Lucent Technologies
Bell Labs Innovations

Optical Line System

Applications, Planning, and Ordering Guide

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Contents

Contents

Contents

Contents

Contents

Figures

Figures

Figures

Figures

Tables

Tables

Tables

9   Reliability and Quality

10   Technical Specifications

Tables

About This Document

This guide provides information about the Lucent Technologies Optical Line System (OLS) with the Optical Translator.

Intended Audience

This book is written primarily for network planners and engineers, as well as for anyone who needs information about the features, applications, operation, engineering, and ordering of the OLS with OT.

How to Use This Document

For general product and release information, refer to Chapters 1, 2, 4, and 5. For information about applications planning, refer to Chapters 2, 3, 4, and 6. Persons engineering a system should refer to Chapters 4 and 6. Those responsible for ordering equipment should refer to Chapters 4, 6, and 7.

The guide is organized as follows:

- "About This Document" describes the purpose, intended audiences, reason for reissue, and the organization of this document. This section also references other related documentation and explains how to order and make comments or recommendations for changes to the document

- Chapter 1, "Introduction," presents a summary description of the OLS with OT and related products

- Chapter 2, "Features," describes the major features of the OLS with OT. The features are further described in Chapter 3, "Applications," Chapter 4, "Product Description," and Chapter 5, "Operations, Administration, Maintenance, and Provisioning"

- Chapter 3, "Applications," describes how the OLS with OT handles point-to-point, Dual End Terminal, and 4 fiber rings

- Chapter 4, "Product Description," describes the OLS with OT architecture. After introducing the various OLS and OT packages, Chapter 4 describes the system control, physical design, transmission, synchronization, protection, and powering down to the circuit pack level

- Chapter 5, "Operations, Administration, Maintenance, and Provisioning," discusses the features available for monitoring and maintaining the OLS with OT

- Chapter 6, "System Planning and Engineering," summarizes descriptive information used with applications information to plan procurement and deployment of the OLS with OT

- Chapter 7, "Ordering," contains equipment ordering information for the OLS with OT

- Chapter 8, "Product Support," describes how Lucent Technologies supports the OLS with OT. This includes information about engineering and installation services, technical support, documentation support, and training

- Chapter 9, "Reliability and Quality," contains the Lucent Technologies quality policy and describes the reliability program

- Chapter 10, "Technical Specifications," lists the technical specifications for the OLS with OT

- The Glossary defines many terms used in this guide

- The Index provides page numbers for key words and subject names.

Related Documentation

The following documents provide information about the OLS with OT:

- Number: 365-575-331

  Title: Optical Line System (OLS) User/Service Manual

  Audience: End user maintenance personnel

  Content: Detailed system description, technical specifications, operation and maintenance, and user interface descriptive/tutorial information

- Number: 365-575-320

  Title: Optical Line System (OLS) Installation Manual

  Audience: Customers planning to install the OLS

  Content: Customer installation instructions

- Number: 824-102-201

  Title: Optical Line System (OLS) Operations Systems Engineering Guide

  Audience: End user maintenance personnel

  Content: Operations Systems software commands, messages, and other information

- Number: 365-575-221

  Title: FT-2000 OC-48 Large Capacity Terminal (LCT) Integration Manual

  Audience: Installers and craft personnel

  Content: Instructions on how to integrate LCT with the OT and OLS systems

Drawings

The following drawings, which are shipped with the product, provide information about the OLS. These drawings are needed for the installation process.

J68982C-1	Optical Line System Cabinet (Equipment and Circuit Packs Ordered with Equipment)
J68982D-1	Optical Line System Integrated Bay (Equipment and Circuit Packs Ordered with Equipment)
J68982CS-1	Optical Line System Cabinet Software and Documentation
J69000C-1	Optical Translator System (Equipment and Circuit Packs Ordered with Equipment)
SD-5G276-01	Optical Line System Application Schematic
SD6G156-01	Optical Translator System Application Schematic
SD5G157-01	Optical Line System Application Schematic (Integrated Bay)
T5G276-33	Optical Line System Interconnection Circuit
T6G156-33	Optical Translator Interconnection Circuit
T5G157-33	Optical Line System Interconnection Circuit (Integrated Bay)
T5G276-30	Optical Translator Circuit
T6G156-30	Optical Line System Circuit
T6G157-30	Optical Line System Circuit (Integrated Bay)
ED7G033-30	Optical Line System Cabinet Framework
ED7G044-30	Optical Translator Cabinet Framework
ED7G048-30	Optical Line System Integrated Bay Framework
ED7G028-20	OLS Cable Assembly

ED7G045-20	OT Cable Assembly
ED7G028-22	OLS Intercabinet Cable Assembly
ED7G045-22	OT Intercabinet Cable Assembly
ED7G028-30	Optical Line System Shelf Assembly
ED7G045-30	Optical Translator Shelf Assembly
ED7G027-30	OLS User/Fuse Panel/Power Indicating Assembly
ED7G047-30	OT User/Power Indicating/Fuse Panel Assembly
FPD 804-604-161	Optical Line System Cabinet (Floor Plan Data Sheets)

The following drawings are available from the Customer Information Center (CIC) at 1-888-582-3688. They contain valuable product information, but are not needed for product installation. Therefore, they are not shipped with the product.

T5G276-30	Optical Line System Circuit
T5G276-33	Optical Line System Interconnection Circuit
T6G156-30	Optical Translator Circuit
T6G156-33	Optical Translator Interconnection Circuit
T6G157-30	Optical Line System Circuit (Integrated Bay)
T6G157-33	Optical Line System Interconnection Circuit (Integrated Bay)

For more information, see "How to Order Documents," later in this chapter.

Documentation for Related Equipment and Software

The following Lucent Technologies documentation provides information about related hardware and software:

365-575-230	FT-2000 OC-48 Large Capacity Terminal Applications, Planning, and Ordering Guide
365-575-231	FT-2000 OC-48 Large Capacity Terminal User/Service Manual
365-575-221	FT-2000 OC-48 Large Capacity Terminal Integration Manual
365-575-220	FT-2000 OC-48 Large Capacity Terminal Installation Manual
824-102-200	FT-2000 OC-48 Large Capacity Terminal Operations Systems Engineering Guide
5408TS	FT-2000 OC-48 Large Capacity Terminal Technical Specifications
365-575-212	FT-2000 OC-48 Large Capacity Terminal Implementation Procedures
365-575-200	FT-2000 OC-48 Lightwave System, Applications, Planning, and Ordering Guide
365-575-101	FT2000 OC-48 Lightwave System, Quick Reference Guide
365-575-102	FT-2000 OC-48 Lightwave System, User/Service Manual
365-575-115	FT-2000 OC-48 Lightwave System, Installation Manual
824-102-147	Lucent Technologies 2000 Product Family Operations Interworking Guide
365-099-142TS	FT-2000 OC-48 Lightwave System Technical Specifications
824-102-148	2000 Family of Products Systems Engineering Guide

Electronic Documentation

Documentation on CD-ROM has many advantages over traditional paper documentation, including cost savings, search and retrieve capability, and the assurance of having current information.

The CD-ROM containing the OLS documentation is part of the FT-2000 CD-ROM family. The CD-ROM comcode is 10977143; its select code is: 300-100-016. To order the CD-ROM, call the Lucent CIC telephone number: 1-888-LUCENT-8 (1-888-582-3688).

For pricing information and a list of all documents available on CD-ROM, contact your Lucent Technologies account executive or the Lucent Technologies Customer Training and Information Products hotline (1-800-334-0404).

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Training

No product offering is complete without a formal training package. Suitcasing of these courses is also available. Contact your account executive to enroll in training classes or to arrange suitcase sessions.

The following courses are provided:

- Number: LW2200

  Title: Optical Networking Overview (with FT-2000 OC-48 and Optical Line System)

  Audience: This course is primarily intended for network planners, product managers, product evaluation/selection managers, equipment engineers, and sales personnel. In general, the course will be helpful to anyone needing a high-level description of networking components

  Content: This course provides an introduction to the products offered by Lucent Technologies for optical networking, that is, building high-capacity transmission networks to transport optical signals

  Prerequisites: None. However, the student must have a basic understanding of digital fundamentals and lightwave transmission systems

- Number: LW2252

  Title: Optical Line System–Optical Translator (OLS-OT) Applications, Architecture, Planning, and Ordering

Audience: This course is primarily intended for network planners, product managers, equipment engineers, technical consultants, and account representatives. In general, the course will be helpful to anyone needing a high-level description of the equipment

Content: This course provides instruction on the product applications, features and architecture, as well as the office and network planning needed for implementation. Included in the last session is instruction and practice on ordering the equipment. The course is based on the Applications, Planning, and Ordering Guide

Prerequisites: The student should have a basic understanding of digital fundamentals and lightwave transmission systems. Unless the student already has experience on a lightwave transmission assignment, the following course is a prerequisite:

- — LW2200, Optical Networking Overview

- — TR0510, Transmission Principles, self paced

■   Number: LW2253

Title: FT-2000 OC-48 Large Capacity Terminal (LCT) Applications, Architecture, Planning, and Ordering

Audience: This course is primarily intended for network planners, product managers, equipment engineers, technical consultants, and account representatives. In general, the course will be helpful to anyone needing a high-level description of the equipment

Content: This course provides instruction on the product applications, features and architecture, as well as the office and network planning needed for implementation. Included in the last session is instruction and practice on ordering the equipment. The course is based on the Applications, Planning, and Ordering Guide

Prerequisites: The student should have a basic understanding of digital fundamentals and lightwave transmission systems. Unless the student already has experience on a lightwave transmission assignment, the following course is a prerequisite:

- — LW2200, Optical Networking Overview

- — TR0510, Transmission Principles, self paced

- Number: LW2652

  Title: Optical Line System–Optical Translator (OLS-OT) Operation and Maintenance (Hands-on)

  Audience: This course is primarily intended for technicians responsible for the operation and maintenance of the equipment, but will be useful to technical support people and anyone needing a working knowledge of the equipment

  Content: This course prepares the student for operation and maintenance of the OLS and OT. The course provides in-depth description of the equipment and how it is used with other lightwave equipment. The course is based on the User Service Manual

  Prerequisites: The student should have a basic understanding of digital fundamentals and lightwave transmission systems. Unless the student already has experience on a lightwave transmission assignment, the following course is a prerequisite:

  — LW2200, Optical Networking Overview

- Number: LW2653

  Title: FT-2000 OC-48 Large Capacity Terminal (LCT) Operation and Maintenance (Hands-on)

  Audience: This course is primarily intended for technicians responsible for the operation and maintenance of the equipment, but will be useful to technical support people and anyone needing a working knowledge of the equipment

  Content: This course prepares the student for operation and maintenance of the LCT. The course provides in-depth description of the equipment and how it is used with other lightwave equipment. The course is based on the User Service Manual

  Prerequisites: The student should have a basic understanding of digital fundamentals and lightwave transmission systems. Unless the student already has experience on a lightwave transmission assignment, the following course is a prerequisite:

  — LW2200, Optical Networking Overview

■   Number: LW2452

Title: Optical Line System–Optical Translator (OLS-OT) Installation

Audience: This course is primarily intended for personnel responsible for the installation of the Optical Line System equipment

Content: This course provides students with the knowledge and hands on experience needed to install and test the OLS-OT equipment. The course is based on the Installation Manual

Prerequisites: None

■   Number: LW2453

Title: FT-2000 OC-48 Large Capacity Terminal (LCT) Installation

Audience: This course is primarily intended for personnel responsible for the installation of the LCT equipment

Content: This course provides students with the knowledge and hands on experience needed to install and test the LCT equipment. The course is based on the Installation Manual

Prerequisites: None

■   Number: LW2454

Title: Optical Line System–Optical Translator (OLS-OT) Installation (Self-paced)

Audience: This course is primarily intended for personnel responsible for the installation of the OLS and OT equipment

Content: This course provides instruction on the equipment architecture, the installation methods and tests, and the content of the Installation Manual

Prerequisites: TR0510, Transmission Principles, self-paced

■ Number: LW2455

Title: FT-2000 OC-48 Large Capacity Terminal Installation (Self-paced)

Audience: This course is primarily intended for personnel responsible for the installation of the LCT equipment

Content: This course provides instruction on the equipment architecture, the installation methods and tests, and the content of the Installation Manual

Prerequisites: TR2448, FT-2000 OC-48 Installation (Hands-on).

To obtain more information or to register for these courses, call:

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Introduction

1

Introduction

1

This chapter presents a brief overview of the Optical Line System (OLS).

Introduction to OLS

Lucent Technologies offers the industry's widest range of transmission systems and related services in order to provide total network solutions. The Optical Line System (OLS), with Dense Wavelength Division Multiplexing (DWDM), is part of an optical networking family of products.

Designed to help telecommunications service providers enter a new century of advanced services and revenue generating capabilities, OLS provides a higher capacity per fiber over longer distances than previously possible.

Metropolitan and Short Haul applications are also addressed.

When used with Lucent Technologies Optical Translator (OT), OLS provides long reach wavelength add/drop and multivendor compatibility, as well as concatenation of multiple OLS terminals. This functionality increases the flexibility and cost effectiveness of OLS.

Several Lucent terminals have been designed to operate directly with the OLS. These include the FT-2000 Lightwave System, FT-2000 OC-48 Large

Capacity Terminal (FT-2000 OC-48 LCT), Add/Drop Ring Terminal (ADR), and SLM-2000.

OLS also works with the Integrated Transport Management Sub Network Controller (ITM SNC). ITM SNC is an element management system that supports synchronous optical network (SONET) network elements (NE) such as the Lucent Technologies DDM-2000, FiberReach WBS, FT-2000, SLC®-2000, and Fujitsu® Lightwave Multiplexer (FLM). ITM SNC provides fault, provisioning, configuration, and security management functions via a graphical user interface (GUI). Through these functions, ITM SNC is able to support communication multiplexing or concentration, to guarantee network security, and to record all database changes. ITM SNC also provides a cut-through capability, allowing the ITM SNC user to access a network element (NE) through its native command set.

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

What is OLS?

OLS systems provide the following functions:

- The OLS End Terminal provides dense wave division multiplexing (DWDM) of up to 16 optical lines onto one optical fiber.

- The OLS Repeater terminal provides signal amplification to allow transmission distances of approximately:

    — 120 km per span in Standard Reach 5-span OLS systems for a total reach of approximately 600 km.

    — 80 km per span in Long Reach OLS systems (up to 8 spans) for a total reach of approximately 640 km.

- Single optical amplifier operation for Short Reach applications.

- OLS Repeater sites between OLS End Terminals support each span.

- The OLS wavelength add/drop facility, using the OT, allows selective add/drop of individual signals.

- 768 DS3 equivalents (516,096 two-way voice circuits per fiber pair).

DWDM permits up to 40 Gb/s of traffic onto one optical line.

OLS transmits over two types of optical fiber:

- Standard, single-mode fiber

- Non-zero dispersion-shifted fiber (for example: TrueWave®).

On either type of fiber, OLS systems support a maximum distance of 640 km before requiring signal regeneration.

The OLS Optical Amplifiers (OAs) amplify signals of different wavelengths in the 1.5 μm wavelength band that have been optically multiplexed onto one fiber. A single OA can amplify up to 16 wavelengths simultaneously.

The high optical power provided by the OAs allows significantly longer spans than previously used. When planning new fiber routes, the longer span capability of the OLS allows longer spans between Repeater sites, yielding savings in construction costs.

The OLS includes telemetry circuit packs (TLMs) for performance monitoring. The TLMs collect data for fault isolation and preventive maintenance and pass the data to a special supervisory channel.

The OLS supports applications that need to grow in order to accommodate increasing amounts of information. The OLS allows wavelength growth and, when equipped with the OT, a highly flexible form of wavelength add/drop.

Wavelength growth increases capacity and decreases the need for fibers, which is especially useful in cases of fiber exhaust. With the OLS, up to 16 wavelengths can be added to a single fiber.

With wavelength add/drop, some wavelengths can be added/dropped at an OLS End Terminal, while other wavelengths are expressed between/within OLSs. Wavelength add/drop is supported on OLS by use of Optical Translator Units (OTUs), which regenerate express wavelengths at add/drop sites.

Figure 1-1 provides simplified block diagrams of an OLS End Terminal and an OLS Repeater.
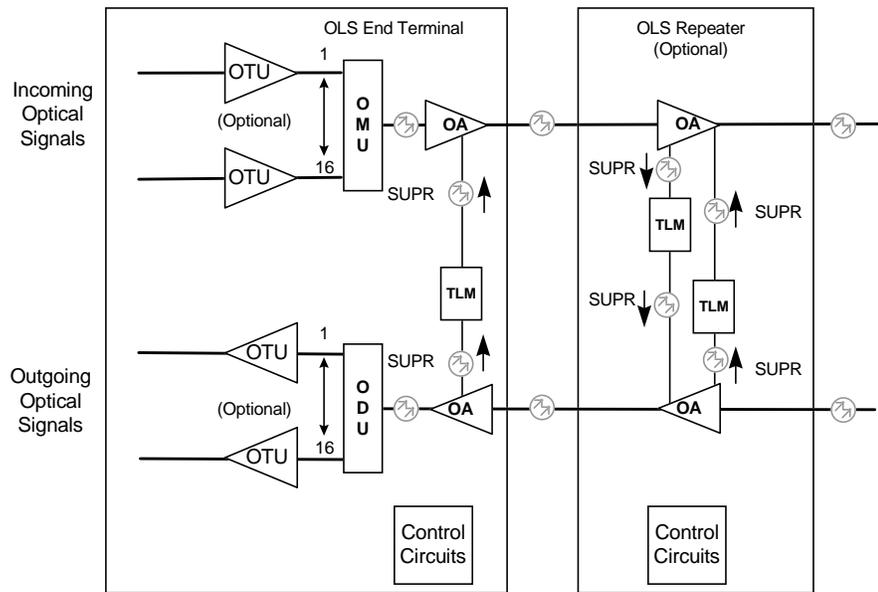
ols01002.00wmfSEV092497r2.1

Figure 1-1. Simplified OLS End Terminal and Repeater Block Diagrams

OLS Features Release Plan

OLS Release 1 included the following features:

- Up to 8 wavelengths at OC-48 bit rate
- Long span transmission up to 360 km
- Flexible span engineering (1 to 3 spans)
- Support for up to four bidirectional optical lines
- Redundantly-pumped optical amplifiers
- Automatic optical amplifier gain control
- Craft Interface Terminal (CIT)
- Transaction Language 1 (TL1) operations system interface
- Orderwire
- Parallel telemetry
- Automatic fault detection and isolation
- 155 Mb/s customer maintenance signal
- Gateway Network Element (GNE) operation
- Alarm Gateway Network Element (AGNE) support
- Optical signal performance monitoring
- Pump performance monitoring
- Threshold Crossing Alert (TCA) reporting
- Automatic and CIT provisioning
- User software download
- Multi-level security
- Login and password aging.

OLS Release 2.0 offered the following additional features:

- The OC-48 Optical Translator (OT) for open optical interface to multi-vendor OC-48 products
- Fully flexible wavelength add/drop capability

- Long Reach transmission up to 640 km

- Flexible span engineering (1 to 8 spans).

OLS Release 2.1 offers these additional new features:

- Up to 16 wavelengths with any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates.

- Open optical interfaces to multi-vendor OC-3, OC-12, and 400-700 Mb/s products with the Quad Optical Translator Units (QOTUs)

- Single OA capability for up to 16 wavelengths

- Short Reach OA for Metro applications

- Dual Facing Shelf

- CenterLink™

- Enhanced security.

Chapter 2, "Features," briefly describes the OLS product features. The remainder of this guide discusses these features in more detail.

Features

2

Features

2

This chapter summarizes the main features and functions of the Optical Line System (OLS).

OLS Functions

OLS Release 2.1 has the following functions:

- Receives up to sixteen optical channels

- Optically multiplexes the signals together with another signal that is used for maintenance purposes by using dense wave division multiplexing (DWDM)

- Amplifies the resulting signal using an erbium-doped fiber Optical Amplifier (OA)

- Transmits the amplified signal over standard single-mode or non-zero dispersion-shifted fiber (for example: TrueWave®)

- Optionally uses OLS Repeater terminals to optically amplify the signal, if needed

- In Long Span configurations, supports a maximum distance of 600 km (five spans, up to four OLS Repeaters) on standard or non-zero dispersion-shifted fiber

- In Long Reach configurations, supports up to eight spans, with a maximum optical line length of 640 km on standard single-mode fiber or non-zero dispersion-shifted fiber

- In Short Reach configurations, supports one span with optical line lengths up to 80 km

- Optically demultiplexes the signals at the other end of the optical line and passes them on to compatible optical receivers

- Uses a highly flexible form of wavelength add/drop

- Concatenates multiple OLSs

- Provides wavelength interchange at network interfaces

- Uses a rich operations, administration, maintenance, and provisioning (OAM&P) feature set.

Benefits of OLS

OLS provides the following benefits:

- Handles more capacity on a single fiber (up to 40 Gb/s)

- Provides a cost-effective solution to fiber-exhaust situations (no need to add more fiber)

- When equipped with the Optical Translator (OT):

    — Provides an open system interface to all types of transmission equipment

    — Extends wavelength sections to thousands of kilometers

    — Reduces office congestion

    — Facilitates Wavelength Add/Drop (WAD)

    — Prevents wavelength blocking via Wavelength Interchange

- Applicable in a variety of topologies, such as point-to-point and ring configurations

- Works with embedded base

- Provides for user-settable alarms and control of equipment co-located with OLS

- Is bit-rate independent

■ Provides for performance monitoring, fault isolation, and preventive maintenance

■ High reliability with a 25-year design life.

16 Wavelength DWDM

In Dense Wave Division Multiplexing (DWDM), different optical wavelengths in the same transmission band are combined onto a single fiber. The OLS supports up to 16 wavelengths in the 1.5 μm band. The channels can be equipped in any order.

The Optical Multiplexer Unit (OMU) multiplexes the signals together using a passive optical coupler.

The Optical Demultiplexer Unit (ODU) optically demultiplexes the signals by using a fixed frequency filter. The optical input signal is separated into 16 separate wavelength signals.

Optical Amplifier

The OLS Optical Amplifier (OA) is an erbium-doped fiber amplifier (EDFA). The OAs generate high optical power which supports longer optical sections and lines between lightwave terminals than traditional lightwave applications.

The OLS uses one or two OAs per line at each End Terminal site. One OA is a power amplifier at the transmit end and the other is an optional pre-amplifier at the receive end. At the OLS Repeater sites, an OA acts as an optical Repeater. Each OA can amplify signals of different wavelengths that have been optically multiplexed onto one fiber. A single OA amplifies up to 16 wavelengths simultaneously.

For any given application, one OA code can serve in all three functions: power amplifier, pre-amplifier, and Repeater.

Flexible Network Applications

The OLS is a point-to-point system that supports a variety of network topologies. It supports high capacity loop, inter-office, outstate, and Long Haul applications with maximum economy and efficiency. These network topologies are described in Chapter 3, "Applications."

Easy Installation and Self-Tests

The OLS minimizes installation time with "one box" product deliveries, connectorized cabling with commercially available connectors, and simplified procedures. The "one box" product delivery concept ensures that all product components arrive at the installation site at the same time in a small number of containers. The use of connectorized cabling with commercially available connectors also saves installation time.

A set of automatic turn-up tests is provided. These tests verify installation cabling to and from the telemetry (TLM) and the Optical Amplifier (OA) circuit packs for each optical line. In addition, a manual local test verifies that the OMU and the optical demultiplexer unit ODU are working properly. Since test signal generators and detectors are integrated into the system, external test equipment is not needed.

Multiple Maintenance Features

The OLS provides multiple maintenance features that are similar to and compatible with those of other Lucent Technologies 2000 family products. The following sections summarize the major features. Chapter 5, "Operations, Administration, Maintenance, and Provisioning," describes these features in more detail.

Maintenance

The OLS maintenance features provide a wide range of system information and control, from summary-level status information to detailed reporting.

CenterLink™

CenterLink is a new software application for Release 2.1 running under the Windows 95® operating system. CenterLink provides extensive on-line help as well as security against unauthorized access.

Operations Interface Flexibility

The OLS offers a variety of operations interfaces to meet the needs of an evolving operations system (OS) network. The operations interfaces include the following:

- **Office alarms interface:** provides a set of discrete relays that control office audible and visible alarms

- **Parallel telemetry interface:** provides a minimum set of alarm and status information to an operations center for local and remote alarm centers

- **Miscellaneous discrete interface:** provides a total of 144 miscellaneous discrete input points and 36 miscellaneous discrete output points. Miscellaneous discrete inputs can monitor conditions like open doors or high temperatures, and miscellaneous discrete outputs can control equipment like fans and generators. Miscellaneous discrete inputs can be used to read status conditions of the OT

- **X.25 interface:** uses X.25 protocol to provide communications with a message-based operations system through Transaction Language 1 (TL1) operations messages. A message-based operations system can access local and remote OLS network elements in a maintenance OLS using the gateway network element (GNE) capability

- **User Panel:** provides indicators showing critical (CR), major (MJ), and minor (MN) alarms, abnormal conditions (ABN), near-end activity (NE ACTY), and far-end activity (FE ACTY). The user panel also features CIT DCE connection, an electrostatic discharge (ESD) jack, power on (PWR ON) light-emitting diode (LED), and an alarm cut-off button (ACO) that silences audible office alarms when pressed and lights up during suppression of the alarm.

Access Domains

In OLS 2.0 and earlier versions, the access domain was defined as a sub-network of two OLS End Terminals and the OLS Repeaters between them. In OLS 2.1, Dual Facing Shelves extend the access domain beyond the End Terminals. The OLS subnetwork now includes all Dual Facing End Terminals and OLS Repeaters interconnected with each other. The subnetwork may originate/terminate at two Single Facing End Terminals, two single side-equipped Dual Facing End Terminals, or in a ring made of Dual Facing End Terminals and repeaters. An OLS, however, comprises two End Terminals and the OLS Repeaters between them.

OLS network elements and the signal transmitter network elements (such as the FT-2000 OC-48 LCT and FT-2000 OC-48 Lightwave System) operate as separate and independent systems. There is no communication (DCC connectivity) between the two types of network elements.

The Dual Facing Shelf feature extends the OLS operations domain in 2-fiber applications to adjoining OLS subnetworks, maintaining DCC connectivity.

For more information about access domains, see Chapter 5, "Operations, Administration, Maintenance, and Provisioning."

Single-Ended Operations

The single-ended operations capability provides operations support from a single location to remote OLS NEs in the same OLS subnetwork. With this capability, you can perform operations, administration, maintenance, and provisioning on a centralized basis, saving travel time and money. Both the CIT and the OS interfaces can access network elements (NEs) that can be OLS End Terminals or OLS Repeaters.

Single-ended operations (operations interworking) capabilities include:

- Gateway Network Element (GNE; remote TL1 operations system access)
- Alarm groups
- Remote login (remote craft access)
- Inventorying capabilities

■   Remote NE status (remote alarming, alarm groups, Alarm Gateway Network Element, status of remote alarms, remote office alarms, and parallel telemetry)

■   Local software copy/upgrades

■   Remote software copy/upgrades

■   Directory Service Network Element (DS-NE).

Gateway Network Element (GNE)

You can use one or more OLS network elements as a GNE. The GNE serves as a single interface to the X.25 message-based operations system of all network elements in the same OLS subnetwork.

The GNE receives operations information from these network elements through the digital communications channel (DCC) and reports that information and its own information to the operations system. The operations information is in the form of TL1 messages. Through the GNE, the operations system can send TL1 commands to any network elements in the OLS subnetwork.

The number of GNEs you use depends on your application and operations needs. For example, to reduce the number of operations data communication links between the OLS subnetwork and the operations system, you might choose to use one OLS network element as the GNE. If you need redundancy, you might choose to use two network elements as GNEs.

Alarm groups

To communicate remote status information efficiently, you must provision each network element with an alarm group parameter. Members of the alarm group exchange remote NE status information through one or more Alarm Gateway Network Elements (AGNEs) that are defined in the same alarm group.

Remote Login

You can log in remotely from one OLS network element to another OLS network element when they are in the same OLS subnetwork.

Inventorying Capabilities

The OLS provides automatic version recognition of all hardware and software installed in the system. Circuit pack types, circuit pack CLEI™ codes, and serial numbers are accessible via the CIT. These capabilities greatly simplify troubleshooting, dispatch decisions, and inventory audits.

Remote NE Status (Through DCC)

Through the Supervisory Channel DCC interface, an OLS network element can receive and transport summary alarm and status information from remote network elements in the same OLS. A far-end activity LED on the local OLS terminal indicates whether any condition is present in an OLS network element elsewhere in the OLS subnetwork.

Local Software Copy/Upgrades

The OLS can upgrade system software while in service. To upgrade, no control circuit packs (CP) changes are required. System monitoring and control are fully functional during software download. You can use the CIT to load software locally, or you can use a modem to download it remotely.

Remote Software Copy/Upgrades

You may also copy/upgrade the system software contained in one OLS (source) to another OLS (destination) in the same OLS maintenance subnetwork. System monitoring and control are fully functional during the copy.

Directory Service Network Element (DS-NE)

Any one node in an OLS system can be designated the Directory Service Network Element (DS-NE). The DS-NE provides a centralized database that maps terminal names (TIDs) to addresses (Network Service Access Points [NSAPs]). The NSAPs are used internally for routing information within the OLS. No provisioning is required for the DS-NE database; the mapping is configured automatically.

Continuous Performance Monitoring

Continuous performance monitoring allows the OLS to detect transmission problems before they affect service. The OLS monitors analog performance on each channel of an optical line. The OLS receives digital performance information on the supervisory channel. Thresholds for each parameter can be provisioned, depending on customer needs.

You can specify a single start time for measuring all 24-hour performance monitoring parameters. The start time can be the beginning of any hour (the default is midnight). The performance monitoring parameters for each day are collected separately, beginning at the specified time. The OLS keeps information for the current day and the previous 6 days. The OLS also records performance data at 15 minute intervals, storing data from the previous 8 hours.

Original Value Provisioning and
User-Selectable Thresholds

The OLS provides extensive circuit provisioning capabilities such as performance monitoring thresholds. The alarm severity of incoming signal failures can be provisioned.

To minimize provisioning, each parameter is initially assigned an original value, which can easily be changed. Either, the CIT or the X.25 interface can be used to modify the value of any parameter.

Security Features

The OLS provides the following three tiers of security to protect against unauthorized access to the CIT and OS functions:

- Port security

- Network element(NE) login security

- Enhanced user login security.

for detailed information, see the "Administration" section of Chapter 5, "Operations, Administration, Maintenance, and Provisioning."

Physical Features

The OLS and OT packaging is designed for ease of use and adaptability.
The following sections highlight some of these features. For more details,
see Chapter 4, "Product Description."

Front Access

You can access all operation, maintenance, and installation activities from
the front of the OLS. Front access provides greater flexibility, permitting
placement of the equipment in physically restricted locations.

Equipment Packages

The OLS is available in the following:

- Cabinets

- Bay frames

- ETSI frames

- Miscellaneously mounted.

Applications

3

Applications

3

This chapter describes the basics of Optical Line System (OLS) transmission technology, transmission elements, and configurations as well as OLS applications.

For a list of OLS features, see Chapter 2, "Features." For more information about the physical components of OLS, see Chapter 4, "Product Description."

For information about Lucent products that are compatible with OLS, see the documents referred to in the section "Documentation for Related Equipment and Software" in "About This Document."

OLS Optical Transmission Elements

The OLS is a bit-rate-independent optical system usable in a variety of applications. This section describes the basic OLS transmission elements. The next section shows basic OLS configurations that use these elements.

The OLS uses Optical Amplifiers (OAs), Optical Multiplexer Units (OMUs), Optical Demultiplexer Units (ODUs), and Optical Translator Units (OTUs/OTPMs) as its basic components.

Optical Amplifiers

Table 3-1 lists the three types of OAs are available in Release 2.1 and their applications.

Table 3-1.   OLS Optical Amplifiers

OA Code	Application	Two-OA Operation	Single-OA Operation
LEA6	Long Span	✔	
LEA7	Long Reach	✔	
LEA105	Short Reach	✔	✔

Optical Multiplexer Units/Optical Demultiplexer Units

Two types of OMUs (8 λ and 16 λ) and three types of ODUs (one 8 λ and two 16 λ) are available in Release 2.1. Channels 1 through 8 are identical in all units, providing compatibility between 8 λ and 16 λ systems. Table 3-2 lists these units.

Table 3-2. OLS OMUs/ODUs

Unit	Code	Channels	Notes
OMU	505A	8	
ODU	605A	8	
OMU	506A	16	
ODU	606A	16	Does not provide supervisory channel output
ODU	606B	16	Provides supervisory channel output for single OA applications

Optical Translator Units

Release 2.1 provides Optical Translator Units (OTUs and OTPMs) covering all 16 channels and OC-48, OC12, and OC-3 bit rates. The OC-48 OTUs are standard OLS OTUs, now covering 16 wavelengths. For OC-12, OC-3, and 400-700 Mb/s applications, a quad OTU (QOTU) carrier pack holds up to four of any Optical Translator Port Modules (OTPMs). Table 3-3 lists the OTUs and OTPMs, and their applications.

Table 3-3. OLS OTUs/OTPMs

Code	Bit Rate	Wavelength Band	Notes
41A(1-16), 41A(1-16)B	OC-48	1.5 μm	OTU. For applications with dispersion of up to 6800 ps/nm
41B, 41BB	OC-48	1.3 μm	OTU
41C(1-16), 41C(1-16)B	OC-48	1.5 μm	For applications with dispersion of up to 10,900 ps/nm
41S	- -	- -	QOTU carrier pack for OTPMs

Table 3-3.   OLS OTUs/OTPMs — *Continued*

Code	Bit Rate	Wavelength Band	Notes
42A1-16	OC-12	1.5 μm	OTPM
42B	OC-12	1.3 μm	OTPM
43A1-16	OC-3	1.5 μm	OTPM
43B	OC-3	1.3 μm	OTPM
44A1-16	400-700 Mb/s	1.5 μm	OTPM
44B	400-700 Mb/s	1.3 μm	OTPM

Other Elements

In addition to the transmission elements described above, the OLS contains telemetry and control circuits, as well as having a co-located external miscellaneous discrete unit (EMDU). These units are described in chapter 4, "Product Description".

OLS Basic Configurations

The OLS can be configured in a variety of ways--ranging from single span, two-terminal systems to complex multi-span systems involving multiple repeaters and End Terminals.

Applications Without Repeaters

Point to point applications may or may not need repeaters. The following section describes this.

Two OA Applications

Figure 3-1 shows a single, bidirectional OLS span. The transmit optical channels from up to 16 OC-48 ADMs are combined by the OMU into an optical line signal, amplified by the OA, and launched on the optical fiber. At the receive end of the span, the optical line signal is pre-amplified by a second OA, then applied to an ODU. The ODU demultiplexes the optical line signal into 16 optical channels for transmission to the receive-end ADMs. The OAs may either be LEA6, LEA7, or LEA105, depending on the particular span distance. Specific engineering rules appear in chapter 6, "System Planning and Engineering".
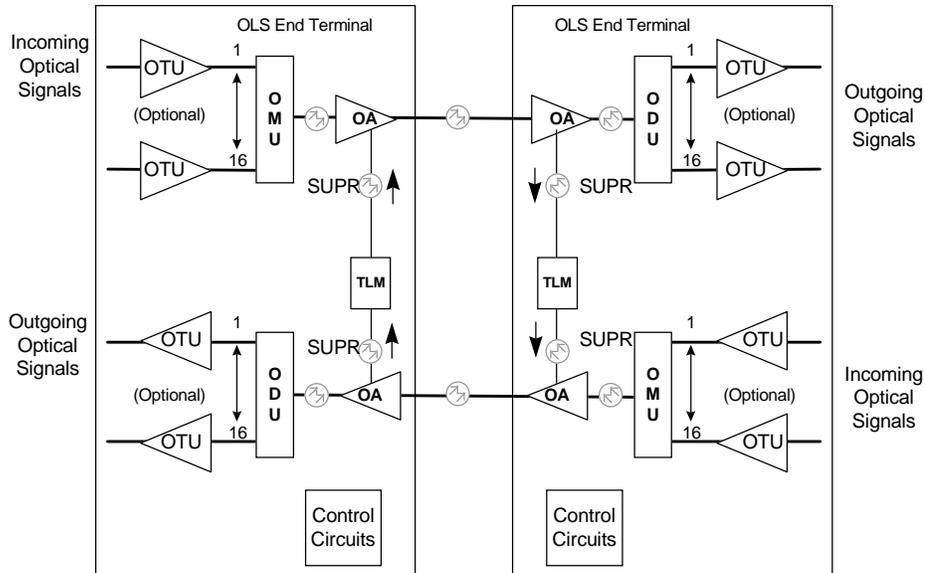
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Figure 3-1. OLS Single Span Using Two OAs

Single OA applications

Figure 3-2 shows the same single, bidirectional OLS span in a Short Reach, metro application. One OA is used as a launch amplifier on the transmit side of the optical fiber. Due to the short span length, pre-amplification at the receive end ODU is not necessary. The LEA105 OA and the 606B ODU are required in these Short Reach applications.
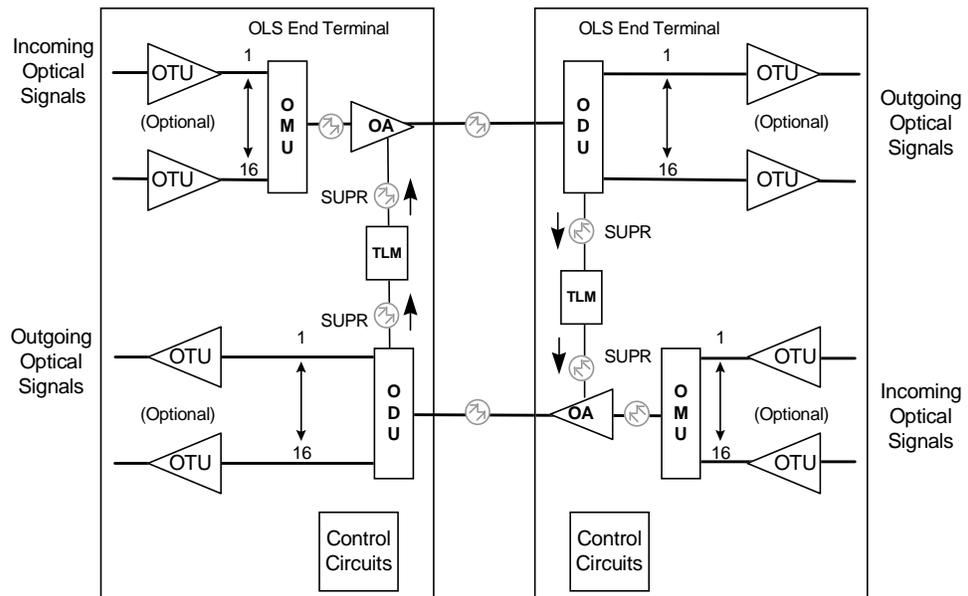
NOTE: OAs must be LEA105
         ODUs must be 606A

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Figure 3-2. OLS Single Span Using Single OA

Applications With Repeaters

Figure 3-3 shows a multi-span OLS. For through-transmission of the optical line signal, OLS Repeater Terminals are used in the intermediate spans. OLS Repeaters contain only OAs and control circuit packs. OMUs and ODUs are not required. Repeaters use LEA6 or LEA7 OAs, depending on span distance and fiber type. Specific engineering rules appear in chapter 6, "System Planning and Engineering".

