letters.

DESCRIPTION

This command sets the performance parameter thresholds of:

- OC-1 lines
- OC-3 lines
- OC-12 lines (When the shelf is equipped with 24 or 29-type OLIUs in Main unit slots)

This command activates and deactivates the processing of threshold crossings for performance parameters.

Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

The input parameters are:

`QHB2CVOC12` This parameter sets the threshold for the OC-12 coding violations count on a quarter-hourly basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 55365. The default value is 5537. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10.

DayB2CVOC12 A positive value of this parameter sets the threshold for the OC-12 coding violation count on a daily basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 5315040. The default value is 531504. A negative value of this parameter sets the parity count threshold in terms of an equivalent BER expressed as a logarithm to the base 10.

QHB2CVOC3 This parameter sets the threshold for the OC-3 coding violations count on a quarter-hourly basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 13841. The default value is 1384. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10.

DayB2CVOC3 A positive value of this parameter sets the threshold for the OC-3 coding violation count on a daily basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1328736. The default value is 132874. A negative value of this parameter sets the parity count threshold in terms of an equivalent BER expressed as a logarithm to the base 10.

QHB2CVOC1 This parameter sets the threshold for the OC-1 coding violations count on a quarter-hourly basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 4613. The default value is 461. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10.

DayB2CVOC1 A positive value of this parameter sets the threshold for the OC-1 coding violation count on a daily basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 442848. The default value is 44285. A negative value of this parameter sets the parity count threshold in terms of an equivalent BER expressed as a logarithm to the base 10.

QHB2CVEC1 This parameter sets the threshold for EC-1 coding violation counts on a quarter-hourly basis. This parameter is an integer with range 0 through 4163 and a default value of 461.

DayB2CVEC1	This parameter sets the threshold for EC-1 coding violation counts on a daily basis. This parameter is an integer with range 0 through 44284 and a default value of 4428.
QHB2ES	This parameter sets the threshold for the ES type A count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and a default value of 40.
DayB2ES	This parameter sets the threshold for the ES type A count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 900.
QHB2ESA	This parameter sets the threshold for the ES type A count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and default value of 30.
DayB2ESA	This parameter sets the threshold for the ES type A count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 90.
QHB2ESB	This parameter sets the threshold for the ES type B count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and default value of 30.
DayB2ESB	This parameter sets the threshold for the ES type B count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 90.
QHB2SES	This parameter sets the threshold for the SES count on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 20.
DayB2SES	This parameter sets the threshold for the SES count on a daily basis. This parameter is an integer with range 0 through 4095 and default value of 60.
QHB2UAS	This parameter sets the threshold for the UAS count on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 30.
DayB2UAS	This parameter sets the threshold for the UAS count on a daily basis. This parameter is an integer with range 0 through 4095 and default value of 90.
QHPSCL	This parameter sets the threshold for the line protection switch counts on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 2.
DayPSCL	This parameter sets the threshold for the line protection switch counts on a daily basis. This parameter is an integer with range 0 through 255 and default value of 4.

QHPJC This parameter sets the threshold for the STS pointer justification counts on a quarter-hourly basis. The parameter is an integer with range 0 through 65535 and default value of 60.

DayPJC This parameter sets the threshold for the STS pointer justification counts on a daily basis. The parameter is an integer with range 0 through 9999999 and default value of 5760.

The following tables show the error counts equivalent to different BER thresholds for OC-12, OC-3, OC-1, EC-1, and STS pointer justification.

B2 OC12 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVOC12)	Equivalent Day Threshold (DayB2CVOC12)
-7	55364	5315052
-8	5537	531505
-9	554	53151
-10	55	5315

B2 OC3 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVOC3)	Equivalent Day Threshold (DayB2CVOC3)
-7	13841	1328736
-8	1384	132874
-9	138	13287
-10	14	1329

B2 OC1 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVOC1)	Equivalent Day Threshold (DayB2CVOC1)
-7	4613	442848
-8	461	44285
-9	46	4428
-10	5	443

B2 EC1 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVEC1)	Equivalent Day Threshold (DayB2CVEC1)
-7	4613	442848
-8	461	44285
-9	46	4428
-10	5	443

The STS pointer justification count parameter (QHPJC and DayPJC) is useful in detecting a frequency error in the SONET synchronization network. The following table shows the PJC equivalent thresholds for a quarter-hour and a daily count resulting from a fixed frequency error.

PJC Count resulting from a Frequency Error

Frequency Error (+-ppm)	Equivalent 15 Min. Threshold (QHPJCL)	Equivalent Day Threshold (DayPJCL)
.01	56	5412
.02	112	10824
.03	169	16236
.04	225	21648
.05	281	27060
.06	338	32472
.07	394	37884
.08	451	43296
.09	507	48708
.1	563	54120
.2	1127	108241
.3	1691	162362
.4	2255	216483
.5	2818	270604
.6	3382	324725
.7	3946	378846
.8	4510	432967
.9	5073	487088
1	5637	541209
2	11275	1082419
3	16912	1623628
4	22550	2164838
10	56376	5412096

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

rtrv-pmthres-line

set-pmthres-sect

NAME

set-pmthres-sect: Set Performance Monitoring Threshold Section

INPUT FORMAT

set-pmthres-sect:[**TxPwr1dB=***n*][,**TxPwr2dB=***n*][,**LaserBias=***n*]
[,**Qhsefs=***nn*][,**Daysefs=***nnnn*];

DESCRIPTION

This command sets the performance-monitoring thresholds of an OC-12, OC-3, and OC-1 sections, as well as activating and deactivating the processing of threshold crossings for performance parameters.

The input parameters are:

TxPwr1dB	This parameter enables/disables the -1 dB threshold for optical transmit power. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G OLIU circuit pack.
TxPwr2dB	This parameter enables/disables the -2 dB threshold for optical transmit power. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G OLIU circuit pack.
LaserBias	This parameter enables/disables the laser bias threshold. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G OLIU circuit pack.
Qhsefs	This parameter sets the threshold for SEFS on a quarter-hourly basis. This parameter is an integer with range of 0 through 63 and default value of 10. Entering a parameter value of zero (0) will disable thresholding for this parameter.
Daysefs	This parameter sets the threshold for SEFS on a daily basis. This parameter is an integer with range of 0 through 4095 and a default value of 30. Entering a parameter value of zero (0) will disable thresholding for this parameter.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

rtrv-pmthres-sect

NAME

set-pmthres-sts1: Set Performance Monitoring Threshold STS-1

INPUT FORMAT

`set-pmthres-sts1`:[**QHB3CV=***nnnn*][,**DayB3CV=***nnnnnn*][,**QHB3ES=***nnn*]
[,**DayB3ES=***nnnnn*][,**QHB3ESA=***nnn*][,**DayB3ESA=***nnnnn*][,**QHB3ESB=***nnn*]
[,**DayB3ESB=***nnnnn*][,**QHB3SES=***nn*][,**DayB3SES=***nnnn*][,**QHB3UAS=***nn*]
[,**DayB3UAS=***nnnn*];

where *nnn...* is the numerical value given in the following parameter descriptions.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command provisions STS-1 path performance parameter thresholds as well as enabling and disabling the processing of threshold crossings for the various parameters. Entering a parameter value of zero (0) will disable thresholding for that parameter.

The input parameters are:

QHB3CV This parameter sets the threshold for the coding violations count on a quarter-hourly basis. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 4510. The default value is 451.

DayB3CV This parameter sets the threshold for the coding violations count on a daily basis. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 432960. The default value is 43296.

QHB3ES This parameter sets the threshold for errored seconds on a quarter-hourly basis. This parameter has an integer range of 0 through 900 and a default value of 40.

DayB3ES This parameter sets the threshold for errored seconds on a daily basis. This parameter has an integer range of 0 through 65535 and a default value of 900.

QHB3ESA This parameter sets the threshold for type A errored seconds on a quarter-hourly basis. A type A ES is a second with a single error. This parameter has an integer range of 0 through 900 and a default value of 30.

DayB3ESA This parameter sets the threshold for type A errored seconds on a daily basis. A type A ES is a second with a single error. This parameter has an integer range of 0 through 65535 and a default value of 90.

QHB3ESB This parameter sets the threshold for type B errored seconds on a quarter-hourly basis. A type B ES is a second with more than one error, but less than the number of errors in a severely errored second. This parameter has an integer range of 0 through 900 and a default value of 30.

DayB3ESB This parameter sets the threshold for type B errored seconds on a daily basis. A type B ES is a second with more than one error, but less than the number of errors in a severely errored second. This parameter has an integer range of 0 through 65535 and a default value of 90.

QHB3SES This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis. This parameter has an integer range of 0 through 63 and a default value of 20.

DayB3SES This parameter sets the threshold for the severely errored frame seconds count on a daily basis. This parameter has an integer range of 0 through 4095 and a default value of 60.

QHB3UAS This parameter sets the threshold for unavailable seconds on a quarter-hourly basis. This parameter has an integer range of 0 through 63 and a default value of 30.

DayB3UAS This parameter sets the threshold for unavailable seconds on a daily basis. This parameter has an integer range of 0 through 4095 and a default value of 90.

The following table shows the error counts equivalent to different BER thresholds.

B3 STS-1 Path Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB3CV)	Equivalent Day Threshold (DayB3CV)
-7	4510	432960
-8	451	43296
-9	45	4330
-10	5	433

RELATED COMMANDS

init-pm

rtrv-pmthres-sts1

rtrv-pm-sts1

rtrv-pm-tca

NAME

set-pmthres-t1: Set Performance Monitoring Threshold T1

INPUT FORMAT

set-pmthres-t1:[**QHESL=***nnn*][**DayESL=***nnnnn*][,**QHCVPSF=***nnnnn*][,**DayCVPSF=***nnnnnnn*]
[,**QHCVPESF=***nnnnn*][,**DayCVPESF=***nnnnnnn*][,**QHESP=***nnn*][**DayESP=***nnnnn*]
[,**QHSESP=***nn*][,**DaySESP=***nnnn*][,**QHUASP=***nn*][,**DayUASP=***nnnn*]
[,**QHCVPFE=***nnnnn*][,**DayCVPFE=***nnnnnnn*][,**QHESPFE=***nnn*][,**DayESPFE=***nnnnn*]
[,**QHSESPFE=***nn*][,**DaySESPFE=***nnnn*][,**QHUASPFE=***nn*][,**DayUASPFE=***nnnn*]

where *nnn....* is a numerical value in the range given in the following parameter descriptions.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command sets DS1 path and line performance monitoring thresholds, and is available with the BBF3/BBF3B circuit pack. This command also enables and disables the processing of threshold crossing alerts (TCAs) for these parameters.

In OC-3 R13.0 and later releases, this command will also set the DS1 path PM thresholds on the BBG20 TMUX circuit pack.

This command may only be used if the `ds1pm` feature is enabled via the **set-feat** command.

Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

A negative integer threshold value indicates that the threshold is specified in terms of an equivalent Bit Error Ratio (BER) of 10^{n}.

The input parameters are:

QHESL This parameter sets the threshold for the errored second line (ESL) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 900 and a default value of 65. This parameter is not applicable to the BBG20 TMUX circuit pack in OC-3 R13.0 and later releases.

DayESL This parameter sets the threshold for the errored second line (ESL) count on a daily basis. This parameter is an integer with a range of 0 through 65535 and a default value of 648. This parameter is not applicable to the BBG20 TMUX circuit pack in OC-3 R13.0 and later releases.

QHCVPSF This parameter sets the threshold for the code violations path SF (CVPSF) count on a quarter-hourly basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -7 through -5, corresponding to BERs of 10^{-7} through 10^{-5}, and an integer range of 0 through 16383. The default value is 72.

DayCVPSF This parameter sets the threshold for the code violations path SF (CVPSF) count on a daily basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -8 through -5, corresponding to BERs of 10^{-8} through 10^{-5}, and an integer range of 0 through 1048575. The default value is 691.

QHCVPESF This parameter sets the threshold for the code violations path ESF (CVPESF) count on a quarter-hourly basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -8 through -5, corresponding to BERs of 10^{-8} through 10^{-5}, and an integer range of 0 through 16383. The default value is 13296.

DayCVPESF This parameter sets the threshold for the code violations path ESF (CVPESF) count on a daily basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -8 through -5, corresponding to BERs of 10^{-8} through 10^{-5}, and an integer range of 0 through 1048575. The default value is 132960.

QHESP This parameter sets the threshold for the errored second path (ESP) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 900 and a default value of 65.

DayESP	This parameter sets the threshold for the errored second path (ESP) count on a daily basis. This parameter is an integer with a range of 0 through 65535 and a default value of 648.
QHSESP	This parameter sets the threshold for the severely errored second path (SESP) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 10.
DaySESP	This parameter sets the threshold for the severely errored second path (SESP) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 100.
QHUASP	This parameter sets the threshold for the unavailable second path (UASP) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 10.
DayUASP	This parameter sets the threshold for the unavailable second path (UASP) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 10.
QHCVPFE	This parameter sets the threshold for the code violations path far-end (CVPFE) count on a quarter-hourly basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -8 through -5, corresponding to BERs of 10^{-8} through 10^{-5}, and an integer range of 0 through 16383. The default value is 13296.
DayCVPFE	This parameter sets the threshold for the code violations path far-end (CVPFE) count on a daily basis. A negative value of this parameter indicates that the code violation count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -8 through -5, corresponding to BERs of 10^{-8} through 10^{-5}, and an integer range of 0 through 1048575. The default value is 132960.
QHESPFE	This parameter sets the threshold for the errored second path far-end (ESPFE) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 900 and a default value of 65.
DayESPFE	This parameter sets the threshold for the errored second path far-end (ESPFE) count on a daily basis. This parameter is an integer with a range of 0 through 65535 and a default value of 648.

QHSESPFE This parameter sets the threshold for the severely errored second path far-end (SESPFE) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 10.

DaySESPFE This parameter sets the threshold for the severely errored second path far-end (SESPFE) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 100.

QHUASPFE This parameter sets the threshold for the unavailable second path far-end (UASPFE) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 10.

DayUASPFE This parameter sets the threshold for the unavailable second path far-end (UASPFE) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 10.

The following tables show the error counts equivalent to different BER thresholds.

DS1 Coding Violations-Path (SF)

BER Threshold	Equivalent 15 Min. Threshold (**QHCVP**)	Equivalent Day Threshold (**DayCVP**)
-5	72	6912
-6	7	691
-7	1	69
-8	--	7

DS1 Coding Violations-Path (ESF)

BER Threshold	Equivalent 15 Min. Threshold (**QHCVP**)	Equivalent Day Threshold (**DayCVP**)
-5	13842	1328832
-6	1384	132883
-7	138	13288
-8	14	1329

This command may only be used if the `ds1pm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

rtrv-feat

rtrv-pmthres-t1

set-feat

NAME

set-pmthres-t3: Set Performance Monitoring Threshold T3

INPUT FORMAT

set-pmthres-t3:[**QHCVL=***nnnnn*][,**DayCVL=***nnnnnnn*][,**QHESL=***nnn*]
[,**DayESL=***nnnnn*][,**QHSESL=***nn*][,**DaySESL=***nnnn*][,**QHSEFS=***nn*]
[,**DaySEFS=***nnnn*][,**QHPCV=***nnnnn*][,**DayPCV=***nnnnnnn*]
[,**QHFMCV=***nnnnn*][,**DayFMCV=***nnnnnnn*][,**QHCP=***nnnnn*][,**DayCP=***nnnnnnn*]
[,**QHESP=***nnn*][,**DayESP=***nnnnn*][,**QHSESP=***nn*][,**DaySESP=***nnnn*]
[,**QHUASP=***nn*][,**DayUASP=***nnnn*][,**QHSEFSFE=***nn*][,**DaySEFSFE=***nnnn*]
[,**QHCPFE=***nnnnn*][,**DayCPFE=***nnnnnnn*][,**QHESPFE=***nnn*][,**DayESPFE=***nnnnn*]
[,**QHSESPFE=***nn*][,**DaySESPFE=***nnnn*][,**QHUASPFE=***nn*][,**DayUASPFE=***nnnn*];

NOTE:
All DS3 line parameters (in addition to DS3 C-bit parity and all other path parameters for the incoming signal from the DSX-3) are only applicable when a BBG4/BBG4B or BBG19 (in Release 11.0 and later) or BBG20 TMUX (in Release 13.0 and later) pack is active (in-service) in a function unit slot.

where *nnn....* is a numerical value in the range given in the parameter description listed below.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command sets the performance parameter thresholds of a DS3 signal as well as activating and deactivating the processing of threshold crossings for error performance parameters. Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

The input parameters are:

QHCVL This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayCVL This parameter sets the threshold for the coding violations count on a daily basis for the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3865.

QHESL This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for the DS3 line with at least one B3ZS coding violation. This parameter has an integer range of 0 through 900 with a default value of 25.

DayESL This parameter sets the threshold for the errored seconds count on a daily basis for the DS3 line with at least one B3ZS coding violation. This parameter has an integer range of 0 through 65535 with a default value of 250.

QHSESL This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for the DS3 line with greater than 44 B3ZS coding violations. This parameter has an integer range of 0 through 63 with a default value of 4.

DaySESL This parameter sets the threshold for the severely errored seconds count on a daily basis for the DS3 line with greater than 44 B3ZS coding violations. This parameter has an integer range of 0 through 4095 with a default value of 40.

QHSEFS This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 2.

DaySEFS This parameter sets the threshold for the severely errored frame seconds count on a daily basis. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 8.

QHPCV This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the **pbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

`DayPCV` This parameter sets the threshold for the coding violations count on a daily basis for the **`pbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

`QHFMCV` This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the **`fmbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

`DayFMCV` This parameter sets the threshold for the coding violations count on a daily basis for the **`fmbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

`QHCP` This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the near-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

`DayCP` This parameter sets the threshold for the coding violations count on a daily basis for the near-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHESP This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 900, with a default value of 25.

DayESP This parameter sets the threshold for the errored seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 65535 with a default value of 250.

QHSESP This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 4.

DaySESP This parameter sets the threshold for the severely errored seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095, with a default value of 40.

QHUASP This parameter sets the threshold for the unavailable seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 10.

DayUASP This parameter sets the threshold for the unavailable seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 10.

QHSEFSFE This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This parameter is monitored by reading the received X-bits in the DS3 C-bit parity frame. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 2.

DaySEFSFE This parameter sets the threshold for the severely errored frame seconds count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This parameter is monitored by reading the received X-bits in the DS3 C-bit parity frame. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095, with a default value of 8.

QHCPFE This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayCPFE This parameter sets the threshold for the coding violations count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHESPFE This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 900 with a default value of 25.

`DayESPFE` This parameter sets the threshold for the errored seconds count on a daily basis for the far-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 65535 with a default value of 250.

`QHSESPFE` This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for the far-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 4.

`DaySESPFE` This parameter sets the threshold for the severely errored seconds count on a daily basis for the far-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 40.

`QHUASPFE` This parameter sets the threshold for the unavailable seconds count on a quarter-hourly basis for the far-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 10.

`DayUASPFE` This parameter sets the threshold for the unavailable seconds count on a daily basis for the far-end **`cpbit`** type of format. The type is selected using the **`set-t3`** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 10.

The following tables show the error counts equivalent to different BER thresholds.

DS3 P-bit, F&M bit, and C-bit Coding Violations

BER Threshold	Equivalent 15 Min. Threshold (**QHCV**)	Equivalent Day Threshold (**DayCV**)
-7	3979	381972
-8	398	38197
-9	40	3820
-10	4	382

DS3 Line Coding Violations

BER Threshold	Equivalent 15 Min. Threshold (**QHCVL**)	Equivalent Day Threshold (**DayCVL**)
-7	4026	386519
-8	402	38651
-9	40	3865
-10	4	386

RELATED COMMANDS

init-pm

rtrv-pm-t3

rtrv-pm-tca

rtrv-pmthres-t3

set-t3

NAME

set-pmthres-vt1: Set Performance Monitoring Threshold VT1.5

INPUT FORMAT

set-pmthres-vt1:[**QHV5ES=***nnnnn*][,**DayV5ES=***nnnnnnn*][,**QHV5SES=***nnn*]
[,**DayV5SES=***nnnnn*][,**QHV5UAS=***nnn*][,**DayV5UAS=***nnnnn*];

where *nnn....* is a numerical value in the range given in the following parameter descriptions.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command sets VT1.5 path performance monitoring thresholds. This command also enables and disables the processing of threshold crossing alerts (TCAs) for these parameters.

This command may only be used if the `vtpm` feature is enabled via the **set-feat** command. Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

The input parameters are:

QHV5ES This parameter sets the threshold for the errored second (ES) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 900 and a default value of 40.

DayV5ES This parameter sets the threshold for the errored second (ES) count on a daily basis. This parameter is an integer with a range of 0 through 65535 and a default value of 900.

QHV5SES This parameter sets the threshold for the severely errored second (SES) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 20.

DayV5SES This parameter sets the threshold for the severely errored second (SES) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 60.

QHV5UAS This parameter sets the threshold for the unavailable second (UAS) count on a quarter-hourly basis. This parameter is an integer with a range of 0 through 63 and a default value of 30.

DayV5UAS This parameter sets the threshold for the unavailable second (UAS) count on a daily basis. This parameter is an integer with a range of 0 through 4095 and a default value of 90.

This command may only be used if the `vtpm` feature is enabled via the **`set-feat`** command. If this feature is not enabled, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available, feature disabled */
```

If this command is entered on a DDM-2000 loaded with a release of software that does not currently support this feature, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Command not available in this release */
```

RELATED COMMANDS

rtrv-feat

rtrv-pmthres-vt1

set-feat

NAME

set-secu: Set Security

INPUT FORMAT

set-secu:*Address*[:[**sec=***Security*][,**to=***Timeout*]};

set-secu:*Address*[:[**porttype=***Porttype*][,**baudrate=***Baudrate*]
[,**echo**=*echo*][,**sec=***Security*][,**to=***Timeout*]];

(OC3 Release 15.0 and later)

DESCRIPTION

This command configures network element (NE) system security on each CIT and DCC interface. Starting with OC-3 Release 15.0, this command will also allow the user to receive and/or transmit TL1 messages from the rear/front CIT ports. The user will also be allowed to change the X.25 synchronous interface to asynchronous

The three default logins are `LUC01`, `LUC02`, and `LUC03` (all upper-case letters). The default password is `DDM-2000`. Privileged users should change these defaults before enabling security or setting security to a lockout state.

NOTE:
This command is available to privileged users only.

The input parameters are:

address Address is the address of one or more CIT and/or DCC ports. There is no default address.

Valid Addresses: **dcc-all, cit-{1,2,all}**
Valid Addresses (OC-1 interfaces): **dcc-all**
Valid Address for X.25 interface is: **x25**
(in Release 15.0 and later)

porttype Specifies whether the provisioned Address **cit-1** (DCE port - front access) or **cit-2** (DTE port - rear access) is used for *CIT* or *TL1* application. If the value of Address is **cit-1 or cit-2**, this parameter can have two possible values: **cit** or **tl1**. Default value is **cit**.

If the value of Address is **x25**, this parameter can have two possible values: **synch** (default port type for TL1), or **asynch**. Default value is **synch**.

Only one CIT port (CIT-1 or CIT-2) can be provisioned to run TL1 (e.g, if CIT-1's port type is provisioned as TL1, CIT-2's port type cannot be provisioned to run TL1, and vice-versa), otherwise a denial message is displayed (defined later).

If a CIT port is provisioned to run TL1, up to 50 TL1 remote associations can be created on that CIT port.

NOTE 1:
If as a result of executing this command, the **`porttype`** parameter's value changes from/to **`cit`** to/from **`tl1`**, any active login session on the specified port will be terminated and the user(s) logged out including Privileged users and current users. The same is true for provisioning the X.25 port to **`synch`** or **`synch`**.

NOTE 2:
Once **`cit-1/2`** ports are set to **`tl1`**, they need to be reprovisioned to **`cit`** before the CIT program can be used again.

The same applies to the asynchronous X2.5 port (DTE Address); the user will have to reprovision the X.25 port type to be **`synch`** (by provisioning **`x25`** for Address, and **`synch`** for Port Type) before the X.25 port can be used as Synchronous again.

`baudrate` Specifies the baudrate in which TL1 messages are received/transmitted. The values for this parameter are: **`1200`**, **`2400`**, **`4800`**, **`9600`** (Default), and **`19200`**.

This parameter is prompted for, only if *`porttype`* parameter has the value of either **`tl1`** or **`asynch`**.

NOTE:
If as a result of executing this command, the **`baudrate`** parameter's value changes, any active login session on the specified port will be terminated and the user(s) logged out; including Privileged users and current users.

`echo` Specifies whether the character entered needs to be echoed back or not. The values for this parameter are: **`enabled`**, or **`disabled`**. The default value is **`enabled`**.

This parameter is prompted for, ONLY if *`porttype`* parameter has the value of **`tl1`** or **`asynch`**.

`sec` Security determines whether security is enabled, disabled, or in lockout state on the specified CIT and DCC port(s). Enabling security requires users to enter a valid login and password pair to access the system via the specified CIT or DCC-all.

The values for this parameter are **`enabled`**, **`disabled`** (default value), and **`lockout`**.

When security is in lockout state, the only user type permitted to access the system through the locked out CIT/DCC port is a privileged user; all non-privileged users, even with a valid login and password pair, are not allowed to access the system.

NOTE 1:
When security is in the lockout state, non-privileged users are not deleted from the login/password database, but are simply blocked from accessing the system. Existing active login sessions initiated by non-privileged users are not affected (that is, not dropped) if security is set to **`lockout`**.

NOTE 2:
If the Address parameter is equal to **`cit-1`** or **`cit-2`** *and Porttype is equal to* **`tl1`**, or Address is equal to **`x25`**, Security is *`enabled`* automatically. As a result, this parameter is not prompted for and will not show in the confirmation message.

`to` Timeout specifies the time, in minutes, before an inactive session on the specified port is automatically terminated. This has a value ranging from 0 to 120 minutes and a default value of 15 minutes. Setting this parameter to 0 will disable the timeout function.

NOTE:
If the value of Address is **`x25`** and Porttype is **`synch`**, then the user will not be prompted for this parameter.

Execution of this command for **security reasons** affects all subsequent attempts to establish login sessions but does not affect the currently active sessions.

When security is enabled, the following four types of users are permitted to access the system with a valid login and password:

`privileged`	The privileged user may execute any commands, including restricted commands.
`general`	The general user may execute any commands not restricted to privileged users.
`maintenance`	The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. This user may not execute any privileged commands.
`reports-only`	The reports-only user may only execute commands that extract reports from the system and several other basic commands.

When security is enabled on a system, only the following commands may be executed by reports-only users:

- **`?`** (help)
- **`logout`** (logout)
- **`rlgn`** (remote login)
- **`set-passwd`** (set password)
- **`set-link`** (set link)
- **`^T`** (toggle)
- All **`rtrv`** commands except **`rtrv-lgn`** and **`rtrv-passwd`**

In addition to **`set-secu`**, the commands **`init-sys`**, **`rtrv-lgn`**, **`set-fecom`**, **`set-feat`**, **`set-lgn`**, **`set-sync`**, **`rtrv-passwd`**, and **`rstr-passwd`** are restricted to privileged users only. The following commands also become restricted to privileged users only when security is enabled on a system:

- **`cpy-prog`** (copy program)
- **`ent-ulsdcc`** (enter upper layer section DCC)
- **`init-pm`** (initialize performance-monitoring)
- **`ins-prog`** (install program)

- **`reset`** (reset system software)
- **`set-date`** (set date)
- **`set-ne`** (set network element)
- **`ent-tl1msgmap`** (enter TL1 message map)
- **`set-x25`** (set X.25 link)
- **`ent-osacmap`** (enter OS application context id map)
- **`dlt-osacmap`** (delete OS application context id map)

Entering the set-secu command to change the value of **`sec`** on a specified Address will cause the following confirmation message to be displayed:

```
/* Caution!  Network Element access is affected by this command.
   You have selected the set-secu command with these parameters:

   Address = address
   Security = security
   Timeout = n */

Execute? (y/n or CANcel/DELete to quit) =
```

Entering this command to change the value of **`porttype`** to **`tl1`**, will cause the following confirmation message to be displayed:

```
/* Caution!  Network Element access is affected by this command.
   All active sessions on the affected port will be terminated
   after command completion.
   You have selected the set-secu command with these parameters:

   Address = address
   Porttype = porttype
   Baudrate = baudrate
   Echo = echo
   Timeout = n */

Execute? (y/n or CANcel/DELete to quit) =
```

Entering this command to change the value of **`porttype`** from **`tl1`** to **`cit`**, will cause the following confirmation message to be displayed:

```
/* Caution!  Network Element access is affected by this command.
   All active sessions on the affected port will be terminated
   after command completion.
   You have selected the set-secu command with these parameters:

   Address = address
   Porttype = porttype
   Baudrate = baudrate
   Echo = echo
   Security = security
   Timeout = n */

Execute? (y/n or CANcel/DELete to quit) =
```

Only **one** CIT port (CIT-1 or CIT-2) can be provisioned to run TL1. If one CIT port is provisioned for TL1 and the user tries to set the other CIT ports to TL1 as well, the following denial message will be displayed:

```
SNVS
/*  Status, Not in Valid State  */
/*  Only one CIT port can support TL1 at a time.  */
```

If an address of **`cit-all`** is entered, the user will be prompted for **`security`** and **`timeout`** parameters only. If the CIT-1 or CIT-2 port is already provisioned to run TL1 (**`porttype=`**`tl1`), then the CIT-1 or CIT-1 **`security`** value cannot be changed to **`disabled`**.

If a user enters a command and does not have valid permissions for that command, the following denial message will be displayed:

```
PICC
/*  Privilege, Illegal Command Code */
/*   You are not authorized to execute this command.  */
```

RELATED COMMANDS

`rtrv-lgn`

`rtrv-secu`

`set-fecom`

`set-lgn`

NAME

set-state-ec1: Set EC-1 Port State

INPUT FORMAT

`set-state-ec1:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the state of the low speed EC-1 ports. This command is used to turn on and off the monitoring of signal failures from a specified port.

The input parameters are:

`Address` Address identifies the EC-1 port(s).

Valid Addresses: **`all,a,b,c`**

`ps` PrimaryState is the port state which may have one of the following values:

`auto` Set state to be monitored for good signal at the specified port.

`nmon` Set memory state to not monitored.

