Lucent Technologies
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Metropolis®DMXpress Access Multiplexer

Applications and Planning Guide

365-372-312
Issue 2.0
May 2002

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Metropolis® DMX Access Multiplexer
Applications and Planning Guide Releases 1.0 and 1.1

365-372-312 Issue 2 May 2002

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Contents

List of Figures

3 Product Description

5 Operations, Administration, Maintenance, and Provisioning

6 Ordering

List of Tables

9 Technical Specifications

About this information product

Purpose

This guide provides the following information for the Metropolis®DMXpress Access Multiplexer:

- Applications
- Operation
- Engineering
- Support
- Specifications
- Ordering

Reason for reissue

This is the first issue of the Metropolis®DMXpress Access Multiplexer applications and planning guide.

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The alert symbol appears throughout this document to alert the user to these safety labels.

This applications and planning guide is intended for network planners and engineers. However, it is also for anyone who needs specific information regarding the features, applications, operation, engineering, and ordering of the DMX*press*.

How to use this information product

The following is a brief description of the contents of each chapter in this document:

- **"About This Document"** describes the purpose, intended audience, reason for reissue, and organization of this document. This section references related documentation and explains how to order, make comments, or recommend changes to this document.
- Chapter 1, **"System Overview,"** describes the DMX*press*. This introductory section also lists the features included in the releases covered by this document.
- Chapter 2, **"Network Topologies,"** describes how the DMX*press* shelf serves diverse needs such as embedded network evolution, access transport for voice and private line services, interoffice transport, broadband business data access, DSLAM access, IP network infrastructure, enterprise LAN interconnect and transport, ISP carrier access, and cable access to internet applications through configurations such as path switched ring, linear optical extensions, homing, and hubbing.
- Chapter 3, **"Product Description,"** describes the DMX*press* hardware, including the shelf, circuit packs, cables, and power.
- Chapter 4, **"System Planning and Engineering,"** summarizes physical arrangement, cross-connection, and synchronization information to help you plan procurement and deployment of the DMX*press*.
- Chapter 5, **"Operations, Administration, Maintenance, and Provisioning,"** defines the "maintenance philosophy," outlining the various features available to monitor and maintain the DMX*press*.
- Chapter 6, **"Ordering,"** provides equipment ordering information for the DMX*press*.
- Chapter 7, **"Product Support,"** describes how Lucent Technologies supports the DMX*press*. This chapter includes information about engineering and installation services, technical support, documentation support, and training available from Lucent Technologies.
- Chapter 8, **"Reliability and Quality,"** provides the Lucent Technologies quality policy and describes the reliability program.
- Chapter 9, **"Technical Specifications,"** lists the technical specifications for the DMX*press*.
- Glossary provides definitions for telecommunication acronyms and terms.
- Index supplies users with specific subjects and corresponding page numbers to find necessary information.

Conventions used

Bold typeface signifies emphasis.

Italic typeface denotes a particular product line or information product.

`Bold Courier` typeface signifies a command.

For the remainder of this information product, "DMX*press* " is used in place of Metropolis®DMXpress Access Multiplexer in most cases.

Electronic documentation

Documentation for the DMX*press* 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.

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1 System Overview

Overview

Purpose

This section provides an overview of the Metropolis®DMXpress Access Multiplexer (DMX*press*) system. Included in this section is a brief overview and a list of supported functions for the various DMX*press* releases.

The DMX*press* is optimized for customer premise deployment. While providing certain advantages in the ILEC/CLEC environment when installed in central offices or co-located central offices. Yet, the DMX*press* main use is on the Customer Premises Equipment (CPE) applications.

The DMX*press* although physically smaller and with fewer ports, has much of the same functionality of the Metropolis™ DMX Access Multiplexer.

Contents

The following topics are included in this chapter:

Overview of Metropolis® Portfolio

Purpose

Metropolitan, “metro”, networks are the communications networks that link homes and businesses to larger, long-distance core networks. These networks are complex because they are filled with both old and new networking equipment and must carry all types of service traffic, including voice, data and video.

Driven by the exponential growth of the Internet, requirements for metropolitan optical transport networks are changing quickly from pure circuit networks to hybrid networks. This evolution requires metro access networks to bridge the bandwidth gap between local area networks (LANs) and core backbone networks. These requirements are driving metropolitan network evolution from traditional SONET multiplexers into more flexible, higher-speed, data-aware platforms - a necessity for optical edge solutions.

Solution

Lucent Technologies is helping Service Providers cost-effectively deploy solutions that can accommodate a multitude of services, such as voice, private line, Ethernet, IP, frame relay, and ATM. The Metropolis® portfolio offers a seamless evolution to next-generation metro solutions that can eliminate the bottleneck in the metropolitan network, allowing service providers to deliver new high-speed, revenue-generating services such as gigabit Ethernet, virtual private networks (VPN), storage area networks and digital subscriber lines (DSL).

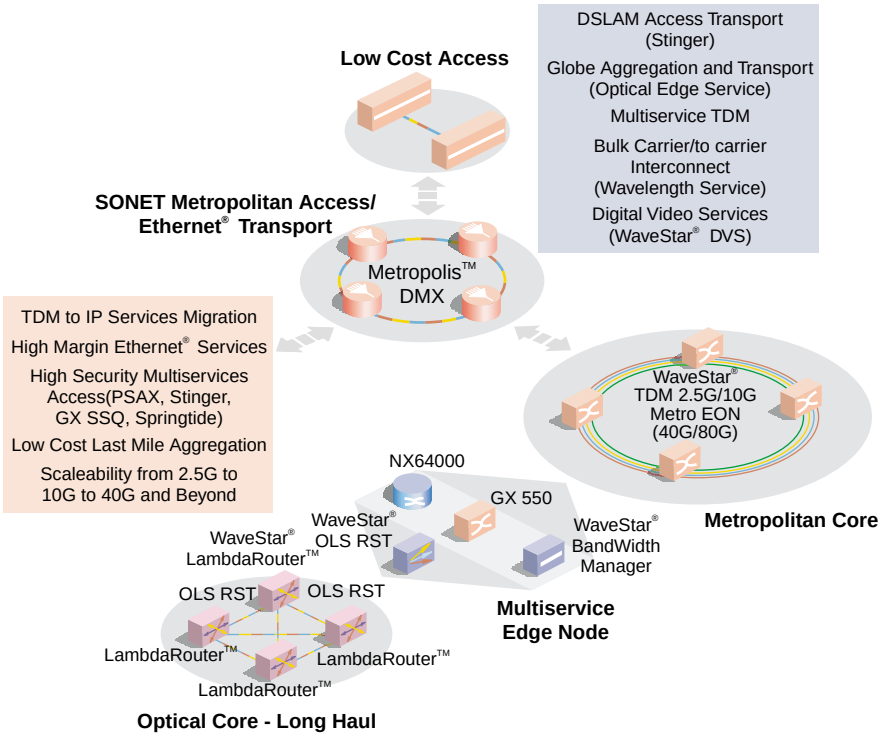
Portfolio

Lucent designed its Metropolis® portfolio so its service provider customers will be able to choose the solution that best accommodates their existing network allowing them to bring new services to market quickly and cost effectively.

Metropolis® includes two categories of next-generation products based on the most common types of metro networks:

- Next-Generation SONET -- Metropolis DMX Access Multiplexer which leverages existing optical equipment while providing a solid foundation for future bandwidth, gigabit Ethernet and IP services growth.
- MetroWDM -- Metropolis EON Enhanced Optical Networking a metro core DWDM solution for regional traffic allows customer to deliver cost-effective optical bandwidth directly to the customer premises.

Each of the Metropolis solutions can fuse with Lucent new multiservice data switches and existing IP and ATM equipment to provide an end-to-end broadband network that links to long-distance or other metro networks.



Metropolis® Products

Overview

The section provides a brief description of each of the following products which comprise the Metropolis portfolio:

- Metropolis® DMX Access Multiplexer
- Metropolis® DMX*press* Access Multiplexer

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Metropolis® DMX Access Multiplexer

Overview

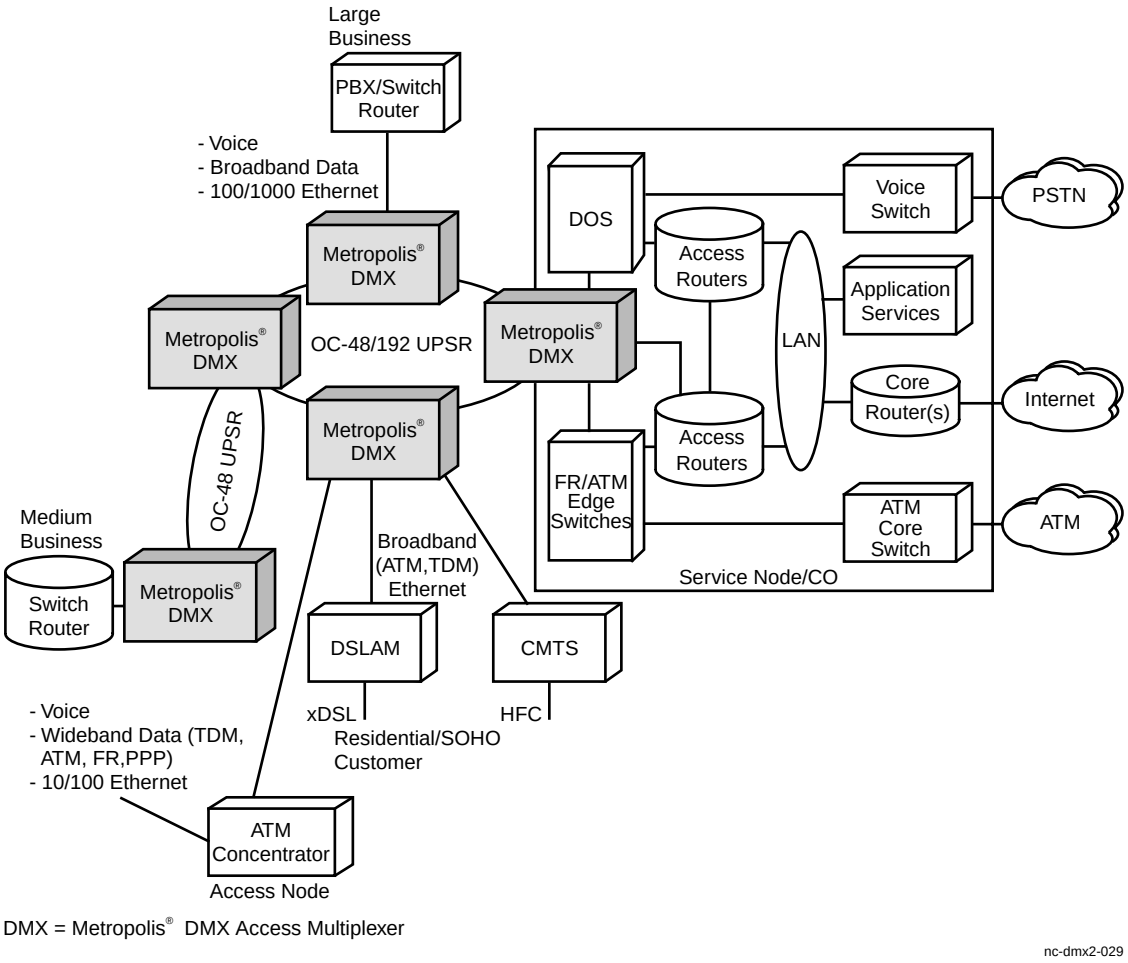
The Metropolis DMX Access Multiplexer product provides a solution for service providers with an embedded SONET base who are seeking to migrate to next generation technology and to new next-generation carriers who are seeking to provide SONET and Ethernet services over the proven reliability of SONET transport from speeds of DS-1 to OC-192. The Metropolis DMX solution helps add revenue opportunities through the addition of new services, and reduces costs through the consolidation of multiple technologies in one network element.

Interfaces

Metropolis DMX supports a wide array of wideband and broadband transport, including traditional SONET transport of DS1, DS3, EC-1, OC-3, OC-12, OC-48, and OC-192 signals, as well as 10/100/1000 Mbps Ethernet LAN transport. This single-shelf product can be equipped to serve many diverse network applications and supports a variety of operations interfaces for current and evolving network operations needs.

Service Applications

The DMX Access Multiplexer provides a wide range of service applications transporting voice and data from the access edge of the network to the core of the network. These applications range from traditional SONET applications to advanced data transport applications.



DMXpress Overview

Introduction to DMX*press*

The DMX*press* system has been designed to provide a last-mile solution at the lowest-cost possible. In its ability to offer low-cost, high revenue, protected transport for both voice and data, DMX*press* is an ideal solution for fiber-to-the-business applications. DMX*press* eliminates the need for a LAN/WAN boundary and simplifies broadband data service delivery. Plus, the DMX*press* has the transmission capability to send signals directly from a customer premise or Multi-Tenant Unit (MTU) to a Central Office (CO).

Release 1.0 and 1.1

Prior to Release 2.0, DMX*press* offers an OC-48 as a standard high-speed (network side) interface. DMX*press* can be equipped with a standard TDM card offering either 16 DS1 ports and 1 DS3 port (which can be removed if not needed), or 12 DS3 ports. At the same time, the DMX*press* can be equipped with either a 16-port Fast Ethernet (10/100 Mbps) or 2-port Gigabit Ethernet (GbE) option pack that provides for a provisionable GbE packet ring capable of eliminating last-mile bottleneck and accommodating a growing demand for data service.

Release 2.0 and beyond

In Release 2.0 the DMX*press* offers an OC-12 high-speed (network side) interface in addition to the high-speed OC-48 interface offered previously. Included in this release are also a set of 16 Dense Wave Division Multiplexing (DWDM) circuit packs, that support 32 different OC-48 wavelengths in the 1550 nm range for high-speed (network side) transmission. These packs are designed to be used with Lucent POUs.

In Release 2.0 the DMX offers OC-3 (4 ports) and OC-12 (2 ports) low-speed (tributary) TDM interfaces in addition to the standard TDM packs.

In Release 3.0 the DMX*press* supports a 16port 10/100 Mbps circuit pack designed for Fast Ethernet Private Line applications. Another, 16 port, Fast Ethernet circuit pack is available in Release 3.0 to support Ethernet packet ring enhancements (CIR, PIR and LCAS). Finally, a 4 port GbE pack (GbE/4) that supports Ethernet enhancements is available in R3.0.

Thus, DMX*press* optimizes last-mile access for internet service growth while maintaining high-revenue voice and private-line capabilities.

The following figure shows the DMX*press* unit with the Main, Option 1, and Option 2 slots.

Figure 1-1 DMXpress Shelf

The DMX*press* can be configured in the following ways:

- DMX*press* with DS1/DS3 Card (DS1/DS3/16/1) ONLY
- DMX*press* with one of the FASTE/16 Cards ONLY
- DMX*press* with GbE/2 or GbE/4 Card ONLY
- DMX*press* with DS1/DS3/16/1 and FASTE/16 card
- DMX*press* with DS1/DS3/16/1 and GbE/2 or GbE/4 Cards
- DMX*press* with DS3/12 Card ONLY
- DMX*press* with DS3/12 and FASTE/16 card
- DMX*press* with DS3/12 and GbE/2 or GbE/4 Cards
- DMX*press* with OC-3 or OC-12 Card ONLY
- DMX*press* with OC-3 or OC-12 card and FASTE/16 card
- DMX*press* with OC-3 or OC-12 card and GbE/2 or GbE/4 Cards

The DMX*press* always comes equipped with either the high-speed OC-12 or OC-48 circuit pack.

Refer to Chapter 7 for ordering information on these configurations.

System Size

The DMX*press* system has a dimension of 17.3”Wx3.5”Hx15”D (2RU) and is designed for use in either 19-inch or 23-inch rack, wall mount, and desk-top.

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Features (Releases 2.0 and 3.0)

Release 2.0 Features

The following are some of the planned features for Release 2.0. Features included in previous Releases are listed on page 1-12.

High Speed (network side) Service Interfaces

- OC-12 intermediate reach (20 km @1310nm) outside plant (OSP) hardened-- 2 ports per circuit pack
- OC-48 DWDM compatible optics (32 wavelengths) in the 1550 nm range for use with passive optics units (POUs)

Low Speed (tributary side) TDM and Ethernet Service Interfaces

- OC-12 intermediate reach (20 km @1310nm) -- 2 ports per circuit pack
- OC-3 intermediate reach (20 km @ 1310nm) -- 4 ports per circuit pack
- GbE/2 (2 GbE ports, 1310 nm) option card. Short reach (850 meters) version of the A1AA008 (which is a long reach GbE card)

Network Configurations

- OC-12 high-speed 0x1 and single or dual homed UPSR configurations
- OC-3/12 tributary interfaces for 0x1 add/drop configurations
- OC-48 Dense Wave Division Multiplexing (DWDM)

Operations, Administration, and Maintenance Capabilities

- PC-CIT can be used on a PC with Windows XP operating system (Windows 98, 2000, and NT4.0 also supported)
- Navis ™ Optical INC support
- Navis ™ Optical EMS support
- TIRKS (R19.6), NMA (R11.1), and Transport (R2.5) support

Other/External Hardware

- Passive Optics Units (POUs) for use with OC-48 DWDM circuit packs (capable of combining 1,2,4,16, or 32 wavelengths on a single fiber)
- Battery Backup module in case of power failures

Release 3.0 Features

Along with the features described in the Release 2.0 section, the following are some of the planned features for Release 3.0.

Tributary TDM and Data Service Interfaces

- FASTE/16 (10/100 Mbps) Private Line option card- support for up to 16 10/100 Mbps (Fast) Ethernet ports designed for Ethernet private line applications
- FASTE/16 (10/100 Mbps) option card- support for up to 16 10/100 Mbps (Fast) Ethernet ports designed for Ethernet enhancements such as CIR and PIR rate shaping
- GbE/4 (4 GbE ports, 1310 nm) option card designed to support Ethernet enhancements such as CIR and PIR rate shaping

Network Configurations

- Fast Ethernet (10/100 Mbps) private line applications
- Committed Information Rate (CIR) and Peak Information Rate (PIR) rate shaping capability on Fast Ethernet (10/100 Mbps) and Gigabit Ethernet (GbE) interfaces.
- **Ethernet Jumbo Frame Support**

  DMX*press* supports jumbo-sized Ethernet frames with a maximum capacity of 9, 000 bytes. Jumbo frame support can increase the total throughput of an Ethernet switch by reducing the number of frames that must be processed when switching a high volume of data.
- **Dynamic Bandwidth Allocation via LCAS**

  This feature (also known as link capacity adjustment scheme--LCAS) enables the DMX*press* to provide each interface with only as much bandwidth as it might need at a particular time. This works because the DMX*press* assigns channels on it's high-speed (network side) interface only to circuits that are transmitting at that time.

Operations, Administration, and Maintenance Capabilities

- SNMP management (limited to alarms and traps on SONET interfaces and alarms on Ethernet interfaces)
- Navis ™ Optical INC support
- Navis ™ Optical EMS support
- TIRKS (R19.6), NMA (R12.0), and Transport (R2.7) support

□

Features (Releases 1.0 and 1.1)

Overview

Listed below are the major features for Release 1.0.

Tributary TDM and Data Service Interfaces

- Two Option Card slots: One dedicated to TDM and one dedicated to Ethernet services.
- TDM Option Card - support for up to 16 DS1's and 1 DS3
- TDM Option Card - DS3/12 Interface Option Card (12 ports)
- FASTE/16 (10/100 Mbps) Option Card - support for up to 16 10/100 (Fast) Ethernet ports
- GbE/2 (2 GbE ports) Option Card.

SNMS Support

SNMS Release 7.0 support.

High Speed Service Interfaces

- OC-48 (1310 nm) Intermediate Reach (20 km), UPSR SONET (VT, STS-1, STS-3c, STS-12c) HS interfaces

Network Configurations

- OC-48 with VT1.5 granularity across 12 STS-1s
- 1-DCC Channels and Operations Interface (DCC) inter-networking with DMX
- OC-48 Holdover, Free Run and Line Timing reference Switch (S1 byte)
- Linear (unprotected--0x1) extensions using OC-48
- Provisionable GbE and 10/100 Mbps “Packet Ring”
- **4093 Virtual Local Area Networks (VLANs)**
  DMX*press* allows the provisioning of up to 4093 separate IEEE802.1q VLANs.
- **Stacked VLANs**
  DMX*press* allows customer traffic to be identified and segregated using “stacked” IEEE 802.1q VLAN tags. VLAN tags enable the formation of Virtual Private Networks (VPNs) by segregating various units of traffic and isolating different end-customers
- Fast spanning tree restoration (per IEEE 802.1w)
- Telcordia OS support (TIRKS, NMA, Transport)

Environmental and Packaging

- EMC, UL 60950, NEBS Level 3, CSA Certified

Operations and Maintenance

- TL 1 on PC-CIT
- Graphic User Interface (GUI) on PC-CIT
- AITS support
- Level 1 Area Provisioning
- Level 2 Routing
- Operations Interworking with DMX
- Local and Remote Software Download capability
- 14 Miscellaneous Discrete Inputs (MDI) and 4 Miscellaneous Discrete Outputs (MDO)
- Office Alarm support
- Network size of up to 256 Network Elements
- IAO-LAN support
- EIA-RS-232 PC-CIT (Front access)
- UPSR protection switching (GR-253 compliance)
- Remote alarm support
- Facility loopback for DS1/DS3/16/1
- Dual -48 VDC or Single AC Power supply
- Wall, Desktop, Rack (19" or 23")
- Physical dimensions - not to exceed 17.3" W x 15" D x 3.5" H
- Four levels of security
- In-service node additions

Release 1.1 Features

Along with the features described in the Release 1.0 section, the following are some of the planned features for Release 1.1.

Operations, Administration, and Maintenance Capabilities

- Enhanced TCP/IP enabling software downloads using FTP through the LAN CIT and RS232 CIT ports located on the front of the OC-48 circuit pack
- Support of operation using SNMS
- Telcordia OS support (TIRKS, NMA, Transport)

2 Network Topologies

Overview

Purpose

The Metropolis® DMXpress Access Multiplexer (DMX*press*) supports a wide range of service applications and a variety of network topologies economically and efficiently.

Contents

The following sections are included in this chapter:

Service Applications

Overview

The DMX*press* is optimized for customer locations where carriers are interested in offering a low cost option for multi-service (Ethernet/TDM) aggregation. The DMX*press* offers OC-12/48 UPSR as a standard interface using 1310nm intermediate reach optics (1550nm when using OC-48 DWDM optics). The integrated switch has VT, STS-1, and Ethernet granularity and it is line timed. In addition to OC-12/48 equipage, DMX*press* can support a TDM service card, and an Ethernet service card, or both.

The system can be equipped with one TDM card offering either 16 DS1 ports and 1 DS3 port, 12 DS3 ports, 4 OC-3 ports, or 2 OC-12 ports. At the same time, you can install either of the following Ethernet option packs:

- 16 port fast Ethernet (FASTE/16)
- 2 port gigabit Ethernet (GbE/2)

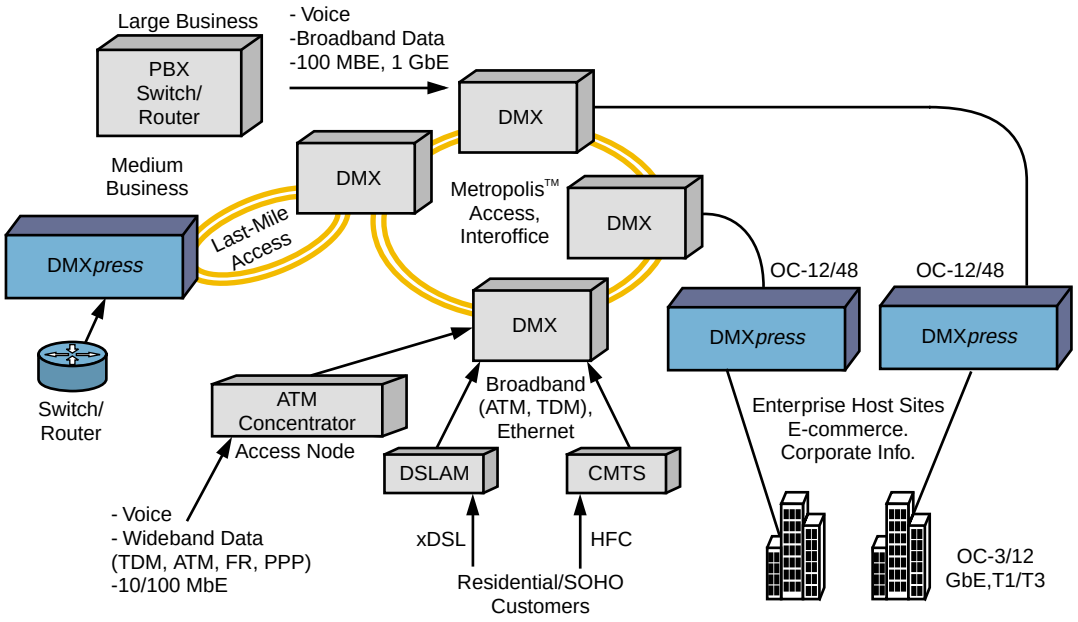
The TDM and Ethernet cards can be mixed and matched at the customers discretion.

The low speed tributaries on DMX*press* are unprotected and the system can be managed by the same operations systems used for DMX*press*, including PC-CIT and Navis™ EMS.

The DMX*press* is NEBS Level 3 compliant and can be outfitted with a choice of power –48 VDC or 110 volt AC. It can be wall mounted, rack/bay mounted, or located on a table.

The following network diagram provides an overview of the network applications served by the DMX*press*:

Figure 2-1 DMX*press* Network Applications



The Metropolis™ DMX*press* allow network providers to choose form a variety of access network deployment strategies to meet their service delivery needs

DMX*press* = Metropolis™ DMX*press* Access Multiplexer
DMX = Metropolis™ DMX Access Multiplexer

NC-Xpress-043

Ultra Low-cost Fiber to the User

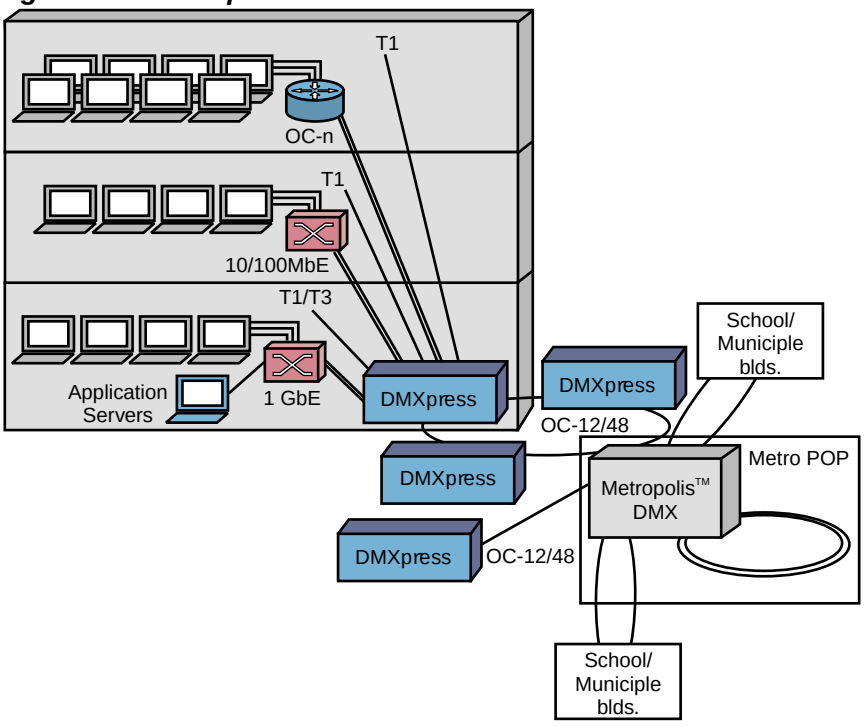
Overview

The DMX*press* provides a compact, multi-service Point of Presence (POP) for Multi Tenant Unit (MTU) collection, cost effectively to the edge, while providing SONET reliability and interoperability. DMX*press* offers higher bandwidth and lower cost per bit than Passive Optical Network (PON) applications. The DMX*press* Ethernet capabilities can be used to offer high-speed Internet access, transparent LAN, VLAN, Ethernet private line, and Ethernet rate shaping in combination with high-revenue voice and private line transport applications.

Description

The DMX*press* can be placed in an office building, office park, corporate campus, medical facility, hotel, or any building housing multiple business units and/or personal dwellings. DMX*press* is ideal as a collection point for multiple DS1, DS3, 10/100 Mbps, and GbE interfaces.

Figure 2-2 DMX*press* POP for MTU



Application advantage

Using the DMX*press* in this application results in the following advantages:

- Low-cost fiber terminations directly to the business
- Flexible service offerings (DS1, DS3, 10/100 Mbps, GbE)
- Easily managed solution: if the DMX*press* is connected to the DMX, Lambda Unite, WaveStar 2.5G/10G, or Lambda Manager the remotely located DMX*press* can be managed from the central office using the Lucent PC-CIT.
- The DMX*press* supports service flexibility with a 16 port DS1/ one port DS3 circuit pack, a 12 port DS3, a 16 port 10/100 Mbps, or 2-port GbE circuit pack all of which are meant to facilitate cost-effective and steady growth.