NOTE: OAs must either be all LEA6 or all LEA7

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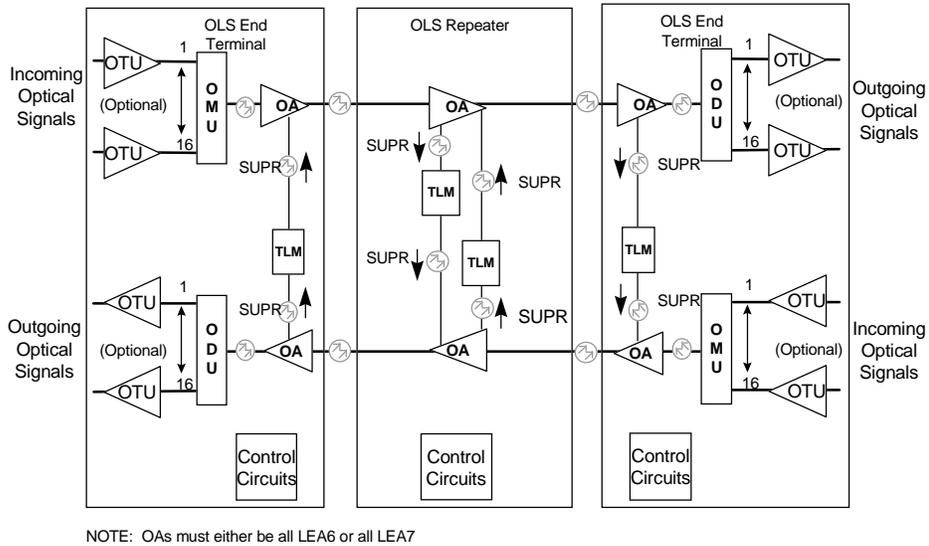
Figure 3-3. OLS Multiple Span System Using Repeaters (one shown)

Applications With Wavelength Add/Drop

Figure 3-4 shows a multi-span OLS with an intermediate wavelength add/drop (AD) site. This site consists of an OLS Integrated Bay, introduced in Release 2.1. The OLS Integrated Bay consists of an OLS End-Terminal shelf, an OT System Controller Shelf and one OT Complementary Shelf.
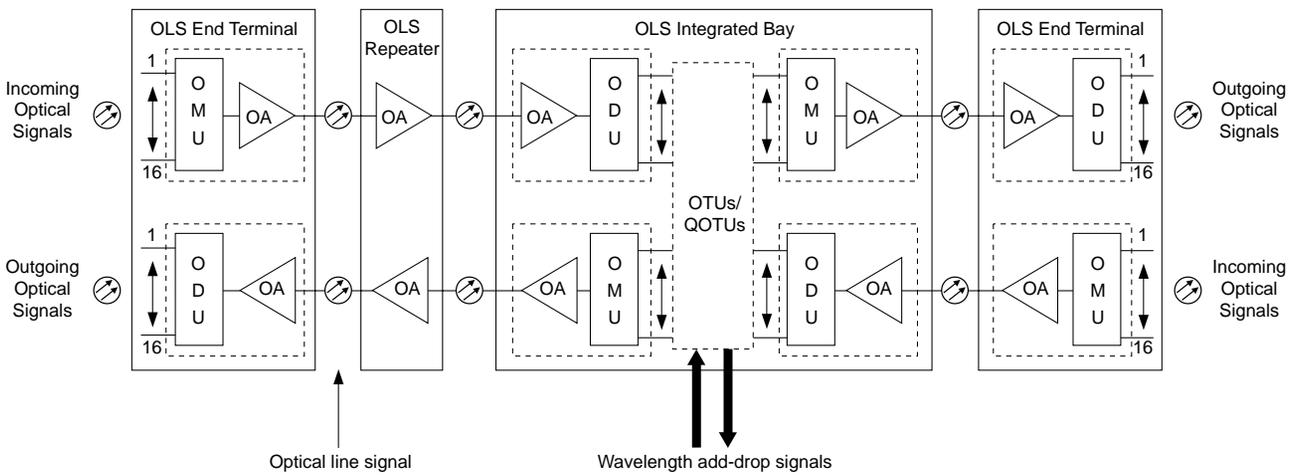
Figure 3-4. OLS With Wavelength Add/Drop

OLS End Terminal

OLS Repeater

OLS Integrated Bay

OLS End Terminal

Incoming Optical Signals

1

16

O M U

OA

OA

OA

OA

O D U

O M U

OA

O D U

Outgoing Optical Signals

1

16

Outgoing Optical Signals

1

16

O D U

OA

OA

OA

O M U

O D U

OA

OA

O M U

Incoming Optical Signals

1

16

OTUs/ QOTUs

Optical line signal

Wavelength add-drop signals

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In applications where it is necessary to carry DCC information between OLSs, an OLS End Terminal Shelf can be provisioned as a Dual-Facing network element. Dual facing shelves allow a compact terminal design to handle Wavelength Add Drop (WAD) applications for two fiber and four fiber rings. Additionally, dual facing shelves allow extension of the operations domain across WAD sites.

Applications With Multi-Regenerated Spans

Figure 3-5 shows a multi-span OLS that extends beyond the 8-span capability of the LEA7 OA. To go beyond eight spans (LEA7) or five spans (LEA6, 8-channels), the optical line signal must be regenerated. Regeneration is performed by Optical Translator Units (OTUs/QOTUs) in an OLS Integrated Bay or in miscellaneously mounted OT shelves. Engineering rules appear in chapter 6, "System Planning and Engineering".
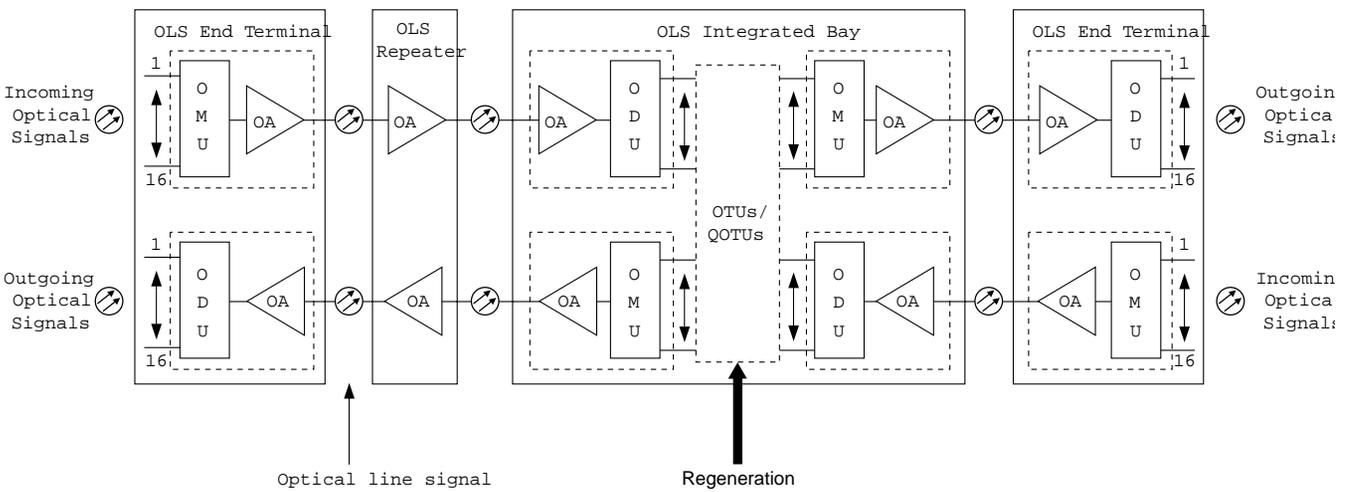
Figure 3-5. Multiple OLS Systems and OTU/QOTUs as Regenerators

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Product Description

4

Product Description

4

This chapter describes shelf design, package descriptions, and configuration information for the Optical Line System (OLS) with the Optical Translator (OT). It also includes package illustrations and information on OLS with OT packages, system control, physical design, transmission, protection, and powering.

Introduction

OLS is available in the following equipment packages:

- OLS End Terminal Cabinet for 4 Bidirectional Optical Lines

- OLS Repeater Cabinet for 4 Bidirectional Optical Lines

- OLS Dual End Terminal Cabinet or Bay

- OLS Dual Repeater Cabinet or Bay

- OLS End Terminal and Repeater Cabinet or Bay

- OLS End Terminal Shelf (miscellaneously-mounted)

- OLS Repeater Shelf (miscellaneously-mounted)

- OLS Integrated Bay.

Additional Optical Translator (OT) equipment is available in the following configurations:

- OT Cabinet or Bay

- Miscellaneously-mounted OT

- Miscellaneously-mounted OT System Controller Shelf

- Miscellaneously-mounted OT Complementary Shelf 1

- Miscellaneously-mounted OT Complementary Shelf 2.

These packages and configurations are described in the following sections.

OLS Cabinet/Bay Design

OLS Cabinet and Bay shelves are similar each other but have key differences. Bay-mounted shelves have front covers while cabinet-mounted shelves have front doors. In addition, a bay frame arrangement or miscellaneously-mounted unit has heat baffles attached to the shelf, whereas heat baffles are supplied as a physical component of the cabinet (one heat baffle is located between the two shelves).

The cabinets used for OLS with OT systems have the following dimensions:

■ 183 cm (6 ft) H

■ 86 cm (34 in) W

■ 60 cm (24 in) D.

Figure 4-1 shows the OLS Cabinet.
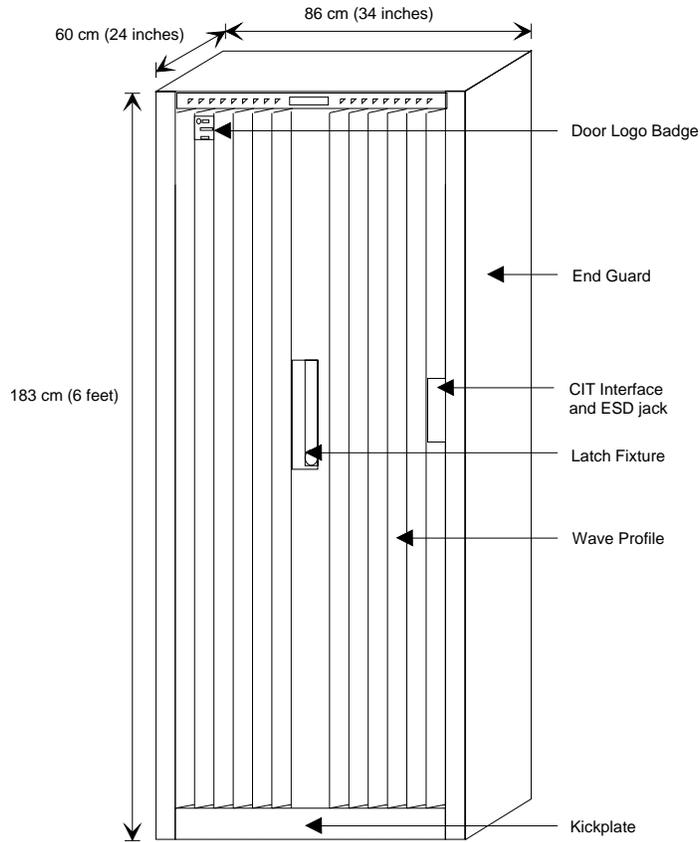
Figure 4-1. OLS Cabinet

The bay frames used for OLS with OT systems have the following dimensions:

- 2134 cm (84 in) H

- 660 cm (26 in) W

- 24 cm (10 in) D.

Figure 4-2 shows a front view of the OLS bay frame.

2134 cm
(84 in.)

660 cm (26 in.)
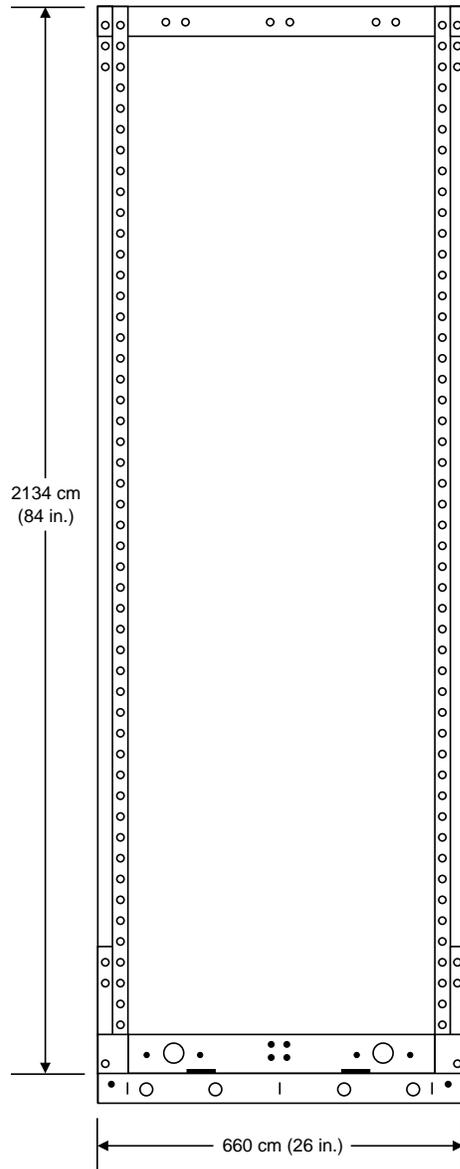
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Figure 4-2.   OLS Bay Frame

OLS Shelf Design

OLS and OT shelves can be housed in Lucent Technologies Newlook 2000 cabinets, mounted in European Telecommunications Standard Institute (ETSI) compatible racks, or mounted in a Network System Bay Framework (800 or 801 type). The shelves can be ordered from the factory with a cabinet or bay frame or as separate, miscellaneously-mounted units.

Miscellaneously-mounted and bay-mounted OLS shelves include:

- Two front shelf covers
- Attached heat baffle
- User panel
- Bay mounting brackets.

Figure 4-3 shows a miscellaneously-mounted OLS shelf with front covers (bay-mounted shelves are similar).

Top Cover

Right Top Cover Latch

User Panel

Top Cover Hinge

Left Bottom Cover Latch

Bottom Cover

Mounting Bracket

Bottom Cover Hinge
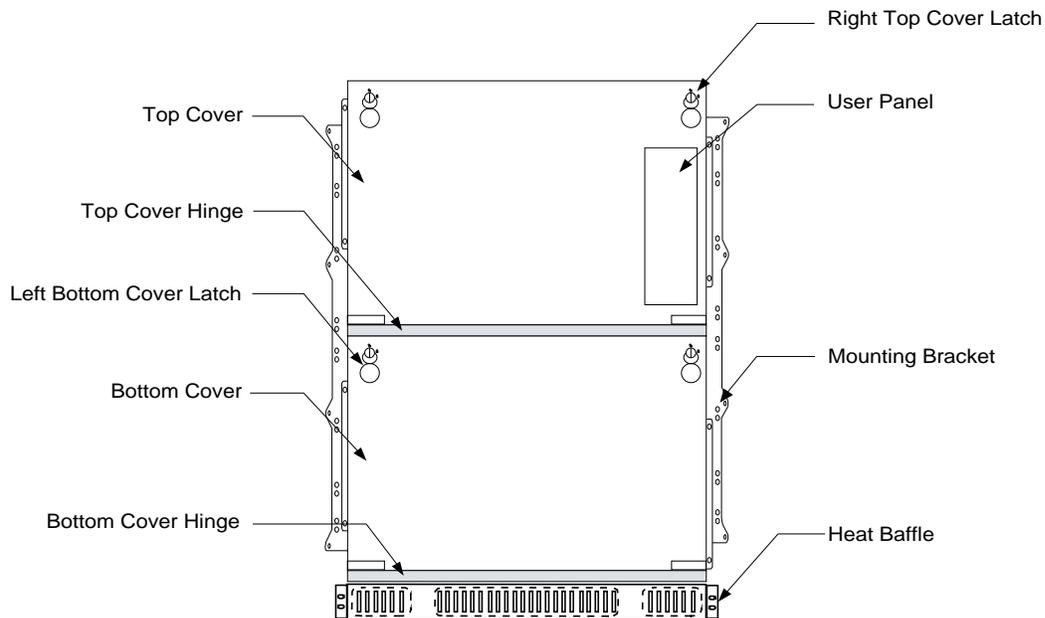
Heat Baffle

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Figure 4-3.   Miscellaneously-Mounted OLS Shelf with Front Covers

Miscellaneously-mounted and bay-mounted OT shelves include:

- One front shelf cover

- Attached heat baffle

- Fuse/power indicating panel for Complementary Shelf 1 and 2

- User panel for the System Controller Shelf

- Bay mounting brackets.

Figure 4-4 shows a miscellaneously-mounted OT shelf with front cover (bay-mounted shelves are similar).

Fuse/Power Indicating Panel
or
User Panel

Mounting Bracket

Cover Hinge

Heat Baffle
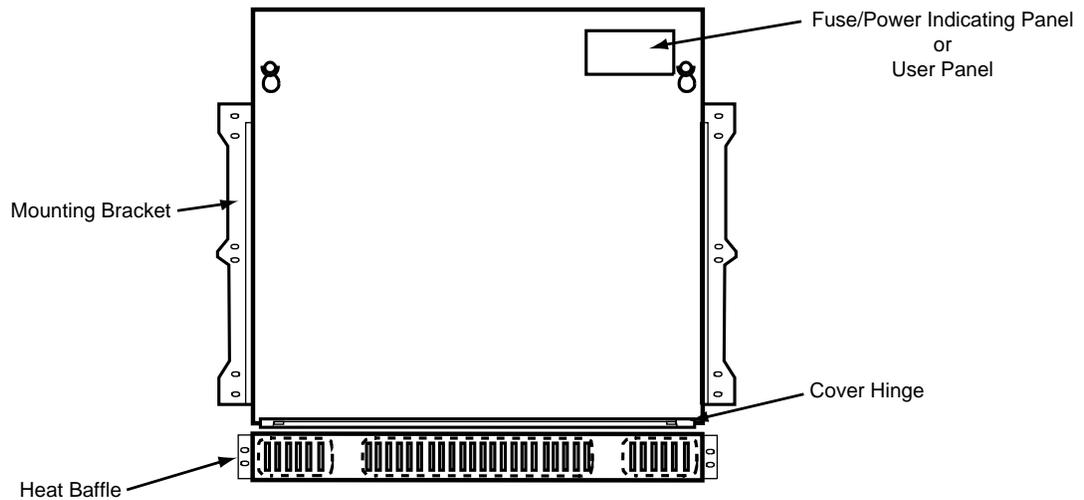
opt04017.01eSEV082297r2.1

Figure 4-4. Miscellaneously-Mounted OT Shelf with Front Cover

Cabinet-mounted OLS and OT shelves include a fuse panel. Alarm and status indicators are provided on an indicator strip at the top of the cabinet, rather than on shelf indicator panels.

Figure 4-5 shows the OLS cabinet shelf (cabinet doors open). Externally, both the OLS and OT Cabinets are similar.

Indicator Strip

Fuse Panel

Heat Baffle
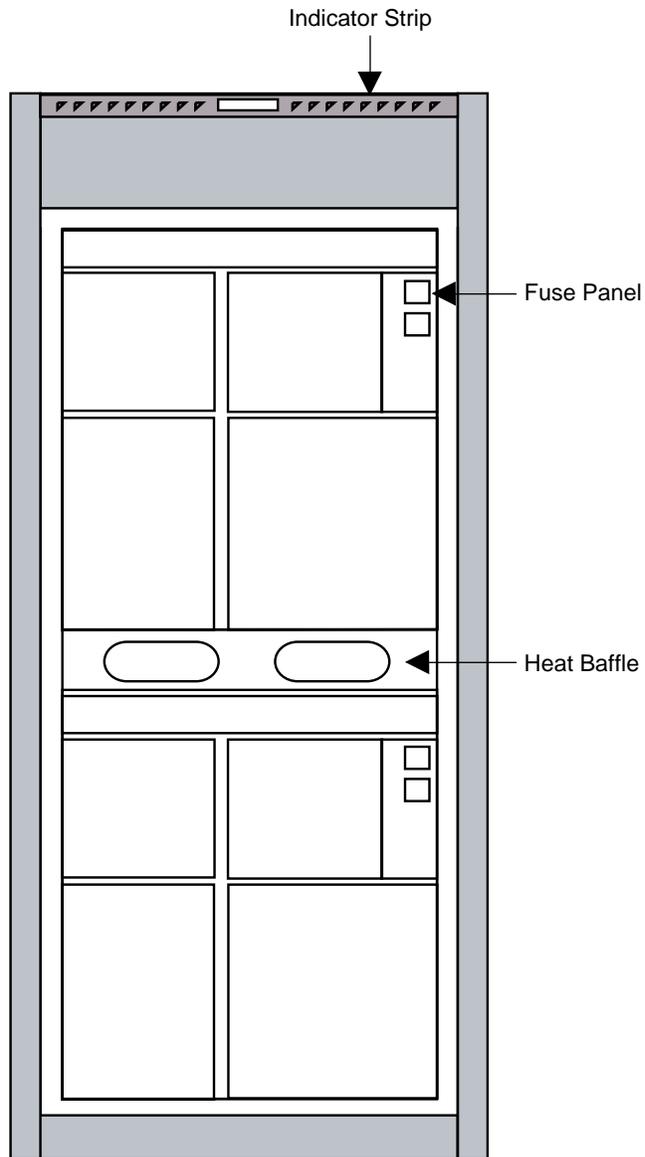
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Figure 4-5.   OLS Cabinet Shelf

OLS Shelf Descriptions

This section describes the basic types of OLS shelves that are equipped with circuit packs. These shelves are:

- End Terminal Shelf

- Repeater Shelf

- Optical Translator System Controller Shelf

- Optical Translator Complementary Shelves 1 and 2.

End Terminal Shelf

In End Terminal shelves, the OMUs and ODUs are placed in different order at each end of an OLS. On one end of the system, OA lines "A" are used as transmitters. On the other end, OA lines "A" are used as receivers. For that reason, one OLS End Terminal is referred to as 1A-TX, and the other End Terminal is referred to as 1A-RCV.

Figure 4-6 shows a cabinet-mounted OLS End Terminal shelf configured for site 1A-TX, site 1A-RCV, and DUAL. This type of shelf contains telemetry (TLMs) circuit packs, OAs, OMUs and ODUs that provide dense wavelength division multiplexing of up to 16 wavelengths per fiber, and system control circuit packs (TOHCTL, SYSCTL, and SYSMEM). For information on circuit packs, refer to "Transmission Circuit Packs and Units" and "Control Circuit Packs" later in this chapter.

Figure 4-6.   Cabinet-Mounted OLS End Terminal Shelves (fully equipped)

Transmit-End Terminal (1A-TX)

Receive-End Terminal (1A-RCV)

Dual-Facing Shelf (DUAL)

Interconnection Panel

Interconnection Panel

Interconnection Panel

T L M	T L M	O M U	O D U	O M U	O D U	Fuse Panel
OA 1A	OA 1B	OA 2A	OA 2B	TOHCTL	SYSCTL	SYSMEM

T L M	T L M	O D U	O M U	O D U	O M U	Fuse Panel
OA 1A	OA 1B	OA 2A	OA 2B	TOHCTL	SYSCTL	SYSMEM

T L M	T L M	O D U	O M U	O M U	O D U	Fuse Panel
OA 1A	OA 1B	OA 2A	OA 2B	TOHCTL	SYSCTL	SYSMEM
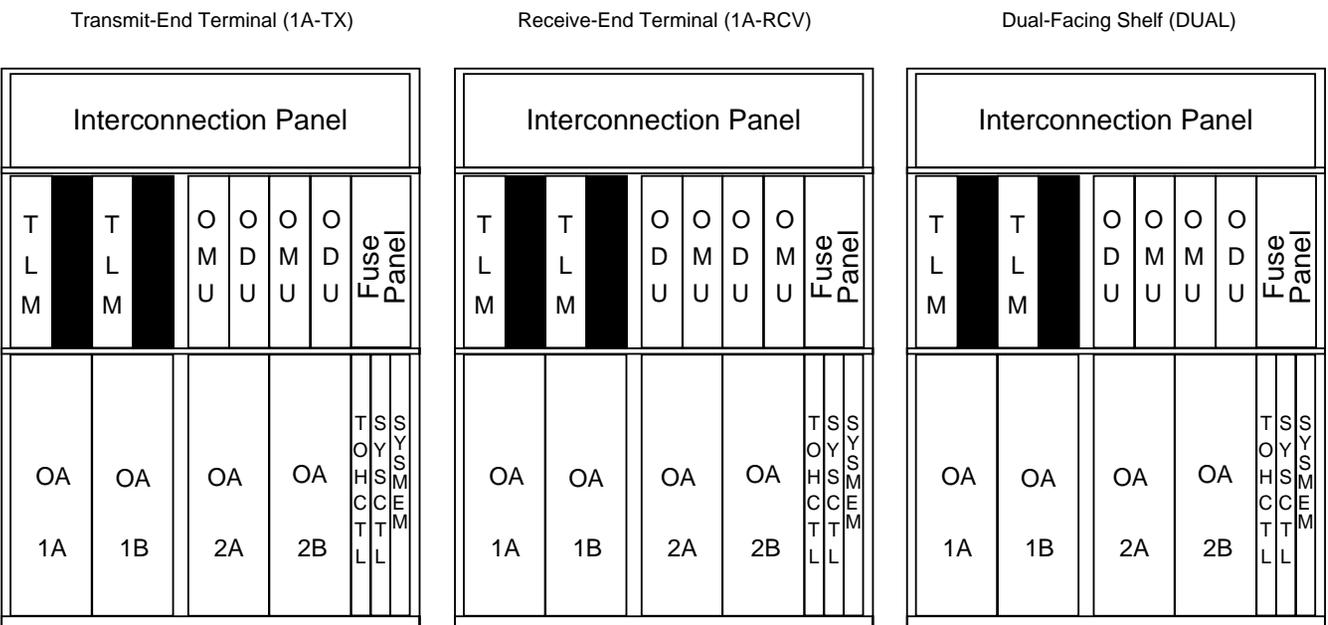
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OLS Repeater Shelf

The OLS Repeater Shelf, shown in Figure 4-7 (cabinet-mounted), is similar to the OLS End Terminal Shelf, except that it does not contain an OMU or ODU and it requires two TLM circuit packs per line. The OLS Repeater shelf contains OA circuit packs, associated system control and telemetry circuit packs, a fuse panel, and an interconnection panel. For information on circuit packs, refer to "Transmission Circuit Packs and Units" and "Control Circuit Packs" later in this chapter.

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Figure 4-7. Cabinet-Mounted OLS Repeater Shelf (fully equipped)

OT System Controller Shelf

Each miscellaneously-mounted System Controller Shelf consists of 8 OTU (or 4 QOTU) circuit pack slots, four empty slots (three of them designated for future installation of controller circuit packs). For information on circuit packs, refer to "Transmission Circuit Packs and Units" and "Control Circuit Packs" later in this chapter.

Figure 4-8 shows a miscellaneously-mounted System Controller Shelf without the front shelf cover.
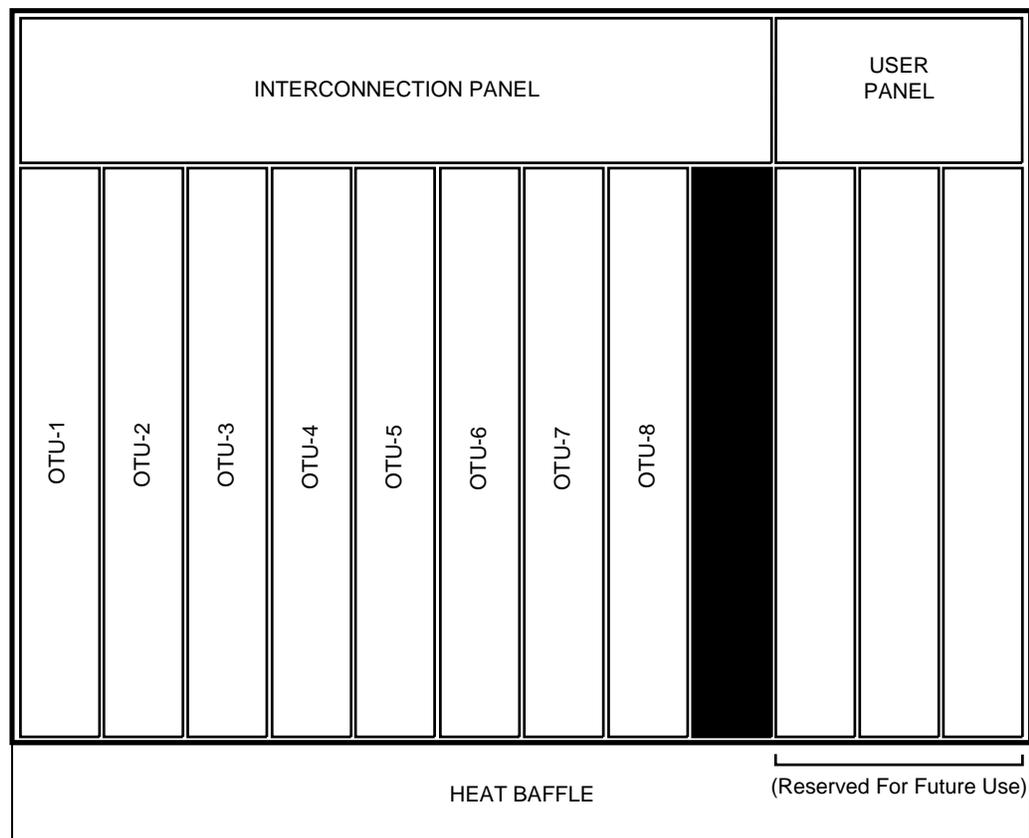
ols04033.01eSEV082297r2.1

Figure 4-8.   Miscellaneously-Mounted System Controller Shelf (8 OTUs; fully equipped)

OT Complementary Shelves 1 and 2

Each miscellaneously-mounted Complementary Shelf consists of 12 OTU (or 6 QOTU) circuit pack slots, an interconnection panel, and a fuse/power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover. For information on circuit packs, refer to "Transmission Circuit Packs and Units" and "Control Circuit Packs" later in this chapter.

Because miscellaneously-mounted shelves are not mounted in a cabinet with an indicator strip, the indicators must be placed on the individual shelves. The Complementary Shelves each have a fuse/power indicating panel that displays a green Power On (PWR ON) LED. The PWR ON LED illuminates to indicate that the respective shelf is receiving -48 V power.

Figure 4-9 shows a miscellaneously-mounted Complementary Shelf 1 without the front shelf cover. Complementary Shelf 2 is identical to Complementary Shelf 1 except that the OTUs are numbered from 21 to 32.
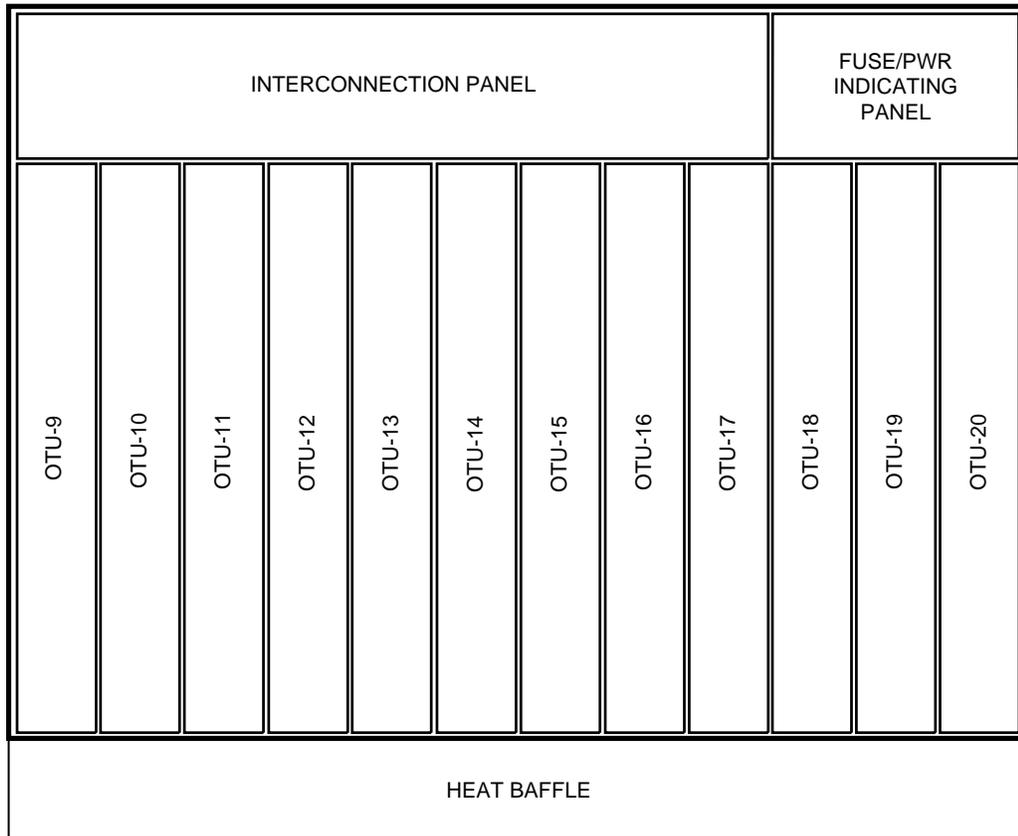
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Figure 4-9.   Miscellaneously-Mounted Complementary Shelf 1 (12 OTUs; fully equipped)

OLS Packages

This section describes the different types of OLS packages that can be housed in cabinet or bay frame arrangements. All OLS network element configurations (except the OLS Integrated Bay) are available in cabinet-mounted configurations. Packages include:

- **OLS 4-Line End Terminal or Repeater Cabinet—** houses two shelves, each shelf having a maximum of two bidirectional optical lines for a total of four bidirectional optical lines per cabinet

- **OLS Dual End Terminal or Dual Repeater Cabinet—** houses two independent shelves, each shelf having a maximum of two bidirectional optical lines

- **OLS Dual End Terminal or Dual Repeater Bay—** houses two independent shelves, each shelf having a maximum of two bidirectional optical lines

- **OLS End Terminal and Repeater Cabinet—** houses two independent shelves, each shelf having a maximum of two bidirectional optical lines

- **OLS End Terminal and Repeater Bay—** houses two independent shelves, each shelf having a maximum of two bidirectional optical lines

- **OLS Integrated Bay—** houses two OT shelves and one OLS End Terminal shelf, containing two bidirectional optical lines

- **OT Cabinet—** houses three shelves, containing a combined maximum of 32 to 64 optical channels per cabinet

- **OT Bay—** houses three shelves, containing a combined maximum of 32 to 64 optical channels per cabinet.

Illustrations of the OLS packages are inlcuded in the following pages. The majority of these illustrations show cabinet-mounted arrangements.

86 cm (34 in)

Interconnection Panel

| T L M | T L M | O M U | O D U | O M U | O D U | Fuse Panel |

| OA 3A | OA 3B | OA 4A | OA 4B | |

72.4 cm
(28.5 in)

Heat Baffle

Interconnection Panel

| T L M | T L M | O M U | O D U | O M U | O D U | Fuse Panel |

| OA 1A | OA 1B | OA 2A | OA 2B | T H C T L | S Y S C T L | S Y S M E M |

1829mm
(6 ft)

7.5 cm
(3 in)

72.4 cm
(28.5 in)

50 cm (20 in)
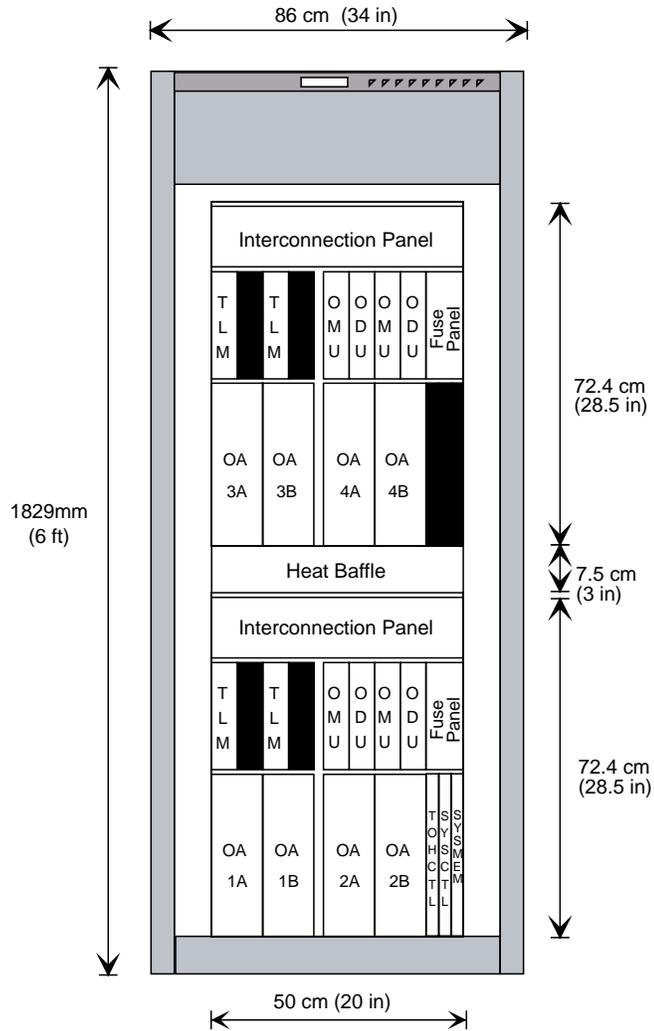
OA lines "A" are transmitters

NOTE: Example shows 1A-TX

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**Figure 4-10.   Cabinet-Mounted OLS End Terminal for 4 Bidirectional Optical
Lines (fully equipped)**
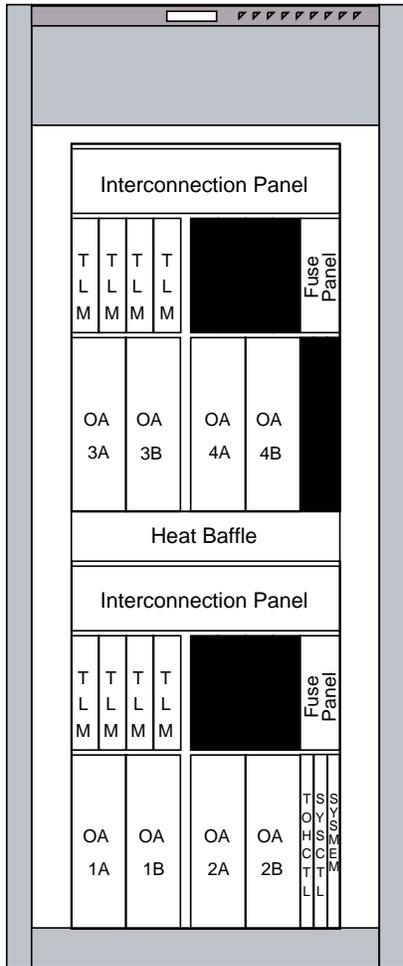
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Figure 4-11.   Cabinet-Mounted OLS Repeater for 4 Bidirectional Optical Lines
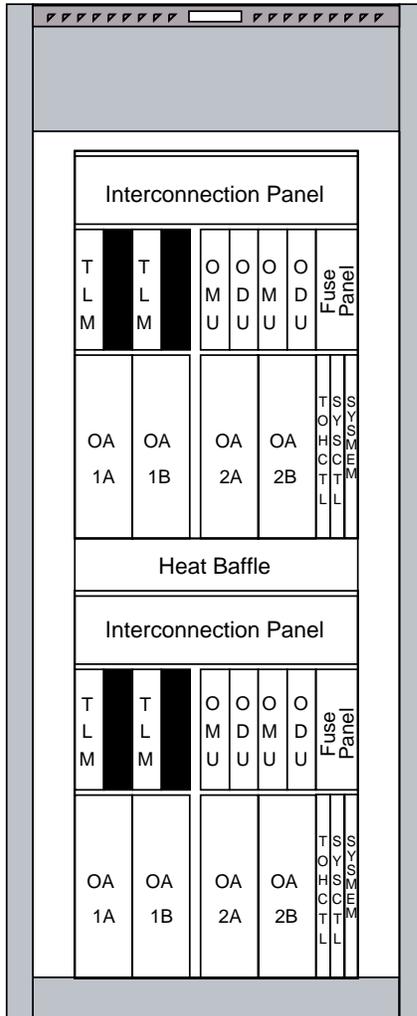
NOTE: Example shows 1A-TX in both shelves

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Figure 4-12.   Cabinet-Mounted OLS Dual End Terminal (fully equipped)
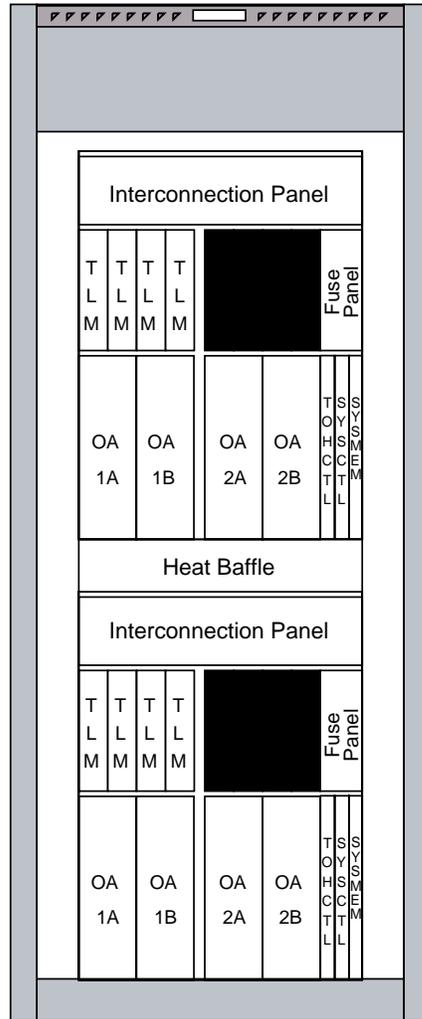
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Figure 4-13.   Cabinet-Mounted OLS Dual Repeater (fully equipped)

Figure shows a cabinet diagram with the following labels:

Interconnection Panel

T L M | T L M | T L M | T L M | (black) | Fuse Panel

OA 1A | OA 1B | OA 2A | OA 2B | T O H C T L | S Y S C T L | S Y S M E M

→ Repeater Shelf

Heat Baffle

Interconnection Panel

T L M | (black) | T L M | (black) | O M U | O D U | O M U | O D U | Fuse Panel

OA 1A | OA 1B | OA 2A | OA 2B | T O H C T L | S Y S C T L | S Y S M E M
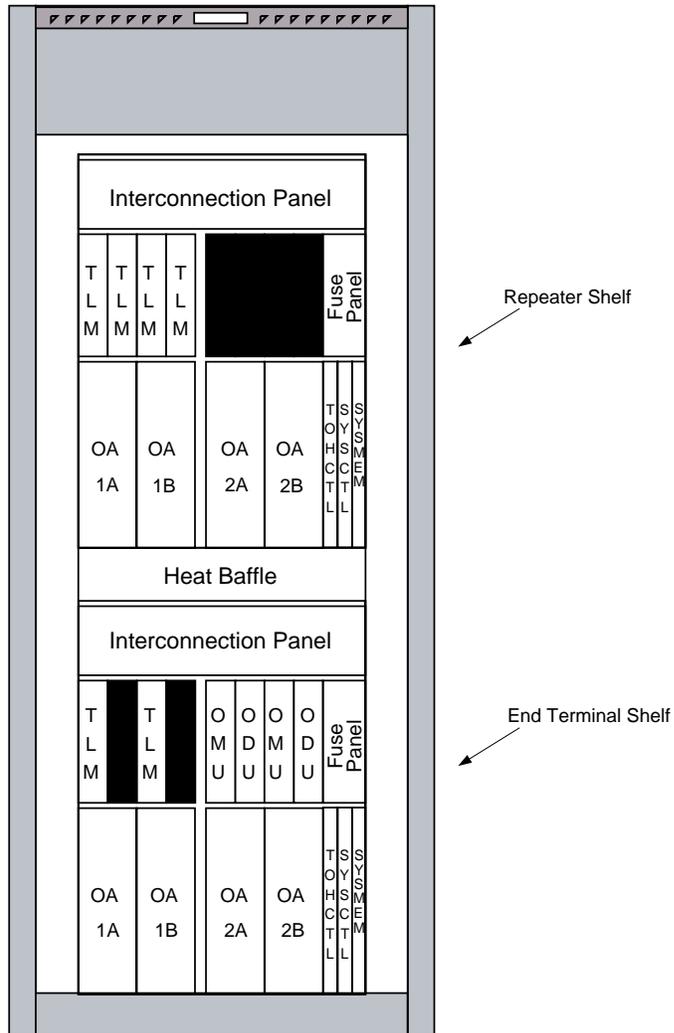
→ End Terminal Shelf

NOTE: Each end terminal shelf can be 1A-TX, 1A-RCV or DUAL.
This figure shows 1A-TX.