NOTE:
If a port is in the **nmon** state, it must be returned to the **`auto`** state, using this command, before any circuit packs associated with that port can be removed from the equipment list by the **upd** command.

If an EC-1 port that is to be put into the **nmon** state is STS-1 cross-connected to a function unit equipped with MXRVO circuit packs, the VT1.5 channels within that EC-1 port should also be put in the **nmon** state.

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Port(s) address will not be monitored or alarmed in this state */
```

This command may be executed only if the specified addresses are not currently VT1.5 cross-connected. If a VT1.5 cross-connection already exists on the specified address, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* VT cross-connection exists.*/
```

If this command is entered with several addresses and one or more of these addresses are VT1.5 cross-connected, the command will complete but send the following message indicating that some of the cross-connections are not STS-1:

```
/* Following STS-1 channels not processed.
   VT cross-connection exists within STS address:
   address
   address
*/
```

If this command is entered with several addresses and one or more of these addresses is not properly equipped, the following message will be displayed:

```
/* Address not equipped properly -- provisioning unchanged. */
```

If this command is executed and an STS-1 cross-connection exists for the address entered, the cross-connection must be cross-connected to an OLIU. If no OLIU is present, the following denial message will be displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* STS1E must be cross-connected to OLIU */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-ec1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-ec1

rtrv-state

rtrv-state-eqpt

rtrv-state-vt1

set-state-vt1

NAME

set-state-oc1: Set OC-1 Line State

INPUT FORMAT

`set-state-oc1:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the state of one or more OC-1 lines. This command is used to turn on and off the monitoring of signal failures from a specified line.

The input parameters are:

`Address` Address identifies the OC-1 line(s).

Valid OC-1 Line Addresses (for 27-type OLIU):
`all, main-all, main-{1,2}-{1,2},`
`fn-all, fn-{a,b,c}-{1,2}-{1,2}`

Valid OC-1 Line Addresses (for 26G2-U OLIU):
`fn-all, fn-{a,b,c}-{1,2}-1`

`ps` PrimaryState is the line state which may have one of the following values:

`nmon` Set the line state to not monitored. Do not report alarm or status conditions for the line. Section and line performance monitoring data collection will be stopped in this state. Do not change the line state to in-service if a good signal is detected. The line will remain in this state until the state is changed again with this command.

NOTE:
When the line state is set to NMON, the data communication channel (DCC) will be disabled.

`is` In-service. Set the line state to be monitored for good signal at the specified line. Reporting of alarm, status conditions, and PMON data is in normal state.

NOTE:
Use the **`set-fecom`** command to enable the corresponding DCC (that might have been disbaled because of a previous state of NMON).

If a line state of **nmon** is entered, the following message will be displayed:

```
   /* Line(s) address will not be monitored or alarmed
      in this state */
```

If this command is entered with several addresses and one or more of these addresses is not equipped with a 27-type OLIU, the following message will be displayed:

```
/* Following OC-1 lines not processed.
   They are not equipped with 27-type OLIUs:
   address
   address
*/
```

If this command is entered with several addresses and one or more of these addresses is not equipped with a 27-type or 26G2-U OLIUs, the following message will be displayed:

```
/* Following OC-1 lines not processed.
   They are not equipped with 27-type or 26G2-U OLIUs:
   address
   address
*/
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-oc1 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

If the line state is being changed to **nmon**, the following warning message followed by the confirmation message will be displayed after command entry:

```
/* Line(s) Address will not be monitored or alarmed in this state.
   This command will automatically disable the DCC communication
   for Address. */

/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-oc1 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-state-oc1

set-fecom

upd

NAME

set-state-oc3: Set OC-3 Line State

INPUT FORMAT

`set-state-oc3:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the state of one or more OC-3 lines. This command is used to turn on and off the monitoring of signal failures from a specified line.

The input parameters are:

`Address` Address identifies the OC-3 line(s).
Valid addresses:
`main-{1,2,all}, fn-all, fn-{a,b,c}-{1,2,all}`

`ps` PrimaryState is the line state which may have one of the following values:

`nmon` Set the line state to not monitored. Do not report alarm or status conditions for the line. Section and line performance monitoring data collection will be stopped in this state. Do not change the line state to in-service if a good signal is detected. The line will remain in this state until the state is changed again with this command. DCC status is still monitored and reported in this state. To disable DCC, the **`set-fecom`** command is used.

`is` Set the line state to be monitored for good signal at the specified line. Reporting of alarm, status conditions, and PMON data is in normal state.

If a line state of **`nmon`** is entered, the following message will be displayed:

```
/* Line(s) address will not be monitored or alarmed in
   this state */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-oc3 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-state-oc3

upd

set-fecom

NAME

set-state-sts1: Set State of STS-1 Channels

INPUT FORMAT

`set-state-sts1:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the states of STS-1 channels. It is used to turn on and off the monitoring of signal failures and maintenance signals for specified channels.

The input parameters are:

`Address` Address identifies the STS-1 channel(s). Valid addresses are:

`all, {m,c}-{1-3,all}, {a,b}-{1-2,all}`

`all, {a,b,c}` (EC-1 Addresses)

`all, {m,a,b,c}-{1,2,all}` (27-type OLIU Addresses)

`{a,b,c}-1` (26G2-U OLIU Addresses)

If the shelf is equipped with 24-type or 29-type (starting with OC-3 Release 15.0) OLIU circuit packs in its Main unit slots, valid Main unit Addresses are:

`all,m-{1-12,all}`

Channel states can be set for:

- STS-1 channels within OC-1, OC-3, and OC-12 (If OC-3 shelf is equipped with 24G-U or 29G-U OLIUs in Main unit slots) interfaces that are cross-connected to DS3, ELAN, or DS1 interfaces
- STS-1 channels that are dropped from an OC-1 ring interface to an OC-3, ELAN, EC-1, or DS1 interface.
- STS-1 channels that are dropped from an OC-3, OC-1 or OC-12 ring interface (24-type or 29-type) in the Main unit slots to an OC-3, EC-1, ELAN, DS1, or DS3 interface
- STS-1 channels within OC-3 or OC-1 or OC-12 (24G-U or 29G-U in Main unit slots) or EC-1 interfaces that are VT1.5 cross-connected to OC-3, OC-1, EC-1, or DS1 interfaces.

`ps` PrimaryState is the channel state which may have one of the following values:

`auto` Set the channel state to automatic. Monitor the channel, but do not report alarm or status conditions. When a good signal is detected, automatically change the channel state to in-service and begin normal reporting of alarm and status conditions.

nmon Set the channel state to not monitored. Do not report alarm or status conditions for the channel. Do not change the channel state to in-service if a good signal is detected. The channel will remain in this state until the state is changed again with this command or until the cross-connection involving this channel is deleted.

NOTE:
It is recommended that an STS-1 channel that is either STS-1 cross-connected to a function unit equipped with MXRVO circuit packs or an STS-1 channel that is VT1.5 cross-connected *not* be put in the **nmon** state. If an STS-1 channel is put in the **nmon** or **auto** state using this command, the VT1.5 channels within the specified STS-1 channel are also put in the **nmon** or **auto** state. This applies only to VT1.5 channels for which channel states are defined (for example, VT1.5 channels that are cross-connected to DS1 interfaces or dropped from a ring).

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Channel(s) address will not be monitored or
    alarmed in this state */
```

If the path address specified in the command is an STS-1 channel that is part of an STS-3c cross-connected channel, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

The following confirmation message will be displayed after the command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-sts1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

NOTE:
If an STS-1 address of **`all`** is provisioned, this command will skip silently all STS-1 channels that are cross-connected as passthrough, dropped not terminated, or not cross-connected at all.

RELATED COMMANDS

ent-crs-sts1

ent-crs-vt1

dlt-crs-sts1

dlt-crs-vt1

rtrv-crs-sts1

rtrv-state-sts1

set-state-vt1

upd

NAME

set-state-t1: Set T1 Port State

INPUT FORMAT

`set-state-t1:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the state of DS1 ports. This command is used to turn on and off the alarm due to signal failures from a specified port.

NOTE:
This command is not applicable to the "internal" DS1s within the TMUX (BBG20) circuit pack that is available in OC-3 Release 13.0 and later.

When using IMA LAN circuit packs, DS1 port state may be set only if there exists a VT1.5 cross-connect on that DS1; otherwise the request will be denied at the user prompt level.

The input parameters are:

`Address` Address identifies the DS1 port(s).

Valid Addresses: **`all, {a,b,c}-{1-7,all}-{1-4,all}`**

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

`ps` PrimaryState is the port state which may have one of the following values:

`auto` Set state to be monitored for good signal at the specified port.

`nmon` Set state to "not alarmed" (not monitored).

NOTE:
If a port is in the **`nmon`** state, it must be returned to the **`auto`** state (using this command) before any circuit packs associated with that port can be removed from the equipment list by the **`upd`** command.

When using the IMA LAN circuit pack, the LAN interface’s primary state is automatically set when the first DS1’s primary state is provisioned on that pack.

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Port(s) address will not be alarmed in this state */
```

The following confirmation message will be displayed after the command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-t1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
If an STS-1 address of **all** is provisioned, this command will skip silent ly all STS-1 channels or VTs within those STS-1 channels that are cross-connected a s passthrough, dropped not terminated or even not cross-connected at all.

RELATED COMMANDS

rtrv-t1

rtrv-state

upd

NAME

set-state-t3: Set T3 Port State

INPUT FORMAT

`set-state-t3:``*Address*`**`:ps=`**`*PrimaryState*`;

DESCRIPTION

This command sets the state of one or more DS3 ports. This command is used to turn on and off the alarm due to signal failures from a specified port.

The input parameters are:

Address — Address identifies the DS3 port(s).

Valid DS3 Port Addresses (BBG4, BBG4B, BBG20 TMUX): **{a,b,c,all}**

Valid DS3 Port Addresses (BBG19): **all, {a,b,c}-{1-2,all}**

ps — PrimaryState is the port state which may have one of the following values:

- **auto** — Set state to be monitored for good signal at the specified port.
- **nmon** — Set memory state to not-alarmed.

NOTE:
If a port is in the **nmon** state, it must be returned to the **auto** state, using this command, before any circuit packs associated with that port can be removed from the equipment list by the **update** command.

If a port state of **nmon** is entered, the following message will be displayed:

```
/*  Port(s) address will not be alarmed in this state */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-t3 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-t3

upd

NAME

set-state-vt1: Set State of VT1.5 Channels

INPUT FORMAT

`set-state-vt1:`*`Address`***`:ps=`***`PrimaryState`*;

DESCRIPTION

This command sets the states of VT1.5 channels within:

- OC-12 interfaces (when using 24G-U or 29G-U OLIU circuit packs)
- OC-3 interfaces
- OC-1 interfaces
- EC-1 interfaces.

This command is used to turn on and off the monitoring of signal failures and maintenance signals for specified channels.

Channel states can be set for VT1.5 channels within OC-12, OC-3, OC-1, and EC-1 interfaces that are cross-connected to DS1 interfaces and for VT1.5 channels that are dropped from an OC-3, OC-12, or OC-1 ring to an OC-3 or EC-1 interface.

The input parameters are:

`Address` Address identifies the VT1.5 channel(s). Valid addresses for both linear and ring are:

`{m,a,b,c}-all`, **`{m,c}-{1-3}-all`**,
`{a,b}-{1-2,all}-{1-7,all}-{1-4,all}`,
`{m,c}-{1-3,all}-{1-7,all}-{1-4,all}`

Valid addresses within EC-1 are:
`{a,b,c}-{1-7,all}-{1-4,all}`

Valid addresses within OC-1 (27-type OLIU) are:
`m-all, m-{1,2}-all, m-{1,2}-{1-7,all}-{1-4,all}`,
`{a,b,c}-all, {a,b,c}-{1,2}-all`,
`{a,b,c}-{1,2}-{1-7}-{1-4,all}`
(Requires 27G2-U OLIUs, Release 11.0 and later)

Valid addresses within OC-1 (26G2-U OLIU) are:
`{a,b,c}-all, {a,b,c}-1-all`,
`{a,b,c}-1-{1-7}-{1-4,all}`
(Release 13.0 and later)

If the shelf is equipped with 24-type or 29-type OLIU circuit packs in its Main unit slots, the valid Main unit addresses are:
`m-{1-12,all}-{1-7,all}-{1-4,all}`

`ps` PrimaryState is the channel state which may have one of the following values:

- **`auto`** Set the channel state to automatic. Monitor the channel, but do not report alarm or status conditions. Do not do performance monitoring for this channel. When a good signal is detected, automatically change the channel state to in-service.
- **`nmon`** Set the channel state to not monitored. Do not report alarm or status conditions for the channel. Do not do performance monitoring for this channel. Do not change the channel state to in-service if a good signal is detected. The channel will remain in this state until the state is changed again with this command or until the cross-connection involving this channel is deleted.

If a primary state of **`nmon`** is entered, the following message will be displayed:

```
/* Channel(s) address will not be monitored or
   alarmed in this state */
```

The following confirmation message will be displayed after the command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-vt1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

NOTE:
If an STS-1 address of **`all`** is provisioned, this command will skip silently all STS-1 channels or VTs within those STS-1 channels that are cross-connected as passthrough, dropped not terminated or even not cross-connected at all.

RELATED COMMANDS

dlt-crs-vt1

ent-crs-vt1

rtrv-crs-vt1

rtrv-state-vt1

set-state-sts1

NAME

set-sts1: Set STS-1 Characteristics

INPUT FORMAT

set-sts1:*Address*:**dgr=***SignalDegrade*:**sfail=***SignalFailure*[,**nsa=***Alarm*]
[,**sa=***Alarm*];

DESCRIPTION

This command provisions the following three types of parameters for STS-1 channels:

Signal Degrade Alarm Threshold:
This parameter is only provisioned for ring channels (for example, incoming STS-1 channels on optical linear extensions in ring systems are not monitored). Possible values are 10^{-5} through 10^{-9}, with a default value of zero (0) for Release 9.0 and earlier, and 10^{-6} for Release 9.1 and later. Only the 22-type, 27-type, and 22F2-U, 24G-U (Release 11.0 and later), and 29G-U (Release 15.0 and later) OLIU circuit packs support the provisionable signal degrade function.

Signal Fail Alarm Threshold:
This parameter is only provisioned for ring channels. Possible values are 10^{-3} and 10^{-6}, with a default value of 10^{-3}.

Alarm Level for SA/NSA STS Path AIS Condition:
The alarm level for a service affecting (SA) path AIS condition can be provisioned for both ring and non-ring channels. The alarm level for a non-service affecting (NSA) path AIS condition can only be provisioned for ring releases.

The input parameters are:

Address Address identifies the STS-1 channels.

Valid Ring and Linear Addresses:
all, m-{1-3,all}, c-{1-3,all}, {a,b}-{1-2,all}

all, m-{1-3,all}

{a,b,c} (EC-1 Addresses)

{m,a,b,c}-{1,2,all} (27-type OLIU Addresses)

{a,b,c}-1 (26G2-U OLIU Addresses)

If the shelf is equipped with 24-type or 29-type (OC-3 Release 15.0) OLIUs in its Main unit slots, the valid Main unit Addresses are:
m-{1-12,all}

dgr *SignalDegrade* specifies a bit error rate (BER) threshold for the STS-1 channel in terms of a logarithm to base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching to the STS-1 protection path will be initiated. The only valid address for the SignalDegrade parameter is **all**. This parameter is independent of OLIU equippage. Note, however, that the signal degrade function is only supported by 22G-U, 22D-U, 27-type, 24G-U, 29G-U, and 22F2-U OLIU circuit packs in Main.

The signal degrade parameter is an integer. The default value is -6, and the parameter cannot be set to "0" (disabled). The signal degrade function is always operational as long as OLIU circuit pack types that support the functionality are used.

sfail *SignalFailure* specifies the BER of the STS-1 channel in terms of a logarithm to the base 10. Meeting or exceeding this threshold in a "VT Path_Switched ring" is considered a signal fail condition, resulting in a VT AIS insertion and subsequently causing a VT path protection switching. Furthermore, in an "STS Path-Switched ring", meeting or exceeding this threshold causes an alarm and STS path protection switching, but no AIS insertion will take place. The only valid address for the SignalFailure parameter is **all**. This parameter can have one of the following values:

- **-3** BER threshold resulting in VT AIS insertion in a "VT Path_switched ring" and causing the VT path protection switching (default). Exceeding this threshold will cause an alarm and an STS path protection switching in the "STS Path_Switched ring" (default).
- **-6** If provisioned, this BER threshold will result in VT AIS insertion in a "VT Path_Switched ring", and will cause a VT path protection switching. This threshold will cause an alarm and an STS path protection switching in the "STS Path_Switched ring".

nsa This parameter is available in OC-3 ring releases. This parameter is the provisioned alarm level of the non-service affecting STS-1 path AIS and has the following values:

- **mn** Minor alarm (default)
- **nr** Not alarmed and not reported.

sa This parameter is the provisioned alarm level of the service affecting STS-1 path AIS and has the following values:

- **cr** Critical alarm (default for ring channels)
- **mn** Minor alarm (non-ring channels only, default)
- **na** Not alarmed, but reported
- **nr** Not alarmed and not reported (non-ring channels only)

If the signal degrade or signal fail threshold parameter is entered and the address used is any value other than "all" the command will be denied with the following message:

```
/* The only valid address for the signal degrade or the signal
   fail parameter is { all }.
   To set the signal degrade parameter enter
   set-sts1:all:dgr=value; */
```

To provision the AIS parameters requires that either an STS-1 or at least one VT cross-connection exist in the specified address range or the command will not execute, and the following message will be displayed.

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

In OC-3 ring releases, the following confirmation message will be displayed after the command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-sts1 command with this parameter:

   SignalDegrade = <value>
   SignalFailure = <value>
   ServiceAffectingAIS = <value>
   NonServiceAffectingAIS = <value> */

   Execute? (y/n or CANcel/DELete to quit) =
```

In linear releases, the following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-sts1 command with this parameter:

   ServiceAffectingAIS = <value>

   Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
If an STS-1 address of **`all`** is provisioned, this command will skip silently all STS-1 channels that are cross-connected as passthrough, dropped not terminated, or not cross-connected at all.

RELATED COMMANDS

rtrv-sts1

NAME

set-sync: Set Synchronization Characteristics

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command provisions the synchronization mode switching, synchronization source, and output mode of the timing signals when the TGS or the TG3 (BBF4) circuit pack hardware is provisioned to be externally timed, internally timed, or line timed.

Beginning with DDM-2000 OC-3 Release 13.0 and later, this command will also be used with the new Stratum 3 timing circuit pack, TG3 (BBF4). This pack can not be used in combination with either of the two TGS circuit packs (BBF2/BBF2B) in the same network element. The BBF4 circuit pack can be used in any BBF2B application. Care must be taken to ensure that a system equipped with these new BBF4 circuit packs will not receive its sync source for line-timing from another system that is equipped with either BBF2 or BBF2B TGS packs.

NOTE 1:
Synchronization provisioning is the same whether the OC-3 shelf is equipped with OC-3 or OC-12 (24G-U or 29G-U) OLIU circuit packs in its Main unit slots.

NOTE 2:
Line timing from OC-1 line #1 on 27-type OLIU circuit packs in main slots is supported.

Each DDM-2000 can be provisioned to one of these timing modes:

- Free running from an internal oscillator.
- Line-timed from an incoming optical interface. This timing reference is used to generate all outgoing signals. If the optical line is protected, the line selected for transmission is also the line selected as the timing reference. If equipped with a BBF2B timing generator (TGS) circuit pack, or with a BBF4 Stratum 3 timing circuit pack (TG3), the line in Function Unit C selected for transmission can optionally be selected for the timing reference.
- External timing from a DS1 reference signal. Each TGS or TG3 circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to the companion TGS or TG3 circuit pack on the same shelf. If a DS1 reference failure is detected on one timing circuit pack, the other will take

the reference from the companion TGS or TG3 on the same shelf.

These timing modes are supported by both the BBF2 and BBF2B TGS circuit packs, and the BBF4 TG3 circuit packs. The BBF2B circuit pack can be used in any BBF2 application and is preferred for use in ring applications.

Use of this command may affect timing for other network elements of the timing network.

NOTE:
This command is available to privileged users only for all CIT or DCC ports on the shelf.

INPUT FORMAT

The following parameters are available for this command when provisioned for a specific synchronization reference. Parameters may vary depending upon whether the application is linear or rings.

RING SYSTEMS - LINE TIMED

set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**omd=***OutputMode*][,**auto=***SyncAutoreconfiguration*];
(BBF2B pack type)
set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**omd=***OutputMode*][,**aisthres=***AISThreshold*]
[,**auto=***SyncAutoreconfiguration*]; (BBF2B pack type ONLY)

For OC-3 R9.1 and later, and BBF4 pack in OC-3 R13.0 and later.

When using the BBF2B TGS or BBF4 TG3 circuit pack, the *SynchronizationSource* parameter is used to select the optical line for *shelf* timing. If the BBF2B TGS or BBF4 TG3 circuit pack is used and hardware is provisioned for DS1 output in SYNC OUT mode and if the *SynchronizationSource* is provisioned for FN-C, then the *OutputMode* parameter may be used.

RING SYSTEMS - EXTERNAL TIMING

set-sync:[**mdsw=***ModeSwitching*]; (BBF2 pack type)

set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**omd=***OutputMode*]; (BBF2B pack type)
set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**omd=***OutputMode*][,**aisthres=***AISThreshold*];

BBF2B ONLY for OC-3 R9.1 and later, and BBF4 for OC-3 R13.0 and later.

If the BBF2B TGS or BBF4 TG3 circuit pack is used and hardware is provisioned for DS1 output in SYNC OUT mode and if the *SynchronizationSource* is provisioned for FN-C, then the *OutputMode* parameter may be used.

NOTE:
For all applications, if the BBF2B or BBF4 TGS or TG3 circuit pack is hardware provisioned for DS1 output in SYNC OUT mode, the *SynchronizationSource* parameter is also used to select the optical line for DS1 output.

The input parameters are:

mdsw ModeSwitching may have one of the following values:

revertive	Revertive mode switching (default value). If the system switches to holdover timing mode due to a failure of the timing references, it will automatically switch back to the provisioned timing mode (`External` or `LineTimed`) after one of the references becomes good.
nonrevertive	Nonrevertive mode switching. If the system switches to holdover timing mode due to a failure of the timing references, it will *not* automatically switch back to the provisioned timing mode (`External` or `LineTimed`) after the reference becomes good. The **switch-sync** command must be used to restore the system to the provisioned timing mode (`External` or `LineTimed`).

src SynchronizationSource. This parameter selects the line from which shelf line timing and/or the DS1 synchronization output will be derived. This parameter may have one of the following values:

- **main** For linear releases (default).
- **main-1** For ring releases (default). If Main-1 contains a 27-type OLIU, this value selects OC-1 line #1.
- **main-2** For ring releases. If Main-2 contains a 27-type OLIU, this value selects OC-1 line #1.
- **fn-c** Linear Releases and rings optical extensions

omd OutputMode. This parameter is available with linear and rings releases when **src** equals **fn-c**. When a line protection switch occurs, **omd** determines whether the source of the DS1 synchronization output will always be derived from the active receive OC-3 line or is locked to a specified line, whether it is active or not. This parameter may have one of the following values:

- **lock1** Lock to line 1
- **lock2** Lock to line 2
- **track** Track transmission to active receive line (Default for linear applications or for ring applications when **src** is fn-c).

aisthres
AISThreshold. It is applicable to the BBF2B and BBF4 circuit pack types. This parameter sets the incoming synchronization message quality level of the active reference upon receiving of which AIS signal is transmitted on the DS1 output of the BBF2B TGS or BBF4 TG3 circuit packs. As long as the incoming quality level number is at or greater than the provisioned level, AIS will be transmitted. This parameter is listed in ascending quality order and may have one of the following values:

- **level5** This is the default value. Send DS1 AIS for incoming quality level 5 (K2: Internal Clock, S1: Traceable SONET Clk) or greater (that is, quality level 6 or 7).
- **level4** Send DS1 AIS for incoming quality level 4 (K2: Stratum 3, S1: Traceable Stratum 3) or greater.
- **level3** Send DS1 AIS for incoming quality level 3 (K2: Stratum 2, S1: Traceable Stratum 2) or greater.
- **level2** Send DS1 AIS for incoming quality level 2 (K2: Sync Quality Unknown, S1: Sync Trace Unknown) or greater.

auto SyncAutoreconfiguration allows the system to choose the best timing source to use when it is provisioned for Line Timing. The synchronization source selection is based on the synchronization messages received from the available timing (synchronization) sources.

Automatic Protection Switching takes place to the standby timing source when the active source fails. The switch is nonrevertive, and there will not be an automatic switch back to the former timing reference.

When SyncAutoreconfiguration is enabled, the system automatically reconfigures between line timing sources **`main`** and **`fn-c`** in linear systems and **`main-1`** and **`main-2`** in ring systems.
In ring releases, **`fn-c`** will also be a source option. Use the **`switch-sync`** command to manually switch to the other timing source.

`enabled`	SyncAutoreconfiguration is active.
`disabled`	SyncAutoreconfiguration is not active (default).

If hardware provisioning switches are set for FreeRunning timing mode, execution of this command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* System provisioned for free-running. */
```

When sync messages are active (as set by the **`set-oc3`** and/or **`set-oc12`** command) and a user requests to set the timing source to a LineTime source which has a sync message that does not support timing, the command will be completed, but the following message will be displayed:

```
/* Source selected currently is unusable for timing.
   Timing will switch to holdover or if Sync Autoreconfiguration is
   enabled, timing may switch to other source. */
```

If this command is entered and both timing slots are empty, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* No change in provisioning - both timing slots are unequipped */
```

For SyncAutoreconfiguration, several other parameters must be set before this feature can be enabled. If these parameters are not set, the SyncAutoreconfiguration request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* <message reason>
Sync Autoreconfiguration cannot be enabled */
```

Valid message reasons include the following:

- K byte messages disabled
- Sync messages disabled.
- Shelf not line timed
- Sync output mode set to lock

In a ring application, if the TGS slots are equipped with BBF2-type circuit packs and FN-C is selected as the timing source, or autoreconfiguration is enabled on any timing source while FN-C is equipped with an OC-3 OLIU circuit pack, the command request will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* TGS slots are not equipped with proper hardware. */
```

When SyncAutoreconfiguration is enabled, the OutputMode cannot be set to **lock** or the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Sync Autoreconfiguration is enabled. */
```

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in the Main slots, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

When SyncAutoreconfiguration is available, the following confirmation message will be displayed after command entry:

```
/* Caution!  Execution of this command may modify network
   synchronization and affect service.
   You have selected the set-sync command with these parameters:

   ModeSwitching = x
   SynchronizationSource = x
   OutputMode = x
   SyncAutoreconfiguration = x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-sync

set-oc3

set-oc12

switch-sync

NAME

set-t1: Set T1 Characteristics

INPUT FORMAT

set-t1:*address*[:**lc=***LineCode*][,**alm=***AlarmLevel*][,**fth=***FailureThreshold*]
[,**dlc=***DLCBPVtoLOS*][,**ais=***AlarmIndicationSignal*][,**pmmd=***PMMode*]
[,**fmt=***Format*];

set-t1:*address*[:**pmmd=***PMMode*][,**fmt=***Format*];
(For OC-3 Release 13.0 and later, BBG20 TMUX circuit pack)

set-t1:*address*[:**alm=***AlarmLevel*][,**pmmd=***PMMode*];
(For OC-3 Release 15.0 and later, IMA LAN circuit pack only)

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command sets the parameters of one or more DS1 ports. These characteristics include alarm levels, line coding, failure thresholds, and AIS conditions.

In OC-3 Release 13.0 and later, this command also sets the PM Mode and Format parameters for the internal DS1 signals associated with the TMUX (BBG20) circuit packs.

Starting with OC-3 Release 15.0, when using the IMA LAN circuit packs, this command sets the Alarm Levels, PM Mode, and PM Format. (PM Format is always set to **esf**).

NOTE:
The DS1 protection circuit pack is automatically provisioned with all the same user-settable options as the service pack it protects, except for the line buildout (LBO) value (which is not provisioned via the CIT).

The input parameters are:

Address Address is the address of the DS1 port(s) to be provisioned. One port or more may be specified.

Valid Addresses: **all, {a,b,c}-{1-7,all}-{1-4,all}**

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid. Specifying `all` selects ports 1 and 2 only.

lc LineCode is the DS1 line coding which may be one of the following:

ami	Alternate Mark Inversion (overrides the linecode switch)
b8zs	Bipolar with 8 Zero Substitution (overrides the linecode switch)
noOverride	No override of the linecode switch (default value).

If either **ami** or **b8zs** is selected, the line code will be set to the selected value and a software override will be active even if the selected value matches the current switch setting. While the software override is active, changes in the switch settings will not affect the line code. A software override will remain active until the set-t1 command is executed again and the **noOverride** option is selected or until the associated circuit pack is removed from the equipment list. This parameter is not applicable to the HDSL, and IMA LAN circuit packs.

alm AlarmLevel sets the alarm level for an incoming DS1 Signal Failure and may be one of the following:

mj	Major Alarm
mn	Minor Alarm
na	No Alarm (default value).

If the system is provisioned for no alarm, the NE ACTY LED on the user panel will be illuminated, and the fault LED on the circuit pack will flash (flashing of LEDs does not apply to the IMA LAN circuit packs). The condition will be reported in the alarm and status report as a near-end activity.

fth FailureThreshold sets the failure threshold in terms of a logarithm to the base 10. The value may be -8, -7, -6, or -3, corresponding to BERs of 10^{-8}, 10^{-7}, 10^{-6}, and 10^{-3}, respectively. The default value is -3. When the failure threshold is crossed, an alarm will be raised and automatic protection switching of the service line will be initiated. This parameter is not applicable to the HDSL, and IMA LAN circuit packs.

dlc (bpv) DLCBPVtoLOS determines whether an incoming DS1 signal failure (a bit error rate above the failure threshold set by the failure threshold parameter, **fth**) will be translated to an outgoing DS1 loss of signal (all zeros) at the far end. The value is either **yes** or **no**. The default value is **no**. Setting this parameter to **yes** permits a digital loop carrier system terminal (such as the SLC® 96 carrier system) to detect the loss of signal and initiate protection switching of the DS1. When the parameter is set to **yes**, the **ais** parameter is automatically set to no. (An all zeros signal, not AIS, is transmitted to the far end even if the **AIS** parameter is set to **yes**.) This parameter is not applicable to the IMA LAN circuit packs.

ais AlarmIndicationSignal determines whether an AIS should be inserted towards the optical fiber when a loss of incoming DS1 signal is detected. The values are **yes** and **no**; the default value is **yes**. This parameter is ignored if the **bpv** parameter (described above) is set to **yes**. This parameter is not applicable to the IMA LAN circuit packs.

pmmd This parameter sets the mode for ports supported by the DS1 performance-monitoring circuit pack. **Pmmd** is only used for performance-monitoring. Setting this parameter does not affect the transmitted or received signal. In OC-3 Release 13.0 and later, this parameter will also be applicable to the TMUX (BBG20) circuit pack to monitor the internal DS1 signals within the incoming (from DSX) DS3 signal. This parameter may be one of the following values:

`off` DS1 PM turned off (default value)

`on` DS1 PM turned on (only if CP type is BBF3, BBF6, BBF9, BBF10 or BBG20).

`fmt` Format supports the PMMode parameter. It is available only if CP type is BBF3. In OC-3 Release 13.0 and later, this parameter will also be applicable to the TMUX (BBG20) circuit pack to monitor the internal DS1 signals within the incoming (from DSX) DS3 signal.

Also starting with OC-3 Release 15.0, this parameter will be applicable to the T1EXT (BBF6) circuit pack.

This parameter sets the format to be monitored by the DS1 performance-monitoring or T1EXT circuit pack. **`Fmt`** is only used for performance-monitoring. Setting this parameter does not affect the transmitted or received signal.

NOTE:
When using the IMA LAN circuit packs, the user is not prompted for this parameter (*`esf`* is the only valid PM format for these packs and it is automatically provisioned).

This parameter may be one of the following values:

`sf` Superframe

`esf` Extended superframe, near-end and far-end. (default)

When using the IMA LAN circuit packs, `esf` is the only valid PM Format that can be entered.

`esfn` Extended superframe, near-end only.

If multiple addresses are specified, the following caution message will be displayed immediately before the confirmation request message:

```
/* Caution: This command addresses multiple objects within this
   system.  Selections other than CurrentValues will affect all
   addressed objects. */
```

The following confirmation message will be displayed after the command entry, when addressing packs without performance-monitoring capability:

```
/* Caution! Execution of this command may affect service.
   You have selected the set-t1 command with these parameters:

   Address = x
   LineCode = x
   AlarmLevel = x
   FailureThreshold = x
   DLCBPVtoLOS = x
   AlarmIndicationSignal = x */

Execute? (y/n or CANcel/DELete to quit) =
```

The following confirmation message will be displayed after the command entry when addressing packs with performance-monitoring capability or if addressing a group of packs using **`all`** in the address:

```
/* Caution! Execution of this command may affect service.
   You have selected the set-t1 command with these parameters:

   Address = x
   LineCode = x
   AlarmLevel = x
   FailureThreshold = x
   DLCBPVtoLOS = x
   AlarmIndicationSignal = x
   PMMode = x
   Format = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

The following confirmation message will be displayed after the command entry when addressing a IMA LAN circuit pack:

```
/* Caution! Execution of this command may affect service.
   You have selected the set-t1 command with these parameters:

   Address = x
   AlarmLevel = x
   PMMode = x */

Execute? (y/n or CANcel/DELete to quit) =
```

| slc

RELATED COMMANDS

rtrv-t1

set-state-t1

NAME

set-t3: Set T3 Characteristics

INPUT FORMAT

set-t3:*Address*:[**md=***Mode*][,**ais=***AlarmIndicationSignal*][,**alm=***AlarmLevel*]
[,**fth=***FailureThreshold*][,**pmmd=***PMMode*][,**frame=***Frame*][,**fmt=***Format*];

set-t3:*Address*:[**alm=***AlarmLevel*][,**aisalm=***AISAlarmLevel*]
[,**fth=***FailureThreshold*][,**pmmd=***PMMode*][,**frame=***Frame*]
[,**fmt=***Format*][,**xbit=***Xbit*];
(For OC-3 Release 13.0 and later, BBG20 TMUX circuit pack)

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command sets the characteristic parameters of one or more DS3 ports. These characteristics include alarm levels, failure thresholds, AIS conditions, and performance monitoring.