□

Packet Rings

Overview

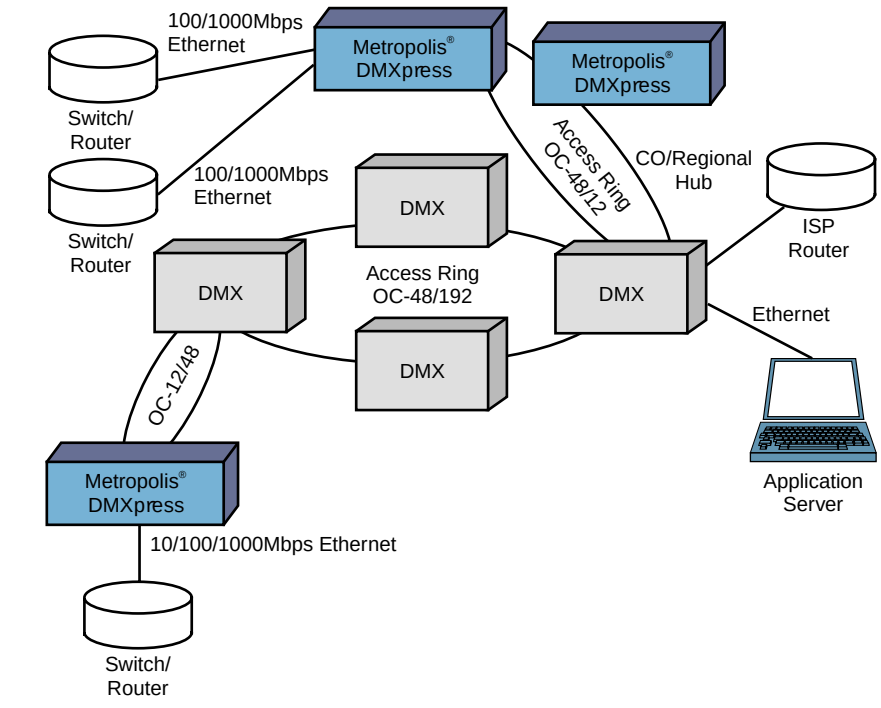
Packet Ring configurations provide business-to-business networking of routers and data switches using Ethernet transport over a reliable, low-cost multi-service network. The DMX*press* provides the unique capability for a packet ring to span multiple ring topologies. As shown in the figure below, packet rings hosted by the DMX*press* can span multiple OC-48, OC-12, or OC-192 ring configurations. Additionally, packet rings hosted by the DMX*press* can reach into areas serviced by dual and single-homed ring extensions (see the figure below).

Ethernet over SONET

A Packet Ring is a set of packet switches connected in a ring topology that use the inherent redundancy of the ring configuration to provide durability and fast restoration in the event of failures.

Packet rings can be used with or without SONET layer protection. At the packet layer, rapid spanning tree protocol (as defined in IEEE 802.1w) is used to provide protection.

Figure 2-3 Packet Rings



DMX*press* uses standard Generic Framing Procedure (GFP) encapsulation (ITU G.7041) for Ethernet over SONET mapping. Packet rings provide efficient aggregation and transport for Ethernet traffic. DMX*press*' virtual concatenation capability (ITU G.707) provides flexible bandwidth granularity in the wide area network (WAN), which can grow with your service demand.

Packet Ring Capacity

The DMX*press* currently (since R1.0) supports the following number of packet rings per circuit pack:

- 1 packet ring on each 10/100 Mbps Fast Ethernet circuit pack (16 in R3.0)
- 2 packet rings on each 1000 Mbps GbE circuit pack (4 in R3.0)

Supported Applications

As stated in the introduction to this document, the DMX*press* has been designed to simplify network architectures by offering native Ethernet interfaces into the metro optical network. This translates into a host of exciting applications that succeed in eliminating discrete customer premise service elements (CPEs) and reducing the number of hub aggregation switches needed for dealing with data service growth. This chapter provides many examples of such applications.

□

Mini-POP Collector

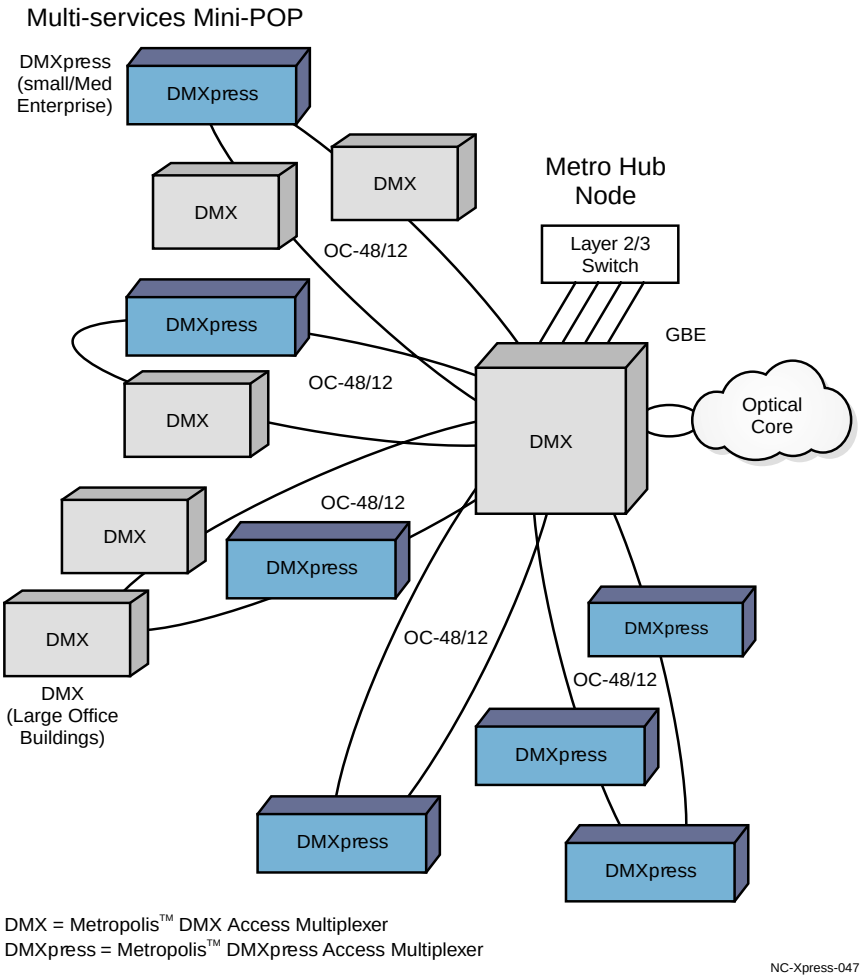
Overview

The DMX*press* offers affordable, mini-POP solutions on the same ring as larger nodes hosting small/medium sized MTUs and remote DSLAMs at a fraction of the cost of comparably equipped SONET muxes.

Description

Providing long-reach OC-48 optics and a mix of DS1, DS3, 10/100 Mbps and GbE optics, the DMX*press* can be a collection point for a variety of interfaces providing service to moderately sized MTUs while simultaneously operating as an intermediate node on the same ring as larger nodes. DMX, WaveStar 2.5G/10G, or BandWidth Manager multiplexers can be used in combination with DMX*press* to support much larger MTUs or to hub multiple OC-48 DMX*press* rings.

Figure 2-4 DMX*press* as Mini-POP Collector



Application advantage

Using the DMX*press* in this application results in the following advantages:

- The DMX*press*' small footprint reduces cost, power consumption, and heat generation at co-location sites.
- Easily managed solution: if the DMX*press* is connected to the DMX, Lambda Unite, or WaveStar 2.5G/10G, a remotely located DMX*press* can be managed from the central office using the Lucent PC-CIT or SNMS.
- Reliable, SONET network protection of both voice and data services.
- Path for secure access to VLAN and transparent LAN services and applications.
- Same operations platform from DMX*press* and DMX.
- The ability to mix and match DMX and DMX*press*, utilizing DMX*press* where service density/demand is lower, allows you to match node size to demand and footprint requirements.

High-speed Internet/Intranet Access

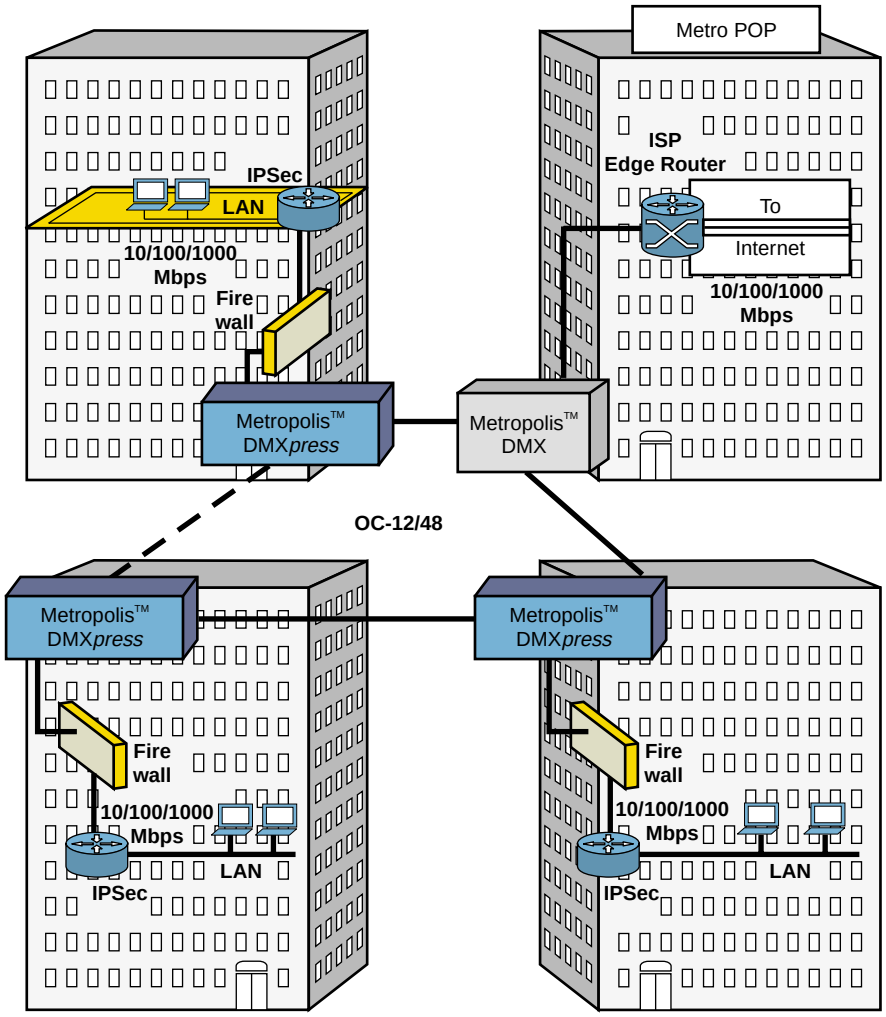
Overview

The DMX*press* provides ultra low-cost remote aggregation of 10/100/1000 Mbps Ethernet clients for broadband Internet access, with various QoS applications that provide dedicated or shared bandwidth, flexible Ethernet packet rings for MTU/CPE data collection, and further aggregation at DMX hub for GbE handoffs to Internet Service Providers.

Description

For example:

Figure 2-5 High-speed Internet Access Using DMX*press*



DMX*press* internet/intranet access applications also offer a statistical multiplexing model that makes efficient use of shared bandwidth.

DMX supports two forms of rate shaping: rate limiting, and committed rate service.

Rate limiting is achieved using Peak Information Rate (PIR) provisioning. Committed rate service is achieved using Committed Information Rate (CIR) provisioning. PIR institutes a limit, or "ceiling", of maximum bandwidth to be allocated to a particular customer at any time. CIR, on the other hand, provides a guaranteed minimum, or "floor" throughput even during periods of high congestion. Banded and/or burstable services can also be deployed based on CIR and PIR combinations. See the following section for a detailed description of Rate Shaped Services.

Application advantage

Using the DMX*press* in this application results in the following advantages:

- Ability to accommodate various service densities by mixing and matching FASTE/16 or GbE/2 with TDM cards as needed.
- Ability to use DMX to hub traffic from multiple DMX*press* shelves.
- Secure and scalable service: as demonstrated in the figure above, the DMX*press* can support the reliable movement of data within the LAN pictured and from anyone of the buildings out in the WAN.
- The use of Ethernet rate shaping enables great versatility in QoS for Ethernet applications.
- Reduced operational expenses in consolidation of resources, conservation of space and power, and the fact that the DMX*press* can be managed through the use of TL1 Commands (as well as a GUI) and so does not require additional training of craft personnel.
- Reliable, SONET protection of both voice and data services.
- Centralization of security and value-added services (both intranet and internet resources) in the fact that data can be exchanged within the LAN pictured above, or can be transmitted and received from one area, housing a single set of servers that interface with the DMX*press*.

Ethernet Private Line

Overview

Ethernet private lines provide the user the ability to transport frames completely transparently between two DMX*press* NEs. No VLAN knowledge or packet-layer provisioning is required by the user in this application. Simple, SONET STS-1 cross-connect provisioning is all that is required. These private line capabilities allow the DMX*press* to provide dedicated bandwidth for individual customers and fast SONET-layer restoration in the event of a facility-based failure.

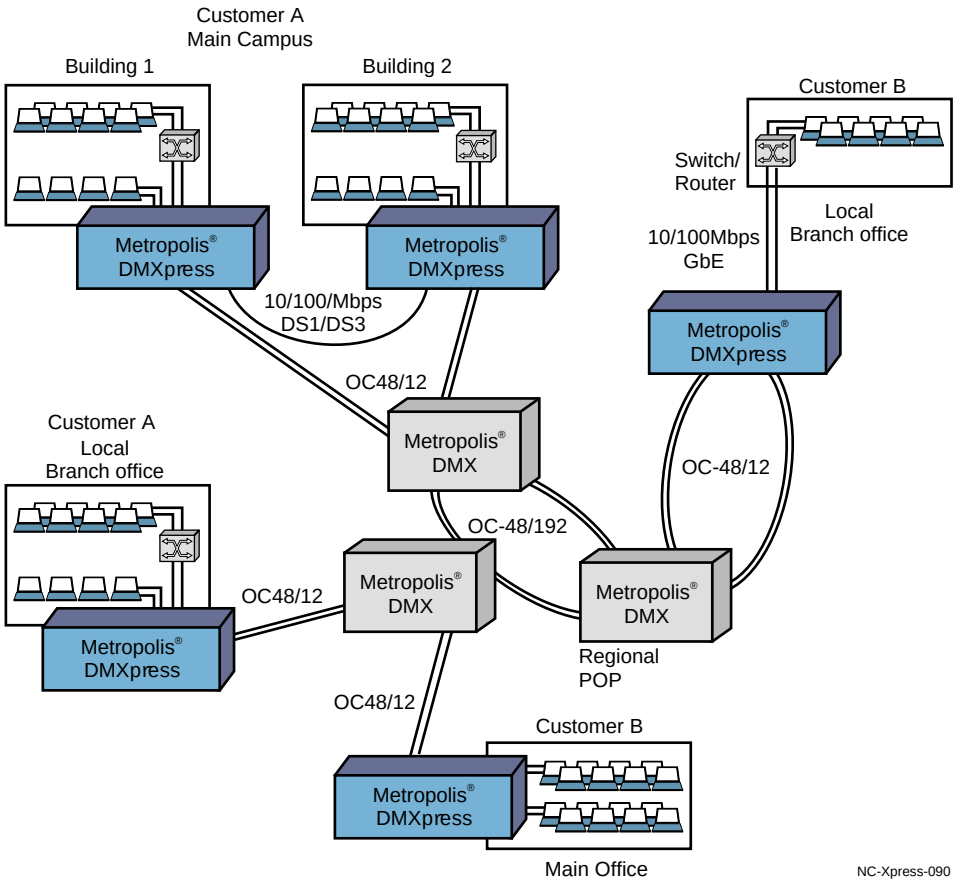
Ethernet Private Line (point-to-point Ethernet) for Enterprise LAN transport

DMX*press* utilizes standard IEEE 802.1 Ethernet switching in combination with standard STS-1 virtual concatenation (ITU G.707) to transport 10/100 Mbps or 1000 Mbps Ethernet services over a SONET OC-48/12 high-speed (network side) interfaces. DMX*press* allows you to transport 1, 2, or 3 STS-1s per private line.

In Release 1.0, the DMX*press* can support 1 protected and 2 unprotected private lines. In Release 3.0 density increases to 16 private lines per DMX*press*.

In this configuration, Ethernet traffic from an end customer may be fed to a core router in the central office (CO), while voice traffic is fed from the same ring to a voice switch in the CO. In private line LAN transport configurations, standard SONET UPSRs can be used to provide restoration within 50 milliseconds.

Figure 2-6 Ethernet Private Line Transport Application



Application advantage

Ethernet Private Lines provide data transport with absolute QoS. They simplify networks by eliminating intermediate WAN protocols, such as frame relay or ATM while providing service providers an ideal migration path from traditional private line, circuit-based services.

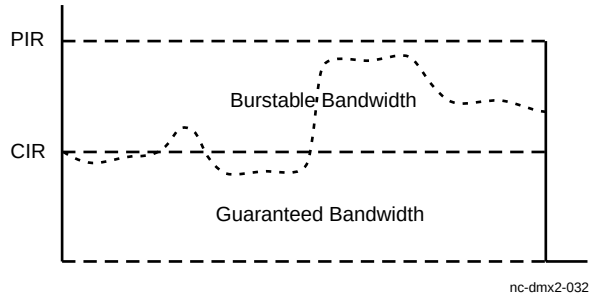
Ethernet Private Lines also provide dedicated bandwidth (with or without protection) and absolute QoS for business critical data transport applications. Private lines are protected by SONET layer protection switching with a guaranteed restoration time of less than 50 milliseconds.

Ethernet Rate Shaping Services

Overview

Rate-shaped services offer a statistical multiplexing model that makes efficient use of shared bandwidth. DMX*press* supports two forms of rate shaping: rate limiting, and committed rate service.

Rate limiting is achieved using Peak Information Rate (PIR) provisioning. Committed rate service is achieved using Committed Information Rate (CIR) provisioning. PIR institutes a limit, or "ceiling", of maximum bandwidth to be allocated to a particular customer at any time. CIR, on the other hand, provides a guaranteed minimum, or "floor" throughput even during periods of high congestion. Banded and/or burstable services can also be deployed based on CIR and PIR combinations.



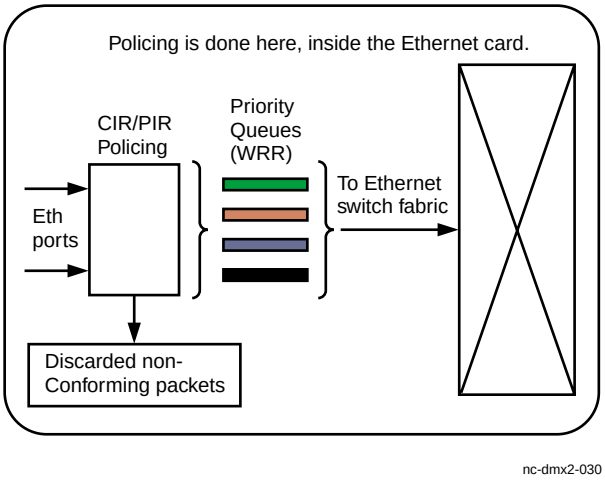
How it Works

The figure above demonstrates the relationship between CIR and PIR services. Again, PIR represents the maximum bandwidth a particular customer will be allocated at any time, while CIR is guaranteed bandwidth that insures a constant level of service even during periods of high congestion. CIR can be provisioned on a per-port or per-VLAN basis.

As the figure above suggests, if the maximum bandwidth for a customer (PIR) is exceeded, surplus packets may be dropped. On the other hand, if a customer's traffic requires enough bandwidth to exceed their CIR, but remain below their PIR, the packets that exceed the CIR will be marked as discardable. This means that they will not be dropped unless other traffic requires that bandwidth. If the network is not congested when packets exceed the CIR level, the packets will reach their destination. As long as a customer does not exceed their CIR, none of their traffic will ever be dropped.

Policing takes place first in order to ensure that a customer meets the CIP/PIR stipulations of their contract. The priority queing relative to other customer's traffic then occurs; providing another QoS capability.

Figure 2-7 Bandwidth Allocation within Ethernet circuit packs



Application advantage

Rate shaping provides the capability to offer both a guaranteed minimum "floor" throughput during periods of high congestion (CIR), and a maximum "ceiling" throughput in place at all times. Thus, the DMX*press* enables versatility in QoS for Ethernet applications. With the possibility of burstable services, the DMX*press* not only provides the possibility of a guaranteed QoS, but also the ability to provide a customer with throughput above and beyond their CIR (when network conditions permit). Finally, all private line services are protected by tried and tested dependability of SONET layer protection.

DDM-2000 Ring Upgrade

Overview

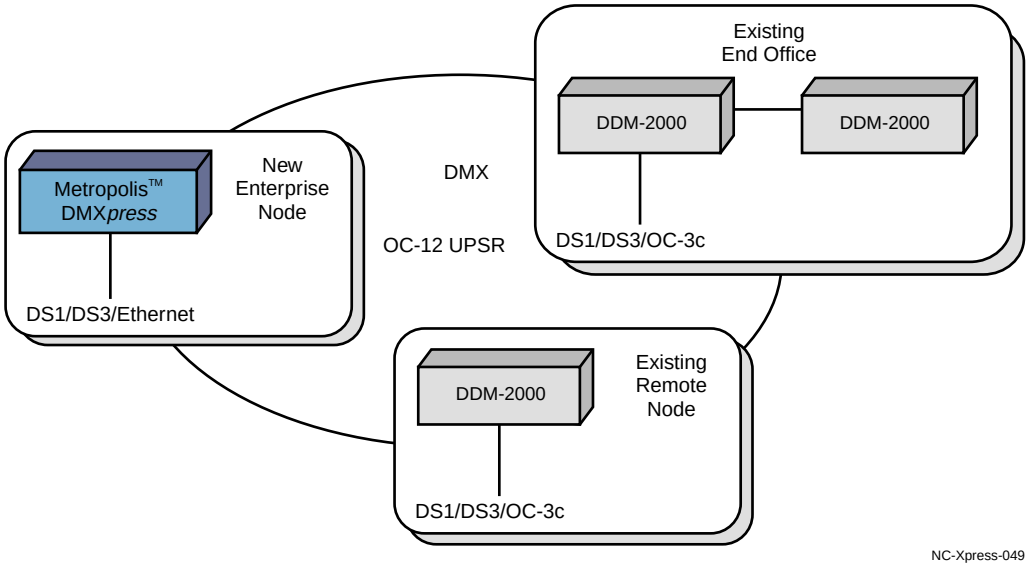
The DMX*press* provides a low-cost evolution strategy for adding Ethernet services to existing DDM rings.

Description

DMX*press* and TARP releases of DDM-2000 shelves with OC-12 optics connected together have a compatible remote operations capability allowing them to communicate.

Interconnection with other OC-12 rings is possible when the DMX*press* shelf is equipped with OC-12 MAIN (available in Release 2.0) circuit packs.

Figure 2-8 DDM-2000 Ring Upgrade



Application advantage

Using the DMX*press* in this application results in the following advantages:

- Interoperability with DDM-2000 (TARP Releases) provides investment protection of legacy equipment.
- Cost effective migration of legacy TDM networks to provide multi- service (both TDM and Ethernet) services.
- DMX*press* (equipped with OC-12 pack) can be added to existing SONET rings to enable new Ethernet services on embedded rings.

□

Wireless Optical Buildout

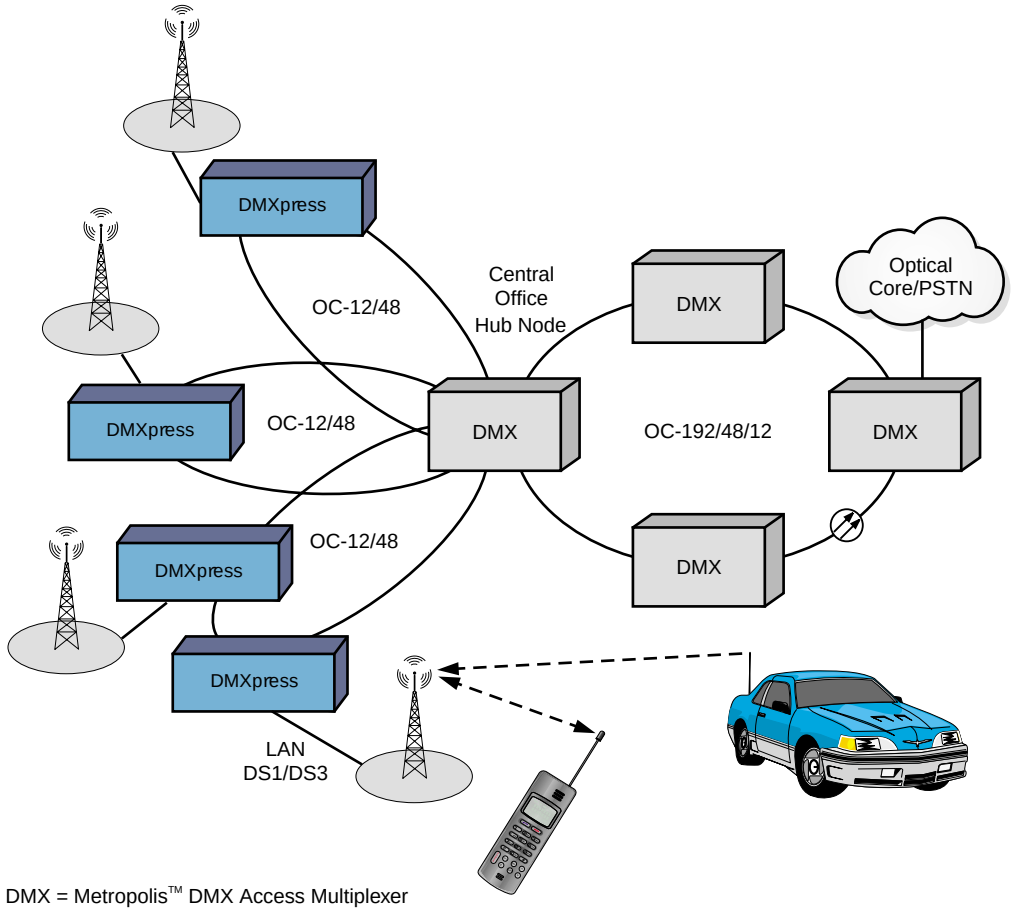
Overview

The DMX*press* is environmentally hardened for outside cabinet deployment using OC-12 high-speed interfaces.

Description

The DMX*press* can be deployed in outside cabinets at such places as wireless/cellular sites, allowing for cost-effective aggregation of DS1, DS3, and OC-3/12 signals and reliable, SONET protected transport of these services to Hub nodes at the CO in a scalable, compact, and easily managed NE.

Figure 2-9 Wireless Optical Buildout



DMX = Metropolis™ DMX Access Multiplexer

Application advantage

Using the DMX*press* in this application results in the following advantages:

- Cost effective transport of wireless service in an environmentally hardened unit designed for outside deployment.
- Compact size of DMX*press* provides for reduced cost, space, and heat generation at antenna sites.
- Easily managed monitoring of equipment at antenna site (such as doors, fire alarms, heating or cooling systems, etc....) through the miscellaneous discrete interfaces on the DMX*press* (14 MDIs and 4 MDOs).

ISP/Access Data Transport

Overview

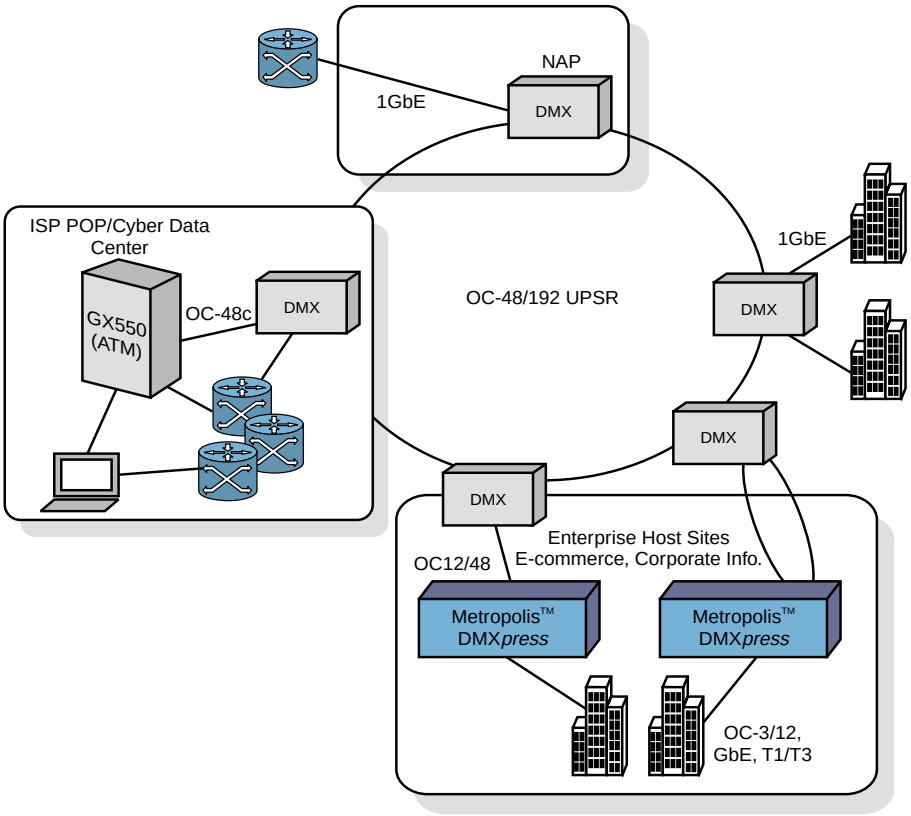
The DMX*press* enables bulk data transport services with a combination of Gigabit Ethernet, Fast Ethernet, broadband and wideband data interfaces.

Description

The DMX*press* is designed to reside near the edge of the network, providing a conduit between enterprise locations, internet service provider (ISP) data centers, network access points, and remote host sites.

The DMX*press* can provide a high-capacity access platform for transporting data from one enterprise location to an ISP point-of-presence (POP), or between service provider data centers. DMX*press*'s ethernet interfaces provide cost-effective data transport, while DS1 and DS3 interfaces provide traditional wideband and broadband time division multiplexing (TDM) transport for ASP and ISP access.

Figure 2-10 ISP/ASP Data Transport



DMX = Metropolis™ DMX Access Multiplexer

NC-Xpress-052

Application advantage

Using the DMX*press* in this application results in the following advantages:

- Reduced operational expenses in consolidation of resources (with DMX*press* offering multi-service transport capabilities) and conservation of space and power (small foot-print and low power consumption).
- Reliable, SONET protection of both voice and data services.
- Full line-rate GbE and low-cost, multi-service access to core networks.