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Figure 4-14.   Cabinet-Mounted OLS End Terminal and Repeater

```
┌───────────────────────────────┐
│  ┌─────────────────────────┐  │
│  │                         │  │
│  ├─────────────────────────┤  │
│  │  Interconnection  Panel │  │
│  ├──┬──┬──┬──┬───────┬──┐  │  │
│  │T │T │T │T │███████│U │  │  │
│  │L │L │L │L │███████│s │  │  │
│  │M │M │M │M │███████│e │  │  │
│  │  │  │  │  │███████│r │  │  │
│  │  │  │  │  │       │P │  │  │
│  ├──┴──┼──┴──┼────┬──┤a │  │  │
│  │OA OA│OA OA│ToYS│Sy│n │  │  │
│  │1A 1B│2A 2B│HcsC│sm│e │  │  │
│  │     │     │Ct T│eM│l │  │  │
│  ├─────┴─────┴────┴──┴──┤  │  │
│  │      Heat Baffle      │  │  │
│  ├───────────────────────┤  │  │
│  │  Interconnection Panel │  │  │
│  ├───┬───┬─┬─┬─┬──┐      │  │  │
│  │T  │T  │O│O│O│U │      │  │  │
│  │L  │L  │M│D│M│s │      │  │  │
│  │M  │███│U│U│U│e │      │  │  │
│  │   │███│ │ │ │r │      │  │  │
│  │   │███│ │ │ │P │      │  │  │
│  ├───┴───┼─┴─┴─┴──┤      │  │  │
│  │OA  OA │OA  OA  │      │  │  │
│  │1A  1B │2A  2B  │      │  │  │
│  ├───────┴────────┤      │  │  │
│  │   Heat Baffle   │      │  │  │
│  └─────────────────┘      │  │  │
│                               │  │
└───────────────────────────────┘
```

NOTE: Example shows IA-TX End Terminal and Repeater

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Figure 4-15.   Bay-Mounted OLS End Terminal and Repeater
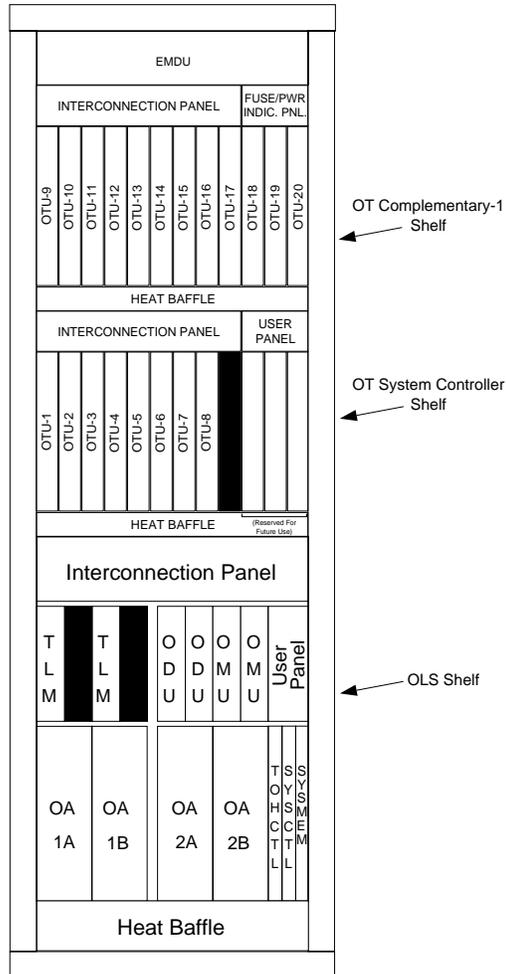
Figure 4-16.   OLS Integrated Bay
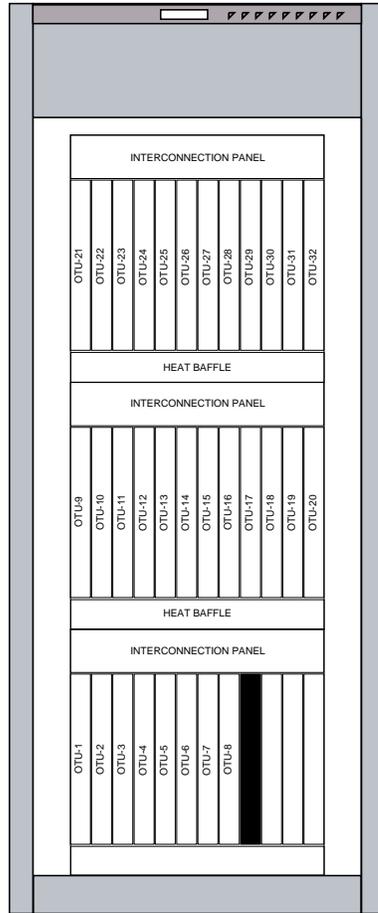
opt04006.02eSEV082297r2.1

Figure 4-17.   Cabinet-Mounted OT Configuration

INTERCONNECTION PANEL

OTU-21 OTU-22 OTU-23 OTU-24 OTU-25 OTU-26 OTU-27 OTU-28 OTU-29 OTU-30 OTU-31 OTU-32

OT Complementary
Shelf 2

HEAT BAFFLE

INTERCONNECTION PANEL

OTU-9 OTU-10 OTU-11 OTU-12 OTU-13 OTU-14 OTU-15 OTU-16 OTU-17 OTU-18 OTU-19 OTU-20

OT Complementary
Shelf 1

HEAT BAFFLE

INTERCONNECTION PANEL

OTU-1 OTU-2 OTU-3 OTU-4 OTU-5 OTU-6 OTU-7 OTU-8

OT System Controller
Shelf

HEAT BAFFLE   (Reserved For Future Use)

opt04013.02eSEV082297r2.1

Figure 4-18.   Bay-Mounted OT Configuration

Within the packages, specific functions are performed by OLS End Terminals, OLS Repeaters, and the OT.

An OLS End Terminal:

- Multiplexes digitally encoded information contained in up to 16 different wavelengths

- Transmits combined signal through optical fibers

- Demultiplexes information at receive end.

See "End Terminal Configuration" for more information.

An OLS Repeater terminal:

- Amplifies the optical line signals

- Add and drops the supervisory signal

- Monitors the received power of each optical channel and the total received optical power.

An OT:

- Provides an open system interface to all types of transmission equipment

- Extends wavelength sections to thousands of kilometers

- Facilitates Wavelength Add/Drop (WAD)

- Prevents wavelength blocking via Wavelength Interchange.

End Terminal Configuration

This section describes the different configuration types of an End Terminal.

In the following sections, the terms 1A-TX (1A-transmit) and 1A-RCV (1A-receive) are used in reference to OLS End Terminals. These terms indicate a different placement order of the OMU and ODU and a different provisioning between the ends of an OLS.

In a 4-line End Terminal, both shelves are used as either 1A-TX or 1A-RCV. For additional information, see "End Terminal Provisioning" in Chapter 5.

Dual Facing Shelf

Release 2.1 introduces the Dual Facing Shelf as a new End Terminal con-figuration. This feature is designed to extend the OLS operations domain in 2-fiber applications. Figure 4-6 shows a Dual Facing Shelf (right).

The Dual Facing Shelf allows the functions of back-to-back collocated sin-gle facing shelves to be combined so that only one shelf, recognized as one NE, is used. In addition to the equipment savings on shelves and SYSCTL/SYSMEM/TOHCTL packs, coordination using OSS (Operations Support System) or other equipment (for example: orderwire) across the old limit of operations domains is no longer necessary. In this application, both OA lines 1A and 1B are used as receivers and OA lines 2A and 2B are used as transmitters. Figure 4-19 depicts the differences between the older OLS operation and the newer operation that uses the Dual Facing Shelf feature.

WITHOUT Dual Facing Shelf Feature

CO= Central Office

Operations
Support System (OSS)

| End Terminal | End Terminal | End Terminal | End Terminal |

CO 1   CO 2   CO 3

Domain 1   Domain 2

WITH Dual Facing Shelf Feature

OSS

Viewed operationally as a Network Element

| End Terminal | **Dual Facing Shelf** | End Terminal |

CO 1   CO 2   CO 3

Single Domain

ols04043.00wmfSEV092497r2.1
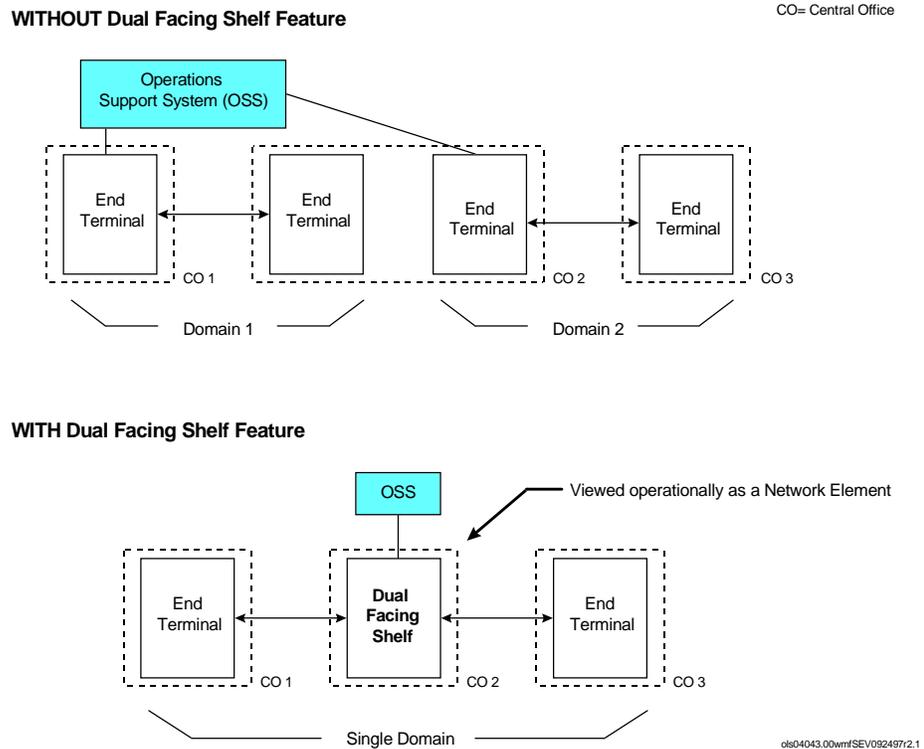
Figure 4-19.   OLS Operation Using Dual Facing Shelf

OLS End Terminal (Two OA Operation)

Figure 4-20 shows a block diagram of OLS End Terminal transmission. An End Terminal is situated at the beginning and at the end of an optical line. Figure 4-6 shows End Terminal shelves (left and center) configured for Two OA operation.

In the transmit direction, the End Terminal does the following:

1. Optically combines up to 16 optical channels onto a common optical fiber.

2. Amplifies the light and launches that signal (known as an optical line signal) onto the transmission fiber.

3. Couples the supervisory signal into the optical line signal.

4. Monitors the power of each optical signal in the OA.

End Terminal Application
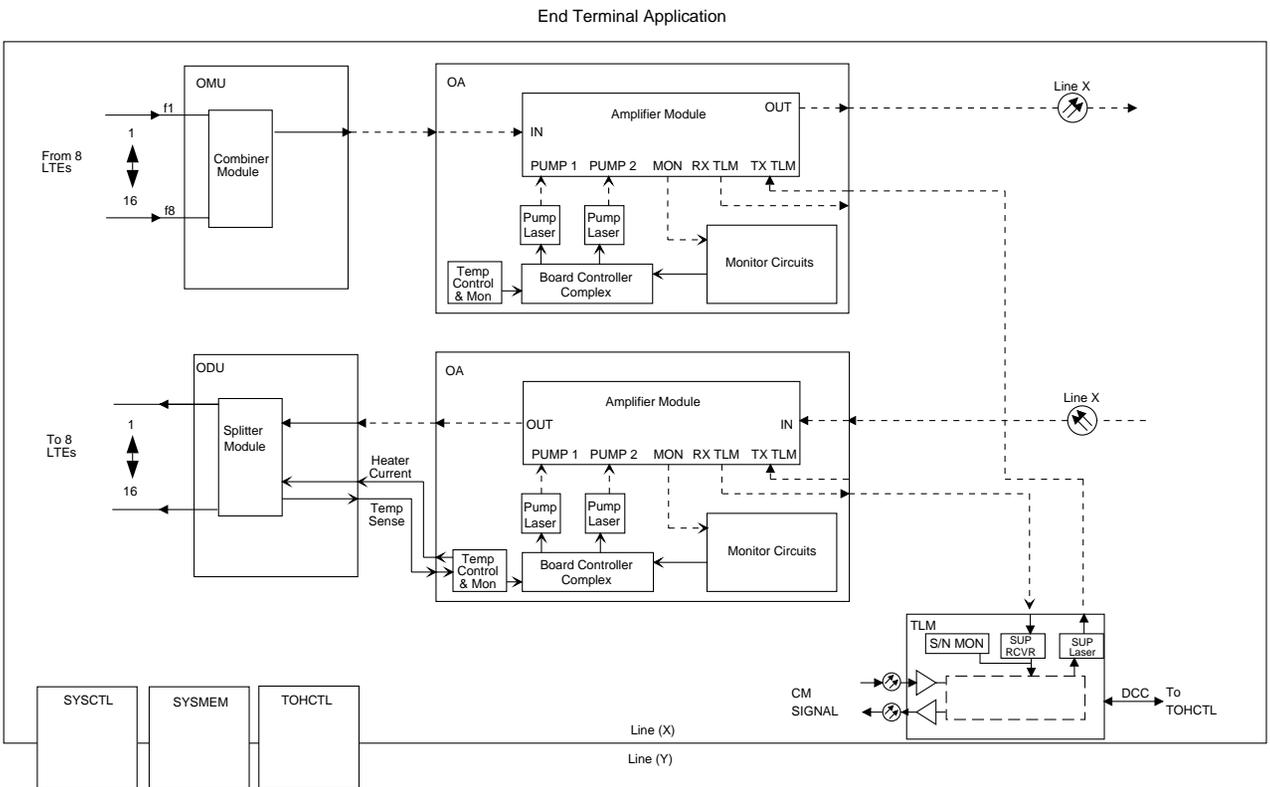
ols04021.02eSEV082297r2.1

In the receive direction, the End Terminal does the following:

1. Receives the low level optical line signal from the optical line and amplifies that signal.

2. Optically demultiplexes up to 16 optical signals from the optical line.

3. Demultiplexes the supervisory signal from the received optical line signal and provides this to the TLM circuit pack.

4. Monitors the received power of each optical channel and the total received optical power.

OLS End Terminal (Single OA Operation)

An OLS End Terminal configured for Short Haul and Metro applications is equipped with a transmit OA only. This is referred to as "single OA operation". Except for not having a receive preamplifier, operation of this End Terminal is the same as for other End Terminals shelves. Figure 4-21 shows an End Terminal shelf configured for single OA operation.

End Terminal Application
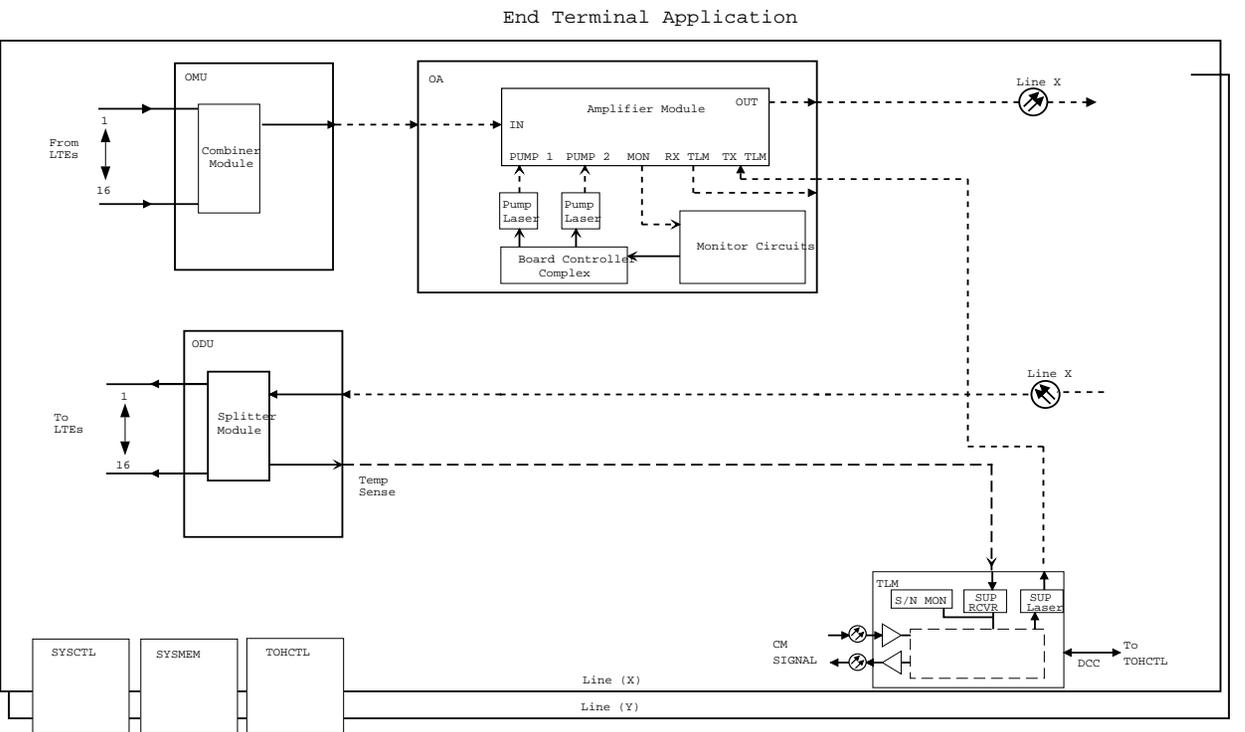
ols04031.01eSEV082

Figure 4-21.   OLS End Terminal (Single OA) Transmission Block Diagram.

Issue 2.1 October 1997   4-33

Transmission Circuit Packs, Units, and Port Modules

The OLS transmission circuit packs and units are as follows:

- Optical Amplifier (OA)

- Optical Multiplexer Unit (OMU)

- Optical Demultiplexer Unit (ODU)

- Optical Translator Unit (OTU)

- Quad Optical Translator Unit (QOTU)

- Optical Translator Port Module (OTPM)

- Telemetry (TLM).

All circuit pack/unit assemblies connect to the backplane. All optical connections in and out of the circuit packs run through faceplate-mounted optical connectors.

Optical Amplifier (OA)

The OAs operate in the 1.5 μm wavelength band. The main components of the OAs are as follows:

- **Pump lasers:** Two high power optical pump lasers operating at a wavelength of 980 nm provide power, which is then combined with the 1.5 μm signal onto a piece of erbium-doped fiber, where the actual gain takes place

- **Filter:** In the middle of the OA, a filter separates the light at 1532 nm from the rest of the 1.5 μm band. This filtering separates the supervisory channel from the optical (signal) channels and reduces noise

- **Optical splitter:** An optical splitter in the OA splits off a small amount of light for monitoring purposes

- **Optical isolators:** Optical isolators prevent optical reflections from degrading system performance.

In Long Span configurations, OLS supports a maximum distance of 600 km (five spans, up to four OLS repeaters) on standard or non-zero dispersion-shifted fiber.

In Long Reach configurations, OLS supports up to eight spans, with a maximum optical line length of 640 km on standard single-mode fiber or non-zero dispersion-shifted fiber.

In Short Reach configurations, OLS supports one span with optical line lengths up to 80 km.

OLS optically demultiplexes the signals at the other end of the optical line and passes them on to compatible optical receivers. OLS also uses a highly flexible form of wavelength add/drop.

For details on span length and network topologies and a description of the engineering rules used in building OLS networks and subnetworks, see Chapter 6, "System Planning and Engineering."

The OA circuit pack does the following:

- Amplifies the optical line signal

- Provides power monitors on the optical monitor point provided by the amplifier module

- Controls the pump lasers, which in turn, automatically controls the OA output power

- Provides add/drop ports for the supervisory signal

- Provides temperature control for the ODU

- Receives data from the OMUs and ODUs for version and type information.

OLS Releases 2 and later support both the LEA6 and LEA7 Optical Amplifiers. Long Reach systems require the LEA7 circuit pack, while long span systems can use either the LEA6 or LEA7. LEA105 is used for Short Reach systems and is required for single OA operation.

Optical Multiplexer Unit (OMU)

The OMU combines up to 16 optical channels into one optical signal called the optical line signal. The OMU is used at the End Terminal site. There are two OMU types:

- 505A 8-channel

- 506A 16-channel.

Both the OMU and ODU units are mechanically fastened to the shelf with screw fasteners and are field replaceable. The shelf card guides enable proper alignment to the backplane.

Optical Demultiplexer Unit (ODU)

The ODU demultiplexes the input optical signal into up to 16 channels. There are three types:

■ 605A 8-channel

■ 606A 16-channel without supervisory channel output

■ 606B 16-channel with supervisory channel output (for single OA operation).

Optical Translator Unit (OTU)

The OTU circuit pack regenerates an OC-48/STM-16 optical signal by

■ Converting the signal from optical to electrical format

■ Converting the signal back into an OC-48 optical signal compatible with OLS or a standard SONET ADM terminal

■ Monitoring it for errors.

Quad Optical Translator Unit (QOTU)

Each QOTU circuit pack occupies two OTU slots in an OT shelf, and contains from one to four OC3 or OC12 Optical Translator Port Modules (OTPM) in any combination. QOTUs must be in odd/even pairs. For example: 1 and 2, 7 and 8.

Optical Translator Port Module (OTPM)

The OTPMs perform the same functions as the OTUs for OC-3/STM-1, OC-12/STM-4, and 400-700 Mb/s rate signals, for 16 wavelengths.

Telemetry (TLM)

The telemetry circuit pack (TLM) provides a supervisory channel on the optical line. This channel is used for fault location and maintenance functions. This circuit pack also provides a customer maintenance signal.

A fully-equipped OLS End Terminal shelf requires one TLM circuit pack per line, while a fully-equipped OLS Repeater shelf requires two TLM circuit packs per line.

The TLM circuit pack hardware supports an IS-3 interface that can be used to transmit an STS-3 maintenance signal. The customer can use the payload in the STS-3 signal for site-to-site customer-specific data. In addition, three orderwire channels, E1, E2, and F1, are available.

OLS System Control Architecture

OLS uses a hierarchical control architecture. The hierarchy consists of a 2-level control system, in which the system controller complex functions as the higher level of control and the board controller, residing on the OA and telemetry (TLM) circuit packs, serve as the lower level of control. Figure 4-22 shows the OLS system control architecture.

The system controller complex is responsible for system-wide computations and system user interface functions. The complex is physically partitioned into two separate circuit packs referred to as the system controller (SYSCTL) and system memory (SYSMEM) circuit packs respectively. The board controller local area network (BCLAN) connects these two control levels. The system controller complex also plays a major role in providing the operations, administration, maintenance, and provisioning functions.

A single system controller complex controls up to four bidirectional optical lines.
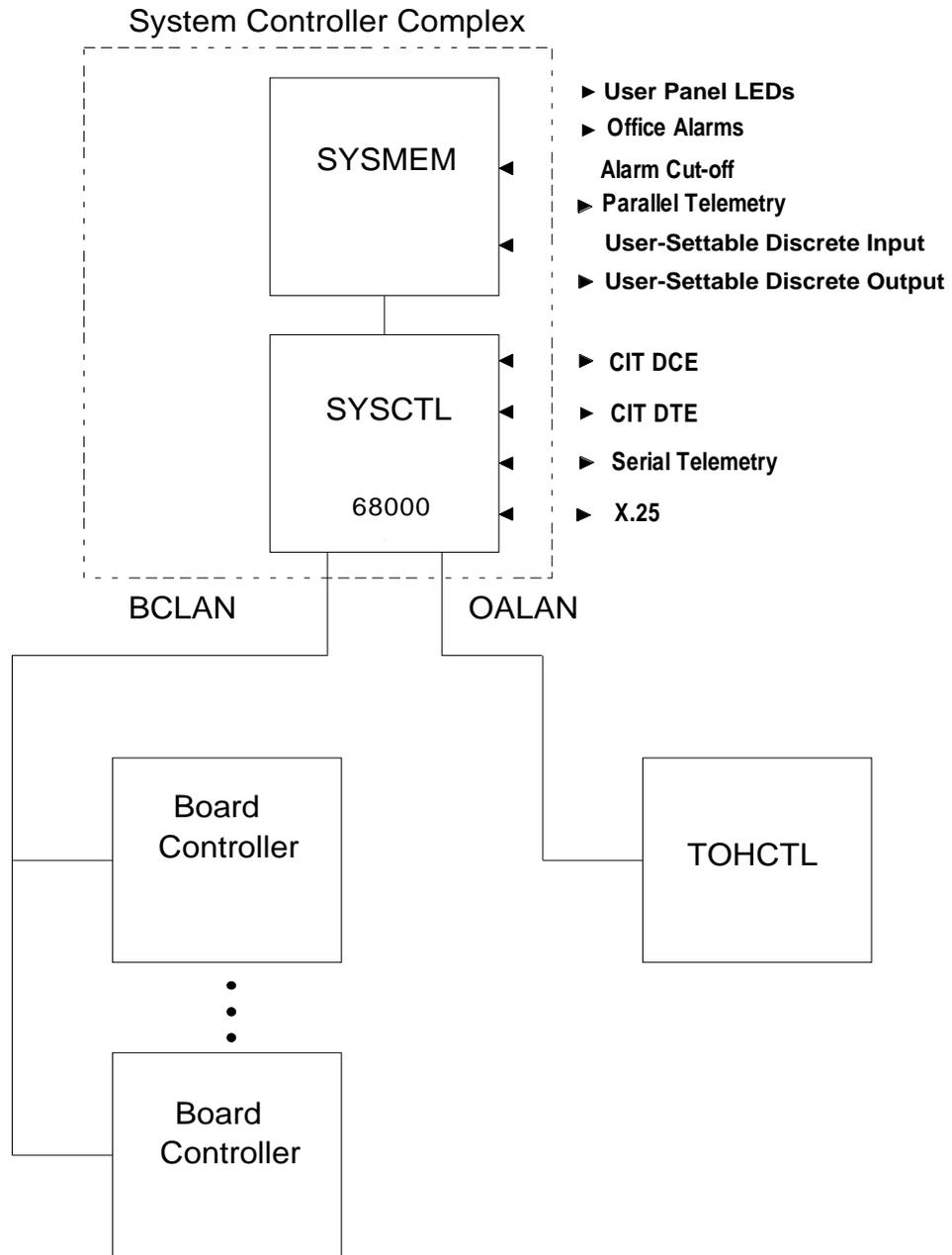
Figure 4-22.   System Control Architecture for the Optical Line System (OLS)

The board controller contains a microcontroller with supporting circuitry. This controller monitors and controls the OA and TLM circuit packs, isolates faults at the pack level, controls the circuit pack FAULT LEDs, controls hardware provisioning data, maintains a sanity timer, and provides debugging functions.

The tributary overhead controller (TOHCTL) performs Data Communications Channel (DCC) processing functions.

The controllers communicate among the various levels of the system using internal local area networks (LANs). The board controllers communicate using the board controller local area network (BCLAN). The TOHCTL circuit pack and the system controller complex communicate using the overhead access local area network (OALAN).

The OLS control features are available to the operator through several craft and operations system (OS) interfaces. In addition to accessing the local terminal, the craft and OS interfaces can reach a remote terminal using the DCC in the optical signal. These functions are provided by the SYSCTL, SYSMEM, and TOHCTL circuit packs. For more information about craft and operations system interfaces, refer to Chapter 5, "Operations, Administration, Maintenance, and Provisioning."

Control Circuit Packs

The OLS control circuit packs are as follows:

- system controller (SYSCTL)

- system memory (SYSMEM)

- tributary overhead controller (TOHCTL).

System Controller (SYSCTL)

The system controller (SYSCTL) circuit pack and the system memory (SYSMEM) circuit pack provide the highest level of system control for OLS. The SYSCTL circuit pack provides system-level user and operations systems interfaces and performs system-wide maintenance computations. It also includes system-wide performance monitoring. The SYSCTL circuit pack supports serial telemetry and X.25 interfaces.

System Memory (SYSMEM)

The system memory (SYSMEM) circuit pack provides memory support for the system controller (SYSCTL) circuit pack. The SYSMEM circuit pack contains erasable programmable read-only memory (EPROM) for nonvolatile storage of user-provisioned data and the system state and a flash EPROM for nonvolatile storage of the software for the entire system. The SYSMEM circuit pack also supports the user panel, parallel telemetry, miscellaneous discretes, and office alarms.

Tributary Overhead Controller (TOHCTL)

The tributary overhead controller (TOHCTL) circuit pack processes the overhead (D1 - D3) of the supervisory channel. The TOHCTL interfaces with the transmission overhead on the TLM circuit pack to deliver and receive DCC data. The TOHCTL interfaces to the system controller complex by means of the OALAN.

Cable Dressing

To keep service and protection fiber and feeder A and feeder B power cables in separate places, the fiber and power feeder cables are dressed on different sides of the shelves.

All drop side optical fiber and electrical cables access each shelf from two cut-outs located on the left and right shelf side-plates above the shelf upper nest (interconnection area).

The OAM&P cables may access the shelf from either cutout, depending upon ease of access.

Figure 4-23 shows how the cables are dressed for the End Terminal shelf. The OLS Repeater shelf follows the same dressing scheme except that the drop side optical fibers are not used.
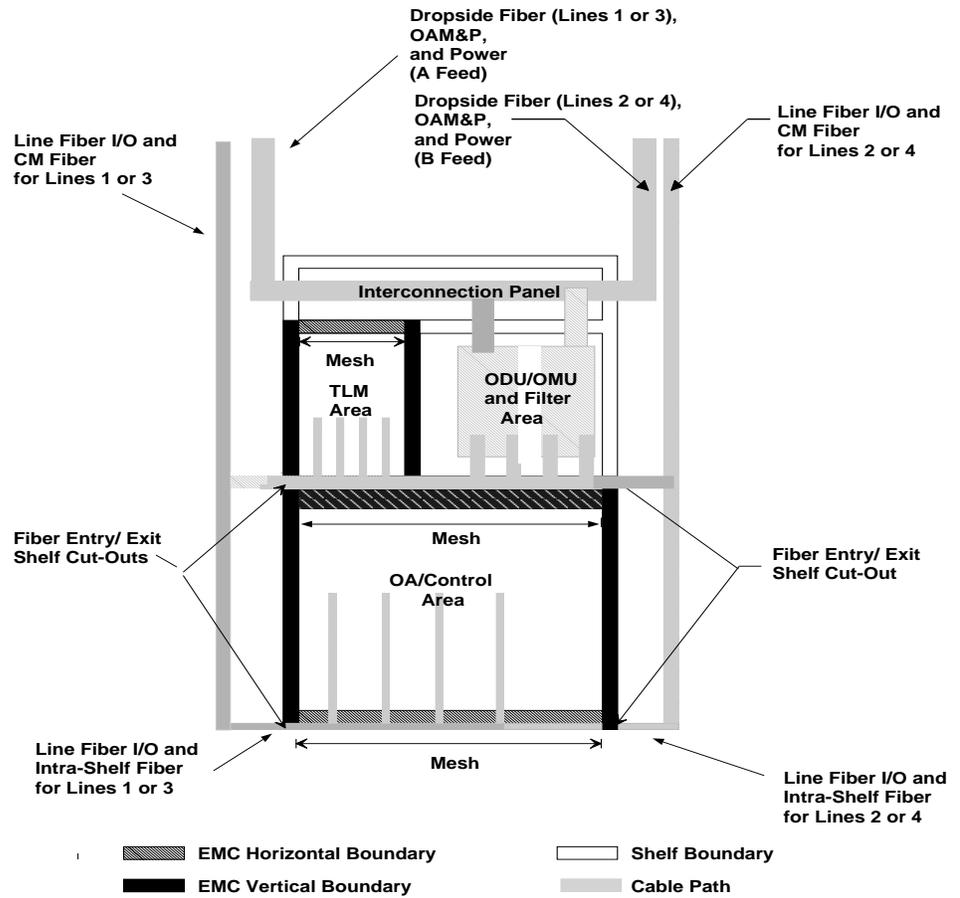
Figure 4-23.   OLS Shelf Fiber/Cable Dressing and EMC/ESD Design

Interconnection Panels

This section describes the interconnections panels, cabinet indicator strips, and fuse and user panels associated with the OLS and OT shelves.

OLS Interconnection Panel

The OLS shelf contains a built-in interconnection area at the top for OAM&P connections. The backplane for each shelf provides intrashelf interconnection between all the circuit packs used in the shelf as well as interconnection from the OAM&P interconnectors at the top of the shelf to the various CP connector pins on the backplane. A Craft Interface Terminal (CIT) access port is available from the interconnection panel. All access to the connections is from the front.

Figure 4-24 shows a diagram of the interconnection panel as seen from the front of the equipment.

[XA]   [XB]   [YA]   [YB]   INTERSHELF CTL

J3 ORDERWIRE   J6 ORDERWIRE   J9 ORDERWIRE   J12 ORDERWIRE   P15 BUS IN

J2 USER CHAN   J5 USER CHAN   J8 USER CHAN   J11 USER CHAN   P14 BUS OUT

J1 ORDERWIRE   J4 ORDERWIRE   J7 ORDERWIRE   J10 ORDERWIRE   J13 INTRAOFFICE

Left Side

SHELF CIT (DCE) J16   SHELF CIT (DTE) P17   SHELF X.25 J18   P20 SER TLM 2 / P19 SER TLM 1   USER PNL EXT J21   P24 MISC DSCRT 2 / P23 MISC DSCRT 1 / J22 CTL IN (B)   SHELF CTL IN (A) J25   SHELF CTL OUT (A) J26   P29 OFICE ALARMS / P28 PAR TLM / J27 CTL OUT (B)

PWR
-48 (A)
-48 (B)

Right Side

Figure 4-24.   OLS Interconnection Panel Diagram

Interconnection Panel for the OT System Controller Shelf

Refer to Figure 4-25 for the diagram of an OT System Controller Shelf's interconnection panel as seen from the front of the shelf.

Figure 4-25.   OT System Controller Shelf Interconnection Panel

160 180 | 220 240 260 | 300 320 | 360 380 400 420 440 460 | 500 520 540 560 580 600

J1 CIT DTE

J3 INC SIG FAIL

J2 CP FAIL

PWR A

OF ALMS J4

I AO LAN J5

CTL IN J6

CTL OUT J7

EQPG OUT J8

EQPG IN1 J9

EQPG IN2 J10

J12 X.25

J11 USER PANEL

J14 RESET OUT2

J13 RESET OUT1

J16 RESET IN

CIT DCE J15

PWR B
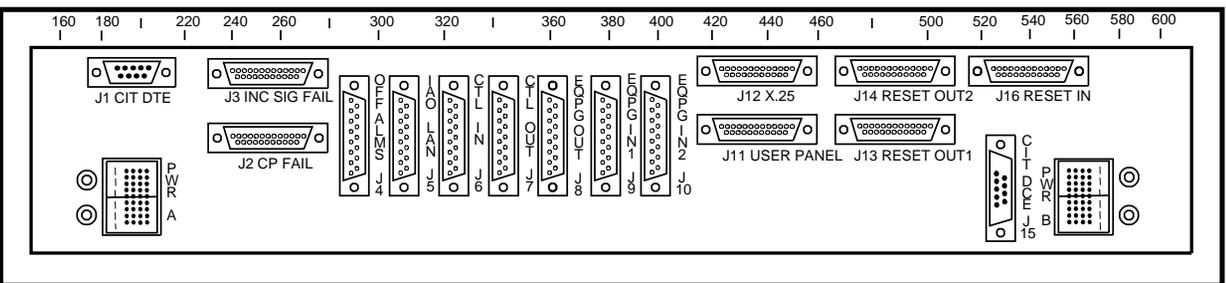
opt04007.02eSEV082297r2.1

Interconnection Panel for the OT Complementary Shelves

Refer to Figure 4-26 for a diagram and a description of a Complementary Shelf's interconnection panel as seen from the front of a Complementary Shelf.

160 180 220 240 260 300 320 360 380 400 420 440 460 500 520 540 560 580 600

J1 CIT DTE
J3 INC SIG FAIL
OF ALMS J4
IAO LAN J5
CTL IN J6
CTL OUT J7
EQPG OUT J8
EQPG IN 1 J9
EQPG IN 2 J10
J12 X.25
J14 RESET OUT2
J16 RESET IN
PWR A
J2 CP FAIL
J11 USER PANEL
J13 RESET OUT1
CIT DCE J15
PWR B
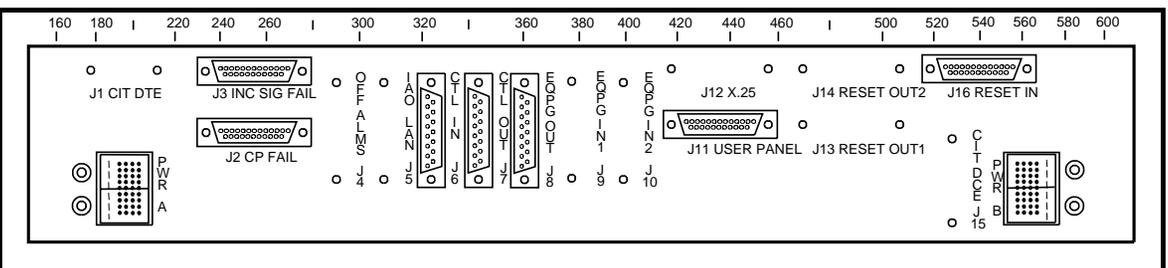
opt04014.01eSEV082297r2.1

Figure 4-26.   OT Complementary Shelf Interconnection Panel

OLS Cabinet Indicator Strips

Each OLS cabinet has an indicator strip located at the top front of the cabinet. Connectorized cabling connects the shelves to this indicator strip. Figure 4-27 shows the indicator strip for the OLS Dual End Terminal and OLS Dual Repeater cabinet, and Figure 4-28 shows the indicator strip for the OLS End Terminal and OLS Repeater for four Bidirectional Optical Lines.