The input parameters are:

Address — Address is the address of the DS3 port(s) to be provisioned. One or all ports may be specified. Function groups equipped with BBG19 DS3 circuit packs have independent ports for each slot in the function group; howerever parameters provisioned for the function group are applied to both ports.

Valid DS3 Port Addresses: **{a,b,c,all}**

md — Mode is the violation monitor removal mode of the DS3 signal. This parameter is not applicable to the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later releases). This parameter may have one of the following values:

- **vmr** — Monitor and remove DS3 P bit errors (default value).
- **vm** — Monitor but do not remove DS3 P bit errors.
- **cc** — Clear channel — Do not monitor or remove DS3 P bit errors.

If this parameter is set to **vmr** or **vm**, the **ais** parameter will not be prompted for.

If this parameter is set to **cc**, the **pmmd**, **frame**, and **fmt** parameters will not be used. Also in this case, the **pmmd**, **frame**, and **fmt** parameters will keep their current values. The current values for both parameters will be available to be used whether the value of **md** is set to vm or vmr.

ais AlarmIndicationSignal determines whether or not a DS3 AIS should be inserted. The value may be `yes` or `no`. This parameter is not applicable to the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later). When AIS is set to `yes`:

— DS3 AIS is inserted towards the DSX-3 upon detection of an OC-3 loss of signal or STS path AIS incoming from the fiber.

— DS3 AIS is inserted towards the fiber upon detection of DS3 LOS incoming from the DSX-3.

NOTE:
AIS is always inserted if the violation monitor removal mode is provisioned for `vmr` or `vm`.

NOTE:
If **md** value was set to `vmr` or `vm`, and it is set to `cc` the AIS always defaults to `off` value.

alm AlarmLevel sets the alarm level for an incoming DS3 Signal Failure and may be one of the following:

cr Critical Alarm

mj Major Alarm

mn Minor Alarm

na No Alarm

The default alarm level is critical. If the system is provisioned for no alarm and there is a loss-of-signal condition, the NE ACTY LED on the user panel will be illuminated, and the fault LED on the circuit pack will flash. The condition will be reported in the alarm and status report as a near end activity.

For the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later), this parameter will be applicable to the following three incoming DS3 (from DSX) alarms: LOS, out-of-frame (OOF), and signal failure BER.

aisalm This parameter is only applicable to the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later). AISAlarmLevel sets the alarm level for an incoming DS3 (from DSX) AIS and may be one of the following:

- **cr** Critical Alarm
- **mj** Major Alarm
- **mn** Minor Alarm
- **na** No Alarm Level (default)

fth FailureThreshold sets the Failure Threshold in terms of a logarithm to the base 10. The value may be either -6 or -3, corresponding to BERs of 10^{-6} and 10^{-3}, respectively. The default value is -3. When the failure threshold is crossed, an alarm will be raised.

pmmd PMMode is only used for performance-monitoring (PM). Setting this parameter does not affect the transmitted or received signal. This parameter will appear only if the **vmr** or **vm** mode has already been selected.

For the BBG20 TMUX circuit pack in OC-3 Release 13.0 and later, this parameter will always appear. Because DS3 BER threshold for the TMUX circuit pack is based on p-bit or c-bit parity violations, a failure threshold of 10^{-4} will cause a "BER signal fail" alarm. This parameter may be one of the following values:

- **on** DS3 PM turned on. This is the default value.
- **off** DS3 PM turned off. PM data is neither collected nor reported in this mode.

frame Frame is only used for performance-monitoring (PM) on the BBG4/BBG4B, BBG11/BBG11B, or BBG19 circuit packs. Setting this parameter does not affect the transmitted or received signal. This parameter will appear only if the **vmr** or **vm** mode has already been selected. For the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later), this parameter will always appear and is transmission affecting. It is used to select the type of DS3 framed signal that is received from the DSX only and is transmitted towards the DSX. This parameter may have one of the following values:

- **m13** The incoming DS3 signal from both the fiber and the dsx-3 is of the M13 framing type. This is the default value.
- **cbit** The incoming DS3 signal from both the fiber and the dsx-3 is of the C-bit framing type.

fmt Format supports the PMMode and Frame parameters and sets the type of PMON that will appear in the DS3 PM report. This parameter will appear only if the **vmr** or **vm** mode has already been selected. If the **cc** mode is selected, these parameters will not be visible to the user. For the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later), this parameter will always appear. This parameter may have one of the following values:

- **pbit** When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 P-bit CV, ES, SES, and UAS (default value). This option is valid for both **frame** types.
- **fmbit** When this value is selected, the DS3 PM report will provide counts of SEFS as well as DS3 adjusted F&M bit CV, ES, SES, and UAS. This option is valid for both **frame** types.
- **cpbit** When this value is selected, the DS3 PM report will provide counts of SEFS as well as DS3 CP-bit parity CV, ES, SES, and UAS for both near-end and far-end (FEBE) data. This option is valid ONLY for **cbit** type of **frame**.

xbit This parameter is only applicable to the BBG20 TMUX circuit pack (OC-3 Release 13.0 and later). It will be prompted only if **m13** has been selected for **frame**. It sets the value of both X-bits in the outgoing DS3 signal (towards DSX). This parameter may have a value of one (default) or zero.

The following confirmation message will be displayed after command entry for DS3 ports on circuit packs other than the BBG20 TMUX pack:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   Mode = x
   AlarmIndicationSignal = x
   AlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Frame = x
   Format = x */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
The above display will only prompt for the alarm indication signal (AIS) if the Mode is set to `cc`. The above display will only prompt for the PMMode, Frame and Format if the Mode parameter is set to `vmr` or `vm`.

If the **m13** frame and **cpbit** format options have both been selected, the following denial message will be displayed:

```
/* <address> - invalid combination of frame and format --
provisioning unchanged */
```

The following confirmation message will be displayed after command entry for DS3 ports on circuit packs other than the BBG20 TMUX pack:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   Mode = x
   AlarmIndicationSignal = x
   AlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Frame = x
   Format = x */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
The above display will only prompt for the alarm indication signal (AIS) if the Mode is set to `cc`. The above display will only prompt for the PMMode, Frame, and Format if the Mode parameter is set to `vmr` or `vm`.

In OC-3 Release 13.0 and later when this command is used to provision a BBG20 TMUX circuit pack, the following confirmation message will be displayed after command entry:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   AlarmLevel = x
   AISAlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Frame = x
   Format = x
   Xbit = x */

Execute? (y/n or CANcel/DELete to quit) =
```

In OC-3 Release 13.0 and later, if the `cbit` frame and `xbit` options have both been selected (for example, during expert mode provisioning), the following denial message will be displayed:

```
/* <address> - invalid combination of frame and xbit --
provisioning unchanged */
```

The following confirmation message will be displayed after the command entry when addressing a group of packs using `all` in the address:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   Mode = x
   AlarmIndicationSignal = x
   AlarmLevel = x
   AISAlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Frame = x
   Format = x
   Xbit = x */

Execute? (y/n or CANcel/DELete to quit) =
```

If multiple addresses are specified, the following caution message will be printed out immediately before the confirmation request message:

```
/* Caution: This command addresses multiple objects within this
system.  Selections other than CurrentValues will affect all
addressed objects. */
```

RELATED COMMANDS

rtrv-t3

set-state-t3

NAME

set-trace-sts1: Set STS Path Trace Characteristics

INPUT FORMAT

`set-trace-sts1`:*`Address`*[:EXPTRC=*`Expectedincomingpathtrace`*]
[,TRC=*`OutgoingPathTrace`*];

DESCRIPTION

This command assigns user-selectable alphanumeric character strings to the transmit and receive path trace fields of an STS cross-connected STS-1 signal. The allowed ASCII characters include the letters "A" through "Z" and "a" through "z", numbers "0" through "9", and the following special characters:

# (pound sign)	$ (dollar sign)
% (percent sign)	& (ampersand)
((open parenthesis)	) (close parenthesis)
+ (plus)	* (asterisk)
| (pipe)	- (hyphen)
[(open square bracket)	] (close square bracket)
{ (open bracket)	} (close bracket)
’ (apostrophe)	‘ (grave accent)
. (period)	/ (slash)
< (less than)	> (greater than).

NOTE:
This feature is only applicable to STS paths terminating to a BBG4B circuit pack.

The input parameters are:

`Address` This is a STS-1 channel address of the SONET path terminating signal for which the path trace is assigned.

Valid Addresses (within OC-3): **`{m,c}-{1-3},{a,b}-{1,2}`**

If the shelf is equipped with 24-type or 29-type (OC-3 Release 15.0) OLIU circuit packs in its Main unit slots, the valid Main unit addresses are: **`m-{1-12}`**

Valid Rings Only Addresses: **`m-{1-3}`**
Valid 27-type OLIU Addresses: **`m-{1,2}`**

`EXPTRC` EXPTRC specifies the expected incoming path trace message. It is a string of 62 or less alphanumeric characters.

TRC TRC specifies the outgoing path trace message. It is a string of 62 or less alphanumeric characters.

If the channel is not cross-connected to a STS-1 PTE, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Valid cross-connection does not exist. STS Path trace cannot be set. */
```

If the STS-1 channel for which this command was issued is not available, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Address points to a non-existent channel. */
```

If an attempt is made to set the path trace for an STS path other than the one terminated to a DS3 (BBG4B) circuit pack, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Check the equipage. BBG4B for OC-3 or FiberReach,
   and BBG11B for OC-12 is required. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

When input, this command will cause the following confirmation request to be displayed:

```
/* You have selected the set-pthtrc command with these
   parameters:

   Address = address
   EXPTRC = message
   TRC = message

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-trace-sts1

rtrv-crs-sts1

set-sts1

NAME

set-vt1: Set VT1.5 Characteristics

INPUT FORMAT

set-vt1:*Address*:**dgr=***SignalDegrade*[,**nsa=***Alarm*][,**sa=***Alarm*];

DESCRIPTION

This command provisions two type of parameters for VT1.5 channels. They are:

1. **Signal Degrade Alarm Threshold**
   This parameter is provisioned only for ring channels (that is, incoming VT1.5 channels on optical linear extensions in ring systems are not monitored). Possible values are 10^{-5} through 10^{-8}, with a default value of 10^{-6}. Only the 22-type, 27-type, 22F2-U, 26G2-U, 24G-U, and 29G-U (starting with OC-3 Release 15.0) OLIU circuit packs support the provisionable signal degrade function.

2. **Alarm Level for SA/NSA VT Path AIS Condition**
   The alarm level for a service affecting path AIS condition can be provisioned for both ring and non-ring channels. The alarm level for a non-service affecting path AIS condition can only be provisioned for ring releases.

The input parameters are:

Address

Address identifies the VT1.5 channels.

Valid Ring and Linear Addresses: **all, m-{1-3,all}-{1-7,all}-{1-4,all}, c-{1-3,all}-{1-7,all}-{1-4,all}, {a,b}-{1-2,all}-{1-7,all}-{1-4,all}**

Valid EC-1 Addresses: **{a,b,c}-{1-7,all}-{1-4,all}, all**

Valid 27-type OLIU Addresses: **all, {m,a,b,c}-{1,2,all}-{1-7,all}-{1-4,all}**

Valid 26G2-U OLIU Addresses: **all, {a,b,c}-1-{1-7,all}-{1-4,all}**

If the shelf is equipped with 24-type or 29-type OLIUs in its Main unit slots, the valid Main unit Addresses are: **m-{1-12,all}-{1-7,all}-{1-4,all}**

dgr

SignalDegrade specifies the bit error ratio (BER) threshold for the VT1.5 signals in terms of a logarithm to the base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching to the protection path will be initiated. The only valid address for the SignalDegrade parameter is **all**.

The default value is -6, and the parameter cannot be set to "0" (disabled). The signal degrade function is always operational as long as OLIU circuit pack types that support the functionality are used.

nsa This parameter is available in OC-3 ring releases. It is the provisioned alarm level of the non-service affecting VT path AIS and has the following values:

- **mn** Minor alarm (default)
- **nr** Not alarmed and not reported.

sa This is the provisioned alarm level of the service affecting VT path AIS and has the following values:

- **mj** Major alarm (default for ring channels)
- **mn** Minor alarm (non-ring channels only, default)
- **na** Not alarmed, but reported
- **nr** not alarmed and not reported (non-ring channels only)

If the signal degrade parameter is entered and the address used is any value other than **all** the command will be denied with the following message:

```
/* The only valid address for the signal degrade parameter is { all }.
   To set the signal degrade parameter enter
 set-vt1:all:dgr=value; */
```

To provision the AIS parameters requires that at least one VT cross-connection exist in the specified address range or the command will not execute and the following message will be displayed.

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-vt1 command with these parameters: */

   SignalDegrade = <value> */
   ServiceAffectingAIS = <value>
   NonServiceAffectingAIS = <value> */

Execute? (y/n or CANcel/DELete to quit) =
```

In linear releases, the following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-vt1 command with these parameters: */

   SignalDegrade = <value> */

Execute? (y/n or CANcel/DELete to quit) =
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

NOTE:
If an STS-1 address of **`all`** is provisioned, this command will skip silently all STS-1 channels or VTs within those STS-1 channels that are cross-connected as passthrough, drop not terminated or even not cross-connected at all.

RELATED COMMANDS

rtrv-vt1

NAME

set-x25: Set X.25 Link

INPUT FORMAT

`set-x25:PKT=`*`pkt`***`;`**

DESCRIPTION

This command sets the packet size of the X.25 link. The packet size may be set to either 128 or 256.

CAUTION:
Execution of this command may affect TL1 communication and will reset the GNE X.25 link. Also, this command will cause all active TL1 logins to be automatically dropped. In addition, all established SVCs on the affected X.25 link will need to be reestablished.

This command should be used at installation time, when network activities are at their minimum level or when the X.25 link can be disabled.

NOTE 1:
This command is available to privileged users only, if security is enabled.

NOTE 2:
While this command may be executed at all network elements in the subnetwork, it will only be active at the GNE.

The input parameter is:

`pkt` This parameter sets the packet size. The valid values are `128` or `256` (default value).

When this command is entered, the following confirmation message will be displayed:

```
/* Caution! If this shelf is an active GNE, X.25 link/TL1
communication is affected by this command.  When executed,
this command causes the GNE x.25 link to be reset, all active
TL1 logins to be dropped, and all SVCs to be cleared.

You have selected the set-x25 command with this parameter:

   PKT = 128/256  */


Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-x25

NAME

switch-fn: Protection Switch Function Unit

INPUT FORMAT

switch-fn:*Address*:**pri=***Priority*;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command controls operation of function unit circuit pack protection switching when equipped with termination packs such as MXRVO, STS1E, TMUX or DS3 circuit packs. This command does not support the BBG19 circuit pack.

The input parameters for this command are:

Address Address of the function unit slot pair.

Valid Addresses: **fn-{a,b,c}**

pri Priority indicates the priority of the protection switching request and has the following values:

reset	Clear active external switch requests.
inhibit	Prevent further switches (automatic, manual, or forced) until the switch is reset.
forced	Switch to the standby slot, whether it is good or not, and prevent further switches (automatic or manual) until the switch is reset.
manual	Switch to the standby slot only if it is good.

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the switch-fn command with these parameters:

   Address = x
   Priority = pri */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is executed with priority **`inhibit`** or **`forced`**, then automatic protection switching will be disabled until this command is executed again with priority **`reset`**.

RELATED COMMANDS

rtrv-state

switch-line

NAME

switch-line: Protection Switch Line

INPUT FORMAT

`switch-line`:*`Address`*:**`pri=`***`Priority`*;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command controls the operation of OC-3 line protection switching. DDM-2000 provides unidirectional (one-way) line switching. This command affects only the selection of one of the pair of incoming OC-3 signals at the local network element. This command is primarily used for maintenance.

The input parameters are:

`Address` Address of the pair of OC-3 lines.

Valid linear Addresses: **`main, fn-{a,b,c}`**
Valid ring Addresses: **`fn-{a,b,c}`**

`pri` Priority indicates the priority of the protection switching request and has the following values:

`reset`	Removes existing external switch requests
`inhibit`	Freezes the protection switching mechanism so that the current active line remains selected regardless of the subsequent failures.
`lockout`	Prevents selection of the protection line. If the protection line is currently selected at the near end as the active line, service will be switched to the service line unless there is an existing **`inhibit`** protection switching request.
`forced`	Selects the standby line unless there is an existing **`inhibit`**, **`lockout`**, or **`forced`** protection switching request.
`manual`	Selects the standby line for the active line provided the standby line is good and there are no existing protection switching requests.

If the function unit specified in the command does not have its Application value (**set-oc3**) set to *1+1*, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified function unit is not a 1+1 application. */
```

When OC-3 line state provisioning is supported, if the OC-3 line state of a protection pack in a function unit specified in the command is set to **nmon**, and a manual switch is requested on that function unit, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

On entry, the following confirmation message is displayed:

```
/* The line protection switching request is unidirectional.
   It may be necessary to perform a switch-line at the far end
   to switch both transmit and receive to the same line */

/* Caution!  Execution of this command may affect service.
   You have selected the switch-line command with these parameters:

   Address = x
   Priority = pri */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is executed with priority **inhibit**, **lockout**, or **forced**, then automatic protection switching will be disabled until this command is executed again with priority **reset**.

RELATED COMMANDS

rtrv-state

rtrv-state-eqpt

rtrv-state-oc3

NAME

switch-ls: Protection Switch Low Speed

INPUT FORMAT

`switch-ls:`*`Address`*:**`pri=`***`Priority`*;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command controls the operation of low-speed circuit pack protection switching.

This command is denied in unprotected low-speed configurations (e.g, when equipped with IMA LAN circuit packs).

The input parameters are:

`Address` The address of the low-speed slot(s). Addresses may either be a single low-speed slot (for example, **`ls-a-l`**) or all low-speed slots in a single group (for example, **`ls-b-all`**). The address **`ls-all`** is *not* valid for this command.

Valid Low-Speed Slot Addresses for **`manual`** and **`forced`**:
`ls-{a,b,c}-{1-7}` (Note: **`all`** not allowed)

Valid Low-Speed Service Slot Addresses for **`reset`** and **`lockout`**:
`ls-{a,b,c}-{1-7,all}`

Valid Low-Speed Protection Slot Addresses for **`reset`** and **`lockout`**:
`ls-{a,b,c}-8` (Protection slot only)

`pri` Priority indicates the priority of the protection switching request and has the following values:

`reset` Clear active external switch requests (**`lockout`**, **`forced`**, or **`manual`**) and return any traffic on the protection slot to the service slot.

`lockout` Locks out protection switching requests (except the reset request). If the lockout is directed to the protection slot, any traffic that is currently on the protection line is unconditionally switched back to the service line and no traffic from any service line will be switched to the protection line. If the lockout is directed to a service slot, traffic on that service line that was previously switched to protection is unconditionally switched back to the service line and no further traffic can be switched from that specific service line to the protection line. The lockout request for either condition will remain in effect until a low-speed protection switch reset is entered.

`forced` Force switch to the protection low-speed slot unless there is an outstanding lockout or forced switch request. For a forced switch, the address must be a single slot. The forced switch will remain in effect until a low-speed protection switch reset or lockout request is entered.

`manual` Manual switch to the protection low-speed slot only if the protection slot is good and not in use (service slot only). For a manual switch, the address must be a single slot. The failure or removal of a DS1 or T1EXT (OC-3 Release 15.0) circuit pack, or a forced, lockout, or reset request will preempt a manual switch request.

If the protection switch request changes the protection switching condition to a condition lower or equal to the priority of the pre-existing protection switching condition, execution of this command will be denied with the following denial message:

```
SPSP
/* Status, Protection Switch Priority */
/* The CIT-initiated protection switch request has a lower priority
   than the existing protection switching condition. */
```

If an address of **`all`** is used with a priority of **`manual`**, the request will be denied with the following denial message:

```
IDNC
/* Input, Data Not Consistent */
/* Manual switch not allowed for multiple slots. */
```

If an address of **`all`** is used with a priority of **`forced`**, the request will be denied with the following denial message:

```
IDNC
/* Input, Data Not Consistent */
/* Forced switch not allowed for multiple slots. */
```

If a protection slot address is used with a priority of **`manual`**, the request will be denied with the following denial message:

```
IDNC
/* Input, Data Not Consistent */
/* Manual switch not allowed for protection slot. */
```

If a protection slot address is used with a priority of **`forced`**, the request will be denied with the following denial message:

```
IDNC
/* Input, Data Not Consistent */
/* Forced switch not allowed for protection slot. */
```

If the switch request would place service onto a slot currently holding a circuit pack type that is not allowed ("CP not allowed" alarm active), the request will be denied with the following denial message:

```
SPFA
/* Status, Protection unit FAiled */
```

On entry, the following confirmation message is displayed:

```
/*Caution! Execution of this command may affect service.
  You have selected the switch-ls command with these parameters:

  Address = x
  Priority = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is executed with priority **`lockout`** or **`forced`**, then automatic protection switching will be disabled until this command is executed again with priority **`reset`**.

RELATED COMMANDS

rtrv-state

rtrv-state-eqpt

NAME

switch-path-sts1: Switch Path STS-1

INPUT FORMAT

switch-path-sts1:*Address*:**pri=***Priority*;

DESCRIPTION

This command controls STS-1 path switching on path protected ring configurations. Path switching is always unidirectional (one-way).

The input parameters are:

Address — Address is the address of the STS-1 channel currently carrying dropped or drop and continue traffic. When this command is executed, traffic will be switched away from this path to the other path on the ring. There is no default for this parameter. Connections provisioned as 0x1 ring or 0x1 DS3 cannot be switched.

Valid OC-3 Addresses:
m{1,2}-{1-3,all} (OC-3 OLIU)

Valid OC-1 Addresses:
m{1,2}-{1-2} (27-type OLIU in Main)
{a,b,c}{1,2}-{1-2} (27G2-U OLIU in FN)
{a,b,c}{1,2}-1 (26G2-U OLIU)
(Release 13.0 and later)

Valid OC-12 Addresses:
m{1,2}-{1-12,all}
(24G-U or 29G-U OLIU in Main, Release 15.0 and later)

pri — Priority indicates the priority of the protection switch request. The one and only valid value is *manual*. This requests a switch from the addressed path to the standby path unless a path signal fail or path signal degrade exists on the standby path.

NOTE:
A drop and continue path is simultaneously dropped to a low-speed interface and passed through.

If the path address specified in the command is not equipped or the STS-1 channel is not drop, add/drop or drop and continue cross-connected, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not equipped and/or cross-connected. */
```

The following message applies only if the Main unit slots of a shelf are equipped with 24G-U or 29G-U OLIU circuit packs. If the path address specified in the command is an STS-1 channel that is part of an STS-3c cross-connected channel, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

If the addressed path is associated with a connection of type

- pass-through
- 0x1 ring
- 0x1 DS3
- dual locked

the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path cannot be switched. */
```

NOTE:
A pass-through path passes directly from the OC-N receiver to the OC-N transmitter. The service carried with this path is not dropped at this node.

If an equal or higher priority switch already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If **-all** appears in the address and if an equal or higher priority switch already exists on some of the addressed paths, the path is part of an STS-3c cross-connected channel (only if Main unit slots are equipped with 24-type or 29-type OLIUs) or if the path is VT1.5 add/drop cross-connected, the command will list these exceptions as follows:

```
/* sts1 address equal or higher priority switch exists
   sts1 address vt cross-connected signals exist
       .
       .
*/
```

If **-all** appears in the address and the path is not equipped, not cross-connected, or is a pass-through, 0x1 ring connection, dual locked connection, or 0x1 DS3 connection, the path will be silently skipped.