Campus Network

Overview

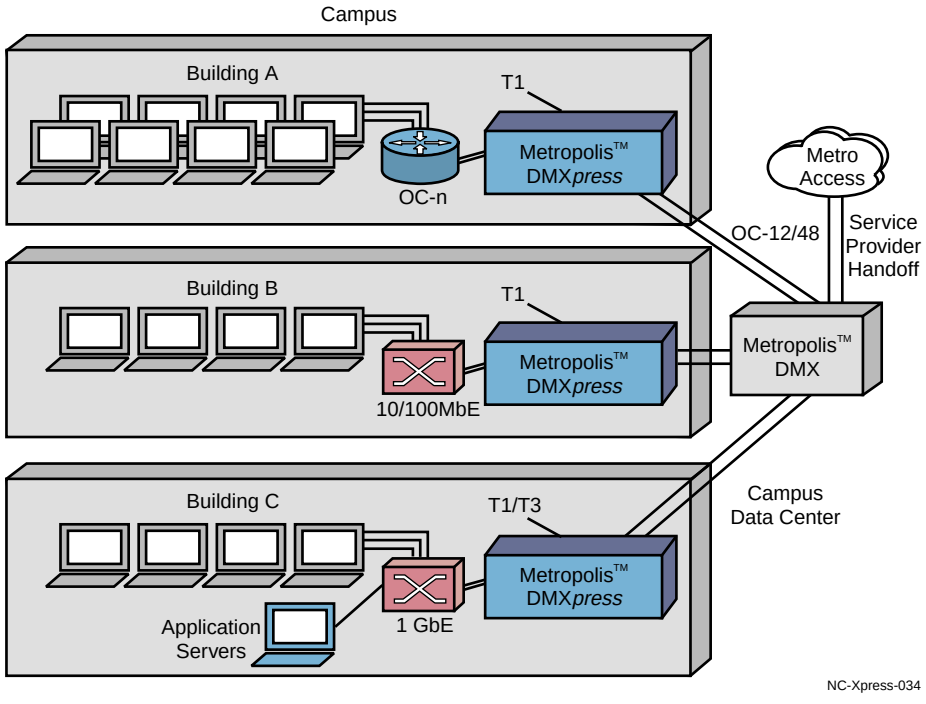
The DMX*press* provides a low cost solution for Campus Networks.

Description

The DMX*press* can be placed in an office building, office park, corporate campus, medical facility, hotel, college dormitory, or any building housing multiple end users. In its ability to provide a flexible mix of DS1, DS3, 10/100 Mbps, and GbE interfaces, the DMX*press* is ideal as a collection point for multiple lines within a diverse MTU providing a variety of both voice and data services.

The figure below shows DMX*presses* in a few different buildings on the same campus. With its OC-12/48 MAIN optics, the DMX*press* is perfect for the application pictured below because it can serve as a collection point for various individual buildings colocated in the same area, and transmitt their traffic directly to a service provider's site or campus data center.

Figure 2-11 Campus Network



Application Advantage

Using the DMX*press* in this application results in the following advantages:

- Low-cost multi-service optical; campus network.
- Reliable, SONET protection of both voice and data services.
- Integrated Ethernet switching and Ethernet compatibility with campus switches.

BLEC and Enterprise Applications

Overview

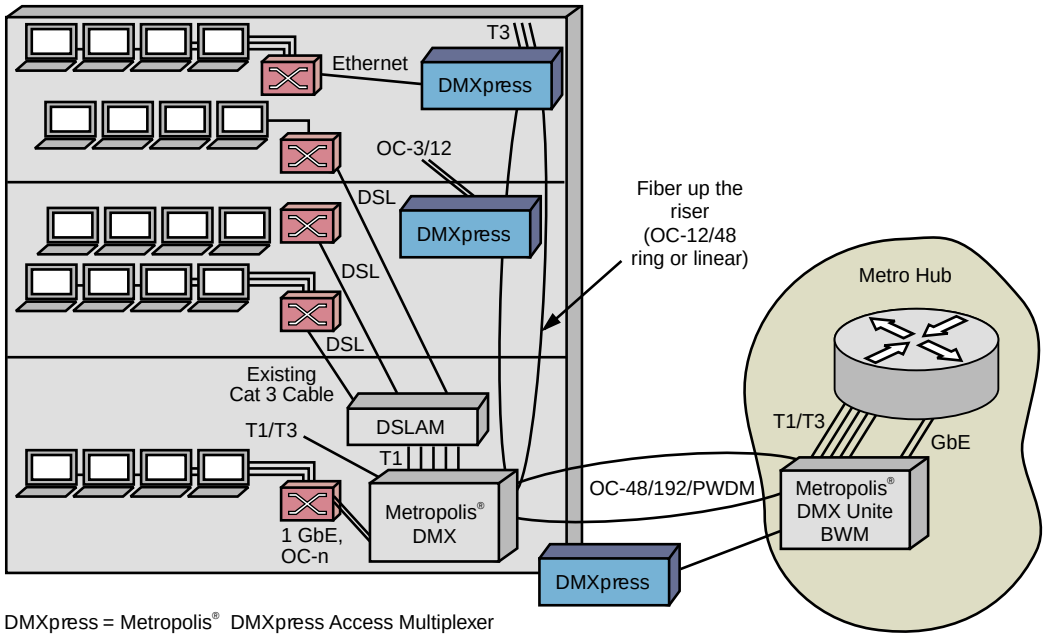
The DMX*press* provides a low cost solution for offering high-speed access to BLECs and Enterprise end customers. The DMX*press* can provide all of the special applications discussed within this chapter (DWDM transport, packet rings, Ethernet private lines, Ethernet rate shaping etc...) when employed in BLEC and Enterprise applications such as the one pictured below.

Description

The DMX*press* is optimized for low-cost, small footprint entry into metro environments. The DMX*press* can be placed in an office building, office park, corporate campus, medical facility, hotel, college dormitory, or any building housing multiple end users. In its ability to provide a flexible mix of DS1, DS3, 10/100 Mbps, and GbE interfaces, the DMX*press* is ideal as a collection point for multiple lines within a diverse MTU, providing a variety of both voice and data services.

The figure below shows DMX*presses* in a few different offices within the same high-rise building. With its OC-48 or OC-12 MAIN optics, the DMX*press* is perfect for the application pictured below because it can serve as a collection point for various individual business groups colo-cated in the same building, and transmitt their traffic either to a DMX located in the basemant or in a wiring closet, or directly to a service provider's site outside of the building. Applications include T1, T3, DSL/DSLAM aggregation, 10/100 Mbps, GbE, and TDM interfaces.

Figure 2-12 BLEC/Enterprise application



DMXpress = Metropolis® DMXpress Access Multiplexer

Application Advantage

Using the DMX*press* in this application results in the following advantages:

- Enhances fiber up the riser distribution within the building.
- Offers low-cost Ethernet and TDM private line transport.
- Enables next generation Ethernet over SONET services such as VLANs, Transparent LANs, Ethernet private lines, and Ethernet rate shaping.
- Low-cost multi-service optical BLEC/Enterprise network.
- Strong transmission capability of low-speed (tributary) interfaces compensates for poor quality fiber within the building.
- DMX*press* offers a mix of 1310nm optics and a set of passive optics in the 1550 nm range (32 individual wavelengths), enabling you to tailor the characteristics of your optical interfaces to best suit the fiber both within the building and that which extends back toward the metro core.
- DMX*press* employs Passive DWDM configurations enabling you to expand service potential/capacity without laying new fiber to the building (up to 32 individual OC-48 wavelengths on one fiber).
- DMX*press* is designed as an ultra-compact, full-service TDM/Ethernet CPE, eliminating the need for larger NEs or data specific switches and routers within the building. This is extremely advantageous as the cost of renting space in high-rise basements for telecommunications equipment is high. This is a viable application for buildings that lie as much as 50km (with OC-48 high-speed optics) to 80km (with OC-48 DWDM optics) from a metro hub or POP.
- Reliable, SONET protection of both voice and data services.
- Integrated Ethernet switching and Ethernet compatibility with BLEC/enterprise switches.

Municipal Backbone

Overview

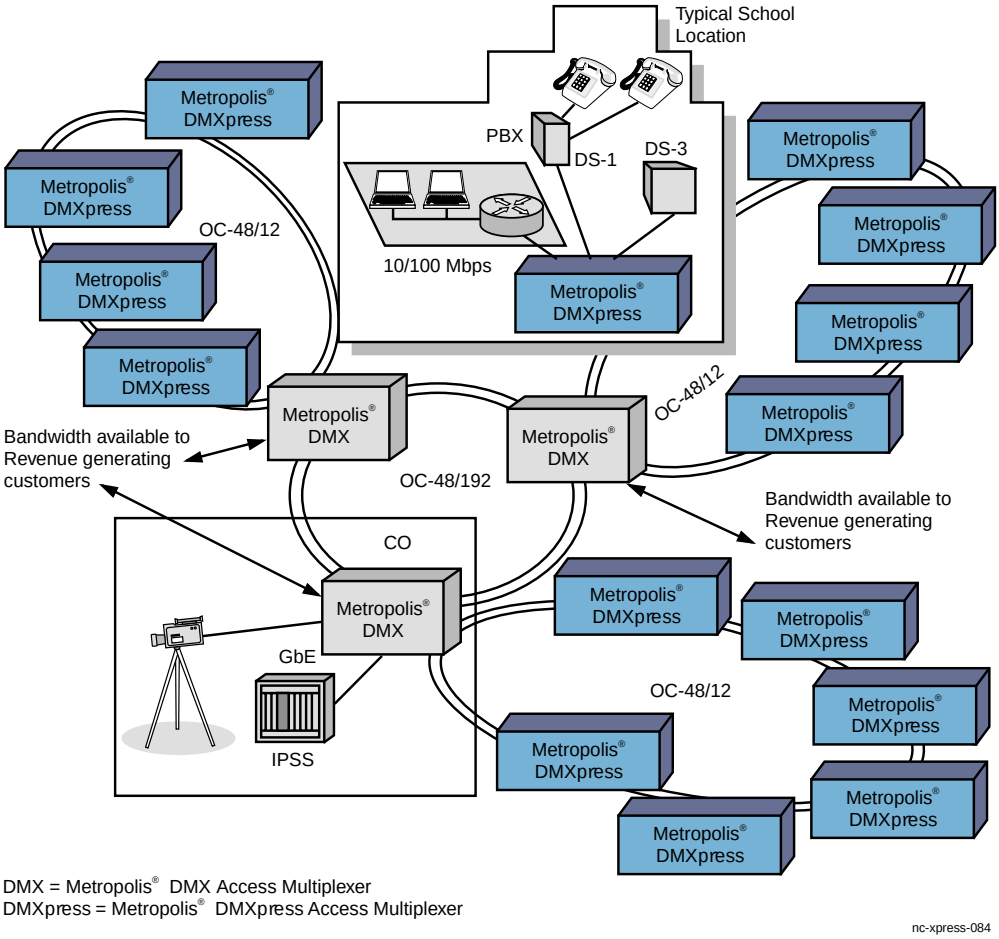
The DMX*press* provides a low-cost solution for offering high-speed optical connection to community facilities.

Description

The DMX*press* is ideal for installations on school grounds or in municipal buildings. With the great service capacity the DMX*press* enables, a single unit is enough to fulfill the needs of most school systems or municipalities. Combine this with affordable pricing and it becomes clear that the DMX*press* is optimized for low-cost, small footprint entry into smaller environments such as municipalities.

The figure below shows DMX*presses* providing a municipal backbone for combined voice/data service. In this instance we could be talking about a utility company who is installing a community network for their own communications and want to provide additional service to the community. Again, with it's affordable price, small footprint, and high multi-service port density, the DMX*press* not only fits such an application, but is capable of providing the additional service capacity to grant bandwidth to revenue generating customers. Furthermore, the DMX units in the figure below are poised to offer great bandwidth to college campuses or large industrial customers over OC-3/12/48, 10/100 Mbps, and GbE interfaces.

Figure 2-13 Municipal Backbone



Application Advantage

Using the DMX*press* in this application results in the following advantages:

- Offers low-cost, high-speed Ethernet and TDM transport.
- Low-cost multi-service optical network.
- Provide voice, data and video to schools.
- Offer additional bandwidth to large customer base.
- Reliable, SONET protection of both voice and data services.
- Integrated Ethernet switching and Ethernet compatibility with campus/enterprise switches.

Linear Optical Extensions Topology

Overview

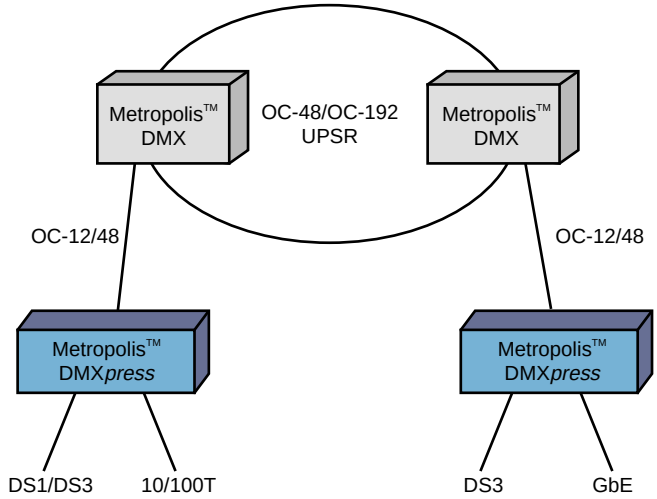
An additional topological flexibility offered by the DMX*press* is the ability to be connected to a access network by way of OC-12/OC-48 extensions from the DMX (or another such multiplexer supporting OC-12/48 signals) ring.

Description

The figure below demonstrates how optical extensions to DMX*press* shelves can satisfy the ever-growing need for larger access networks. Optical extensions connect both ports of an OC-12/48 pack in a DMX*press* to a DMX (or another such multiplexer supporting OC-12/48 signals). The DMX*press* is placed at a customer location, such as in a telecommunications closet on each floor of a high-rise office complex, and is capable of supporting DS1, DS3, 100-TX, and GbE signals. This topology is ideal for locations such as urban areas where fiber to the enterprise is both scarce and at a premium.

The figure below shows a DMX OC-48/OC-12 path switched ring with OC-12/OC-48 services using linear optical extensions to DMX*press* shelves.

Figure 2-14 Linear Optical Extensions



Configuration advantage

Optical extensions from a DMX*press* ring provide fast, reliable transport of voice, video, and data directly to end users when fiber topologies warrant protected linear (rather than ring) connections.

DWDM Optics

Overview

Metropolis®DMXpress Access Multiplexer supports low-cost passive optics. These optics include 16 different OLIUs (2 wavelengths per OLIU) for OC-48 transmission, and a choice of 5 different Passive Optics Units (POUs) where the various wavelengths are combined for transmission over one fiber. The DWDM wavelengths or channels are chosen at 100 GHz increments per the ITU grid.

Port units

DMX*press* OC-48 DWDM OLIUs are available in 32 different wavelengths. Each port unit is capable of transmitting 2 different wavelengths (1 wavelength at a time). These units are compatible with the SONET standards.

The DWDM OLIUs are designed to be used with the Lucent POUs. By using the DWDM OLIUs and the POUs, you are able to increase fiber from 1 to 32.

Passive optics shelves

Each MUX/DMUX POU is capable of multiplexing and demultiplexing many wavelengths together for transmission over a single fiber. The Add/drop units are capable of adding or dropping wavelengths to a DWDM line.

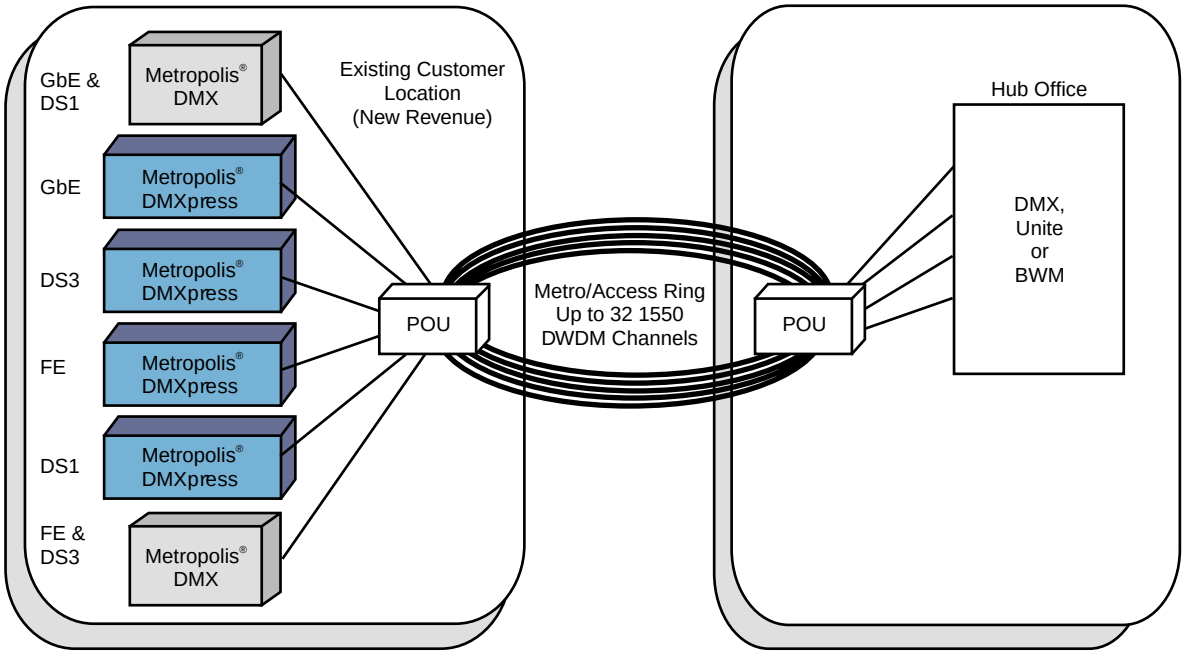
Lucent offers the following options for the Passive Optics Units (POUs):

- 1, 2, or 4 dual add/drop optical multiplexer (OADM) POUs. These three types of OADMs are capable of adding or dropping 1, 2, or 4 wavelengths to/from a DWDM line.
- 16 Channel MUX: This POU supports unidirectional and bidirectional transmission systems.
- 16 Channel DMUX: This POU supports unidirectional and bidirectional transmission systems. The filters are cascaded in reverse order of the 16 Channel MUX module.
- 16 Channel MUX and Interleaver: This POU supports unidirectional and bidirectional transmission systems, and includes an interleaver to support 16 additional channels.
- 16 Channel DMUX and Interleaver: This POU supports unidirectional and bidirectional transmission systems. The filters are cascaded in reverse order of the 16 Channel MUX and Interleaver POU. The POU also includes an interleaver to support 16 additional channels.

Protection The passive optic port units support the same protection modes as the standard port units. For example, both sets of passive port units support UPSR, and 0x1 protection.

Example The figure below shows 4 lines to and from DMX*press* systems and two DMXs. The OC-48 traffic is transmitted over one fiber using DWDM on the Lucent passive optics unit (POU) to a remote Lucent POU. The traffic is similarly transmitted and received by that system. Alternatively, the equipment can be set up to handle 8, 16, or 32 transmit lines on one end of the POU (pictured below as "PWDM" to denote the passive wave division multiplexing taking place between the POUs) and 8, 16, or 32 receive lines on the other end.

Figure 2-15 Lucent POU with DMX*press* and DMX



BWM = WaveStar® BandWidth Manager
DMX = Metropolis® DMX Access Multiplexer
DMXpress = Metropolis® DMXpress Access Multiplexer

NC-Xpress-082

3 Product Description

Overview

Purpose

This section provides a detailed view of the Metropolis®DMXpress Access Multiplexer (DMX*press*) architecture. After introducing the DMX*press*, this chapter describes the system circuit packs, control, power, and cabling.

Contents

The following hardware is described in this chapter:

System Description

Overview

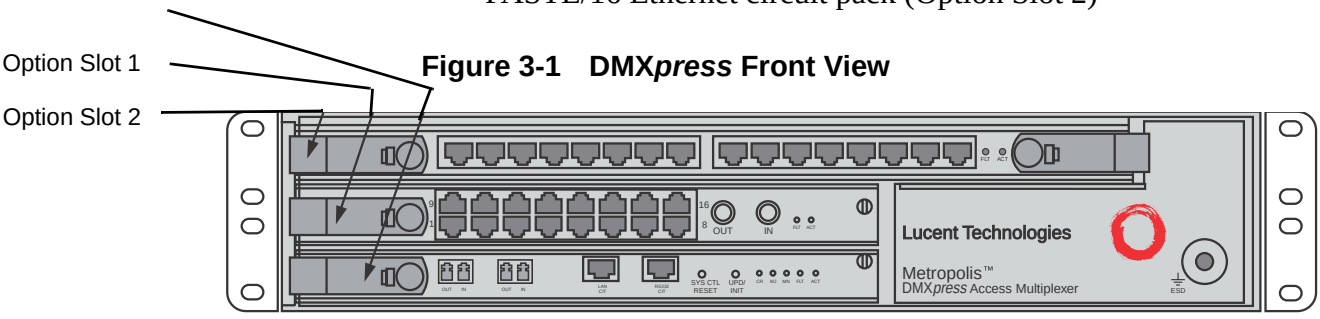
The DMX*press* is a single-shelf, compact multiplexer which comes standard with an OC-12/48 high-speed high speed optics module (intermediate reach 1310 nm and the OC-48 DWDMs in 1550 nm range) that can be configured for UPSR rings or 0x1 linear.

The system is 17.3” W x 15” D x 3.5” H (2RU), is rack-mountable, contains 3 circuit pack slots, and can be mounted in a rack or on a table. The DMX*press* is also available with either an AC or DC power supply (for more information refer to the section of this chapter entitled *Power).*

The following figure shows the DMX*press* front view, displaying the following:

- MAIN circuit pack
- DS1/DS3/16/1 TDM circuit pack (Option Slot 1)
- FASTE/16 Ethernet circuit pack (Option Slot 2)

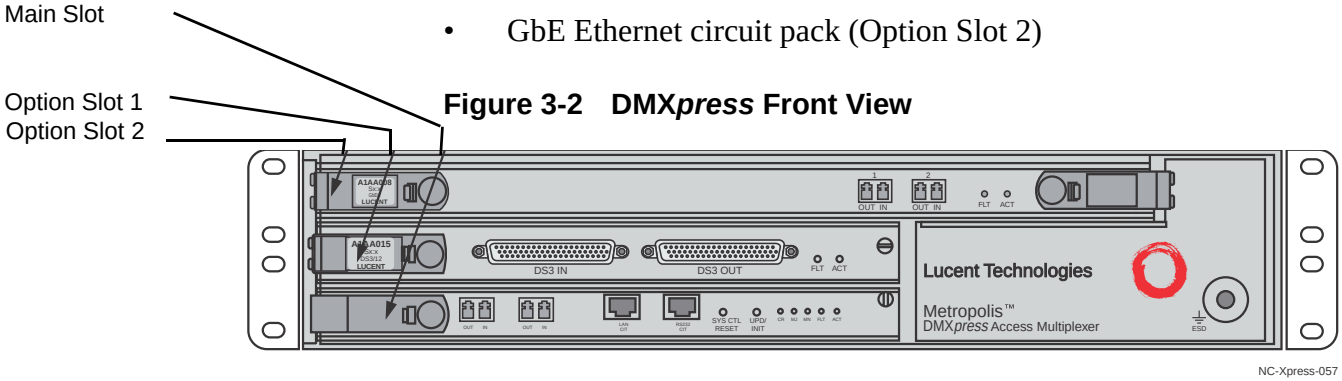
Figure 3-1 DMX*press* Front View



The following figure shows the DMX*press* front view, displaying the following:

- MAIN circuit pack
- DS3/12 TDM circuit pack (Option Slot 1)
- GbE Ethernet circuit pack (Option Slot 2)

Figure 3-2 DMX*press* Front View



Passive Optics Units

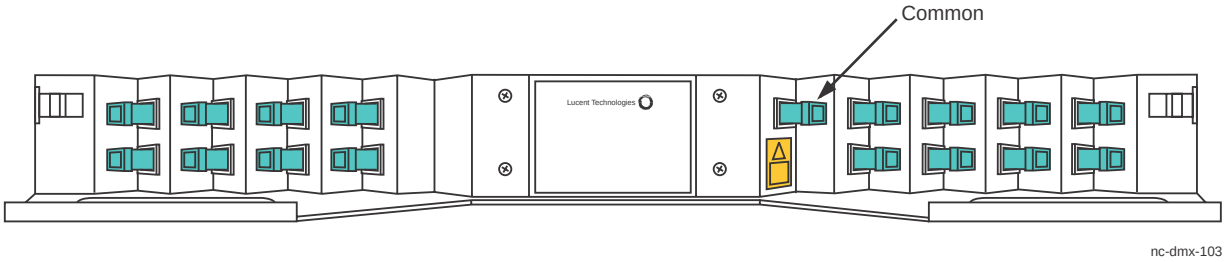
The Passive Optics Units (POUs) are a lower-cost solution to using DWDM for transmitting large amounts of traffic on one fiber. The shelf fits in a bay frame with DMX*press*. The POUs do not need any power supply or management system.

POU shelves are available to support the following applications:

- Optical add-drop module (OADM): 1, 2, or 4 wavelengths
- 16 unidirectional/bidirectional wavelengths (2 versions): MUX/DMUX
- 32 wavelengths; 16 unidirectional/bidirectional wavelengths with a wavelength interleaver used to add another 16 wavelengths: MUXINT/DMUXINT

The following figure shows the POU shelves.

Figure 3-3 Passive Optics Unit (POU) Shelves (DWDM Filter Units): MUX/DMUX



The dimensions of the MUX/DMUX module are:

Height (mm/inches)	Width (mm/inches)	Depth (mm/inches)
74/2.913	498/19.606	378.64/14.907

DMX*press* Components

Components

The DMX*press* can be configured in the following ways:

- DMX*press* with DS1/DS3 Card (DS1/DS3/16/1) ONLY
- DMX*press* with one of the FASTE/16 Ethernet Card ONLY
- DMX*press* with one of the GbE/2 or GbE/4 Card ONLY
- DMX*press* with DS1/DS3/16/1 and FASTE/16 card
- DMX*press* with DS1/DS3/16/1 and GbE/2 or GbE/4 Cards
- DMX*press* with DS3/12 Card ONLY
- DMX*press* with DS3/12 and FASTE/16 card
- DMX*press* with DS3/12 and GbE/2 or GbE/4 Cards
- DMX*press* with OC-3 or OC-12 Card ONLY
- DMX*press* with OC-3 or OC-12 card and FASTE/16 card
- DMX*press* with OC-3 or OC-12 card and GbE/2 or GbE/4 Cards

The DMX*press* always comes equipped with either the OC-48 or OC-12 high-speed circuit pack.

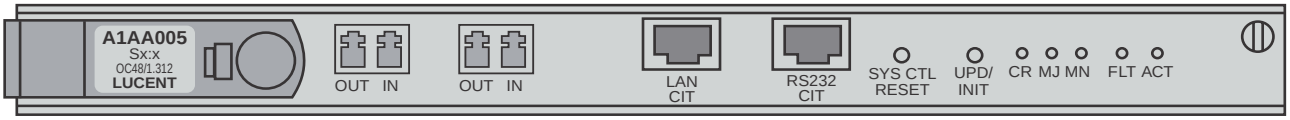
Refer to Chapter 7 for ordering information concerning these configurations.

OC-48 Main (High-speed) Circuit Pack Architecture and Interfaces

Overview

The OC-48 high-speed circuit pack is a intermediate reach 1310 nm optical line interface unit. The OC-48 high-speed pack supports OC-48 add/drop and UPSR configurations, single-homing, non-revertive protection switching, and VT1.5, STS-1, STS-3(c), STS-12(c), and STS-48(c) signal transport. The OC-48 high-speed circuit pack can be divided into three functional blocks: Transmission, System Control, and System Timing.

Figure 3-4 OC-48 Circuit Pack



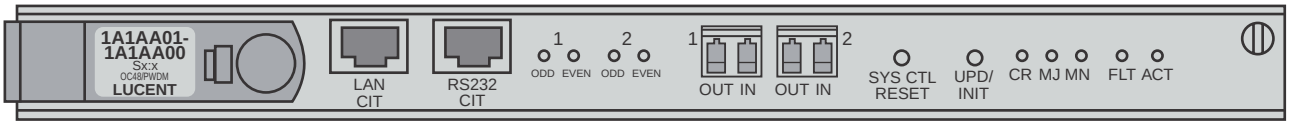
NC-Xpress-031

OC-48 DWDM circuit packs

The DMX*press* OC-48 DWDM OLIUs are optical port units designed for use with passive MUX/DMUX and optical add/drop shelves. These are available in 32 different wavelengths. Each port unit supports two wavelengths via a special hardware configuration. These units are compatible with the SONET and SDH standards.

The passive optic port units are designed to be used with the Lucent Passive Optics Shelves. By using the DWDM passive optic port units and the Passive Optic Shelves, you are able to increase fiber capacity by a factor of 2, 4, 16, or 32.

Figure 3-5 OC-48 DWDM Circuit Pack



NC-Xpress-088

OC-48 High-speed Transmission Architecture

The OC-48 high-speed circuit pack is an intermediate reach 1310 nm optical line interface unit. The OC-48 high-speed supports OC-48 add/drop and UPSR configurations, non-revertive protection switching, and VT1.5, STS-1, STS-3(c), STS-12(c), and STS-48(c) signal transport. The 20PPM (parts per minute) SMC (SONET Minimum Clock) and central TDM switch fabrics are embedded in the OC-48 high-speed circuit pack.

System Control

The Main circuit pack provides communication with other circuit packs on the DMX*press* shelf. The Main supports all DMX*press* operations interfaces, including IAO LAN (OSI or TCP/IP), PC-CIT, and miscellaneous discretes. The Main also supports DCC terminations for each optical line interface, a cross-connect fabric that supports path switching, and timing functions.

The Main faceplate has push-button switches and alarm/status LEDs.

The Main circuit pack provides a microprocessor, nonvolatile memory to store the generic program software and provisioning database, and additional memory for system operation. The Main circuit pack also has interfaces across the backplane to monitor and control every circuit pack in the shelf.

The Main circuit pack supports PC-CIT access to the DMX*press* via the serial RS-232 port located on the front of the DMX*press* shelf.