Refer to Table 4-1 for a list and description of the indicators.
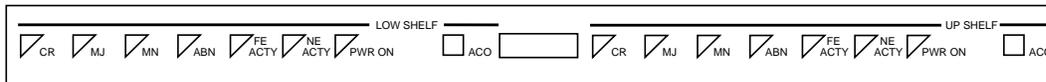
ols04003.01eSEV082297r2.1

Figure 4-27. Indicator Strip for Dual End Terminal and Dual Repeater Cabinets

ols04004.01eSEV082297r2.1

Figure 4-28. Indicator Strip for OLS End Terminal and Repeater Cabinet for 4 Bidirectional Optical Lines

Table 4-1.   User Panel Indicators for OLS in SONET Applications

Indicator Name	Abbrev.	Type	Color	Description
Critical	CR	LED	Red	Indicates critical active alarm level
Major	MJ	LED	Red	Indicates major active alarm level
Minor	MN	LED	Yellow	Indicates minor active alarm level
Alarm Cut-off	ACO	SW/LED	Green	When depressed, silences active audible alarms
Abnormal	ABN	LED	Yellow	Indicates an abnormal condition
Near End Activity	NE ACTY	LED	Yellow	Indicates alarm or status conditions at the local equipment
Far End Activity	FE ACTY	LED	Yellow	Indicates alarm or status conditions at the remote equipment
Power On (Lower Shelf)*	PWR ON LOW SHELF	LED	Green	Indicates that lower shelf is receiving -48V power
Power On (Upper Shelf)*	PWR ON UP SHELF	LED	Green	Indicates that upper shelf is receiving -48V power

* Applies only to cabinet applications.

Table 4-2 shows the synchronous digital hierarchy (SDH) equivalents of SONET-based indicator names on the OLS.

Table 4-2. User Panel Indicators for OLS in SDH Applications

Indicator Name	Abbrev.	Type	Color	Description
Critical	CR	LED	Red	Indicates critical active alarm level
Prompt	PROMPT	LED	Red	Indicates prompt active alarm level
Deferred	DEFR	LED	Yellow	Indicates deferred active alarm level
Suppress	SUPPRESS	SW/LED	Green	When depressed, silences active audible alarms
Abnormal	ABN	LED	Yellow	Indicates an abnormal condition
Info-N	INFO-N	LED	Yellow	Indicates alarm or status conditions at the local equipment
Info-F	INFO-F	LED	Yellow	Indicates alarm or status conditions at the remote equipment
Power On (Upper Shelf)[*]	PWR ON	LED	Green	Indicates that lower shelf is receiving -48V power
Power On (Lower Shelf)[*]	PWR ON	LED	Green	Indicates that upper shelf is receiving -48V power

* Applies only to cabinet applications.

OT Cabinet Indicator Strip

Each OT cabinet is equipped with an indicator strip located at the top front of the cabinet. Refer to Table 4-3 for a list and description of the indicators. Connectorized cabling connects the shelves to the indicator strip.

opt05001.00ejf123096

Figure 4-29.   OT Cabinet Indicator Strip

Although Table 4-3 lists all the indicators that appear on the indicator strip, only the three Power On (PWR ON) LEDs are active. To make upgrading in future releases easier, the other LEDs are also provided now.

No components will be replaced or removed to upgrade; new components will simply be added to the existing configurations to provide additional features.

Table 4-3.   Indicator Strip LEDs for OT (SONET)

Indicator Name	Abbrev.	Color	Description
Power On[*]	PWR	Green	Indicates that the respective shelf is receiving -48 V power
Critical	CR	Red	Indicates critical active alarm level
Major	MJ	Red	Indicates major active alarm level
Minor	MN	Yellow	Indicates minor active alarm level
Near End Activity	NE ACTY	Yellow	Indicates alarm or status conditions at the local equipment

Table 4-3.   Indicator Strip LEDs for OT (SONET) — *Continued*

Indicator Name	Abbrev.	Color	Description
Far End Activity	FE ACTY	Yellow	Indicates alarm or status conditions at the remote equipment
Alarm Cut-off†	ACO	Green	When depressed, silences active audible alarms
Abnormal	ABN	Yellow	Indicates an abnormal condition

* The indicator panel has three PWR LEDs representing the three shelves installed in the cabinet. The three LEDs are designated as Lower Shelf (LOW SHELF) (System Controller Shelf), Middle Shelf (MID SHELF) (Complementary Shelf 1), and Upper (UP SHELF) (Complementary Shelf 2).
† The ACO switch is functional only after controller circuit packs are installed in future releases.

User and Fuse Panels

Figure 4-30 shows a diagram of the OLS user panel for the miscellaneously-mounted shelf and bay configurations.
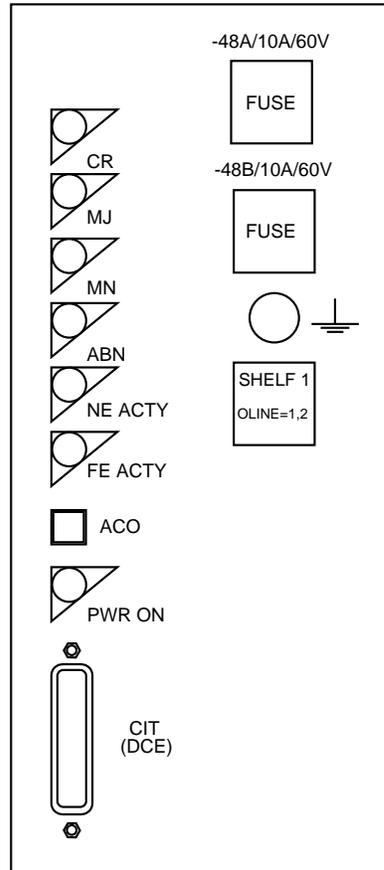
ols04038.01eSEV082297r2.1

Figure 4-30.   OLS Shelf User Panel

OLS Fuse Panel

The fuse panel displays the fuse indicators for overcurrent protection (A and B feeds) and provides an electrostatic discharge (ESD) jack that is connected to frame ground.The fuse panel can be replaced in the field. Figure 4-31 shows a diagram of the OLS fuse panel.

-48A/10A/60V

-48B/10A/60V
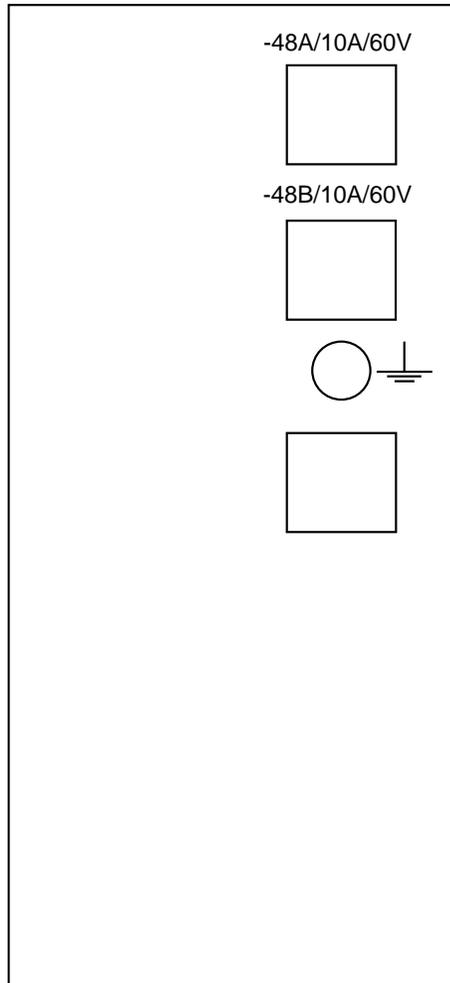
ols04039.01eSEV082297r2.1

Figure 4-31.   OLS Fuse Panel

OT User Panel

The user panel on a miscellaneously-mounted OT System Controller Shelf is located in the same area as the fuse panel in the cabinet-based shelves. However, the user panel not only functions as a fuse panel, but also displays the same alarm LEDs and power indicators for the shelves as the indicator strip on the cabinet configuration.

Each user panel provides the following items that are active in R1-OT:

- Fuse indicators for overcurrent protection (A and B feeds)

- An Electrostatic Discharge (ESD) jack that is connected to a frame ground

- One green Power On (PWR ON) LED that illuminates to indicate that the shelf is receiving -48 V power.

To avoid the interruption of power when removing the user panel, the fuses are not physically attached to the user panel. Therefore, the panel can be replaced in the field.

Figure 4-32 shows a diagram of the OT user panel for a miscellaneously-mounted System Controller Shelf. Refer to Table 4-4 for a list and description of the indicators present on the user panel.
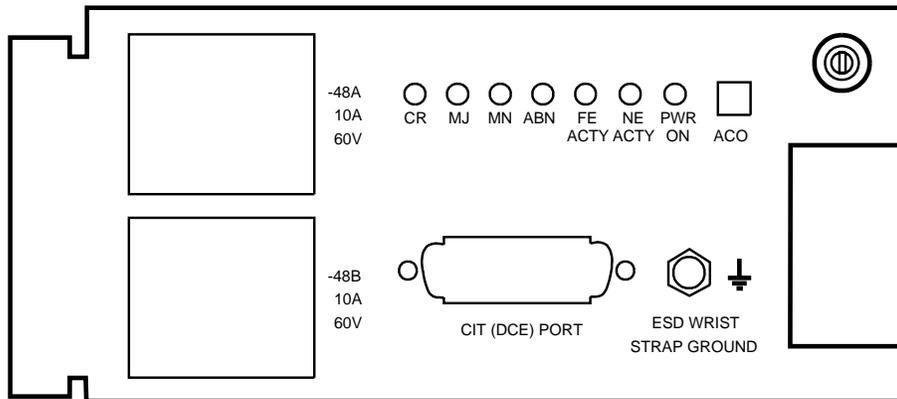
opt04019.01eSEV082297r2.1

Figure 4-32.   Miscellaneously-Mounted OT System Controller Shelf User Panel

Although Table 4-4 lists all the indicators that appear on the user panel, only the green Power On (PWR ON) LED is active. The other LEDs are provided now, to make upgrading in future releases easier. No components will be replaced or removed in order to upgrade; new components will simply be added to the existing configurations to provide additional features.

Table 4-4.   SONET Indicators Present on OLS User Panel (L10 and L11)

Indicator Name	Abbrev.	Color	Description
Power On	PWR	Green	Indicates that the shelf is receiving -48 V power
Critical	CR	Red	Indicates critical active alarm level
Major	MJ	Red	Indicates major active alarm level
Minor	MN	Yellow	Indicates minor active alarm level

Table 4-4. SONET Indicators Present on OLS User Panel
                (L10 and L11) — *Continued*

Indicator Name	Abbrev.	Color	Description
Near End Activity	NE ACTY	Yellow	Indicates alarm or status conditions at the local equipment
Far End Activity	FE ACTY	Yellow	Indicates alarm or status conditions at the remote equipment
Alarm Cut-off[*]	ACO	Green	When depressed, silences active audible alarms
Abnormal	ABN	Yellow	Indicates an abnormal condition

[*] The ACO switch is functional only after controller circuit packs are installed in future releases.

Table 4-5. SDH Indicators Present on OLS User Panel (L10 and L11)

Indicator Name	Color	Description
Power On	Green	Indicates that the shelf is receiving -48 V power
Critical	Red	Indicates critical active alarm level
Prompt	Red	Indicates prompt active alarm level
Deferred	Yellow	Indicates deferred active alarm level
Info-N	Yellow	Indicates alarm or status conditions at the local equipment
Info-F	Yellow	Indicates alarm or status conditions at the remote equipment
Suppress	Green	When depressed, silences active audible alarms
Abnormal	Yellow	Indicates an abnormal condition

**OT Complementary Shelf Fuse/Power
Indicating Panel**

In OT miscellaneously-mounted and bay configurations, both Complementary Shelf 1 and 2 are equipped with a fuse/power indicating panel. Each panel provides

■ Fuse indicators for overcurrent protection (A and B feeds)

■ One green Power On (PWR ON) LED that illuminates to indicate that the respective shelf is receiving -48 V power

■ An Electrostatic Discharge (ESD) jack that is connected to a frame ground.

To avoid the interruption of power when removing the fuse/power indicating panel, the fuses are not physically attached to the fuse/power indicating panel. Therefore, the panel can be replaced in the field.

Figure 4-33 shows a diagram of the OT complementary shelf fuse/power indicating panel.
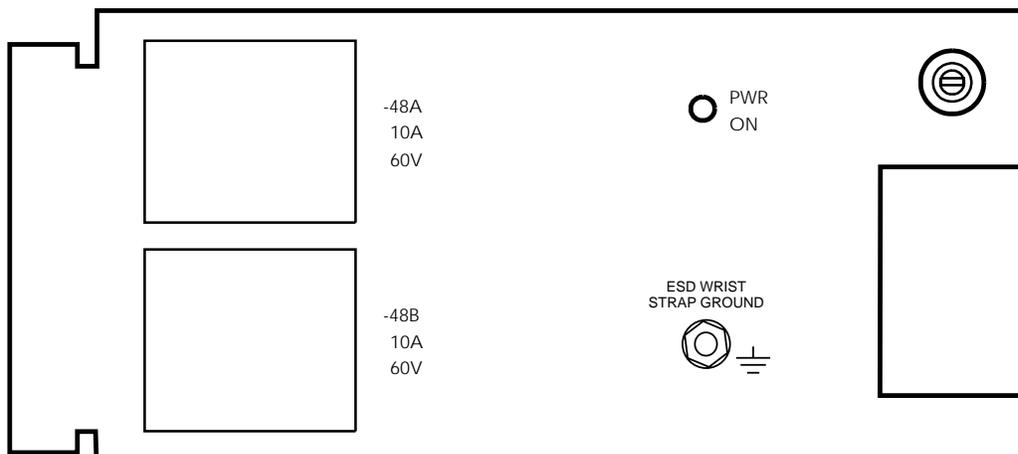
opt05003.01JPK073197

**Figure 4-33.   Miscellaneously-Mounted OT Complementary Shelf Fuse/Power
Indicating Panel**

Fuse Panel for all OT Shelves in Cabinet Configurations

The fuse panel provides fuse indicators for overcurrent protection (A and B feeds).

To avoid the interruption of power when removing the fuse panel, the fuses are not physically attached to the fuse panel. Therefore, the fuse panel can be replaced in the field.

Figure 4-34 shows a diagram of the fuse panel.

-48A
10A
60V

-48B
10A
60V
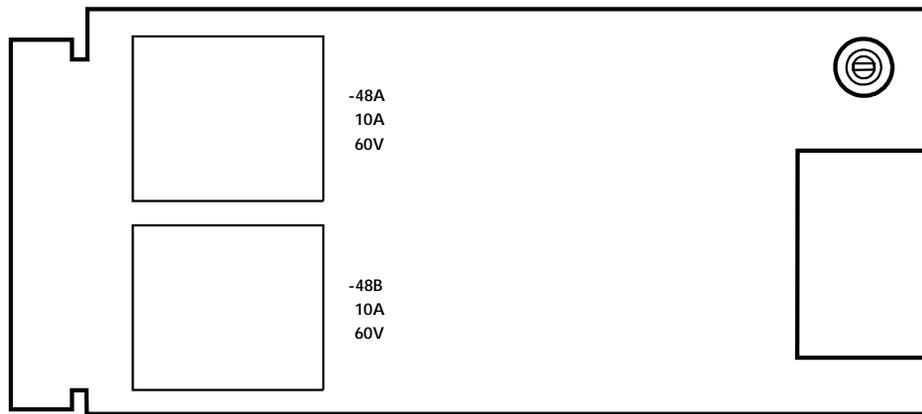
opt05002.00ejf120196

Figure 4-34.   OT Shelf Fuse Panel

Power

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

OLS is powered by -48 V DC. Power filtering and fusing are performed on the shelf level. DC-to-DC on-board power converters convert power on individual circuit packs.

Power Cables

The power feed cable uses stranded, color coded, and keyed connectors.

All panel-mounted power connector functions are labeled. Table 4-6 shows the color codes used for power cabling.

Table 4-6.   Power Cable Color Codes

Description	Color
-48V A	Red
-48V A RTN	Black
-48V B	Slate
-48V B RTN	Slate/Black

Power Distribution for OLS End Terminal and Repeater Bays and Cabinets

Figure 4-35 shows the overall two-shelf installation power distribution. Dual -48V feeders (feeders A and B) provide redundant power. Each installation uses two 8-gauge power cables that branch into two 10-gauge power cables (one for each shelf). These power cables terminate directly onto the shelves. Each branch connects to an overcurrent limiter located on the shelves.

FROM BATTERY PLANT

-48 A   -48 A RTN   -48 B   -48 B RTN

-48 A   -48 A RTN   -48 B   -48 B RTN

PFU
A

PFU
B

Fuses

UPPER SHELF

PFU
A

PFU
B

LOWER SHELF
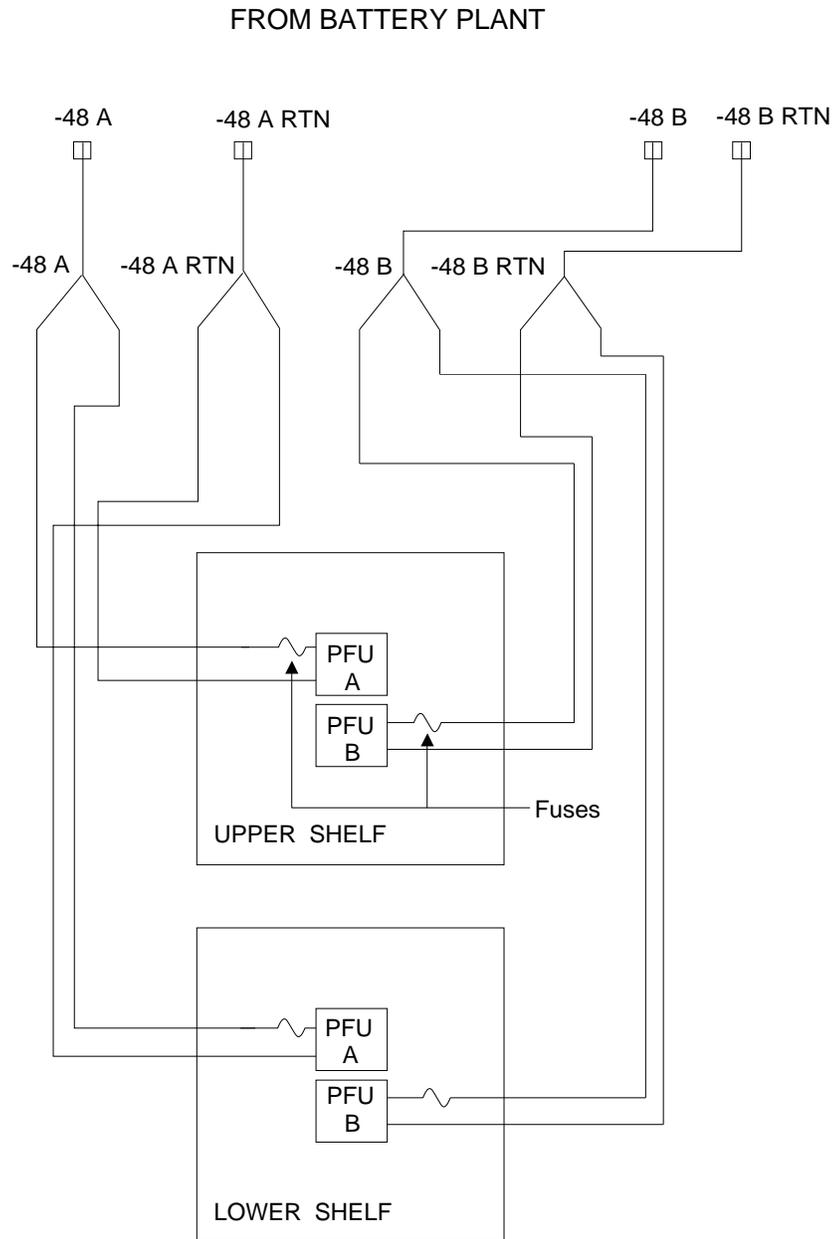
ols04019.01eSEV082297r2.1

Figure 4-35.   OLS Overall Power Distribution in a Two-Shelf Bay or Cabinet

Power Distribution for OLS Integrated Bay and OT Bays and Cabinets

Dual -48 V feeders (feeders A and B) provide redundant power. Each application uses two 8 gauge power cables. Each 8 gauge cable branches into three 10 gauge power cables (one for each shelf) that terminate directly on the shelves. Each branch connects to an overcurrent limiter located on the shelves. Figure 4-36 shows the power distribution for a three-shelf installation.
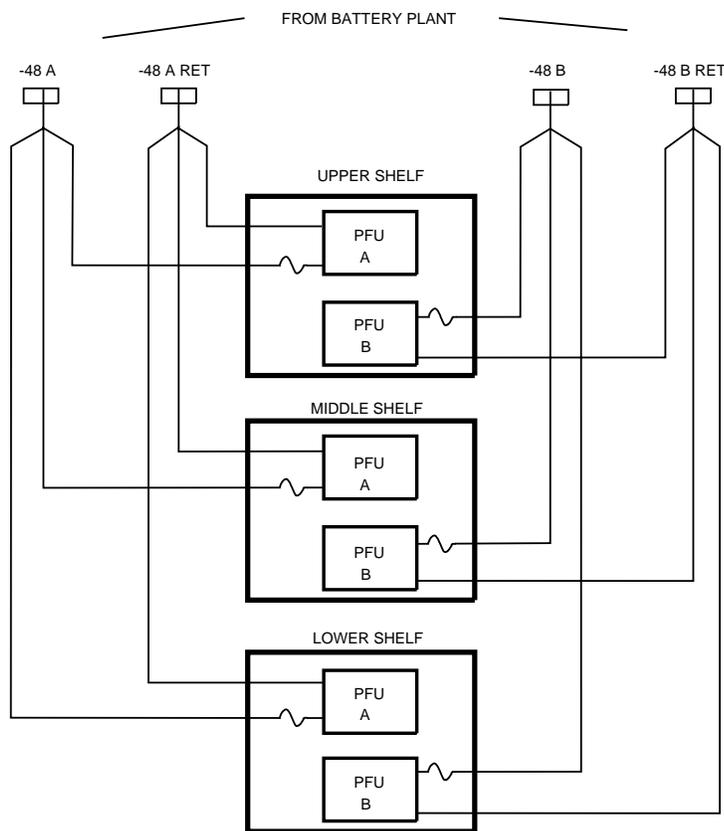
opt04008.01SEV082297r2.1

Figure 4-36.   OLS Overall Power Distribution in a Three Shelf Bay or Cabinet

Shelf-Level Power Distribution

Figure 4-37 shows a block diagram of the OLS power distribution at the shelf level.

opt04009.00ejf120196
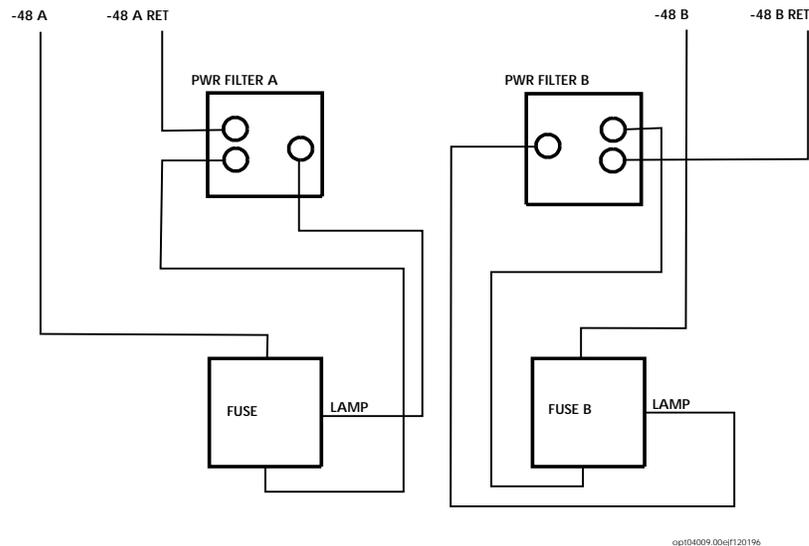
Figure 4-37.   OLS Shelf Level Power Distribution

Shelf-Level Filtering

The filters (one for each feeder) smooth the input current to the shelf. They plug directly into the backplane via a connector. The backplane distributes -48 V power to all the circuit packs by means of a printed power bus that spans the entire width of the panel.

The power filter units also provide a low voltage cutoff feature. This protects the equipment from abnormally low incoming voltage. If the incoming voltage drops below -38± 1.5V, the power is cut off until the incoming voltage returns to -42.5±1.5V. The Optical Translator will sustain no damage if the power fluctuates between -38±1.5V and -42.5±1.5V.

If a fuse blows, a light illuminates on the fuse cap to indicate which power feeder has opened.

Backplane and Circuit Pack Interface

All OLS and OT circuit packs have identical common battery power and return pins. This avoids catastrophic failure if a pack is plugged into the wrong connector.

An active circuit on the circuit packs provides in-rush current protection whenever a circuit pack is inserted and also when circuit packs are equipped and bay power is applied.

Diode ORing, On-Board Fusing, Filtering, and Powering

Each OLS and OT circuit pack is equipped with diodes that provide ORing of the two redundant feeds and their return leads as well as a fuse that protects the feeders. Board-mounted fuses are provided on each circuit pack. If one of these board-mounted fuses fails, the circuit pack fails and must be replaced with a new pack. A filtering section prior to the DC-to-DC conversion follows the fused input.

On-board power converters are used for -48V power conversion.

Operations, Administration, Maintenance, and Provisioning

5

Operations, Administration, Maintenance, and Provisioning

5

This chapter describes the various features available to operate, maintain, administer, and provision (OAM&P) the Optical Line System (OLS).

Operations

This section describes OLS operations.

General Description

This section describes the hardware and software user interfaces that control the administration, maintenance, and provisioning of the OLS. The OLS maintenance procedures use the Craft Interface Terminal (CIT) to retrieve detailed reports about performance monitoring, alarms and status, and system configuration for local and remote terminals. Office alarms, the indicator strip, and the circuit pack faceplate LEDs provide audible and visible alarm information.

Operations Interfaces

OLS supports CIT and a message-based operations system interface (X.25), as well as office alarms, parallel telemetry, user-settable miscellaneous discretes.

Craft Interface Terminal (CIT)

OLS supports CIT local access, remote access using a modem, and remote access using the data communications channel (DCC).

OLS provides enhanced security features to protect against unauthorized access to the CIT system functions (for example, provisioning). Security includes logins, passwords, CIT port disabling/enabling, and authorization levels for the system capabilities.

The CIT provides the following functions:

- Reporting

- Testing

- Initializing performance-monitoring storage registers

- Provisioning.

CenterLink™-CIT

The CenterLink-CIT is a personal computer in which OLS CIT software has been installed. The CenterLink-CIT uses Microsoft ® Internet Explorer to provide a user-friendly operations interface. The CenterLink-CIT provides detailed information and system control for specialized local and remote maintenance and administrative activities. You must use the CenterLink-CIT if you are installing or accepting a system.

The following are the minimum requirements for the CenterLink-CIT:

- Pentium™ desktop or laptop PC (66 MHz clock speed or greater)

- 16 Mb RAM

- 20 Mb of available hard disk space

- 800 x 600 or higher resolution VGA monitor

- Microsoft Mouse or compatible pointing device

- 2x CD-ROM Drive

- 16 bit sound (optional)

- Windows 95 or higher operating system

- Microsoft Internet Explorer 3.0.2 or higher

- Serial port (EIA-232-D) — configured as COM1 or COM2.

➡ **NOTE:**

A dumb terminal can be connected to the CIT ports on the OLS for experienced TL1 users. However, CenterLink-CIT is highly recommended.

CIT Access

OLS provides two CIT ports compatible with the ASCII EIA-232-D standard. The first port is configured as data communications equipment (DCE) for direct CIT access.

The second port, found on the interconnection panel, is configured as data-terminating equipment (DTE) to permit connection to a modem or an RS-232 switch. A pair of compatible modems are required for remote dial-up access to OLS from a CIT over the public switched telephone network.

A digital data network may be used in place of the modem pair to provide remote dial-up access to OLS from the CIT.

A compatible modem or digital data network must support full duplex, asynchronous, and byte serial data transmission of 8-bit bytes with one start bit and one stop bit.

To use CenterLink-CIT, the modems must comply with the V.32 transmission standard, operating at a rate of 9600 baud. To use CIT-TL1, the modems must comply with one of the transmission standards shown in Table 5-1, depending on the desired baud rate. These standards apply to signaling used between modems.

Table 5-1.   CIT-TL1 Modem Transmission Standards

Standard	Baud Rate
Bell 212A	1200
V.22	1200
V.22 bis	2400

Table 5-1. CIT-TL1 Modem Transmission Standards — *Continued*

V.32	4800, 9600
V.32 bis	14,400
V.34	28,800

Message-Based Interface (X.25/TL1)

OLS supports a message-based operations systems interface. This interface uses the X.25 protocol to provide communications with a message-based operations system and supports Transaction Language 1 (TL1). A message-based operations system can access the local OLS terminal (local access capability) and any remote terminals in a maintenance subnetwork using the DCC (gateway network element [GNE] capability).

OLS provides predefined sets of OS types. An OS type is a filter that determines the types of TL1 autonomous messages that appear at a port in addition to TL1 commands and responses. The sets are as follows:

- **Maintenance:** send reports on the maintenance status of the system (for example: alarm and event reports)

- **Memory administration:** send reports on changes in the provisioning status of equipment (for example: database changes)

- **Command response only**: send no autonomous messages (you can manually request information through TL1 commands)

- **Other:** send all autonomous messages

- **Peer:** automatically assign peer as the OS type if the user provisions none of the other OS types (if the OS type is peer, messages are commands and responses)

- **Restoration**: sends same system status reports as the maintenance OS type, except TCAs and user command information.

Access Domains

The access domain for OLS allows remote access to any OLS network element in the same subnetwork. For example, a CenterLink-CIT login at an OLS End Terminal allows remote access to the other OLS End Terminal and all repeaters between them. See Figure 5-1. A CenterLink-CIT login at OLS X1 allows remote logins to X2 and X3.

OLS NEs   Network Elements

OLS Domains
X.1 - X.2 - X.3
Y.1 - Y.2 - Y.2
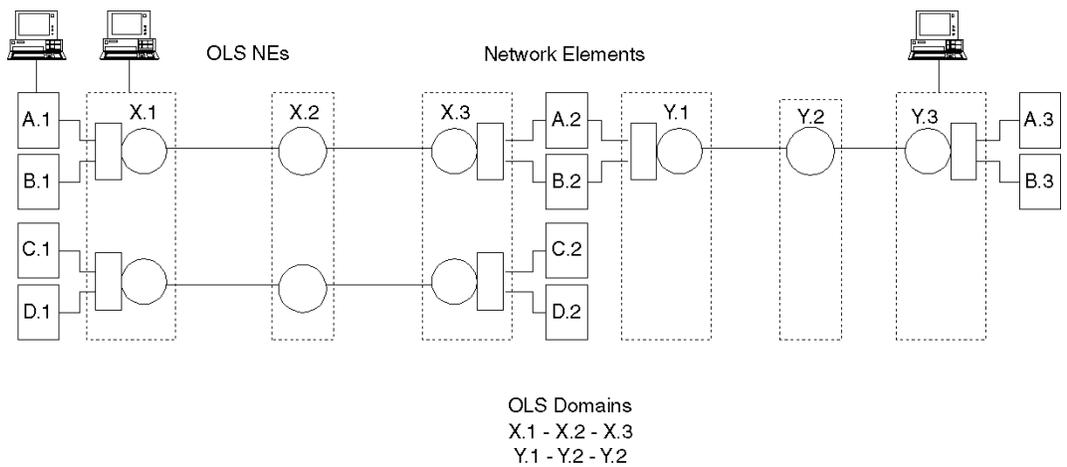
ols05004.01tifSFV082297r2.1

Figure 5-1.   CIT Access Domain with Standard End Terminals

With a dual-facing shelf, the access domain can be extended to additional OLS NEs. See Figure 5-2. With a dual-facing terminal at an intermediate add/drop site, a CenterLink-CIT login at OLS X1 allows remote logins to X2 and X3 and through to Y1, Y2 and Y3.

OLS Domains
X.1 - X.2 - X.3/Y.1 - Y.2 - Y.2,
where X.3/Y.1 is a single node
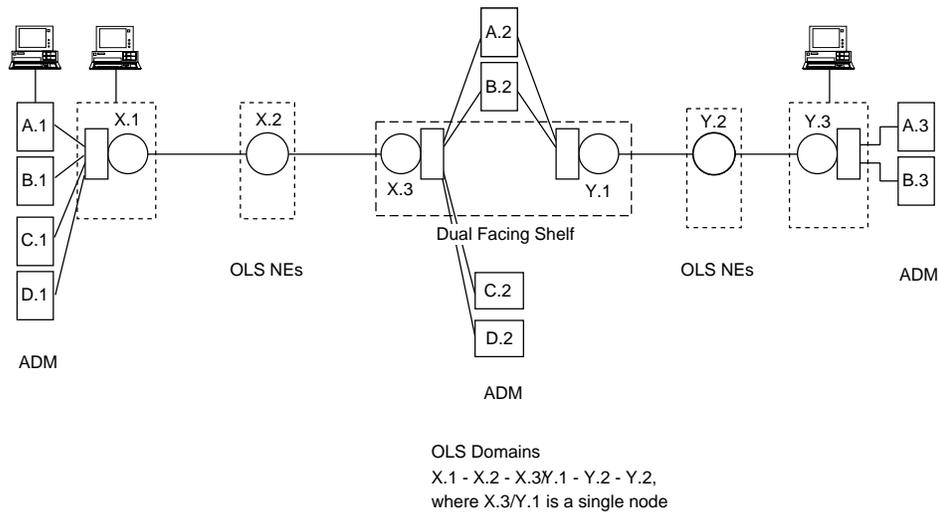
ols05005.01eSEV082297r2.1

Figure 5-2.   CIT Access Domain with Dual Facing End Terminal

Office Alarms Interface

The office alarms interface is a set of discrete relays that control office audible and visible alarms. Separate relays handle Critical, Major, and Minor alarms[*]. The Critical and Major alarm outputs can be wire OR'd to the office major alarm, if desired.

---

[*]   "Critical", "Major", and "Minor" are SONET-based alarm classifications. "Critical", "Prompt", and "Deferred" are the equivalent SDH-based alarm classifications, respectively.

Parallel Telemetry Interface

Parallel telemetry brings a minimum set of alarm and status information to an operations center. Six alarm closures show Critical, Major, and Minor alarms for local and remote terminals.

Miscellaneous Discrete Interface

The state of the miscellaneous discrete inputs can be reported on demand to a remote operations center via the CIT. Miscellaneous discrete state changes are autonomously reported by the TL1 interface. 16 inputs and 4 outputs are available. 128 additional inputs and 32 additional outputs are supported using an optional External Miscellaneous Discrete Unit (EMDU), available from Dantel, Inc. or Harris Corp. This optional EMDU can be connected to the SER TLM interface of OLS to provide an additional set of miscellaneous discrete input and output points.

The EMDU allows an operations system to control and monitor equipment collocated with OLS through a set of input and output contact closures.

The EMDU interface offers 128 additional user-settable inputs that can monitor external conditions like open doors or high temperature, plus an additional 32 user-settable outputs for the control of equipment such as external fans and generators. The EMDU is used to monitor the miscellaneous discrete inputs from the OTU/QOTUs.

Circuit Pack Faceplate LED

Each circuit pack has a red FAULT LED on its faceplate. A continuously lighted FAULT LED means that the OLS has isolated a failure to that circuit pack.
A flashing FAULT LED:

- On a transmission circuit pack shows that an incoming signal to that circuit pack has failed

- On the system memory (SYSMEM) circuit pack shows that the contents of the nonvolatile memory differs from the duplicate copy in the system controller (SYSCTL) circuit pack. It can also indicate corrupted data in the nonvolatile memory of the SYSMEM circuit pack.

Administration

Version Recognition

OLS provides automatic version recognition of all installed hardware and software. OLS reports the type, version, and serial number of the circuit pack installed in each slot. Each circuit pack CLEI™ code and serial number is stored on the circuit pack and is accessible by the system controller circuit pack (SYSCTL). The equipment catalog item (ECI) version identification and apparatus code for each circuit pack are also provided.

The OMU and ODU units have four discrete leads that are used by the OA to determine the version and type.

Security

OLS provides three tiers of security to protect against unauthorized access to the CIT and OS functions (for example, provisioning). The three tiers are:

- Port security

- Network element login security

- Enhanced user login security.

Port Security

In CenterLink-CIT mode, port security is provided through the CIT inter-face. Port security controls access to the system through a per-port enable/disable mechanism and inactivity time-outs.

Network Element Login Security

This feature controls access to the system through a lockout mechanism to disable all but administrative logins.

User Login Security

OLS Release 2.1 provides Enhanced user login security features. These fea-tures control access to the system on an individual user basis including:

- **Login ID and password assignment:** Requires the user to enter a valid login ID and password to access the system. OLS allows up to 100 login IDs and passwords. Two of these login IDs are privileged and the balance are reports only and general

- **User authorization levels:** Commands are separated into four func-tion categories. Each command is assigned a command function cat-egory and a user authorization level. The four function categories are:

    — Configuration Management (C)

    — Fault Management (F)

    — Performance Monitoring (PM)

    — Security Management (S)

Five user authorization levels are provided within each function category to control which NE functions a particular user may perform (based on login ID). The five authorization levels are:

    — **Expert (Level 5):** Provides access to all commands and options. Only expert users have access to the security and access functions. These functions include assigning and changing logins/passwords, setting login/password aging times, enabling/disabling ports, setting TID names, and rebooting the system

— **Privileged (Level 4):** Provides access to all commands and options except those that may affect all service at once (for example, TEST-AUTO-TURNUP)

— **General (Level 3):** Provides access to all commands except those relating to security and system access

— **Basic (Level 2):** Provides access to commands used to carry out minimum administration work for the system

— **Reports Only (Level 1):** Provides access to the reports only (OPR-ACO and TEST-LED). The reports only users are not allowed to change any of the system provisioning values.

Users may execute any commands on their Function category Authorization Level, as well as all commands at lower levels than theirs. for example, a user with Authorization Level 4 in the security Management function category (denoted S4), can execute commands listed in levels 4, 3, 2 and 1 in the Security Management function category.

■ **Login aging:** Enables a privileged user to set individual **non-expert** logins to be deleted if unused for a certain number of days or on a particular date (for example, for a visitor or for temporary access during installation)

■ **Password aging:** Enables a privileged user to require each user to change his or her password periodically

■ **Autonomous indications and history log records:** Provides autonomous indications and history log records for security auditing of successful/unsuccessful logins and intrusion attempts

■ **Guest login:** Enables a privileged user to set a temporary login that is automatically deleted after a specified amount of time.

Equipment Inventory

OLS maintains an automatic inventory equipment list of circuit packs in the cabinet. The list contains serial numbers and CLEI codes. The inventory is automatically updated when a new circuit pack is inserted.

System Start-up

System start-up is an initialization process that identifies all nodes in an OLS subsystem and establishes communications. Start-up is triggered by the following actions:

- An OLS subsystem is started for the first time

- A node is added or deleted

- The SYSCTL in a neighboring node is replaced

- A node is reset.

Maintenance

Maintenance Philosophy

The objective of OLS maintenance is to detect failures, monitor facility performance degradation, isolate faults to specific circuit packs, and report to an OS and/or raise alarm indicators. Maintenance consists of reactive maintenance and proactive maintenance (performance monitoring). Reactive maintenance identifies a failure after it occurs. Performance monitoring identifies transmission degradation before it causes a service-affecting condition.

Reactive Maintenance

Reactive maintenance features identify failures after they occur. Reactive maintenance conditions detected by OLS are:

- Signal failures

- Equipment failures.

Proactive Maintenance

Proactive maintenance refers to the process of detecting degrading conditions not severe enough to initiate alarming, but indicative of degradations that may lead to hard failures. Proactive maintenance conditions detected by OLS's performance monitoring are:

- B2 parity errors

- Out of range (OOR) on Laser Bias Current (LBC) and Laser Backface Current (LBFC)

- Single fuse failure on a -48 V feeders

- Threshold crossing alert (TCAs).

To avoid service-affecting failures if a proactive maintenance condition is detected, maintenance activities should be scheduled to isolate and correct the condition.

Remote Maintenance Philosophy

Remote maintenance is provided through DCC links between OLS network elements. Remote access lets you perform maintenance at a remote site as if you were local to that site.

This capability provides operations support from a single location to local and remote OLS network elements (NEs) that are in the same subnetwork.

The OLS uses an additional optical signal, the supervisory signal, for communication of maintenance information. This signal is in the STS-3 format and is generated by the TLM circuit pack and is optically multiplexed onto the optical line at each OA. This signal is also optically demultiplexed from the amplified line at each OA and returned to the TLM circuit pack, providing an add/drop function for it at every OLS site. The OLS uses the DCC channel (D1-D3) within the STS-3 format for OLS communication. The orderwire bytes (E1, E2, F1) and the payload within the STS-3 signal are provided to the customer.