Since DDM-2000 path switching is unidirectional, the user will receive the following notification message immediately before the confirmation request:

```
/* The path protection switching request is unidirectional.
   It may be necessary to perform a switch-path-sts1 at the far end
   to switch both transmit and receive to the same path. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the sw-path-sts1 command with these parameters:

   Address=
   Priority=        */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-crs-sts1

rtrv-crs-vt1

rtrv-state-eqpt

rtrv-state-path e

NAME

switch-path-vt1: Switch Path VT1.5

INPUT FORMAT

switch-path-vt1:*Address*:**pri=***Priority*;

DESCRIPTION

This command controls VT1.5 path switching on path protected ring configurations. Path switching is always unidirectional (one-way).

The input parameters are:

Address Address is the address of the VT1.5 path currently carrying drop or drop and continue traffic. When this command is executed, traffic will be switched away from this path to the other path on the ring. There is no default for this parameter.
Valid Addresses:

m{1,2}-{1-3,all}-{1-7,all}-{1-4,all}
(OC-3 OLIU in Main slots)

m{1,2}-{1-2}-{1-7,all}-{1-4,all}
(27-type OLIU in Main slots)

{a,b,c}{1,2}-{1,2}-{1-7,all}-{1-4,all}
(27G2-U OLIU in FN slots)

{a,b,c}{1,2}-1-{1-7,all}-{1-4,all}
(26G2-U OLIU in FN slots, Release 13.0 and later)

m{1,2}-{1-12,all}-{1-7,all}-{1-4,all}
(24-type or 29-type OLIU in Main slots, Release 15.0 and later)

Connections provisioned as **0x1 ring** or **locked** cannot be switched.

NOTE:
A drop and continue path is simultaneously dropped to a low-speed interface and passed through.

pri Priority indicates the priority of the protection switch request. The one and only valid value is:

manual This parameter requests a switch from the addressed path to the standby path unless a path signal failure or path signal degrade exists on the standby path.

If the path address specified in the command is not equipped or VT1.5 cross-connected, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not equipped and/or cross-connected. */
```

If the path address specified in the command is a pass-through path, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path cannot be switched. */
```

NOTE:
A pass-through path passes directly from the OC-N receiver to the OC-N transmitter. The service carried with this path is not dropped at this node.

If the path address specified in the command is a 0x1 ring or a locked path, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path cannot be switched. */
```

If an equal or higher priority switch already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If **-all** appears in the address and if an equal or higher priority switch already exists on some of the addressed paths, the command will list these exceptions. If **-all** appears in the address and the path is STS-1 add/drop cross-connected, it will be listed as an exception.

```
/* vt address equal or higher priority switch exists
   vt address sts cross-connected signal exists
      .    .    .    .    .    .    .
      .    .    .    .    .    .    .
      .    .    .    .    .    .    .
*/
```

Since DDM-2000 path switching is unidirectional, the user will receive the following notification message and confirmation request:

```
/* The path protection switching request is unidirectional.
   It may be necessary to perform a switch-path-vt1 at the far end
   to switch both transmit and receive to the same path. */


/* Caution! Execution of this command may affect service.
   You have selected the sw-path-vt1 command with these parameters:

   Address=
   Priority=        */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-state-path

NAME

switch-sync: Protection Switch Synchronization

INPUT FORMAT

`switch-sync`:**`s=`***`SyncFunction`*,**`pri=`***`Priority`*;

DESCRIPTION

⚠ **CAUTION:**
Execution of this command may affect service.

This command controls operation of the synchronization protection switching. This command lets the user control which synchronization reference is used and enables the user to switch a synchronization reference when needed.

The input parameters are:

`s` SyncFunction specifies the synchronization function and may be one of the following:

`reference`	Selects protection switching of DS1 timing references. Specify only if the system is provisioned for `External` DS1 timing.
`mode`	Selects protection switching of timing mode. Specify only if the system is provisioned for `External` DS1 or `LineTimed`.
`circuitpack`	Selects protection switching of timing circuit packs.
`src`	Selects the optical line from which shelf line-timing and/or the DS1 synchronization output will be derived. This parameter is available with OC-3 ring releases. This parameter is only applicable if SyncAutoreconfiguration is enabled using the **`set-sync`** command. The SynchronizationSources that can be switched are **`main-1`**, **`main-2`**, and **`fn-c`**.

`pri` Priority indicates the priority of the protection switching request. For SyncFunction values of **`reference`** and **`circuitpack`**, priority values are:

`reset`	Clear active protection switch requests
`inhibit`	Freeze the protection switching mechanism
`manual`	Switch from active timing reference/circuit pack to standby timing reference/circuit pack

For a SyncFunction value of **`mode`**, the priority (**`pri`**) values are:

reset	Clear any active manual switch. This will allow the system to switch back to `External` or `LineTimed` if the system is provisioned for non-revertive mode switching or if it has been manually switched to holdover mode.
manual	Switch from the provisioned timing mode, `External` or `LineTimed`, to holdover mode. The system will remain in holdover mode until the switch is reset.

For a SyncFunction value of **src**, the priority (**pri**) value is:

manual	Switch from the active SynchronizationSource to the standby source.

For Releases 8.0 and 9.0, any slot equipped with an OC-1 OLIU is not a valid synchronization source. Thus, a manual synchonization source switch will never select a slot with an OC-1 OLIU.

Starting with Release 9.1, a 27-type OLIU is a valid synchronization source when in a Main slot, but not FN-C. OC-1 line #1 is used as the synchronization source in such a case.

If no synchronization source switch can be completed due to the equippage of the alternate sources, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* Alternate sync sources improperly equipped */
```

If this command is executed with `Priority=`**inhibit** or with `SyncFunction=`**mode**, then automatic protection switching will be disabled until this command is executed again with the same SyncFunction and with `Priority=`**reset**.

If an equal or higher priority switch (for example, **`pri`**=inhibit) already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If the SyncFunction is **`src`** and the priority of **`reset`** or **`inhibit`** is entered, the request will be denied with one of the following denial messages:

```
IDNC
/* Input, Data Not Consistent */
/* Reset not allowed for source switching. */
```

or

```
IDNC
/* Input, Data Not Consistent */
/* Inhibit not allowed for source switching. */
```

If the switch request is issued for the SyncFunction value of **`src`** and SyncAutoreconfiguration is not enabled, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* SyncAutoreconfiguration is not enabled. */
```

The reference switching (reset, inhibit, manual) applies only to DS1 references. The command will not be executed if **`reference`** is entered for the synchronization function and the provisioned synchronization mode is not `External`.

If this command is entered and both timing slots are empty, the command will be denied and the following denial message will be displayed:

```
ENEQ
/* Equipage, Not EQuipped */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the switch-sync command with these parameters:

   SyncFunction=s
   Priority=pri */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-sync

set-sync

NAME

test-alm: Test Office Alarms

INPUT FORMAT

`test-alm`:[**`md=`***`Mode`*][,**`r=`***`Repeat`*];

DESCRIPTION

This command tests the audible and visible office alarms and associated user panel LEDs.

The specific office alarm test turns on a specific alarm for 10 seconds and turns it off for 10 seconds, after which the office alarm reverts to its normal operation.

The general office alarm test cycles through the various alarm levels (CR, MJ, MN) at 4-second intervals as shown in the following table:

General Alarm Test

Step	Time (Seconds)	ALARM LEVEL CR	MJ	MN
1	0-4	*off*	*off*	*off*
2	4-8	ON	*off*	*off*
3	8-12	off	ON	*off*
4	12-16	*off*	*off*	ON
5	16-20	*off*	*off*	*off*

The alarm cutoff (ACO) button functions normally while this test is executing. Depressing ACO silences audible office alarms.

Input parameters are:

`md` Mode identifies the office alarm test to be performed. It takes the following values:

- **`all`** General test of all office alarms (default)
- **`cr`** Specific test of critical alarm
- **`mj`** Specific test of major alarm
- **`mn`** Specific test of minor alarm.

`r` Repeat specifies the number of times that Steps 2 through 4 should be repeated. It is an integer with a range of **`1`** through **`10`** and a default value of **`1`**.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

The following denial message will be output if the test cannot be performed due to other activity in the system:

```
test-alm: DENY
SSRB
/* Status, System Resource Busy */
```

NAME

test-led: Test LED Indicators

INPUT FORMAT

`test-led`:[*`Address`*]:[**`r=`***`Repeat`*];

DESCRIPTION

This command activates circuit pack or user panel LEDs for 10 seconds on, then 10 seconds off, after which the LED reverts to normal operation. This command does not affect office alarms.

This test can also be done by pressing the alarm cutoff (ACO) button on the user panel.

The input parameters are:

`Address` This is the address of any slot(s) or **`userpanel`**, with a default value of **`all`**.

Valid Addresses: **`all, main-{1,2,all}, fn-{a,b,c,all}-{1,2,all}, ls-{a,b,c,all}-{1-8,all}, tg-{1,2,all}, sysctl, auxctl, userpanel`**

`r` Repeat specifies the number of times that the test should be repeated. It is an integer with the range **`1`** through **`10`** and a default value of **`1`**.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

When this command is entered while an alarm test is in progress, the following denial message will be output if the test cannot be done due to other activity in the system.

```
test-led:address DENY
SSRB
/* Status, System Resources Busy */
```

NAME

test-sysctl: Test System Controllers

INPUT FORMAT

test-sysctl;

DESCRIPTION

This command causes the entire control system (system controller and overhead controller) to perform a self-test. If this command is entered while a transmission test (**test-trmsn-t1** or **test-trmsn-t3**) is in progress, the following denial message will be displayed:

```
SSRB
/* Status, System Resources Busy  */
```

At the end of the test, one of the following messages will be displayed.

If the test passes, the following message will be displayed:

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
====================================================================
Test PASSED
*/
```

NOTE:
In the event this command was submitted from a *MegaStar* 2000 SONET Subsystem, and if the test passes, the following message will be displayed:

```
test-sysctl: COMPLD
/* SONET Controller Diagnostic Test Report
===================================================================
Test PASSED
*/
```

If the test fails, one of the following messages may be displayed, indicating that one or both controller circuit packs have failed:

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
===================================================================
SYSCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
===================================================================
OHCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
===================================================================
SYSCTL CP FAILED
OHCTL CP FAILED
*/
```

NOTE:
In the event this command was submitted from a *MegaStar* 2000 SONET Subsystem, and if the test fails, one of the following messages may be displayed, indicating that one or both controller circuit packs have failed:

```
test-sysctl: COMPLD
/* SONET Controller Diagnostic Test Report
===================================================================
SYSCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* SONET Controller Diagnostic Test Report
===================================================================
OHCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* SONET Controller Diagnostic Test Report
===================================================================
SYSCTL CP FAILED
OHCTL CP FAILED
*/
```

In addition to a failure message, the Fault LED on the failed circuit pack(s) and the Major alarm LED on the user panel will be illuminated, and the MJ office alarm will be activated.

NAME

test-trmsn-t1: Test Transmission T1

INPUT FORMAT

`test-trmsn-t1:`*`Address`***`:[dirn=`***`Direction`***`][,dur=`***`Duration`***`]`**;

DESCRIPTION

CAUTION:
Execution of this command will affect service. This command causes the insertion of a test signal on the selected channel in the MUX or DEMUX direction and will affect service on the selected channel.

This command is not applicable to the IMA LAN circuit pack

This command sets up an automated transmission test for a low-speed DS1 port.

This command will also set up an automated transmission test for an "internal" DS1 port within the TMUX (BBG20) circuit pack in OC-3 Release 13.0 and later. The test signal is a repetitive pattern which the system checks for bit errors. Only one channel is tested each time; multiple channels may not be tested simultaneously. Before this command is executed, the signal must be appropriately looped back. DDM-2000 checks for the presence of a loopback before beginning the test. If no loopback exists, the system will return a warning message before peforming the test.

This command is used for installation of new equipment and for maintenance.

The input parameters are:

`Address` Address of the DS1 port.

Valid Addresses: **`{a,b,c}-{1-7}-{1-4}`**

The T1EXT (BBF6) circuit pack (OC-3 Release 15.0) supports two T1 ports. When addressing ports on a BBF6, only port numbers 1 and 2 are valid.

`dirn` Direction of the transmission test. This parameter has the following values:

- **`mux`** The test signal is inserted in the MUX direction (towards the optical fiber) as shown in Figure 11-13. This is the default for this parameter.
- **`demux`** The test signal is inserted in the DEMUX direction (towards the DSX) as shown in Figure 11-14.

dur Duration of the test in minutes. This value has a range of 1 through 120 with a default value of 1.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

NOTE:
Loopbacks on the fiber when testing in the MUX direction will cause an "inconsistent DCC switches" alarm condition. The alarm should be ignored during the loopback testing. To avoid this alarm, the user may disable the DCC prior to performing this test.

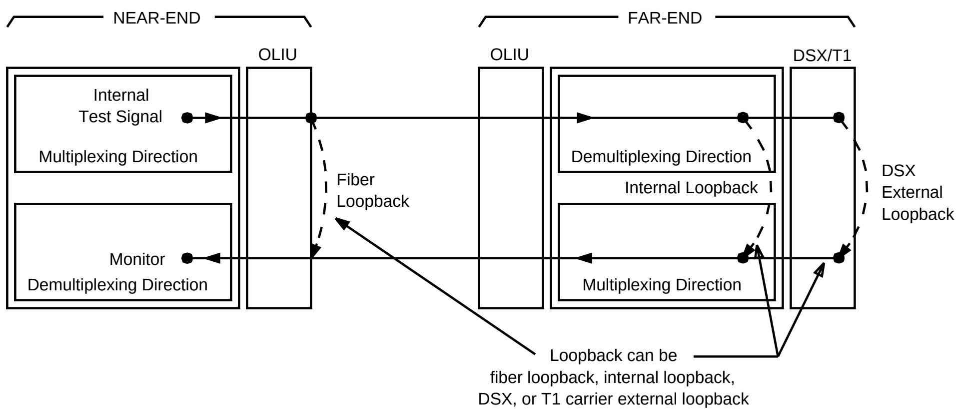


Figure 11-13. Automated Transmission Test of DS1 Signal in MUX Direction

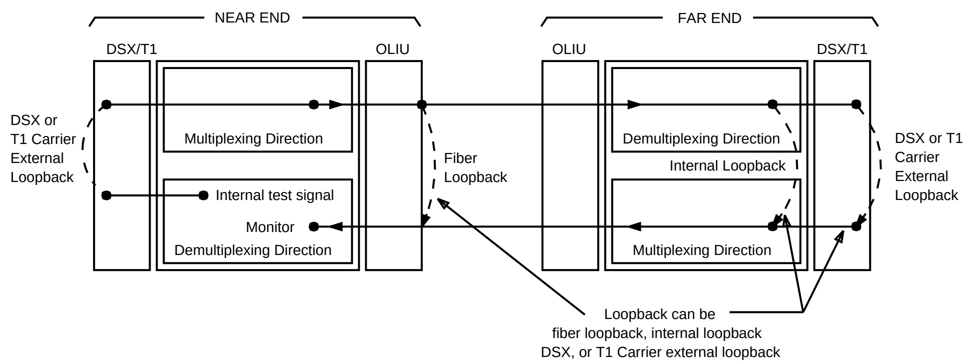


Figure 11-14. Automated Transmission Test of DS1 Signal in DEMUX Direction

This command displays the following output report:

```
/* DS1 Transmission Test Report
=============================================================
DS1 Port = addr, Direction = dirn, Duration = dur minutes
=============================================================
Elapsed       Errored
Time(sec)     Seconds
=============================================================
 nnn           nnn
  .
  .
  .
 nnn           nnn
  */
```

The output parameters are:

`DS1 Port`	The address of the DS1 port
`Direction`	The direction of the transmission test
`Duration`	The duration of the test in minutes
`Elapsed Time`	Elapsed time of the test in seconds
`Errored Seconds`	Total number of errored seconds.

A question mark (?) as the rightmost character in the `Errored Seconds` indicates uncertain data because of a protection switch during the test.

If an equipment failure is detected during test, the following message is displayed:

```
/* Hardware failed - Test Aborted */
```

The system checks for presence of a loopback at the beginning of the test. If a loopback does not exist, the test continues and the following message appears before and after the report:

```
/* Preliminary hardware test indicates no loopback. */
```

If the test is interrupted or aborted, the following message is displayed:

```
/* Test Manually Aborted */
```

The following denial message will be displayed if the test cannot be performed due to other activity in the system:

```
SSRB
/* Status, System Resources Busy */
```

When this command is entered, the following confirmation message is displayed:

```
/* Establish appropriate loopbacks (manual or electronic)
   prior to test execution, if appropriate. */

/* Caution! Execution of this test may interrupt service.
   You have selected the test-trmsn-t1 command with these parameters:

   Address = x
   Direction = dirn
   Duration = dur */

Execute? (y/n or CANcel/DELete to quit) =
```

Starting with OC-3 Release 15.0, if T1 ports (3, and 4) are specified when using the T1EXT circuit pack, the command will be denied and the following denial message displayed:

```
IIAC
/* Input, Invalid ACcess identifier */
```

RELATED COMMANDS

opr-lpbk-t1

rls-lpbk-t1

NAME

test-trmsn-t3: Test Transmission T3

INPUT FORMAT

test-trmsn-t3:*Address*:**[dirn=***Direction***][,dur=***Duration***];**

DESCRIPTION

CAUTION:
Execution of this command will affect service. This command causes the insertion of a test signal on the selected channel in the MUX or DEMUX direction and will affect service on the selected channel.

NOTE:
For the TMUX (BBG20) circuit pack in DDM-2000 OC-3 Release 13.0 and later, only the DEMUX direction of this command will be applicable.

This command sets up an automated transmission test for a low-speed DS3 port. The direction of the test can be towards either the MUX (towards the optical fiber) or the DEMUX (towards the DSX) transmission directions. The test signal is a framed DS-3 signal which DDM-2000 checks for P-bit parity errors. Only one channel is tested each time; multiple channels may not be tested simultaneously. Before this command is executed, the signal must be appropriately looped back.

This command is used for installation of new equipment and for maintenance. In either case, the signal must be appropriately looped back.

If the test is run in the MUX direction and an external loopback is established at the far end, then the far end must be provisioned for clear channel (CC) mode with no AIS in order to test the entire transmission path. If an external loopback is used and the far end is provisioned for VMR Mode, only errors in the receive direction will be monitored.

If the test is run using a DS3 internal loopback, DDM-2000 automatically puts the path in clear channel mode while the loopback is active. When the loopback is released, the mode returns to its previous state.

DDM-2000 checks for the presence of a loopback before beginning the test. If no looback exists, the system will return a warning message before peforming the test.

For TMUX circuit packs in OC-3 R13.0 and later, a DS3 AIS signal will be transmitted in the DEMUX direction (towards DSX-3), and the received signal will be checked for P-bit parity errors.

NOTE 1:
Loopbacks on the fiber when testing in the MUX direction will cause an "inconsistent DCC switches" alarm condition. The alarm should be ignored during the loopback testing. To avoid this alarm, the user may disable the DCC prior to performing this test.

NOTE 2:
When the addressed port is on a BBG19 DS3 circuit pack, the cross-connection between the port and the OC-N ring is a 0x1 DS3 connection. This means that for a test in the MUX direction, the test signal is transmitted only on the outgoing fiber connected to one of the main OLIUs. Only the signal received via the same OLIU is monitored for errors. It is the user's responsibility to ensure that the far-end loopback causes the signal to return on the proper fiber interface.

The input parameters are:

Address Address of the DS3 port.
Valid DS3 Port Addresses (BBG4, BBG4B, BBG20 TMUX): **{a,b,c}**

Valid DS3 Port Addresses (BBG19): **{a,b,c}-{1-2}**

dirn Direction of the transmission test. This parameter has the following values:

- **mux** The test signal is inserted in the MUX direction and the received signal is monitored from the MUX direction (default) as shown in Figure 11-15. This option is not applicable to the TMUX (BBG20) circuit pack.
- **demux** The test signal is inserted in the DEMUX direction and the received signal is monitored from the DEMUX direction as shown in Figure 11-16. Additionally, Figure 11-17 shows a TMUX signal inserted in the DEMUX direction.

dur Duration of the test in minutes. This value has a range of 1 through 120 with a default value of 1.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

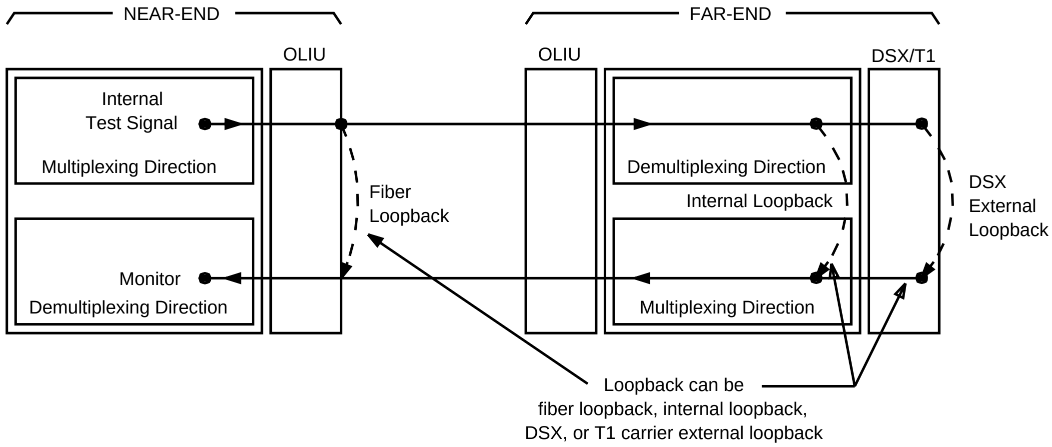


Figure 11-15. Automated Transmission Test of DS3 Signal in MUX Direction

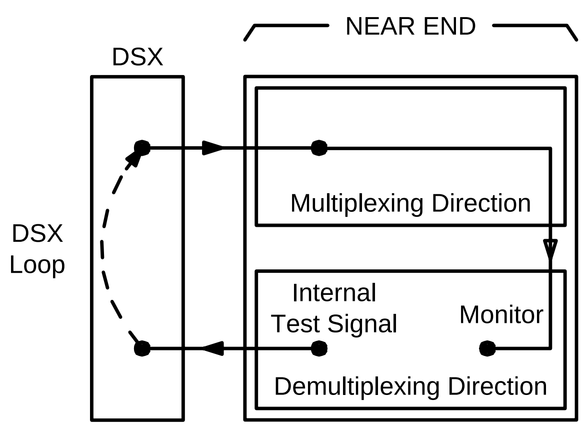


Figure 11-16. Automated Transmission Test of DS3 Signal in DEMUX Direction

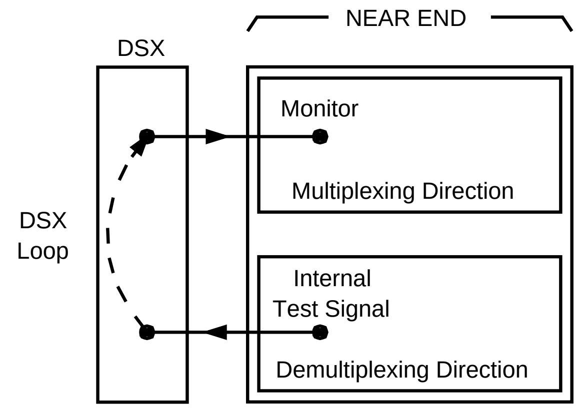


Figure 11-17. Automated Transmission Test of TMUX Signal in DEMUX Direction

This command displays the following output report:

```
/* DS3 Transmission Test Report
=============================================================
DS3 Port = addr, Direction = dirn, Duration = dur minutes
=============================================================
Elapsed       Errored
Time(sec)     Seconds
=============================================================
 n               n      Out Of Frame
 .               .
 .               .
 .               .
  */
```

The output parameters are:

`DS3 Port`	The address of the DS3 port
`Direction`	The direction of the transmission test
`Duration`	The duration of the test in minutes
`Elapsed Time`	Elapsed time of the test in seconds
`Errored Seconds`	Total number of errored seconds.

A question mark (`?`) as the rightmost character in the `Errored Seconds` column indicates uncertain data because of a protection switch during the test.

The message "Out Of Frame" appears in the report if an out-of-frame condition is detected during the test.

If an equipment failure is detected during the test, the following message is displayed:

```
/* Hardware Failed - Test Aborted */
```

The system checks for the presence of a loopback at the beginning of the test. If a loopback does not exist, the test continues and the following message appears before and after the report:

```
/* Preliminary hardware test indicates no loopback. */
```

If the test is interrupted or aborted, the following message is displayed:

```
/* Test Manually Aborted */
```

The following denial message will be output if the test cannot be performed due to other activity in the system:

```
SSRB
/* Status, System Resources Busy */
```

The following denial message will be output if the addressed port is a TMUX (BBG20) circuit pack and the **`mux`** option has been selected for the **`dirn`** parameter:

```
EQWT
/* EQuipage, Wrong Type */
/* This direction is not applicable to this pack. */
```

When this command is entered, the following confirmation message is displayed:

```
/* Establish appropriate loopbacks (manual or electronic)
   prior to test execution, if appropriate. */

/* Caution! Execution of this test may interrupt service.
   You have selected the test-trmsn-t3 command with these parameters:

   Address = x
   Direction = dirn
   Duration = dur */
Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

opr-lpbk-t3

rls-lpbk-t3

rtrv-pm-t3

NAME

toggle: Toggle Between Local and Remote Sessions

INPUT FORMAT

^t (Press "**t**" while holding the CTRL key)

DESCRIPTION

This command toggles the user between the local and remote sessions. It provides a quick and easy way to switch from the local session to the remote session, while not terminating either one. The user must have established two valid sessions with network elements (NEs) in the local NE's subnetwork before this command executes successfully.

This command may be entered *only* between command executions; that is, *only* at the system prompt. If entered as a response to a parameter prompt, an error message will be displayed.

This command does not display a typical completion message. When entered, the TID for the NE switched to is displayed, followed by the date and time. This line is followed by a prompt from that system.

The following denial message will be output if the toggle cannot be performed.

```
SNVS
/* Status, Not in Valid State */
/* No remote login is active */
```

If the toggle request fails due to a far-end communication failure (after trying for 45 seconds or more), the following denial message will be displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Far end Communication failure */
```

RELATED COMMANDS

logout

rlgn

NAME

upd: Update Equipment List

INPUT FORMAT

upd;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command updates the system data base (as recorded in the nonvolatile memory) to reflect the existing hardware configuration and incoming signals.

This command can be executed either by pushing the Update/Initialize button, located on the SYSCTL circuit pack or by entering the command from the CIT. When the Update/Initialize button is pushed, a dot (.) will appear on the 7-segment display.

NOTE 1:
An **upd** may be performed at any time *except* before or during the 10-second window after powering up the System Controller (SYSCTL) while the critical (CR) LED is flashing.

NOTE 2:
The user should note that the critical LED light on the SYSCTL circuit pack will continue to flash after pressing the Update/Initialize button for a system reset. Do *not* reenter this command. The LED light will stop flashing after 10 seconds.

Starting with OC-3 Release 15.0, the IMA LAN circuit pack will be supported and allowed in the Low Speed slots of the OC-3 shelf.

Upon insertion of the IMA LAN circuit pack, the LAN port goes to **auto**. If a VT cross-connect is created, the VT channel goes to **auto**. If a good signal is received through this cross-connect, the VT channel, the DS1 port, and the LAN interface go to **in-service** (when the first VT/DS1 goes to **in-service**, the corresponding LAN interface goes to **in-service**). If the cross-connected VT channel receives **inc. VT AIS** signal on both rings and the user hits **upd**, the VT channel and the DS1 go back to **auto**. When the last DS1 port goes to **auto**, then the corresponding LAN interface goes to **auto** as well.

This command should be executed after the following:

- Removing a circuit pack — Activating the **upd** command following circuit pack removal deletes the circuit pack from the equipment list and clears the associated alarm. This command also changes the slot state to `auto`. Failure to update after removing a circuit pack will continue the "CP removed" alarm, which will become an "unexpected CP type", or similar alarm when a new and different type of circuit pack is placed in the slot. Performing the update at this later time will clear this alarm and provide default provisioning for the new circuit pack, provided the circuit pack is acceptable.
- Removing a signal input — When an incoming DS1, T1, or EC1 signal is removed, the system data base must be updated to reflect the change and clear the associated alarm.
- Removing an STS1 or VT1.5 AIS alarm for incoming channels.
- Changing a switch setting on a circuit pack — The **upd** command should be activated following switch setting changes on the BBF1/BBF1B DS1, BBF3 DS1PM, BBG6 STS1E, or BBF6 T1EXT (OC-3 Release 15.0) 21G OLIU, or BBF2/BBF2B TGS circuit packs. This command enters the new settings into the system. Failure to update will cause an "unexpected CP switches" or "unexpected CP type" alarm, since the new switch settings do not agree with the switch settings already recorded in the system. Activating the update function will clear this alarm and make the new switch settings effective.
- Replacing Circuit Pack types — The user can "upgrade" from one type of circuit pack to another type in the following cases.

  Automatic Upgrades — no alarms occur and there is no need to update:

  1. For low-speed slots — from any BBF1/BBF1B to any other BBF1B/BBF1 type DS1 pack
  2. For 1+1 slot pairs — from older 26-type to enhanced 26-type OLIU packs.
  3. For low-speed slots — from any BBG4/BBG4B to any other BBG4B/BBG4 type DS3 pack
  4. For 1+1 slot pairs — from any 21-type OLIU to any other 21-type OLIU pack
  5. For 1+1 slot pairs — from older 22-type to enhanced 22-type OLIU packs.
  6. For 1+1 slot pairs — from older 27-type to enhanced 27-type OLIU packs.
  7. For timing slots — from BBF2 to BBF2B type TGS packs.

Manual Upgrades — "unexpected CP type" alarm will occur, and an update must be done:

1. For low-speed slots — from BBF1/BBF1B to BBF3 type DS1 packs
2. For low-speed slots — from BBF3 to BBF1/BBF1B type DS1 packs
3. For 1+1 slot pairs — from 21-type to 22-type OLIU packs.
4. For 1+1 slot pairs — from 22-type to 21-type OLIU packs.
5. For 1+1 slot pairs — from 22-type to 24-type OLIU packs.
6. For 1x1 slot pairs — from BBG2 MXRVO to BBG6 STS1E (high speed) packs.
7. For low-speed slots (b & c) — from BBG6 STS1E to 22-type OLIU packs for ring applications.

Manual Upgrades — "unexpected CP switches" alarm will occur and an update must be done:

1. For timing slots — between BBF2B and BBF2 TGS packs.

Following the documented upgrade procedures (slot 1 of 1x1 or 1+1 pairs), the old type circuit pack is removed and replaced with the new type circuit pack. Activating the update function will clear the alarm for new pack type and make the new circuit pack settings active.

Note: Upgrading from a 1x1 STS1E to an OC-3/IS-3 will force the application to 1+1.

ALARM RESTRICTIONS

Pressing the UPD button or issuing the **`update`** command will *not* change provisioning if the following alarms exist. The user will have to correct the alarmed condition before executing this command. These alarms are:

- illegal CP type
- CP not allowed -(*reason*)
- 2nd CP required for BBF3
- invalid CP switches.

SYSTEM RESTRICTIONS AND CORRECTIVE ACTIONS

Pressing the UPD button or issuing the **`update`** command will not retire a "CP removed", "unexpected CP type", or "unexpected CP switches" alarm or allow the system to accept the new provisioning request if certain system conditions exist. The user will have to correct the condition before updating the system.

If a restriction is detected, the following message will be displayed:

```
/* Address not equipped properly -- provisioning unchanged. */
```

The system restriction and corrective actions needed are:

- **Port status in NMON or IN SERVICE**
  If a low-speed circuit pack is removed before the incoming signal is removed or while the associated port or ports are in the *nmon* state, the system will not recognize that the service is no longer being carried on the port and will not remove the circuit pack from the equipment list. Note that this restriction does not apply to OLIU circuit packs in systems that support OC-N line states.
  Corrective Action: If the port is in the *nmon* state, it must be moved to the *auto* state, using the **set-state-t1**, **set-state-t3**, or **set-state-ec1**, command, before the circuit pack can be removed and the system can be updated. If an incoming signal is present, it must first be removed, then the circuit pack can be removed, and the system can be updated.

- **Manual cross-connection exists**
  A manual cross-connection is entered into the system when an arrangement other than the default is desired and to support various applications.
  Corrective Action: The system will not recognize a circuit pack removal until the manual cross-connection to the addressed circuit pack is deleted. (See the **dlt-crs-sts1**, **dlt-crs-vt1**, **rtrv-crs-vt1**, and **rtrv-crs-sts1** commands for more information on manual cross-connections.)

  For 1+1 or 1x1 slot pairs, one circuit pack of the pair can be removed as long as the other remains to support the cross-connection. For rings systems, the MAIN circuit packs are special and all cross-connections in the system must be deleted before the addressed circuit pack can be removed.

  For function units to which a 0x1 path is connected, one circuit pack of the pair can be removed as long as the other remains to support the cross-connection.