OC-48 High-speed System Timing

The system timing section has two major components, a Timing Generator Synchronous (TGS) circuit and a Clock Synchronization Frame (CSF) circuit. The system timing is used to synchronize the SONET interfaces familiar to the DMX*press* system.

□

OC-12 Main (High-speed) Circuit Pack Architecture and Interfaces

Overview

The OC-12 high-speed circuit pack is a intermediate reach 1310 nm optical line interface unit.

OC-12 high-speed Transmission Architecture

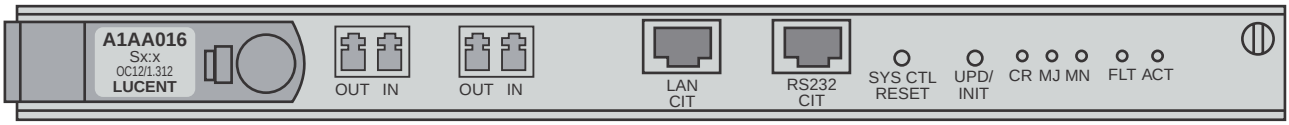
The OC-12 high-speed circuit pack is an intermediate reach 1310 nm optical line interface unit. The OC-12 high-speed supports OC-12 add/drop and UPSR configurations, non-revertive protection switching, and VT1.5, STS-1, STS-3(c), and STS-12(c) signal transport. The 20PPM SMC and central TDM switch fabrics are embedded in the OC-12 high-speed circuit pack.

For technical specifications concerning the OC-12 high-speed circuit pack (A1AA016), refer to Chapter 9.

OC-12 high-speed System Timing

The system timing section has two major components, a Timing Generator Synchronous (TGS) circuit and a Clock Synchronization Frame (CSF) circuit. The system timing is used to synchronize the SONET interfaces familiar to the DMX*press* system.

Figure 3-6 OC-12 High Speed Circuit Pack



NC-Xpress-085

System Control

The system control functionality of the OC-12 high-speed circuit pack is the same as that of the OC-48 high-speed pack detailed in the previous section.

□

OC-12 low-speed (tributary side) Circuit Pack Architecture and Interfaces

Overview

This section details the physical interfaces and transmission capabilities of the OC-12 low-speed circuit pack.

OC-12 Low-speed Transmission Capabilities

The OC-12 low-speed circuit pack is an intermediate reach (20 km) 1310 nm optical line interface unit. The OC-12 low-speed pack has 2 bidirectional ports, supporting OC-12 bidirectional signals, and VT1.5, STS-1, STS-3(c), and STS-12(c) signal transport.

Physical Interfaces

The OC-12 low-speed circuit pack is designed to fit in Option Slot 1 of the DMX*press*. It provides 2 bidirectional ports (ingress and egress interfaces on each port) supporting the transmission capabilities described above.

For technical specifications concerning the OC-12 low-speed circuit pack (A1AA018), refer to Chapter 9.

Figure 3-7 OC-12 Low-Speed Circuit Pack

OC-3 low-speed (tributary side) Circuit Pack Architecture and Interfaces

Overview

This section details the physical interfaces and transmission capabilities of the OC-3 low-speed circuit pack.

OC-3 Low-speed Transmission Capabilities

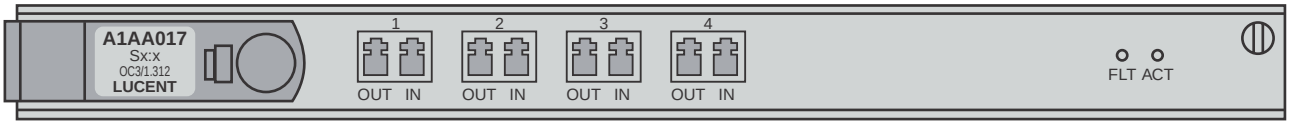
The OC-3 low-speed circuit pack is an intermediate reach (20 km) 1310 nm optical line interface unit. The OC-3 low-speed pack has 4 bidirectional ports, supporting OC-3 bidirectional signals, and VT1.5, STS-1, STS-3(c) signal transport.

Pshycial Interfaces

The OC-3 low-speed circuit pack is designed to fit in Option Slot 1 of the DMX*press*. It provides 4 bidirectional ports (ingress and egress interfaces on each port) supporting the transmission capabilities described above.

For technical specifications concerning the OC-3 low-speed circuit pack (A1AA017), refer to Chapter 9.

Figure 3-8 OC-3 Low-Speed Circuit Pack



NC-Xpress-086

DS1/DS3/16/1 Circuit Pack Architecture and Interfaces

Overview

This section defines the electrical interfaces for the DS1/DS3/16/1 Circuit Pack.

The DS1/DS3/16/1 circuit pack provides for the bi-directional transport of 16 DS1 (1.544 MHz) signals and 1 DS3 (44.736 MHz) signal and maps them into STS-1 (51.84 MHz) signals.

The following section describes the transmission, control, and timing for the "DS1 Slot 1" section of the DS1/DS3/16/1 circuit pack.

LEDs

The LEDs are a common function for both virtual slots A1 and B1 on this circuit pack. Therefore one green and one red LED reside on the circuit pack.

> **Important!** Throughout the rest of this chapter you will see reference, similar to that made above, to “virtual slots”. As the name implies, a virtual slot is not a physical location in the DMX*press* shelf. Each Option Slot in the DMX*press* has 2 AIDs (Access Identifiers), hence “virtual” slot. For instance, A1 and B1 mentioned above, are AIDs associated with Option Slot 1. The ability to provision multiple AIDs for one physical slot enables the DMX*press* to support multiple signal types in the same circuit pack/slot. In the case of the DS1/DS3/16/1 circuit pack, virtual slot AIDs allow one pack to support both DS1 and DS3 signals simultaneously.

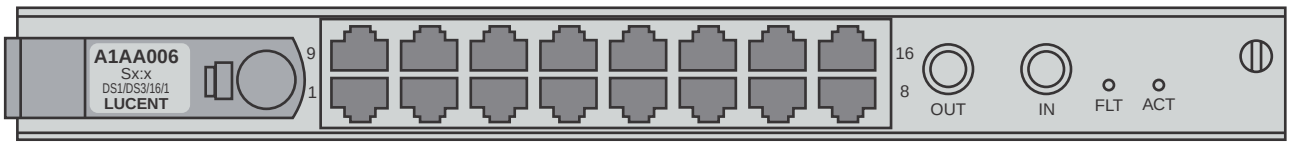
DS3 Timing Architecture

DS3 Interface Timing

Transmit Direction - a 44.736MHz clock, RCLK, is recovered from the incoming DS3 signal and is used to recover the DS3 data.

Receive Direction - A phase lock loop (PLL) generated 44.736MHz clock is used to drive the Line Interface Unit.

Figure 3-9 DS1/DS3/16/1 Circuit Pack



NC-Xpress-032

DS3/12 Circuit Pack Architecture and Interfaces

Overview

This section defines the electrical interfaces for the 12-Port DS3 Circuit Pack.

The DS3/12 circuit pack provides 12 ports for the bi-directional transport of 12 DS3 (44.736 MHz) signals, maps them into STS-1 (51.84 MHz) signals, and supports transport of DS3 signals coded in bipolar 3-zero substitution (B3ZS).

LEDs

The LEDs are a common function for virtual slots G2 on this circuit pack. One green and one red LED reside on the circuit pack.

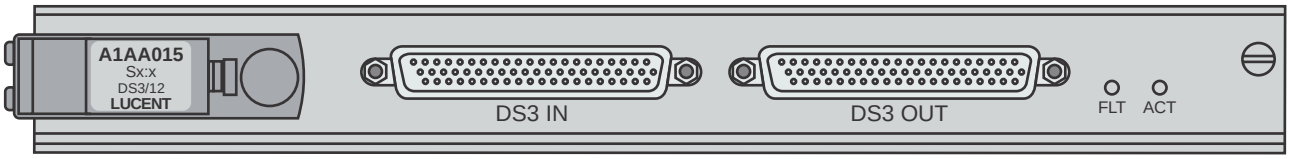
DS3 Timing Architecture

DS3 Interface Timing

Transmit Direction - a 44.736MHz clock, RCLK, is recovered from the incoming DS3 signal and is used to recover the DS3 data.

Receive Direction - A phase lock loop (PLL) generated 44.736MHz clock is used to drive the Line Interface Unit.

Figure 3-10 DS3/12 Circuit Pack



NC-Xpress-055

GbE/2 LX and SX (R2.0) Circuit Pack Architecture and Interfaces

Overview

The GbE/2 LX and SX packs support the same features and interfaces. The only difference is that the GbE/2 LX (long reach) can bridge spans between 2 and 10 kilometers in length, where as the GbE/2 SX (short-reach) is designed to bridge spans between 2 and 550 meters. The GbE/2 SX circuit pack is available in Release 2.0 while the GbE/2 LX is available in Release 1.0.

Features common to the Data circuit packs include:

- Control of circuit pack through the use of the VLSI, I^2C and DCC/HDLC control channel interfaces.
- Conformance to IEEE 802.3 MAC bridge specifications.
- Conformance to IEEE 802.1q VLANs.
- Conformance to IEEE 802.1w fast spanning tree protection, with rapid restoration time.
- IEEE 802.3 MAC packet performance monitoring including number of forwarded, dropped and errored packets.
- Control through message based protocol between system controller and circuit pack (The design can be extended to SNMP agent and MIB for future developments.)

End Customer Data Services

Point-to-Point and Multipoint

The following features are included for data services:

- Switching on MAC destination address to one or more VCGs.
- Includes VLAN mapping.
- Point-to-point GbE service with UPSR protection; 2 ports at line rate.
- Multi-point GbE services with spanning tree protection; 2 ports at line rate.
- Mixing of 1 point-to-point and 1 multipoint.

GbE/2 Features

Features specific to the GbE/2 circuit pack include:

- Standard support of two full duplex GbE/2 interfaces, optical connections are face plate mounted.
- Link availability indication.
- Auto-negotiation and flow control.
- FCC Class B compliance.

Figure 3-11 GbE/2 Circuit Pack

NC-Xpress-(

GbE/4 (R3.0) Circuit Pack Architecture and Interfaces

Overview

The GbE/4 circuit packs, available in Release 3.0, conform to the same standards as those described for the GbE/2 circuit packs above.

There are 2 main differences between the GbE/2 and GbE/4 circuit packs:

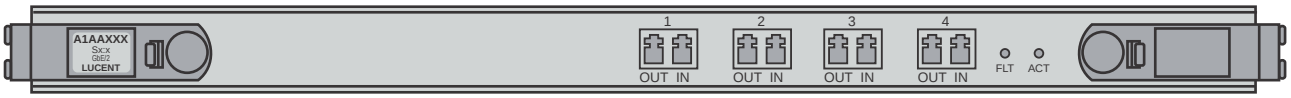
- The GbE/4 supports 4 bidirectional ports, where as the GbE/2 supports 2 ports.
- The GbE/4 provides support for the enhanced Ethernet features listed below.
- The GbE/4 provides support for 4 Ethernet private lines, where the GbE/2 supports 2 private lines.

GbE/4 Enhanced Ethernet Features

In addition to the features described for the GbE/2 packs, the Gbe/4 packs support the following enhanced Ethernet features:

- Support for Committed Information Rate (CIR) provisioning.
- Support of Peak Information Rate (PIR) provisioning.
- Support of dynamic bandwidth allocation which enables the DMX*press* to provide each interface with only as much bandwidth as it might need at a particular time. This works because the DMX*press* assigns channels on it's high-speed (network side) interface only to circuits that are transmitting at that time.

Figure 3-12 GbE/4 Circuit Pack



NC-Xpress-039

Important! For technical specifications concerning the GbE/4 circuit pack, refer to Chapter 9.

For more information about CIR and PIR provisioning see the section entitled "Ethernet Rate Shaping" in Chapter 2.

FASTE/16 (10/100T) Circuit Pack Architecture and Interfaces

Overview

There are two versions of the FASTE/16 circuit packs. The version currently available supports all of the features listed below except for those specific to the Enhanced Ethernet Capabilities pack. The Enhanced Ethernet Capabilities pack supports the additional features detailed below, and is available in Release 3.0.

Refer to the Overview (3-13) in the previous section to see features common to the Data circuit packs.

End Customer Data Services

Point-to-Point and Multipoint

The following features are included for point-to-point data services:

- Switching on MAC destination address to one of several VCGs.
- Includes VLAN mapping.
- The FASTE/16 pack supports 1 private line (protected/2 unprotected, network interface) or 1 GPR (gigabit packet ring, network interface).

FASTE/16 Features

Features specific to the FASTE/16 circuit pack include:

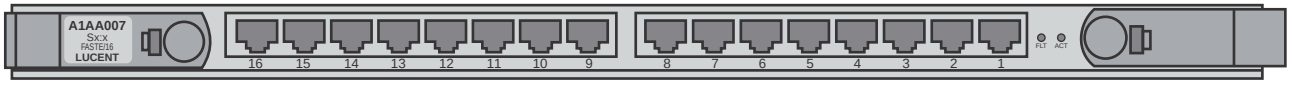
- Standard support of up to 16 10/1000 BASE-TX interfaces (16 tributary interface/LAN ports and 2 network interface/WAN ports).
- Link availability indication.
- Auto-negotiation and flow control.
- FCC Class B compliance.

FASTE/16 Enhanced Ethernet Features (R3.0)

Features specific to the FASTE/16 circuit pack available in R3.0 include:

- Standard support of up to 16 10/1000 BASE-TX interfaces (16 tributary interface/LAN ports and 4 network interface/WAN ports). Thus it can support 2 private lines (protected/4 unprotected, network interface) or 2 GPR (gigabit packet rings, network interface).
- Support for Committed Information Rate (CIR) provisioning.
- Support of Peak Information Rate (PIR) provisioning.
- Support of dynamic bandwidth allocation which enables the DMX*press* to provide each interface with only as much bandwidth as it might need at a particular time. This works because the DMX*press* assigns channels on it's high-speed (network side) interface only to circuits that are transmitting at that time.

Figure 3-13 FASTE/16 Circuit Pack



NC-Xpress-033

Important! For technical specifications concerning the FASTE/16 circuit pack, refer to Chapter 9.

For more information about CIR and PIR provisioning see the section entitled "Ethernet Rate Shaping" in Chapter 2.

FASTE/16 (R3.0) Circuit Pack Architecture and Interfaces

Overview

The FASTE/16 (10/100 Mbps) circuit packs are designed specifically for Ethernet Private Line applications.

Refer to the Overview (3-13) in the previous section to see features common to the Data circuit packs.

End Customer Data Services

Point-to-Point and Multipoint

The following features are included for point-to-point data services:

- Switching on MAC destination address to one of several VCGs.
- Includes VLAN mapping.
- Mixing of 1 point-to-point and 1 multipoint.

FASTE/16 Features

Features specific to the FASTE/16 circuit pack include:

- Standard support of up to 16 10/1000 BASE-TX interfaces (16 ports), optical connections are face plate mounted.
- Link availability indication.
- Auto-negotiation and flow control.
- FCC Class B compliance.

□

Shelf Mounting

Overview

This section describes shelf mounting arrangements. For information regarding ordering COMCODES for each arrangement, refer to Chapter 6 of this guide.

DMX*press* mounting options

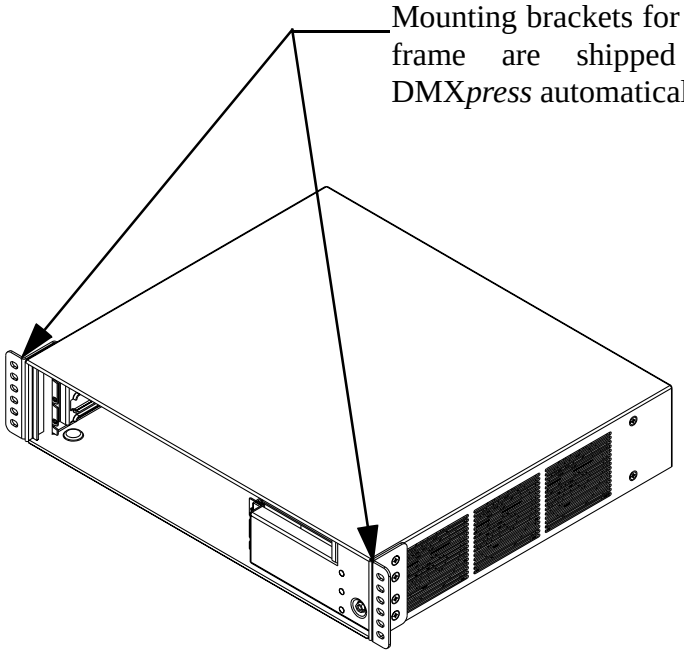
The DMX*press* can be ordered to fit into the various mounting arrangements below.

- 19-inch bay frame
- 23-inch bay frame
- wall mounted
- tabletop mount

19-inch bay frame

The DMX*press* is shipped with mounting brackets attached for mounting in a 19-inch frame (see the figure below). These brackets must be removed before mounting the DMXpress in any of the other arrangements (23-inch frame, on a wall, or on a tabletop).

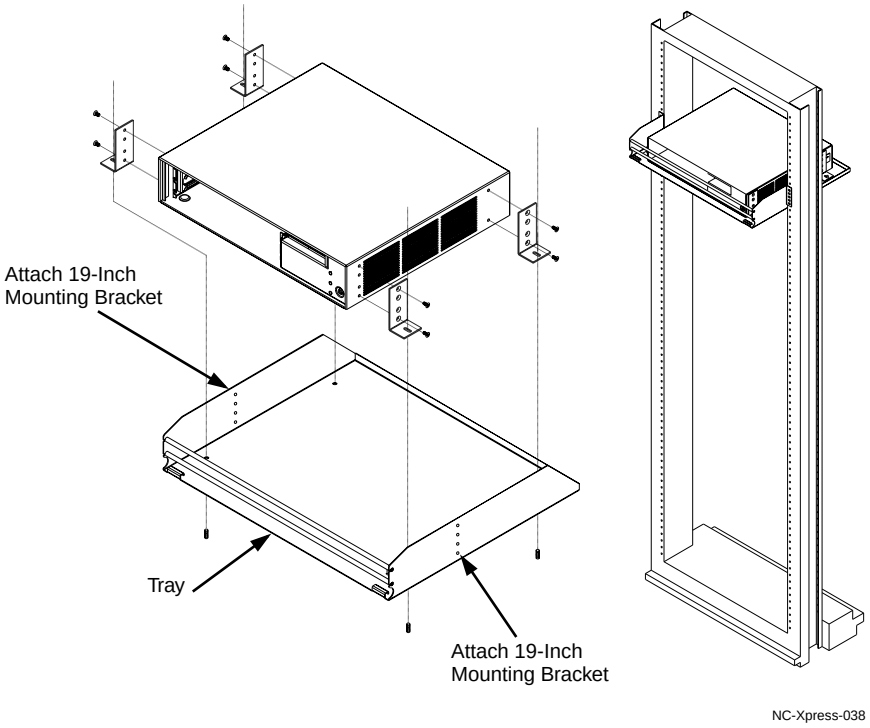
Figure 3-14 19-inch Bay Frame Mounting



23-inch bay frame

The DMXpress can be mounted in a 23-inch bay frame as shown in the figure below.

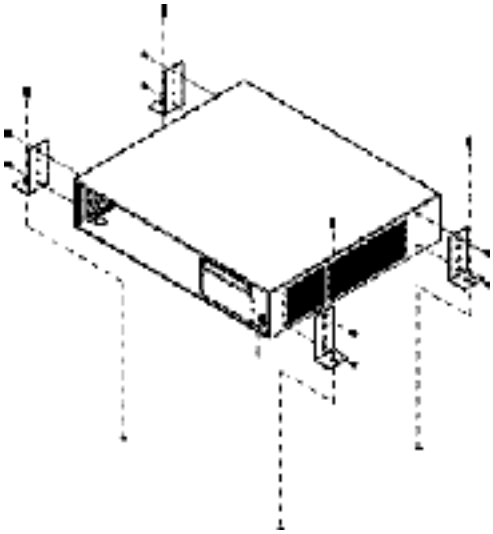
Figure 3-15 23-inch Bay Frame Mounting



Mounting the DMX*press* to a wall

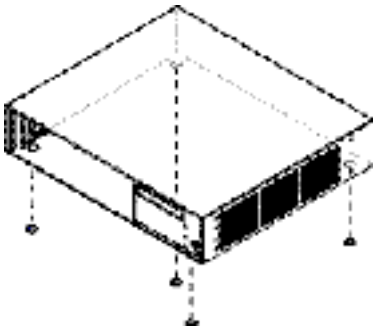
The DMXpress shelf can be mounted directly on a wall in a CO or on a customer site.

Figure 3-16 Wall mounting



Tabletop mount The DMXpress can be mounted on top of a desk or table as shown below.

Figure 3-17 Tabletop Mounting



Power

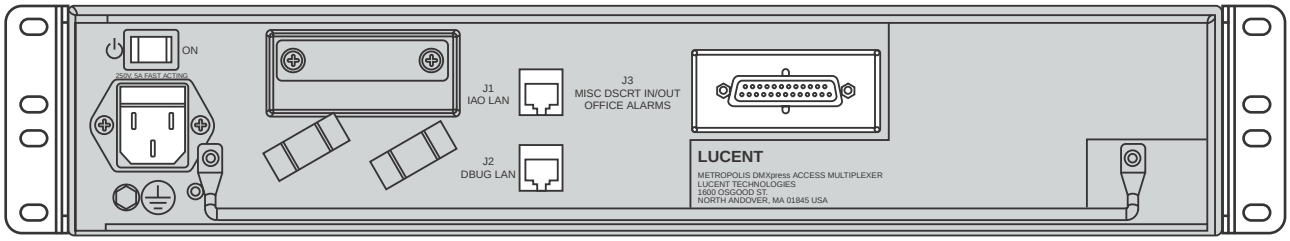
Power Supply

The DMX*press* uses a diverse power supply which allows for mounting in a central office or campus environment. The DMX*press* is available with either a -48VDC or 110 VDC power supplies. When ordering the DMX*press* you must specify which power supply the shelf must be equipped with. For comcodes needed to order both the DMX*press* shelf equipped with an AC or the shelf equipped with a DC power supply, refer to Chapter 6.

Rear View of Shelf

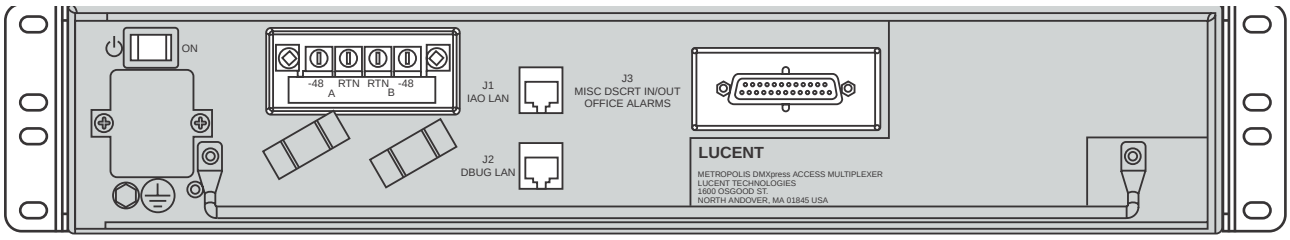
The figures below depict the DMX*press* shelf with each of the power sources available (both AC and DC).

Figure 3-18 Rear View of Shelf with AC power supply



NC-Xpress-041

Figure 3-19 Rear View of Shelf with DC power supply



NC-Xpress-040

Current drain

The table below provides the maximum and average current drain requirements for a DMX*press* shelf equipped with a MAIN OC-48, TDM, and Data card.

Table 3-1 DMX*press* Current Drains

Shelf	**Current Drains per Feeder in Amperes**	
	Average @ –48V	**Average @ –40V**
DMX*press* Shelf	3.5	4.2

Cabling

Overview

This section briefly describes cabling information, including the number of particular cables required. For information regarding available cable lengths and ordering COMCODES, refer to Chapter 6 of this guide.

Metro DMXpress cables

The following table details the various cables used with the DMXpress.

Table 3-2 Cables

Connection	Description
Power Supply • A/C • DC	Standard 110 A/C Power cable. The DC input cable is 13 inches in length and uses ¼ inch FAST ON connectors. Refer to the Technical Specifications section of this guide for the exact pin outs for the DC outputs of the DMX*press*.
Main OC-48 high-speed Card (Optical OIs)	The card uses Dual-LC connectors for the optical I/Os.
Main OC-48 high-speed Card (LAN Operations)	This card uses two RJ-45 connectors for LAN and one RJ-45 for transmitting (NOTE 1).
16DS1/1DS3 TDM Card	This TDM card uses 16 RJ-45 connectors for DS1 data transmitting and receiving. The card also uses two BNC connectors for DS3 data transmitting and receiving (NOTE 2)
DS3/12 TDM Card	One DS3 Cable Assembly is required for each Function Unit group housing a DS3/12 circuit pack. Only one DS3 Cable Assembly is required even when both slots of a Function Unit group are populated with DS3/EC1 circuit packs. (NOTE 3)
FASTE/16 Ethernet Card	The FASTE/16 Ethernet Card uses 16 RJ-45 connectors for Ethernet data transmitting and receiving.
GbE/2 Card	The GbE/2 card uses two, dual-LC connectors for the optical I/Os.

Notes

1. The *Crossover* cable is used when connecting to a PC. The *Straight Through* cable is used when connecting with a hub.

□

2. The DS1 cables for the hybrid DS1/DS3 circuit pack can be ordered as a bundle of 16 cables that provides for all DS1 interfaces on the pack, or one-by-one. The DS3 cables for the hybrid pack are ordered in pairs of 2 (one transmit and one receive) and employ BZC connectors at both the near- and far-end.

□

3. The DS3 Cable Assembly consists of a pair of cables, each containing 735A cables. Cable 1 consists of 12 inputs and cable 2 consists of 12 outputs. The DS3 cable uses 62-pin D-SUB connectors at the near-end interface, and straight BNC at the far end patch cable

□

4 System Planning and Engineering

Overview

Purpose This section summarizes basic system planning and engineering information to plan procurement and deployment of the Metropolis®DMXpress Access Multiplexer (DMX*press*).

Contents The following sections are included in this chapter:

Physical Arrangements

Overview

This section describes the possible physical arrangements of the DMX*press* Access Multiplexer. The following physical arrangement considerations are covered in this section:

- System Configurations
- Cabinet Arrangements
- Cabling
- Environmental Considerations

Planning Overview

There are a number of considerations that should be kept in mind when planning the DMX*press*' role in the network. Projected customer requirements will determine initial capacity needed, as well as evolution to higher capacities. The advanced networking capabilities of the DMX*press*' offer many economic and planning benefits, and certain guidelines should be followed to maximize these benefits.

Physical installation considerations are guided by the installation location (central office, uncontrolled, or customer locations). Initial network configuration determine synchronization requirements. Synchronization should be planned on a network basis considering items like topology, reliability, internetwork connectivity, and service evolution.

The following sections are included in this chapter:

- Physical Arrangements
- Cross-connections
- Synchronization

Cabinet Arrangements

Outside plant (OSP) cabinet configurations supporting TDM-based DMX*press* are available. More specific information will be included in this section as it becomes available.

Cabling

Lucent Technologies offers a full complement of transmission cables and optical jumpers. All interfaces to the DMX*press* use standard connectors. For more information regarding cable ordering, refer to Chapter 7, “Ordering.”

Environmental Considerations

The DMX*press* meets NEBS Level 3 standards for use in central office environments as specified in GR-63-CORE and GR-1089-CORE. DMX*press* also meets standards for uncontrolled environments as specified in GR-63-CORE and GR-499-CORE. For detailed specifications, refer to Chapter 10, “Technical Specifications.”

□

Cross-Connections

Overview

This section provides cross-connection information for the DMX*press*. For cross-connect provisioning information, refer to Chapter 6, “Operations, Administration, Maintenance, and Provisioning.”

Cross-Connect Types

The DMX*press* has cross-connect capabilities offering users flexibility in directing traffic flow through systems to support a wide variety of customer applications using two-way and mltpt (multi-point [data specific]) cross-connections.

Making Cross-Connections

Cross-connections are made by specifying the SONET rate (VT1.5 or STS-n), the end point addresses (AIDs), and the cross-connection type (for example, two-way). Each single cross-connection command (when the “two-way” option is selected) establishes a two-way cross-connection.

Bidirectional (Two-way) Cross-Connections

The two-way cross-connection connects a low-speed port or channel to a channel in the high-speed ring interface or on another OC-3/12 tributary interface. This is used in all path switched ring applications where VT1.5, STS-1, STS-3(c), or STS-12(c) low-speed signals on high-speed channels are cross-connected to low-speed DS1, DS3, 1000BASE ports. In the transmit direction, all added signals are bridged on to both rotations of the ring. In the receive direction, the better of the two received signals is selected and dropped.

Mltpt (Data Specific) Cross-Connections

The data specific mltpt (multi-point) cross-connect is a bidirectional cross-connection between two STS-1 Virtual Concatenation Groups (VCGs) on 100BASE-TX or 1000BASE-SX/LX ports to two different ring interfaces.

Manual Cross-Connect Rates

The following lists the signals that can be cross-connected:

- VT1.5
- STS-1
- Ethernet Virtual Concatenation from STS-1 to STS-12c
- STS-3c and STS-12c pass-through cross-connections

Allowable Cross-Connects

In addition to the data specific mltpt (multi-point) cross-connect, the DMX*press* utilizes several types of two-way cross-connections, including:

- add/drop
- single 0x1
- pass-through
- multi-point (data specific)

Add/Drop

A two-way add/drop cross-connection is a bidirectional cross-connection between a channel on a path protected ring and a port or channel on a ring or non-ring interface.

Single 0x1

A two-way single 0x1 cross-connection is a bidirectional cross-connection between channels on one side of DMX*press* interfaces (same slot in the FNs on both sides of connection: Slot 1 to Slot 1 or Slot 2 to Slot 2). Single 0x1 cross-connections are primarily used in dual homing applications and do not support path switching or equipment switching.