OLS uses the Supervisory channel DCC to provide the following:

■ **Craft interface terminal (CIT) remote access:** The local terminal provides a remote login capability from its CIT to a remote terminal

■ **Indicator strip remote activity:** The indicator strip/user panel provides a far-end activity (FE ACTY) LED to show that one or more remote terminals have a lighted near-end activity (NE ACTY) LED

■ **Operations system remote access:** A message-based operations system (X.25) can access local and remote OLS elements

■ **Alarm report remote access:** The local terminal provides a summary alarm report that indicates the highest active alarm, if any, at all remote network elements in the same alarm group

■ **Remote software copy:** This feature allows you to copy software from one OLS element to another anywhere in the subnetwork.

Gateway Network Element

You can use one or more OLS elements as a gateway network element (GNE). The GNE serves as a single interface to the local X.25 message-based operations system of all the OLS elements in the same subnetwork.

The GNE receives operations information from these network elements through the DCC and reports that information and its own to the operations system. The operations information is in the form of TL1 messages. Through the GNE, the operations system can send TL1 commands to any network elements in the OLS subnetwork.

You can use one or more OLS terminals as GNEs, but the number you use depends on your application and operations needs. For example, to reduce the number of operations data communication links between the network and operations system, you might choose to use only one OLS terminal as the network GNE. If you need redundancy, then two OLS elements could be used as GNEs.

Remote NE Status

Through DCC, an OLS terminal can receive and transport summary alarm and status information from remote OLS terminals that are in the same subnetwork.

The remote NE status feature conveys remote summary alarm and status information through

- Logical ORing of local and remote office alarms

- A set (CR, MJ, MN) of far-end parallel telemetry relays

- A far-end activity LED

- A network alarm report that indicates the highest severity alarm active at other NEs in the subnetwork.

Members of an alarm group exchange remote NE status information through one or more Alarm Gateway Network Elements (AGNEs) that are defined in the same alarm group. The AGNEs and remote NEs use the DCC to receive and report alarm status information from and to all NEs in the alarm group. When an AGNE receives alarm and status information, it rebroadcasts the information to other NEs in the group. The information allows each NE in the group to provide, for example, far-end activity indications and a remote alarm report for all other NEs in the group.

The use of AGNEs makes it unnecessary for each NE in an alarm group to communicate directly with every other NE in the group, thus using DCC resources efficiently.

Local and Remote Software Copy/Upgrades

OLS lets you upgrade the OLS system software at a local site without changing any circuit packs. System monitoring and control are fully functional during the upgrade. To upgrade software at the local network element (NE), use the DCE port and installation software distributed with the generic. See the "Software Release Description" for performing an upgrade.

You may also copy/upgrade the system software contained in an OLS terminal can copy software to other local or remote OLS terminals in the same subnetwork using CenterLink. System monitoring and control are fully functional during the copy.

Optical Transmission Maintenance

OLS maintenance is based on a three-tier approach to performance monitoring of optical parameters

- **First tier:** functioning of the Threshold Crossing Alert (TCA) which uses a provisionable delta threshold

- **Second tier:** use of predetermined threshold values to indicate signal degrade

- **Third tier:** use of predetermined threshold values to indicate signal failure conditions.

OLS is a bit-rate-independent analog system. Tone, supervisory signal, and optical line ID are used to support maintenance of the analog transmission.

- Tones are used to determine the power of the optical signal

- Supervisory signal carries the DCC for internodal communication and out- of-band messages

- Optical line ID is carried by the supervisory signal. It is an integer associated with a line. This ID is transmitted and received by each OLS NE to identify any misconnection of fibers between sites.

Protection Switching for DCC Signal

OLS provides automatic protection for the DCC signal. In two-line (four-fiber) systems DCC protection is implemented on an optical span basis (between 2 adjacent OLS NEs). In one-line (two-fiber) systems closed ring applications, OLS provides protection of the DCC channel via the OSI stack protocols. The DCC is the only protected part of the signal on the primary supervisory channel. The DCC protection switching is bidirectional, revertive, and 1x1.

DCC offers the following types of protection switching:

- **Bidirectional switching**– protection switching is performed in both the transmit and receive directions

- **Revertive switching**– the traffic switches from the service line to the protection line when a fault occurs. When the fault clears, the traffic reverts to the service line

- **1x1 switching**– one service and one protection line exist.

Automatic Detection of Facility Failures

OLS continuously monitors the performance of the optical signal and the health of the circuit packs. Any failures or degradations are automatically detected and reported.

Optical Facility Failure Conditions

The optical facility failure conditions based on detected defects are as follows:

- **Optical Channel Loss of Signal:** An optical channel loss of signal is declared when the signal power of the channel (SPR-C) falls below a set level of the strongest SPR-C present. When there is only one channel, the optical channel LOS is declared when the SPR-C falls below a set absolute level

- **Optical Line Loss of Signal:** If all the optical channels in an optical line and the supervisory channel have loss of signal, a correlation of defects results in an optical line loss.

Digital Facility Failure Conditions for Supervisory Signal

The digital facility failure conditions for the supervisory signal are:

- Supervisory Signal (SUPR) loss of signal (LOS)

- SUPR loss of frame (LOF)

- SUPR signal failure (SF)

- SUPR signal degrade (SD).

Digital Facility Failure Conditions for Customer Maintenance Signal

The digital facility failure conditions for customer maintenance signals are:

- Customer Maintenance Signal (CMS) LOS

- CMS LOF

- CMS SF

- CMS SD.

Fault Isolation

OLS continuously monitors circuit packs and incoming signals for defects. When a fault is detected, OLS employs automatic diagnostics to isolate the failed circuit pack or signal. Failures are reported to local craft and operations systems so that repair decisions can be made. If desired, operations system personnel and local craft can use the CIT to gain more detailed information on the fault condition.

All fault conditions detected and isolated by OLS are stored and made available to be reported, on demand. In addition, a history of the past 500 alarm and status conditions and command events is maintained and available for on-demand reporting. Each event is date and time stamped.

OLS detects and reports alarm and status conditions autonomously through the office alarm relays, indicator strip, equipment LEDs, parallel telemetry, and message-based operations systems.

Baselining

Signal quality degradation in the OLS is detected by measuring the following parameters for deviations from baselines:

- Total optical power received (TOPR-OL)

- Signal power per channel (SPR-C).

Measured values of these parameters vary depending on the number of optical channels present, optical amplifier performance, etc. Therefore, new baselines are required when channels are added or removed. OLS automatically measures and provisions the baseline parameters when optical channels transition from the AUTO to IS state. The user is provided with CIT commands to baseline manually when channels are removed. For future reference, the user can also record the reason for the manual baselining.

Performance Monitoring

OLS does performance monitoring as part of its proactive maintenance philosophy. Performance parameters include digital performance data (coding violation counts on the supervisory channel) and threshold crossing alerts of analog parameters. **Proactive maintenance** refers to the process of detecting degrading conditions not severe enough to initiate alarming, but indicative of degradations that may lead to hard failures.

Certain performance parameters are inhibited during periods of unavailability.

Supervisory Channel Digital and Optical
Performance Monitoring Parameters

The supervisory channel carries B2 parity information. The telemetry (TLM) circuit pack can detect the following parameters:

- Line coding violation (CV) counts

- Line errored second counts

- Line severely errored second counts

- Line unavailable second counts.

This data is collected in 15 minute and 24 hour registers and is available for retrieval by operations interfaces.

Thresholds are set on these parameters to show degraded performance. When a performance-monitoring threshold is crossed, it is reported to the operations system where all threshold crossings associated with a particular path can be correlated and the likely source of the degradation can be identified.

- SUPR optical parameters

— **Laser bias current (LBC-SU):** A signal indicating whether or not the system is operating within normal margins

— **Supervisory Signal Power (SPR-SU):** The signal power is determined by monitoring the tone power on the supervisory signal. TCAs are reported when the supervisory signal power falls below a fixed value

■ SUPR digital parameters

— **Composite B2 coding violations (CV-L):** The sum of B2 parity violations on the supervisory signal is an indicator of the line's performance. The system calculates, writes, and checks the composite B2 parity for errors. For each line bit-interleaved-parity (BIP) error it detects, it increments the B2 parity violation counter

— **Errored seconds (ES-L):** An ES-L is a second in which the system detects one or more B2 parity violations or an alarm indication signal (AIS)

— **Severely errored seconds (SES-L):** An SES-L is a second in which the system detects 32 or more B2 parity violations or a line AIS

— **Unavailable seconds (UAS-L):** A UAS-L is a second in which the line is "unavailable." A line is considered unavailable during loss of signal, loss of frame, and line AIS conditions.

Optical Performance Monitoring Parameters for Optical Channels and Optical Line

The following parameters are monitored for optical channels and optical lines:

■ **Laser Bias Currents (LBC-P1, LBC-P2):** Laser bias currents of both OA pumps are monitored and reported as "in range" and "out of range." An "out of range" condition causes pump shut off

■ **Laser Backface Currents (LBFC-P1, LBFC-P2):** Laser backface currents of both OA pumps are monitored and reported as "in range" and "out of range." An "out of range" condition causes pump shut-off

■ **Signal Power per channel (SPR-C):** Signal power per channel is monitored by measurements of tone power on a channel. Its normalized values can be retrieved in a scale of 0 to 100. TCAs are reported when thresholds are crossed

■ **Total Optical Power Received (TOPR-OL)**: Total optical power for all the channels is monitored and normalized values can be retrieved in a scale of 0 to 100. TCAs are reported when thresholds are crossed.

Performance Parameter Thresholds

The threshold for each performance monitoring parameter, except LBFC-P1, P2, and LBC-P1, P2, are provisionable. Whenever the threshold for a given performance-monitoring parameter is reached or exceeded, OLS generates a threshold-crossing alert (TCA).

Performance Monitoring Data Storage

OLS provides a current and 32 previous 15-minute registers and a current and 6 previous 24-hour registers for all accumulated performance parameters. OLS enables you to provision the hour that the system is to begin measuring all daily performance monitoring periods. The performance monitoring parameters begin daily at the provisioned time. OLS can retrieve and report the contents of any parameter storage register ay any time. It can also initialize the current 15-minute and/or current 24-hour registers at any time.

Performance Monitoring During Failed Conditions

When a trouble condition is detected, OLS stops accumulating affected digital performance parameters per Bellcore requirements. All unaffected performance parameters continue to be accumulated during the condition.

Threshold-Crossing Alert Transmission to an Operations System

OLS supports the TL1 REPORT EVENT autonomous messages for TCA reporting. The TL1 messages provide information on the crossing of a CV, ES, SES, UAS, or Optical Power Received threshold for the current 24-hour and 15-minute registers.

Testing

OLS provides turn-up tests to verify signal path continuity. These tests are a combination of automatic and manual tests designed to provide the

most certainty that the cables are correctly installed. OLS supports the following installation tests:

- **Local:** Local self-tests check cabling within a network element. Fiber loopbacks are necessary for these tests

    — Automatic Turn-up Test: verifies installation cabling to and from TLM and OA circuit packs for each optical line

    — Automatic CMS Cable Test: verifies the continuity of customer maintenance signal cables

    — Manual Local Test: verifies the OMU and ODU are working properly. These tests require an optical power meter but do not require external line terminating equipment to drive the lines

- **CMS Cable Test:** automatic test to verify the continuity of customer maintenance signal cables.

OLS also provides self-tests for office alarms, parallel telemetry, and LEDs.

Provisioning Consistency Audits

OLS network elements provide a function that monitors (audits) the consistency of the provisioning information. This function alerts you to situations that may result in lost traffic.

In particular, OLS audits the following information to insure consistent operation of the ring subnetwork as a whole:

- **Target Identifier (TID):** The TID must be unique within a given subnetwork for proper operation of the OS interface. OLS uses a protocol called Directory Services to ensure the uniqueness of TIDs for all network elements in a subnetwork. You can make changes to a TID at any time. However, if a change would result in a duplication, OLS sends an alarm and does not put the changes into effect until you make another change that removes the duplication

- **Provision End Terminal (1A-TX, 1ARCD, and DUAL):** See "End Terminal Provisioning" in this chapter for information on provisioning telemetry circuit pack orientation. OLS checks at start-up and after each ENT-SYS command to ensure that all nodes are provisioned as transmit or receive with respect to each other.

Reports

Active Alarms and Status

OLS provides a report showing all active alarm and status conditions. Immediately after logging in, OLS automatically displays the local alarm and status report on the local and remote CIT. This report shows the following alarm levels:

- Critical (CR)

- Major (MJ)

- Minor (MN)

- Abnormal (ABN)

- Near-end activity (NE ACTY).

The source address and description of the condition (for example, controller failure and incoming high speed signal failure) are included in the report along with the date and time it was detected. The report also indicates if the condition affects service. The option to display specified subsets of conditions by severity is also provided.

Performance Monitoring

OLS provides reports that contain values for all requested performance monitoring (PM) registers. The start time of each register's recording period is included.

The reports provide optical and digital PM data for optical lines, optical channels, and supervisory channels recorded in a series of 15-minute and 24-hour storage registers.

History

The history report displays the past 500 events. An event is any change in the OLS that may affect its performance (for example, a failure) or change its operational status (for example, loopback setup). This summary report includes time stamps showing when each condition was detected and when it cleared. The user's initiated events contain a time stamp showing when the command was entered.

Version/Equipment List

The version/equipment list report is an on-demand report that lists all the circuit packs that are present. This report also lists the circuit pack version and the software generic (if applicable).

State

An on-demand report displays the state of each addressed slot and port (optical line, optical channel, supervisory signal, or customer maintenance signal) in the OLS. For each addressed entity, the report includes the following:

- Address

- Circuit pack type (for slots only)

- Port state

- Slot state.

The possible port states are:

- **Auto (AUTO):** means the port is available for automatic provisioning. An optical channel transitions from the AUTO state to the IS state if a good signal is detected

- **Not monitored (NMON):** means the port is not monitored and will not transition to the IS state even if a good signal is detected

- **In service (IS):** means the port is fully monitored and alarmed.

The possible slot states are:

- **Auto (AUTO):** is the original value of the circuit pack slot state parameter. AUTO means the slot is available for automatic provisioning

- **Equipped (EQ):** means the slot is fully monitored and alarmed.

Orderwire

Orderwire provides voice communications through a DANTEL® unit, for personnel performing facility maintenance. OLS provides three EIA-422, 64 kb/s orderwire interfaces per optical line, one for section orderwire, one for line orderwire, and one for section user channel.

The overhead controller (OHCTL) circuit packs in Enhanced High Speed (EHS) Shelf No. 1 allow access to the orderwire interfaces.

The orderwire shelf must be installed within a few feet of the cabinet. Refer to the "Related Products" section in Chapter 7 for orderwire shelf ordering information.

Provisioning

Provisioning is the assigning of values to parameters in memory. These parameters, in turn, affect the operation of the network element. OLS provides two types of provisioning modes

- **Auto-provisioning:** NE parameters that are provisioned automatically, based on the presence or absence of circuit packs and/or good incoming signals

- **Technical provisioning:** manual provisioning of parameter values via Technical Interface commands or the OS interface (TL1 command).

Parameters and Original Value Provisioning

Original values minimize installation provisioning. At the factory, each provisionable parameter is assigned an original value. The provisionable parameters and original values are copied (using CenterLink) from floppy disks to the system memory (SYSMEM) circuit pack.

Under normal conditions, there are three complete sets of data (parameters and their values) in the system:

- One set contains the system parameters and their original values (values assigned to parameters at the factory). This set is located in the nonvolatile memory of the SYSMEM circuit pack

- The second set contains system parameters and their current values (values currently being used by the system). This set is also located in the nonvolatile memory of the SYSMEM circuit pack

- The third set contains the system parameters and their current values. This set is located in the volatile memory of the SYSCTL circuit pack.

The original values assigned at the factory cannot be changed. Current values can be overridden through local or remote provisioning.

Local or Remote Provisioning

The OLS software control allows local and remote provisioning of all provisionable parameters using CenterLink or the TL1 interface. Most of these parameters are also provisionable through TL1 commands. The provisionable parameters and values (current and original) are maintained in the nonvolatile memory of the SYSMEM circuit pack. For more information about provisioning parameters and original values using CenterLink or TL1 commands, refer to the Optical Line System (OLS), User/Service Manual.

Preprovisioning Slots

To simplify circuit pack installation, slot parameters can be provisioned before the corresponding circuit pack is installed. All system parameters and values (current and original) are preserved by OLS in the nonvolatile memory of the SYSMEM circuit pack. The parameters and values are protected by the nonvolatile memory if a power failure occurs and are retrievable on demand regardless of the means used for provisioning. The parameters are downloaded automatically when the affected circuit pack is installed.

Provisioning on Circuit Pack Replacement

Replacement of a failed circuit pack is simplified by OLS slot provisioning. The system controller (SYSCTL) and SYSMEM circuit packs maintain a provisioning map of the entire system. When a transmission or timing circuit pack is replaced, the SYSCTL and SYSMEM circuit packs automatically download provisioning parameters and values to the new circuit pack.

Provisionable Parameters Summary

The following list shows a high level summary of provisionable parameters:

- End terminal type (1A-TX, 1A-RCV, and DUAL)
- 1A – Transmit/1A – Receive /Dual (See"End Terminal Provisioning" following)
- Network element access security (TID, port states, etc.)
- Login ID security (login IDs, log-in aging, etc.)

- Miscellaneous discrete attributes (names, alarm levels, etc.)

- Supervisory channel (SD threshold, alarm level, etc.)

- Performance monitoring thresholds (optical, digital) and start times

- Optical pump power.

Network Element Configuration

OLS automatically provisions a network element to be an End Terminal or a Repeater by detecting the presence or absence of the OMU and ODU

End Terminal Provisioning

The End Terminals and repeaters in one direction (transmit) are connected to the OA circuit packs in the A slot (1A). The End Terminals and repeaters in the other direction (receive) are connected to the OA circuit pack in the B slot (1B). This configures one bidirectional OLS optical line.

The 1A telemetry (TLM) circuit pack in one End Terminal and all repeaters have the same orientation (transmit). The outputs of these TLM packs are connected to the 1A OA circuit pack. The 1A TLM pack in the opposite End Terminal is connected to the 1B OA circuit pack. It is necessary to provision this circuit pack orientation for fault isolation. Therefore, the End Terminal where the 1A TLM pack is connected to the 1A OA pack and all repeaters are provisioned as 1A – TX (transmit). The other End Terminal is provisioned as 1A – RCV (receive).

Dual Facing Shelves (R2.1) are provisioned as DUAL.

System Planning and Engineering

6

System Planning and Engineering

6

This chapter summarizes information needed for applications planning before procuring and deploying the Optical Line System (OLS).

There are several considerations to keep in mind when planning a network. Projected customer requirements determine the initial capacity needed, as well as growth. Where you install the network and how you plan to use it determine the physical installation considerations.

Before ordering or installing the equipment, you need to develop an overall plan and select or construct the building that is to serve as a terminal office or Repeater site. This plan should take into consideration the eventual system size and include the following:

- Engineering rules

- Floor plan layout

- Equipment interconnection

- Cabling

- Environmental considerations

- Power planning.

Lucent Technologies offers engineering and installation services for planning and installing OLS. For more information, refer to Chapter 8, "Product Support."

Engineering Rules

This section describes the engineering rules for OLS Release 2.1.

Use of LBOs

If outside plant loss is within the nominal range, no LBOs are required. If any span loss is below the specified minimum limit, an LBO is required. Detailed LBO selection guidelines are provided in the LCT Integration Manual.

To adjust signal power distribution among the channels, LBOs should be used at End Terminals.

OLS Network Topologies

Table 6-2 shows the three types of Optical Amplifiers (OA) used in OLS R2.1. OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates. OLS supports two-OA and single-OA operations.

Table 6-2.   Optical Amplifiers used in OLS

OA Code	Application	Two-OA	Single-OA
LEA6	Long Span	✔	
LEA7	Long Reach	✔	
LEA105	Short Reach	✔	✔

Engineering Rules for Two-OA Applications

Figure 6-3 shows the configuration of a two-OA OLS system where each span is supported by two OAs. The OLS systems carry up to 16 signals on an optical line of up to eight spans. The engineering rules for two-OA systems are shown in Table 6-3.
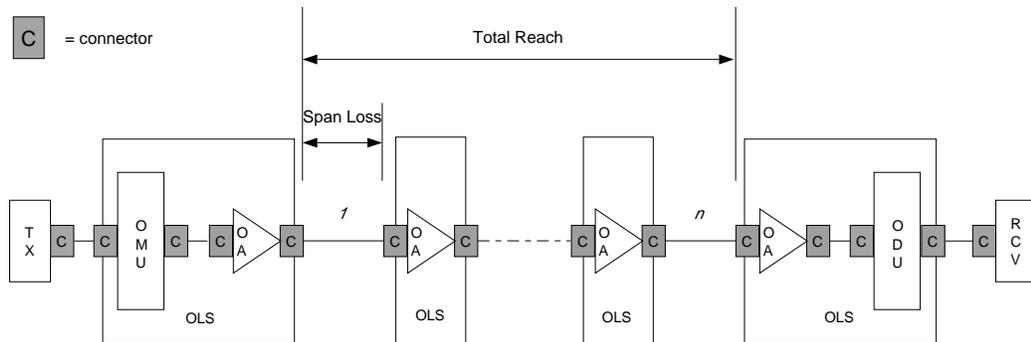
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Figure 6-3.   OLS Two-OA System

Table 6-3.   Engineering rules for Two-OA OLS Systems [*]

| Application | OA Code | Max No. Channels | No. Spans | Span Loss dB | | Total Reach (dB) Max | Max Span Distance (km)[†] | Max Total Reach (km)[†] |
				Min	Max		Fiber Loss= 0.25dB/km	
Long Span	LEA6	8	1	22	35	35	140	140
			2	22	34	68	136	272
			3	22	33	99	132	396
			4	26	31	124	1224	496
			5	26	30	150	120	600
		16	1	22	33	33	132	132
Long Reach	LEA7	16	1	22	33	33	132	132
			2	22	30	60	120	240
			3	22	28	84	112	336
			4	22	27	108	108	432
			5	21	26	130	104	520
			6	21	26	156	104	624
			7	17	22	154	88	616
			8	17	22	176	88	640[‡]
Short Reach	LEA105	16	1	14	18	18	72	72

[*] OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates.

[†] Some spans with distances greater than the maximum value may be accommodated by using fiber with lower loss values. Lucent Technologies provides network engineering support to optimize OLS systems for actual networks. Please contact your Lucent Technologies sales representative for more information.

[‡] This distance is limited by the dispersion characteristics of standard single-mode fiber (640 km x 17 ps/nm-km=10,900 ps/nm). Longer distances are available with non-zero dispersion-shifted fiber (for example: TrueWave®).

Engineering Rules for Single-OA Applications

For metropolitan, short span applications, Release 2.1 introduces Single Optical Amplifier Operation as a new feature. The receive end of a span may operate without an input OA, providing additional economy.

Figure 6-4 shows the single-OA operation with only one span between End Terminals. Single OA systems use the LEA105 OA, and carry up to 16 channels. Engineering rules for Single-OA OLS systems are shown in Table 6-4.
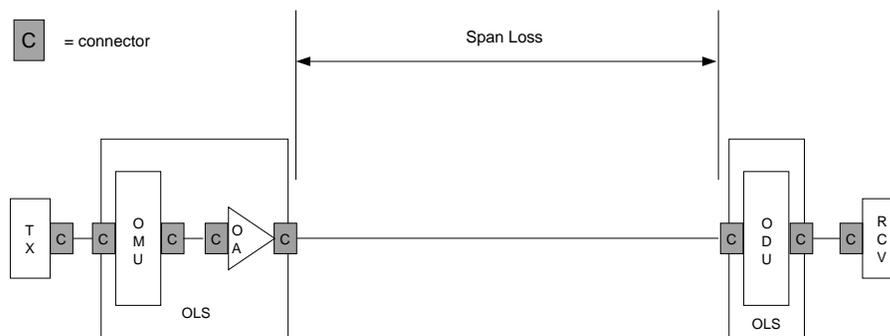
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Figure 6-4.   OLS Single OA System

Table 6-4 displays engineering rules for Single-OA OLS systems.

Table 6-4. Engineering Rules for Single-OA OLS Systems using LEA105[*][†]

OA Code	Max No. Channels	No. Spans	Span Loss dB		Total Reach (km)	Bit Rates
			min	max	Fiber Loss= 0.25dB/km	
LEA105	16	1	0	12	48	OC-48/12/3, STM-16/4/1, or 400-700 Mb/s
		1	0	12	48	OC-48/12, STM-16/4, or 400-700 Mb/s
		1	0	13	52	OC-48/3 or STM-16/1
		1	0	16	64	0C-12/3, STM-4/1, or 400-700 Mb/s
		1	0	13	52	OC-48 alone
		1	0	16	64	OC-12 alone or 400-700 Mb/s
		1	0	20	80	OC-3 alone

---

* For standard single-mode fiber (SSMF)

† OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates.

Dispersion

Guidelines for dealing with dispersion are as follows:

With OLS systems having dispersion less than 6800 ps/nm, use of 41AX OTU or Lucent Add/Drop Multiplexers (ADM) with an equivalent OLS-compatible transmitter is recommended.

With OLS systems having dispersion between 6800 ps/nm and 10,900 ps/nm, use of 41CX OTUs or Lucent ADMs with an equivalent OLS-compatible transmitter is required for OC-48/STM-16 signals. The 42Ax and 43Ax OTPMs, associated with the QOTUs introduced in Release 2.1, can accommodate dispersions of up to 10,900 ps/nm.

OLS With OT

An Optical Translator Function (OTF) can be used to concatenate OLS systems to increase the distance between SONET/SDH line terminals. An OTF is provided by an OTU (OC-48) or an OTPM that is installed in a QOTU (OC-3, OC-12, or broadband 400-700Mb/s). An OTF can also be used for adding and dropping wavelengths.

➡ **NOTE:**
All OTFs can be used to concatenate OLS systems except broadband 400-700Mb/s OTPM.

A maximum of twelve OTFs can be used between SONET/SDH line terminals. Figure 6-5 shows OLS systems using OTF for adding or dropping wavelengths (may or may not be needed). The OTF can also be used to concatenate multiple point-to-point OLS systems. Each OLS system can have a different number of spans.

For terminal equipment that does not require OTFs for adding or dropping wavelengths, OTFs can be used to concatenate up to thirteen OLS systems and support up to twelve WAD sites.

For terminal equipment that requires OTFs for adding and dropping wavelengths, OTFs can be used to concatenate up to eleven OLS systems and support up to ten WAD sites.

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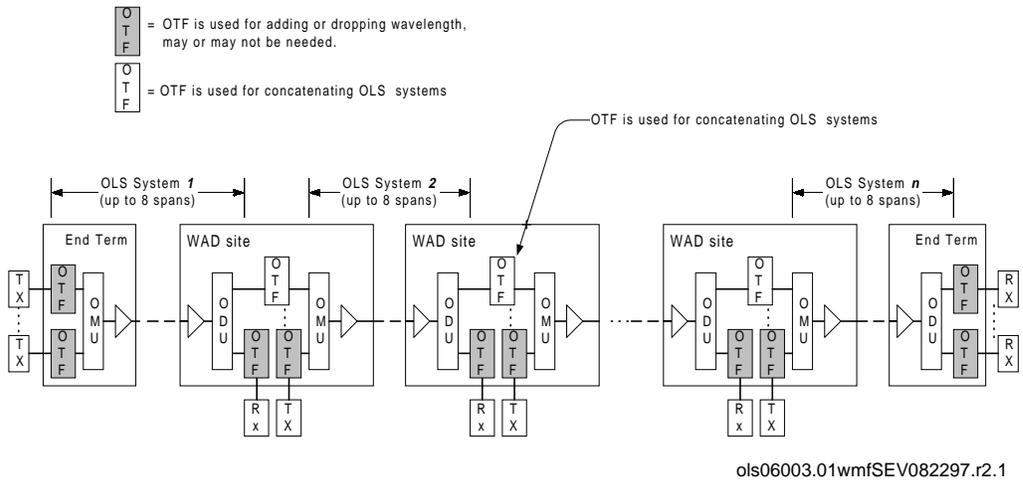
Figure 6-5. OLS with OT

Table 6-5 and Table 6-6 show examples of maximum overall distance in cases where twelve OTFs are used to concatenate thirteen point-to-point OLS systems and each system has the maximum number of spans. For example, when twelve OTFs are used to concatenate thirteen OLS systems with LEA7 OAs (each OLS system has 8 spans with 22dB loss each), the maximum overall distance is 8320km. These tables also show examples of maximum distance for OLS systems using LEA6 and LEA105 OAs.

Table 6-5. Examples of OTs Used to Concatenate 8-Channel OLS Systems

Description	LEA6 OA	LEA6 OA
Per OLS System*		
Max. No. Spans	3	5
Max. Span Loss (dB)	33	30
Total Reach (km)†	396	600
Per Wavelength		
Max. No. OTFs	12	12
Max. No. Spans	39	65
Max. Overall Distance (km)	5148	7800

---

 * Data is based on use of standard single-mode fiber (SSMF)
    and assumes a dispersion rate of 17ps/nm-km.

 † Assumes a fiber loss rate of 0.25dB/km.

Table 6-6. Examples of OTs Used to Concatenate 16-Channel OLS Systems

Description	LEA6 OA Two-OA System	LEA7 OA Two-OA System	LEA105 OA Two-OA System	LEA105 OA Single-OA System
Per OLS System*				
Max. No. Spans	1	8	1	1
Max. Span Loss (dB)	33	22	18	12
Total Reach (km)[†]	132	640	72	48
Per Wavelength				
Max. No. OTFs	12	12	12	12
Max. No. Spans	13	104	13	13
Max Overall Distance (km)	1716	8320	936	624

---

* Data is based on use of either standard single-mode fiber (SSMF) or non-zero dispersion-shifted fiber (for example: TrueWave®). Data assumes a dispersion rate of 17ps/nm-km for SSMF and 4ps/nm-km for non-zero dispersion-shifted fiber.

† Assumes a fiber loss rate of 0.25 dB/km.

Upgrade Considerations

To upgrade from an existing 8-wavelength Release 2.0 OLS system to a 16-wavelength Release 2.1 OLS system, the following considerations need to be made during the planning stage:

- Verify the span loss of the existing 8-wavelength system is within the engineering rules of the 16-wavelength system. If it is not within the rules, re-engineering is needed

- The 8-wavelength OMU/ODU circuit packs must be changed to 16-wavelength OMU/ODU circuit packs

- To accommodate 16-wavelengths, OLS Release 2.1 software is required.

Floor Plan Layout

Figure 6-4 shows a typical floor plan layout for OLS and OT in a central office. OLS and OT are front access systems. The rear aisle space of 2 feet is recommended to allow the rear doors to be fully opened. If floor space is limited, the rear aisle can be reduced to no less than 4 inches. Refer to the floor plan data sheets (804-604-161-001 and 804-604-162-001) for explicit details.

2' - 10"
No less than 4 inches
2' - 0"
Front
2' - 10"   Minimum Maintenance Aisle

Front Access Only

2' - 10"
2' - 0"
2' - 0"
Front
2' - 10"   Minimum Maintenance Aisle

Front and Rear Access
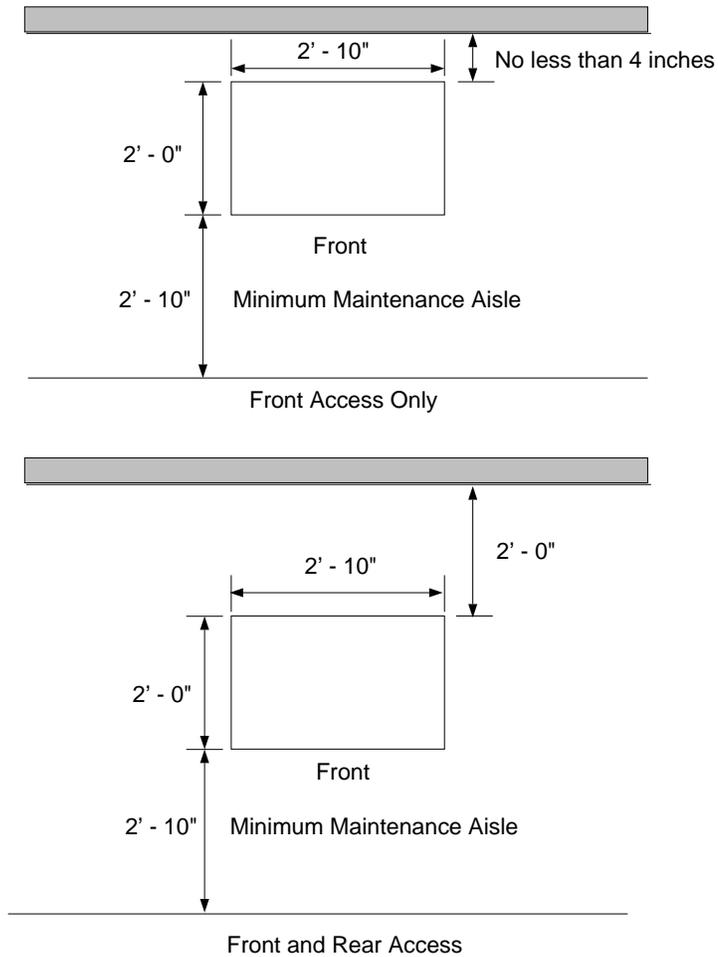
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Figure 6-4.   Floor Plan Layout

Equipment Interconnection

OLS is designed as a front access product; all cable and fiber connections can be made from the front of the system. This feature allows planners to design networks with OLS in controlled environment vaults, concrete huts, or other locations, where space is limited and equipment must be placed close to the wall.

All external interconnection cabling uses industry standard connectors.

Cabling

The following are major classes of signals cabled to OLS:

- Optical channels (drop side signals)

- OAM&P electrical signals

- Customer maintenance (CM) optical signals

- Optical line signals.

The eight-wavelength optical interfaces (telemetry [TLM], optical demultiplexer unit [ODU], optical multiplexer unit [OMU], and optical amplifier [OA]) are designed to provide connections through a front mounted connector system. The connector system supports the use of three different types of connectors:

- ST$^{®}$ type

- FC type

- SC type

- LC type.

The connector system also provides optical attenuation (optical lightguide build-out [LBO]) if required. All optical interfaces are factory-equipped with ST connectors with 0dB attenuation. By replacing the factory-equipped connectors, you can change the type of connector. In addition, a kit with LBO values from 3 to 10dB is shipped with the ODU. The correct LBO value must be chosen after the system is installed.

The 16-wavelength ODU and OMU require LC type connectors, due to the higher density of optical connections associated with the 16-wavelength feature.

Figure 6-5 shows the build-out block and ST-type LBOs. Figure 6-6 shows
the buildout block and FC-type LBOs. Figure 6-7 shows the build-out
block and SC-type LBOs. Figure 6-8 shows an LC-type LBO.

Build-out Block

Lightguide Build-out
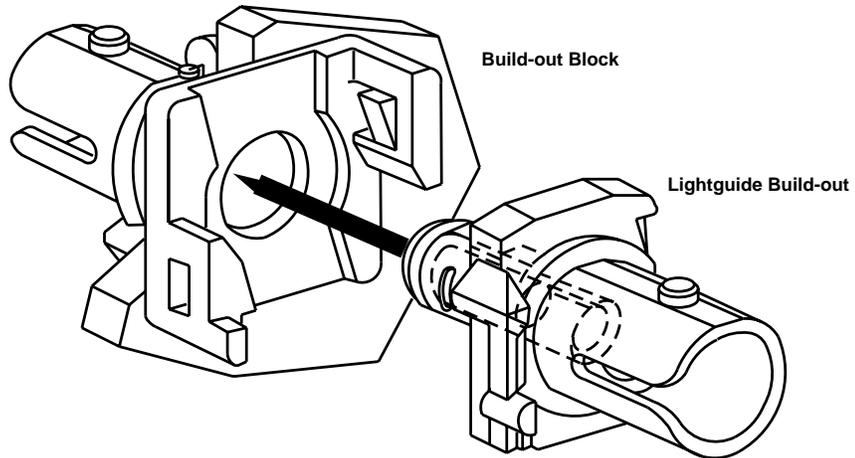
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Figure 6-5.   ST-Type Build-Out Assembly

Build-out Block

Lightguide Build-out
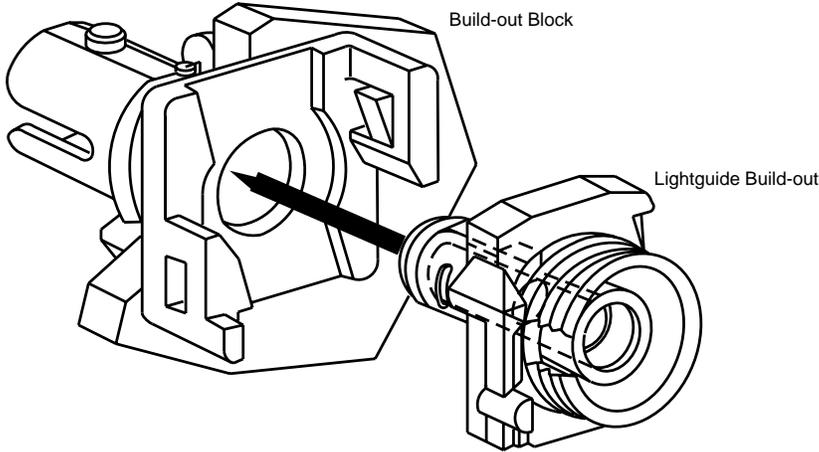
ols06003.00eJF070196r1.0

Figure 6-6.   FC Type Build-Out Assembly

Build-out Block

Lightguide Build-out
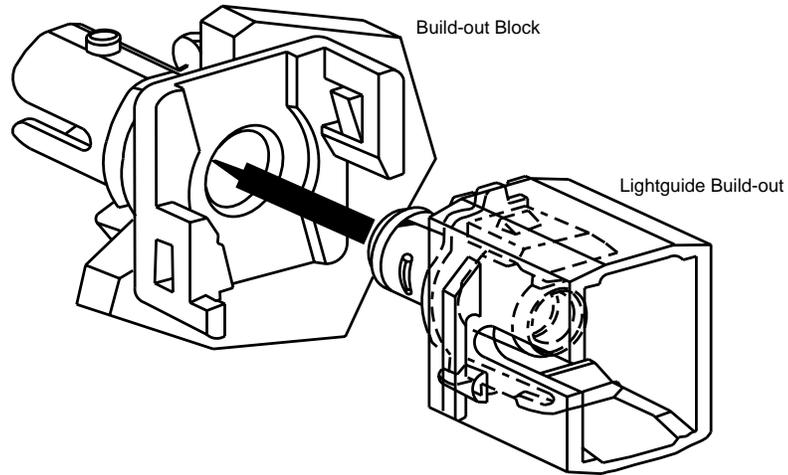
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Figure 6-7.   SC-Type Build-Out Assembly
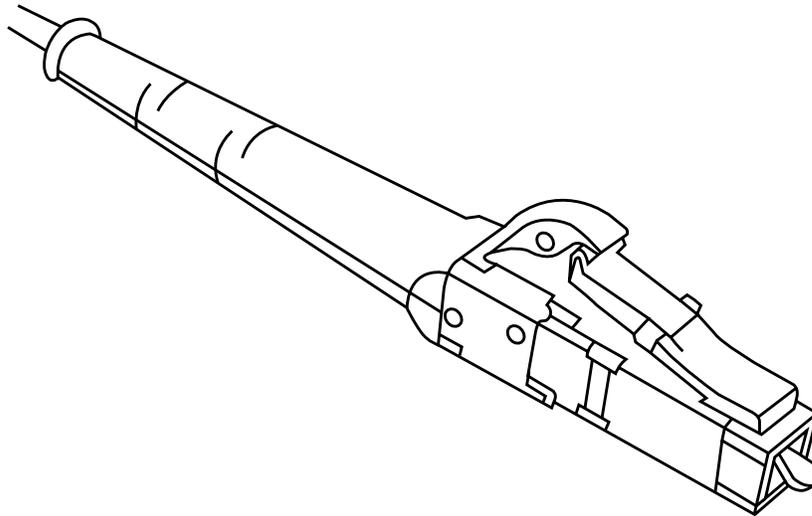
ols06006.00eSEV082297r2.1

Figure 6-8.   LC-Type Build-Out Assembly

All fiber jumpers connecting to the OMU and ODU units must use sin-
gle-mode fiber. The intrashelf fiber jumpers and the optical line I/O fiber
must use single-mode fiber. Single mode or multi-mode fiber (depending
on the type of input source) can be used for the input customer mainte-
nance signal. However, multi-mode fiber must be used for output cus-
tomer maintenance signal.

When ST, FC, SC or LC connectors are used together, hybrid jumpers
must be used. A hybrid jumper has different types of connector at either
end. The connectors at both ends of the jumper must match the panel-
mounted connectors. ST connectors are available for use at the LBO
cross-connect panel and can be installed when OLS is installed.

➡ **NOTE:**
All optical fiber connectors (ST, FC, SC, and LC types), lightguide
buildouts, and buildout blocks must be cleaned before initial or sub-
sequent connections are made. Refer to "Related Products" in Chap-
ter 7 for ordering information on cleaning materials.