  For 27-type OLIU function units to which a locked path is connected, the pack of the pair to which the connection is addressed cannot be removed until the manual cross-connection to the addressed pack is deleted.

- **Low-speed protection circuit pack in service**
  The low-speed protection slot is currently supporting service.
  Corrective Action: Before the protection pack can be removed and the protection slot moved to the `auto` state, the service must be moved back to the service pack.

- **Upgrades from Slot 2**
  Upgrades from Slot 2 of a 1x1 or 1+1 pair are not permitted when Slot 1 is equipped.
  Corrective Action: The documented upgrade procedures to change one type of circuit pack for another require that the change first be made in slot 1 of a slot pair when slot 1 is equipped.

- **TGS switches do not support timing source selected**
  The shelf is currently provisioned to be line-timed and the new TGS pack type or switch settings do not support the existing condition.
  Corrective Action: Reset the switches on the TGS circuit pack, or replace the circuit pack with one that supports timing from FN-C; or change Linetiming source to MAIN. Prior to Release 9.1, the system may be line-timed only from an 21- or 22-type OLIU in the MAIN or FN-C slots; the 27-type OLIU does not support line timing. Starting with Release 9.1, line-timing from 27-type OLIUs is available.

- **Timing Source removed**
  When the sync timing source is provisioned to be LineTimed and the addressed circuit pack is selected for timing, the slot state will not change to `auto`.
  Corrective Action: Insert an OLIU circuit pack that supports the timing selected or change the timing source.

- **Sync Autoreconfiguration Selected**
  When the sync timing is provisioned for Autoreconfiguration and the addressed circuit pack is one of the sources for timing, the slot state will not change to `auto`.
  Corrective Action: Insert an OLIU circuit pack that supports the timing selected or change the timing provisioning.

- **Change Time setting from Line to External**
  If a system's sync timing source switch from Line to External timing is attempted by changing the switches on the TGS pack to an External timing setting while leaving the sync timing in Autoreconfiguration mode `enabled`, the attempt to switch from Line to External Timing will fail.
  Corrective Action: In order to switch from Line to External timing, the user MUST ensure that in addition to setting the switches on the TGS pack to External timing, the Sync Autoreconfiguration parameter is set to `disabled`.

If a protection switch request of **`forced`**, **`inhibit`**, or **`lockout`** is specified to a slot that is now empty, entering the **`upd`** command may cause the protection switch to occur possibly affecting service. When this occurs, the following confirmation message will be displayed:

```
/* Caution!  Execution of the update command may interrupt
   service because of an active protection switch request on
   an empty slot.  It also updates the equipment list and
   initializes ALL parameters associated with empty slots. */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-sts1

dlt-crs-vt1

rtrv-crs-sts1

rtrv-crs-vt1

rtrv-state-eqpt

rtrv-state-path

set-state-t1

set-state-t3

set-state-ec1

set-state-oc1

Detailed Alarm and History Reports

This section provides details of the Retrieve Alarm and Retrieve History commands with explanations of specific output messages.

Each command includes an **INPUT FORMAT** part, providing the syntax for the command, and a **DESCRIPTION** part, providing the details of the command input and output parameters. Following the **DESCRIPTION** part is a table listing the output messages associated with each command and a description of each message.

NAME

rtrv-alm: Retrieve Alarm and Status

INPUT FORMAT

`rtrv-alm[:alm=`*`AlarmLevel`*]**;**

DESCRIPTION

This command displays a report of active alarm and status conditions of the local network element. The report includes the source address of the alarm, as well as the date and time of the alarm, whether or not the condition is service affecting, and a short description of the condition.

The input parameter is:

`alm` AlarmLevel for which a report is desired. This parameter may have one of the following values:

- **`all`**
- **`cr`**
- **`mj`**
- **`mn`**
- **`pmn`**
- **`other`**

Alarms are listed from greatest to least severity. Within a severity level, newer alarms are listed first.

Example Alarm Report:

```
/* Active Alarms and Status Report
============================================================
 Alarm       Source    Date   Time      Srv   Description
 Level       Address     Detected
============================================================
 Condition   address   MM-DD HH:MM:SS   srv   description
                             .
                             .
                             .
 Condition   address   MM-DD HH:MM:SS   srv   description
*/
```

The output parameters are:

`Alarm Level` Alarm level is the alarm or status condition being reported. A status condition is named status if there is no user panel LED illuminated for that condition. An alarm condition is the name of the topmost LED on the user panel that is illuminated and may be one of the following conditions:

`CRITICAL`

`MAJOR`

`MINOR`

`PWR MINOR`

`abnormal (status LED)`

`ne-acty (status LED)`

`fe-acty (status LED)`

`status (no LED)`

`Source Address` Source address is the address of the event. An event source may be a slot, channel, port, IAO LAN interface or an operations interface. See Table 11-1 at the beginning of this chapter for the address of slots, ports, channels, IAO LAN, and operations interfaces, respectively.

Starting with OC-3 Release 15.0, when an IMA LAN apply is in progress, Source will indicate the address of the Low Speed slot(s) equipped with the IMA LAN pack. Valid Slot Addresses: **`ls-{a,b,c}-{1-7,all}`**

NOTE:
Knowing that the IMA LAN pack occupies two consecutive Low Speed slots, following guidelines are used:

the IMA LAN pack address is the address of lowest slot number of the two occupied by the pack; for example: If the IMA LAN circuit pack is inserted in Low Speed slots *`a-1`* and *`a-2`*, the Address used in this case is *`ls-a-1`*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed Address combinations:
`ls-{a,b,c}-{3 and 4}` is allowed.
`ls-{a,b,c}-{6 and 7}` is allowed

Refer to Table 11-1 for other source addresses.

`Date Detected`	Month (MM) and day (DD) of the event.
`Time Detected`	Time (Hours, Minute, Seconds) of event occurrence.
`Srv`	Srv indicates whether the condition is service affecting or not, and may have the following values:

SA	Service affecting
NSA	Not service affecting
-	Not applicable for this condition (not service affecting).

`Description`	Table 11-3 lists the meanings and likely causes of the conditions reported in the alarm and status report. For conditions with more than one possible cause, the most likely causes are listed first.

RELATED COMMANDS

rtrv-hsty

Table 11-3. RTRV-ALM Descriptions

Description	Meaning
`2nd CP required for BBF3`	The BBF3 (DS1PM) circuit pack requires both function unit slots in the group to be equipped. A second circuit pack of the same type should be inserted in the empty function unit slot.
`2nd CP reqd for BBF6/BBF9`	The BBF6 (T1EXT) and the IMA LAN circuit packs require both function unit slots in the group to be equipped. A second circuit pack of the same type should be inserted in the empty function unit slot.
`–48V power/fuse failed`	A –48 volt power feeder or a fuse on the user panel has failed.
`–48V power/fuse FA|FB failed`	A –48 volt power feeder or a fuse on the user panel has failed. (FA or FB identifies failure if BBG8 controller used.)
`AC power failed`	The AC power supply to a remote terminal cabinet has failed.
`ACO active`	The parallel telemetry outputs and audible office alarms normally active due to the alarm conditions in the system are being suppressed. See the **`opr-aco`** command.
`AGNE communication failure`	A network element cannot establish communication with the alarm gateway network element (AGNE), or the AGNE cannot establish communication with a network element in the same alarm group. Use the **`rtrv-map-network`** command to determine if both network elements are in the same alarm group. In OC-3 Release 9.8, 13.0, and later TARP releases, "AGNE communication failure" events will no longer be detected or reported. Starting with OC-3 Release 15.0, the remote NE status feature is reinstated. If this event is reported it means that a network element cannot establish communication with the alarm gateway network element (AGNE), or that the AGNE has lost communication with a network element in the same alarm group.
`APS - automatic lock`	The service associated with a DS1 or T1EXT CP has been automatically switched and locked onto the protection DS1 or T1EXT CP. The automatic protection switching (APS) lock will remain active until midnight. Cause: Four automatic switches of a single DS1 or T1EXT CP in 10 minutes, probably because of an intermittent failure of the DS1 or T1EXT CP.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`APS channel failed`	The SONET automatic protection switching (APS) channel on the protection OC-3 line has failed. Likely causes: Failure of the OLIU CP on the protection line at the far end; failure of the OLIU CP on the protection line at the near end.
`auto turnup test IP`	An automatic turnup test is in progress.
`BBF5 required in LS-4`	A BBF5 circuit pack is missing from a group 3 (or earlier) shelf with two 27G2-U OLIU circuit packs in a function unit. The BBF5 is required to cross-couple transmission between the 27G2-U OLIUs. The alarm will clear when a BBF5 circuit pack is installed in slot 4 of the low-speed unit. This alarm is also issued for group 3 shelves equipped with two native mode lan (ELAN BBG21) circuit packs in a function unit. In this application the BBF5 is required to transmit status information between the working and standby BBG21 circuit packs.
`BBF5 required in LS-8`	A BBF5 circuit pack is missing from a group 3 (or earlier) shelf with two 27-type OLIU circuit packs in a function unit. The BBF5 is required to allow proper DCC operation of the associated 27-type OLIUs with the DDM-2000 FiberReach shelves. The alarm will clear when a BBF5 circuit pack is installed in slot 8 of the low-speed unit.
`control`**n**	The specified environmental control point (miscellaneous discrete output) is active. Note: The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-cont`** and **`set-attr-cont`** commands. Cause: The system was instructed to close the environmental control point by either a TBOS control point or by the closing of the corresponding environmental control input at the far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`CP not allowed-(crs)`	The circuit pack does not support the manual cross-connection(s) currently provisioned for this slot. The user should change the circuit pack type or change the cross-connection(s) to the slot.
`CP not allowed-(eqpt)`	A DS1, DS1PM, T1EXT or IMA LAN CP is installed in a low-speed slot associated with a function unit currently provisioned for DS3, STS1E_L, or OLIU service. The DS1, DS1PM, T1EXT or IMA LAN CP should be removed from the shelf, or the function unit CP should be replaced with a MXRVO or STS1E_H (linear releases only) CP. A second reason for getting this message is that a DS1, DS1PM or T1EXT For IMA LAN, this message might indicate also that the pack is inserted in slots 7&8, slot 4 as the lower slot number or across groups. A DS1, DS1PM, or T1EXT CP is installed in a low-speed slot and has caused a protection mismatch between a service slot and a protection slot. For IMA LAN, inserting the pack in LS slot 7&8 or across LS slots will cause this message. Also for T1EXT in a Group 4 shelf, equipping the corresponding Function Units with BBG2 packs will cause this message.
`CP not allowed-(timing)`	When associated with a TG slot, the current circuit pack switch settings do not support the synchronization timing provisioned. The user should change the circuit pack switches or change the settable synchronization parameters. When associated with function unit slot C, the circuit pack type does not support the current provisioned synchronization parameters. The circuit pack type or the timing options should be changed.
`CP removed`	A CP previously installed in this system is removed. The CP should be replaced, or an "update" should be done to remove it from the system equipment list. **NOTE:** Starting with OC-3 Release 11.0, if this alarm event exists on Fn-X (where a 27G2-U OLIU pack is installed) and if at least one local Hairpin Add-Drop cross-connect is established between Fn-X and Fn-Y, an automatic protection switch on the Main circuit packs (CPs) is done as a result of this alarm event (that is, detecting a circuit pack removal of a 27G2-U in Fn-X-1/2, which will cause the Main packs to switch as well).

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`DS1 CP failed`	Internal equipment failure of the specified DS1 CP.
`DS1 loopback`	A loopback (toward the optical fiber) is active on the specified T1 port. See the **`opr-lpbk-t1`** and **`rls-lpbk-t1`** commands.
`DS1 loopback (to fiber)`	A loopback (toward the optical fiber) is active on the specified T1 port. See the **`opr-lpbk-t1`** and **`rls-lpbk-t1`** commands.
`DS1 loopback (to DSX)`	A loopback (toward the DSX) is active on the specified T1 port. See the **`opr-lpbk-t1`** and **`rls-lpbk-t1`** commands.
`DS1 trmsn test IP`	A transmission test using the internal test signal generator and monitor is in progress on the specified T1 port. See the **`test-trmsn-t1`** command.
`DS1PM CP failed`	Internal equipment failure of the specified DS1PM CP.
`DS3 CP failed`	Internal equipment failure of the specified DS3 CP. _ `DS3 loopback`!T{ A loopback (toward the optical fiber) is active on the specified T3 port. See the **`opr-lpbk-t3`** and **`rls-lpbk-t3`** commands.
`DS3 loopback (to Fiber)`	A loopback (toward the optical fiber) is active on the specified T3 port. See the **`opr-lpbk-t3`** and **`rls-lpbk-t3`** commands.
`DS3 loopback (to DSX)`	A loopback (toward the DSX) is active on the specified T3 port. See the **`opr-lpbk-t3`** and **`rls-lpbk-t3`** commands.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`DS3 trmsn test IP`	A transmission test using the internal test signal generator and monitor is in progress on the specified T3 port. See the **`test-trmsn-t3`** command.
`dormant/exec code mismatch`	This alarm condition is raised when the network element detects that it contains dormant software with a release number that does not match the release number of the executing software. (NA to IMA LAN)
`EC1 loopback`	A loopback (toward the optical fiber) is active on the specified EC1 port. See the **`opr-lpbk-ec1`** and **`rls-lpbk-ec1`** commands for more information.
`EC1 loopback (to Fiber)`	A loopback (toward the optical fiber) is active on the specified EC1 port. See the **`opr-lpbk-ec1`** and **`rls-lpbk-ec1`** commands for more information.
`EC1 loopback (to DSX)`	A loopback (toward the DSX) is active on the specified EC1 port. See the **`opr-lpbk-ec1`** and **`rls-lpbk-ec1`** commands for more information.
`environment`**n**	The specified environmental alarm point (miscellaneous discrete input) is active. The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-env`** and **`set-attr-env`** commands.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`excessive holdover`	The system has been in holdover mode for more than 4 hours. This may cause degraded performance (high error rates) on the transmitted and/or received signals. Whenever this condition exists, the condition "`holdover mode active`" also exists. Likely Causes: See "`holdover mode active`."
`externalMinor`	The external minor alarm input (environmental alarm input 15) is active. Typically, this input will be connected to the power shelf and will indicate that the DC power or the cooling fan in a remote terminal cabinet has failed. The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-env`** and **`set-attr-env`** commands.
`fan control relay failed`	The thermostat on the SYSCTL indicates that the cooling fan should be turned on, and the fan control relay on the SYSCTL CP failed to operate or the fan control relay output (backplane connector P62) does not connect to a fan. The system will continue to operate but might overheat if the SYSCTL controls a fan, leading to degraded or interrupted transmission and/or circuit pack failures. Likely causes: Telemetry output common pin on P62 is not grounded; SYSCTL CP failure.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`fan shelf failed`	The system has detected a failure of the DDM-2000 fan shelf. The system will continue to operate but it may overheat. The fan must be replaced within *4 hours* of the failure; otherwise service might be interrupted and/or circuit packs might fail. Likely causes: Filter needs replacing, a fan pack failed, fan shelf has lost one or both power feeders, or the fan shelf control board has failed.
`forced switch`	When associated with a line, this message means that the identified line is not selected as the active receiving line, and an automatic or manual protection switch to make this the active receiving line will not be done. The forced switch will remain in effect until the protection switch is reset, or a lockout or inhibit switch request is received. Note that switching is unidirectional (one-way). Because of this, the specified line might still be active (if the far end is selecting the specified line to receive traffic), and the far end might still be free to switch the line it is selecting to receive traffic. See the **`switch-line`** command. When associated with a function unit slot or a low-speed service slot, this message means that the identified equipment is not active, and an automatic or manual switch to make it active will not be done. The forced switch will remain in effect until the protection switch is reset, or a lockout or inhibit switch request is received. See the **`switch-fn`** and **`switch-ls`** commands.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`holdover mode active`	The system is in holdover synchronization mode. Likely causes: a. The system was manually switched to holdover mode (with the **`switch-sync`** command, or, in a central office system, with a TBOS control point) and the switch has not been reset b. The system automatically switched to holdover mode due to failure of the timing references, as follows: 1. The reference failures have not cleared. 2. The system is provisioned for nonrevertive synchronization mode switching. 3. The system is provisioned for `External` timing and no external timing references are available. 4. The system is provisioned for line-timed operation and the optical line or OLIU circuit pack has failed, or a message indicating an upstream clock problem has been received on the sync message bits of the optical line. (See the **`rtrv-sync`** command.) 5. The system is provisioned for sync message signaling, but the upstream system from which it line-times has not been provisioned for sync message signaling. The condition can be cleared by provisioning both systems the same. (See the **`set-sync`** and **`rtrv-sync`** commands.) The condition can be cleared by repairing at least one of the timing references (if both are failed) and resetting synchronization mode protection switch with the command **`switch-sync:s=mode,pri=reset`**. In a central office system, the synchronization mode can also be reset with a TBOS control point.
`illegal CP type`	An illegal or unknown circuit pack type has been inserted into the shelf. The circuit pack should be removed from the shelf.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`LAN CP failed`	Internal equipment failure of the specified IMA LAN CP.
`inc. (from DSX) DS1 LOS`	At least 128 consecutive zeros are received in the DS1 signal incoming from the DSX-1, or the energy at the DS1 input is below a preset threshold. Likely causes: Hard failure of upstream equipment or facility (towards the DSX-1). The DS1 input is disconnected at the backplane or the DSX-1; equipment is failed or removed at DSX-1.
`inc. (from DSX) DS1 sig fail`	The bit error ratio (BER) in the DS1 signal incoming from the DSX-1 exceeds the provisioned failure threshold, 10^{-3}, 10^{-6}, 10^{-7}, or 10^{-8}. Likely causes: Mismatch of line code (AMI/B8ZS); failure of upstream equipment or facility (towards the DSX-1); cross talk in office wiring; failure of the DS1 CP.
`inc. (from fiber) DS1 LOF`	Applicable to the IMA LAN circuit pack only. Indicates that the DS1 framer is unable to frame align with the incoming DS1 signal. Likely cause: Hard failure of upstream DS1 equipment or a failure of the local DS1 equipment. A DS1 LOF could also result from a facility failure although a DS1 AIS condition is normally reported if there is an upstream facility failure affecting the DS1.
`inc. (from fiber) DS1 AIS`	Applicable to the IMA LAN CP only --- The system has detected a DS1 alarm indication signal incoming from the SONET side. The system responds by transmitting DS1 AIS. Likely causes: An upstream facility failure affecting the DS1.
`inc. DS1 sync. ref. AIS`	DS1 alarm indication signal (AIS) is being received from the DS1 synchronization reference signal. Likely causes: Failure of upstream equipment or facility (towards the DSX-1).
`inc. DS1 sync. ref. BER`	The bit error ratio (BER) in the DS1 synchronization reference signal exceeds 10^{-3}. Likely causes: Failure of upstream equipment or facility (towards the DSX-1).
`inc. DS1 sync. ref. EOOF`	Excessive out-of-frame (OOF) events were detected in the DS1 synchronization reference signal. Excessive OOF is defined as more than 512 out-of-frame events in one day. Likely cause: Failure of the incoming DS1 synchronization reference signal.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. DS1 sync. ref. LOF`	The system is unable to frame on the DS1 synchronization reference signal. Likely causes: Upstream failure in the clock providing the reference signal; high bit error ratio on the received signal, caused by failure of the office timing supply that provides the DS1 timing reference; the system is provisioned for SF format on the specified DS1 synchronization reference signal and the received DS1 signal is in ESF format.
`inc. DS1 sync. ref. LOS`	At least 128 consecutive zeros were received in the DS1 synchronization reference signal, or the energy at the DS1 input is below a preset threshold. Likely causes: Failure of the office timing supply that provides the DS1 timing reference or failure of the connection to the timing supply.
`inc. DS1 sync. ref. OOL`	The incoming DS1 synchronization reference signal is out of lock (OOL). The frequency of the clock providing the DS1 reference signal is out of specification. Likely causes: Failure of the office timing supply that provides the DS1 timing reference.
`inc. (from fiber) DS3 AIS`	The system has detected DS3 alarm indication signal (AIS) in the DEMUX direction (that is, coming from the fiber) for the specified DS3 signal. Likely causes: The incoming DS3 signal at the far end is failed, or DS3 AIS is received from the DSX-3 at the far end.
`inc. (from DSX) DS3 AIS`	The system has detected DS3 alarm indication signal (AIS) in the MUX direction (that is, coming from the DSX-3) for the specified DS3 signal. This alarm is applicable to the TMUX (BBG20) circuit pack only. Likely cause: The incoming DS3 signal at the far end is failed.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc DS3 LOS`	At least 128 consecutive zeros were detected in the DS3 signal received from the DSX-3. Likely causes: Equipment failed or removed at DSX-3; DS3 input disconnected at the DSX-3 or at the DDM-2000 backplane.
`inc. (from fiber) DS3 OOF`	The system has detected a DS3 out-of-frame (OOF) condition in the DEMUX direction (that is, coming from the fiber) for the specified DS3 signal. This condition is reported only if the DS3 interface is provisioned in VM or VMR mode. See the **`set-t3`** and **`rtrv-t3`** commands. Likely causes: An out-of-frame DS3 signal incoming to the DSX-3 at the far end; failure of the DS3 CP at the far end or near end; the DS3 signal is looped at both ends.
`inc. (from DSX) DS3 OOF`	The system has detected a DS3 out-of-frame (OOF) condition in the MUX direction (that is, coming from the DSX-3) for the specified DS3 signal. This alarm is applicable to the TMUX (BBG20) circuit pack only. Likely cause: An out-of-frame DS3 signal incoming to the DSX-3 at the far end.
`inc. (from DSX) DS3 sig. fail`	The bit error ratio (BER) in the incoming DS3 signal exceeds the provisioned failure threshold, 10^{-3} or 10^{-6}. Likely causes: Failure of the upstream equipment or facility (towards the DSX-3); cross talk in office wiring; unprotected failure of DS3 CP.
`inc. EC1 FERF`	The system has detected the EC-1 far-end receive failure (FERF) signal in the incoming EC-1 signal. Likely causes: The far end has detected an incoming signal failure on the specified EC-1 line. This may be caused by failure of the STS1E or 3STS1E CP at the near end, the STS1E or 3STS1E CP at the far end, or the transmit cable on the specified line.
`inc. EC1 LOF`	The system has detected a loss-of-frame (LOF) condition in an incoming EC-1 signal. LOF is defined as an out-of-frame (OOF) condition (five consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the STS1E or 3STS1E or equivalent CP at the far end, failure of the STS1E or 3STS1E or equivalent CP at the near end, failure of the incoming cable, or a cable disconnect at the STSX-1 or shelf connector.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. EC1 LOS`	The system has detected a loss-of-signal (LOS) condition on the EC-1 line. Likely causes: Failure of the incoming signal or cable from the STSX-1, failure of the STS1E or 3STS1E CP at the near end, or a cable disconnect at the STSX-1 or shelf connector.
`inc. EC1 line AIS`	The system has detected an EC-1 line alarm indication signal (AIS) on an incoming EC-1 line. Likely cause: Failure of an STS1E or 3STS1E CP at the far end.
`inc. EC1 sig. degrade (BER)`	The bit error ratio (BER) in the received EC-1 signal exceeds the provisioned threshold (10^{-5} to 10^{-9}). Likely causes: Failure of the STS1E or 3STS1E CP at the near end, failure of the incoming cable, cross talk in office wiring, or failure of the incoming signal from the STSX-1.
`inc. EC1 sig. fail (BER)`	The bit error ratio (BER) in the received EC-1 signal exceeds the fixed threshold of (10^{-3}). Likely causes: Failure of the STS1E CP at the near end, failure of the incoming cable, cross talk in office wiring, or failure of the incoming signal from the STSX-1.