Pass-through

A pass-through cross-connection is made between two interfaces in the same TDM card (OC-3/12/48), allowing the signal to be “passed-through” a ring node on the same timeslot. The DMX*press* can host multiple rings on the low-speed interfaces of the shelf. This is accomplished by intra-pack, pass-through cross-connections. The DMX*press* can close a low-speed ring by supporting a cross-connection between a receive port on one circuit pack and a transmit port on the same circuit pack. All protection switching advantages/capabilities of UPSR configurations still apply in pass-through applications

Multi-point

The data specific multi-point (mltpt) cross-connect is a bidirectional cross-connection between two STS-1 Virtual Concatenation Groups (VCGs) on Fast Ethernet (10/100 Mbps) and GbE (1000Mbps) ports to two different ring interfaces. All mltpt cross-connections are done at the STS-1 level. Multi-point cross-connections are used to create packet rings.

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Synchronization

Overview

This section describes the synchronization features and functions for the DMX*press*.

Network Synchronization Environment

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

Synchronization Recommendations

The following are some key recommendations regarding synchronization.

A node can only receive the synchronization reference signal from another node that contains a clock of equivalent or superior quality (stratum level).

The facilities with the greatest availability (absence of outages) should be selected for synchronization facilities.

Where possible, all primary and secondary synchronization facilities should be diverse, and synchronization facilities with the same cable should be minimized.

No timing loops may be formed in any combination of primary and secondary facilities.

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Synchronization Features

Synchronization features

DMX*press* supports two synchronization reference configurations:

- **Line Timing** from incoming OC-48/OC-12 signal (for small COs or remote sites).
- **Free Running** from the multiplexer's internal SONET Minimum Clock (reference GR-253-CORE 5.4.1).

These timing modes are supported by the embedded SONET Minimum Clock in the OC-48 or OC-12 high-speed circuit pack. The three basic timing modes can be combined into various network configurations.

Internal timing functions such as reference interfaces, the on-board clock elements, and timing distribution, are provided by the SONET Minimum Clock. The timing generator distributes clock and frame signals, derived from the selected reference source, to the transmission packs.

Line Timing Mode

In line timing mode, the SONET Minimum Clock derives local system timing from the incoming service OC-48 or OC-12 high-speed signal in the Main slot. The DPLL serves to remove any timing transients for improved network jitter performance. If one of the OC-48 or OC-12 references is corrupted or unavailable, the timing generator makes a nonrevertive protection switch to the other reference without causing timing degradations. If all OC-48 and OC-12 timing signals are lost (for example, due to a cable cut), the timing generator will switch to holdover mode. The timing generator normally switches back to the line timing mode when a reference is no longer corrupted, but it can be provisioned to require a manual switch.

Free running mode

In free running mode, no mode switching is performed. The SONET Minimum Clock derives timing from a high stability temperature-compensated, voltage-controlled crystal oscillator that has an end of life performance of +/- 20.0 ppm. Only one DMX*press* in a subnetwork can be provisioned in the free running mode. All other DMX*press* NEs in the subnetwork must be line timed to this free running system to avoid performance degradation.

Holdover mode

In case of unprotected synchronization reference failure, the timing generator will switch to “holdover mode” and continue to provide system timing, using the internal oscillator to maintain the last known good reference frequency.

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5 Operations, Administration, Maintenance, and Provisioning

Overview

Purpose

This chapter describes the operations, administration, maintenance, and provisioning (OAM&P) functions for the Metropolis®DMXpress Access Multiplexer (DMX*press*).

Contents

The following sections are included in this chapter:

Maintenance

Overview

This section describes the maintenance philosophy of the DMX*press*.

Remote Maintenance Philosophy

The DMX*press* has incorporated a remote maintenance philosophy as part of its optimization for operations in the access transport environment. This allows operation and maintenance of all remote DMX*press* NEs in a subnetwork from a single shelf. Similarly, a technician working at a remote DMX*press* site can gain access to other DMX*press* NEs in that subnetwork.

The DMX*press* uses the SONET data communications channel (DCC) to provide craft interface terminal (PC-CIT) remote access, remote CO alarms, remote alarm reports, and remote OS access. In addition, OSs are available to allow operation of the DMX*press* NEs from a centralized operations center. The terms remote maintenance and single-ended operations (SEO) are synonymous.

Three-tiered Operations

The DMX*press* operations procedures are built on three levels of system information and control, spanning operations needs from summary-level status to detailed reporting.

Main Faceplate (Operations Tier 1)

Office alarms are provided by a set of discrete relays that control office visual alarms. Separate relays handle critical (CR), major (MJ), and minor (MN) alarms, although the CR and MJ alarms can be wire ORed and reported as office major, if desired.

The first operations tier consists of light-emitting diodes (LEDs) and push buttons on the MAIN faceplate. These allow routine tasks to be performed without a craft interface terminal (PC-CIT) or any test equipment. The MAIN faceplate provides system-level alarm and status information for the local and remote terminals. The circuit pack faceplate FAULT LEDs allow fast and easy fault isolation to a particular circuit pack.

The MAIN faceplate LEDs default to show local system information. The highest active alarm level is shown by the red LEDs for CR and MJ alarms. Yellow LEDs are shown for MN alarms. A green PWR ON LED shows that the power is on and the terminal is receiving a -48V source.

The Update/Initialize (UPD/INIT) button addresses the local system. The recessed UPD/INIT button serves several functions during installation and circuit pack replacement. During the first 10 seconds after powering up the MAIN circuit pack, depressing this button initializes the nonvolatile memory with provisioning and state information. Secondly, after removing a circuit pack or low-speed input, depressing this button updates the system equipment list to show the slot or signal is now unequipped.

The MAIN faceplate's remote display functions serve the single-ended maintenance needs of access transport applications. When any alarm or status condition exists at a remote DMX*press* shelf, that alarm can be viewed in the Alarm List on the PC-CIT.

The following table details the various LEDs and push-button switches and describes their functions.

Table 5-1 MAIN faceplate LEDs

LED/Push-button	Indicator name	Function
FAULT	Fault	Indicates isolated circuit pack failure (located on circuit packs in option slots, not on the pack in the MAIN slot).
CR	Critical	Indicates critical alarm for local system.
MJ	Major	Indicates major alarm for local system.
MN	Minor	Indicates minor alarm for local system.
UPD/INIT	Update/Initialize	Updates the local system.
Active	Active	Glows green to indicate that the DMX*press* is active and in-service.
SYSCTL Reset Button	SYSCTL RESET BUTTON	Performs LED tests.

Interface LEDs

To supplement the MAIN faceplate's system-level view, each interface provides a red FAULT LED on its faceplate. A lighted FAULT LED shows that the DMX*press* has isolated a failure to that interface. On transmission and synchronization interfaces, a flashing FAULT LED shows that an incoming signal to that interface has failed.

Local craft interfaces (Operations Tier 2)

The local craft interfaces include the PC-CIT and the signals that may be interpreted through its use (such as an AIS signal), which may be utilized in a variety of ways.

Craft Interface Terminal (PC-CIT) (software download)

The DMX*press* contains an IAO LAN and serial port located at the front of the shelf (over an RJ45 and an RS-232 interface respectively). These ports are labeled “LAN CIT” (IAO LAN) and “RS-232 CIT” (serial). These ports are used to connect the PC-CIT (PC- based “craft interface terminal”-- or “CIT”) to the DMX*press* for maintenance, provisioning, and administrative operations activities. The DMX*press* also provides an IAO LAN port on the rear of the shelf that is designed primarily for remote PC-CIT access (network management systems such as the Navis™ Optical EMS can also use this port). This port is configured as an LAN data communication port for direct terminal access, and it provides data rates of up to 115,000 baud. Local and remote software download operations can only be performed through both of the front PC-CIT ports (PC must be connected directly to one of the front PC-CIT interfaces).

The DMX*press* also supports TL1 Command Messaging via the PC-CIT, allowing TL1 messages to be exchanged over PC-CIT asynchronous ports. Again, the PC-CIT can be connected to either one of the serial ports located at the front of the shelf for local PC-CIT access. For remote PC-CIT access, it is recommended that the IAO LAN port, located at the rear of the shelf, be used.

PC-CIT (TL1 over TCP/IP)

The PC-CIT is a small CIT interface that provides a flexible TL1 command builder and a Graphical User Interface (GUI). The PC-CIT connects to a network element using either one of the PC-CIT interfaces located at the front of the shelf, or the rear IAO LAN port. The PC-CIT supports TCP/IP connections through both the front and rear IAO LAN interfaces.

The PC-CIT is used for report generation, as well as command and system response. Access to the system is provided via RS-232 (serial) or RJ45 (IAO LAN) interfaces.

PC-CIT Minimum requirements

It is anticipated that most customers will dedicate a lap-top PC to run the PC-CIT applications software. However, a properly configured desktop PC will also suffice.

The following list shows the minimum requirements for the customer-provided PC with recommended Windows operating system.

- Microsoft Windows XP, 2000 or NT 4.0 Operating System with service pack 4. The customer is responsible for ensuring that the PC remains virus -free.
- Pentium 266 MHz processor; Pentium III 500 MHz processor is recommended for optimum performance
- 128 MB RAM minimum, 256 recommended
- One-gigabyte hard-disk drive with at least 150 megabytes of free space. The PC-CIT application requires 50 MB, and the installation requires 30MB. In addition, each copy of the NE generic requires an additional 60 MB.
- CD-ROM drive
- SVGA monitor 800x 600 resolution (1024 x 768 recommended)
- 10 BASE-T LAN interface
  Pin Designations/signals are:
  - -1 TD+
  - -2 TD-
  - -3 RD+
  - -6 RD-

Operations System (OS) TL1/LAN Interfaces (Operations Tier 3)

The third operations tier consists of the remote OS interfaces. These OS interfaces include TL1/X.25, IAO LAN, and PC-CIT LAN.

The DMX*press* supports TL1 alarm surveillance and performance monitoring with OSs such as Telcordia's Network Monitoring and Analysis (NMA). The DMX*press* supports service provisioning with memory administration OSs such as Lucent's SNMS or Telcordia's *Transport*. The TL1 message set used has been updated to offer full remote reporting capabilities.

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. The TL1/X.25 GNE serves as a single interface to the OS for the NEs in the same subnetwork. The TL1/X.25 GNE receives operations information from all the 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 NE in the subnetwork. Lucent's SNMS, as well as other-vendor NEs that adhere to GR-253-CORE, can serve as the TL1/X.25 GNE for the DMX*press*. Note: the DMX*press* does not serve as a GNE itself and does not contain a TL1/X.25 port.

Front LAN CIT (IAO LAN) and RS232 CIT (Serial)

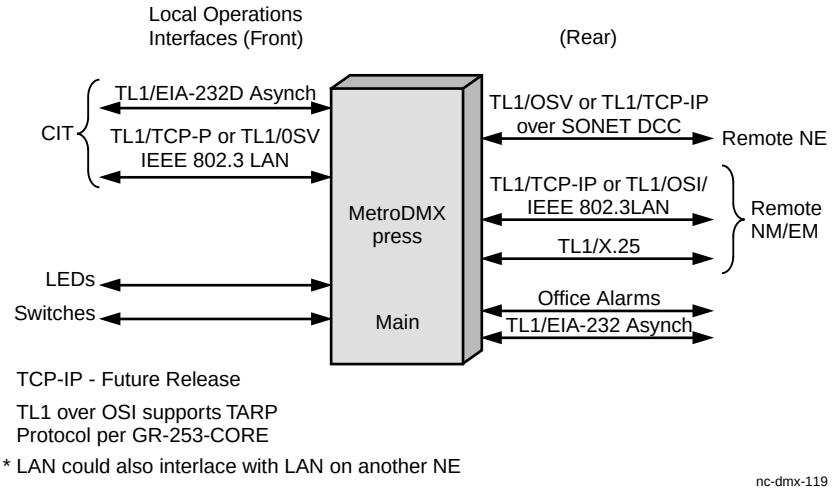
The front LAN CIT and RS232 CIT interfaces provide a connection to the PC-CIT and are intended for OSI LAN or TCP/IP based communications. OAM&P activities such as loopbacks and testing, protection switching, provisioning, PM, retrieving reports, and security on any and all DMX*press* NEs in a subnetwork are provided by the front IAO LAN interface. These interfaces are located on the circuit pack housed in the MAIN SLOT of the DMX*press* shelf.

Rear IAO LAN

The primary purpose of the rear IAO LAN interface is to provide remote OS access, such as OS TL1 access over TCP/IP Gateway. It also supports a faster software download from Navis® EMS (or any FTP server) using file transfer protocol (FTP) to Lucent DMX*press* systems when software is being upgraded. This rear IAO LAN port can also be used for PC-CIT OSI-based interfaces and TCP/IP support.

The following figure, shows how the DMX*press* works with the various operations interfaces.

Figure 5-1 DMX*press* Operations Interfaces



Lucent Technologies Operations Interworking (OI)

Overview

OI provides the capability to access, operate, administer, maintain, and provision remote Lucent NEs from any Lucent NE in a subnetwork or from a centralized OS. OI among the Lucent 2000 and *WaveStar* Product Families uses Target ID Address Resolution Protocol (TARP) and is applicable for the DMX*press*.

OI Support

The following Lucent Technologies products support OI:

- DDM-2000 OC-12 Multiplexer, R7.0 and later
- DDM-2000 FiberReach Multiplexer, R3.0 and later
- FT-2000 OC-48 Add/Drop-Rings Terminal, R9.1 and later
- All *WaveStar* Product Family systems

The Lucent OI is available among NEs that are connected through the SONET DCC or IAO LAN. With this feature, users can perform OAM&P activities on a centralized basis, saving travel time and money.

OI features including the following:

- Remote OS access via TL1 over TCP/IP
- Remote login
- Remote office alarms
- Remote software download and copy

For more information on OI, refer to *Lucent Technologies WaveStar Product Family Operations Interworking Guide*, 365-372-303.

Alarm Groups

An alarm group is a set of NEs that share status information between themselves, such as alarms, LEDs, and ACO status. The set of remote NEs that an NE can exchange status information with is determined by the value of the local alarm group parameter. This parameter is provisioned at each local NE and specifies whether that local NE does or does not exchange remote NE status with other Lucent NEs in the same SONET subnetwork. In DMX*press*, all NEs are defaulted into the same alarm group (number 255).

Alarm groups can be nodes in a ring, nodes of a linear extension, or any other logical grouping such as a maintenance group or geographical group. For example, 24 NEs could be provisioned into three alarm groups with eight NEs that share a community of interest such as the same OC-3 low-speed optical interface.

All members of the same alarm group share NE status information but do not share information with other alarm groups.

Alarm Group Functions

Depending on provisioning, a member of an alarm group can:

- Know the alarm/status of all members of the same alarm group.
- List a report of the summary alarm or status condition of other NEs in the group.

Alarm Gateway Network Element (AGNE)

Members of an alarm group exchange information through one or more alarm gateway NEs (AGNEs) that are defined in the same alarm group. All DMX*press* NEs use the DCC to receive and report alarm and status information to the AGNEs. The AGNE rebroadcasts all alarm and status information from one NE to all the other NEs in the same alarm group.

This information is used to activate remote far-end summary alarm reports and remote office alarms for each NE in the alarm group. At least one NE in each alarm group must be provisioned as the AGNE. An additional AGNE can be provisioned for redundancy, but it is recommended that only one AGNE be provisioned for each alarm group. Considerations for choosing an NE as an AGNE include being central to the group to make communications links easily accessible for maintenance purposes.

The AGNE and TL1/X.25 GNE should be separate NEs. Furthermore, the AGNE is a “collection point” and does not have to be a NE in a CO.

□

Multi-Vendor Operations Interworking

TARP

To support multi-vendor OI, the DMX*press* supports Target ID Address Resolution Protocol (TARP).

TARP provides NSAP-TID translations and is the established multi-vendor standard for SONET NEs that support TL1 OS interfaces. DMX*press* supports the TARP Data Cache (TDC) function to reduce the frequency of TARP propagation throughout the subnetwork and to improve performance.

Compatibility

The DMX*press* is developed to be compatible with any other-vendor NEs that support TARP, OSI, IAO LAN, and TL1/X.25 as specified in Telcordia Technologies GR-253. In addition, DMX*press*'s TARP Manual Adjacency feature enables it to operate in networks that include CMISE-based NEs which may not support TARP propagation. DMX*press* supports 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, DMX*press* supports user provisioning of NSAP area addresses and Level 2 Intermediate System (IS) functionality.

The DMX*press*' compatibility with other-vendor NEs will be tested by independent third parties such as Telcordia Technologies on behalf of the SONET Interoperability Forum (SIF).

OI Applications Supported

The DMX*press* supports the following Lucent proprietary OI applications between Lucent NEs in multi-vendor subnetworks:

- Remote PC-CIT login
- Remote software download and copy
- Remote NE-to-NE automatic time/date synchronization and start-up.

□

Software Download and Copy

Overview

The DMX*press* can upgrade the system software while in-service. It uses flash erasable programmable read-only memory (flash EPROM) chips to store the system software. System software can be downloaded using a PC (see specifications in Section 10) through the RS-232 interface on the MAIN faceplate into the local system, or to another system connected to the local system via the SONET DCC. In addition, system software can be copied between like systems connected by the SONET DCC. The remote software download and copy capabilities enable the network service providers to avoid costly craft dispatches for software upgrade.

Downloads

The DMX*press* accepts downloads without disrupting transmission and with minimal impact on operation functions. This enables the software upgrades to be transparent to the transmission services and to the network operations. While the current software version is still running, DMX*press* accepts the downloading of compressed, dormant software copies without affecting the operation of the system. An “apply” command can be scheduled to be applied at any time the user specifies. This reduces the time that incompatible NEs would be isolated during cut-over to a new software release and reduces the total time required to upgrade a subnetwork.

Telcordia OSs will lose communications while the network is being upgraded for a half an hour or less.

The DMX*press* can also accept software downloads from the Navis® EMS (or any FTP server) when upgrading to subsequent releases.

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Maintenance Signaling

Alarm Indication Signals

Alarm indication signals (AIS) are maintenance signals that notify equipment downstream from a failure that the failure has been detected and alarmed by some upstream equipment and notify upstream equipment to initiate trunk conditioning because of a downstream detected failure (remote defect indicator [RDI]).

Compliance

Maintenance signaling is compliant with SONET (Telcordia Technologies GR-253) and asynchronous (Telcordia Technologies TR-TSY-000191) network requirements. Alarm indication signals include SONET line AIS, STS-1 path AIS, virtual tributary (VT) path AIS, DS3 AIS, and DS1 AIS. Remote defect indication signals include STS-1 path RDI and VT path RDI. Other maintenance signals include STS-1 path unequipped, and VT path unequipped.

Tier 2 Maintenance Signals on the DS1/DS3/16/1 and DS3/12 circuit packs.

The following are included in AIS and controlled via either the DS1/DS3/16/1 or DS3/12 (Release 1.1) device:

- Detection of STS-1 AIS -receive direction.
- Detection of STS-1 Path Yellow Signal-receive direction.
- Detection of STS-1 Path Unequipped Indication receive/transmit direction.
- STS-1 Path Trace Read-receive direction.
- DS3 AIS Detection-receive direction.
- Generation of STS-1 Path Yellow Signal -transmit direction.
- STS-1 Path Trace Write -transmit direction.
- DS3 AIS Generation -receive/transmit direction.

Fault Detection, Isolation, and Reporting

Overview

The DMX*press* continuously monitors incoming signals and internal system conditions. Incoming SONET signals are monitored for loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), line AIS, path AIS (rings only), bit error ratio (BER) thresholds and unequipped signals. The BER threshold crossings are detected for DS1, DS3, and STS-1, STS-3(c), STS-12(c) signals.

Fault Detection

When an internal fault is detected, automatic diagnostics isolate the faulty circuit pack. Faults are reported to local technician and operations systems so that technician dispatch and repair decisions can be made. If desired, OS personnel and local technicians can use the PC-CIT to gain more detailed information on the fault condition.

Fault Isolation

All fault conditions detected by the system are stored and made available to be reported, on demand, through the PC-CIT. In addition, a history of past alarm and status conditions and PC-CIT events is maintained and available for on-demand reporting. Each event is real time and date stamped.

Fault Reporting

The system also automatically and autonomously reports all detected alarm and status conditions through the office alarm relays, MAIN faceplate and equipment LEDs, and TL1 message-based OS interface.

Loopbacks and Tests

Overview

The DMX*press* allows technicians to perform loopback tests on all low- and high-speed interfaces. Low-speed DS1 and DS3 electronic loopbacks, directed toward the high-speed line (terminal loopback), are individually controllable from the PC-CIT or the OS interface. Active electronic loopbacks in the alarm and status report. DS1 and DS3 facility loopbacks toward the DSX are also available.

Manual Optical Loopbacks

Front access to the optical connectors on the optical line interface unit (OLIU) circuit pack allows easy manual optical loopback. This loopback is performed by connecting a fiber jumper from the OLIU circuit pack output to its input. In some cases a lightguide buildout assembly is required to prevent receiver overload when performing loopbacks.

Software Controlled Electrical Loopbacks

There are three software-controlled electrical loopbacks. They are controlled through the VLSI serial link and are provided in the DS1/DS3/16/1 and DS3/12 (Release 1.1) device. The first loopback is a DS3 rate loopback which connects the outputs of the receive side desynchronizer to the transmit side of the synchronizer inputs. The second loopback is an STS-1 loopback which connects the STS-1 outputs of the transmit side synchronizer to the inputs of the receiver desynchronizer inputs. The third loopback is the DS3 Facility Loopback and it connects the DS3 transmit side input to the DS3 receiver side output while the signal is not subjected to the B3ZS decoding/encoding.

Internal Testing Capabilities

Technicians can use the internal testing capabilities for installation and manual troubleshooting. The DS1 and DS3 test signal generators and detectors are integrated into the system, eliminating the need for external test equipment to perform transmission tests.

The DMX*press* also allows technicians to test specific system components. In addition to the automatic diagnostics, DMX*press* provides tests for LEDs, office alarms, and the MAIN circuit pack.

Protection Switching

Overview

This section describes the types and functions of protection switching in the DMX*press*.

Path Protection Switching (Path Switched Rings)

The DMX*press* supports path switched ring applications using the path protection switching schemes described in Telcordia Technologies GR-1400. This scheme offers 60-millisecond restoration times and simple network administration for access applications. The ring facility consists of two fibers, with service and protection rotating in opposite directions. Each input is bridged and transmitted in both directions around the ring. The receiving end terminal monitors the quality of both signals and selects the best signal to drop.

UPSR Configurations

The DMX*press* supports the following OC-12/OC-48 (OC-12 in Release 1.1)path switched ring configurations:

- VT1.5/STS-1 (R1.0)
- VT1.5/STS-1/STS-3(c)/STS-12(c) (R1.1)

Path protection switching is non-revertive. A manual path protection switching command allows switching to the other path for ease of ring maintenance. STS-n path switching is triggered by incoming line LOS, LOF, LOP, AIS, and unequipped or STS-1 path BER exceeding a signal fail (10-3) or signal degrade threshold. The system also supports VT path protection switching based on VT AIS, LOP, unequipped, and signal degrade.

Unprotected Paths (0x1)

DMX*press* provides an unprotected or locked cross-connect mode referred to as 0x1. This option is user-provisionable and supports single-homed ring on ring topologies.

1+1 Port-level Facility Protection

The high-speed OC-12/48 circuit packs have 2 bidirectional ports, each with its own path selector. The path selectors choose and drop the best signal from the two incoming, high-speed lines to the low-speed circuit packs in the Option Slots. The low-speed circuit packs are configured to accept a signal from only one of the two path selectors, each of which is associated with a particular port. In the event that the port associated with the path selector that the low-speed pack is configured to accept signals from fails, the low-speed pack performs a switch to accept signals coming from the other path selector in the high-speed circuit pack. This amounts to 1+1 facility/equipment protection at the port-level.

Ethernet Interface Protection

On the WAN (SONET) side of the network, DMX*press* utilizes standard IEEE 802.1w spanning tree protection for multipoint applications and/or STS-1 UPSR protection (for point-to-point applications).

Protection Switching Priorities

The following protection switching priorities on equipment are user-controllable through TL1 commands:

- Inhibit switch
- Forced switch
- Manual switch.

Protection switching is available for all traditional SONET interfaces when provisioned for path and/or line protection switching.

□

Performance Monitoring

Overview

This section lists and describes performance monitoring parameters, data storage, thresholds, and TCA transmission.

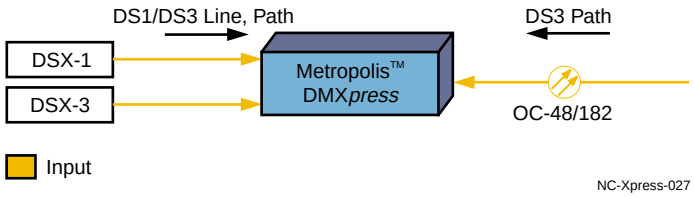
The DMX*press* uses performance monitoring (PM) to support proactive maintenance of the network and tariffed service performance verification. Proactive maintenance refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming but indicative of an impending hard or soft failure. Hard and soft failures result in reactive maintenance. PM conditions are reported on both SONET and Ethernet interfaces.

Proactive Maintenance

Proactive maintenance consists of monitoring performance parameters associated with the SONET sections, lines and paths within the SONET network, as well as incoming and outgoing bytes and frames on ethernet ports.

The following figure, shows DS1/DS3/16/1 line and path and DS3 path performance monitoring. The DMX*press* monitors DS3 line and path parameters from the DSX-3 and DS3 path parameters from the optical path.

Figure 5-2 DS1/DS3 Performance Monitoring



Line Parameter

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.

Path Parameter

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.

SONET PM Parameters The following table, lists the performance monitoring parameters for the SONET interfaces

Table 5-2 SONET Performance Monitoring Parameters

Facility	Measured Parameter
OC-48 Section	Severely Errored Frame Seconds (SEFS)
DS3 Line	Line Coding Violations (CVL) Errored Seconds (ES) Severely Errored Seconds (SES)
OC-48 Line	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) STS Pointer Justification Counts (PJC)
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)
VT1.5 Path	V5 Errored Seconds (ES) V5 Severely Errored Seconds (SES) V5 Unavailable Seconds (UAS)
DS3 Path	P-bit Coding Violations Severely Errored Frame Seconds (SEFS)

Facility	Measured Parameter
DS3 Path for both P-bit and F&M bits (from fiber only)	CP-V Coding Violations Severely Errored Frame Seconds (SEFS) ES-P Errored Seconds SES-P Errored Seconds UAS-P Unavailable Seconds
DS3 Path for P-bit, F&M bits, and C-bit (from fiber and DSX)	CV-P Coding Violations Severely Errored Frame Seconds (SEFS) ES-P Errored Seconds SES-P Errored Seconds UAS-P Errored Seconds

DS3 Performance Monitoring

The DMX*press* provides DS3 performance monitoring with 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.

P-Bit

When provisioned for P-bit, the system calculates and provides counts of DS3 P-bit coding violations (CV), errored seconds (ES), and unavailable seconds (UAS) incoming from the fiber. Quarter-hour and day registers are provided with provisionable threshold crossing alerts (TCAs) on a per shelf basis. Severely errored frame seconds (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 performance monitoring 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 coding violations (CV), errored seconds (ES), severely errored seconds (SES), and unavailable seconds (UAS) incoming from the fiber.

Quarter-hour and current day registers are provided with provisionable threshold crossing alerts (TCAs) on a per shelf basis. Severely errored frame seconds (SEFS) are also monitored.

C-Bit

The DMX*press* also provides DS3 path PM using the C-bit option. When the 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 parity coding violations (CV-P), errored seconds (ES-P), severely errored seconds (SES-P), and unavailable seconds (UAS-P) incoming from the DSX-3 and the fiber. The type of performance monitoring is provisioned per DS3 service by a PC-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 threshold crossing alerts (TCAs). The TCAs are provisionable on a per-shelf basis. Severely errored frame seconds (SEFS) counts are also provided.

Ethernet Performance Monitoring

DMX*press* provides PM capabilities for the FASTE/16, GbE/2 Ethernet interfaces. PM data is collected at each LAN and WAN interface in the network for both incoming and outgoing directions. The WAN interface provides a connection to a SONET Virtual Concatenation Group (VCG).

Listed below are the six PM parameters that provide PM data on all ethernet interfaces:

- Dropped Frames (Congestion) - This parameter counts the number of incoming ethernet frames dropped at a specific LAN/WAN port due to buffer overflow. Buffer overflow occurs when the network is congested.
- Dropped Frames (errors) - This parameter counts the number incoming ethernet frames dropped at a LAN/WAN port due to a frame check sequence (FCS) error or another defect in the frame.
- Incoming Number of Bytes - This parameter counts the total number of bytes incoming to a LAN/WAN port.
- Incoming Number of Frames - This parameter counts the total number of ethernet frames incoming to a LAN/WAN port.
- Outgoing Number of Bytes - This parameter counts the total number of outgoing bytes transmitted by a specified LAN/WAN port.
- Outgoing Number of Frames - This parameters counts the total number of outgoing frames transmitted by a specified LAN/WAN port.

Performance Monitoring Data Storage

Quarter-hour and Current Day Registers

The DMX*press* provides current quarter-hour and current day registers for all accumulated performance parameters. The previous 8 hours of quarter-hour and previous day registers are also provided.

Access

The DMX*press* system can initialize these registers through the PC-CIT locally or remotely at any time, as well as retrieve and report their contents.

Performance Parameter Thresholds

Provisioning

The current quarter-hour and current day thresholds for each parameter type are provisionable, using the PC-CIT, on a per-shelf basis. If values other than the defaults are used, only one value for each parameter type needs to be set.

Threshold Crossing Alerts (TCAs)

Whenever the current quarter-hour or the current day threshold for a given parameter is exceeded, DMX*press* generates a threshold-crossing alert (TCA) that is entered into the performance monitoring exception report and reported to the OS through the TL1 interface.

TCA Transmission to OS

Overview

The TCA information may be reported to the OS using any of the TL1 message-based OS interfaces. TCAs can be used to trigger proactive maintenance activity at the OS.

TL1 over TCP/IP Access

The TL1 over TCP/IP OS interfaces should be used to derive full benefit from DMX*press*'s performance monitoring capabilities. The full set of PM data stored by DMX*press* (TCAs and the contents of PM registers) is provided through any of the TL1 interfaces.

Provisioning

Overview

This section describes the many types of provisionable parameters available in DMX*press*.

The DMX*press* allows the user to customize many system characteristics through provisioning features. Provisioning parameters are set by software controls.