The OAM&P cables are terminated with D-subminiature connectors, shown in Figure 6-9, that have crimp removable contacts.

The length of the power feeds are individually engineered and are sized to handle the maximum current drain the equipment can experience.

For more information about cabling, refer to Chapter 7, "Ordering."
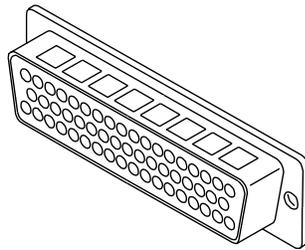
ols06011.00JF080896r1.0

Figure 6-9.   D-Subminiature Connector

Environmental Considerations

OLS and OT shelves and cabinets comply with the environmental compatibility requirements in documents GR-63-CORE, Issue 1, October 1995 and GR-1089-CORE, Issue 1, November 1994.

Perforated metal meshes are used as part of the shelf construction to cover the top and bottom areas of the shelf in order to form an electromagnetic enclosure for all circuit packs in the shelf. OLS and OT shelves, circuit packs (CPs), and cable treatments are designed to satisfy the requirements of GR-1089-CORE, Issue 1, November 1994.

OLS and OT comply with the IEC 801-2 electrostatic discharge (ESD) recommendation for exchange carriers. The shelves are grounded to the cabinet by the shelf mounting hardware. An ESD jack is provided on the fuse panel for grounding straps.

Power Planning

Two power feeders and returns (feeders A and B) should be used to power each OLS or OT cabinet. Redundant power feeders are used to ensure maximum system reliability. All power feeders should be sized to carry the maximum cabinet power consumption. Each feeder is equipped with a filter to reduce any switching noise that may be present on the input current.

OLS and OT dissipate heat by natural convection cooling and do not require a cooling fan. Table 6-7 presents information on power dissipation and current drains for different OLS and OT configurations.

Table 6-7.   OLS/OT Power Planning

	Maximum Power Dissipation		Current Drains per Feeder[*]	
	Watts	Watts per Square Foot	Nominal at -48V (List 1[†])	Maximum (List 2[‡])
J68982C-1 Equipment Package				
OLS End Terminal 4 Bidirectional Optical Lines	252	20.2	2.6	5.9
OLS Repeater 4 Bidirectional Optical Lines	320	25.6	3.3	7.5
OLS Dual End Terminal	276	22.1	2.9	6.5
OLS Dual Repeater	344	27.6	3.6	8.0
OLS End Terminal & Repeater	310	24.8	3.2	7.3

OLS Miscellaneously-mounted Shelf:
    Dual End Terminal Shelf
    Dual Repeater Shelf
    Dual Facing Shelf
	
	138
	172
	138
		
		NA
		NA
		NA
			
			1.4
			1.8
			1.4
				
				3.2
				4.0
				3.2

J69000C-1 Equipment Package				
OT System Controller Shelf	182	14.6	1.7	3.7
OT Complementary Shelf	232	18.6	2.1	4.7

Table 6-7.   OLS/OT Power Planning — *Continued*

Fully-equipped OT Cabinet (3 Shelves)	646	51.7	5.9	13.2
J68982D-1 Equipment Package				
OLS Integrated Bay	552	78.4	5.8	12.9
OLS End Terminal	138	11.1	1.5	3.3
OT System Controller Shelf	182	14.6	1.7	3.7
OT Complementary Shelf	232	18.6	2.1	4.7

* Nominally, both feeders share the current equally for the cabinet or shelf. If one feeder fails, the remaining feeder carries the total load for the cabinet (feeder A + feeder B current).

† In power engineering, List 1 refers to the current drains used to size batteries and rectifiers. To size batteries and rectifiers, use twice the Nominal (List 1) current drain per feeder. These current drains represent the average busy-hour current at normal operating voltages.

‡ In power engineering, List 2 refers to the current drains used to size feeder cables and fuses. To size feeder cables and fuses, use the Maximum (List 2) current drain per feeder. These current drains represent the peak current under worst case operating conditions.

Ordering

7

Ordering

7

This chapter provides information about:

- Ordering Optical Line System (OLS) equipment
- Ordering Optical Translator (OT) equipment
- Lucent Technologies software release ratings
- Ordering related products that operate with OLS and OT
- Slot, circuit pack/unit/port module, and software compatibility.

Chapter Organization

This chapter contains ordering procedures and information for two related equipments that are now (release 2.1) combined into one product.

How to Order Optical Line System Equipment

OLS consists of equipment, cables, circuit packs, miscellaneous hardware, software, and related documentation. The equipment necessary to form different applications is grouped together into J-drawing specifications and list numbers.

Worksheets

This section provides worksheets for ordering complete OLS packages. The worksheets list circuit packs/units and the associated number per line, along with other equipment such as cables, software, and LBOs that are needed to form each package.

⇒ **NOTE:**
Each worksheet lists the external miscellaneous discrete unit (EMDU) as an ordering option. However, when the OLS is used with the OT, an EMDU is required.

Step 1 Use the appropriate worksheet for the package you want to order:

Miscellaneously-mounted End Terminal	Table 7-1
Miscellaneously-mounted Repeater	Table 7-2
Miscellaneously-mounted OT System Controller Shelf	Table 7-3
Miscellaneously-mounted OT Complementary Shelf 1	Table 7-4
OLS End Terminal, 4 line	Table 7-5
OLS Dual End Terminal	Table 7-6
OLS Repeater, 4 line	Table 7-7
OLS Dual Repeater	Table 7-8
OLS End Terminal/Repeater	Table 7-9
OLS Integrated Bay	Table 7-10
OT Bay or Miscellaneously-mounted	Table 7-11
OT Cabinet	Table 7-12
4 Line End Terminal-to-Dual End Terminal Conversion	Table 7-13
4 line Repeater-to-Dual Repeater Conversion	Table 7-14

Step 2 Follow the worksheet, selecting the number of circuit packs necessary for the product and number of optical lines you want.

Step 3 Select the number of needed cables, lightguide build-outs (LBOs), and lightguide jumpers. Photocopy the worksheets to make copies.

Table 7-1. Miscellaneously-Mounted Shelf– End Terminal (J68982C-1)

Description	Choice	List/ Group	Reference
Miscellaneously Mounted Shelf - End Terminal Shelf		L10 or L11	Table 7-15
Miscellaneously Mounted End Terminal Kit		L106	
SDH kit for SDH OLS application		L108	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Short Haul	Quantity _____ (1 or 2 per optical line required)[*]	L23	
Telemetry circuit pack	Quantity _____ (1 per optical line required)	L25	Table 7-15
Tributary overhead controller circuit pack	Quantity _____ (1 per shelf required)	L30	
System controller circuit pack	Quantity _____ (1 per shelf required)	L35	
System memory circuit pack	Quantity _____ (1 per shelf required)	L40	

**Table 7-1.   Miscellaneously-Mounted Shelf– End Terminal
          (J68982C-1) —** *Continued*

Description	Choice	List/ Group	Reference
Optical Demultiplexer Unit (ODU 8λ,)	Quantity_____ (1 per optical line required)	L50	Table 7-15
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	L52	
Optical Multiplexer Unit (OMU 8λ)	Quantity _____ (1 per optical line required)	L60	
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	
Lightguide jumper kit (for 8λ, systems)	Quantity _____ (1 per optical line required)	L161	
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	
Lightguide jumper kit (for 16λ, systems, single-OA operation)	Quantity _____ (1 per optical line required)	L163	
Lightguide jumper kit (for 16λ, systems, two-OA/two-OA Dual-Facing Shelf operations	Quantity _____ (1 per shelf required)	L164	

Table 7-1.   Miscellaneously-Mounted Shelf– End Terminal
(J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Lightguide jumper kit (Dual-Facing other than two-OA/single-OA, single-OA/two-OA, single-OA/single-OA Dual-Facing)	Quantity _____ (1 per shelf required)	L165	Table 7-15
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ) Length _____		
Office alarm cable	Quantity _____ (1 per shelf required)		Table 7-22
X.25 interface cable	Quantity _____ (1 per shelf required)		
CIT interface cable	Quantity _____ (1 per shelf required)		
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30

**Table 7-1.   Miscellaneously-Mounted Shelf– End Terminal
(J68982C-1) —** *Continued*

Description	Choice	List/ Group	Reference
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

* A particular Metro application may require either one or two OAs on an optical line. Refer to Chapter 3, "Applications", and Chapter 6, "System Planning and Engineering".

**Table 7-2.   Miscellaneously-Mounted Shelf– Repeater
(J68982C-1)**

Description	Choice	List/ Group	Reference
Miscellaneously-mounted Shelf– Repeater Shelf		L10 or L11	Table 7-15
Miscellaneously-mounted – Repeater Kit		L107	

**Table 7-2.   Miscellaneously-Mounted Shelf– Repeater
           (J68982C-1) —** *Continued*

Description	Choice	List/ Group	Reference
SDH kit for SDH OLS application		L108	Table 7-15
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA) (16λ)– Long Reach	Quantity _____ (2 per optical line required)	L21	
Telemetry circuit pack	Quantity _____ (2 per optical line required)	L25	
Tributary overhead control-ler circuit pack	Quantity _____ (1 per shelf required)	L30	
System controller circuit pack	Quantity _____ (1 per shelf required)	L35	
System memory circuit pack	Quantity _____ (1 per shelf required)	L40	
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	Table 7-15
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (8 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (16 per optical line required for 16λ) Length _____		

**Table 7-2.   Miscellaneously-Mounted Shelf– Repeater
(J68982C-1) —** *Continued*

Description	Choice	List/ Group	Reference
Office alarm cable	Quantity _____ (1 per shelf required)		Table 7-22
X.25 interface cable	Quantity _____ (1 per shelf required)		
CIT interface cable	Quantity _____ (1 per shelf required)		
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Documentation			Table 7-18, Table 7-19, and Table 7-20
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	

Table 7-2.   Miscellaneously-Mounted Shelf– Repeater
(J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

Table 7-3.   Miscellaneously-Mounted OT System Controller Shelf Worksheet
(J69000C-1)

Description	Choice	List/Group	Reference
Miscellaneously-mounted System Controller Shelf	Quantity _____	L11	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTU 41A1B	Quantity _____	L221	Table 7-27, Table 7-36 and "Circuit Pack/Unit Descriptions"
OTU 41A2B	Quantity _____	L222	
OTU 41A3B	Quantity _____	L223	
OTU 41A4B	Quantity _____	L224	
OTU 41A5B	Quantity _____	L225	
OTU 41A6B	Quantity _____	L226	
OTU 41A7B	Quantity _____	L227	
OTU 41A8B	Quantity _____	L228	
OTU 41A9B	Quantity _____	L289	
OTU 41A10B	Quantity _____	L290	
OTU 41A11B	Quantity _____	L291	
OTU 41A12B	Quantity _____	L292	

**Table 7-3.   Miscellaneously-Mounted OT System Controller Shelf Worksheet
(J69000C-1) — *Continued***

Description	Choice	List/Group	Reference
OTU 41A13B	Quantity _____	L293	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A14B	Quantity _____	L294	
OTU 41A15B	Quantity _____	L295	
OTU 41A16B	Quantity _____	L296	
OTU 41BB	Quantity _____	L229	
OTU 41C1B	Quantity _____	L241	
OTU 41C2B	Quantity _____	L242	
OTU 41C3B	Quantity _____	L243	
OTU 41C4B	Quantity _____	L244	
OTU 41C5B	Quantity _____	L245	
OTU 41C6B	Quantity _____	L246	
OTU 41C7B	Quantity _____	L247	
OTU 41C8B	Quantity _____	L248	
OTU 41C9B	Quantity _____	L249	
OTU 41C10B	Quantity _____	L300	
OTU 41C11B	Quantity _____	L301	
OTU 41C12B	Quantity _____	L302	
OTU 41C13B	Quantity _____	L303	
OTU 41C14B	Quantity _____	L304	
OTU 41C15B	Quantity _____	L305	
OTU 41C16B	Quantity _____	L306	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	

**Table 7-3.   Miscellaneously-Mounted OT System Controller Shelf Worksheet
(J69000C-1) — *Continued***

Description	Choice	List/Group	Reference
OTPM 42A2	Quantity _____	L52	Table 7-36, Table 7-27, and "Circuit Pack/Unit Descriptions"
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	
OTPM 42A5	Quantity _____	L55	
OTPM 42A6	Quantity _____	L56	
OTPM 42A7	Quantity _____	L57	
OTPM 42A8	Quantity _____	L58	
OTPM 42A9	Quantity _____	L59	
OTPM 42A10	Quantity _____	L60	
OTPM 42A11	Quantity _____	L61	
OTPM 42A12	Quantity _____	L62	
OTPM 42A13	Quantity _____	L63	
OTPM 42A14	Quantity _____	L64	
OTPM 42A15	Quantity _____	L65	
OTPM 42A16	Quantity _____	L66	
OTPM 42B	Quantity _____	L67	
OTPM 43A1	Quantity _____	L71	
OTPM 43A2	Quantity _____	L72	
OTPM 43A3	Quantity _____	L73	
OTPM 43A4	Quantity _____	L74	
OTPM 43A5	Quantity _____	L75	
OTPM 43A6	Quantity _____	L76	
OTPM 43A7	Quantity _____	L77	

Table 7-3. Miscellaneously-Mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 43A8	Quantity _____	L78	Table 7-36, Table 7-27, and "Circuit Pack/Unit Descriptions"
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	
OTPM 43A14	Quantity _____	L84	
OTPM 43A15	Quantity _____	L85	
OTPM 43A16	Quantity _____	L86	
OTPM 43B	Quantity _____	L87	
OTPM 44A1	Quantity _____	L141	
OTPM 44A2	Quantity _____	L142	
OTPM 44A3	Quantity _____	L143	
OTPM 44A4	Quantity _____	L144	
OTPM 44A5	Quantity _____	L145	
OTPM 44A6	Quantity _____	L146	
OTPM 44A7	Quantity _____	L147	
OTPM 44A8	Quantity _____	L148	
OTPM 44A9	Quantity _____	L149	
OTPM 44A10	Quantity _____	L150	

**Table 7-3.   Miscellaneously-Mounted OT System Controller Shelf Worksheet
(J69000C-1) —** *Continued*

Description	Choice	List/Group	Reference
OTPM 44A11	Quantity _____	L151	Table 7-36, Table 7-27, and "Circuit Pack/Unit Descriptions"
OTPM 44A12	Quantity _____	L152	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	
Non-transmission Cables (ED7G045-22)			
Incoming Signal Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	Table 7-23 and "Intraoffice Electrical Nontransmission Cable Descriptions"
OTU Circuit Pack Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	
Documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
LBO Kits (J69000C-1)			
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OT Package Descriptions"

Table 7-3.   Miscellaneously-Mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	Table 7-15 and "OT Package Descriptions"
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L122	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L132	

Table 7-4.   Miscellaneously Mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1)

Description	Choice	List/Group	Reference
Miscellaneously Mounted Complementary Shelf: — Shelf 1 — Shelf 2	Quantity _____ Quantity _____	L12 L13	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTU 41A1B	Quantity _____	L221	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A2B	Quantity _____	L222	
OTU 41A3B	Quantity _____	L223	
OTU 41A4B	Quantity _____	L224	
OTU 41A5B	Quantity _____	L225	

**Table 7-4.   Miscellaneously Mounted OT Complementary Shelf 1 or 2
Worksheet (J69000C-1) —** *Continued*

Description	Choice	List/Group	Reference
OTU 41A6B	Quantity _____	L226	Table 7-27, Table 7-36 and "Circuit Pack/Unit Descriptions"
OTU 41A7B	Quantity _____	L227	
OTU 41A8B	Quantity _____	L228	
OTU 41A9B	Quantity _____	L289	
OTU 41A10B	Quantity _____	L290	
OTU 41A11B	Quantity _____	L291	
OTU 41A12B	Quantity _____	L292	
OTU 41A13B	Quantity _____	L293	
OTU 41A14B	Quantity _____	L294	
OTU 41A15B	Quantity _____	L295	
OTU 41A16B	Quantity _____	L296	
OTU 41BB	Quantity _____	L229	
OTU 41C1B	Quantity _____	L241	
OTU 41C2B	Quantity _____	L242	
OTU 41C3B	Quantity _____	L243	
OTU 41C4B	Quantity _____	L244	
OTU 41C5B	Quantity _____	L245	
OTU 41C6B	Quantity _____	L246	
OTU 41C7B	Quantity _____	L247	
OTU 41C8B	Quantity _____	L248	
OTU 41C9B	Quantity _____	L249	
OTU 41C10B	Quantity _____	L300	
OTU 41C11B	Quantity _____	L301	
OTU 41C12B	Quantity _____	L302	

**Table 7-4.   Miscellaneously Mounted OT Complementary Shelf 1 or 2
Worksheet (J69000C-1) —** *Continued*

Description	Choice	List/Group	Reference
OTU 41C13B	Quantity _____	L303	Table 7-27, Table 7-36 and "Circuit Pack/Unit Descriptions"
OTU 41C14B	Quantity _____	L304	
OTU 41C15B	Quantity _____	L305	
OTU 41C16B	Quantity _____	L306	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	
OTPM 42A2	Quantity _____	L52	
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	
OTPM 42A5	Quantity _____	L55	
OTPM 42A6	Quantity _____	L56	
OTPM 42A7	Quantity _____	L57	
OTPM 42A8	Quantity _____	L58	
OTPM 42A9	Quantity _____	L59	
OTPM 42A10	Quantity _____	L60	
OTPM 42A11	Quantity _____	L61	
OTPM 42A12	Quantity _____	L62	
OTPM 42A13	Quantity _____	L63	
OTPM 42A14	Quantity _____	L64	
OTPM 42A15	Quantity _____	L65	
OTPM 42A16	Quantity _____	L66	
OTPM 42B	Quantity _____	L67	

Table 7-4.   Miscellaneously Mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 43A1	Quantity _____	L71	Table 7-27, Table 7-36 and "Circuit Pack/Unit Descriptions"
OTPM 43A2	Quantity _____	L72	
OTPM 43A3	Quantity _____	L73	
OTPM 43A4	Quantity _____	L74	
OTPM 43A5	Quantity _____	L75	
OTPM 43A6	Quantity _____	L76	
OTPM 43A7	Quantity _____	L77	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	
OTPM 43A14	Quantity _____	L84	
OTPM 43A15	Quantity _____	L85	
OTPM 43A16	Quantity _____	L86	
OTPM 43B	Quantity _____	L87	
OTPM 44A1	Quantity _____	L141	
OTPM 44A2	Quantity _____	L142	
OTPM 44A3	Quantity _____	L143	
OTPM 44A4	Quantity _____	L144	
OTPM 44A5	Quantity _____	L145	

Table 7-4.   Miscellaneously Mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 44A6	Quantity _____	L146	Table 7-27, Table 7-36 and "Circuit Pack/Unit Descriptions"
OTPM 44A7	Quantity _____	L147	
OTPM 44A8	Quantity _____	L148	
OTPM 44A9	Quantity _____	L149	
OTPM 44A10	Quantity _____	L150	
OTPM 44A11	Quantity _____	L151	
OTPM 44A12	Quantity _____	L152	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	
Non-transmission Cables (ED7G045-22)			
Incoming Signal Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	Table 7-23 and "Cables"
OTU Circuit Pack Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	
Documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	

Table 7-4. Miscellaneously Mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
LBO Kits (J69000C1)			
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OT Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L122	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L132	

Table 7-5. 4 Bidirectional Line End Terminal Worksheet (J68982C-1)

Description	Choice	List/ Group	Reference
End Terminal	Cabinet	L1	Table 7-15
End Terminal, 4 Line Kit		L101	
SDH kit for SDH OLS application		L108	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26

**Table 7-5.   4 Bidirectional Line End Terminal Worksheet
(J68982C-1) —** *Continued*

Description	Choice	List/ Group	Reference
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)-Short Haul	Quantity _____ (1 or 2 per optical line required)[*]	L23	
Telemetry circuit pack (TLM)	Quantity _____ (1 per optical line required)	L25	
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per cabinet required)	L30	
System controller circuit pack (SYSCTL)	Quantity _____ (1 per cabinet required)	L35	
System memory circuit pack (SYSMEM)	Quantity _____ (1 per cabinet required)	L40	
Optical Demultiplexer Unit (ODU 8λ)	Quantity _____ (1 per optical line required)	L50	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	L52	

Table 7-5. 4 Bidirectional Line End Terminal Worksheet
(J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Optical Multiplexer Unit (OMU 8λ)	Quantity _____ (1 per optical line required)	L60	Table 7-15 and Table 7-26
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	
Lightguide jumper kit (for 8λ, systems)	Quantity _____ (1 per optical line required)	L161	Table 7-15
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	
Lightguide jumper kit (for 16λ, systems, single-OA operation)	Quantity _____ (1 per optical line required)	L163	
Lightguide jumper kit (for 16λ, systems, two-OA/two-OA Dual-Facing Shelf operations	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (Dual-Facing other than two-OA/single-OA, single-OA/two-OA, single-OA/single-OA Dual-Facing)	Quantity _____ (1 per shelf required)	L165	
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C

Table 7-5. 4 Bidirectional Line End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ) Length _____		Fiber Optic Products Catalog 2492C
Office alarm cable	Quantity _____ (1 per cabinet required)		Table 7-22
X.25 interface cable	Quantity _____ (1 per cabinet required)		
CIT interface cable	Quantity _____ (1 per cabinet required)		
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Order-wire Shelf"

Table 7-5.   4 Bidirectional Line End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

* A particular Metro application may require either one or two OAs on an optical line. Refer to Chapter 3, "Applications", and Chapter 6, "System Planning and Engineering."

Table 7-6.   Dual End Terminal Worksheet (J68982C-1)

Description	Choice	List/ Group	Reference
Dual End Terminal	Cabinet Bay	L2 or L14	Table 7-15
Dual End Terminal Kit		L103	
SDH kit for SDH OLS application		L108	

Table 7-6.   Dual End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Short Haul	Quantity _____ (1 or 2 per optical line required)[*]	L23	
Telemetry circuit pack	Quantity _____ (1 per optical line required)	L25	
Tributary overhead controller circuit pack	Quantity _____ (2 per cabinet required)	L30	
System controller circuit pack	Quantity _____ (2 per cabinet required)	L35	
System memory circuit pack	Quantity _____ (2 per cabinet required)	L40	
Optical Demultiplexer Unit (ODU 8λ)	Quantity _____ (1 per optical line required)	L50	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	L52	
Optical Multiplexer Unit (OMU 8λ)	Quantity _____ (1 per optical line required)	L60	

Table 7-6. Dual End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	Table 7-15 and Table 7-26
Lightguide jumper kit (for 8λ, systems)	Quantity _____ (1 per optical line required)	L161	
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	
Lightguide jumper kit (for 16λ, systems, single-OA operation)	Quantity _____ (1 per optical line required)	L163	
Lightguide jumper kit (for 16λ, systems, two-OA/two-OA Dual-Facing Shelf operations	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (Dual-Facing other than two-OA/single-OA, single-OA/two-OA, single-OA/single-OA Dual-Facing)	Quantity _____ (1 per shelf required)	L165	
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ) Length _____		

Table 7-6.   Dual End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Office alarm cable	Quantity _____ (2 per cabinet required)		Table 7-22
X.25 interface cable	Quantity _____ (2 per cabinet required)		
CIT interface cable	Quantity _____ (2 per cabinet required)		
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Order-wire Shelf"
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	

Table 7-6.   Dual End Terminal Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

* A particular Metro application may require either one or two OAs on an optical line. Refer to Chapter 3, "Applications", and Chapter 6, "System Planning and Engineering."

Table 7-7.   4 Bidirectional Line Repeater Worksheet (J68982C-1)

Description	Choice	List/ Group	Reference
4 Bidirectional Line Repeater	Cabinet	L1	Table 7-15
Repeater Kit		L102	
SDH kit for SDH OLS application		L108	
Optical Amplifier circuit pack (OA)	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)	Quantity _____ (2 per optical line required)	L21	
Telemetry circuit pack	Quantity _____ (2 per optical line required)	L25	
Tributary overhead control-ler circuit pack	Quantity _____ (1 per cabinet required)	L30	

Table 7-7.   4 Bidirectional Line Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
System controller circuit pack	Quantity _____ (1 per cabinet required)	L35	Table 7-15 and Table 7-26
System memory circuit pack	Quantity _____ (1 per cabinet required)	L40	
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (8 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (16 per optical line required for 16λ) Length _____		
Office alarm cable	Quantity _____ (1 per cabinet required)		Table 7-22
X.25 interface cable	Quantity _____ (1 per cabinet required)		
CIT interface cable	Quantity _____ (1 per cabinet required)		
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30

Table 7-7.   4 Bidirectional Line Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Order-wire Shelf"
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

Table 7-8. Dual Repeater Worksheet (J68982C-1)

Description	Choice	List/Group	Reference
Dual Repeater	Cabinet Bay	L2 L14	Table 7-15
Dual Repeater Kit		L104	
SDH kit for SDH OLS application		L108	Table 7-16
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)- Long Reach	Quantity _____ (2 per optical line required)	L21	
Telemetry circuit pack	Quantity _____ (2 per optical line required)	L25	
Tributary overhead controller circuit pack	Quantity _____ (2 per cabinet required)	L30	
System controller circuit pack	Quantity _____ (2 per cabinet required)	L35	
System memory circuit pack	Quantity _____ (2 per cabinet required)	L40	
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	Table 7-15
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (8 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C

Table 7-8.   Dual Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (16 per optical line required for 16λ) Length _____		Fiber Optic Products Catalog 2492C
Office alarm cable	Quantity _____ (2 per cabinet required)		Table 7-22
X.25 interface cable	Quantity _____ (2 per cabinet required)		
CIT interface cable	Quantity _____ (2 per cabinet required)		
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Order-wire Shelf"
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"

Table 7-8.   Dual Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	Table 7-15 and "OLS Package Descriptions"
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

Table 7-9.   End Terminal/Repeater Worksheet (J68982C-1)

Description	Choice	List/ Group	Reference
End Terminal/Repeater	Cabinet Bay	L2 L14	Table 7-15
End Terminal/Repeater Kit		L105	
SDH kit for SDH OLS application		L108	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	Table 7-15 and Table 7-26
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (1 or 2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Short Haul	Quantity _____ (1 or 2 per optical line required)[*]	L23	

Table 7-9.   End Terminal/Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Telemetry circuit pack	Quantity _____ (1 per optical line required [End Terminal shelf]) (2 per optical line required [Repeater shelf])	L25	Table 7-15 and Table 7-26
Tributary overhead controller circuit pack	Quantity _____ (2 per cabinet required)	L30	
System controller circuit pack	Quantity _____ (2 per cabinet required)	L35	
System memory circuit pack	Quantity _____ (2 per cabinet required)	L40	
Optical Demultiplexer Unit (ODU 8λ)	Quantity _____ (1 per optical line required [End Terminal shelf only])	L50	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	L52	
Optical Multiplexer Unit (OMU 8λ)	Quantity _____ (1 per optical line required [End Terminal shelf only])	L60	

Table 7-9.   End Terminal/Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	Table 7-15 and Table 7-26
Lightguide jumper kit (for 8λ, systems)	Quantity _____ (1 per optical line required)	L161	Table 7-15
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	
Lightguide jumper kit (for 16λ, systems, single-OA operation)	Quantity _____ (1 per optical line required)	L163	
Lightguide jumper kit (for 16λ, systems, two-OA/two-OA Dual-Facing Shelf operations	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (Dual-Facing other than two-OA/single-OA, single-OA/two-OA, single-OA/single-OA Dual-Facing)	Quantity _____ (1 per shelf required)	L165	
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ) Length _____		

Table 7-9.   End Terminal/Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
Office alarm cable	Quantity _____ (2 per cabinet required)		Table 7-23
X.25 interface cable	Quantity _____ (2 per cabinet required)		
CIT interface cable	Quantity _____ (2 per cabinet required)		
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
ED7G028-22 cable	Quantity (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Order-wire Shelf"
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OLS Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	Table 7-15 and "OLS Package Descriptions"

Table 7-9.   End Terminal/Repeater Worksheet (J68982C-1) — *Continued*

Description	Choice	List/ Group	Reference
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	Table 7-15 and "OLS Package Descriptions"
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L114	

* A particular Metro application may require either one or two OAs on an optical line between End Terminals. Refer to Chapter 3, "Applications," and Chapter 6, "System Planning and Engineering."

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1)

Description	Choice	List/ Group	Reference
OLS Integrated Bay		L1	Table 7-16
SDH kit for SDH OLS application		L108	
Optical Amplifier circuit pack (OA)-Long Span	Quantity_____ (2 per optical line required)	L20	Table 7-26
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Short Haul	Quantity _____ (1 or 2 per optical line required)[*]	L23	
Telemetry circuit pack	Quantity _____ (2 per bay required)	L25	
Tributary overhead controller circuit pack	Quantity _____ (1 per shelf required)	L30	
System controller circuit pack	Quantity _____ (1 per bay required)	L35	
System memory circuit pack	Quantity _____ (1 per bay required)	L40	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	L52	

Table 7-10. OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/Group	Reference
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	
Circuit Packs			
OTU 41A1B	Quantity _____	L221	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A2B	Quantity _____	L222	
OTU 41A3B	Quantity _____	L223	
OTU 41A4B	Quantity _____	L224	
OTU 41A5B	Quantity _____	L225	
OTU 41A6B	Quantity _____	L226	
OTU 41A7B	Quantity _____	L227	
OTU 41A8B	Quantity _____	L228	
OTU 41A9B	Quantity _____	L289	
OTU 41A10B	Quantity _____	L290	
OTU 41A11B	Quantity _____	L291	
OTU 41A12B	Quantity _____	L292	
OTU 41A13B	Quantity _____	L293	
OTU 41A14B	Quantity _____	L294	
OTU 41A15B	Quantity _____	L295	
OTU 41A16B	Quantity _____	L296	
OTU 41BB	Quantity _____	L229	
OTU 41C1B	Quantity _____	L241	
OTU 41C2B	Quantity _____	L242	
OTU 41C3B	Quantity _____	L243	
OTU 41C4B	Quantity _____	L244	

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/ Group	Reference
OTU 41C5B	Quantity _____	L245	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41C6B	Quantity _____	L246	
OTU 41C7B	Quantity _____	L247	
OTU 41C8B	Quantity _____	L248	
OTU 41C9B	Quantity _____	L249	
OTU 41C10B	Quantity _____	L300	
OTU 41C11B	Quantity _____	L301	
OTU 41C12B	Quantity _____	L302	
OTU 41C13B	Quantity _____	L303	
OTU 41C14B	Quantity _____	L304	
OTU 41C15B	Quantity _____	L305	
OTU 41C16B	Quantity _____	L306	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L251	
OTPM 42A2	Quantity _____	L252	
OTPM 42A3	Quantity _____	L253	
OTPM 42A4	Quantity _____	L254	
OTPM 42A5	Quantity _____	L255	
OTPM 42A6	Quantity _____	L256	
OTPM 42A7	Quantity _____	L257	
OTPM 42A8	Quantity _____	L258	
OTPM 42A9	Quantity _____	L259	
OTPM 42A10	Quantity _____	L260	

Table 7-10. OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/ Group	Reference
OTPM 42A11	Quantity _____	L261	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 42A12	Quantity _____	L262	
OTPM 42A13	Quantity _____	L263	
OTPM 42A14	Quantity _____	L264	
OTPM 42A15	Quantity _____	L265	
OTPM 42A16	Quantity _____	L266	
OTPM 42B	Quantity _____	L267	
OTPM 43A1	Quantity _____	L271	
OTPM 43A2	Quantity _____	L272	
OTPM 43A3	Quantity _____	L273	
OTPM 43A4	Quantity _____	L274	
OTPM 43A5	Quantity _____	L275	
OTPM 43A6	Quantity _____	L276	
OTPM 43A7	Quantity _____	L277	
OTPM 43A8	Quantity _____	L278	
OTPM 43A9	Quantity _____	L279	
OTPM 43A10	Quantity _____	L280	
OTPM 43A11	Quantity _____	L281	
OTPM 43A12	Quantity _____	L282	
OTPM 43A13	Quantity _____	L283	
OTPM 43A14	Quantity _____	L284	
OTPM 43A15	Quantity _____	L285	

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/ Group	Reference
OTPM 43A16	Quantity _____	L286	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 43B	Quantity _____	L287	
OTPM 44A1	Quantity _____	L341	
OTPM 44A2	Quantity _____	L342	
OTPM 44A3	Quantity _____	L343	
OTPM 44A4	Quantity _____	L344	
OTPM 44A5	Quantity _____	L345	
OTPM 44A6	Quantity _____	L346	
OTPM 44A7	Quantity _____	L347	
OTPM 44A8	Quantity _____	L348	
OTPM 44A9	Quantity _____	L349	
OTPM 44A10	Quantity _____	L350	
OTPM 44A11	Quantity _____	L351	
OTPM 44A12	Quantity _____	L352	
OTPM 44A13	Quantity _____	L353	
OTPM 44A14	Quantity _____	L354	
OTPM 44A15	Quantity _____	L355	
OTPM 44A16	Quantity _____	L356	
OTPM 44B	Quantity _____	L357	
Lightguide jumper kit (for 8λ, systems)	Quantity _____ (1 per optical line required)	L161	Table 7-16

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/Group	Reference
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	Table 7-16
Lightguide jumper kit (for 16λ, systems, single-OA operation)	Quantity _____ (1 per optical line required)	L163	
Lightguide jumper kit (for 16λ, systems, two-OA/two-OA Dual-Facing Shelf operations	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (Dual-Facing other than two-OA/single-OA, single-OA/two-OA, single-OA/single-OA Dual-Facing)	Quantity _____ (1 per shelf required)	L165	
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ) Length _____		Fiber Optic Products Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ) Length _____		
Office alarm cable	Quantity _____ (2 per cabinet required)		Table 7-22 and Table 7-23
X.25 interface cable	Quantity _____ (2 per cabinet required)		
CIT interface cable	Quantity _____ (2 per cabinet required)		

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/Group	Reference
HARRIS EMDU kit	Yes/No _____ Enter choice	L501	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Software and documentation			Table 7-18, Table 7-19, and Table 7-20
ED7G028-22 cable	Quantity (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Orderwire Shelf"
For OLS shelf: ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-16, "OLS Package Descriptions," and "OT Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L112	

Table 7-10.   OLS Integrated Bay Worksheet (J68982D-1) — *Continued*

Description	Choice	List/ Group	Reference
FC LBO kit (OLS R2.1 and later) **For OT shelf:**	Yes/No _____ (1 per optical line required)	L114	Table 7-16, "OLS Package Descriptions," and "OT Package Descriptions"
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L113	
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L123	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L133	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L122	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L132	

* A particular Metro application may require either one or two OAs on an optical line. Refer to Chapter 3, "Applications," and Chapter 6, "System Planning and Engineering."

Table 7-11. OT Bay or Miscellaneously Mounted Application Worksheet (J69000C-1)

Description	Choice	List/ Group	Reference
Miscellaneously-mounted Application OT Bay	Quantity _____	L10 or L14	"OT Package Descriptions"
Circuit Packs			
OTU 41A1B	Quantity _____	L221	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A2B	Quantity _____	L222	
OTU 41A3B	Quantity _____	L223	
OTU 41A4B	Quantity _____	L224	
OTU 41A5B	Quantity _____	L225	
OTU 41A6B	Quantity _____	L226	
OTU 41A7B	Quantity _____	L227	
OTU 41A8B	Quantity _____	L228	
OTU 41A9B	Quantity _____	L289	
OTU 41A10B	Quantity _____	L290	
OTU 41A11B	Quantity _____	L291	
OTU 41A12B	Quantity _____	L292	
OTU 41A13B	Quantity _____	L293	
OTU 41A14B	Quantity _____	L294	
OTU 41A15B	Quantity _____	L295	
OTU 41A16B	Quantity _____	L296	

**Table 7-11.   OT Bay or Miscellaneously Mounted Application Worksheet
(J69000C-1) —** *Continued*

Description	Choice	List/Group	Reference
OTU 41BB	Quantity _____	L229	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41C1B	Quantity _____	L241	
OTU 41C2B	Quantity _____	L242	
OTU 41C3B	Quantity _____	L243	
OTU 41C4B	Quantity _____	L244	
OTU 41C5B	Quantity _____	L245	
OTU 41C6B	Quantity _____	L246	
OTU 41C7B	Quantity _____	L247	
OTU 41C8B	Quantity _____	L248	
OTU 41C9B	Quantity _____	L249	
OTU 41C10B	Quantity _____	L300	
OTU 41C11B	Quantity _____	L301	
OTU 41C12B	Quantity _____	L302	
OTU 41C13B	Quantity _____	L303	
OTU 41C14B	Quantity _____	L304	
OTU 41C15B	Quantity _____	L305	
OTU 41C16B	Quantity _____	L306	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	
OTPM 42A2	Quantity _____	L52	
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	

**Table 7-11.   OT Bay or Miscellaneously Mounted Application Worksheet
(J69000C-1) — *Continued***

Description	Choice	List/Group	Reference
OTPM 42A5	Quantity _____	L55	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 42A6	Quantity _____	L56	
OTPM 42A7	Quantity _____	L57	
OTPM 42A8	Quantity _____	L58	
OTPM 42A9	Quantity _____	L59	
OTPM 42A10	Quantity _____	L60	
OTPM 42A11	Quantity _____	L61	
OTPM 42A12	Quantity _____	L62	
OTPM 42A13	Quantity _____	L63	
OTPM 42A14	Quantity _____	L64	
OTPM 42A15	Quantity _____	L65	
OTPM 42A16	Quantity _____	L66	
OTPM 42B	Quantity _____	L67	
OTPM 43A1	Quantity _____	L71	
OTPM 43A2	Quantity _____	L72	
OTPM 43A3	Quantity _____	L73	
OTPM 43A4	Quantity _____	L74	
OTPM 43A5	Quantity _____	L75	
OTPM 43A6	Quantity _____	L76	

**Table 7-11.   OT Bay or Miscellaneously Mounted Application Worksheet
(J69000C-1) —** *Continued*

Description	Choice	List/ Group	Reference
OTPM 43A7	Quantity _____	L77	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	
OTPM 43A14	Quantity _____	L84	
OTPM 43A15	Quantity _____	L85	
OTPM 43A16	Quantity _____	L86	
OTPM 43B	Quantity _____	L87	
OTPM 44A1	Quantity _____	L141	
OTPM 44A2	Quantity _____	L142	
OTPM 44A3	Quantity _____	L143	
OTPM 44A4	Quantity _____	L144	
OTPM 44A5	Quantity _____	L145	
OTPM 44A6	Quantity _____	L146	
OTPM 44A7	Quantity _____	L147	
OTPM 44A8	Quantity _____	L148	
OTPM 44A9	Quantity _____	L149	
OTPM 44A10	Quantity _____	L150	
OTPM 44A11	Quantity _____	L151	
OTPM 44A12	Quantity _____	L152	

Table 7-11. OT Bay or Miscellaneously Mounted Application Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 44A13	Quantity _____	L153	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	
Non-transmission Cables (ED7G045-22)			
Incoming Signal Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	Table 7-23 and "Cables"
OTU Circuit Pack Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	
Documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
LBO Kits (J69000C-1)			
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OT Package Descriptions"

**Table 7-11. OT Bay or Miscellaneously Mounted Application Worksheet
(J69000C-1) —** *Continued*

Description	Choice	List/ Group	Reference
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	Table 7-15 and "OT Package Descriptions"
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L122	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L132	

Table 7-12.   OT Cabinet Worksheet (J69000C-1)

Description	Choice	List/Group	Reference
Optical Translator Cabinet	Quantity _____	L1	"OT Package Descriptions"
Circuit Packs (J69000C-1)[*]			
OTU 41A1	Quantity _____	L21	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A2	Quantity _____	L22	
OTU 41A3	Quantity _____	L23	
OTU 41A4	Quantity _____	L24	
OTU 41A5	Quantity _____	L25	
OTU 41A6	Quantity _____	L26	
OTU 41A7	Quantity _____	L27	
OTU 41A8	Quantity _____	L28	
OTU 41A9	Quantity _____	L89	
OTU 41A10	Quantity _____	L90	
OTU 41A11	Quantity _____	L91	
OTU 41A12	Quantity _____	L92	
OTU 41A13	Quantity _____	L93	
OTU 41A14	Quantity _____	L94	
OTU 41A15	Quantity _____	L95	
OTU 41A16	Quantity _____	L96	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTU 41A1B	Quantity _____	L221	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41A2B	Quantity _____	L222	
OTU 41A3B	Quantity _____	L223	
OTU 41A4B	Quantity _____	L224	
OTU 41A5B	Quantity _____	L225	
OTU 41A6B	Quantity _____	L226	
OTU 41A7B	Quantity _____	L227	
OTU 41A8B	Quantity _____	L228	
OTU 41A9B	Quantity _____	L289	
OTU 41A10B	Quantity _____	L290	
OTU 41A11B	Quantity _____	L291	
OTU 41A12B	Quantity _____	L292	
OTU 41A13B	Quantity _____	L293	
OTU 41A14B	Quantity _____	L294	
OTU 41A15B	Quantity _____	L295	
OTU 41A16B	Quantity _____	L296	
OTU 41B	Quantity _____	L29	
OTU 41BB	Quantity _____	L229	
OTU 41C1	Quantity _____	L41	
OTU 41C2	Quantity _____	L42	
OTU 41C3	Quantity _____	L43	
OTU 41C4	Quantity _____	L44	
OTU 41C5	Quantity _____	L45	
OTU 41C6	Quantity _____	L46	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTU 41C7	Quantity _____	L47	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41C8	Quantity _____	L48	
OTU 41C9	Quantity _____	L99	
OTU 41C10	Quantity _____	L100	
OTU 41C11	Quantity _____	L101	
OTU 41C12	Quantity _____	L102	
OTU 41C13	Quantity _____	L103	
OTU 41C14	Quantity _____	L104	
OTU 41C15	Quantity _____	L105	
OTU 41C16	Quantity _____	L106	
OTU 41C1B	Quantity _____	L241	
OTU 41C2B	Quantity _____	L242	
OTU 41C3B	Quantity _____	L243	
OTU 41C4B	Quantity _____	L244	
OTU 41C5B	Quantity _____	L245	
OTU 41C6B	Quantity _____	L246	
OTU 41C7B	Quantity _____	L247	
OTU 41C8B	Quantity _____	L248	
OTU 41C9B	Quantity _____	L249	
OTU 41C10B	Quantity _____	L300	
OTU 41C11B	Quantity _____	L301	
OTU 41C12B	Quantity _____	L302	
OTU 41C13B	Quantity _____	L303	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTU 41C14B	Quantity _____	L304	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTU 41C15B	Quantity _____	L305	
OTU 41C16B	Quantity _____	L306	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	
OTPM 42A2	Quantity _____	L52	
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	
OTPM 42A5	Quantity _____	L55	
OTPM 42A6	Quantity _____	L56	
OTPM 42A7	Quantity _____	L57	
OTPM 42A8	Quantity _____	L58	
OTPM 42A9	Quantity _____	L59	
OTPM 42A10	Quantity _____	L60	
OTPM 42A11	Quantity _____	L61	
OTPM 42A12	Quantity _____	L62	
OTPM 42A13	Quantity _____	L63	
OTPM 42A14	Quantity _____	L64	
OTPM 42A15	Quantity _____	L65	
OTPM 42A16	Quantity _____	L66	
OTPM 42B	Quantity _____	L67	
OTPM 43A1	Quantity _____	L71	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 43A2	Quantity _____	L72	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 43A3	Quantity _____	L73	
OTPM 43A4	Quantity _____	L74	
OTPM 43A5	Quantity _____	L75	
OTPM 43A6	Quantity _____	L76	
OTPM 43A7	Quantity _____	L77	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	
OTPM 43A14	Quantity _____	L84	
OTPM 43A15	Quantity _____	L85	
OTPM 43A16	Quantity _____	L86	
OTPM 43B	Quantity _____	L87	
OTPM 44A1	Quantity _____	L141	
OTPM 44A2	Quantity _____	L142	
OTPM 44A3	Quantity _____	L143	
OTPM 44A4	Quantity _____	L144	
OTPM 44A5	Quantity _____	L145	
OTPM 44A6	Quantity _____	L146	
OTPM 44A7	Quantity _____	L147	
OTPM 44A8	Quantity _____	L148	
OTPM 44A9	Quantity _____	L149	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
OTPM 44A10	Quantity _____	L150	Table 7-27, Table 7-36, and "Circuit Pack/Unit Descriptions"
OTPM 44A11	Quantity _____	L151	
OTPM 44A12	Quantity _____	L152	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	
Non-transmission Cables (ED7G045-22)			
Office Alarm cable	Quantity _____ (For future use, 1 per cabinet)	G1 or G2	Table 7-22, Table 7-23, and "Cables"
X.25 interface cable	Quantity _____ (For future use, 1 per cabinet)	G6 or G7 or G9 or G10	
CIT (DTE) cable	Quantity _____ (For future use, 1 per cabinet)	G14 or G15	
Incoming Signal Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	
OTU Circuit Pack Failure Cable	Quantity _____ (1 per shelf required)	G3 or G4	
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30
Documentation			Table 7-18, Table 7-19, and Table 7-20
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	

Table 7-12.   OT Cabinet Worksheet (J69000C-1) — *Continued*

Description	Choice	List/Group	Reference
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	Table 7-22
DANTEL Orderwire Shelf	Yes/No _____ Enter choice		"DANTEL Orderwire Shelf"
LBO Kits (J69000C-1)			
ST LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L111	Table 7-15 and "OT Package Descriptions"
FC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L121	
SC LBO kit (OLS R2.0 and earlier)	Yes/No _____ (1 per optical line required)	L131	
ST LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L122	
FC LBO kit (OLS R2.1 and later)	Yes/No _____ (1 per optical line required)	L132	

* 41A, 41B, and 41C circuit packs are used in cabinet applications only.