`inc. OC12 FERF`	The system has detected the OC-12 far end receive failure (FERF) signal in the incoming OC-12 signal. Likely causes: The far end has detected an incoming signal failure on the specified OC-12 line. This may be caused by failure of the OLIU CP at the near end, the OLIU CP at the far end, or the transmit fiber on the specified line.
`inc. OC12 line AIS`	The system has detected OC-12 line alarm indication signal (AIS) on an incoming OC-12 line. Likely cause: Failure of an OLIU CP at the far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. OC12 LOF`	The system has detected a loss-of-frame (LOF) condition in an incoming OC-12 signal. LOF is defined as an out-of-frame (OOF) condition (four consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
`inc. OC12 LOS`	The system has detected a loss-of-signal (LOS) condition on the OC-12 line. Likely causes: Failure of the OLIU CP at near end, failure of the OLIU CP at far end, or failure of the receive fiber.
`inc. OC12 sig. degrade (BER)`	The bit error ratio (BER) in the specified OC-12 line exceeds the provisioned soft error threshold (10^{-9} to 10^{-5}) but is below the hard error threshold of 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, failure of the receive fiber, or optical attenuator is being used when it should not be, or is not being used when it should be.
`inc. OC12 sig. failed (BER)`	The bit error ratio (BER) in the received OC-12 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.
`inc. OC3 BER`	The bit error ratio (BER) in the received OC-3 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.
`inc. OC3 FERF`	The system has detected the OC-3 far end receive failure (FERF) signal in the incoming OC-3 signal. Likely causes: The far end has detected an incoming signal failure on the specified OC-3 line. This may be caused by failure of the OLIU CP at the near end, the OLIU CP at the far end, or the transmit fiber on the specified line.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. OC3 LOF`	The system has detected a loss-of-frame (LOF) condition in an incoming OC-3 signal. LOF is defined as an out-of-frame (OOF) condition (five consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
`inc. OC3 LOP STS1` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-3 lines, the likely cause is an unprotected failure of a MXRVO or DS3 CP at the far end. If this condition occurs only on one OC-3 line, the likely cause is failure of the OLIU CP at the near end or far end.
`inc. OC3 LOS`	The system has detected loss-of-signal (LOS) condition on the OC-3 line. Likely causes: Failure of the OLIU CP at near end, failure of the OLIU CP at far end, or failure of the receive fiber.
`inc. OC3 line AIS`	The system has detected OC-3 line alarm indication signal (AIS) on an incoming OC-3 line. Likely cause: Failure of an OLIU CP at the far end.
`inc. OC3 sig. degrade (BER)`	The bit error ratio (BER) in the specified OC-3 line exceeds the provisioned soft error threshold (10^{-9} to 10^{-5}) but below the hard error threshold of 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, failure of the receive fiber, or incorrect setting of the optical power switch on the OLIU CP.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. OC3 sig. failed (BER)`	The bit error ratio (BER) in the received OC-3 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.
`inc. OC1 FERF`	The system has detected the OC-1 far end receive failure (FERF) signal in the incoming OC-1 signal. Likely causes: The far end has detected an incoming signal failure on the specified OC-1 line. This may be caused by failure of the OLIU CP at the near end, the OLIU CP at the far end, or the transmit fiber on the specified line.
`inc. OC1 LOF`	The system has detected a loss-of-frame (LOF) condition in an incoming OC-1 signal. LOF is defined as an out-of-frame (OOF) condition (five consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
`inc. OC1 LOS`	The system has detected loss-of-signal (LOS) condition on the OC-1 line. Likely causes: Failure of the OLIU CP at near end, failure of the OLIU CP at far end, or failure of the receive fiber.
`inc. OC1 line AIS`	The system has detected OC-1 line alarm indication signal (AIS) on an incoming OC-1 line. Likely cause: Failure of an OLIU CP at the far end.
`inc. OC1 sig. degrade (BER)`	The bit error ratio (BER) in the specified OC-1 line exceeds the provisioned soft error threshold (10^{-9} to 10^{-5}) but below the hard error threshold of 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
`inc. OC1 sig. failed (BER)`	The bit error ratio (BER) in the received OC-1 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. STS1 AIS`	The system has detected an incoming STS-1 alarm indication signal (AIS) in the active OC-3 or OC-1 line. or DS3 AIS toward the DSX and transmitting STS-1 yellow back toward the fiber from which the AIS is being received. Likely causes: Incomplete or incorrect cross-connect provisioning in an end-to-end network; unprotected removal or failure of a DS3, MXRVO, STS1E, or OLIU CP at the far end; unprotected optical line failure.
`inc. STS1 LOP EC1` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: Failure of the far end or near end STS1E or 3STS1E circuit pack.
`inc. STS1 LOP OC1` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-1 lines, the likely cause is an unprotected failure of an MXRVO or an OLIU CP at the far end. If this condition occurs on only one OC-1 line, the likely cause is failure of the OLIU CP at the near end or far end.
`inc. STS1 LOP OC12` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on only one OC-12 line, the likely cause is failure of the OLIU CP at the near end or far end of the line. If the condition affects the same pointer in both OC-N lines of an OC-N interface, the cause could be an unprotected failure of an STS crossconnected circuit pack (DS3, MXRVO, TMUX, OLIU, STS1E) in the adjacent upstream network element. The problem could also be the result of a local or an upstream timing synchronization failure or invalid timing configuration.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. STS1 LOP OC3 x`	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-3 lines, the likely cause is an unprotected failure of an MXRVO or a DS3 CP at the far end. If this condition occurs on only one OC-3 line, the likely cause is failure of the OLIU CP at the near end or far end.
`inc. STS1 sig. degrade (BER)`	For STS-1 path switched ring applications, the bit error ratio (BER) of the specified STS-1 signal exceeds the user-provisioned signal degrade threshold. Likely causes: Failure at a fiber or failure of an OLIU circuit pack at some point in the STS-1 path.
`inc. STS1 unequipped`	The system has detected the unequipped code (SONET path overhead signal code label byte=0) on an in-service STS-1 channel. Likely cause: An upstream STS-1 cross-connect has been deleted.
`inc. STS1 sig. failed (BER)`	For ring applications, the bit error ratio (BER) of the specified STS-1 signal exceeds the signal fail threshold (10^{-3}) or (10^{-6}). For VT1.5 path-switched rings, the system responds by inserting VT Path AIS in each pass-through VT contained in the STS-1. Locally, the system will select the VTs from the STS-1 on the other ring, as appropriate. Likely causes: Failure of the near end OLIU CP reporting the STS-1 failure, failure of the far end OLIU, or failure of the receive fiber if the OC-n is also reporting a failure.
`inc. STS1 yellow`	The system has detected an incoming STS-1 yellow signal inserted by the far-end path terminating equipment. Likely causes: Unprotected unidirectional failure of an OLIU CP or fiber at some point in the end-to-end path.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. VT AIS`	The system has detected a VT path alarm indication signal (AIS) incoming from the active OC-n line. The system responds by transmitting DS1 AIS toward the DSX-1 (DSX-1 NA to IMA LAN) or DSX-3 (for the BBG20 TMUX circuit pack only) and VT yellow back toward the fiber from which the AIS is being received. Likely causes: Incomplete or incorrect cross-connect provisioning in end-to-end network; unprotected removal or failure of a DS1, T1EXT or IMA LAN or TMUX (BBG20) CP at the far end. In ring applications, a non-service affecting VT AIS alarm message may result from an upstream OLIU or fiber failure affecting only one ring direction. A VT yellow alarm message is not returned for a non-service affecting VT AIS.
`inc. VT LOP`	The system has detected a VT loss-of-pointer (LOP) condition. Likely causes: Unprotected failure of a DS1, T1EXT or IMA LAN CP at the near end; unprotected failure of a DS1, T1EXT or IMA LAN or TMUX (BBG20) CP at the far end; unprotected failure of an MXRVO CP at the near or far end; unprotected failure of an OC1 CP at the far end.
`inc. VT sig. degrade (BER)`	In a VT path switched ring, the system has detected a VT error rate that exceeds the provisioned threshold of 10^{-5} to 10^{-8}. The system selects a good VT signal from the other ring path. Likely causes: An OLIU circuit pack failure or a fiber failure at some point on the failed ring.
`inc. VT unequipped`	The system has detected the unequipped code (SONET path overhead VT signal code label byte=0) on an in-service VT1.5 channel. Likely cause: An upstream VT1.5 cross-connect has been deleted.
`inc. VT yellow`	The far end is detecting VT AIS or VT LOP and inserting VT yellow in its transmit signal. Likely causes: Unprotected unidirectional failure of a circuit pack or fiber at some point in the end-to-end path.
`inconsistent DCC values`	The "User/Network" parameter values are set the same at both ends of the DCC.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inhibit switch`	When associated with an OC-3 line, this message means that the identified line is not selected as the active receiving line, and a protection switch to make this the active receiving line will not be done. No further protection switching of specified line will be done until the protection switch is reset. Note: Line switching is unidirectional. Because of this, the specified line might still be active (if the far end is selecting the specified line to receive traffic), and the far end might still be free to switch the line it is selecting to receive traffic. See the **`switch-line`** command. When associated with a function unit slot, timing slot, or timing reference, this message means that the identified equipment or reference is not active, and protection switches to the identified equipment or reference will not be done until the protection switch is reset. See the **`switch-fn`** and **`switch-sync`** commands.
`inhibit auto. OS messages`	This message occurs when TL1 autonomous alarm reporting is inhibited by the TL1 **`inh-msg`** command. This message is cleared by enabling autonomous message reporting with the TL1 **`alw-msg`** command.
`Intersubsystem link failure`	In a *MegaStar* 2000 system, the SONET subsystem session is active but is unable to communicate with the RADIO subsystem.
`invalid CP switches`	When associated with a TG slot, this message means that the timing mode switch settings on the TGS or TG3 (in OC-3 R13.0 and later) CP is invalid.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc LAN fail (from cust_lan)`	This message indicates cable disconnect from the 10/100BaseT interface of the IMA LAN CP. If the cable is connected this alarm indicates that the IMA LAN circuit pack is not receiving valid link test pulses from other LAN terminating equipment. The following guidelines are used for AIDs in this case: If IMA LAN pack is in ls-a-1 and ls-a-2 and the LAN interface fails, this alarm is created, and ONLY the first port address *a-1* is used; even if multiple cross-connected channels already exist on the pack. LAN Port addresses for the IMA LAN in the OC-3 and FiberReach shelves are in Table 11-1.
`inc LAN fail (from fiber_lan)`	This message indicates cable disconnect from the 10/100BaseF fiber interface of the IMA LAN CP. If the cable is connected this alarm indicates that the IMA LAN circuit pack is not receiving valid link test pulses from other LAN terminating equipment. The following guidelines are used for AIDs in this case: If IMA LAN pack is in ls-a-1 and ls-a-2 and the LAN interface fails, this alarm is created, and ONLY the first port Address *a-1* is used; even if multiple cross-connected channels already exist on the pack. LAN Port addresses for the IMA LAN in the OC-3 shelves are in Table 11-1.
`inc LAN fail (from sonet)`	This message indicates failure from the SONET side into the IMA LAN CP. A more detailed description of the failure should be indicated in an associated status message. The corresponding AID follow the same guidelines as for the previous message.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc LAN Link LOCD`	This status message indicates a loss of cell delineation (LOCD) failure from the SONET side into the IMA LAN CP. An LOCD condition may result from a failure of the ATM (Asyncronous Transfer Mode) mapping function in the local or far-end IMA LAN circuit pack. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a failure of the local or far-end IMA circuit pack. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm. Failure of an upstream ATM switch in the path could also produce this message.
`inc IMA Link LIF`	This status message indicates a loss of IMA frame (LIF) failure from the SONET side into the IMA LAN CP. An LIF condition may result from a failure of the IMA function in the local or far-end IMA LAN circuit pack. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a failure of the local or far-end IMA circuit pack. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm. Failure of an upstream ATM switch in the path could also produce this message.
`inc IMA Link LODS`	This status message indicates a loss of IMA delay synchronization (LODS) failure from the SONET side into the IMA LAN CP. An LODS condition results from excessive differential delay between one or more DS1 paths in the IMA channel. The condition is cleared by changing the routing of the DS1 channels so that the maximum differential delay is less than 50ms. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Link Misconnect`	This status message indicates an IMA link failure from the SONET side into the IMA LAN CP. The misconnect condition indicates that the link in question does not have the correct IMA Group ID. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a provisioning error of the far-end IMA termination or a crossconnect provisioning error. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm.
`inc IMA Link RFI`	This status message indicates that the far-end IMA terminating equipment (e.g. IMA LAN CP) has detected one or more failure conditions (e.g. LOCD, Link Misconnect, DS1 AIS, DS1 LOF) on the corresponding incoming IMA links and is sending a remote failure indication (RFI) on its trasmitted signal. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1).
`inc MAC Err (from sonet)`	This status message indicates that the IMA LAN circuit pack has discarded one or more MAC layer protocol packets incoming from the SONET side. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: If the 10/100 BaseX LAN is operating in half-duplex mode this message may result from congestion on the local area network. If the LAN is operating in the full-duplex mode, this message may result from a local or far-end IMA CP failure.
`inc AAL5 Err (from sonet)`	This status message indicates that the IMA LAN circuit pack has dropped one or more AAL5 protocol packets incoming from the SONET side. This message has the source address of an IMA LAN port (e.g a-1) and should always be accompanied by an "incoming LAN Fail (sonet)" alarm. Likely Causes: The most likely cause is a local or far-end IMA CP failure.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Grp Abort NE)`	This status message indicates that the near-end IMA circuit pack was unable to negotiate a mutually acceptable IMA configuration with the far-end IMA termination. The system was unable to transition the IMA group into the operational state. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: The near-end or far-end IMA termination may need a provisioning change to achieve mutually acceptable configuration parameters.
`inc IMA Grp Abort FE)`	This status message indicates that the far-end IMA circuit pack was unable to negotiate a mutually acceptable IMA configuration with the near-end IMA termination. The system was unable to transition the IMA group into the operational state. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: The near-end or far-end IMA termination may need a provisioning change to achieve mutually acceptable configuration parameters.
`inc IMA Grp Fail Startup NE)`	This status message indicates that the near-end IMA circuit pack is stuck in the IMA Group Startup state. This could result from a near-end IMA circuit pack failure or if the far-end IMA circuit pack does not acknowledge the near-ends transition to the Startup State. This message has the source address of an IMA LAN port (e.g a-1).
`inc IMA Grp Fail Startup FE)`	This status message indicates that the far-end IMA circuit pack is stuck in the IMA Group Startup state. This could result from a far-end IMA circuit pack failure or if the near-end IMA circuit pack does not acknowledge the far-end transition to the Startup State. This message has the source address of an IMA LAN port (e.g a-1).
`inc IMA Grp Insuff Links NE)`	This status message indicates that the near-end IMA circuit pack has not detected sufficient links to transition the IMA Group into the operational mode. The IMA circuit pack requires only one good link to transition into operational mode. This message has the source address of an IMA LAN port (e.g a-1).

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Grp Insuff Links FE)`	This status message indicates that the far-end IMA circuit pack has not detected sufficient links to transition the IMA Group into the operational mode. This message has the source address of an IMA LAN port (e.g a-1). This message has the source address of an IMA LAN port (e.g a-1).
`lockout of protection`	When associated with an OC-3 line, this message means that the identified protection line is not selected as the active receiving line, and a protection switch to make this the active receiving line will not be allowed. Note: Line switching is unidirectional. Because of this, the specified line might still be active (if the far end is selecting the specified line to receive traffic), and the far end might still be free to switch the line it is selecting to receive traffic. The lockout will remain in effect until the protection switch is reset or until a protection switch "inhibit" request is entered. See the **`switch-line`** command. When associated with a low-speed protection slot, this message means that no service slot in the entire low-speed group will be allowed to switch to protection. The lockout will remain in effect until the protection switch is reset. See the **`switch-ls`** command.
`lockout of service`	When associated with a low-speed service slot, this message means that the specified low-speed service slot is active and will not be switched to protection. The lockout will remain in effect until the protection switch is reset. See the **`switch-ls`** command.
`ls prot mode not chgd-(crs)`	An attempt to change the low-speed protection mode has failed because all cross-connections terminating on low-speed ports were not removed. The user should remove all such cross-connections and execute the reset function.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`manual switch`	The specified DS1 or T1EXT CP is manually switched to protection. The manual switch will remain in effect until the protection switch is reset or until a failure occurs and an automatic switch preempts the manual switch. See the **`switch-ls`** command.
`manual sync. mode switch`	The synchronization mode has been manually switched to holdover or free-running and will remain in that mode until the switch request is reset. See the **`switch-sync`** command.
`MXRVO CP failed`	Internal equipment failure of the specified MXRVO CP.
`TMUX CP failed`	Internal equipment failure of the specified TMUX CP.
`OC12 connector failed`	The faceplate connector which carries the pass through channels between the OC12 interfaces on the 24-type or 29-type OLIUs has been removed or has failed.
`OHCTL CP failed`	Internal equipment failure of the OHCTL CP.
`OHCTL standby boot fail`	Internal equipment failure of the OHCTL circuit pack during a local or remote software download. Likely cause: OHCTL circuit pack hardware failure.
`OLIU CP failed`	Internal equipment failure of the specified OLIU CP. **NOTE:** Starting with OC-3 Release 11.0, if this alarm event exists on Fn-X where a 27G2-U OLIU exists, and at least one local Hairpin Add-Drop cross-connect is established between Fn-X and Fn-Y, an automatic protection switch on the Main circuit packs (CPs) is done as a result of this alarm event (that is, detecting a circuit pack failure of a 27G2-U in Fn-X-1/2, which will cause the Main slots to switch as well).
`program installation IP`	This system is being used to install software into another system. If this procedure is interrupted prior to completion, the remote systems' control circuit packs will likely become inoperable until another install program attempt is successful. For OC-3 Release 11.0 and later, the initiating of the **`apply`** command will cause this event as well.
`lan program installation IP`	Starting with OC-3 Release 15.0, this message will appear in the alarm report of a Network Element while it is the source of an IMA LAN software download (cpy-prog or remote ins-prog) into another Network Element. The initiating of the **`apply`** command for IMA LAN will cause this event as well.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`section DCC channel failed`	The system cannot communicate with the far-end system through the SONET section data communications channel (DCC) or IAO LAN. Likely causes: SYSCTL or OHCTL CP failure, reset, or initialization at the far end; failed program installation at far end; program installation in progress at the far end; SYSCTL or OHCTL CP failure at the near end. When "Address=LAN, the likely causes are: LAN link integrity failure, excessive LAN retransmission attempts, collisions...
`STS1E_H CP failed`	Internal equipment failure of the specified high-speed STS1E CP.
`STS1E_L CP failed`	Internal equipment failure of the specified low-speed STS1E CP.
`SYSCTL CP failed`	Internal equipment failure of the SYSCTL CP. The system has determined that some part of the SYSCTL CP has failed. Note that some types of failures cannot be reported since the SYSCTL CP cannot function under these conditions.
`SYSCTL standby boot fail`	Internal equipment failure of the SYSCTL circuit pack during a local or remote software download. Likely cause: SYSCTL circuit pack hardware failure.
`SYSCTL/IMA gen partially compatible`	clearable alarm (by "update") - the SYSCTL and IMA generic are partially compatible. Likely cause: Rebooting SYSCTL SW generics (as a result of upgrade, downgrade, system command, or reseating) while IMA LAN packs are present will result in a comparison with the IMA LAN pack SW generic which may result in this alarm.
`SYSCTL/IMA gen incompatible`	unclearable alarm - the SYSCTL and IMA generics are incompatible. Likely cause: Rebooting SYSCTL SW generics (as a result of upgrade, downgrade, system command, or reseating) while IMA LAN packs are present will result in a comparison with the IMA LAN pack SW generic which may result in this alarm.
`T1EXT CP failed`	Internal equipment failure of the specified T1EXT CP.
`TGS CP failed`	Internal equipment failure of the specified TGS CP, or the systems at both ends of the span are line-timed from each other.
`TG3 CP failed`	Internal equipment failure of the specified TG3 CP. This timing pack is available with OC-3 Release 13.0 and later

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`unexpected CP present`	A DS1 circuit pack has been installed in a low-speed slot associated with a function unit currently provisioned for DS3 service. The DS1 CP should be removed from the shelf, or the DS3 CP should be replaced with an MXRVO CP.
`unexpected CP switches`	When associated with the SYSCTL or OHCTL slot, this message means that an invalid switch setting has been selected on the CP, or that some of the unused switches are not in the prescribed position. For OLIU slots, it indicates that the optical power switch on the OLIU CP was different from what it was before the OLIU CP was replaced. For DS3 or DS1 or T1EXT slots, this message means that a change in a circuit pack switch setting was made. When associated with a TG slot, this message means: 1. The timing mode switch settings on the TGS or TG3 (OC-3 R13.0, OC-12 R7.0, and later) CP are: a. different from those on the companion TGS or TG3 CP, or b. different from what they were before the TGS or TG3 CP was replaced, or 2. The DS1 format or line coding switches on the TGS or TG3 CP are not the same as they were before the TGS or TG3 CP was replaced.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`unexpected CP type`	When associated with a function unit (FN) slot, this message means that a different but supported circuit pack is inserted in a slot already provisioned. When associated with a low-speed slot, this message means that a different but supported circuit pack type (for example, BBF3) is inserted in a slot already provisioned. For the STS1E circuit pack, this message means that the CP type switch (located on the circuit pack) is different from that already provisioned for the slot. This message is issued as a status condition if a 24-type OLIU is inserted in a main slot provisioned for a 22-type OLIU. This will occur during an upgrade of an OC3 ring interface to an OC12 ring interface on an OC3 shelf. This message is issued as a status condition if a 29-type OLIU is inserted in a main slot provisioned for a 22-type OLIU. This will occur during an upgrade of an OC3 or OC12 ring interface to an OC12 ring interface on an OC3 shelf.
`unsupported DCC connection`	This message is issued when the DCC is enabled on an OC-1 connection between the main slots in two OC-3 shelves. The alarm is cleared by disabling the DCC on the OC-1 interface using the **`set-fecom`** command. The DDM-2000 OC-3 system does not support a DCC link over an OC-1 line terminating on the main slots between two OC-3 shelves.

NAME

rtrv-hsty:Retrieve History

INPUT FORMAT

`rtrv-hsty;`

DESCRIPTION

This command displays an event-history report. This report contains a list of the most recent system events. This report contains up to 500 events. The events are listed in last-in, first-out order and are date- and time-stamped.

The output report appears as follows:

```
/* Maintenance History Report
==============================================================
Date   Time     Sys.Alm.     Source      Event
                 Level                   Description
==============================================================
MM-DD HH:MM:SS  alarm        address     description
                   .
                   .
                   .
MM-DD HH:MM:SS  alarm        address     description
*/
```

The output parameters are:

`Date`	Month (MM) and day (DD) of the event.
`Time`	Time (hours, minute, seconds) of event occurrence. Time stamps reflect the time the entry is made. Entries are added to the history report BEFORE any applicable holdoff delays and AFTER any applicable clear delays.
`System Alarm Level`	Alarm level corresponds to the system alarm level at the time immediately after the event occurred. Alarm level is the level of the highest active or pending alarm/status condition. The alarm level is reported as if the holdoff delay was zero. Additionally, the alarm level column may show CR, MJ, MN, or PMN alarms for troubles that never really became alarms, since holdoff delays may prevent the troubles from reaching an alarm condition.

The alarm level may be one of the following:

`CRITICAL`	Critical Alarm
`MAJOR`	Major Alarm
`MINOR`	Minor Alarm
`PWR MINOR`	Power Minor Alarm
`abnormal`	Abnormal condition
`ne-acty`	Near-End Activity
`fe-acty`	Far-End Activity This alarm level is reported in all non-TARP releases. For the TARP releases, this alarm level is reported starting with OC-3 Release 15.0
`status`	Status condition
—	No active alarm or status condition in the system.

`Source` The source of the event. An event source may be the entire system or a slot, a channel, or an operations interface. If security is enabled, it may also be a CIT or a login name. Refer to "Commands" and Table 11-1 at the beginning of this section for the addresses of lines, slots, ports, channels, and operations interfaces.

Starting with OC-3 Release 15.0, when an IMA LAN apply is started or completed, Source will indicate the address of the Low Speed slot(s) equipped with the IMA LAN pack. Valid Addresses: **`ls-{a,b,c}-{1-7,all}`**

NOTE:
Since the IMA LAN pack occupies two consecutive Low Speed slots, following guidelines are used:

The IMA LAN pack address is the address of lowest slot number of the two occupied by the pack. For example, if the IMA LAN circuit pack is inserted in Low Speed slots *a-1* and *a-2*, the Address used in this case is *ls-a-1*. The same rules apply if the pack is inserted in other Low Speed slots.

When using Low Speed addresses (4 and 7), the following are the allowed Address combinations:
`ls-{a,b,c}-{3 and 4}` is allowed.
`ls-{a,b,c}-{6 and 7}` is allowed

`Event Description`	Table 11-4 lists the meaning and likely cause of each of the messages that appear in the maintenance history report. In addition to the messages listed here, any of the messages that appear in the alarm and status report can appear in the history report to record the onset of alarm and status conditions.

Also, all CIT and TL1 commands that affect the state of the system (provisioning commands; protection switching commands; loopbacks; transmission, alarm, and telemetry tests) will appear in the report.

NOTE:
Any messages that appear in the RTRV-ALM report may also appear in the history report.

Table 11-4. RTRV-HSTY Descriptions

Description	Meaning
`2nd CP required clrd`	A second circuit pack has been inserted into the empty function unit slot. The BBF3 (DS1PM), BBF9 (IMA LAN) or BBF6 (T1EXT) circuit pack requires both function unit slots in the group to be equipped.
`-48V power/fuse good`	A failed -48 volt power feeder or a failed fuse on the user panel has been repaired.
`CP removed`	A circuit pack has been removed from the specified slot.
`AC power failed-FE clrd`	The AC power supply to a remote terminal cabinet has been restored.
`AC power good`	The AC power supply to the shelf has been restored.
`AGNE communication good`	An AGNE communication failure has been cleared. In OC-3 Release 9.8, 13.0, and later TARP releases, this event will not appear in the history report anymore, since the "AGNE communication failure" is no longer detected in those releases. Starting with OC-3 Release 15.0, this event will be detected and reported and therefore will be cleared in this report.
`APS - CP failed`	An automatic protection switch was done because the system detected a circuit pack failure.
`APS - Fn failure`	This means that there exists at least one local Hairpin Add-Drop cross-connect established between Fn-X and Fn-Y, where Fn-X contains a 27G2-U OLIU circuit pack. An automatic protection switch on the Main circuit packs (CPs) was done because the system detected a circuit pack failure/removal of a 27G2-U in Fn-X-1/2, which caused the Main packs to switch as well. **NOTE:** The APS of Mains did not take place in this case because of a Main CP failure
`APS - OC3c Data intf failed`	An automatic protection switch was done because the system detected a failure of the OC3C data interface on the BBG21 circuit pack. Use the rtrv-state-eqpt command to view the current state of this circuit pack.
`APS - LAN Data intf failed`	An automatic protection switch was done because the system detected a failure of one or more native mode LAN interfaces associated with the BBG21 circuit pack. Use the rtrv-state-eqpt command to view the current state of this circuit pack.
`APS - automatic lock reset`	The automatic protection switch lock for a DS1 or T1EXT circuit pack has been released.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`APS channel good`	A failure of the SONET automatic protection switching channel has cleared.
`APS - sig. degraded`	An automatic protection switch was done because the system detected a degraded signal on the OC-N line or path.
`APS - sig. failed`	An automatic protection switch was done because the system detected a failure of the OC-N line or path (incoming AIS, loss of signal, or bit error rate higher than 10^{-3}).
`auto switch`	An automatic protection switch of a DS1 or T1EXT circuit pack is active. When the failure that caused the switch to be done clears, the switch will be reset automatically. Likely causes: Protected failure or removal of a DS1 or T1EXT CP.
`auto sync. mode switch`	An automatic protection switch of the synchronization mode is active. When the failure that caused the switch to be done clears, the switch will be reset automatically if automatic mode switching is enabled. (See the **`set-sync`** and **`rtrv-sync`** commands.)
`BBF5 required in LS-4 clrd`	A BBF5 jumper pack has been inserted into low-speed slot 4 of a function group that has a pair of 27G2-U OLIUs installed in the corresponding function unit slots. The BBF5 is required for transmission cross-coupling between the 27G2-U OLIUs in group 3 (and earlier) shelves. If a function unit pair is equipped with the BBG21 native mode lan circuit packs (ELAN) a BBF5 in low-speed slot 4 is required to transmit status information between the working and standby circuit pack.
`BBF5 required in LS-8 clrd`	A BBF5 jumper pack has been inserted into low-speed slot 8 of a function group that has a pair of 27-type OLIUs installed in the corresponding function unit slots. The BBF5 is required for correct DCC operation for the 27-type OLIUs in group 3 (and earlier) shelves.
`CIT timeout`	A craft interface terminal (CIT) session was automatically terminated because there was no activity on the CIT for the provisioned time. (See the **`set-secu`** command.)

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`controln rlsd`	The system has released the specified miscellaneous discrete environmental control because it has been requested to do so through the serial telemetry or discrete telemetry interface. This message will appear only in a remote terminal. Any name may be provisioned in place of the `controln` part of this message.
`cpy-prog compl.`	The software copy procedure has been completed. This message will show at the source NE.
`lan cpy-prog compl.`	Starting with OC-3 Release 15.0, this message indicates that the IMA LAN software copy procedure has been completed. This message will show at the source NE.
`lan apply compl.`	Starting with OC-3 Release 15.0, this message indicates that the IMA LAN software apply procedure has been completed. This message will show with the source (Address) of each affected IMA LAN pack.
`lan apply fail.`	Starting with OC-3 Release 15.0, this message indicates that the IMA LAN software apply procedure has failed. This message will show with the source (Address) of each affected IMA LAN pack.
`lan apply cancel compl.`	Starting with OC-3 Release 15.0, this message indicates that the IMA LAN software apply procedure has been canceled. This message will show with the source (Address) of each affected IMA LAN pack.
`disconnect`	The craft interface terminal has been disconnected.
`dlt-ulsdcc compl.`	Starting with OC-3 Release 13.0 and later TARP releases, this event will indicate the deletion of provisionable parameters of Layer 4 (that is, deletion of TARP Adjacent NE from the Manual Adjacency list, deletion of a TARP Data Cache entry).
`DS1 CP good`	The failure of the specified circuit pack has cleared.
`DS1 CP inserted`	A circuit pack was inserted into the shelf.
`DS1 port in service`	A DS1 port was put in the in-service state. This happens automatically when an incoming signal is detected (coming from the DSX) unless the port has been provisioned to the not monitored state.
`DS1 sync. ref. port in service`	A DS1 `External` timing reference was automatically put in the in-service state because an incoming DS1 signal was detected.
`DS1PM CP good`	The failure of the DS1PM circuit pack has cleared.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`DS1PM CP inserted`	A DS1PM circuit pack was inserted into the shelf.
`DS3 CP good`	The failure of the DS3 CP has been cleared.
`DS3 CP inserted`	A DS3 circuit pack was inserted into the shelf.
`DS3 port in service`	A DS3 port was put in the in-service state. This happens automatically when an incoming signal is detected (coming from the DSX) unless the port has been provisioned to the not monitored state.
`EC1 port in service`	An EC1 port has been placed in the in-service state.
`ELAN CP good`	The failure of the specified native mode LAN interface circuit pack has cleared.
`ELAN CP inserted`	An ELAN circuit pack was inserted into the shelf in the specified slot.
`enable auto OS messages`	Autonomous OS message reporting has been enabled with the TL1 command **`alw-msg`**.
`environment`**n** `rlsd`	The specified miscellaneous discrete environment alarm input point has been released, indicating that an environmental alarm or status condition has cleared. This message will appear only in a remote terminal. Any name may be provisioned in place of the `environment`**n** part of this message.
`externalMinor clrd`	The external minor alarm condition has cleared.
`fan control relay good`	The fan control relay on the SYSCTL CP was failed but is now operating properly to turn on the fans.
`fan shelf good`	A fault on the fan shelf has been cleared.
`frequency error clrd`	The frequency offset failure has been cleared.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`holdover mode clrd`	The system is no longer in holdover timing mode. It has switched from holdover mode to the provisioned timing mode (either `LoopTimed` or `phaselocked` to an `External` DS1 timing reference).
`inc. DS1 good`	A failure of the DS1 signal coming from the DSX is cleared. For IMA LAN, a failure of the DS1 signal coming from the (high speed) fiber is cleared.
`inc. DS1 sync. ref. good`	A failure of the `External` DS1 timing reference is cleared.
`inc. (from fiber) DS3 AIS clrd`	The system is no longer detecting DS3 AIS (alarm indication signal) in the DEMUX direction (that is, coming from the fiber).
`inc. DS3 good`	A failure of the DS3 signal coming from the DSX is cleared.
`inc. (from fiber) DS3 OOF clrd`	A DS3 out-of-frame (OOF) condition in the DEMUX direction (coming from the fiber) is cleared. Starting with FiberReach Release 3.1, this event is applicable if the Function unit slots are equipped with DS3 circuit packs.
`inc. EC1 FERF clrd`	The system is no longer detecting an EC-1 far end receive signal failure (FERF) signal.
`inc. EC1 good`	A failure of the EC-1 signal has been cleared.
`inc. (from DSX) DS3 AIS clrd`	The system is no longer detecting DS3 AIS (alarm indication signal) in the MUX direction (that is, coming from the DSX-3). This is applicable to the TMUX (BBG20) circuit pack only.
`inc. (from DSX) DS3 OOF clrd`	A DS3 out-of-frame (OOF) condition in the MUX direction (coming from the DSX-3) is cleared. This is applicable to the TMUX (BBG20) circuit pack only.
`inc. EC1 line AIS clrd`	The EC-1 alarm indication signal (AIS) is no longer being received. A downstream failure has cleared.
`inc. EC1 sig. degrade (BER) clrd`	A failure of the specified EC-1 signal has cleared.
`inc. OC12 FERF clrd`	The system is no longer detecting the OC-12 far end receive failure (FERF) signal.
`inc. OC12 good`	A failure of the OC-12 signal from the DSX has been cleared.
`inc. OC12 LOP STS1 #`*`x`*` clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`inc. OC12 sig. degrade clrd`	A failure of the specified OC-12 signal has cleared. OC-12 line AIS and/or OC-12 line FERF conditions may still be present on the specified OC-12 line. The OC-12 LOP condition may still be present for one or more of the STS-1 signals in the OC-12 line.
`inc. OC12 line AIS clrd`	The system is no longer detecting the OC-12 alarm indication signal (AIS) on the specified OC-12 line.
`inc. OC3 FERF clrd`	The system is no longer detecting the OC-3 far end receive failure (FERF) signal.
`inc. OC3 good`	A failure of the OC-3 line has been cleared.
`inc. OC3 LOP STS1 #`*`x`* `clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. OC3 sig. degrade clrd`	A failure of the specified OC-3 signal has cleared. OC-3 line AIS and/or OC-3 line FERF conditions may still be present on the specified OC-3 line. The OC-3 LOP condition may still be present for one or more of the STS-1 signals in the OC-3 line.
`inc. OC3 line AIS clrd`	The system is no longer detecting the OC-3 alarm indication signal (AIS) on the specified OC-3 line.
`inc. OC1 FERF clrd`	The system is no longer detecting the OC-1 far end receive failure (FERF) signal.
`inc. OC1 good`	A failure of the OC-1 line has been cleared.
`inc. OC1 sig. degrade clrd`	A failure of the specified OC-1 signal has cleared. OC-1 line AIS and/or OC-1 line FERF conditions may still be present on the specified OC-1 line. The OC-1 LOP condition may still be present for the STS-1 signal in the OC-1 line.
`inc. OC1 line AIS clrd`	The system is no longer detecting the OC-1 alarm indication signal (AIS) on the specified OC-1 line.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`inc. STS1 AIS clrd`	The STS-1 alarm indication signal (AIS) is no longer being received. An upstream failure (in the MUX direction) has cleared.
`inc. STS1 LOP EC1 clrd`	A loss-of-pointer condition on the STS-1 signal of the EC-1 line has been cleared.
`inc. STS1 LOP OC12` *`slot`* `clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. STS1 LOP OC3` *`slot`* `clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. STS1 LOP OC1` *`slot`* `clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. STS1 sig. degrade clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 sig. failed clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 unequipped clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 yellow clrd`	The STS-1 yellow signal is no longer being received.
`inc. VT AIS clrd`	The VT alarm indication signal (AIS) is no longer being received. A downstream failure (in the MUX direction) has cleared
`inc. VT LOP clrd`	A loss-of-pointer condition on the VT1.5 signal has been cleared.
`inc. VT sig. degrade clrd`	Failure of the specified VT1.5 signal has cleared.
`inc. VT unequipped clrd`	A failure of the specified VT1.5 signal has cleared.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`inc. VT yellow clrd`	The VT yellow signal is no longer being received from the fiber (in the DEMUX direction).
`ins-prog compl.`	The software installation procedure has been completed. This message will show at the source NE.
`lan ins-prog compl.`	Starting with OC-3 Release 15.0, this message indicates that the IMA LAN software installation procedure has been completed. This message will show at the source NE.
`Intersubsystem link clrd`	In a *MegaStar* 2000 system, the active SONET subsystem can communicate with the RADIO subsystem.
`LAN CP good`	The failure of the specified IMA LAN interface circuit pack has cleared.
`LAN CP inserted`	An IMA LAN circuit pack was inserted into the shelf in the specified Low Speed slot.
`inc LAN fail (from cust_lan)`	This message indicates cable disconnect from the 10/100BaseT interface of the IMA LAN CP. If the cable is connected this alarm indicates that the IMA LAN circuit pack is not receiving valid link test pulses from other LAN terminat ing equipment. The following guidelines are used for AIDs in this case: If IMA LAN pack is in ls-a-1 and ls-a-2 and the LAN interface fails, this alarm is created, and ONLY the first port address *a-1* is used; even if multiple cross-connected channels already exist on the pack. LAN Port addresses for the IMA LAN in the OC-3 shelves are in Table 11-1.
`inc LAN good (from cust_lan)`	10/100BaseT interface cable is reconnected to the IMA LAN CP
`inc LAN fail (from fiber_lan)`	This message indicates cable disconnect from the 10/100BaseF fiber interface of the IMA LAN CP. If the cable is connected this alarm indicates that the IMA LAN circuit pack is not receiving valid link test pulses from other LAN terminat ing equipment. The following guidelines are used for AIDs in this case: If IMA LAN pack is in ls-a-1 and ls-a-2 and the LAN interface fails, this alarm is created, and ONLY the first port Address *a-1* is used; even if multiple cross-connected channels already exist on the pack. LAN Port addresses for the IMA LAN in the OC-3 shelves are in Tab le 11-1.

Table 11-4. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc LAN good (from fiber_lan)`	10/100BaseF interface cable is reconnected to the IMA LAN CP
`inc LAN fail (from sonet)`	This message indicates failure from the SONET side into the IMA LAN CP. A more detailed description of the failure should be indicated in an associated status message. The corresponding AID follow the same guidelines as for the previous message.
`inc LAN good (from fiber_sonet)`	The failure from the SONET side to the IMA LAN CP has cleared
`inc LAN Link LOCD`	This status message indicates a loss of cell delineation (LOCD) failure from the SONET side into the IMA LAN CP. An LOCD condition may result from a failure of the ATM (Asyncronous Transfer Mode) mapping function in the local or far-end IMA LAN circuit pack. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a failure of the local or far-end IMA ci rcuit pack. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm. Failure of an upstream ATM switch in the path could also produce this message.
`inc LAN Link LOCD clrd`	The incoming loss of cell delineation (LOCD) condition to the IMA LAN circuit pack has cleared.
`inc IMA Link LIF`	This status message indicates a loss of IMA frame (LIF) failure from the SONET side into the IMA LAN CP. An LIF condition may result from a failure of the IMA function in the local or far-end IMA LAN circuit pack. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a failure of the local or far-end IMA ci rcuit pack. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm. Failure of an upstream ATM switch in the path could also produce this message.

Table 11-4. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Link LIF clrd`	The incoming loss of IMA frame (LIF) condition to the IMA LAN circuit pack has cleared.
`inc IMA Link LODS`	This status message indicates a loss of IMA delay synchronization (LODS) failure from the SONET side into the IMA LAN CP. An LODS condition results from excessive differential delay between one or more DS1 paths in the IMA channel. The condition is cleared by changing the routing of the DS1 channels so that the maximum differential delay is less than 50ms. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm.
`inc IMA Link LODS clrd`	The incoming loss of delay synchronization (LODS) to the IMA circuit pack has cleared.
`inc IMA Link Misconnect`	This status message indicates an IMA link failure from the SONET side into the IMA LAN CP. The misconnect condition indicates that the link in question does not have the correct IMA Group ID. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1), and should always be accompanied by an "inc LAN fail (from sonet)" alarm. Likely Causes: The most likely cause is a provisioning error of the far-end IMA termination or a crossconnect provisioning error. Upstream SONET or DS1 facility failures would normally mask this message with a DS1 AIS or LOF alarm.
`inc IMA Link Misconnect clrd`	The incoming IMA link misconnect condition has cleared.

Table 11-4. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Link RFI`	This status message indicates that the far-end IMA terminating equipment (e.g. I MA LAN CP) has detected one or more failure conditions (e.g. LOCD, Link Misconnect, DS1 AIS, DS1 LOF) on the corresponding incoming IMA links and is sending a remote failure indication (RFI) on its trasm itted signal. This message may have a source address corresponding to one or more DS1 ports assigned to the IMA LAN CP (e.g. a-1-1).
`inc IMA Link RFI clrd`	The incoming IMA Link remote failure indication (RFI) has cleared. _
`inc MAC Err (from sonet)`	This status message indicates that the IMA LAN circuit pack has discarded one or more MAC layer protocol packets incoming from the SONET side. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: If the 10/100 BaseX LAN is operating in half-duplex mode this message may result from congestion on the local area network. If the LAN is operating in the full-duplex mode, this message may result from a local or far-end IMA CP failure.
`inc MAC Err (from sonet) clrd`	The incoming LAN MAC Error condition from the SONET side has cleared.
`inc AAL5 Err (from sonet)`	This status message indicates that the IMA LAN circuit pack has dropped one or m ore AAL5 protocol packets incoming from the SONET side. This message has the source address of an IMA LAN port (e.g a-1) and should always be accompanied by an "incoming LAN Fail (sonet)" alarm. Likely Causes: The most likely cause is a local or far-end IMA CP failure.
`inc AAL5 Err (from sonet) clrd`	The incoming AAL5 packet error condition from the SONET side has cleared.

Table 11-4. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Grp Abort NE`	This status message indicates that the near-end IMA circuit pack was unable to negotiate a mutually acceptable IMA configuration with the far-end IMA termination. The system was unable to transition the IMA group into the operational state. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: The near-end or far-end IMA termination may need a provisioning change to achieve mutually acceptable configuration parameters.
`inc IMA Grp Abort FE`	This status message indicates that the far-end IMA circuit pack was unable to negotiate a mutually acceptable IMA configuration with the near-end IMA termination. The system was unable to transition the IMA group into the operational state. This message has the source address of an IMA LAN port (e.g a-1). Likely Causes: The near-end or far-end IMA termination may need a provisioning change to achieve mutually acceptable configuration parameters.
`inc IMA Grp Fail Startup NE`	This status message indicates that the near-end IMA circuit pack is stuck in the IMA Group Startup state. This could result from a near-end IMA circuit pack failure or if the far-end IMA circuit pack does not acknowledge the near-ends transition to the Startup State. This message has the source address of an IMA LAN port (e.g a-1).
`inc IMA Grp Fail Startup FE`	This status message indicates that the far-end IMA circuit pack is stuck in the IMA Group Startup state. This could result from a far-end IMA circuit pack failure or if the near-end IMA circuit pack does not acknowledge the far-end transition to the Startup State. This message has the source address of an IMA LAN port (e.g a-1).
`inc IMA Grp Startup Ack NE`	The near-end IMA circuit pack has received an IMA group startup Acknowledgement from the far-end IMA termination and is ready to transition to the IMA operational state.
`inc IMA Grp Startup Ack FE`	The far-end IMA termination has received an IMA group startup Acknowledgement from the near-end IMA circuit pack and is ready to transition to the IMA operational state.
`inc IMA Grp Operational NE`	The near-end IMA group has entered the operational state.
`inc IMA Grp Operational FE`	The far-end IMA group has entered the operational state.

Table 11-4. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc IMA Grp Insuff Links NE`	This status message indicates that the near-end IMA circuit pack has not detected sufficient links to transition the IMA Group into the operational mode. The IMA circuit pack requires only one good link to transition into operational mode. This message has the source address of an IMA LAN port (e.g a-1).
`inc IMA Grp Insuff Links FE`	This status message indicates that the far-end IMA circuit pack has not detected sufficient links to transition the IMA Group into the operational mode. This message has the source address of an IMA LAN port (e.g a-1). This message has the source address of an IMA LAN port (e.g a-1).
`login:`*`login_id`*	A login session with a user's login identification has been started on the specified CIT port.
`login:`*`login_id DENY`*	A login session was attempted but denied because of an invalid login and password pair, or the system was in Lockout state.
`logout:`*`login_id`*	A login session with a user's login identification has ended on the specified CIT port.
`logout:`*`login_id DISCONNECT`*	A login session with a user's login identification has ended by a disconnect on the specified CIT port.
`main-{1,2} protection switch`	Equipment switching in a ring application has occurred due to equipment failure.
`MXRVO CP good`	The failure of the specified circuit pack has cleared.
`MXRVO CP inserted`	A circuit pack was inserted into the shelf.
`OHCTL CP good`	The internal equipment failure of the OHCTL circuit pack has cleared.
`OLIU CP good`	The failure of the specified circuit pack has cleared.
`OLIU CP inserted`	A circuit pack was inserted into the shelf.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`remote session logout`	A remote CIT session (set up by the `rlgn` command) has been terminated. This may have been caused by normally logging out of the remotely accessed far end session, or once in the far end session, the user toggled back and logged out of the local session.
`remote session terminated`	A remote CIT session (set up by the `rlgn` command) has been abnormally terminated. This may have been caused by a failure of the controller, circuit pack failure, timeout, or any other abnormal termination at the far end NE.
`reset`	The system software program has been reset.
`rlgn:`*`login_id DENY`*	A remote login session was attempted but denied because of an invalid login and password pair, or the DCC connecting the remote system was in Lockout state.
`section DCC channel good`	The failure of the SONET section data communications channel or IAO LAN has cleared.
`STS1 channel in service`	An STS1 channel was put in the in-service state. This happens automatically when a "good" signal is detected on the channel (neither AIS, unequipped signal, nor "loss of pointer" condition is present), unless the channel has been provisioned to the "not monitored" state.
`STS1E CP good`	The failure of the specified STS1E circuit pack has cleared.
`STS1E CP inserted`	An STS1E circuit pack was inserted into the shelf.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
switch reset	— An automatic protection switch of a DS1 or T1EXT circuit pack been automatically reset. — The system has switched from holdover synchronization mode to the provisioned synchronization mode (LoopTimed or phaselocked to an External DS1 timing reference). or — A manually initiated protection switch has been reset (by the **switch-sync**, **switch-line, switch-fn**, or **switch-ls** command), or by removing a CP from the shelf.
sysctl crs map recovered	A read failure of the cross-connection data base occurred during restart, but the backup copy was recovered and is being used.
sysctl crs map initialized	A read failure of the cross-connection data base occurred during restart, and recovery using backup copies also failed. The cross-connection map was initialized.
sysctl channel states initialized	A read failure of the channel state data base occurred during restart, and recovery using backup copies also failed. The channel state data on SYSCTL was used.
sysctl port states initialized	A read failure of the port state data base occurred during restart, and the recovery using backup copies also failed. The port state data on SYSCTL was used.
T1EXT CP good	The failure of the specified circuit pack has cleared.
T1EXT CP inserted	A circuit pack was inserted into the shelf.
TGS CP good	The failure of the specified circuit pack has cleared.
TGS CP inserted	A circuit pack was inserted into the shelf.
TG3 CP good	The failure of the specified circuit pack has cleared.
TG3 CP inserted TMUX CP good	A circuit pack was inserted into the shelf. The failure of the TMUX CP has been cleared.
TMUX CP inserted	A TMUX circuit pack was inserted into the shelf.
VT channel in service	A VT channel was put in the in-service state. This happens automatically when a "good" signal is detected on the channel (neither AIS, unequipped signal, nor "loss of pointer" condition are present), unless the channel has been provisioned to the "not monitored" state.

A SONET Overview

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A SONET Overview

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Overview

This section briefly describes the Synchronous Optical Network (SONET).

History

In the early 1980's, the American National Standards Institute (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, Telcordia 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.

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-4 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.

* Registered trademark of America National Standards Institute

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).

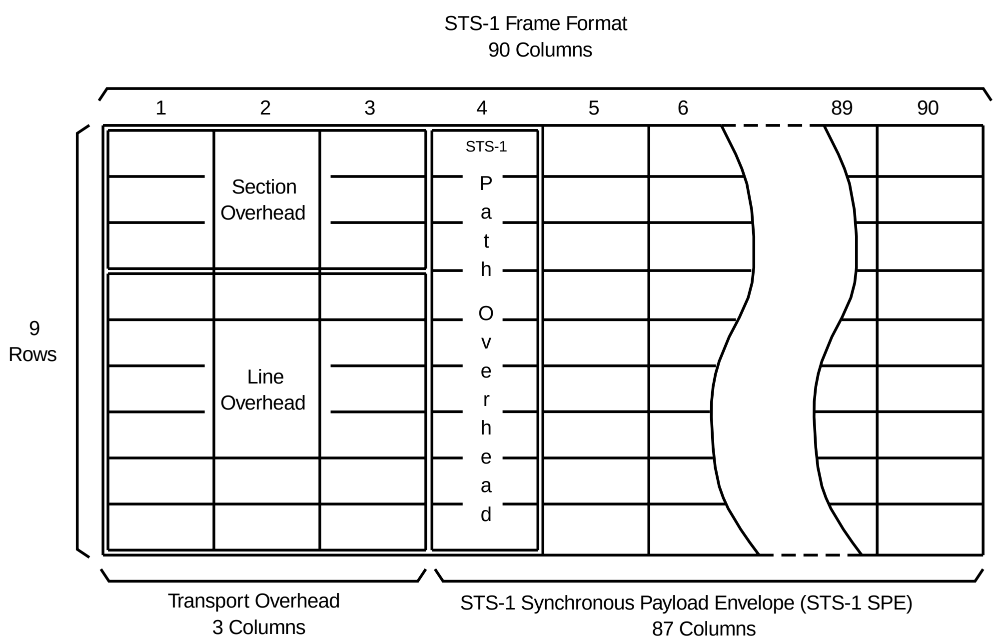


Figure A-4. SONET STS-1 Frame — Simplified Version

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-5 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.

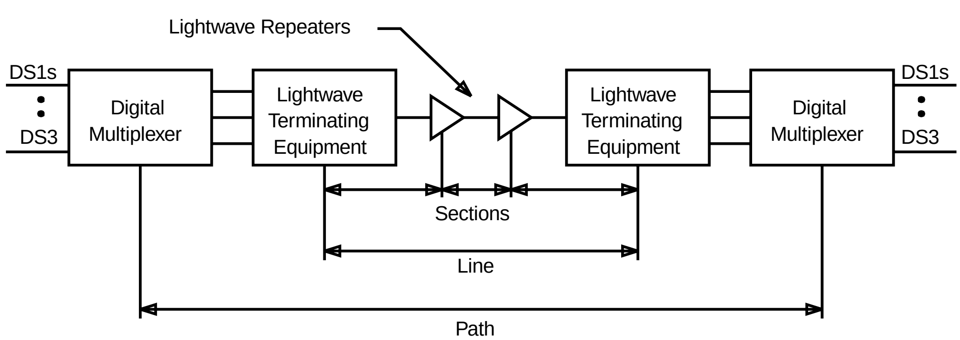


Figure A-5. Section, Line, and Path Definitions

Each SONET layer has a set of overhead bytes as shown in Figure A-6. These bytes carry information used by various network elements.

- **Section 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.

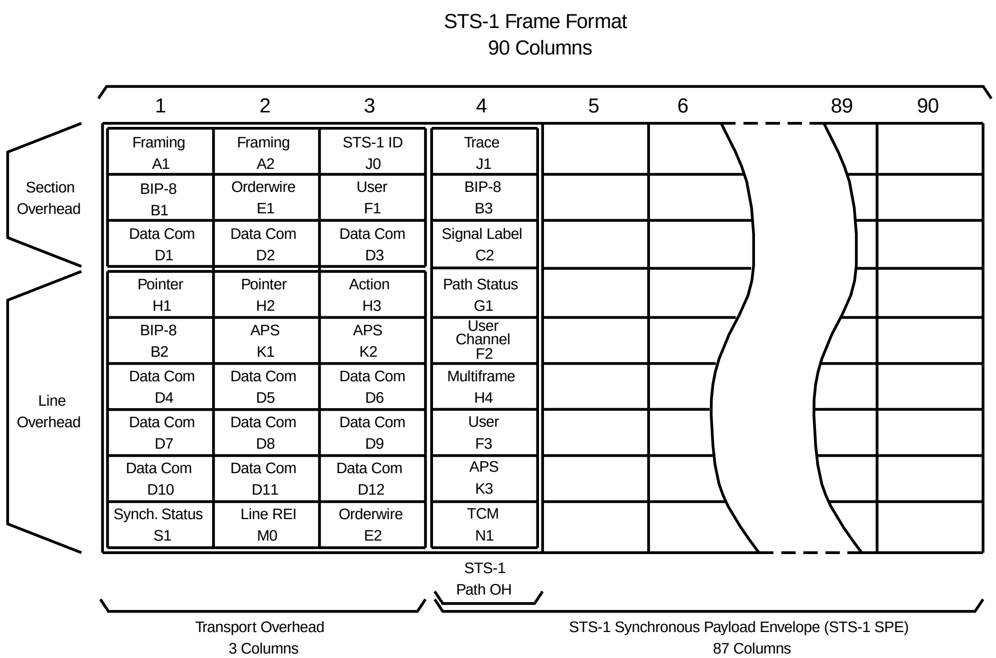


Figure A-6. SONET Frame Format

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.
- STS-1 ID (J0)
  - Provides the order of appearance in a byte-interleaved STS-*N* frame; for example, STS-1 #1, STS-1 #2......STS-1 #48. In future applications, this byte will provide a section trace function. For information on STS-*N* signals, see the "Higher Rate Transport" part of this section.
- 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.
- Synch. Status (S1)
  - In STS-1 #1, the S1 byte is for synchronization status messages, and only bits 5 through 8 are used.