Default Provisioning

Installation provisioning is minimized with thoughtfully chosen default values set in the factory. Every parameter has a factory default value. These factory defaults for software parameters are maintained in the MAIN circuit pack, and a single command is provided to restore all default values. All provisioning data is stored in nonvolatile memory to prevent data loss during power failures and maintenance operations.

Remote Provisioning

Software control allows remote provisioning of DMX*press* NEs. This feature is provided especially for provisioning parameters likely to change in service, in support of centralized operations practices.

Cross-Connect Provisioning

The DMX*press* can be provisioned for signal routing. Depending on the application, VT1.5, STS-1, STS-3(c), STS-12(c), or STS-48(c) signal cross-connections may be established to route traffic in a specific manner. All cross-connections are bidirectional.

All VT1.5 or STS-n cross-connections are bidirectional. Thus, each connection goes from MAIN to Option slot and from Option slot to MAIN.

VT1.5 and STS-n signals may be cross-connected in several ways. For bidirectional drop services, the 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 slot equipped with low-speed DS1 or DS3 interfaces.

STS-1 cross-connections to Ethernet interfaces are also available. The normal “two-way” cross-connection is used for UPSR point-to-point Ethernet applications. A multi-point (data specific) cross-connect is used for Ethernet packet ring applications.

The bidirectional pass-through cross-connect is used to pass VT1.5 or STS-n signals through the NE all on the same timeslot.

Intra-pack, pass-through cross-connections are supported on low-speed (tributary interface) OC-3/12 circuit packs.

Automatic Provisioning on Circuit Pack Replacement (R1.1)

Replacement of a failed circuit pack is simplified by automatic provisioning of the original circuit pack values. The Main circuit pack maintains a provisioning map of the entire shelf, so when a transmission pack is replaced, the Main circuit pack automatically downloads the correct values to the new circuit pack. Likewise, if the Main circuit pack is ever replaced, the correct provisioning data from every other circuit pack in the shelf is automatically uploaded to the new main circuit pack's nonvolatile memory.

Port State Provisioning

Port state provisioning is a feature provided on DMX*press* NEs that can help suppress alarm reporting and performance monitoring by supporting multiple states for DS1, DS3, and LAN ports.

The states supported are as follows:

- Automatic (AUTO)
- In-service (IS)
- Not monitored (NMON)

Ports without signals (undriven) are in the automatic state until changed to the in-service state when a signal is present. Commands allow a user to retrieve and change the state of a port to the not-monitored state or from the not-monitored state to the automatic state.

Channel State Provisioning

Automatic channel state provisioning is a capability provided on DMX*press* NEs that suppresses reporting of transient alarms and events during provisioning by supporting multiple states (AUTO, IS, NMON) for VT1.5, STS-1, STS-3(c), and STS-12(c) channels.

Automatic Channel State Provisioning

While an end-to-end circuit is being set up, particularly during VT1.5 and STS-n cross-connect provisioning, several transient maintenance signals result. Without automatic channel state provisioning, these are reported as alarms and 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, DMX*press* provides automatic channel state provisioning.

Channel States

A VT1.5 or STS-n channel is kept in the default automatic (AUTO) state until the reception of a valid signal (a framed non-AIS or non-LOP) in that channel. While in AUTO state, no alarms or events are reported on the channel. On receiving a valid signal, which occurs when the end-to-end circuit is completely provisioned, the channel automatically changes to the in-service (IS) state, where it resumes normal alarm and event reporting. An additional state, not-monitored (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 capabilities already provided for physical ports like DS1, and DS3 the user can submit commands to manually change a channel from IS or AUTO to NMON, and from NMON to AUTO. A user cannot manually change from AUTO or NMON to IS.

Reports

Overview

This section describes reports generated by DMX*press*.

Alarm and Status Reports

The system provides an alarm report that lists all the active alarm and status conditions, including a remote alarm status feature that summarizes alarms in other NEs in an alarm group. A description of the condition (for example, controller failure, incoming high-speed signal failure, synchronization hardware or reference failure, etc.) is included in the report along with a time stamp indicating when the condition was detected, its severity, and whether it is service affecting or not. The option to display specified subsets of alarm conditions is provided (for example, critical alarms only).

Status conditions include:

- Manually initiated abnormal conditions (for example, forced switch, manual lockouts, loopbacks, system testing)
- Incoming AIS detected

A description of the status condition (for example, DS1 loopback active, DS3 facility loopback active, and so on.) is included in the report along with a time stamp indicating when the condition began.

Performance Monitoring Reports

TCA summary report

The DMX*press* provides a report that lists the number of SONET performance-monitoring parameters that have crossed their thresholds. This report provides a snapshot of the system performance level. If there is signal degradation, it is quickly pinpointed so that corrective action may be taken before customers are affected, thus supporting proactive maintenance. Threshold-crossing alerts (TCAs) are not reported on ethernet interfaces.

This report provides separate parameter summaries for each signal level in the system, including SONET section, line, and path, as well as dropped/incoming/outgoing ethernet bytes and frames. The parameter summaries show the user which performance status to request if they want further information.

Performance Status Reports

These reports provide detailed information on the current and previous 8 hours in quarter-hour (15-minute) increments, as well as the current and previous day's performance. Threshold crossing alerts are clearly identified and the time the performance registers were last initialized is also shown. Any registers that may have been affected by this initialization are marked. There are separate reports for section, line, and path parameters, as well as ethernet parameters.

Maintenance History Reports

A maintenance history report contains the following past conditions:

- Alarms
- Status
- Protection switching
- User interface commands (for example, provisioning, loopback request, manual protection, and so on.)

The maintenance history report contains time stamps indicating when each condition was detected and when it cleared, as well as when the command was entered. Note that any system reset clears all records in the log.

Refer to the *Metropolis*®DMXpress Access Multiplexer *User Operations Guide, 365-372-314,* for details on the history log.

State Reports

The state report shows the protection state of all interfaces installed in the system and the state of the individual low/high-speed channels.

Interface States The interface state is reported as “active” or “standby.”

Path States The state of the individual VT1.5 /STS-n channels and paths may be one of the following:

- Not monitored (NMON)
- In service (IS)
- Auto (AUTO).

The system reports this information on all interfaces. AUTO refers to a slot that is available for automatic provisioning. For VT1.5/STS-n channels and paths, the AUTO state would transition to the IS state if a good signal is detected.

Port States The state of individual ports, including those contained in multiport interfaces (DS1 and DS3), may be NMON, IS, or AUTO.

Line States The state of individual lines may be IS or NMON.

Provisioning Reports The DMX*press* provides a variety of provisioning reports that contain the current values of all electronically-provisionable parameters and switch-selectable parameters (if any). For more information on the provisioning reports generated, refer to the *Metropolis*®DMXpress Access Multiplexer *User Operations Guide, 365-372-314.*

Version/Equipment List The DMX*press* system provides a full inventory report on all hardware and software installed in local and remote systems.

Information Provided The version/equipment list provides the following information:

- Circuit pack name
- 10-character *CLEI* code
- 6-digit equipment catalog item (ECI)
- 7-character apparatus code
- 6-character series number
- 12-character serial number (includes date and location of manufacture)
- 6-digit program version (software generic) code
- Program version for dormant area.

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Administration

Overview

This section provides information on system administration.

Software Upgrades

The DMX*press* provides an in-service software installation capability to update the generic program in local and remote systems. Upgrades are distributed on CD-ROMs containing the new software and an installation program. These software upgrades are the primary mechanism to add new feature enhancements to the in-service DMX*press* network. All software upgrades are “in-service” and do not affect any provisionable parameters. For example, cross-connections are left unchanged by the software upgrade.

Software Download

In the DMX*press* system, software download takes place in two stages. In the first stage, the new generic software is downloaded into a dormant “flash” area as a compressed file. In the second stage, the new generic is uncompressed and moved into an active “flash” space. During this process, the old release continues to run from random access memory (RAM). When the download is complete, the system automatically reboots and executes the new generic. Installation is not service-affecting, so down time is limited to the reboot time.

Local Installation Procedure

The procedure is straightforward. The technician connects a personal computer (PC) to the RS-232 front serial port on the local DMX*press*, starts the installation program, and is prompted with a few warnings before the upgrade installation actually begins. After the technician confirms to proceed, the PC takes over the process and completes the installation.

In future releases, installation may be performed via Lucent’s SNMS over the IAO LAN interface using FTP. For more information on software download and upgrade via SNMS, refer to the *WaveStar Subnetwork Management System (SNMS) User Guide*, 190-224-100.

Software Compatibility

DMX*press* is compatible with many Lucent products, including DDM-2000, FT-2000, SNMS, and other *WaveStar* products.

OI software compatibility

The following table lists the SONET software compatibility within a subnetwork for Lucent 2000 Product Family and Lucent *WaveStar* Product Family systems. All products listed support operations interworking (OI).OI Software Compatibility

Table 5-3 Software Compatability

Product Name	Compatible Software Release
DDM-2000 OC-12 Multiplexer	7.0 and later
DDM-2000 FiberReach	3.1 and later
FT-2000 OC-48 Lightwave System	9.1 and later
SNMS	5.1 and later
WaveStar™ BandWidth Manager	All releases
WaveStar™ TDM 2.5G	All releases
WaveStar™ TDM 10G	All releases

Security

The DMX*press* offers security against unauthorized access to the system functions. The use of security is provisionable for the front RS232 CIT port, the LAN CIT port, and through the DCC. In addition to this, the DCC can be disabled, thus securely isolating the DMX*press* system from possible remote intrusion. A provisionable time-out is available for each access port that enables automatic termination of inactive or unattended sessions.

User Types

There are four types of users:

- General users can select and maintain their own password.
- Three privileged user accounts are reserved for system security administration.
- Maintenance users are allowed to perform basic maintenance functions. These users can select and maintain their own passwords.
- Reports-only users can display certain system information but cannot change provisioning or maintenance parameters.

Security Features

The DMX*press* provides security features such as 0 (to disable) or 7-999 day password aging, customized login proprietary messages, and 150 users.

Password aging - This feature allows the customer to enable or disable the aging of a user's password.

Customized login proprietary notice - This feature affords privileged users the opportunity to provision a proprietary banner, to be displayed upon login, to improve the system's security. The banner is displayed in conjunction with the Lucent Proprietary banner.

By default this feature is "disabled." When the banner is disabled, only the Lucent Proprietary notice appears upon login. If the banner is "enabled", the Lucent Proprietary notice is displayed first, followed by the customer-provisioned banner.

The banner has a maximum line number of 9 and a maximum character number of 450 (9 lines x 60 characters = 450).

150 users - DMX*press* provides 150 users: 3 privileged users and 147 other users distributed among the general, maintenance, and reports-only users.

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6 Ordering

Overview

Purpose

This chapter contains information on ordering Metropolis DMX Access Multiplexer equipment and software. The information in this chapter tells you where to go for ordering information, and provides important sparing information and FIT rates relative to both circuit packs and other equipment.

Ordering topics included in this chapter are:

Introduction

Overview

Lucent has created a set of engineering drawings (ED8C946-10) to facilitate the ordering of all products in the future. These drawings are updated each time the hardware in the DMX system changes, and contain all of the information needed to order DMX equipment. The information contained in the engineering drawings will not be duplicated anywhere in the interest of keeping all information current and consistent at all times. This chapter will explain how to make sure you are using the most current version of the engineering drawing and where to order it.

Software and Documentation ordering information is not included in the engineering drawings and is therefore included in this chapter. This chapter also contains important information regarding sparing information and FIT rates for all DMX equipment. Any information about particualr pieces of equipment (i.e. the uses of various cables versus other) is meant to convey usefull information that may/may not be contained in the engineering drawings. This information is meant to be used in conjunction with engineering drawings, but not to replace them.

How to Order

Equipment and software orders may be placed via Lucent's online ordering process. For more information, contact your Account Executive.

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Engineering Drawings

Overview

In the interest of ensuring that ordering information is always consistent and up-to-date, Lucent has created a set of engineering drawings meant to contain all information needed to order a DMX system.

Where to Obtain Engineering Drawings

The enginnering drawing is included as an Appendix with each release of the Metropolis® DMX Access Multiplever Applications and Planning Guide (refer to Appendix C of this document). Yet, the engineering drawing is likely to be updated more frequently than the Applications and Planning Guide. Therefore, it is possible to order the most current version of the engineering drawing individually from CIC.

Whenever ordering equipment, first ensure that you have the most current version of ED8C946-10. You may do so by contacting CIC through one of the mediums detailed below.

How to order Engineering Drawings

The most up-to-date version of the Engineering drawing (ED8C946-10) may be obtained through CIC. There are 2 ways to obtain material from CIC:

- Got to www.CIC.lucent.com and follow the link for Drawings. Enter the drawing number in the proper field (ED8C946-10).
  - Verify that the drawing you have is the same Issue number as the drawing on the site.
  - If it is not the same number, follow the steps on the CIC website for ordering a new drawing.
  - If it is the same number, the drawing is fit to help you configure an order.
- Contact CIC by phone: 1-800-582-3688

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DMXpress Mounting Hardware:

Mounting Hardware Information

Listed below are some need-to-know items before ordering DMXpress mounting hardware:

The 19” mounting brackets are included and on the DMXpress when shipped from the factory. The DMX*press* can be wall-mounted, mounted in a bay, or simply placed on top of a secure surface. In order to mount DMX*press* you will need to determine whinch of the following hardware components you need. For a detailed description of DMX*press* mounting option, refer to Chapter 3, Product Description.

Table 6-1 Mounting Hardware

DMX*press* Mounting Hardware	Comcode	Description
23” bay frame mounting hardware	848816500	Includes four 23” brackets and 12 screws to mount brackets to enclosure (19” brackets must be removed before hand)
19” cable tie mounting hardware	848824850	Includes 2 cable tie bars and and brackets to mount the cable bunches to the enclosure

DMXpress Software and Documentation:

Software Ordering Information

Listed below are some need-to-know items before ordering DMXpress software:

The DMXpress Multiplexer Application Software is included and is preloaded on the DMXpress when shipped from the factory. As a precaution, it may be desirable to have backup CD-ROMs for all releases of software.

Table 6-2 Software

Comcode	Product Release	Description
109153387	R1.0	Initial Installation Software (CD-ROM and SRD)
109248633	R2.0	Initial Installation Software (CD-ROM and SRD)
109248461	R2.0	Upgrade Software (from R1.0 to R2.0) (CD-ROM and SRD)
109248658	R2.0	Upgrade Software (from R1.1 to R2.0) (CD-ROM and SRD)
109248666	R2.0	R2.0 Spare Software
109205534	R2.1	R2.0 Software Release Description (SRD)

Documentation

The following table lists documention that may be ordered to accompany the DMX*press* system. Documents that come with a DMX*press* shelf or software are noted.

Table 6-3 Documentation

Document Number	Title
365-372-312	*Metropolis*®DMXpress Access Multiplexer *Multiplexer Applications and Planning Guide, Release 2.0 and 3.0*
365-372-314	*Metropolis*®DMXpress Access Multiplexer, *Release 2.0 User Operations Guide*
365-372-315	*Metropolis*®DMXpress Access Multiplexer , *Release 2.0 Alarm Messages and Trouble Clearing Guide*
365-372-311	*Metropolis*®DMXpress Access Multiplexer *Installation Manual*
109248682	*Metropolis*®DMXpress Access Multiplexer, Release 2.0 Document CD-ROM (includes APG, UOG, and AMTCG)

Important! The comcodes for these documents are not supplied so as to limit confusion. This book, the Applications and Planning Guide, is not updated concurrently with the other documents listed in this table, but before them. As such, if comcodes were supplied here, it could result in confusion and the ordering of the wrong version of a document. Use the telephone number for CIC, provided on page 3 of this Chapter, to obtain the correct comcodes for the desired documents. The comcode for the User Documentation CD is supplied, but it is recommended that CIC be called to verify that the correct version of the CD is being ordered.

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Failure Rates

Port unit failure rates

The table below provides the steady-state port unit Failure in Time (FIT) rates for DMX*press*.

Table 6-4 Port Unit Failure Rates

Circuit Pack	Apparatus Code	Release	FIT Rate
MAIN OC48/1.3I2 IR (20km)	A1AA014	1.0	6810
MAIN OC48/1.3I2 IR (20km)	A1AA005	1.0	TBD
16 DS1 Port and One DS3 Port TDM Option Card	A1AA006	1.0	6379
DS3/12 TDM Option Card	A1AA0015	1.0	TBD
FASTE/16-- 16 Port Ethernet Option Card	A1AA007	1.0	TBD
GbE/2-- 2 Port Ethernet Option Card	A1AA008	1.0	TBD

NOTES

These FIT rates are subject to change.

Sparing Graph

Overview

This section provides guidelines and a procedure to determine the number of spares needed at each location. The number of spares for each circuit pack or port unit code must be determined and maintained separately, based on that code's in-service population at each given location.

Using the sparing graph

Use the following procedure to determine how many spare circuit packs, port units, or other pieces of equipment are required for each code at each location to maintain 99.9% service continuity, given a 10-day lead time.

1 Locate the failure rate for the unit under consideration using Table 7-10, "Circuit Pack Failure Rates" (7-20), or Table 7-11, "Equipment Failure Rates" (7-21).

2 Refer to the figure on the following page and select the curve that represents the nearest failure rate.

3 Follow the curve until it intersects the vertical line that represents the number of units in service at the given location.

4 Refer to the horizontal line immediately above the intersection. The number associated with this line is the minimum number of spares recommended for that location.

5 Repeat steps 1-4 for each circuit pack, port unit, and type of equipment listed in Table 7-10, "Circuit Pack Failure Rates" (7-20), or Table 7-11, "Equipment Failure Rates" (7-21).

END OF STEPS

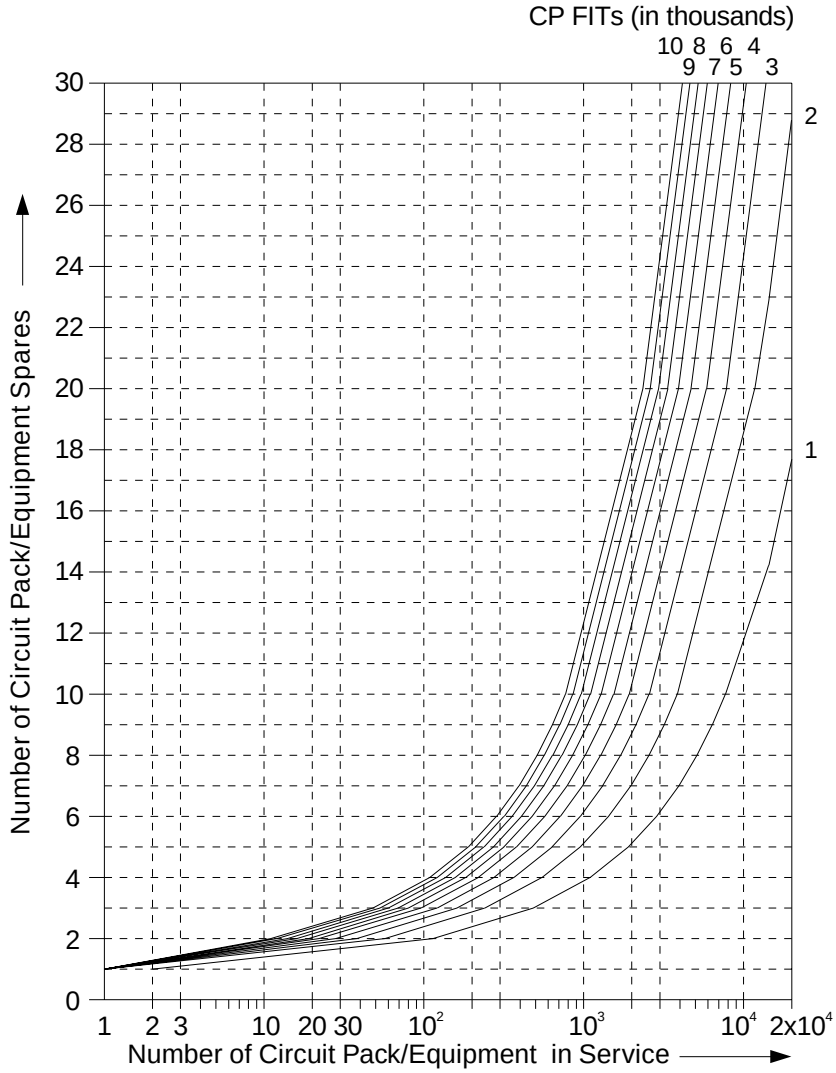
Example of using the graph

If there are 100 OC48/1.3I2 MAIN OLIUs (failure rate of 6810) in service at a given location and your lead time is 10 days, then you should order and stock 3 spare OC48/1.3I2 MAIN OLIUs port units for that location.

Sparing graph for 10-day lead time

Use Sparing Graph for a 10-Day Lead Time to plan the number of spares necessary for the circuit packs, port units and pieces of common equipment used in DMX*press*.

Figure 6-1 Sparing Graph for a 10-Day Lead Time



7 Product Support

Overview

Purpose

This chapter describes the support services available to Lucent Technologies' customers.

Lucent Technologies offers a number of services to assist customers with Engineering, Installation and Technical Support of their networks. Additionally, Lucent Technologies offers product-specific training courses.

Contents

The following topics are discussed in this chapter:

Worldwide Services

Overview

Lucent Worldwide Services provides a full life-cycle of services and solutions to help you plan, design, implement, and operate your network in today’s rapidly changing and complex environment.

Engineering Services

Engineering Services provide information and technical support to customers during the planning, implementation, and placement of equipment into new or existing networks. We determine the best, most economical equipment solution for a customer and help ensure equipment is configured correctly for the customer’s network needs, works as specified, and is ready for installation on delivery. These services consist of the following:

- Equipment engineering
- Software engineering
- Site records
- Engineering consulting
- Additional engineering services (for example, Network Realignment, System Capacity Planning, System Health Assessment

Installation Services

Lucent Technologies offers Installation Services focused on providing the technical support and resources customers need to efficiently and cost-effectively install their network equipment. We offer a variety of options that provide extensive support and deliver superior execution to help ensure the system hardware is installed, tested, and functioning as engineered and specified. Installation Services provides a complete flexible solution tailored to meet customers' specific needs. These services consist of the following:

- Equipment installation
- Specialized equipment installation
- Network connectivity services
- Installation support services

Technical Support

Lucent Technologies provides the following Technical Support Services:

- Remote Technical Support (RTS) - remote technical support to troubleshoot and resolve system problems.
- On-site Technical Support (OTS) - on-site assistance with operational issues and remedial maintenance.
- Repair and Replacement (R&R) - technical support services for device repair/return or parts replacement.
- Lucent OnLine Customer Support - online access to information and services that can help resolve technical support requests.

Important! Technical Support Services are available 24 hours a day, 7 days a week.

Customers inside the United States and Canada

Technical Support Services can be reached at **1-866-LUCENT8** (866-582-3688): *Prompt 1*.

Customers outside the United States

Technical Support Services can be reached at **+1-630-224-4672**: *Prompt 2*.

Web-Site

For additional information regarding Worldwide Services, refer to the Lucent Technologies' web-site at **http://www.lucent.com/products**

1. Click on **Browse the catalog**
2. Click on **Worldwide Services Solutions**
3. Select the desired service to display:
   - Engineering and Installation
   - Technical Support Services

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Training

Overview

Lucent Technologies offers a formal training curriculum to complement your product needs.

Registering for a course

To review the available courses or to enroll in a training course at one of Lucent's corporate training centers,

- Within the United States,
  - Visit **https://www.lucent-product-training.com**
  - Call **1-888-LUCENT8** (888-582-3688): *Prompt 2*.
- Outside the continental United States,
  - Visit **https://www.lucent-product-training.com**
  - Contact your in-country training representative
  - Call: **+1-407-767-2798**
  - Fax: **+1-407-767-2677**

Suitcasing

To arrange for a suitcase session at your facility,

- Within the United States, call **1-888-LUCENT8** (888-582-3688): *Prompt 2*.
- Outside the continental United States,
  - Contact your in-country training representative
  - Call: **+1-407-767-2798**
  - Fax: **+1-407-767-2677**

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8 Reliability and Quality

Overview

Purpose

This section provides the Lucent Technologies' quality policy, describes the reliability program, and describes the International Standards Organization (ISO) certification awarded to Lucent Technologies' Transmission Business Unit.

Contents

The following reliability and quality information is included in this chapter:

Lucent's Commitment to Quality and Reliability

Statement

Quality excellence is the foundation for the management of our business and the keystone of our goal of customer satisfaction. It is, therefore, our policy to:

- *Consistently provide products and services that meet the quality expectations of our customers.*
- *Actively pursue ever-improving quality through programs that enable each employee to do his or her job right the first time.*

Quality plan

This Lucent Technologies Quality Policy guided the development of the Metropolis®DMXpress Access Multiplexer and will continue affecting this product throughout its lifetime. The primary tool ensuring product quality is the Quality Plan, used with the Lucent Technologies Transmission Systems Reliability Program.

Reliability Specifications

Overview

Reliability is a key ingredient of the product life cycle, beginning at the earliest planning stage. Major efforts at the start of the project were system reliability modeling, creating the project quality team (with representatives of all major activity areas), and writing and imposing the quality plan. A key part of the quality plan is the reliability plan.

Design and development

During the design and developmental stage, reliability predictions, qualification and selection of components, definition of quality assurance audit standards, and prototyping of critical areas of the system ensured built-in reliability.

Manufacturing and field deployment

During manufacturing and field deployment, techniques such as premanufacturing, qualification, production quality tracking, failure mode analysis, and feedback and correction further enhance the ongoing reliability of the DMX*press*.

Reliability requirements

The DMX*press* meets all applicable Telcordia Technologies reliability requirements that cover transmission availability. The applicable Telcordia Technologies requirements and objectives were clarified through interactions with Telcordia Technologies during their audit of DMX*press*. The basis for these requirements comes from GR-TSY-000418, “Generic Reliability Assurance Requirements for Fiber Optic Transport Systems.” The methods and assumptions used to calculate the DMX*press* 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 central office environment and 5.25 minutes per year in a remote terminal environment (GR-NWT-000418, Issue 1, December 1997). Telcordia Technologies objectives for outages are 0.25 minutes per year for the central office and 0.75 minutes per year for remote terminal environments (GR-NWT-000418, Issue 1, December 1997).

The outage requirements and objectives apply to any part of the product needed to process an incoming high-speed (OC-48) or low-speed (DS1, DS3, EC1, OC-3, OC-12) signal . 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 (GR-499-CORE, Issue 2, December 1998, Section 2.1.2).

Markov modeling was used to calculate the predicted system outage. The analysis 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 GR-TSY-000332, "*Reliability Prediction Procedure for Electronic Equipment (RPP).*"

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Infant Mortality and Design Life

Environmental stress testing

DMX*press* 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 subject 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.

International Standards Organization (ISO) Certification

Overview

Lucent Technologies' Transmission Systems Business Unit received ISO 9001 certification for its Merrimack Valley manufacturing facility and associated development organization on September 15, 1992. Merrimack Valley manufactures systems for transporting data, voice, and images over public and private telecommunications networks. Major product lines consist of digital access and cross-connect systems, network multiplex systems, and lightwave systems.

ISO 9001

ISO 9001 is an international quality standard recognized by more than 50 countries. ISO 9001 is the most comprehensive standard in the ISO 9000 series, requiring well-documented and implemented controls for design development, production, delivery, installation, and service. Its purpose is to ensure manufacturers produce products with consistently high levels of quality and service.

Warranty

Hardware warranty

Lucent Technologies provides a one year hardware warranty on the DMX Access Multiplexer, effective from the manufactured date stamped on each individual unit.

Lucent Technologies provides two contacts for hardware failure emergencies. The Repair and Return line is to be used when ever a piece of equipment has failed to the point that it requires repairs, or must be replaced. The only times the Hotline is to be used is in the event of a service outage or during the initial installation and turn-up of the DMX*press*.

- Repair and Return: 1-800-255-1402
- Emergency Hotline: 1-800-869-6757

Software warranty

Lucent Technologies provides a one year software warranty on the DMX*press*, effective when one of the following actions occurs (whichever comes first):

- date of customer's first service installation
- date of customer's acceptance as identified in the purchase agreement
- 30 days after shipment of the software generic.

Lucent's warranty on any software release will not exceed 24 months after general availability (GA) of that release. All warranties pertain to the deployment of a release and do not apply to individual software licenses. For more warranty information, contact your local Lucent Technologies Account Executive.

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9 Technical Specifications

Overview

Purpose

The DMX*press* system consists of a chassis with three slots: Main, Option 1 and Option 2. The Main slot must always be equipped with the OC48/12 MAIN card. Option slot 1 accepts the DS3/DS1 TDM (Time Division Multiplex), DS3/12 TDM, as well as the OC-3 and OC-12 low-speed cards. Option slot 2 accepts the FASTE/16 or the GbE. A power supply, permanently mounted inside the chassis converts AC or DC power to the voltages needed by the system components. The DMX*press* can be ordered to support either AC or DC input voltage.

NOTE

The technical specifications for the GbE/4, FASTE/16 with Ethernet enhancements, and private line Ethernet cards are not yet available. General descriptions of these packs are provided in Chapter 3.

This section contains the technical specifications for the Metropolis®DMXpress Access Multiplexer (DMX*press*), including the following:

- Transmission Interface Standards
- Electrical Interfaces
- Optical Interfaces
- System Performance
- Operations Interfaces
- Physical Specifications

Contents This chapter contains the following sections:

DMX*press* Component Specifications and Operating Conditions

Overview

Purpose

This section will detail the specifications for each component of the DMX*press* system. This section will also detail the environmental operating conditions for the DMX*press* components and system.

Contents

DMX*press* Component Specifications

Chassis

The chassis consists of the following:

- Dimensions: Approximately 17.3” W, 15” D, 3.5 H (2RU)
- Card guides for three horizontally oriented circuit packs
- Three cooling fans located on the right side of the chassis
- One power supply rated for 300W maximum input
- AC input connector or DC input terminal strip (four positions) for two redundant DC feeds (-48V nominal)
- Air flow direction is from left to right
- Power on/standby switch

OC-48 High-speed (Main) Circuit Packs

The 2 port OC-48 circuit packs (A1AA005 and the A1AA121-159 DWDM series) consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 25mm overall height.
- Power Dissipation: 91.00 W (A1AA005) estimated and 121.00 W (DWDM series) maximum at 55^{o} C ambient.
- Optical Interfaces: Two sets of LC connectors for OC48 intermediate reach 1310nm (nominal) SONET optical signals.
- Metallic Interfaces: Three RJ45 interfaces, one for RS-232 Craft Interface and two for LAN Craft Interface (front/rear LAN).