**Table 7-13.   4 Line End Terminal-to-Dual End Terminal Conversion
Worksheet (J68982C-1)** [*]

Description	Choice	List	Reference
Telemetry circuit pack	Quantity_____ (1 per optical line required)	L25	Table 7-15 and Table 7-26
Tributary overhead controller pack	Quantity_____ (1 per shelf required)	L30	
System controller pack	Quantity_____ (1 per shelf required)	L35	
System memory circuit pack	Quantity_____ (1 per shelf required)	L40	
Conversion kit[†]	Quantity_____ (1 per conversion required)	L310	Table 7-21[‡]
Dual End Terminal kit	Quantity_____ (1 per cabinet required)	L103	
Lightguide office cable (FS1EP-EP-?) "?" indicates length"	Quantity_____ (20 per optical line required)		Fiber Optic Products Catalog 2492C
Office alarm cable	Quantity_____ (1 per shelf required)		Table 7-22
X.25 interface cable	Quantity_____ (1 per shelf required)		
CIT interface cable	Quantity_____ (1 per shelf required)		
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	

**Table 7-13.   4 Line End Terminal-to-Dual End Terminal Conversion
Worksheet (J68982C-1) —** *Continued* [*]

Description	Choice	List	Reference
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30

_____

  * Depending on the type of application/configuration you want, order the appropriate OA,
    ODU, and OMU circuit packs, lightguide jumper kits, and LBOs.
  † Please refer to document #: 365-575-312 (MIP001) for the conversion procedure. This
    procedure assumes one empty shelf prior to the conversion.
  ‡ Table 7-21 provides ordering information for the underlying components in the conver-
    sion kit.

Table 7-14. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) *

Description	Choice	List	Reference
Telemetry circuit pack	Quantity_____ (1 per optical line required)	L25	Table 7-15 and Table 7-26
Tributary overhead controller pack	Quantity_____ (1 per shelf required)	L30	
System controller pack	Quantity_____ (1 per shelf required)	L35	
System memory circuit pack	Quantity_____ (1 per shelf required)	L40	
Conversion kit†	Quantity_____ (1 per conversion required)	L310	Table 7-21‡
Dual Repeater kit	Quantity_____ (1 per cabinet required)	L104	
Lightguide jumper kit	Quantity_____ (1 per optical line required)	L161	Table 7-15
Lightguide office cable (FS1EP-EP-?) "?" indicates length	Quantity_____ (8 per optical line required)		Fiber Optic Products Catalog 2492C
Office alarm cable	Quantity_____ (1 per shelf required)		Table 7-22
X.25 interface cable	Quantity_____ (1 per shelf required)		
CIT interface cable	Quantity_____ (1 per shelf required)		
ED7G028-22 cable	Quantity_____ (1 per unit required)	G201	

Table 7-14. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) — *Continued* *

Description	Choice	List	Reference
DANTEL or HARRIS EMDU kit	Yes/No _____ Enter choice	L 300 or L301	
METRAL Pin/Tool Kit	Yes/No _____ Enter choice		Table 7-31 and Table 7-32
CLETOP Fiber Cleaning Materials	Yes/No _____ Enter choice		Table 7-30

_____

* Depending on the type of Repeater application and configuration you want, order the appropriate OA, ODU, and OMU circuit packs, and LBOs.

† Refer to Document #: 365-575-312 (MIP001) for the conversion procedure. This procedure assumes one empty shelf prior to the conversion.

‡ Table 7-21 provides ordering information for the underlying components in the conversion kit.

Ordering Guidelines

This section provides further aid for ordering OLS packages, including supplemental ordering tables, package descriptions, and ordering information for software and documentation.

Table 7-15.   OLS J68982C-1 Equipment

List No.	Description
main L10	Miscellaneously-mounted Shelf (Lucent Newlook-2000 Cover)
main L11	Miscellaneously-mounted Shelf (Flat Cover)
main L1	4-line cabinet equipped with 2 shelves
main L2	Dual cabinet equipped with 2 system shelves
main L14	Dual bay equipped with 2 shelves.
sub L300 or sub L301	DANTEL or HARRIS EMDU kit
subL101[*]	End Terminal (4 line) kit
subL102[*]	Repeater (4 line) kit
subL103[*]	Dual End Terminal kit
sub L104[*]	Dual Repeater kit
subL105[*]	End Terminal and Repeater kit
sub L106[*]	Miscellaneously Mounted Shelf - End Terminal kit
sub L107[*]	Miscellaneously Mounted Shelf - Repeater kit
sub L108	SDH kit for SDH OLS application
sub L20	Optical Amplifier circuit pack, 2 per optical line (LEA6)
sub L21	Optical Amplifier circuit pack, 2 per optical line (LEA7)
subL23	Optical Amplifier circuit pack, 1 or 2 per optical line (LEA105)
sub L25	Telemetry circuit pack, 1 per optical line for End Terminal, 2 per optical line for Repeater (LDA1)
sub L30	Tributary Overhead Controller (TOHCTL), 1 per system (LEA5)

Table 7-15.   OLS J68982C-1 Equipment — *Continued*

List No.	Description
sub L35	System Controller(SYSCTL) circuit pack, 1 per system (LEA1)
sub L40	System memory(SYSMEM) circuit pack 1 per system (LEA2)
sub L50	Optical Demultiplexer Unit (ODU 8λ), 1 per optical line (605A) End Terminal only
subL51	Optical Demultiplexer Unit (ODU 16λ), 1 per optical line (606A), without supervisory channel, End Terminal only
subL52	Optical Demultiplexer Unit (ODU 16λ), 1 per optical line (606B), with supervisory channel, End Terminal only
sub L60	Optical Multiplexer Unit (OMU 8λ), 1 per optical line (505A) End Terminal only
subL61	Optical Multiplexer Unit (OMU 16λ), 1 per optical line (506A) End Terminal only
main/sub L161	Lightguide jumper kit TLM, OMU, ODU, OA, 8λ (1 per line)
main/sub L162	Lightguide jumper kit TLM, OMU, ODU, OA, 16λ (1 per line)
main/sub L163	Lightguide jumper kit TLM, OMU, ODU, OA, 16λ (1 per line)
main/sub L164	Lightguide jumper kit TLM, OMU, ODU, OA, 16λ (1 per shelf)
main/sub L165	Lightguide jumper kit TLM, OMU, ODU, OA, 16λ (1 per shelf)
sub L111	LBO kit, ST (OLS R2.0 and earlier, 1 per line)
sub L121	LBO kit, FC (OLS R2.0 and earlier, 1 per line)
sub L131	LBO kit, SC (OLS R2.0 and earlier, 1 per line)
sub L112	LBO kit, ST (OLS R2.1 and later, 1 per line)
sub L114	LBO kit, FC (OLS R2.1 and later, 1 per line)
sub L310	Conversion kit (4 Line End Terminal-to-Dual End Terminal, 4 Line Repeater-to-Dual Repeater)

Table 7-15.   OLS J68982C-1 Equipment — *Continued*

List No.	Description
REF	Lightguide office cable from outside to OA, TLM, ODU, and OMU (MS1EP-EP-?, for 8λ)
REF	Lightguide office cable from outside to OA, TLM, ODU, and OMU (MS1LC-EP-?, for 16λ)
REF	Office alarm cable
REF	X.25 interface cable length is 150 ft. maximum
REF	CIT interface cable length as required, 150 ft. maximum

* These list numbers are factory-installed.

Table 7-16.   OLS J68982D-1 Equipment

List No.	Description
main L1	OLS Integrated Bay with OT System Controller Shelf, OT Complementary Shelf 1, and an OLS System Controller Shelf
sub L501	HARRIS EMDU Kit[*]
	For OLS shelf:
sub L111	LBO kit, ST (OLS R2.0 and earlier, 1 per line)
sub L121	LBO kit, FC (OLS R2.0 and earlier, 1 per line)
sub L131	LBO kit, SC (OLS R2.0 and earlier, 1 per line)
sub L112	LBO kit, ST (OLS R2.1 and later, 1 per line)
sub L114	LBO kit, FC (OLS R2.1 and later, 1 per line)
	For OT shelf:
sub L113	LBO kit, ST (OLS R2.0 and earlier, 1 per line)
sub L123	LBO kit, FC (OLS R2.0 and earlier, 1 per line)
sub L133	LBO kit, SC (OLS R2.0 and earlier, 1 per line)
sub L122	LBO kit, ST (OLS R2.1 and later, 1 per line)
sub L132	LBO kit, FC (OLS R2.1 and later, 1 per line)
sub L161	Lightguide jumper kit, ST-ST (1 line intrashelf interconnections)
sub L162	Lightguide jumper kit, ST-ST and LC-ST (1 line intrashelf interconnections)
sub L163	Lightguide jumper kit, ST-ST and LC-ST (1 line intrashelf interconnections)
sub L164	Lightguide jumper kit, ST-ST and LC-ST (1 shelf intrashelf interconnections)
sub L165	Lightguide jumper kit, ST-ST and LC-ST (1 shelf intrashelf interconnections)
sub L108	SDH Kit for SDH OLS application

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* Required when ordering main L1.

Table 7-17.   OT J69000C-1 Equipment

List/Group No.	Description
main L1	OT Cabinet with three unequipped shelves
main L10	Miscellaneously-mounted OT with three unequipped miscellaneously-mounted shelves
main L14	OT Bay with three unequipped miscellaneously-mounted shelves
sub L21-L96	OTU 41A1 - 41A16 circuit packs[*]
sub L221 - L228	OTU 41A1B - 41A8B circuit packs
sub L289 - L296	OTU 41A9B - 41A16B circuit packs
sub L29	OTU 41B circuit pack*
sub L229	OTU 41BB circuit pack
sub L41 - L106	OTU 41C1 - 41C16 circuit packs*
sub L241 - L249	OTU 41C1B - 41C9B circuit packs
sub L300 - L306	OTU 41C10B -41C16B circuit packs
sub L49	QOTU 41S circuit pack
sub L51 - L66	OTPM 42A1 - 42A16 circuit packs
sub L67	OTPM 42B circuit pack
sub L71 - L86	OTPM 43A1 - 43A16 circuit packs
sub L87	OTPM 43B circuit pack
sub L141 - L156	OTPM 44A1 - 44A16 circuit packs
sub L157	OTPM 44B circuit pack
sub L300 or L301	DANTEL or HARRIS EMDU kit
G1 or G2	Office alarm cable
G6 or G7 or G9 or G10	X.25 interface cable
G14 or G15	CIT (DTE) cable
G201	ED7G028-22 cable

Table 7-17. OT J69000C-1 Equipment

List/Group No.	Description
G3 or G4	Incoming Signal Failure Cable
	OTU Circuit Pack Failure Cable
REF	CLETOP Fiber Cleaning Materials
REF	METRAL Pin/Tool Kit
REF	DANTEL Orderwire Shelf
sub L111	ST LBO kit (OLS R2.0 and earlier)
sub L121	FC LBO kit (OLS R2.0 and earlier)
sub L131	SC LBO kit (OLS R2.0 and earlier)
sub L122	ST LBO kit (OLS R2.1 and later)
sub L132	FC LBO kit (OLS R2.1 and later)

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* 41A, 41B, and 41C circuit packs are used in cabinet applications only.

OLS Package Descriptions

Drawing J68982C-1

4 Bidirectional Line End Terminal/Repeater Application (L1) Package Description: The End Terminal/Repeater package provides a 2 shelf cabinet equipped with a heat baffle, fuse panel, power filters, indicator strip, cables, rear cover, and door.

EMDU (L300 or L301) Package Description: The EMDU package provides one DANTEL or one HARRIS EMDU kit. An EMDU is required for OLS when used with OT.

Dual End Terminal/Repeater Application (L2) Package Description: The Dual End Terminal/Repeater package provides a 2 shelf cabinet equipped with a heat baffle, fuse panel, power filters, indicator strip, cables, rear cover, and door.

Miscellaneously Mounted Shelf Application (L10) Package Description: The Miscellaneously Mounted Shelf package provides a miscellaneous mounted shelf, heat baffle, and Lucent Newlook-2000 covers.

Miscellaneously Mounted Shelf Application (L11) Package Description: The Miscellaneous Mounted Shelf package provides a miscellaneous mounted shelf, heat baffle, and flat covers.

Dual End Terminal/Repeater Application-Bay Mounted (L14) Package Description: The Dual End Terminal/Repeater Bay mounted package provides a 2 shelf bay equipped with heat baffles, fuse panel, power filters, user panels and cables.

4 Line End Terminal (L101) Kit Package Description: The 4 Line End Terminal kit provides the necessary labels for a 4 line End Terminal application.

4 Line Repeater (L102) Kit Package Description: The 4 Line Repeater kit provides the necessary labels for a 4 line Repeater application.

Dual End Terminal (L103) Kit Package Description: The Dual End Terminal kit provides the necessary labels for a dual End Terminal application.

Dual Repeater (L104) Kit Package Description: The Dual Repeater kit provides the necessary labels for a dual Repeater application.

Dual End Terminal/Repeater Combination (L105) Kit Package Description: The Dual End Terminal/Repeater combination kit provides the necessary labels for an End Terminal/Repeater application.

Miscellaneously Mounted Shelf/End Terminal (L106) Kit Package Description: The Miscellaneously Mounted Shelf/End Terminal kit provides the necessary labels for a miscellaneously mounted shelf/End Terminal application.

Miscellaneously Mounted Shelf/Repeater (L107) Kit Package Description: The Miscellaneously Mounted Shelf/Repeater kit provides the necessary labels for a miscellaneously mounted shelf/Repeater application.

SDH Kit for SDH OLS Application (L108) Package Description: This package provides the user panel label for SDH OLS End Terminal and Repeater applications.

Lightguide Jumper (L161) Package Description: This lightguide jumper package provides 50-inch ST-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L162) Package Description: This lightguide jumper package provides 50-inch ST-ST and LC-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L163) Package Description: This lightguide jumper package provides 50-inch ST-ST, LC-ST, and 20-inch LC-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L164) Package Description: This lightguide jumper package provides 50-inch ST-ST and LC-ST lightguide jumpers and associated labels that are required for one shelf intrashelf interconnections.

Lightguide Jumper (L165) Package Description: This lightguide jumper package provides 50-inch ST-ST, LC-ST, and 20-inch LC-ST lightguide jumpers and associated labels that are required for one shelf intrashelf interconnections.

ST LBO (L111) Package Description: The ST lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with ST connectors for one bidirectional OLS line.

FC LBO (L121) Package Description: The FC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with FC connectors for one bidirectional OLS line.

SC LBO (L131) Package Description: The SC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with SC connectors for one bidirectional OLS line.

LBO (L112, L114) Package Description: These lightguide build-out kits (OLS R2.1 and later) each provide a kit of lightguide build-outs with connector to ST and FC connector transitions, respectively, for one bidirectional OLS line.

Drawing J68982D-1

OLS Integrated Bay (L1) Package Description: The OLS Integrated Bay package provides a three shelf bay with one OLS End Terminal shelf, one OT System Controller Shelf, one OT Complementary 1 Shelf, heat baffles, fuse / power indicating panel, power filters, user panels, and cables.

HARRIS EMDU (L501) Package Description: The EMDU package provides one HARRIS EMDU kit. This is required when ordering L1.

SDH kit for SDH OLS Application (L108) Package Description: This package provides the user panel label for SDH OLS End Terminal and Repeater applications. This is used in the OLS shelf.

ST LBO (L111) Package Description: The ST lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with ST connectors for one bidirectional OLS line. This package is used in the OLS shelf.

FC LBO (L121) Package Description: The FC lightguide build-out kit (OLS R2.0 and earlier) provides lightguide build-outs with FC connectors for one bidirectional OLS line. This package is used in the OLS shelf.

SC LBO (L131) Package Description: The SC lightguide build-out kit (OLS R2.0 and earlier) provides lightguide build-outs with SC connectors for one bidirectional OLS line. This package is used in the OLS shelf.

LBO (L112, L114) Package Description: These lightguide build-out kits (OLS R2.1 and later) each provide a kit of lightguide build-outs with connector to ST and FC connector transitions, respectively, for one bidirectional OLS line. These packages are used in the OLS shelf.

LBO (L113) Package Description: This ST lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with ST connectors per OTU and OTPM. This package is used in the OT shelf.

LBO (L123) Package Description: This FC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with FC connectors per OTU and OTPM. This package is used in the OT shelf.

LBO (L133) Package Description: This SC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with SC connectors per OTU and OTPM. This package is used in the OT shelf.

LBO (L122, L132) Package Description: These lightguide build-out kits (OLS R2.1 and later) each provide a kit of lightguide build-outs with connectors to ST and FC connector transitions, respectively, per OTU and OTPM. These packages are used in the OT shelf.

Lightguide Jumper (L161) Package Description: This lightguide jumper package provides 50-inch ST-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L162) Package Description: This lightguide jumper package provides 50-inch ST-ST and LC-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L163) Package Description: This lightguide jumper package provides 50-inch ST-ST, LC-ST, and 20-inch LC-ST lightguide jumpers and associated labels that are required for one line intrashelf interconnections.

Lightguide Jumper (L164) Package Description: This lightguide jumper package provides 50-inch ST-ST and LC-ST lightguide jumpers and associated labels that are required for one shelf intrashelf interconnections.

Lightguide Jumper (L165) Package Description: This lightguide jumper package provides 50-inch ST-ST, LC-ST, and 20-inch LC-ST lightguide jumpers and associated labels that are required for one shelf intrashelf interconnections.

OT Package Descriptions

Drawing J69000C-1

OT Cabinet (L1) Package Description: The OT Cabinet Package provides a cabinet with three unequipped shelves, two heat baffles, fuse panels, power filters, indicator strip, designation label strips, cables, rear cover, and doors.

Miscellaneously Mounted Application (L10) Package Description: The Miscellaneously Mounted Application Package provides three unequipped miscellaneously mounted shelves. Each shelf is equipped with an interconnection panel, a user panel or a fuse/power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover.

Miscellaneously Mounted System Controller Shelf (L11) Package Description: The Miscellaneously Mounted System Controller Shelf Package provides one System Controller Shelf equipped with an interconnection panel, a user panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover.

Miscellaneously Mounted Complementary Shelf 1 (L12) Package Description: The Miscellaneously Mounted Complementary Shelf 1 Package provides one Complementary Shelf 1 equipped with an interconnection panel, a fuse/power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover. This shelf should only be ordered to upgrade a system that contains L11.

Miscellaneously Mounted Complementary Shelf 2 (L13) Package Description: The Miscellaneously Mounted Complementary Shelf 2 Package provides one Complementary Shelf 2 equipped with an interconnection panel, a fuse/power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover. This shelf should only be ordered to upgrade a system that contains L11 and L12.

OT Bay (L14) Package Description: The OT bay-mounted package provides three unequipped miscellaneously mounted shelves. Each shelf is equipped with an interconnection panel, a user panel or a fuse/power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, and a front and rear cover mounted in a ED8C800-50, G1 network bay frame.

EMDU (L300 or L301) Package Description: The EMDU package provides one DANTEL or one HARRIS EMDU kit. An EMDU is required for OLS when used with OT.

LBO (L111) Package Description: This ST lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with ST connectors per OTU and OTPM.

LBO (L121) Package Description: This FC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with FC connectors per OTU and OTPM.

LBO (L131) Package Description: This SC lightguide build-out kit (OLS R2.0 and earlier) provides a kit of lightguide build-outs with SC connectors per OTU and OTPM.

LBO (L122, L132) Package Description: These lightguide build-out kits (OLS R2.1 and later) each provide a kit of lightguide build-outs with connectors to ST and FC connector transitions, respectively, per OTU and OTPM.

See"Ordering Spare Circuit Packs/Units/Port Modules and Fuses" for descriptions of the individual circuit packs and units.

Related Software and Documentation

Table 7-18, Table 7-19, and Table 7-20 provide list numbers for OLS software and documentation.

Table 7-18.   OLS J68982CS-1 Software and Documentation Shipped with or Separately from the Equipment

J68982CS-1 List No.		Description
Main	2	R2.0.0-OLS software
Sub	M2R	Application Software Right-to-Use Fee (new system)
Sub	P2R	Operating System Software Right-to-Use Fee (new system)
Sub	B	User Service Manual
Main	3	– OLS Software R2.1 (3.5" diskettes) – Software Release Description (paper copy)
Sub	C	User Service Manual (North American version, paper copy)
Sub	M3R	Application Software Right-to-Use Fee
Sub	P3R	Operating System Software Right-to-Use Fee
Main	4	– R2.1-OLS software (CD-ROM) – Applications, Planning, and Ordering – Installation Manual – Operations System Engineering Guide – Job Aids – Software Release Description (CD-ROM) – User Service Manual (CD-ROM) – Additional Software Release Description (paper copy)
Sub	M3R	Application Software Right-to-Use Fee (new system)
Sub	P3R	Operating System Software Right-to-Use Fee (new system)

Table 7-19. OLS J68982CS-1 Upgrades

Release	List No. (CD-ROM)	List No. (3.5" Diskette)
1.0 - 2.0.0	N/A	2, B, M2S, P2S
2.0.0 - 2.1.0	4, M4S, P4S	3, C, M4S, P4S

Table 7-20. Ordering Additional Copies of Software and Documentation

OLS Release	J68982CS-1 List	Software Release Description Comcode	User Service Manual Document Order No.*	3.5" Diskette Comcode	CD-ROM Comcode
2.0.0	2	107896607	365-575-301, Issue 2	108128851	N/A
2.1.0	3 or 4	108066382	365-575-331	108066432	108096231

* Additional copies of all documentation (except the *Software Release Description)* must be ordered through the Customer Information Center.

Conversion Kit

Table 7-21 contains information on the conversion kit for the OLS.

Table 7-21.   Conversion Kit (L310)

Description	List	Group	Quantity	Comcode
Bus Termination	ED7G028-20	G-6	2	
User Panel Extension Cable for Upper Shelf (3')	ED7G028-20	G-10A	1	
User Panel Extension Cable for Lower Shelf (7')		G-10B	1	
CIT (DCE) Extension Cable for Upper Shelf (5')		G-27A	1	
OLS Indicator Strip Assembly			1	847419652
481A Circuit Module			1	107678864

Cables

This section contains information on the cables required for OLS.

Table 7-22.   Intraoffice Electrical Non-transmission Cables Associated with OLS

Application	T5G276-33 Figure	ED7G028-22		Remarks
		Group	**Length**	
Line OW, section OW, section user channel	8, 10, 11	401	as required	2850 ft. maximum
		451	150 ft.	
		461	250 ft.	
X.25 cable	13	602	as required	150 ft. maximum
		652	150 ft.	
1st or 2nd serial telemetry cable	14	201[*]	as required	4000 ft. maximum
		251	150 ft.	
		261	250 ft.	
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry	15, 16, 17, 18	301	as required	
		351	150 ft.	
		361	250 ft.	
CIT Interface cable	20	702	as required	150 ft. maximum
	20	752	150 ft.	

* Use group 201 to connect from serial TLM 1 to the Miscellaneous Discrete Unit.

Table 7-23.   Intraoffice Electrical Non-transmission Cables Associated with OT

Application	T6G156-33 Figure	ED7G045-22		Remarks
		Group	Length	
Office Alarm Cable	5	G1	as required	
		G2	150 ft.	
X.25 Interface Cable (plug to connector)	9	G6	as required	300 ft. maximum
		G7	150 ft.	
X.25 Interface Cable (plug to plug)	9	G9	as required	300 ft. maximum
		G10	150 ft.	
CIT (DTE) Cable	8	G14	as required	300 ft. maximum
		G15	150 ft.	
System Controller Shelf Incoming Signal Failure Cable	6	G3	as required	4000 ft. maximum
		G4	150 ft.	
System Controller Shelf OTU Circuit Pack Failure Cable	7	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 1 Incoming Signal Failure Cable	12	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 1 OTU Circuit Pack Failure Cable	13	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 2 Incoming Signal Failure Cable	12	G3	as required	4000 ft. maximum
		G4	150 ft.	

**Table 7-23.   Intraoffice Electrical Non-transmission Cables Associated with
              OT —** *Continued*

Application	T6G156-33 Figure	ED7G045-22		Remarks
		Group	**Length**	
Complementary Shelf 2 OTU Circuit Pack Failure Cable	13	G3	as required	4000 ft. maximum
		G4	150 ft.	

Intraoffice Electrical Nontransmission Cable Descriptions

OLS

Line OW: Line orderwire provides voice communication (E2 byte) between adjacent OLS network elements.

Section OW: Section orderwire provides voice communication (E1 byte) between adjacent OLS network elements.

Section User Channel: Section user cable provides access to overhead section user channel bits.

X.25: X.25 cable provides access to an OS interface.

Serial Telemetry: Serial telemetry cable connects OLS to a serial telemetry interface.

Miscellaneous Discrete: Miscellaneous discrete cable connects OLS to a user definable set of monitor points.

Office Alarm: Office alarm cable connects OLS to the office alarms.

Parallel Telemetry: Parallel telemetry cable connects OLS to a parallel telemetry interface.

CIT Interface: Craft Interface Terminal (CIT) Data Terminating Equipment (DTE) provides a remote interface to OLS that is functionally similar to the CIT Data Communications Equipment(DCE) port. The port may be used to load software and perform system diagnostics.

OT

The X.25, office alarm, and CIT (DTE) cables may be ordered now to pre-provision a system for future upgrades, but they are not required for R1-OT.

X.25 Cable: X.25 cable provides access to an OS interface.

Office Alarm Cable: Office alarm cable connects OT to the office alarms.

CIT (DTE) Cable: Craft Interface Terminal (CIT) Data Terminating Equipment (DTE) cable provides a remote interface to a co-located OLS that is functionally similar to the CIT Data Communications Equipment (DCE) port. The port may be used to perform system diagnostics.

The incoming signal failure and circuit pack failure cables are required for R1-OT.

Incoming Signal Failure Cable: One incoming signal failure cable connects from the interconnection panel on each shelf to the External Miscellaneous Discrete Unit (EMDU). The cable relays any incoming signal LOS/LOF or B_1 parity errors detected by a Miscellaneous Discrete 2 (MD2) on an OTU to the EMDU.

Circuit Pack Failure Cable: One OTU circuit pack failure cable connects from the interconnection panel on each shelf to the External Miscellaneous Discrete Unit (EMDU). The cable relays any circuit pack failure conditions detected by a Miscellaneous Discrete 1 (MD1) on an OTU to the EMDU.

The items in Table 7-24 and Table 7-25 provide the assembly and wiring required for one 8 Ga, -48V power feeder.

Table 7-24.   OLS Power Cables

Description	T5G276-33 Figure	ED9C103-22		Remarks
		Group	Length	
-48V (A) power feeder	1	1	15 feet	Used to power 2 shelves in a bay or cabinet
-48V (B) power feeder	1	2	15 feet	
-48V (A) power feeder	1	3	15 feet	Used to power miscella-neously mounted shelf
-48V (B) power feeder	1	4	15 feet	
-48V (A) power feeder	1	23	15 feet	Used to power OLS Inte-grated Bay
-48V (B) power feeder	1	24	15 feet	
-48V (A) power feeder	1	11	as required	Used to power 2 shelves in a cabinet
-48V (B) power feeder	1	12	as required	
-48V (A) power feeder	1	13	as required	Used to power miscella-neously mounted shelf
-48V (B) power feeder	1	14	as required	
-48V (A) power feeder	1	25	as required	Used to power OLS Inte-grated Bay
-48V (B) power feeder	1	26	as required	

Table 7-25.   OT Power Cables

Description	T5G156-33 Figure	ED9C103-22		Provided with
		Group	Length	
-48 V (A) power feeder	1	5	15 feet	List 1, List 10, and List 14
-48 V (B) power feeder	1	6	15 feet	
-48 V (A) power feeder	1	15	as required	
-48 V (B) power feeder	1	16	as required	
-48 V (A) power feeder	2	7	15 feet	List 11, List 12, and List 13
-48 V (B) power feeder	2	9	15 feet	
-48 V (A) power feeder	2	8	as required	
-48 V (B) power feeder	2	10	as required	

Ordering Spare Circuit Packs/Units/Port Modules and Fuses

Table 7-26 and Table 7-27 provide comcodes for ordering spare circuit packs/units. Guidelines to help you determine the number of spares to keep on hand are provided in the "Circuit Pack/Unit Sparing Guidelines" section later in this chapter.

Table 7-26.   OLS Circuit Pack/Unit Comcodes

Circuit Packs/Units	Code	Comcode	CLEI
SYSCTL	LEA1	107272510	SNC3SH0A
SYSMEM	LEA2	107786586	SNC3TJTA
TOHCTL	LEA5	107273328	SNC2S00B
TLM	LDA1	107272569	SNC2R00B
OMU (8 wavelength)	505A	107292179	SNC2JL0A
ODU (8 wavelength)	605A	107292187	SNC2KL0A
OMU (16 wavelength)	506A	107727828	SNC5ED0D
ODU (16 wavelength)	606A	108032814	FHUM2B0G
ODU (16 wavelength)	606B	108032822	FHUM2BAG
OA (Long Span)	LEA6	107273366	SNC2U00B
OA (Long Haul)	LEA7	107742439	SNC7RROC
OA (Short Haul)	LEA105	108045394	SNPQB2EA

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes

Circuit Pack	Code	Comcode	CLEI Code
OTU	41A1	107848764	SNC6110E
OTU	41A2	107848772	SNC6120E
OTU	41A3	107848780	SNC6130E

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI Code
OTU	41A4	107848806	SNC6140E
OTU	41A5	107848814	SNC6150E
OTU	41A6	107848822	SNC6160E
OTU	41A7	107848830	SNC6170E
OTU	41A8	107848848	SNC6180E
OTU	41A9	108022419	SNC640GE
OTU	41A10	108022427	SNC640HE
OTU	41A11	108022435	SNC640JE
OTU	41A12	108022443	SNC640KE
OTU	41A13	108022450	SNC640LE
OTU	41A14	108022468	SNC640ME
OTU	41A15	108022476	SNC640NE
OTU	41A16	108022484	SNC640PE
OTU	41A1B	108128398	SNP2U0ED
OTU	41A2B	108128406	SNP2U0FD
OTU	41A3B	108128414	SNP2U0GD
OTU	41A4B	108128422	SNP2U0HD
OTU	41A5B	108128430	SNP2U0JD
OTU	41A6B	108128448	SNP2U0KD
OTU	41A7B	108128455	SNP2U0LD
OTU	41A8B	108128463	SNP2U0MD
OTU	41A9B	108128471	SNP2U0ND
OTU	41A10B	108128489	SNP2U0PD
OTU	41A11B	108128497	SNP2U0RD
OTU	41A12B	108128505	SNP2U0SD

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI Code
OTU	41A13B	108128513	SNP2U0TD
OTU	41A14B	108128521	SNP2U0UD
OTU	41A15B	108128539	SNP2U0VD
OTU	41A16B	108128547	SNP2U0WD
OTU	41B	107849663	SNC6100E
OTU	41BB	108128737	SNP2V0XD
OTU	41C1	107884413	SNC611CE
OTU	41C2	107884421	SNC612CE
OTU	41C3	107884439	SNC613CE
OTU	41C4	107884447	SNC614CE
OTU	41C5	107884454	SNC615CE
OTU	41C6	107884462	SNC616CE
OTU	41C7	107884470	SNC617CE
OTU	41C8	107884488	SNC618CE
OTU	41C9	108022492	SNC650GE
OTU	41C10	108022500	SNC650HE
OTU	41C11	108022518	SNC650JE
OTU	41C12	108022526	SNC650KE
OTU	41C13	108022534	SNC650LE
OTU	41C14	108022542	SNC650ME
OTU	41C15	108022559	SNC650NE
OTU	41C16	108022567	SNC650PE
OTU	41C1B	108128562	SNP2W0ED
OTU	41C2B	108128570	SNP2W0FD
OTU	41C3B	108128588	SNP2W0GD

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI Code
OTU	41C4B	108128596	SNP2W0HD
OTU	41C5B	108128604	SNP2W0JD
OTU	41C6B	108128612	SNP2W0KD
OTU	41C7B	108128620	SNP2W0LD
OTU	41C8B	108128646	SNP2W0MD
OTU	41C9B	108128653	SNP2W0ND
OTU	41C10B	108128661	SNP2W0PD
OTU	41C11B	108128679	SNP2W0RD
OTU	41C12B	108128687	SNP2W0SD
OTU	41C13B	108128695	SNP2W0TD
OTU	41C14B	108128703	SNP2W0UD
OTU	41C15B	108128711	SNP2W0VD
OTU	41C16B	108128729	SNP2W0WD
QOTU	41S	108022823	SNC6101E
OTPM	42A1	108022872	SNC670RE
OTPM	42A2	108022898	SNC670SE
OTPM	42A3	108022906	SNC670TE
OTPM	42A4	108022914	SNC670UE
OTPM	42A5	108022922	SNC670VE
OTPM	42A6	108022930	SNC670WE
OTPM	42A7	108022948	SNC670XE
OTPM	42A8	108022955	SNC670YE
OTPM	42A9	108022963	SNC670GE
OTPM	42A10	108022971	SNC670HE
OTPM	42A11	108022989	SNC670JE

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI Code
OTPM	42A12	108022997	SNC670KE
OTPM	42A13	108023003	SNC670LE
OTPM	42A14	108023011	SNC670ME
OTPM	42A15	108023029	SNC670NE
OTPM	42A16	108023037	SNC670PE
OTPM	42B	108023334	SNC670ZE
OTPM	43A1	108023045	SNC660RE
OTPM	43A2	108023052	SNC660SE
OTPM	43A3	108023060	SNC660TE
OTPM	43A4	108023078	SNC660UE
OTPM	43A5	108023086	SNC660VE
OTPM	43A6	108023094	SNC660WE
OTPM	43A7	108023102	SNC660XE
OTPM	43A8	108023110	SNC660YE
OTPM	43A9	108023128	SNC660GE
OTPM	43A10	108023136	SNC660HE
OTPM	43A11	108023144	SNC660JE
OTPM	43A12	108023151	SNC660KE
OTPM	43A13	108023169	SNC660LE
OTPM	43A14	108023177	SNC660ME
OTPM	43A15	108023185	SNC660NE
OTPM	43A16	108023193	SNC660PE
OTPM	43B	108023359	SNC660ZE
OTPM	44A1	108089459	SNP2TYED
OTPM	44A2	108090622	SNP2TYFD

Table 7-27.   OTU/QOTU/OTPM Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI Code
OTPM	44A3	108090630	SNP2TYGD
OTPM	44A4	108090648	SNP2TYHD
OTPM	44A5	108090655	SNP2TYJD
OTPM	44A6	108090663	SNP2TYKD
OTPM	44A7	108090671	SNP2TYLD
OTPM	44A8	108090689	SNP2TYMD
OTPM	44A9	108090697	SNP2TYND
OTPM	44A10	108090705	SNP2TYPD
OTPM	44A11	108090713	SNP2TYRD
OTPM	44A12	108090721	SNP2TYSD
OTPM	44A13	108090739	SNP2TYTD
OTPM	44A14	108090747	SNP2TYUD
OTPM	44A15	108090754	SNP2TYVD
OTPM	44A16	108090762	SNP2TYWD
OTPM	44B	108089467	SNP2TYXD

Power Fuse

The power fuse has a capacity of 10 amperes. When ordering this item, use the following comcode:

Fuse: 405749920

Circuit Pack/Unit Descriptions

For more information on electrical and optical circuit packs and units, refer to Chapter 4, "Product Description."

OLS (J68982C-1)

SYSCTL (L35): The system controller circuit pack provides system level user and operations system interfaces and performs system wide maintenance and performance monitoring operations. SYSCTL supports serial telemetry and X.25 interfaces.

SYSMEM (L40): The system memory circuit pack provides memory support for SYSCTL. User provisioned data and system software are stored in EPROMs on the SYSMEM circuit pack.

TOHCTL (L30): The tributary overhead controller circuit pack processes the SONET section overhead of the supervisory channel. TOHCTL interfaces with the TLM circuit pack to exchange DCC data.

TLM (L25): The telemetry circuit pack provides the supervisory signal that is used for fault location and maintenance functions. This circuit pack also provides the customer maintenance signal and three orderwire channels.

OMU (L60): The Optical Multiplexer Units combine the eight drop side signals into one optical signal called the optical line signal.