- Line REI (M0)
  - The M0 byte is for STS-1 line far-end block error (FEBE), and only bits 5 through 8 are used.
- 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. A value of 00000000 indicates an unequipped STS-1 SPE. Values for various payload mappings are defined in TR-NWT-000253, Issue 2.

■ 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, F3)

  — User communication channel between Path elements.

■ VT Multiframe Indicator (H4)

  — Provides a general multiframe indicator for VT-structured payloads.

■ STS-1 Path Automatic Protection Switching (K3)

  — Path Automatic Protection Switching

■ TCM - Tandem Connection Maintenance (N1)

  — Bits 1-4 used for incoming error monitoring. Bits 5-8 used as communications channel.

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.

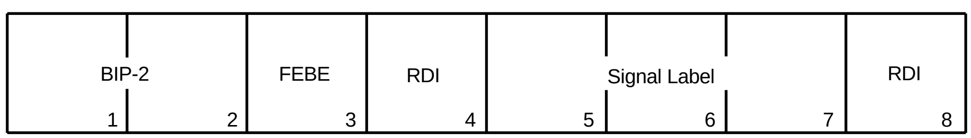
The bit assignments of the VT path overhead are specified in the following list and are illustrated in Figure A-7:

— 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-7. VT Path Overhead Byte

SONET Multiplexing Procedure

SONET has provisions for multiplexing asynchronous DS1s, synchronous DS1s, and asynchronous DS3s. Refer to Figure A-8 and Figure A-9.

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-8, provides the scrambled STS-*N* signal to the optical conversion stage.

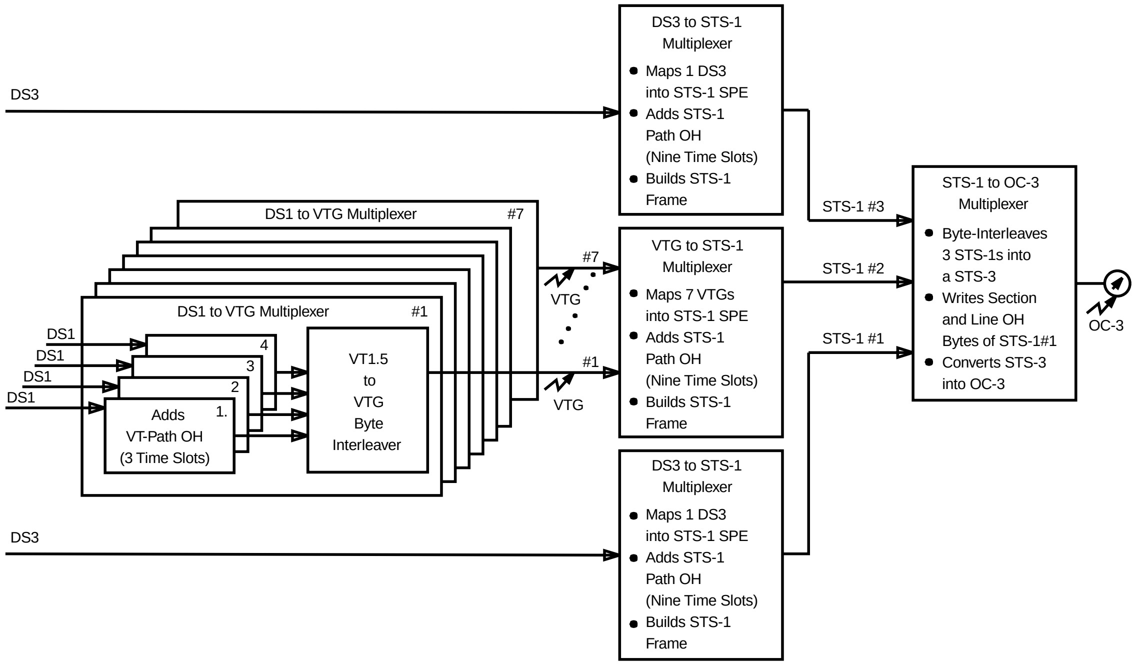


Figure A-8. SONET Multiplexing Procedure

SONET Demultiplexing Procedure

As shown in Figure A-9, 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.

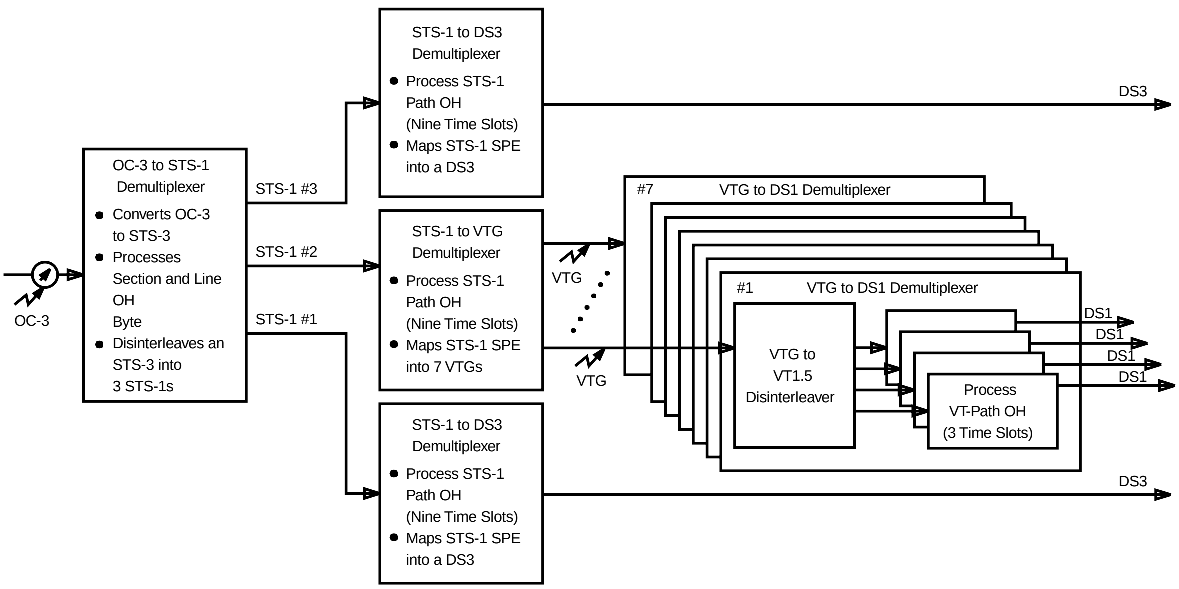


Figure A-9. SONET Demultiplexing Procedure

Two key points should be noted at this time. First, the SONET frame is a fixed time (125 µs) and no bit-stuffing is used. Second, as shown in Figure A-10, 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-µs frame boundary. SONET STS pointers are used to locate the SPE relative to the transport overhead.

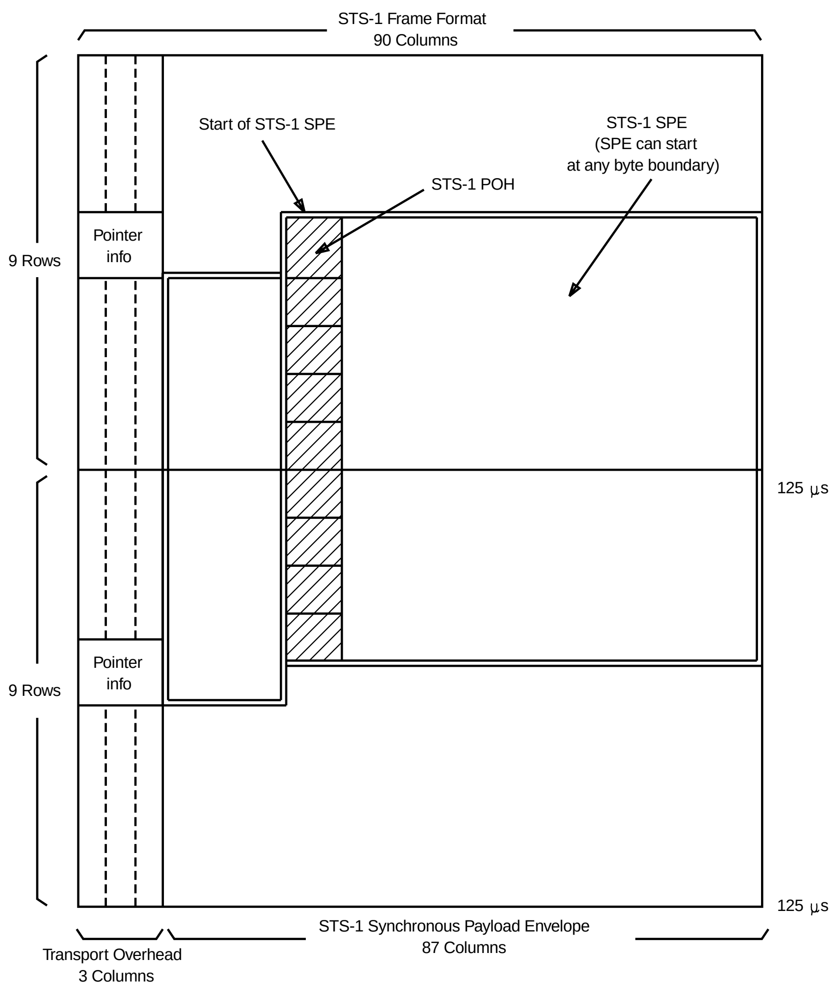


Figure A-10. STS-1 Synchronous Payload Envelope in Interior of STS-1 Frame

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-11. 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.

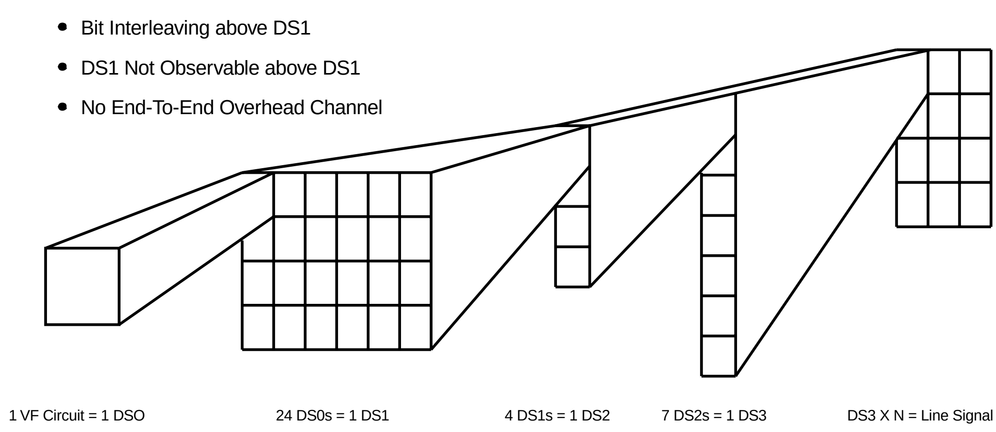


Figure A-11. Asynchronous Multiplexing

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-12).

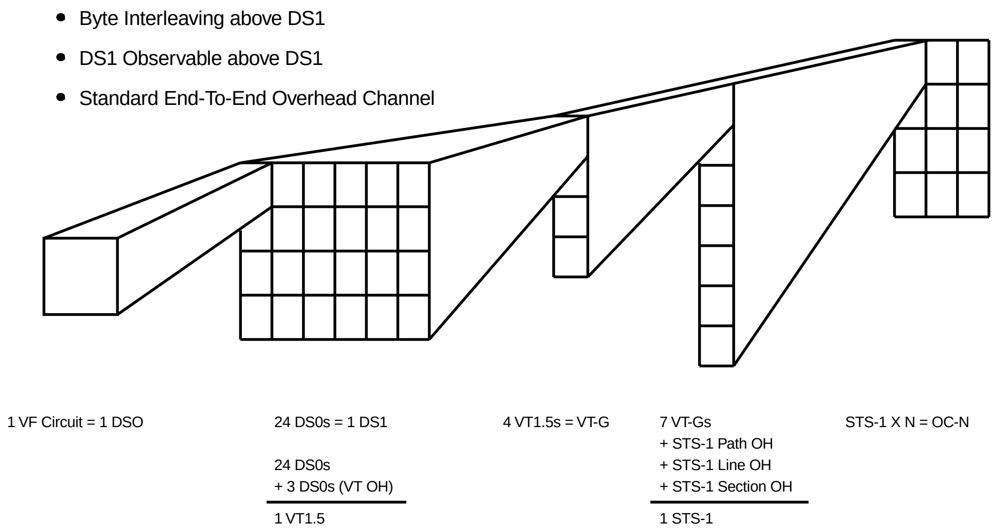


Figure A-12. Synchronous Multiplexing

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, 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-13 shows an example of an STS-3c SPE. It consists of 3 x 87 columns and 9 rows of bytes. The order of transmission is row by row, from left to right.

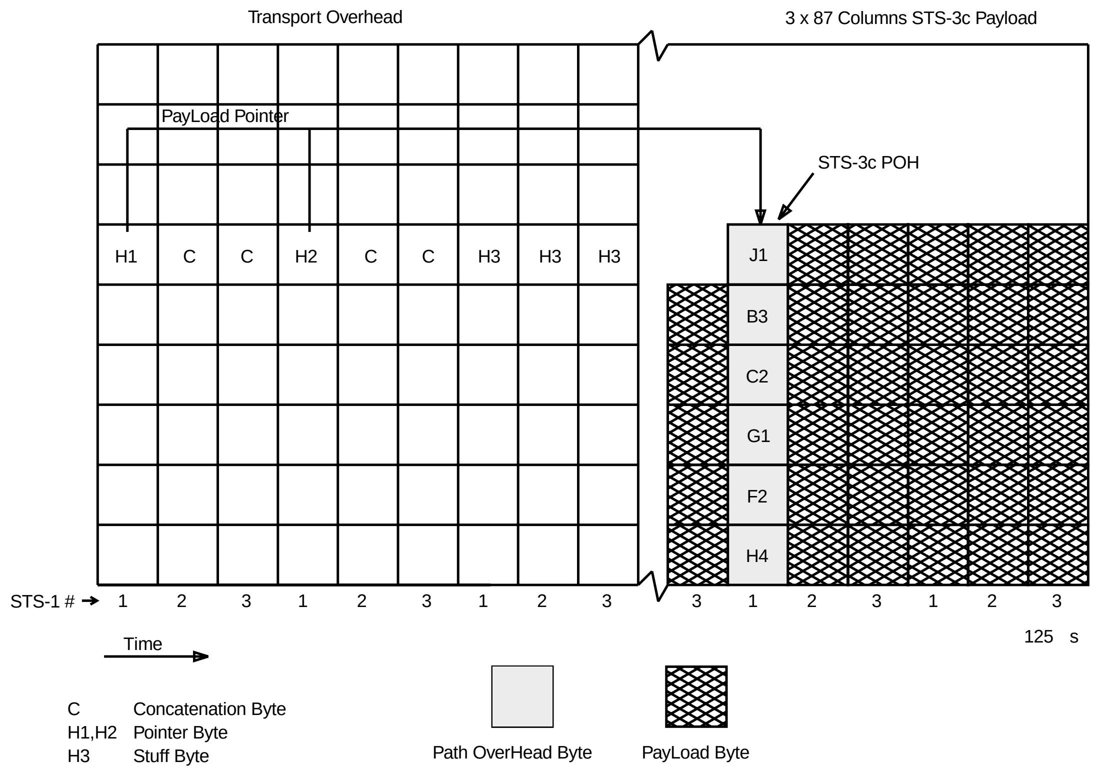
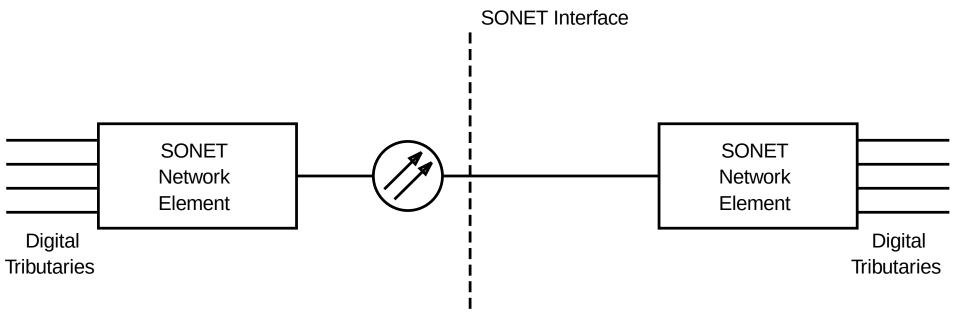


Figure A-13. STS-3c Concatenated Payload

SONET Interface

The SONET interface (Figure A-14) 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.



Standard optical interconnect at SONET interface

Family of standard rates at N X 51.84 Mb/s
[Synchronous Transport Signal (STS-1)]

Overhead channels defined for interoffice operations
and maintenance functions

Figure A-14. SONET Interface

SONET Payloads

Table A-33 shows the digital signals that can be transported as SONET payloads.

Table A-33. SONET Payloads

Input Tributary	Equivalent Channels	Rate	SONET 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	150.336Mb/s
ATM		149.76 Mb/s	STS-3c	150.336Mb/s
FDDI		125.00 Mb/s	STS-3c	150.336Mb/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-34).

Table A-34. 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

0x1
See Ring (0x1) Low Speed Interface.

1+1
The 1+1 protection switching architecture protects against failures of the optical transmit/receive equipment and their connecting fiber facility. One bidirectional interface (two fibers plus associated OLIUs on each end) is designated "service," and the other is designated "protection." In each direction, identical signals are transmitted on the service and protection lines ("dual-fed"). The receiving equipment monitors the incoming service and protection lines independently, and selects traffic from one line (the "active" line) based on performance criteria and technician/OS control. In 1+1 both service and protection lines could be active at the same time (service in one direction—protection in the other).

1xN, 1x1
1xN protection switching pertains to circuit pack protection that provides a redundant signal path through the DDM-2000 (it does not cover protection switching of an optical facility; see "1+1"). In 1xN switching, a group of N service circuit packs share a single spare protection circuit pack. 1x1 is a special case of 1xN, with N=1. In 1x1 only one is active at a time.

A

ABN
Abnormal (status condition)

ACO
Alarm Cutoff — A pushbutton switch available on the user panel that can be used to retire an audible office alarm.

ACO/TST
Alarm Cutoff and Test — The name of a pushbutton on the user panel.

Active
Active identifies a 1+1 protected OC-N line which is currently selected by the receiver at either end as the payload carrying signal or a 1x1 or 1xn protected circuit pack that is currently carrying service. (See Standby.)

ADM
Add/Drop Multiplexer.

AIS
Alarm Indication Signal — A code transmitted downstream in a digital network that shows that an upstream failure has been detected and alarmed.

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

APS
Automatic Protection Switch

ARM
Access Resource Manager

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.

ATM
Asynchronous Transfer Mode

Auto
Automatic — One possible state of a DS1 or DS3 port. In this state, the port will automatically be put "in service" if a good signal is detected coming from the DSX panel.

Automatic Protection Switch
A protection switch that occurs automatically in response to an automatically detected fault condition.

Automatic Synchronization Reconfiguration
A feature that allows another synchronization source to be automatically selected and the synchronization source provisioning to be automatically reconfigured in the event of a synchronization source failure or network synchronization change, for example, a fiber cut.

AUXCTL
Auxiliary Control — The name of the slot to the left of the SYSCTL slot on the DDM-2000 OC-3 and FiberReach wideband shelves and to the right of the SYSCTL slot on the DDM-2000 OC-12 shelf.

Available Time
In performance monitoring, the 1-second intervals.

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.

Backbone Ring
A host ring.

BDFB
Battery Distribution and Fuse Bay.

BER
Bit Error Ratio — The ratio of bits received in error to the total bits sent.

BIP
Bit Interleaved Parity — A method of error monitoring over a specified number of bits, that is, BIP-3 or BIP-8.

BITS
Building Integrated Timing Supply — A single clock that provides all the DS1 and DS0 synchronization references required by clocks in a building.

BRI
Basic Rate Interface

Broadband
Any communications channel with greater bandwidth than a voice channel; sometimes used synonymously with wideband.

C

CC
Clear Channel — A provisionable mode for the DS3 output that causes parity violations not to be monitored or corrected before the DS3 signal is encoded.

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 Telecommunications Standards Sector (ITU-TSS).

CEV
Controlled Environment Vault

CD-ROM
Compact Disk, Read Only Memory

CDTU
Channel and Drop Test Unit

Channel
A logical signal within a port. For example, for an EC-1 port, there is one STS-1 channel and sometimes 28 VT1.5 channels. See Port.

Channel State Provisioning
A feature that allows a user to suppress reporting of alarms and events during provisioning by supporting multiple states (automatic, in-service and not monitored) for VT1.5 and STS-1 channels. See Port State Provisioning.

CIT
Craft Interface Terminal

CLF
Carrier Line Failure Status

CLK
Clock

CMISE
Common Management Information Service Element

CMOS
Complementary Metal Oxide Semiconductor

CO
Central Office

COACH
A system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents.

CP
Circuit Pack

CPE
Customer Premises Equipment

CR
Critical (alarm status)

CSA
Carrier Serving Area

CSU
Channel Service Unit

CS&O
Customer Support and Operations

CV
Coding Violation (a performance-monitoring parameter)

CVFE
Coding Violation Far-End — An indication returned to the transmitting terminal that an errored block has been detected at the receiving terminal.

D

DACS III-2000
Digital Access and Cross-Connect System that provides clear channel switching at either the DS3 or the STS-1 rates, eliminating the need for manual DSXs.

DACS IV-2000
Digital Access and Cross-Connect System that provides electronic DS3/STS-1 or DS1/VT1.5 cross-connect capability, eliminating the need for manual DSXs.

DCC
Data Communications Channel — The embedded overhead communications channel in the SONET line. It is used for end-to-end communications and maintenance. It carries alarm, control, and status information between network elements in a SONET network.

DCE
Data Communications Equipment — In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line. The DCE may be separate equipment or an integral part of the DTE or of intermediate equipment. A DCE may perform other functions usually performed at the network end of the line.

DDM-1000
Lucent's Dual DS3 Multiplexer — A digital multiplexer that multiplexes DS1, DS1C, or DS2 signals into a DS3 signal or a 90 Mb/s or 180 Mb/s optical signal.

DDM-Plus
Lucent's optical and electrical DS1 transport system. DDM-Plus transports up to four DS1s per pair of optical fiber and can provide T1 extension over existing copper wires.

DDM-2000
Lucent's next generation network multiplexers that multiplex DS1, DS3, or EC-1 inputs into EC-1, OC-1, OC-3, or OC-12 outputs.

Default Provisioning
The parameter values that are preprogrammed as shipped from the factory.

Demultiplexing
A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

DEMUX
Demultiplexer - "the DEMUX direction" is from the fiber toward the DSX.

Digital Multiplexer
Equipment that combines by time-division multiplexing several digital signals into a single composite digital signal.

DLC
Digital Loop Carrier

DPLL
Digital Phase-Locked Loop

DRI
Dual Ring Interworking. Two ring networks interconnected at two common nodes.

Drop and Continue
A technique that allows redundant signal appearances at two central offices in a DRI network, allowing protection against central office failures.

DS1
Digital Signal Level 1 (1.544 M/bs)

DS1 Circuit Pack
The DS1 interface circuit pack interfaces to the DSX-1 panel.

DS3
Digital Signal Level 3 (44.736 M/bs)

DS3 Circuit Pack
The DS3 circuit pack interfaces to the DSX-3 panel.

DSn
Digital Signal Rate n — One of the possible digital signal rates at DDM-2000 OC-3 and OC-12 interfaces: DS1 (1.544 Mb/s) or DS3 (44.736 Mb/s).

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.

DT
Distant Terminal

DTE
Data Terminating Equipment — That part of a data station that serves as a data source (originates data for transmission), a data sink (accepts transmitted data), or both.

Dual 0x1 Cross-Connection

In a single-homed application, the DDM-2000 OC-3/OC-12 Multiplexer uses a dual 0x1 cross-connection to map the VT1.5 channels between the DDM-2000 FiberReach OC-1 and the DDM-2000 OC-3/OC-12 rings. This dual 0x1 architecture means that the VT1.5 path switching is only in the DDM-2000 FiberReach and not in the host DDM-2000. Individual DS1 signals within an STS-1 can therefore be dropped to DDM-2000 OC-3 shelves at several nodes around the ring. See Single 0x1.

Dual Homing

In DDM-2000 FiberReach, a network topology in which two OC-3 shelves serve as DDM-2000 FiberReach Multiplexer hosts supporting up to twelve OC-1 rings. Each DDM-2000 FiberReach Multiplexer ring is interconnected between the two separate hosts. Two *SLC*-2000 Access Systems serving as DDM-2000 FiberReach hosts can support up to four OC-1 rings. See Single Homing."

E

EC-1, 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. An EC-1 signal can be built in two ways: A DS1 can be mapped into a VT1.5 signal and 28 VT1.5 signals multiplexed into an EC-1 (VT1.5 based EC-1), or a DS3 can be mapped directly into an EC-1 (DS3 based EC-1).

ECI

Equipment Catalog Item — The bar code number on the faceplate of each circuit pack used by some inventory systems.

EEPROM

Electrically Erasable Programmable Read-Only Memory

EIA

Electronic Industries Association

EMC

Electromagnetic Compatibility

EMI

Electromagnetic Interference

EOOF

Excessive Out of Frame

EPROM

Erasable Programmable Read-Only Memory

EQ

Equipped (memory administrative state)

ES
Errored Seconds — A performance monitoring parameter. ES "type A" is a second with exactly one error; ES "type B" is a second with more than one and less than the number of errors in a severely errored second for the given signal. ES by itself means the sum of the type A and type B ESs.

ESD
Electrostatic Discharge

ESF
Extended Super Frame (format for DS1 signal)

EST
Environmental Stress Testing

F

FCC
Federal Communications Commission

FDDI
Fiber Distribution Data Interface

FE
Far-End. Any other network element in a maintenance subnetwork other than the one the user is at or working on. Also called remote.

FE-ACTY
Far End Activity — An LED on the user panel.

FEBE
Far End Block Error — An indication returned to near-end transmitting node that an errored block has been detected at the far end.

FE ID
Far End Identification — The 7-segment display on the faceplate of the SYSCTL circuit pack.

FEPROM
Flash EPROM — A new technology that combines the nonvolatility of EPROM with the in-circuit reprogrammability of EEPROM (electrically-erasable PROM).

FERF
Far-End-Receive Failure — An indication returned to a transmitting terminal that the receiving terminal has detected an incoming section failure.

FE SEL
Far End Select — An LED on the user panel.

FIT
Failures in10^{-9} hours of operation.

Free Running
An operating condition of a clock in which its local oscillator is not locked to an internal synchronization reference and is using no storage techniques to sustain its accuracy.

FT-2000
Lucent's SONET OC-48 lightwave system.

Function Unit
Refers to any one of a number of different circuit packs that can reside in the A, B, or C function unit slots on the DDM-2000 OC-3 Multiplexer, or in the A, B, C, or D function unit slots of the DDM-2000 OC-12 Multiplexer.

G

GNE
Gateway Network Element — A network element that has an active X.25 link. Can also be a DSNE.

GR
Telcordia General Requirement

Group
The eight slots that may be equipped.

GTP
General Telemetry Processor

GUI
Graphical User Interface

H

Hairpin Routing
A cross-connection between function units (*inter*-function unit). For example, function unit C to function units A or B. Also, a cross-connection within the same function unit (*intra*-function unit). Cross-connections go through main, but no bandwidth or time slots are taken from the backbone ring. Eliminates need for another shelf.

HECI
Humans Equipment Catalog Item

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

IAO LAN
IntrAOffice Local Area Network

IC
Internal Clock. Used in synchronization messaging.

ID
Identifier. See shelf ID and site ID.

IEC
International Electrotechnology Commission

IMF
Infant Mortality Factor

INC
Incoming Status

I/O
Input/Output

IP
Internet Protocol

IR
Intermediate Reach. A term used to describe distances of from 15 to 40 km between optical transmitter and receiver without regeneration. See long reach.

IS
In Service — One possible state of a DS1, DS3, or EC-1 port. Other possible states are "auto" (automatic) and "nmon" (not monitored).

ISCI
Intershelf Control Interface

ISI
Intershelf Interface

ISDN
Integrated Services Digital Network

IS-3
An intraoffice short reach proprietary interface provided by the 22D-U optical line interface units.

ISO
International Standards Organization. See OSI.

IVHS
Intelligent Vehicle Highway System

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

LAPD

Link Access Procedure "D"

LBO

Line Build Out — An equalizer network between the DDM-2000 OC-3 and OC-12 Multiplexers and the DSX panel. It guarantees the proper signal level and shape at the DSX panel.

LCN

Local Communications Network

LEC

Local Exchange Carrier

LED

Light Emitting Diode — Used on a circuit pack faceplate to show failure (red) or service state. It is also used to show the alarm and status condition of the system.

Line Timing

The capability to directly derive clock timing from an incoming OC-N signal while providing the user the capability to provision whether switching to an alternate OC-N from a different source (as opposed to entering holdover) will occur if the OC-N currently used as the timing reference for that NE becomes unsuitable as a reference. For example, intermediate nodes in a linear network are line timed. See Loop Timing.

Local

See Near-End.

Locked Cross-Connection

This is a variation of the ring cross-connection that allows the user to lock the path selector to a specified rotation of the ring. Any signal received from the other rotation of the ring is ignored.

LOF

Loss of Frame — A failure to synchronize to an incoming signal.

Loop Timing
Loop timing is a special case of line timing. It applies to NEs that have only one OC-N interface. For example, terminating nodes in a linear network are loop timed. See Line Timing.

LOP
Loss of Pointer — A failure to extract good data from an STS-1 payload.

LOS
Loss of Signal — The complete absence of an incoming signal.

LR
Long Reach. A term used to describe distances of 40 km or more between optical transmitter and receiver without regeneration. See intermediate reach.

LS
Low Speed

M

Main
Slots on the DDM-2000 shelf in which the OLIU circuit packs are installed.

Midspan Meet
The capability to interface between two lightwave terminals of different vendors. This applies to high-speed optical interfaces.

MD
Mediation Device

MJ
Major Alarm

MM
Multimode

MML
huMan-Machine Language defined by ITU-TSS, formerly CCITT.

MN
Minor Alarm

MPEG
Moving Picture Experts Group

MSDT
Multi-Services Distant Terminal

MTBF
Mean Time Between Failures

MTBMA
Mean Time Between Maintenance Activities

Multiplexing
The process of combining several distinct digital signals into a single composite digital signal.

Mult
Multipling. The cascading of signals in a bay. In the MULT mode, the DS1 external reference can be cascaded to other shelves in a bay using Mult cables. Normally starting with the bottom shelf (Number 1) and working towards the top of the bay.

MUX
Multiplex

MXBIU
Multiplexer and Backplane Interface Unit

MXRVO Circuit Pack
The MXRVO circuit pack multiplexes seven VT-G signals from the DS1 circuit packs to an STS-1 signal for connection to the OLIU circuit packs.

N

NE
Near-End. The network element the user is at or working on. Also called local.

NE
Network Element — The basic building block of a telecommunications equipment within a telecommunication network that meets SONET standards. Typical internal attributes of a network element include: one or more high- and low-speed transmission ports, built-in intelligence, synchronization and timing capability, access interfaces for use by technicians and/or operation systems. In addition, a network element may also include a time slot interchanger.

NE-ACTY
Near End Activity — An LED on the user panel.

NEBS
Network Equipment-Building System

nm
Nanometer (10^{-9} meters)

NMA
Network Monitoring and Analysis — An operations system designed by Telcordia which is used to monitor network facilities.

NMON
Not Monitored — A provisioning state for equipment that is not monitored or alarmed.

Node
In SONET a node is a line terminating element.

Non-Revertive
A protection switching mode in which, after a protection switch occurs, the equipment remains in its current configuration after any failure conditions that caused a protection switch to occur clear or after any external switch commands are reset. (See Revertive.)

NRZ
Nonreturn to Zero

NSA
Not Service Affecting

NSAP
Network Services Access Point — An address that identifies a network element. Used for maintenance subnetwork communication using the OSI protocol.

NTF
No Trouble Found

O

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.

OC-1
Optical Carrier Level 1 Signal (51.84 Mb/s)

OC-3
Optical Carrier Level 3 Signal (155 Mb/s)

OC-3c (STS-3c)
Optical Carrier Level 3 Concatenated Signal — Low-speed broadband signal equivalent to three STS-1s linked together with a single path overhead.

OC-12
Optical Carrier Level 12 Signal (622 Mb/s)

OHCTL
The overhead controller circuit pack provides user access to the SONET overhead channels.

OLIU
Optical Line Interface Unit

OOF
Out of Frame

OOL
Out of Lock

Operations Interface
Any interface that provides information on the system performance or control. These include the equipment LEDs, user panel, CIT, office alarms, and all telemetry interfaces.

OPS/INE
Operations System/Intelligent Network Element

OS
Operations System — A central computer-based system used to provide operations, administration, and maintenance functions.

OS-GNE
Operations System - Gateway Network Element

OSI
Open Systems Interconnection — Referring to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

OSGNE
Operations System Gateway Network Element — An OSGNE serves as a single interface to the OS for NEs in the same subnetwork using X.25 interfaces.

OSMINE
Operations Systems Modifications for the Integration of Network Elements.

OSP
Outside Plant

P

Pass Through
Paths that are cross-connected directly across an intermediate node in a ring network.

P-bit
Performance Bit

PC
Personal Computer

PCU
Power Conversion Unit

PID
Program Identification

PINFET
Positive Intrinsic Negative Field Effect Transistor

PJC
Pointer Justification Count

Plesiochronous Network
A network that contains multiple maintenance subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant. For example in SONET networks, each timing traceable to their own Stratum 1 clock are considered plesiochronous with respect to each other.

PLL
Phased-Locked Loop

PM
Performance Monitoring — Measures the quality of service and identifies degrading or marginally operating systems (before an alarm would be generated).

PMN
Power Minor Alarm

POH
Path Overhead

POP
Points of Presence

Port
The physical, electrical, or optical interface on a system. For example, DS1, DS3, EC-1, OC-3, and OC-12. See Channel.

Port State Provisioning
A feature that allows a user to suppress alarm reporting and performance monitoring during provisioning by supporting multiple states (automatic, in-service and not monitored) for low speed ports. See Channel State Provisioning.

POTS
Plain Old Telephone Service

Proactive Maintenance
Refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming, but indicative of an impending signal fail or signal degrade defect (for example, performance monitoring).

Protection Line
As defined by the SONET standard, the protection line is the pair of fibers (one transmit and one receive) that carry the SONET APS channel (K1 and K2 bytes in the SONET line overhead). On a DDM-2000 OC-3 system, a *protection* line is a pair of fibers that terminate on an OLIU circuit pack in the `main-2`, `fn-a-2`, `fn-b-2`, or `fn-c-2` slot. (See "Service Line.")

PRM
Performance Report Message

PROTN
Protection

Product Family 2000
Lucent's line of SONET standard network products providing total network solutions.

PRS
Primary Reference Source

PSU
Power Supply Unit

PVC
Permanent Virtual Circuit

PWR
Power

R

RAM
Random Access Memory

Reactive Maintenance
Refers to detecting defects/failures and clearing them.

Remote
See Far-End (FE)

Revertive
A protection switching mode in which, after a protection switch occurs, the equipment returns to the nominal configuration (that is, the service equipment is active, and the protection equipment is standby) after any failure conditions that caused a protection switch to occur clear or after any external switch commands are reset. (See "Non-Revertive.")

Ring
A configuration of nodes comprised of network elements connected in a circular fashion. Under normal conditions, each node is interconnected with its neighbor and includes capacity for transmission in either direction between adjacent nodes. Path switched rings use a head-end bridge and tail-end switch. Line switched rings actively reroute traffic over a protection line.

Ring (0x1) Low-Speed Interface
Formerly referred to as dual 0x1 or single 0x1. In ring applications, the DDM-2000 OC-3 and OC-12 Multiplexers use a 0x1 interface meaning both fibers carry service as opposed to a linear (1+1) low speed interface where one fiber is used for service and the other for protection. See 1+1.

RPP
Reliability Prediction Procedure — Described in Telcordia TR-NWT-00032.

RT
Remote Terminal — An unstaffed equipment enclosure that may have a controlled or uncontrolled environment.

RTAC
Lucent Regional Technical Assistance Center (1-800-225-RTAC)

RZ
Return to Zero

S

SA
Service Affecting

SCADA
Supervisory Control and Data Acquisition

SD
Signal Degrade

SDH
Synchronous Digital Hierarchy

Self-Healing
Ring architecture in which two or more fibers are used to provide route diversity. Node failures only affect traffic dropped at the failed node.

SEFS
Severely Errored Frame Seconds

SEO
Single-Ended Operations — The maintenance capability that provides remote access to all DDM-2000 systems from a single location over the DCC.

Service Line
On a DDM-2000 system, a service (or "working") line is a pair of fibers (one transmit and one receive) that terminate on an OLIU circuit pack in the `main-1`, or `fn-a-1`, or `fn-b-1`, or `fn-c-1` slot. As defined by the SONET standard, the SONET APS channel is not defined on a service (or "working") line. (See "Protection Line.")

SES
Severely Errored Seconds — This performance monitoring parameter is a second in which a signal failure occurs, or more than a preset amount of coding violations (dependent on the type of signal) occurs.

SF
Super Frame (format for DS1 signal)

Shelf ID
A switch settable parameter with values of from 1 to 8. Used to log into a selected shelf in a bay using the CIT.

SID
System Identification

Single 0x1 Cross-Connection
In a dual-homed application, the DDM-2000 OC-3/OC-12 Multiplexer uses a single 0x1 cross-connection to map the VT1.5 channels between the DDM-2000 FiberReach OC-1 and the DDM-2000 OC-3/OC-12 rings. This single 0x1 architecture maps low speed to high speed on a specified ring rotation. The high speed to low speed drop is made on the same specified ring with no path switching. Protection is provided at the VT1.5 end points. See Dual 0x1.

Single Homing
In DDM-2000 FiberReach, a network topology in which a single OC-3 shelf serves as a DDM-2000 FiberReach Multiplexer host supporting up to six OC-1 rings. A *SLC*-2000 Access System serving as a host can support up to two OC-1 rings. See Dual Homing.

Site ID
A switch settable parameter with values of from 1 to 8. Displayed on SYSCTL circuit pack to indicate to which site the user panel alarms and LEDs apply.

SLIM
Subscriber Loop Interface Module

SM
Single Mode

SONET
Synchronous Optical NETwork

SPE
Synchronous Payload Envelope

SQU
Sync Quality Unknown. Used in synchronization messaging.

SRD
Software Release Description

Standby
Standby identifies a 1+1 protected OC-N line which is not currently selected by the receiver at either end as the payload carrying signal, or a 1x1 or 1xn protected circuit pack that is not currently carrying service. (See Active.)

Star Topology
For DDM-2000 FiberReach, this refers to a configuration of multiple point-to-point OC-1 extensions from a single DDM-2000 OC-3/OC-12 Multiplexer.

Status
The indication of a short-term change in the system.

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 SPE
STS-1 Synchronous Payload Envelope — A 125-microsecond frame structure composed of STS path overhead and the STS-1 payload.

STS-3c
Synchronous Transport Level 3 Concatenated Signal. See OC-3c.

Subnetwork
Group of SONET network elements that share a SONET data communications channel.

Synchronization Messaging
SONET synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork.

SYSCTL
The system controller circuit pack that provides overall administrative control of the terminal.

T

T1EXT
T1 Carrier Extension Circuit Pack

T1X1 and T1M1
The ANSI committees responsible for telecommunications standards.

TA
Telcordia Technical Advisory

TARP
Target ID Address Resolution Protocol

TCA
Threshold-Crossing Alert — A condition set when a performance-monitoring counter exceeds a user-selected threshold. A TCA does not generate an alarm but is available on demand through the CIT and is shown by TBOS and causes a message to be sent to NMA via the X.25/TL1 interface.

TCVCXO
Temperature-Compensated Voltage-Controlled Crystal Oscillator — A highly stable and accurate clock source used in the DDM-2000 TGS circuit pack.

TGS
The timing generator circuit pack generates clock signals for distribution to the transmit circuits. It operates in the free-running, loop-timing, phase-lock, and holdover modes.

TID
Target Identifier — The Telcordia name for the system name.

TL1
Transaction Language 1 — A Telcordia machine-to-machine communications language that is a subset of ITU-TSS, formerly CCITT's, human-machine language.

TLB
Timing Looped Back. Used in synchronization messaging.

TOP
Task Oriented Practice

TR
Telcordia Technical Requirement

TSA
Time Slot Assignment

TSI
Time Slot Interchange

TSO
Technical Support Organization — Supports RTAC and the customers.

U

UAS
Unavailable Seconds. In performance monitoring, the count of seconds in which a signal is declared failed or, in which, 10 consecutively severely errored seconds (SES) occurred, until the time when 10 consecutive non-SES occur.

Unidirectional
A protection switching mode in which the system at each end of an optical span monitors both service and protection lines and independently chooses the best signal (unless overridden by an equipment failure or by an external request, such as a forced switch or lockout). In a system that uses unidirectional line switching, both the *service* and *protection* lines may be *active* simultaneously, with one line carrying traffic in one direction and the other line carrying traffic in the other direction. For a 1+1 protection scheme the K1 and K2 bytes in the SONET line overhead are used to convey to the far end which line the near end receiver has chosen, so that an "active" indication may be made at the far end.

UOC
Universal Optical Connector — Receptacles on the faceplate of some OLIUs that accept *ST*®, SC, or FC connectors.

UPD/INIT
A pushbutton on the user panel.

V

VF
Voice Frequency

VLSI
Very Large Scale Integration — Refers to very complex state of the art integrated circuits.

VM
Violation Monitor — A mode of the DS3 circuit pack in which it will monitor but not remove P-bit parity violations on the DS3 signal received from the fiber.

VMR
Violation, Monitor, and Removal — A mode of the DS3 circuit pack in which it will monitor and remove P-bit parity violations on the DS3 signal received from the fiber.

VONU
Virtual Optical Network Unit

VT
Virtual Tributary — A structure designed for transport and switching of a sub-DS3 payload.

VT1.5
A 1.728 Mb/s virtual tributary

VT-G
Virtual Tributary Group — A 9-row by 12-column SONET structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte-interleaved within the VT-organized STS-1 synchronous payload envelope.

W

WAN
Wide Area Network

Z

Zero Code Suppression
A technique used to reduce the number of consecutive zeros in a line-codes signal (B3ZS for DS3 signals and B8ZS for DS1 signals).

Numerics

C