OC-12 High-speed (Main) Circuit Packs

The 2 port OC-12 circuit packs (A1AA016) consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 25mm overall height.
- Power Dissipation: 85.00 W estimated.
- Optical Interfaces: Two sets of LC connectors for OC--12 intermediate reach 1310nm (nominal) SONET optical signals.
- Metallic Interfaces: Three RJ45 interfaces, one for RS-232 Craft Interface and two for LAN Craft Interface (front/rear LAN).

OC-12 low-speed Circuit Pack

The 2 port OC-12 circuit pack (A1AA018) consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 30mm overall height.
- Power Dissipation: 40.00 W typical.
- Optical Interfaces: Two sets of LC connectors for OC12 intermediate reach 1310nm (nominal) SONET optical signals.
- Metallic Interfaces: Three RJ45 interfaces, one for RS-232 Craft Interface and two for LAN Craft Interface (front/rear LAN).

OC-3 low-speed Circuit Pack

The four port OC-3 (A1AA017) circuit pack consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 30mm overall height.
- Power Dissipation: 36.00 W typical.
- Optical Interfaces: Four sets of LC connectors for OC12 intermediate reach 1310nm (nominal) SONET optical signals.
- Metallic Interfaces: Three RJ45 interfaces, one for RS-232 Craft Interface and two for LAN Craft Interface (front/rear LAN).

DS1/DS3/16/1 (TDM) Circuit Pack

The TDM circuit pack (A1AA006) consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 30 mm overall height
- Power Dissipation: 10.0 W typical
- Interfaces:
  2 BNC connectors for DS3 interfaces
  16 RJ45 connectors for DS1 interfaces

DS3/12 (TDM) Circuit Pack

This TDM circuit pack (A1AA015) consists of the following:

- Dimensions: 250 mm wide, 320 mm deep, 30 mm overall height
- Power Dissipation: 29.0 W typical
- Interfaces:
  12 BNC connectors for DS3 interfaces

FASTE/16 Fast Ethernet Circuit Pack

The FASTE/16 (10/100 Mbps-- A1AA007) Ethernet circuit pack consists of the following:

- Dimensions: 370 mm wide, 320 mm deep, 25 mm overall height
- Power Dissipation: 46.0W typical.
- Interfaces: 16 (sixteen) RJ45 connectors for 10/100BaseT

GbE/2 (1000BASE-LX and 1000BASE-SX Gigabit Ethernet) Circuit Pack

The GbE/2 circuit packs (LX=A1AA008, SX=A1AA019) consists of the following:

- Dimensions: 370 mm wide, 320 mm deep, 25 mm overall height
- Power Dissipation: 66.0W estimated
- Interfaces: 2 dual LC optical connectors for 1000BASE-LX or 1000BASE-SX based on IEEE 802.3.

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DMX*press* Operating Conditions

Overview

The DMX*press* system is intended for indoor controlled environment applications. However, the DMX*press* can also be installed in outdoor huts or enclosures.

NOTE: The OC-48/12 MAIN, OC-48 DWDM, OC-3/12 low-speed, GbE/2, and FASTE/16 cards are not rated for outdoor installations because of component operating temperature limitations.

Current drain

The table below provides the maximum and average current drain requirements for a DMX*press* shelf equipped with a MAIN OC-48, TDM, and GbE Ethernet card.

Table 9-1 DMX*press* Current Drains

Shelf	Current Drains per Feeder in Amperes	
	Average @ –48V	Average @ –40V
DMX*press* Shelf	3.5	4.2

Environmental Specifications

The following table lists the environmental specifications for the individual DMX*press* components.

Table 9-2 Environmental Specifications

Item	Operating Ambient Temperature Range° Celsius	Humidity Range% R.H.	Altitude Range, referred to Sea Level in Meters
Chassis, Power Supply	-40 to +65	5 - 95	-60 - +1,800
OC48 MAIN Card	-5 to +55	5 - 90	-60 - +1,800
OC48 DWDM MAIN Card	-5 to +55	5 - 90	-60 - +1,800
OC12 MAIN Card	-40 to +65	5 - 95	-60 - +1,800
OC12 low-speed Card	-5 to +55	5 - 90	-60 - +1,800
OC3 low-speed Card	-5 to +5‘5	5 - 95	-60 - +1,800
DS3/DS1 Card	-40 to +65	5 - 95	-60 - +1,800

Item	Operating Ambient Temperature Range° Celsius	Humidity Range% R.H.	Altitude Range, referred to Sea Level in Meters
DS3/12 Card (Release 1.1)	-40 to +65	5 - 95	-60 - +1,800
GbE/2 Cards (SX/LX)	-5 to +55	5-90	-60 - +1,800
FASTE/16 Card	-5 to +55	5-90	-60 - +1,800

System Power Specifications

The following table lists the system power specifications for the DMX*press*.

Table 9-3 System Power

Item	Minimum	Maximum	Nominal
DC Power, A and B Feeds	-40 VDC	-57 VDC	-48 VDC
AC Power	90 VAC	265 VAC	120 VAC
System Power Dissipation	90 W	300 W	NA

Transmission interface standards

The following table lists the transmission interface standards for electrical, optical, and Ethernet interfaces for the DMX*press* circuit packs.

Table 9-4 Transmission Interface Standards

Interface	Standard	Comments
DS1/DS3/16/1	*ANSI* T1.231-1997, GR-499-CORE, Issue 2, 1998	B8ZS/AMI option, SF/ESF (DS1) VMR, VM, or clear channel (DS3)
DS3/12	*ANSI* T1.231-1997 GR-499-CORE, Issue 2, 1998	B8ZS/AMI option, SF/ESF (DS1) VMR, VM, or clear channel (DS3)
OC48 MAIN OC48 DWDM OC12 MAIN	GR-253-CORE, Issue 3, 2000 GR-496-CORE, Issue 1, 1998 GR-1400-CORE, Issue 2, 1999 *ANSI* T1.231-1997	
OC3 low-speed OC12 low-speed	GR-253-CORE, Issue 3, 2000 GR-496-CORE, Issue 1, 1998 GR-1400-CORE, Issue 2, 1999 *ANSI* T1.231-1997	
FASTE/16 GbE/2	IEEE 802.3 IEEE802.1	

OC-48 MAIN OLIU (A1AA005) and DWDM OLIUs (A1AA121-159)

Optical specification

The 2 port OC-48 OLIU photonics meet or exceed SONET intermediate-reach specifications (SONET IR-1 DFB category). The distributed feedback laser (DFB) supplies a 1310 nm, scrambled NRZ-coded signal.

This OC-48 interface supports span lengths up to 20 km. Refer to the "OC-48 (A1AA005) and OC-12 (A1AA016) High-Speed (MAIN) Circuit Packs" (9-15) and "OC-48 DWDM Optics (A1AA121-A1AA159)" (9-18) section in this chapter for detailed system, transmitter, receiver, and link budget specifications.

Alarm thresholding

The following parameters are monitored on the OC-48 MAIN interface:

- LOS
- LOF
- LOP
- AIS-L
- RDI-L (FERF)
- Line AIS
- Path Unequipped
- Signal Degrade (BER)
- Signal Fail (BER).

Performance monitoring

SONET line and path performance monitoring complies with the standards outlined in GR-253-CORE. For detailed PM parameter thresholds on the OC-48 MAIN interface, refer to Table 10-15, SONET PM Parameters (9-44).

OC-12 MAIN OLIU (A1AA016)

Optical specification

The two port OC-12 MAIN OLIU photonics meet or exceed SONET intermediate-reach specifications (SONET IR-1 FP category). The FP laser supplies a 1310 nm, scrambled NRZ-coded signal.

This OC-12 MAIN interface supports span lengths up to 20 km. Refer to the “OC-48 (A1AA005) and OC-12 (A1AA016) High-Speed (MAIN) Circuit Packs” (9-15) section in this chapter for detailed system, transmitter, receiver, and link budget specifications.

Alarm thresholding

The following parameters are monitored on the OC-12 MAIN interface:

- LOS
- LOF
- LOP
- AIS-L
- RDI-L (FERF)
- Line AIS
- Path Unequipped
- Signal Degrade (BER)
- Signal Fail (BER).

Performance monitoring

SONET line and path performance monitoring complies with the standards outlined in GR-253-CORE. For detailed PM parameter thresholds on the OC-12 MAIN interface, refer to Table 10-15, SONET PM Parameters (9-44).

OC-3 Low-speed OLIU (A1AA017)

Optical specification

The 4 port OC-3 low-speed photonics meet or exceed SONET intermediate-reach specifications (SONET IR-1 Fabry Perot [FP] category). The FP laser transmitter supplies a 1310 nm, scrambled non-return-to-zero (NRZ) coded signal (155.52 Mb/s).

The long reach OC-3 interface supports span lengths up to 20 km. Refer to the SONET Optical Specifications section in this chapter for detailed system, transmitter, receiver, and link budget specifications.

Alarm thresholding

The following parameters are monitored on the OC-3 interface:

- LOS
- LOF
- LOP
- AIS-L
- RDI-L (FERF)
- Path AIS
- Path Unequipped
- Signal degrade (BER)
- Signal fail (BER).

Performance monitoring

SONET line and path performance monitoring complies with the standards outlined in GR-253-CORE. For detailed PM parameter thresholds on the OC-3 interface, refer to the SONET PM Parameters table at the end of this chapter.

OC-12 Low-speed OLIU (A1AA018)

Optical specification

The two port OC-12 low-speed photonics meet or exceed SONET intermediate-reach specifications (SONET IR-1 FP category). The FP laser supplies a 1310 nm, scrambled NRZ-coded signal (622.08 Mb/s).

The OC-12 low-speed interface supports span lengths up to 20 km. Refer to the “OC-48 (A1AA005) and OC-12 (A1AA016) High-Speed (MAIN) Circuit Packs” (9-15) section in this chapter for detailed system, transmitter, receiver, and link budget specifications.

Alarm thresholding

The following parameters are monitored at the low-speed OC-12 interface.

- LOF
- LOS
- LOP
- AIS-L
- RDI-L (FERF)
- Path AIS
- Path Unequipped
- Signal Degrade (BER)
- Signal Fail (BER).

Performance monitoring

SONET line and path performance monitoring complies with the standards outlined in GR-253-CORE. For detailed PM parameter thresholds on the OC-12 interface, refer to the SONET PM Parameters table at the end of this chapter.

GbE/2 (1000Mbps LX and SX) OLIUs (A1AA008 and A1AA019)

Optical specification

The A1AA008 OLIU photonics meet or exceed SONET Long-reach specifications (SONET LR-1 DFB category). The A1AA019 OLIU photonics meet or exceed SONET Short-reach specifications (SONET SR-1 DFB category). The distributed feedback laser (DFB) supplies a 1310 nm, scrambled NRZ-coded signal (2.488 Gb/s).

This GbE interface supports span lengths up to 20 km. Refer to the "GbE/2 LX (1000 Mbps) Ethernet" (9-26) and "GbE/2 SX (1000Mbps) Ethernet (A1AA019)" (9-32) sections in this chapter for detailed system, transmitter, receiver, and link budget specifications.

Alarm thresholding

The following parameters are monitored on the GbE/2 interface:

- LOS
- LOF
- LOP
- AIS-L
- RDI-L (FERF)
- Line AIS
- Path Unequipped
- Signal Degrade (BER)
- Signal Fail (BER).

Performance monitoring

SONET line and path performance monitoring complies with the standards outlined in GR-253-CORE. For detailed PM parameter thresholds on the GbE/2 interface, refer to "Performance Monitoring" (9-44).

SONET Optical Specifications

Overview

Purpose This section details the SONET optical specifications associated with both the high-speed and low-speed optical packs supported by the DMX*press*.

Contents

OC-48 (A1AA005) and OC-12 (A1AA016) High-Speed (MAIN) Circuit Packs

Overview

The following tables present the optical specifications for the OC-48 (AA1005) and OC-12 (A1AA016) MAIN OLIUs.

System specifications

The table below, lists the OC-48 (AA1005) and OC-12 (A1AA016) MAIN OLIUs system specifications.

Table 9-5 SONET Optical System Specifications

System Information	A1AA005	A1AA016
Optical Line Rate	2.488 Gb/s	622.08 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength	1310nm	1310 nm
Performance	SONET IR-1 (Intermediate Reach)	SONET IR-1 (Intermediate Reach)
Temperature Range (ambient)	-5 to +55^{o}C	-40 to +65^{o}C

Transmitter specifications

The table below, lists the OC-48 (AA1005) and OC-12 (A1AA016) MAIN OLIUs transmitter information.

Table 9-6 SONET Optical Transmitter Information

Transmitter Info.	A1AA005	A1AA016
Optical Device Temperature Controller	None	None
FDA Classification	Class I	Class I
Optical Source	Distributed Feed-Back (DFB) Laser	Fabry Perot (FP) Laser
Faceplate Optical Connector	LC connector	LC connector

Receiver specifications

The table below, lists the OC-48 (AA1005) and OC-12 (A1AA016) MAIN OLIUs receiver information.

Table 9-7 SONET Optical Receiver Information

Receiver Information	A1AA005	A1AA016
Optical Detector	PIN	PIN
Faceplate Optical Connector	LC connector	LC connector

Link budgets

The table below, lists the OC-48 (AA1005) and OC-12 (A1AA016) MAIN OLIUs link budgets.

Table 9-8 Optical Specifications and Link Budgets

Parameter (Note 1)	A1AA005 OC-48 IR-1	A1AA016 OC-12 IR-1
Minimum Wavelength	1260 nm	1293 nm (1274 nm)
Maximum Wavelength	1360 nm	1334 nm (1356 nm)
Maximum Spectral Width ($\Delta\lambda_{20}$)	1.0	NA
Maximum RMS Spectral Width (σ)	NA	2.5 nm (4.0 nm)
Maximum Transmitter Power	0.0 dBm	-8.0 dBm
Minimum Transmitter Power	-5.0 dBm	-15.0 dBm
Maximum Received Power ($1x10^{-12}$ BER)	-0.0 dBm	-8.0 dBm
Minimum Received Power ($1x10^{-12}$ BER)	-18.0 dBm	-28.0 dBm
Minimum System Gain (see Note 2)	13.0 dB	13.0 dB
Optical Path Penalty (see Note 3)	1.0 dB	1.0 dB
Additional Connector Loss Margin (see Note 4)	1.5 dB	1.5 dB
Additional Unallocated Margin (see Note 5)	1.5 dB	1.5 dB
Minimum Loss Budget	0.0 dB	0.0 dB
Maximum Loss Budget (see Note 6)	9.0 dB	9.0 dB
Approximate Span Length (see Note 7)	20 km	20 km

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3. All values

are worst-case end of life (EOL).

2. The System Gain includes connector loss at the transmitter and receiver points S and R in GR-253-CORE, Issue 3.
3. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1310 nm optics is a maximum of 1.0 dB.
4. One additional connector (0.75 dB) on each end is assumed to connect station cable to outside plant.
5. Additional unallocated margin, or safety margin, can be 0-3 dB. Typically, a 1.5 dB value is assumed.
6. The stated maximum loss budget equals the System Gain, less the Optical Path Penalty, the Additional Connector Loss Margin, and the Additional Unallocated Margin. The resultant Maximum Loss Budget is available for station cable loss, transmission cable loss, and splice loss.
7. The Approximate Span Length values are calculated per an attenuation assumption. As a general rule, for attenuation-limited systems, an attenuation of 0.45 dB/km is used for 1310 nm optics. This estimate includes typical cable loss (0.40 dB/km) and up to 11 splice losses (0.2 dB per splice). For 1310 nm OC-48 systems, dispersion is not a limiting factor, and the applications are attenuation-limited. Approximate Span Lengths can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

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OC-48 DWDM Optics (A1AA121-A1AA159)

Overview

The following tables present the optical specifications for the OC-48 DWDM circuit packs.

System specifications

The following table lists the DWDM high-speed (network interface) system specifications.

Table 9-9 SONET Optical System Specifications

System Information	OC-48 high-speed DWDM Optics (A1AA121-A1AA159)
Optical Line Rate	2.488 Gb/s
Optical Line Coding	Scrambled NRZ
Optical Wavelength	1530 nm - 1560 nm
Performance	Customized LR-2 (for DWDM)
Temperature Range	CO

Transmitter specifications

The following table lists the DWDM optics transmitter information.

Table 9-10 SONET Optical Transmitter Information

Transmitter Info.	OC-48 high-speed DWDM Optics (A1AA121-A1AA159)
Optical Device Temperature Controller/Thermo-Electric Cooler (TEC)	Yes
Transmission Medium	Input Fiber: Standard Single-Mode Non-Dispersion Shifted Fiber Output Fiber: Standard Single-Mode Non-Dispersion Shifted Fiber
FDA Classification	Class I
Optical Source	Distributed Feed-Back (DFB) Laser or Externally Modulated Laser (EML)
Faceplate Optical Connector	LC connector

Receiver specifications

The following table lists the passive DWDM optics receiver information.

Table 9-11 SONET Optical Receiver Information

Receiver Information	OC-48 high-speed DWDM Optics (A1AA121-A1AA159)
Optical Detector	Avalanche Photodiode (APD)
Faceplate Optical Connector	LC connector

Operating wavelengths

The table below lists the ITU channel numbers, operating wavelengths, and frequencies for the OC-48 DWDM OLIUs.

Table 9-12 OC-48 DWDM OLIUs Wavelength Plan

Port Unit	ITU Channel #	Wavelength (nm)	Frequency (Thz)
A1AA121	21 22	1560.606 1559.794	192.10 192.20
A1AA123	23 24	1558.983 1558.173	192.30 192.40
A1AA125	25 26	1557.363 1556.555	192.50 192.60
A1AA127	27 28	1555.747 1554.940	192.70 192.80
A1AA131	31 32	1552.524 1551.721	193.10 193.20
A1AA133	33 34	1550.918 1550.116	193.30 193.40
A1AA135	35 36	1549.315 1548.515	193.50 193.60
A1AA137	37 38	1547.715 1546.917	193.70 193.80
A1AA143	42 43	1543.730 1542.936	194.20 194.30
A1AA145	44 45	1542.142 1541.349	194.40 194.50
A1AA147	46 47	1540.557 1539.766	194.60 194.70
A1AA149	48 49	1538.976 1538.186	194.80 194.90
A1AA153	52 53	1535.822 1535.036	195.20 195.30
A1AA155	54 55	1534.250 1533.465	195.40 195.50
A1AA157	56 57	1532.681 1531.898	195.60 195.70
A1AA159	58 59	1531.116 1530.334	195.80 195.90

Optical requirements and loss budgets

The table below lists the optical requirements and link budgets for the OC-48 DWDM OLIUs.

Table 9-13 Optical Requirements and Link Budgets for the OC-48 DWDM OLIUs

Parameter	OC-48 DWDM (A1AA121-A1AA159)
Interface Type (Note 1)	OC-48 Custom LR-2 for DWDM
DWDM Wavelength Range (100 GHz spacing)	1530.334-1560.606 nm
Maximum Spectral Width ($\Delta\lambda_{20}$)	0.5 nm
Maximum Transmitter Power	+2.0 dBm
Minimum Transmitter Power	-1.0 dBm
Maximum Received Power ($1x10^{-10}$BER)	-8.0 dBm
Minimum Received Power ($1x10^{-10}$BER)	-29.0 dBm
Minimum System Gain (see Note 2)	28.0 dB
Dispersion	1800 ps/nm
Optical Path Penalty (see Note 3)	2.0 dB
Additional Connector Loss Margin (see Note 4)	1.5 dB
Additional Unallocated Margin (see Note 5)	1.5 dB
Minimum Loss Budget (see Note 6)	10.0 dB
Maximum Loss Budget (see Note 7)	23.0 dB
Approximate Span Length (see Note 8)	85 km*
*This span length assumes no passive optical unit (POU) is being used.	

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3. All values are worst-case end of life (EOL).
2. The System Gain includes connector loss at the transmitter and receiver points S and R in GR-253-CORE, Issue 3.
3. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1550 nm optics is normally 2.0 dB.
4. One additional connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

5. Additional unallocated margin, or safety margin, can be 0-3 dB. Typically, a 1.5 dB value is assumed.
6. The LNW 121B-159B, LNW221-259, and LNW421-459 series all require an external lightguide build-out (optical attenuator) as part of the connector assembly for optical loopbacks and for loss budgets less than 10 db to avoid overloading the optical reciever.
7. The stated maximum loss budget equals the System Gain, less the Optical Path Penalty, the Additional Connector Loss Margin, and the Additional Unallocated Margin. The resultant Maximum Loss Budget is available for station cable loss, transmission cable loss, and splice loss. The stated maximumloss budget is conservative; i.e. if additional connector loss margins and additional unallocated margin are not needed, an additional 3 dB of budget is available.
8. The Approximate Span Length values are calculated per an attenuation assumption. As a general rule, for attenuation-limited systems, an attenuation of 0.27 dB/km is used for 1550 nm optics. This estimate includes typical cable loss (0.22 dB/km) and up to 11 splice losses (0.2 dB per splice). For 1550 nm OC-48 systems, dispersion can also be limiting factor. Approximate Span Lengths can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

□

OC-3 (A1AA017) and OC-12 (A1AA018) Low-speed OLIUs Optical Specifications:

Overview

The following tables present the optical specifications for the four port OC-3 (A1AA017) and two port OC-12 (A1AA018) OLIUs.

System specifications

The table below lists the four port OC-3 (A1AA017) and two port OC-12 (A1AA018) OLIUs system specifications.

Table 9-14 SONET Optical System Specifications

System Information	A1AA017	A1AA018
Optical Line Rate	155.52 Mb/s	622.08 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength	1310nm	1310 nm
Performance	SONET IR-1 (Intermediate Reach)	SONET IR-1 (Intermediate Reach)
Temperature Range (ambient)	-40 to +65^{o}C	-5 to +55^{o}C

Transmitter specifications

The table below lists the OC-3 (A1AA017) and OC-12 (A1AA018) OLIUs transmitter information.

Table 9-15 SONET Optical Transmitter Information

Transmitter Info.	A1AA017	A1AA018
Optical Device Temperature Controller	None	None
FDA Classification	Class I	Class I
Optical Source	Fabry Perot (FP) Laser	FP Laser
Faceplate Optical Connector	LC connector	LC connector

Receiver specifications

The table below lists the OC-3 (A1AA017) and OC-12 (A1AA018) OLIUs receiver information.

Table 9-16 SONET Optical Receiver Information

Receiver Information	A1AA017	A1AA018
Optical Detector	PIN	PIN
Faceplate Optical Connector	LC connector	LC connector

Link budgets

The table below, lists the OC-3 (A1AA017) and OC-12 (A1AA018) MAIN OLIUs link budgets.

Table 9-17 SONET Optical Link Budgets

Parameter (Note 1)	A1AA017 OC-3 IR-1	A1AA018 OC-12 IR-1
Minimum Wavelength	1261 nm	1274 nm (1293 nm)
Maximum Wavelength	1360 nm	1356 nm (1334 nm)
Maximum Spectral Width ($\Delta\lambda_{20}$)	NA	NA
Maximum RMS Spectral Width (σ)	7.7 nm	2.5 nm (4.0 nm)
Maximum Transmitter Power	-8.0 dBm	-8.0 dBm
Minimum Transmitter Power	-15.0 dBm	-15.0 dBm
Maximum Received Power ($1x10^{-12}$ BER)	-8.0 dBm	-8.0 dBm
Minimum Received Power ($1x10^{-12}$ BER)	-28.0 dBm	-28.0 dBm
Minimum System Gain (see Note 2)	13.0 dB	13.0 dB
Optical Path Penalty (see Note 3)	1.0 dB	1.0 dB
Additional Connector Loss Margin (see Note 4)	1.5 dB	1.5 dB
Additional Unallocated Margin (see Note 5)	1.5 dB	1.5 dB
Minimum Loss Budget	0.0 dB	0.0 dB
Maximum Loss Budget (see Note 6)	9.0 dB	9.0 dB
Approximate Span Length (see Note 7)	20 km	20 km

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3. All values are worst-case end of life (EOL).
2. The System Gain includes connector loss at the transmitter and

receiver points S and R in GR-253-CORE, Issue 3.

3. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1310 nm optics is a maximum of 1.0 dB.
4. One additional connector (0.75 dB) on each end is assumed to connect station cable to outside plant.
5. Additional unallocated margin, or safety margin, can be 0-3 dB. Typically, a 1.5 dB value is assumed.
6. The stated maximum loss budget equals the System Gain, less the Optical Path Penalty, the Additional Connector Loss Margin, and the Additional Unallocated Margin. The resultant Maximum Loss Budget is available for station cable loss, transmission cable loss, and splice loss.
7. The Approximate Span Length values are calculated per an attenuation assumption. As a general rule, for attenuation-limited systems, an attenuation of 0.45 dB/km is used for 1310 nm optics. This estimate includes typical cable loss (0.40 dB/km) and up to 11 splice losses (0.2 dB per splice). For 1310 nm OC-48 systems, dispersion is not a limiting factor, and the applications are attenuation-limited. Approximate Span Lengths can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

□

GbE/2 LX (1000 Mbps) Ethernet

Optical specification

The GbE/2 LX circuit pack provides a long-reach, 2-port, 1000BASE-LX, IEEE 802.3-compliant interface. The GbE/2 LX circuit pack performs protocol transparent filtering and bridging of incoming media access control (MAC) frames. MAC frames with a destination address on the local bus are filtered by the GbE/2 LX to prevent unnecessary transmission of frames over the wide area network (WAN). The GbE/2 LX must be housed in Option Slot 2 and is not equipment protected. However, protection is provided via SONET UPSR or through the IEEE 802.1D spanning tree algorithm.

The GbE/2 LX Ethernet interface complies with the following transmission standards:

- standard IEEE 802.1D for transparent bridging and spanning tree protection
- standard IEEE 802.3 auto negotiation (for flow control).

System specifications

The following are the GbE/2 LX system specifications:

- Optical Line Rate: 1.25 Gb/s +/- 100 ppm
- Optical Line Coding: 8B/10B
- Performance: Long-reach.
- Transmitter Type: LX-long wavelength (long-reach)

Operating range

The table below shows the operating range for the GbE/2 LX optical Ethernet interface. A 1000BASE-LX compliant transceiver supports 10 µm fiber media types. A transceiver that exceeds the operational range requirement while meeting all other optical specifications is considered compliant (e.g., a 10 µm solution operating at 5500 m meets the minimum range requirement of 2 to 5000 m).

Table 9-18 GbE/2 LX Operating Range Over Each Optical Fiber Type

Fiber Type	Modal Bandwidth @ 1300 nm (minimum overfilled launch) (MHz-km)	Minimum Range (meters)
10 µm SMF	N/A	2 to 5000

Transmitter specifications

The table below describes the transmit specifications for GbE/2. The 1000BASE-LX transmitter meets these specifications per measurement techniques define in IEEE 802.3, Section 38, Clause 6.

Table 9-19 GbE/2 LX Transmit Specifications

Description	10 μm SMF	Unit
Transmitter type	Longwave Laser	
Signaling speed (range)	1.25 +/- 100 ppm	GBd
Wavelength (l, range)	1270 to 1335	nm
T_{rise}/T_{fall} (max; 20%-80% response time)	0.26	ns
RMS spectral width (max)	4	nm
Average launch power (max)	-3	dBm
Average launch power (min)	-11.0	dBm
Average launch power of OFF transmitter (max)	-30	dBm
Extinction ratio (min)	9	dB
RIN (max)	-120	dB/Hz
Coupled Power Ratio (CPR) (min) **(Note 1)**	N/A	dB

Receiver specifications

The GbE/2 LX receiver meets the specifications defined in the table below, per measurement techniques defined in IEEE 802.3, Section 38.6. The sampling instant is defined to occur at the eye center. The receive sensitivity includes the extinction ratio penalty.

Table 9-20 GbE/2 LX Receive Specifications

Description	10 μm SMF	Unit
Signaling speed (range)	1.25 +/- 100 ppm	GBd
Wavelength (range)	1270 to 1355	nm
Average receive power (max)	-3	dBm
Receive sensitivity	-19	dBm
Return loss (min)	12	dB
Stressed receive sensitivity **(Notes 1 and 2)**	-14.4	dBm
Vertical eye-closure penalty **(Note 3)**	2.60	dB
Receive electrical 3 dB upper cutoff frequency (max)	1500	MHz

Notes:Table notes

1. Measured with conformance test signal at TP3 (see IEEE 802.3, Section 38.6.11) for BER at the eye center.
2. Measured with a transmit signal having a 9 dB extinction ratio. If another extinction ratio is used, the stressed receive sensitivity should be corrected for the extinction ratio penalty.
3. Vertical eye-closure penalty is a test condition for measureing stressed receive sensitivity. It is not a required characteristic of the receiver.

Link budgets

The worst-case power budget and link penalties for a GbE/2 LX channel are shown in the table below.

Table 9-21 GbE/2 LX Link Budgets and Penalties

Parameter	**10 μm SMF**	**Unit**
Modal bandwidth as measured at 850 nm (minimum, overfilled launch)	N/A	MHz-km
Link power budget	8.0	dB
Operating distance	5000	m
Channel insertion loss **(Notes 1 and 2)**	4.57	dB
Link power penalties **(Note 2)**	3.27	dB
Unallocated margin in link power budget **(Note 2)**	0.16	dB

Notes:Table notes

1. Operating distances used to calculate the channel insertion loss are the maximum values specified in Table 10-10.
2. A wavelength of 1270 nm is used to calculate the channel insertion loss, link power penalties, and unallocated margin.

Format specification

The GbE/2 LX Ethernet interface complies with the following formatting standards:

- standard IEEE 802.1Q VLAN encapsulation (user assigned or network assigned)
- standard ANSI T1X1.5/2000-147 generic framing procedure (encapsulating Ethernet frames and mapping them into SONET format)
- standard ITU G.707 STS-1 virtual concatenation.

Performance monitoring

Threshold Crossing Alerts (TCAs) are not supported on the GbE/2 LX interface, however PM capabilities are available including:

- Dropped Frames (congestion)
- Dropped Frames (errors)
- Incoming Number of Bytes
- Outgoing Number of Bytes
- Incoming Number of Frames
- Outgoing Number of Frames.

GbE/2 SX (1000Mbps) Ethernet (A1AA019)

Optical specification

The GbE/2 SX circuit pack provides a short-reach, 2-port, 1000BASE-SX, IEEE 802.3-compliant interface. The GbE/2 SX circuit pack performs protocol transparent filtering and bridging of incoming media access control (MAC) frames. MAC frames with a destination address on the local bus are filtered by the GbE/2 SX to prevent unnecessary transmission of frames over the wide area network (WAN). The GbE/2 SX must be housed in slot 1 of a Function Unit group and is not equipment protected. However, protection is provided via SONET UPSR or through the IEEE 802.1D spanning tree algorithm.

The GbE/2 SX Ethernet interface complies with the following transmission standards:

- standard IEEE 802.1D for transparent bridging and spanning tree protection
- standard IEEE 802.3 auto negotiation (for flow control).

System specifications

The following are the GbE/2 SX system specifications:

- Optical Line Rate: 1.25 Gb/s +/- 100 ppm
- Optical Line Coding: 8B/10B
- Performance: Short-reach.

Operating range

The table below shows the operating range for the GbE/2 SX optical Ethernet interface. A 1000BASE-SX compliant transceiver supports both 50 µm and 62.5 µm fiber media types. A transceiver that exceeds the operational range requirement while meeting all other optical specifications is considered compliant (e.g., a 50 µm solution operating at 600 m meets the minimum range requirement of 2 to 550 m).

Table 9-22 GbE/2 SX Operating Range Over Each Optical Fiber Type

Fiber Type	Modal Bandwidth @ 850 nm (minimum overfilled launch) (MHz-km)	Minimum Range (meters)
62.5 µm MMF	160	2 to 220
62.5 µm MMF	200	2 to 275
50 µm MMF	400	2 to 500
50 µm MMF	500	2 to 550
10 µm SMF	Not supported	Not supported

Transmitter specifications

The table below shows GbE/2 SX optical transmitter specifications. The 1000BASE-SX transmitter meets these specifications per measurement techniques define in IEEE 802.3, Section 38, Clause 6.

Table 9-23 GbE/2 SX Transmit Specifications

Description	62.5/50 μm MMF	Unit
Transmitter type	Shortwave Laser	
Signaling speed (range)	1.25 +/- 100 ppm	GBd
Wavelength (l, range)	770 to 860	nm
T_{rise}/T_{fall} (max; 20%-80%; l > 830 nm)	0.26	ns
T_{rise}/T_{fall} (max; 20%-80%; l < 830 nm)	0.21	ns
RMS spectral width (max)	0.85	nm
Average launch power (max)	**Note 1**	dBm
Average launch power (min)	-9.5	dBm
Average launch power of OFF transmitter (max) **(Note 2)**	-30	dBm
Extinction ratio (min)	9	dB
RIN (max)	-117	dB/Hz
Coupled Power Ratio (CPR) (min) **(Note 3)**	9 < CPR	dB

Notes:Table notes

1. The 1000BASE-SX launch power shall be the lesser of the class 1 safety limit as defined by IEEE 802.3, Section 38, Clause 7.2 or the average receiver power (maximum) defined by Table 10-8.
2. Examples of an OFF transmitter are as follows: no power supplied to the Physical Medium Dependent (PMD), laser shutdown for safety conditions, and activation of a “transmit disable” or other optional module laser shut-down conditions. During all conditions when the Physical Medium Attachment (PMA) is powered, the ac signal (data) into the transmit port will be valid encoded 8B/10B patterns (this is a requirement of the Physical Coding Sublayer [PCS]) except for short durations during system power-on-reset or diagnostics when the PMA is placed in a loopback mode.
3. Radial overfilled launches (described in IEEE 802.3, Section 38A, Clause 2) should be avoided even if they meet CPR ranges.

Receiver specifications

The 1000BASE-SX receiver meets the specifications defined in the table below, per measurement techniques defined in IEEE 802.3, Section 38, Clause 6. The sampling instant is defined to occur at the eye center. The receive sensitivity includes the extinction ratio penalty.

Table 9-24 GbE/2 SX Receive Specifications

Description	62.5 μm MMF	50 μm MMF	Unit
Signaling speed (range)	1.25 +/- 100 ppm	1.25 +/- 100 ppm	GBd
Wavelength (range)	770 to 860	770 to 860	nm
Average receive power (max)	0	0	dBm
Receive sensitivity	-17	-17	dBm
Return loss (min)	12	12	dB
Stressed receive sensitivity **(Notes 1 and 2)**	-12.5	-13.5	dBm
Vertical eye-closure penalty **(Note 3)**	2.60	2.20	dB
Receive electrical 3 dB upper cutoff frequency (max)	1500	1500	MHz

Notes:Table notes

1. Measured with conformance test signal at TP3 (see IEEE 802.3, Section 38.6.11) for BER at the eye center.
2. Measured with a transmit signal having a 9 dB extinction ratio. If another extinction ratio is used, the stressed receive sensitivity should be corrected for the extinction ratio penalty.
3. Vertical eye-closure penalty is a test condition for measureing stressed receive sensitivity. It is not a required characteristic of the receiver.

Link budgets The worst-case power budget and link penalties for a 1000BASE-SX channel are shown in the table below.

Table 9-25 GbE/2 SX Link Budgets and Penalties

Parameter	**62.5 μm MMF**		**50 μm MMF**		**Unit**
Modal bandwidth as measured at 850 nm (minimum, overfilled launch)	160	200	400	500	MHz-km
Link power budget	7.5	7.5	7.5	7.5	dB
Operating distance	220	275	500	550	m
Channel insertion loss **(Notes 1 and 2)**	2.38	2.60	3.37	3.56	dB
Link power penalties **(Note 2)**	4.27	4.29	4.07	3.57	dB
Unallocated margin in link power budget **(Note 2)**	0.84	0.60	0.05	0.37	dB

Notes:Table notes

1. Operating distances used to calculate the channel insertion loss are the maximum values specified in Table 10-6.
2. A wavelength of 830 nm is used to calculate the channel insertion loss, link power penalties, and unallocated margin.

Format specification

The GbE/2 SX Ethernet interface complies with the following formatting standards:

- standard IEEE 802.1Q VLAN encapsulation (user assigned or network assigned)
- standard ANSI T1X1.5/2001-024R5 generic framing procedure (encapsulating Ethernet frames mapping them into a SONET payload)
- standard ITU G.704.1 STS-1 virtual concatenation.

Performance monitoring

Performance monitoring capabilities are available on the GbE/2 SX interface, however Threshold Crossing Alerts (TCAs) are not supported. Monitored parameters include:

- Dropped Frames (congestion)
- Dropped Frames (errors)
- Incoming Number of Bytes
- Outgoing Number of Bytes
- Incoming Number of Frames
- Outgoing Number of Frames.

Electrical Interface Parameters

Overview

Purpose This section contains the technical specifications for the low-speed electrical interfaces.

Contents

DS1/DS3/16/1 TDM Option Card (A1AA006)

Electrical specification

The DS1/DS3/16/1 low-speed interface transmits and receives a standard electrical DS1 or DS3 signal as specified in GR-499-CORE (1.544 Mb/s nominal rate, DSX-1 and DSX-3 interconnect specification). Line coding is provisionable per DS1 port to alternate mark inversion (AMI) or AMI with bipolar 8-zero substitution (B8ZS).

Format specification

The DS1/DS3/16/1 low-speed interface provides clear channel transport of any DSX-1 and/or DSX-3 compatible signal. There are no format constraints on this interface. The DS1/DS3/16/1 interface can be provisioned for the following DS1/DS3 formats: clear channel (default), superframe (SF), or extended superframe (ESF) as specified in GR-499-CORE, Section 10. In the case of SF or ESF format selections, DS1 performance monitoring information is collected by monitoring the associated DS1 framing format per *ANSI* T1.231-1997.

Alarm thresholding

The following parameters are monitored on the DS1/DS3/16/1 interface:

- Loss of signal (LOS)
- Bit error rate threshold (BER) based on line coding violations (CV-L).

The alarm level for the monitored parameters can be provisioned to critical (CR), major (MJ), minor (MN), or status. B8ZS and AMI coding violation failure thresholds are user setable to 10^{-3} through 10^{-8}.

Loopbacks

The following loopbacks are supported on the DS1/DS3/16/1 low-speed interface:

- Per-port DS1 facility loopback
- Per-port DS1 terminal loopback.
- Per-port DS3 facility loopback
- Per-port DS3 terminal loopback

Line build-outs (LBOs)

Line build-outs are software-provisionable. The maximum distance depends on the cable type (maximum 565 feet).

Performance monitoring

PM data is reported for DS3 signals when DMX*press* is equipped with the DS1/DS3/16/1 circuit pack. For a detailed list of PM parameters and thresholds, refer to Table 10-15, SONET PM Parameters (9-44).

□

DS3/12 TDM Option Card (A1AA015)

Electrical specification (DS3)

The low-speed DS3 interface (Release 1.1) transmits/receives a standard electrical DS3 signal as specified in GR-499-CORE, Section 9 (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.

FASTE/16 (10/100 Mbps) Ethernet Option Card (A1AA007)

Electrical specification

The FASTE/16 circuit pack provides a 16-port, 100BASE-TX, IEEE 802.3-compliant interface. The FASTE/16 port performs protocol transparent filtering and bridging of incoming media access control (MAC) frames. MAC frames with a destination address on the local bus are filtered by the FASTE/16 to prevent unnecessary transmission of frames over the wide area network (WAN). The FASTE/16 interface auto-negotiates in full/half duplex mode and speeds (10/100 Mb/s) when interfacing with other 802.3-compliant devices over twisted pair media. The FASTE/16 must be housed in Option Slot 2 and is not equipment protected. However, facility protection is provided through the WAN via SONET UPSR or through the IEEE 802.1D spanning tree algorithm. The FASTE/16 supports span lengths of 100 meters.

The FASTE/16 (10/100 Mb/s) Ethernet interface complies with the following transmission standards:

- standard IEEE 802.1D for transparent bridging and spanning tree protection
- standard IEEE 802.3, Section 25 for 10/100 Mbps auto negotiation (including flow control, full-duplex transmission, and half-duplex transmission).

Format specification

The FASTE/16 (10/100 Mb/s) Ethernet interface complies with the following formatting standards:

- standard IEEE 802.1Q VLANs
- standard *ANSI* T1X1.5/2000-147 generic framing procedure (encapsulating Ethernet frames and mapping them into a SONET payload.
- standard ITU G.707 STS-1 virtual concatenation.

Performance monitoring

Performance monitoring capabilities are available on the FASTE/16 (10/100 Mb/s) interface, however Threshold Crossing Alerts (TCAs) are not supported. Monitored parameters include:

- Dropped Frames (congestion)
- Dropped Frames (errors)
- Incoming Number of Bytes
- Outgoing Number of Bytes
- Incoming Number of Frames
- Outgoing Number of Frames.

Performance Monitoring

Overview

DMX*press* performance monitoring complies with GR-253-CORE and *ANSI* T1.231-1997 specifications for SONET and asynchronous networks.

SONET PM parameters

The table below lists the provisionable threshold range for monitored parameters and, in brackets, the default thresholds. Thresholding of any parameter(s) can be disabled.

Table 9-26 SONET PM Parameters

Parameter Definition		Threshold Range (Default)	
Facility	**Measure**	**Current Quarter Hour**	**Current Day**
OC-48 Section	SE Frame Seconds (SEFS)	1-63 [63]	1-4095 [30]
OC-48 Line	Coding Violations (CV)	1-55365 [5537]	1-5315040 [531504]
	Errored Seconds (ES)	1-900 [40]	1-65535 [900]
	Errored Seconds Type A (ESA)	1-900 [30]	1-65535 [90]
	Errored Seconds Type B (ESB)	1-900 [30]	1-65535 [90]
	Severely Errored Seconds (SES)	1-63 [20]	1-4095 [60]
	Unavailable Seconds (UAS)	1-63 [30]	1-4095 [90]
	STS Pointer Justification Counts (PJC)	1-65535 [60]	1-9999999 [5760]
DS3 Line	CV-L Coding Violations	1-16383 [40]	1-1048575 [3820]
	Errored Seconds, Line (ES-L)	1-900 [25]	1-65535 [250]
	Severely Errored Seconds, Line (SES-L)	1-63 [4]	1-4095 [40]
DS3 Path	P-Bit Error Counts	1-4026 [403]	1-386500 [38650]
	SE Frame Seconds (SEFS)	1-63 [10]	1-4095 [30]

Parameter Definition		**Threshold Range (Default)**	
Facility	**Measure**	**Current Quarter Hour**	**Current Day**
Enhanced DS3 Path for P-Bits, F&M Bits, and C-Bits from Fiber and DSX	Coding Violations (CV)	1-16383 [40]	1-1048575 [3820]
	ES-P Errored Seconds	1-900 [25]	1-65535 [250]
	SES-P Severely Errored Seconds	1-63 [4]	1-4095 [40]
	UAS-P Unavailable Seconds	1-63 [10]	1-4095 [10]
	SE Frame Seconds	1-63 [2]	1-4095 [8]
STS-1 Path	Coding Violations (CV)	1-4510 [451]	1-432960 [43296]
	Errored Seconds (ES)	1-900 [40]	1-65535 [900]
	Errored Seconds Type A (ESA)	1-900 [30]	1-65535 [90]
	Errored Seconds Type B (ESB)	1-900 [30]	1-65535 [90]
	Severely Errored Seconds (SES)	1-63 [20]	1-4095 [60]
	Unavailable Seconds	1-63 [30]	1-4095 [90]
VT1.5 Path	Errored Seconds (ES)	1-900 [40]	1-65535 [900]
	Severely Errored Seconds (SES)	1-63 [20]	1-4095 [60]
	Unavailable Seconds (UAS)	1-63 [30]	1-4095 [90]

Glossary

Acronyms and Abbreviations

1G
Gigabit

A

ABN
Abnormal (status condition)

ACO
Alarm Cutoff

ACO/SW
Alarm Cutoff and Test

ADM
Add/Drop Multiplexer

AGNE
Alarm Gateway Network Element

AIS
Alarm Indication Signal

AMI
Alternate Mark Inversion

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

ASN.1
Abstract Syntax Notation 1

ASNE
Alarm Server Network Element

ATM
Asynchronous Transfer Mode

Auto
Automatic

AUXCTL
Auxiliary Control

B

B3ZS
Bipolar 3-Zero Substitution

B8ZS
Bipolar 8-Zero Substitution

BDFB
Battery Distribution and Fuse Bay

BER
Bit Error Ratio

BIP
Bit Interleaved Parity

BITS
Building Integrated Timing Supply

BRI
Basic Rate Interface

C

CC
Clear Channel

CCITT
International Telephone and Telegraph Consultative Committee

CEV
Controlled Environment Vault

CD-ROM
Compact Disk, Read-Only Memory

CDTU
Channel and Drop Test Unit

CIT
Craft Interface Terminal

CLEC
Competitive Local Exchange Carrier

CLF
Carrier Line Failure Status

CMISE
Common Management Information Service Element

CMOS
Complementary Metal Oxide Semiconductor

CMTS
Cable Modem Termination System

CO
Central Office

CP
Circuit Pack

CPE
Customer Premises Equipment

CR
Critical (alarm status)

CSA
Carrier Serving Area

CSU
Channel Service Unit

CTL
Control

CTS
Customer Technical Support

CV
Coding Violation

CVFE
Coding Violation Far End

D

DCC
Data Communications Channel

DCE
Data Communications Equipment

DCS
Data Collection System

DEMUX
Demultiplexer

DLC
Digital Loop Carrier

DNS
Data Networking Services

DPLL
Digital Phase-Locked Loop

DRI
Dual Ring Interworking

DS1
Digital Signal Level 1

DS3
Digital Signal Level 3

DSL
Digital Subscriber Line

DSLAM
Digital Subscriber Line Access Multiplexer

DSNE
Directory Services Network Element

DSX
Digital Cross-Connect Panel

DT
Distant Terminal

DTE
Data Terminating Equipment

E

EC-1
Electrical Carrier Level 1

ECI
Equipment Catalog Item

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

ESD
Electrostatic Discharge

ESF
Extended Super Frame

EST
Environmental Stress Testing

F

FCC
Federal Communications Commission

FDDI
Fiber Distribution Data Interface

FE
Far End

FE ACTY
Far End Activity

FEBE
Far End Block Error

FE ID
Far End Identification

FEPROM
Flash EPROM

FERF
Far End Receive Failure

FE SEL
Far End Select

FIT
Failures in 10^{-9} hours of operation.

G

GbE
Gigabit Ethernet

GNE
Gateway Network Element

GR
Telcordia Technologies General Requirement

GTP
General Telemetry Processor

GUI
Graphical User Interface

H

HECI
Humans Equipment Catalog Item

HFC
Hybrid Fiber Coaxial

I

IAO LAN
Intra-Office Local Area Network

IC
Internal Clock

ID
Identifier

IEC
International Electrotechnology Commission

IMF
Infant Mortality Factor

INC
Incoming Status

I/O
Input/Output

IP
Internet Protocol

IR
Intermediate Reach

IS
In Service

ISCI
Intershelf control Interface

ISI
Intershelf Interface

ISDN
Integrated Services Digital Network

ISO
International Standards Organization

ISP
Internet Service Provider

IVHS
Intelligent Vehicle Highway System

L

LAN
Local Area Network

LAPD
Link Access Procedure "D"

LBO
Line Build Out

LCN
Local Communications Network

LEC
Local Exchange Carrier

LED
Light-Emitting Diode

LOF
Loss of Frame

LOP
Loss of Pointer

LOS
Loss of Signal

LR
Long Reach

LS
Low Speed

M

MD
Mediation Device

MJ
Major Alarm

MM
Multimode

MML
huMan-Machine Language

MN
Minor Alarm

MPEG
Moving Picture Experts Group

MSDT
Multi-Services Distant Terminal

MSO
Metropolitan Serving Office

MTBF
Mean Time Between Failures

MTBMA
Mean Time Between Maintenance Activities

Mult
Multipling

MUX
Multiplex

MXBIU
Multiplexer and Backplane Interface Unit

N

NAP
Network Access Point

NE
Near End

NE
Network Element

NE ACTY
Near-End Activity

NEBS
Network Equipment-Building System

nm
Nanometer (10^{-9} meters)

NMA
Network Monitoring and Analysis

NMON
Not Monitored (provisioning state)

NRZ
Nonreturn to Zero

NNI
Network-Network Interface

NSA
Not Service Affecting

NSAP
Network Services Access Point

NTF
No Trouble Found

O

OAM&P
Operations, Administration, Maintenance, and Provisioning

OC-1
Optical Carrier Level 1 Signal (51.84 Mb/s)

OC-3
Optical Carrier Level 3 Signal (155 Mb/s)

OC-12
Optical Carrier Level 12 Signal (622 Mb/s)

OC-48
Optical Carrier Level 48 Signal

OLIU
Optical Line Interface Unit

OOF
Out of Frame

OOL
Out of Lock

OPS/INE
Operations System/Intelligent Network Element

OS
Operations System

OSGNE
Operations System Gateway Network Element

OSI
Open Systems Interconnection

OSMINE
Operations Systems Modifications for the Integration of Network Elements

OSP
Outside Plant

P

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

PLL
Phase-Locked Loop

PM
Performance Monitoring

PMN
Power Minor Alarm

POH
Path Overhead

POP
Points of Presence

POTS
Plain Old Telephone Service

PRM
Performance Report Message

PROTN
Protection

PRS
Primary Reference Source

PSU
Power Supply Unit

PVC
Permanent Virtual Circuit

PWR
Power

R

RAM
Random Access Memory

RDC
Regional Data Center

RPP
Reliability Prediction Procedure (described in Telcordia Technologies TR-NWT-00032)

RT
Remote Terminal

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

SEFS
Severely Errored Frame Seconds

SEO
Single-Ended Operations

SES
Severely Errored Seconds

SF
Super Frame (format for DS1 signal)

SID
System Identification

SLA
Service Level Agreements

SLIM
Subscriber Loop Interface Module

SM
Single Mode

SONET
Synchronous Optical NETwork

SPE
Synchronous Payload Envelope

SQU
Sync Quality Unknown

SRD
Software Release Description

STS, STS-n
Synchronous Transport Signal

STM
Synchronous Transfer Mode

STS-1 SPE
STS-1 Synchronous Payload Envelope

STS-3c
Synchronous Transport Level 3 Concatenated Signal

STS-12c
Synchronous Transport Level 12 Concatenated Signal

SYSCTL
System Controller (circuit pack)

T **T1X1 and T1M1**
The ANSI committees responsible for telecommunications standards

TA
Telcordia Technologies Technical Advisory

TABS
Telemetry Asynchronous Byte Serial (Protocol)

TARP
Target ID Address Resolution Protocol

TCA
Threshold-Crossing Alert

TCP/IP
Transmission Control Protocol/Internet Protocol

TCVCXO
Termperature-Compensated Voltage-Controlled Crystal Oscillator

TDM
Time Division Multiplexing

TID
Target Identifier

TIRKS
Trunk Integrated Record Keeping System

TG3
Stratum 3 Timing Generator

TL1
Transaction Language 1

TLB
Timing Looped Back

TOP
Task Oriented Practice

TR
Telcordia Technologies Technical Requirement

TSA
Time Slot Assignment

TSI
Time Slot Interchange

TSO
Technical Support Organization

U

UAS
Unavailable Seconds

UNI
User Network Interface

UOC
Universal Optical Connector

UPD/INIT
Update/Intialize

UPSR
Unidirectional Path Switched Rings

V

VF
Voice Frequency

VLAN
Virtual Local Area Network

VLSI
Very Large Scale Integration

VM
Violation Monitor

VMR
Violation Monitor and Removal

VoIP
Voice over Internet Protocol

VONU
Virtual Optical Network Unit

VPN
Virtual Private Network

VT
Virtual Tributary

VT1.5
Virtual Tributary 1.5 (1.728 Mb/s)

VT-G
Virtual Tributary Group

W **WAN**
Wide Area Network

Glossary

Terms and Definitions

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 DMX 2.5G Multiplexer (it does not cover protection switching of an optical facility; se "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 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).

AGNE - Alarm Gateway Network Element
A defined NE in an alarm group through which members of the alarm group exchange information.

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.

ASCII - American Standard Code for Information Interchange
A standard 8-bit code used for exchanging information among data processing systems and associated equipment.

Auto
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 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.

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.

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.

Broadband
Any communications channel with greater bandwidth than a voice channel; sometimes used synonomously 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).

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.

CLEC - Competitive Local Exchange Carrier
Company that provides local phone services in competition with RBOCs.

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-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 time-division multiplexing several digital signals into a single composite digital signal.

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 Mb/s

DS1(28) Circuit Pack
The DS1(28) circuit pack interfaces to the DSX-1 panel.

DS3
Digital Signal Level 3 (44.736 Mb/s).

DS3/EC-1 Circuit Pack
The DS3/EC-1 circuit pack interfaces to the DSX-3 panel.

DSn - Digital Signal Rate n
One of the possible digital signal rates at DMX 2.5G Multiplexer interfaces: DS1 (1.544 Mb/s) or DS3 (44.736 Mb/s).

DSNE - Directory Services Network Element
A designated network element that is responsible for administering a database that maps network element names (TIDs) to addresses (NSAPs - network service access points) in an OSI subnetwork. There can be one DSNE per ring. Can also be a GNE.

DSX - Digital Cross-Connect Panel
A panel designed to interconnect to equipment that operates at a designated rate. For example, a DSX-3 interconnects equipment operating at the DS3 rate.

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 Homing
A network topology in which two OC-3 or OC-12 shelves serve as DMX 2.5G Multiplexer hosts supporting up to 16 OC-3 rings or 4 OC-12 rings. Each DMX 2.5G Multiplexer ring is interconnected between the two separate hosts.

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.

ES - Errored Seconds
A performance monitoring parameter.

ESF - Extended Super Frame
The format for a DS1 signal.

F

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 SYSCTL circuit pack faceplate.

FEBE - Far End Block Error
An indication returned to the 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 the transmitting terminal that the receiving terminal has detected an incoming section failure.

FE SEL - Far End Select
An LED on the faceplate of the SYSCTL circuit pack.

FIT
Failures in 10^{-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, C, or D function unit slots on the DMX 2.5G Multiplexer.

G

GNE - Gateway Network Element

A network element that has an active X.25 link. Can also be a DSNE.

H

Hairpin Routing

A cross-connection between function units (inter-function unit). For example, function unit C to function untis A, B, or D. 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.

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.

HFC - Hybrid Fiber Coaxial

Technology using coaxial and fiber cable to transport data services in addition to television channels.

I

IC - Internal Clock

Used in synchronization messaging.

ID

See shelf ID and site ID.

IR - Intermediate Reach

A term used to describe distances of 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).

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

LBO - Line Build Out

An equalizer network between the DMX 2.5G Multiplexer and the DSX panel. It guarantees the proper signal level and shape at the DSX panel.

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 theuser 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 reciever without regeneration. See Intermediate Reach.

M Main

The two slots (M-1 and M-2) on the DMX 2.5G Multiplexer shelf in which the OC-48 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.

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.

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: onr or more high- and low-speed transmission ports, built-in intelligence, synchronization and timing capability, and 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 faceplate of the SYSCTL circuit pack.

NMA - Network Monitoring and Analysis

An operations system designed by Telcordia Technologies 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.

NSAP - Network Services Access Point
An address that identifies a network element. Used for maintenance subnetwork communication using the OSI protocol.

O

OC, OC-n - Optical Carrier
The optical signal that results from an optical inversion of an STS signal; that is, OC-1 from STS-1 and OC-n from STS-n.

OC-1
Optical Carrier Level 1 Signal (51.844 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 equivalent to three STS-1s linked together with a single path overhead.

OC-12
Optical Carrier Level 12 Signal (622 Mb/s).

OC-12c (STS-12c)
Optical Carrier Level 12 Concatenated Signal. High-speed broadband equivalent to twelve STS-1s linked together with a single path overhead.

OC-48
Optical Carrier Level 48 Signal.

Operations Interface
Any interface that provides information on the system performance or control. These include the equipment LEDs, SYSCTL faceplate, and office alarms.

OS - Operations System
A central computer-based system used to provide operations, administration, and maintenance functions.

OSI - Open Systems Interconnection
Referring to the OSI reference model, a logical structure for network operations standardized by the Internation 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.

P

Pass Through
Paths that are cross-connected directly across an intermediate node in a ring network.

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.

PM - Performance Monitoring
Measures the quality of service and identifies degrading or marginally operating systems (before an alarm would be generated).

Port
The physical, electrical, or optical interface on a system. For example, DS1, DS3, EC-1, OC-3, OC-12, and OC-48. *See Channel*.

Port State Provisioning
A feature that allows a user to supress 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*.

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 DMX 2.5G Multiplexer, a protection line is a pair of fibers that terminate an OLIU circuit pack in the Main-2, A-2, B-2, C-2, or D-2

slots. *See Service Line*.

Product Family 2000
Lucent's line of SONET standard network products providing total network solutions.

PSTN - Public Switched Telephone Network
The network that provides public telephone service.

R

Reactive Maintenance
Refers to decting 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 the clearing of any failure conditions that caused a protection switch to occur 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 DMX 2.5G Multiplexer may 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 other for protection. *See 1+1*.

RPP - Reliability Prediction Procedure
Described in Telcordia Technologies TR-NWT-00032.

RT - Remote Terminal
An unstaffed equipment enclosure that may have a controlled or uncontrolled environment.

S

S3-TG - Stratum 3 Timing Generator

The timing generator circuit pack, located in the OC-48 OLIU circuit pack, generates clock signals for distribution to the transmit circuits. It operates in the free-running, loop-timing, phase-lock, and holdover modes.

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.

SEO - Single-Ended Operations

The maintenance capability that provides remote access to all DMX 2.5G Multiplexer systems from a single location over the DCC.

Service Line

On a DMX 2.5G Multiplexer 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, A-1, B-1, C-1, or D-1 slots. As defined by the SONET standard, the SONET APS channel is not defined on a service line. *See Protection Line*.

SES - Severely Errored Seconds

This performance monitoring parameter is a second in which a signal fail occurs, or more than a preset amount of coding violations (dependent on the type of signal) occurs.

SF - Super Frame

The format for DS1 signals.

Shelf ID

A switch-settable parameter with values from 1 to 8. Used to log into a selected shelf in a by using the CIT.

Single 0x1 Cross-Connection

In a dual-homed application, the DMX 2.5G Multiplexer uses a single 0x1 cross-connection to map the VT1.5 channels between the DDM-2000 FiberReach, OC-3 Multiplexer, or OC-12 Multiplexer and the DMX 2.5G Multiplexer 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.

Single Homing

A network topoly in which a single DDM-2000 FiberReach, OC-3 Multiplexer, or OC-12 Multiplexer serves as a DMX 2.5G Multiplexer host supporting up to six

OC-3 or OC-12 rings.

Site ID
A switch-settable parameter with values from 1 to 8. Displayed on the SYSCTL circuit pack to indicate to which site the faceplate alarms and LEDs apply.

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 1x1 or 1xN protected circuit pack that is not currently carrying service. *See Active*.

Status
The indication of a short-term change in the system.

STS, STS-n - Synchronous Transport Signal
The basic 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 - System Controller
The system controller circuit pack that provides overall administrative control of the terminal.

T

T1X1 and T1M1
The ANSI committees responsible for telecommunications standards.

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 causes a message to be sent to NMA via the X.25/TL1 interface.

TL1 - Transaction Language 1
A Telcordia Technologies machine-to-machine communications language that is a subset of ITU-TSS, formerly CCITT's, human-machine language.

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 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 - Univeral Optical Connector
Receptacles on the faceplate of some OLIUs that accept *ST,* SC, or FC connectors.

UPD/INIT
A push-button on the SYSCTL faceplate.

V

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 from the received 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.

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 WaveStar Product Family

Lucent's next generation line of network products.

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).

Index