ODU (L50): The Optical Demultiplexer Units demultiplex the optical line signal into the eight drop side signals.

OMU (L61): This Optical Multiplexer Unit combines 16 drop side signals into one optical signal called the optical line signal.

ODU (L51): This Optical Demultiplexer Unit demultiplexes the optical line signal into 16 drop side signals (only).

ODU (L52): This Optical Demultiplexer Unit demultiplexes the optical line signal into 16 drop side signals plus a 17th supervisory line signal.

OA LEA6 (L20): Used for Long Span applications, this Optical Amplifier circuit pack amplifies the optical signal and controls the pump lasers.

OA LEA7 (L21): Used for long reach applications, this Optical Amplifier circuit pack amplifies the optical signal and controls the pump lasers.

OA LEA105 (L23): Used for short haul and Metro applications, this Optical Amplifier circuit pack amplifies the optical signal and controls the pump lasers.

OT (J69000C-1)

OTU 41A(1-16) (L21-L28, L89-L96): For cabinet applications only. Each of these Optical Translator Unit (OTU) circuit packs electrically regenerates a single input OC-48 optical signal and inserts the tone required by OLS onto that signal. The sixteen 41A OTU codes support sixteen wavelengths on OLS systems with total dispersion not exceeding 6800 ps/nm.

OTU 41A(1-16)B (L221-L228, L289-L296): Each of these Optical Translator Unit (OTU) circuit packs electrically regenerates a single input OC-48 optical signal and inserts the tone required by OLS onto that signal. These sixteen OTU codes support sixteen wavelengths on OLS systems with total dispersion not exceeding 6800 ps/nm.

OTU 41B (L29): For cabinet applications only. This Optical Translator Unit (OTU) circuit pack electrically regenerates a single input OC-48 optical signal and inserts a clean tone onto the signal. The 41B OTU code regenerates OC-48 signals in the 1.3μm range for other SONET OC-48/SDH STM-16 receivers.

OTU 41BB (L229): This Optical Translator Unit (OTU) circuit pack electrically regenerates a single input OC-48 optical signal and inserts a clean tone onto the signal. The 41BB OTU code regenerates OC-48 signals in the 1.3μm range for other SONET OC-48/SDH STM-16 receivers.

OTU 41C(1-16) (L41-L48, L99-L106): For cabinet applications only. Each of these Optical Translator Unit (OTU) circuit packs electrically regenerates a single input OC-48 optical signal and inserts the tone required by OLS onto that signal. The sixteen 41C OTU codes support sixteen wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTU 41C(1-16)B (L241-L249, L300-L306): Each of these Optical Translator Unit (OTU) circuit packs electrically regenerates a single input OC-48 optical signal and inserts the tone required by OLS onto that signal. These sixteen OTU codes support sixteen wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

QOTU 41S (L49): The Quad Optical Translator Unit (QOTU) mounts up to four Optical Translator Port Modules (OTPM). Each OTPM regenerates the received signal. OTPMs 42A,B and 43A,B also re-time the received signal.

OTPM 42A(1-16) (L51-L66): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input OC-12 optical signal and inserts the tone required by OLS onto that signal. The sixteen 42Ax OTPM codes support the 16 1.5μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTPM 42B (L67): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input OC-12 optical signal and removes the tone required by OLS from that signal. The 42B OTPM code supports 1.3μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTPM 43A(1-16) (L71-L86): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input OC-3 optical signal and inserts the tone required by OLS onto that signal. The sixteen 43Ax OTPM code supports 1.5μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTPM 43B (L87): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input OC-3 optical signal and removes the tone required by OLS from that signal. The 43B OTPM code supports 1.3μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTPM 44A(1-16) (L141-L156): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input 400-700 Mb/s optical signal and inserts the tone required by OLS onto that signal. The sixteen 44Ax OTPM codes supports 1.5μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OTPM 44B (L157): Each of these Optical Translator Port Modules (OTPM) electrically regenerates a single input 400-700 Mb/s optical signal and removes the tone required by OLS from that signal. The 44B OTPM code supports 1.3μm wavelengths on OLS systems with total dispersion not exceeding 10,900 ps/nm.

OLS (J68982D-1)

> For the OLS Integrated Bay (J68982D-1), the same circuit packs in OLS (J68982C-1) and OT (J69000C-1) apply. However, OT circuit pack and port module list numbers are different. Refer to Table 7-10.

Circuit Pack/Unit Sparing Guidelines

This section provides the sparing information for OLS. The information is provided in the form of graphs. An example using the graphs is included.

You can use sparing information for 10-day and 64-day lead times and up to 20000 circuit packs in service. Lead time is the time between placing an order for a circuit pack/unit and receiving it.

Lead Time

Lead time, also known as turnaround time, is defined as the elapsed time from when a circuit pack is known to fail at a given service location to when a repaired (or new) circuit pack arrives at the location where spare circuit packs are stocked (centralized or local) to maintain a circuit spare level consistent with the circuit pack population in service.

Lead time should not be confused with Mean Time to Repair (typically, 2 to 4 hours), which is the time elapsed from when a circuit pack is known to fail in service to when a spare circuit pack is placed in service to replace the failed pack.

Sparing Examples

This section provides guidelines and a procedure to help you determine how many spare circuit packs or units to order for OLS. The steps listed below show how to use Table 7-28, Figure 7-1, and Figure 7-2 to determine how many spare circuit packs to order to maintain 99.9% service continuity, given either a 10-day lead time or a 64-day lead time.

1. Refer to Table 7-28 and determine the circuit pack or unit (circuit pack/unit) FIT rate. For example, the circuit pack FIT rate for SYS-MEM (LEA2) is 1600.

2. Select the chart corresponding to one of the following lead times:

    ■ Figure 7-1 for 10-day lead time

    ■ Figure 7-2 for 64-day lead time

For example, if the lead time is 10 days, use Figure 7-1.

3. Refer to the chart and select the curve that represents the nearest circuit pack FIT rate. For example, the nearest curve for a FIT rate of 1149 (SYSMEM circuit pack) is 1000.

4. Follow the curve to the intersection with the vertical line that represents the number of circuit packs in service at a given location. For example, let us say that there are 100 circuit packs in service.

5. The horizontal line immediately above the intersection represents the minimum number of circuit pack spares recommended for that location. For example, suppose there are 100 circuit packs in service at a location, the FIT rate is 1149, and the lead time is 10 days (see Figure 7-1). In this case, you would need to order and stock 2 spare circuit packs at this location.

Table 7-28. Circuit Pack/Unit/Port Module FIT Rates for OLS

Description	Code	FIT[*]
SYSCTL	LEA1	1374
SYSMEM	LEA2	1149
TOHCTL	LEA5	969
ODU (8λ)	605A	374
OMU (8λ)	505A	354
ODU (16λ)	606A, 606B	600
OMU (16λ)	506A	600
OA	LEA6	4726
OA	LEA7	4726
OA	LEA105	4726
TLM	LDA1	1414
OTU	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	2000
QOTU	41S	300
OTPM (OC-12)	42A(1-16), 42B	1500
OTPM (OC-3)	43A(1-16), 43B	1000
OTPM (PDH)	44A(1-16), 44B	1500

* Based on the Lucent Technologies *Reliability Information Notebook*, 7th Edition, August 1995.
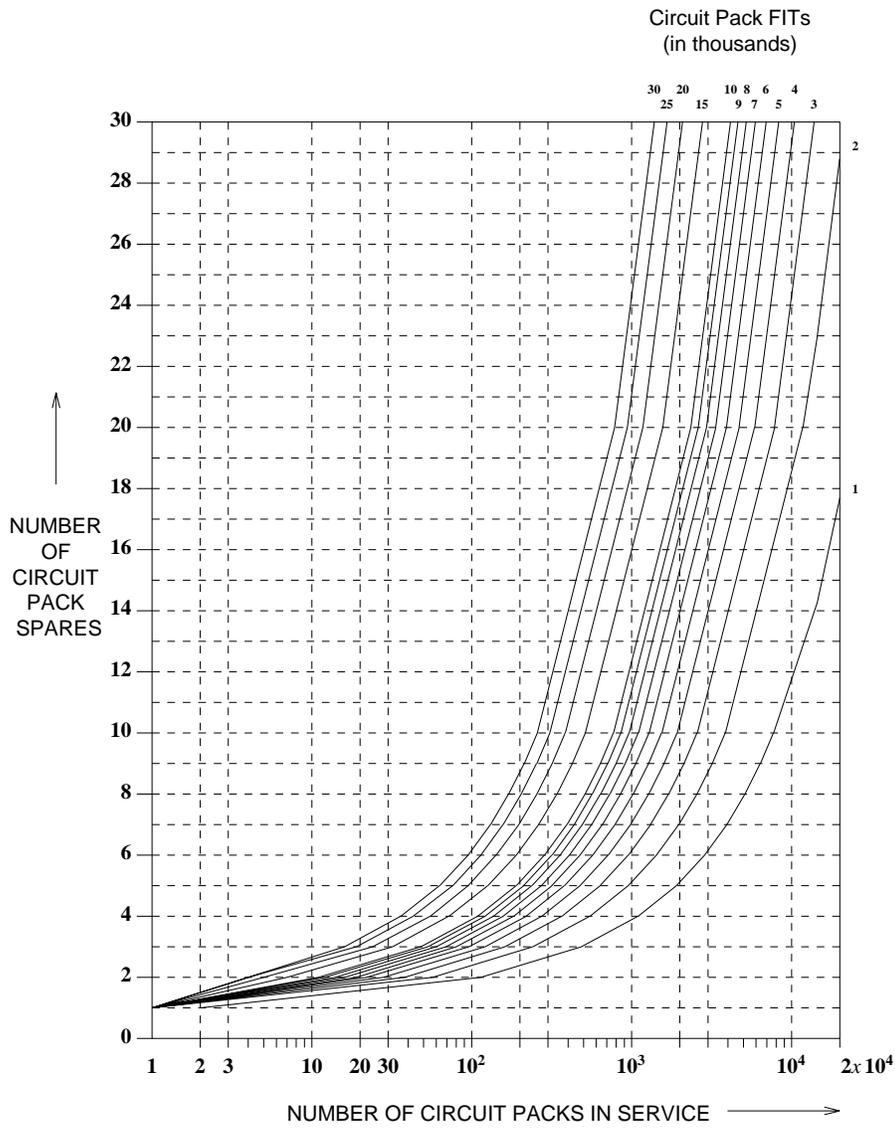
Circuit Pack FITs
(in thousands)

Figure 7-1.   Sparing Chart -- 10-Day Lead Time
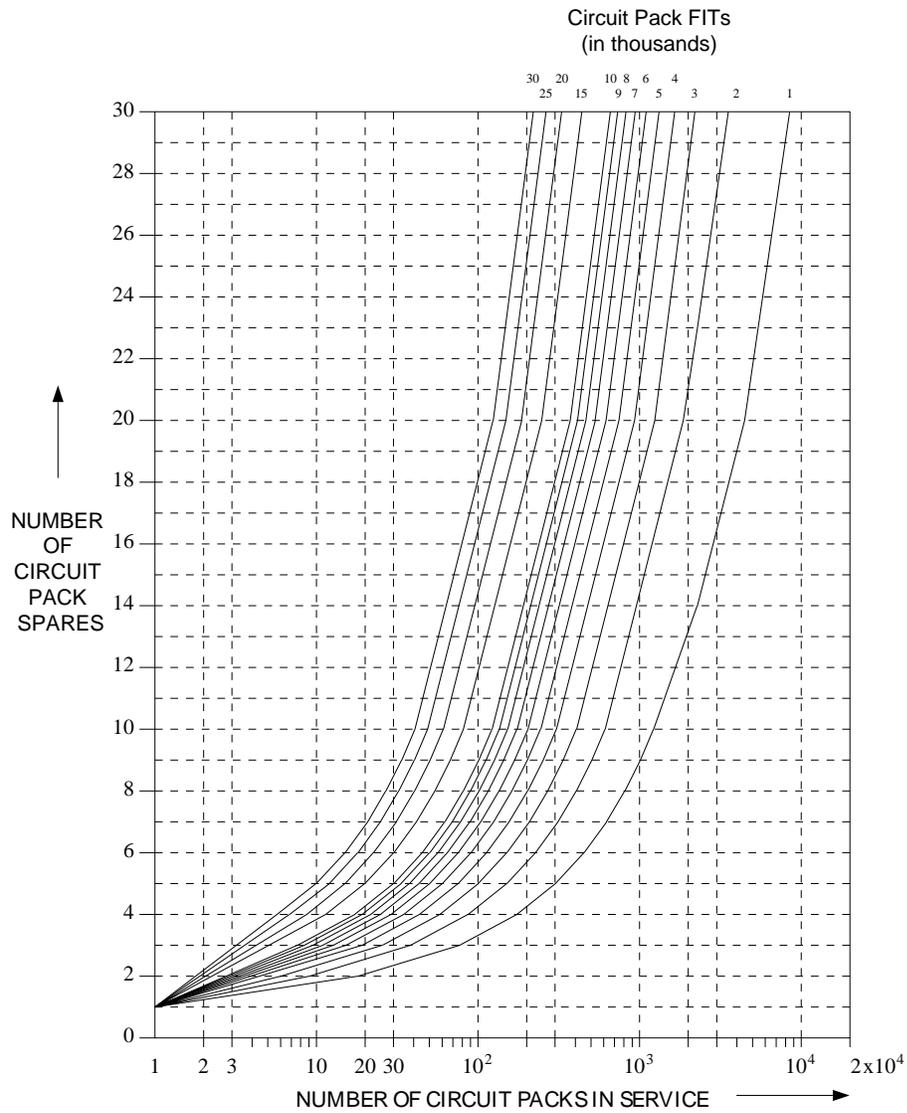
Circuit Pack FITs
(in thousands)

Figure 7-2.   Circuit Pack Sparing Chart -- 64-Day Lead Time

Related Framework

This section is provided for your convenience, as an overview to OLS cabinet hardware and framework. To order framework for the miscellaneously mounted shelf, use the *Seismic Network Bay Frame Application, Planning and Ordering Guide* (065-215-200).

1. OLS provides front access for all office and user interfaces. All interoffice cables and fiber connections are possible from the front of the system.

2. 120V AC power is needed near the cabinet to power a PC or charge a portable PC.

3. The following table provides ordering information for recommended cable racking systems and end guards for OLS.

Table 7-29.   Related Cabinet Hardware

Framework	Number	Group
Cable rack	ED5D779-70	1B 2 required per cabinet
End guard	ED5D786-70	1A 2 required per cabinet

Related Products

This section provides information on related products for use with the OLS.

Ordering Cleaning Materials

All optical fiber connectors (ST, FT, LC, and SC), lightguide buildouts, and buildout blocks or equivalents should be cleaned before making initial connections or re-connections (see the Optical Line System (OLS) User/Service Manual for complete cleaning information). Table 7-30 lists the cleaning materials recommended for use in cleaning the optical fiber connectors (all types). Order these materials directly from the distributor, **Speer Fiber Optics**, at **1-908-359-1173**.

Table 7-30.   Cleaning Materials for Optical Fiber Connectors

Vendor	Product Description	Part #
Speer Fiber Optics	CLETOP Cleaning Cassette	14100500
	CLETOP Replacement Reel	14100700
	CLETOP Sticks (200 sticks/box)	14100400

Ordering METRAL Backplane Replacement Pins

Backplane pins sometimes bend or break from incorrect circuit pack insertion and removal. Table 7-31 and Table 7-32 provide ordering information for replacement pin kits and pin tool kits.

Table 7-31. OLS Equipment Locations and Pin Types

Circuit Pack	Backplane Location	Rows Using Pin Type A	Rows Using Pin Type B	Rows Using Pin Type C	Rows Using Pin Type D
SYSMEM (LEA2)	220-604	1-18, 25-72, 97-156	19-24, 85-96	157-162	
SYSCTL (LEA1)	20-534	1-12, 49-72, 85-114, 127-150	151-156	157-162	
TOHCTL (LEA5)	20-554	19-66, 85-90, 97-102, 115-138	151-156	157-162	
OA (LEA6)	20-534, 20-434, 20-330, 20-230	1-12, 19-114, 121-150	151-156		
TLM (LDA1)	52-1800, 52-230, 52-280, 52-330	19-42, 55-90	91-96		
OMU/ODU (505A/605 A)	52-382, 52-430, 52-478, 52-526	1-224, 73-96			
USER PNL	45-557	1-12			
PWR A	50-597				1-12
PWR B	44-597				1-12

Table 7-32.   Ordering Information for Pin Kit / Pin Tool Kit

Product Name	Supplier's Order Number *
METRAL Backplane Pin Kit	74731-002
METRAL Pin Replacement Tool Kit	MT-330 (rear-side removal)
	MT-340 (front-side removal)

* Order from Berg Electronics, 825 Old Trail Road, Etters, PA. 17319
Tel: 1-717-938-6711

Ordering the External Miscellaneous Discrete Unit (EMDU)

Table 7-33 lists EMDUs available from DANTEL, Inc. and HARRIS, Inc. These units provide user-settable functions, as described in Chapter 5, for the control and monitoring of equipment collocated with OLS.

An EMDU is required for the OLS when used with the OT. You may order the units either directly from the manufacturer using the order numbers listed in the table, or from Lucent Technologies using the Comcode numbers listed.

➡ **NOTE:**
You must use Cable ED7G028-22, G201 to connect an EMDU to the first Serial Telemetry SER TLM1(P19) port
.

Table 7-33.   Ordering Information for External Miscellaneous Discrete Unit (EMDU)

Manufacturer's Name	Manufacturer's Model Name	Manufacturer's Order Number	Lucent Comcode Number
DANTEL*	Alarm Control Block	Model No. 46220-00	407567924

Table 7-33.   Ordering Information for External Miscellaneous Discrete Unit (EMDU) — *Continued*

Manufacturer's Name	Manufacturer's Model Name	Manufacturer's Order Number	Lucent Comcode Number
DANTEL	Mounting Bar	A25-00508-01	406863621
HARRIS[†]	C-1000 Centurion	594-T043	407567932
HARRIS	Strip Terminal	620-T030	407532217

* DANTEL, Inc., 2991 No. Argyle Avenue, Fresno, CA 93727-1321

† HARRIS Corp., Controls Division, Network Support Products,1850 No. Greenview Ave., M/S 184, Richardson TX 75081

DANTEL Orderwire Shelf

The DANTEL orderwire shelf provides a 64 kb/s interface to OLS. It is shipped separately and does not mount in an OLS cabinet.

The orderwire shelf is optional and is available from either Lucent Technologies or DANTEL Inc. Use the following information, when ordering:

Lucent Comcode: 407790286 Kit, DANTEL interface voice-data orderwire

DANTEL Part #: D18-05547-04

DANTEL Inc., 2991 No. Argyle Ave., Fresno, CA 93727-1321
(Tel: 209-292-1111).

OLS Software Compatibility

The following table provides information on the compatibility of OLS software generic releases and equipment configurations. An 'X' indicates that the software release is designed to recognize, maintain, and operate with the specified equipment configuration.

Table 7-34.   OLS Software/Equipment Compatibility

Equipment Code	Equipment Configuration	Software Generic R 2.0.0	Software Generic R2.1
L1	End Terminal or Repeater (4 Bidirectional Lines)	X	X
L2, L14	Dual End Terminal or Dual Repeater	X	X
L10, L11	Miscellaneously Mounted Shelf	X	X

Table 7-35.   OLS Slot/Circuit Pack/ Software Compatibility

Optical Line System Slot/Circuit Pack/Software Compatibility Matrix		
Slot	Supported Pack Codes	Software Generic Release 2.1 Quantity
OA End Terminal (Shelf 1, Miscellaneous, or Dual)		
TLM 1A	LDA1	0 or 1
TLM 2A	LDA1	0 or 1
1A- 2B*	505A	0 or 1
	506A	
	605A	
	606A	
	606B	
OA 1A - 2B	LEA6	0 - 4
	LEA7	
TOHCTL	LEA5	1

Table 7-35.   OLS Slot/Circuit Pack/ Software Compatibility — *Continued*

Optical Line System Slot/Circuit Pack/Software Compatibility Matrix		
Slot	**Supported Pack Codes**	**Software Generic Release 2.1 Quantity**
SYSCTL	LEA1	1
SYSMEM	LEA2	1
OA End Terminal (Shelf 2)		
TLM 3A	LDA1	0 or 1
TLM 4A	LDA1	0 or 1
3A - 3B[*]	505A	0 or 1
	506A	
	605A	
	606A	
	606B	
OA 3A - 4B	LEA6	0 or 1
	LEA7	
OA Repeater Shelf (Shelf 1, Miscellaneous or Dual Shelf)		
TLM 1A - 2B	LDA1	0 - 4
OA 1A - 2B	LEA6	0 - 4
	LEA7	
TOHCTL	LEA5	1
SYSCTL	LEA1	1
SYSMEM	LEA2	1
OA Repeater Shelf (Shelf 2)		
TLM 3A - 4B	LDA1	0 - 4

**Table 7-35.   OLS Slot/Circuit Pack/ Software
Compatibility —** *Continued*

Optical Line System Slot/Circuit Pack/Software Compatibility Matrix		
Slot	**Supported Pack Codes**	**Software Generic Release 2.1 Quantity**
OA 3A - 4B	LEA6	0 - 4
	LEA7	

---

* Equipment units (NOT circuit packs) go into these slots. Specifically, for 1A-TX OLS End Terminals, an OMU is expected in an xA slot and an ODU is expected in an xB slot. At 1A-RCV OLS End Terminals, an OMU is expected in an xB slot and an ODU is expected in an xA slot (the factory ships all OLS equipment in the 1A-TX OLS End Terminal configuration. Reconfiguration for 1A-RCV OLS End Terminal and OLS Repeater applications are made during installation).

OT Circuit Pack Compatibility

The figures in Table 7-36 apply to the specified shelves in all OT applications.

Table 7-36. OT Slot/Circuit Pack Compatibility

Shelf	Slot	Supported Pack Codes	R1-OT Quantity	R2.1-OLS Quantity
System Controller Shelf	OTU (1-8)	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	0 to 8	0 to 8
		41S	- -	0 to 4
Complementary Shelf 1	OTU (9-20)	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	0 to 12	0 to 12
		41S	- -	0 to 6
Complementary Shelf 2	OTU (21-32)	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	0 to 12	0 to 12
		41S	- -	0 to 6

Product Support

8

Product Support

8

This chapter describes how Lucent Technologies supports the Optical Line System (OLS). Support includes engineering and installation services, technical support, documentation support, and training.

Engineering and Installation Services

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

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

tion, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

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

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

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

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

Technical Support

Assistance in maintaining your installed system is available through the Regional Technical Assistance Center (RTAC) and Customer Technical Support (CTS). As shown in Figure 8-1, your single point of contact is the RTAC. RTAC personnel troubleshoot field problems 24 hours a day over the phone and, if necessary, on site. For technical assistance, simply call **1-800-225-RTAC (7822)**. One call guarantees support. You can also call this number to provide comments on OLS or to suggest enhancements.

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

CTS has also established a technical support medium: the COACH customer support tools. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. COACH tools reside on a dedicated time-share computer accessible over toll free lines and are available 24 hours a day, seven days a week. For information about how to access COACH, contact your local Account Executive.

Many transmission products are currently supported by COACH, including OLS.

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

Customer
    Technician
    Customer Escalation Procedures
    COACH Self-Help Tools

Lucent Technologies RTAC
    First Lucent Technologies Contact
    Supports Customer
    Supports Lucent Technologies Installer
    COACH Self-Help Tools

Lucent Technologies Network Systems Transmission CTS
    RTAC Assistance
    Problem Diagnosis/Isolation
    Provide Solutions/Workarounds
    Consultation
    Enhancements

Lucent Technologies Bell Laboratories
    Highest Level of Support
    Product Design Subject Matter Experts

Figure 8-1.   Product Support

These COACH tools are available to the user:

Diagnostic dictionary	The diagnostic dictionary contains histories of previously encountered problems and the descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem. Your support staff is allowed to enter problems and solutions into the customer input area of the diagnostic dictionary. CTS personnel evaluate the data daily and, when appropriate, the data is moved to the general area.
News and bulletins	Immediately after a user log in to the COACH tools, the news and bulletins tool displays bulletins containing urgent information relating to all the user's products. All users are automatically notified about urgent matters such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.
Compatibility data	Occasionally, hardware/software configuration problems arise when new software generics are issued. The compatibility data tools permit users to view the correct hardware configuration associated with a specific software generic. The user simply enters the appropriate software generic number and COACH responds with page-formatted lists of circuit packs compatible with the selected software generic.
Ordering guides	With the COACH ordering guide tool, users can obtain an electronic copy of the latest version of the ordering guide for selected products served by COACH tools. This eliminates the time-consuming delays experienced in distributing printed documentation.
COACH user's guide	COACH supplies an on-line version of its user's guide. The COACH user's guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

CTS strives to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, CTS provides you with the best possible customer support.

Documentation Support

The Lucent Technologies Customer Training and Information Products (CTIP) organization provides a customer comment form in the front of this guide. Please use the form to report errors or make suggestions about the document. If the form is missing, please send or fax your comments to:

Lucent Technologies
Customer Training and Information Products
Building 21, Room 3A-06
1600 Osgood Street
North Andover, MA 01845

Fax Number: (508) 960-6835

Training Support

For course information, refer to "Training" in the "About This Document" chapter.

Warranty Support

Lucent Technologies provides a limited 5-year hardware warranty for this product. For more information, contact your local Lucent Technologies account executive.

Account Executive Support

Your local account executive serves as a single point of contact if you encounter difficulties in any area of product support.

Reliability and Quality

9

Reliability and Quality

9

Overview

Reliability is a key ingredient of a product's life cycle, beginning at the earliest planning stage and continuing into product architecture, design and simulation, documentation, prototyping, testing, design change control, manufacturing and product testing (which includes 100% screening), product quality assurance, product field performance, and product field return management. Each stage of the product's life cycle relies on people and processes that contribute to product reliability growth with customer satisfaction as the primary goal.

Using critical elements to ensure the product's reliability, product development requires strict adherence to

- Design standards

- Design and test practices

- Comprehensive qualification programs

- System-level reliability integration

- Reliability audits and predictions

- Development of assurance standards for the manufactured product.

During manufacturing and field deployment, the reliability of the OLS is further enhanced by the following:

- Pre-manufacturing

- Qualification

- Accelerated product testing

- Production screening

- Product quality tracking

- Failure mode analysis

- Feedback and corrective actions.

Independent Quality Representatives are also present at manufacturing locations to ensure Shipped Product Quality.

Reliability Specifications

The tables in this chapter list OLS and OT reliability specifications.

The numbers in Table 9-1 are based on the *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995. The mean time to repair assumption is less than or equal to two hours (includes dispatch, diagnostic, and repair time).

Table 9-1.   Channel Unavailability (min/year/channel)

Description	Value
2 Line[*] End Terminal	0.003
2 Line[*] Repeater	0.002
4 Line[*] End Terminal	0.006
4 Line[*] Repeater	0.005
640 km 4 Line[*] System (2 x 4 Line[*] End Terminals and 7 x 4 Line[*] Repeaters)	0.05
Optical Translator Unit (OTU)	
OC-48 Channel	0.00027
Optical Translator Port Module (OTPM)	
OC-3 Channel	0.00004
OC-12 Channel	0.00015
400-700 Mb/s Channel	0.00015

* Based on ADM protection.

Telemetry Channel Unavailability

The telemetry channel unavailability rates for the OLS are as follows:

End Terminal: 42 minutes per year per channel

Repeater: 49 minutes per year per channel

Silent Failure Unavailability

For the OLS End Terminal, OLS Repeater, and the OT, there is no silent failure unavailability.

Mean Time Between Maintenance

Table 9-2 shows the mean time between maintenance activity for the OLS. Mean Time Between Maintenance Activities is based on the Lucent Technologies Reliability Information Notebook, 7th edition, August 1995.

Table 9-2. Mean Time Between Maintenance Activity

Equipment	Mean Time (months)
OLS 1 Line End Terminal	84
OLS 1 Line Repeater	80
OLS 2 Line End Terminal	42
OLS 2 Line Repeater	40
OLS 4 Line End Terminal	21
OLS 4 Line Repeater	20
OLS Integrated Bay	19
OT Complementary Shelf (full)	58
OT System Controller Shelf (full, no controller circuit packs)	85
OT Cabinet (fully equipped, 3 shelves)	22

Infant Mortality and Design Life

The OLS equipment has the following infant mortality rate and design life duration:

Infant Mortality: less than or equal to 1.6 x steady state failure rate

Design Life: 25 years

Table 9-3 shows failures in time (FIT) rates for OLS circuit packs and units.

Table 9-3.   OLS Circuit Pack/Unit FIT Rates per Bellcore RPP[*]

Description	Code	FIT
SYSCTL	LEA1	3387
SYSMEM	LEA2	7118
TOHCTL	LEA5	2549
ODU (8λ)	605A	1540
ODU (16λ)	606A/606B	2500
OMU (8λ)	505A	1538
OMU (16λ)	506A	2500
OA	LEA6/LEA7 LEA105	16848
TLM	LDA1	6625

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* Based on Method I of the *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995.

Table 9-4 shows FIT rates for OT circuit packs, units, and port modules.

Table 9-4. OT FIT Rates

Description	Code	FIT[*]
OTU (OC-48)	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	8000
QOTU	41S	1000
OTPM (OC-12)	42A(1-16), 42B	6000
OTPM (OC-3)	43A(1-16), 43B	3000
OTPM (PDH)	44A(1-16), 44B	6000

* Based on Method I of the *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995.

Maintainability Specifications

OLS with OT requires no periodic maintenance. Continuous performance monitoring allow OLS with OT to detect problems before they become service-affecting.

Warranty

The terms and conditions of sale include a five-year warranty on OLS with OT hardware and a one-year warranty on software.

Technical Specifications

10

Technical Specifications

10

This chapter contains the technical specifications for the Optical Line System (OLS), including the Optical Translator (OT). Bellcore Technical Reference 253 (TR 253) is the basis for this information.

Optical Connector Interfaces

The OLS Optical Amplifier, telemetry circuit packs, Optical Multiplexer (OMU) and Optical Demultiplexer Units (ODU), as well as the Optical Translator Units (OTU) and Optical Translator Port Modules (OTPM) use ST®, FC, LC, or SC lightguide connectors.

Transmission Medium

The following types of transmission media can be used with OLS:

- Standard single-mode fiber (SSMF)

- Non-zero dispersion-shifted fiber (for example: TrueWave®).

Lightguide Jumpers

Single-mode lightguide jumpers are used on the Optical Amplifier and telemetry-supervisory circuit packs. Multi-mode lightguide jumpers are used with the telemetry–customer maintenance signal.

Refer to Chapter 7, "Ordering", for information on ordering lightguide jumpers.

Optical Safety (BRH Classification)

OLS meets the Class 1 optical safety standard.

Operating Wavelength

The operating wavelength range for OLS is 1550 nm ± 6 nm.

Optical Dispersion

See "Engineering Rules" later in this chapter.

Optical Return Loss

The optical return loss for OLS is > 40 dB.

Optical Reflections Tolerance

The OA ports within OLS tolerate up to -27 db of reflectance.

Low Voltage Cut-off

The following low-voltage cut-off values apply to OLS:

Cut-off: Power filter input of -38 V DC ±1.5 V

Restart: Power filter input of -42.5 V DC ±1.5 V

Optical Line Rate

OLS supports an optical line rate of up to 40 Gb/s.

Optical Amplifier Output Power

Table 10-1 provides values for the output power of the Optical Amplifier (OA).

Table 10-1.   OA Output Power

No. of Equipped OLS Channels	Output Power (dBm) for 8-Channel Systems	Output Power (dBm) for 16-Channel Systems
0	11.9 ±±± 0.9	8.1 ± 0.9
1	12.4 ± 0.7	8.6 ±± 0.7
2	12.4 ± 0.7	9.1± 0.7
3	13.7 ± 0.7	10.8 ± 0.7
4	14.5 ± 0.7	11.8 ± 0.7
5	15.2 ±± 0.7	12.7 ± 0.7
6	15.7 ± 0.7	13.3 ± 0.7
7	16.0 ± 0.7	13.9 ± 0.7
8	16.0 ± 0.7	14.1 ± 0.7
9		14.5 ± 0.7
10		14.9 ± 0.7
11		15.2 ± 0.7
12		15.5 ± 0.7
13		15.8 ± 0.7
14		16.0 ± 0.7
15		16.3 ± 0.7
16		16.5 ± 0.7

The OA output power depends only on the number of equipped input channels. It is adjusted automatically by software whenever the number of channels changes. The table above lists the OA output power as a function of the number of equipped OLS channels. The output power ranges of the table assume a 0 dB output LBO.

Outside Plant Loss

Table 10-2 shows minimum and maximum plant loss values for OA.

Table 10-2.   Plant Loss Between OA Sites

Optical Amplifier Standard Performance	Loss Between OA Sites	
	Min (dB)	Max (dB)
Long Span Systems (5-span)	26	30
Long-Reach Systems (8-Span)	17	22
Short Reach Systems	14	18

Capacity

768 DS3 equivalents (516,096 two-way voice circuits per fiber pair). Up to 4 fiber pairs per cabinet.

Transmission Standards Compliance

OLS meets single-mode interoffice digital fiber optic systems requirements and objectives as specified in TR 253 and TR 499. Table 10-3 shows OA spacing for the OLS.

Table 10-3.   Minimum and Maximum OA Spacing for OLS

OA Spacing Parameter		$<10^{-9}$ accumulated error rate for systems up to 400 kilometers (250 miles)
Long-Span systems	Max	35 dB
	Min	22 dB
Long-Reach systems	Max	22 dB
	Min	17 dB

Cable Access

- Front for all customer access
- Connectorized cabling with commercially available connectors.

Power Specifications

This section provides power specifications on the OLS. Table 10-4 shows power planning information for the OLS and OT.

Table 10-4. OLS/OT Power Planning

	Maximum Power Dissipation		Current Drains per Feeder[*]	
	Watts	Watts per Square Foot	Nominal at -48V (List 1[†])	Maximum (List 2[‡])
J68982C-1 Equipment Package				
OLS End Terminal 4 Bidirectional Optical Lines	252	20.2	2.6	5.9
OLS Repeater 4 Bidirectional Optical Lines	320	25.6	3.3	7.5
OLS Dual End Terminal	276	22.1	2.9	6.5
OLS Dual Repeater	344	27.6	3.6	8.0
OLS End Terminal & Repeater	310	24.8	3.2	7.3

OLS Miscellaneously-mounted Shelf:
    Dual End Terminal Shelf
    Dual Repeater Shelf
    Dual Facing Shelf
	
	138
	172
	138
		
		NA
		NA
		NA
			
			1.4
			1.8
			1.4
				
				3.2
				4.0
				3.2

J69000C-1 Equipment Package				
OT System Controller Shelf	182	14.6	1.7	3.7
OT Complementary Shelf	232	18.6	2.1	4.7
Fully-equipped OT Cabinet (3 Shelves)	646	51.7	5.9	13.2
J68982D-1 Equipment Package				
OLS Integrated Bay	552	78.4	5.8	12.9
OLS End Terminal	138	11.1	1.5	3.3
OT System Controller Shelf	182	14.6	1.7	3.7
OT Complementary Shelf	232	18.6	2.1	4.7

* Nominally both feeders share the current equally for the cabinet or shelf. If one feeder fails, the remaining feeder carries the total load for the cabinet (feeder A + feeder B current).

† In power engineering, List 1 refers to the current drains used to size batteries and rectifiers. To size batteries and rectifiers, use twice the Nominal (List 1) current drain per feeder. These current drains represent the average busy-hour current at normal operating voltages.

‡ In power engineering, List 2 refers to the current drains used to size feeder cables and fuses. To size feeder cables and fuses, use the Maximum (List 2) current drain per feeder. These current drains represent the peak current under worst case operating conditions.

Table 10-5 shows OLS and OT power specifications.

Table 10-5.   OLS and OT Power Specifications

Description	Specification
Voltage Range, all components	-42.75 to -60 V DC
Power Feeders	Two -48 V power feeders ("A" and "B") required
Fuse Size (per shelf)	10 amperes

Dimensions

Table 10-6 shows the dimensions of physical OLS components.

Table 10-6.   OLS Physical Dimensions

Equipment	Height	Width	Depth
OLS Cabinet[*]	72.0 inches (183 cm)	34.0 inches (86 cm)	24.0 inches (61 cm)
OLS Shelf (Cabinet)	28.5 inches (72.4 cm)	19.6 inches (50 cm)	11.0 inches (28.0 cm)
OLS Heat Baffle (Cabinet)	3.0 inches (7.5 cm)	19.6 inches (50 cm)	11.0 inches (28.0 cm)
OLS Shelf (Miscellaneous)	31 inches (80 cm)	19.6inches (50 cm)	11.0 inches (28.0 cm)

* OLS cabinets and miscellaneously mounted shelves are central
   office white. The cabinet end guards, cable racks, and lower
   door frame are office soft blue.

Table 10-7 shows the dimensions of physical OT components.

Table 10-7.   OT Physical Dimensions

Equipment	Height	Width	Depth
OT Cabinet	72.0 inches (183.0 cm)	34.0 inches (86.0 cm)	24.0 inches (61.0 cm)
OT Shelf (Cabinet)	17.7 inches (45.0 cm)	19.6 inches (50.0 cm)	11.0 inches (28.0 cm)
OT Heat Baffle (Cabinet)	3.0 inches (7.5 cm)	19.6 inches (50.0 cm)	11.0 inches (28.0 cm)
OT Shelf (Miscellaneous)	20.7 inches (52.5 cm)	19.6 inches (50.0 cm)	11.0 inches (28.0 cm)

Circuit Pack/Unit Dimensions

Table 10-8 shows OLS circuit pack and unit dimensions.

Table 10-8.   OLS Circuit Pack/Unit Dimensions

Equipment	Height	Width	Depth
OLS SYSCTL	14 inches (35.6 cm)	1.2 inches (3.0 cm)	8 inches (20.0 cm)
OLS SYSMEM	14 inches (35.6 cm)	0.8 inches (2.0 cm)	8 inches (20.0 cm)
OLS OA	14 inches (35.6 cm)	4 inches (10.0 cm)	8 inches (20.0 cm)
OLS TOHCTL	14 inches (35.6 cm)	0.8 inches (2.0 cm)	8 inches (20.0 cm)
OLS OMU	9 inches (22.8 cm)	2 inches (5.0 cm)	6 inches (15.0 cm)
OLS ODU	9 inches (22.8 cm)	2 inches (5.0 cm)	6 inches (15.0 cm)
OLS TLM	9 inches (22.8 cm)	2 inches (5.0 cm)	8 inches (20.0 cm)
OT OTUs 41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	13.2 inches (33.6 cm)	1.6 inches (4.0 cm)	9.3 inches (23.6 cm)
QOTU 41S	13.2 inches (33.6 cm)	3.2 inches (8.0 cm)	9.3 inches (23.6 cm)
OTPMs 42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), 44B	15.3 inches (13.5 cm)	1.2 inches (3.0 cm)	8.1 inches (20.6 cm)

Floor Loading Specifications

Table 10-9 shows floor loads for OLS.

Table 10-9.   OLS Floor Loads

Configuration	End Terminal		Repeater	
	Weight (lbs)	Weight per Square Foot (lbs/sq. ft.)	Weight (lbs)	Weight per Square Foot (lbs/sq. ft.)
Miscellaneous Shelf	95	N/A	90	N/A
1-Shelf equipped Cabinet	568	45.4	564	45.1
2-Shelf Cabinet	615	49.2	608	48.6
2-Shelf Bay	330	43.5	322	42.5
3-Shelf Integrated Bay	373	49.1	N/A	N/A

Table 10-10 shows floor loads for OT.

Table 10-10.   OT Floor Loads

Configuration	Weight (lbs)	Weight per Square Foot (lbs/sq. ft.)
Fully-equipped OT Cabinet	700	56.0
Fully-equipped Miscellaneously Mounted System Controller Shelf	64	N/A
Fully-equipped Miscellaneously Mounted Complementary Shelf	74	N/A
3-Shelf OT Bay	342	45.0

Environmental Specifications

Table 10-11 shows the various temperatures and humidity levels at which the OLS can operate.

Table 10-11. Operating Temperature/Humidity Values

Operating Condition	Temperature/Humidity
Normal Operating Temperature	5°C to 40°C (41°to 104°F)
Short-Term* Operating Temperature	-5°C to 50°C (23° to 122°F)
Normal Operating Humidity†	5% to 85%
Short-Term* Operating Humidity†	5% to 90%
Max. Operating Temperature Change Rate	1°C/min.(1.8° F/min.)

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 * Short-term refers to a period of up to 96 consecutive hours and a
    total of 15 days in one year.
 † Non-condensing.

Earthquake and vibration, fire resistance, and airborne contaminant requirements meet the standards of GR-63-CORE Issue 1, October 1995.

Electrostatic, electromagnetic, electrical grounding, and safety requirements meet standards of GR-1089-CORE Issue 1, November 1994.

OLS and OT meet the electromagnetic compatibility requirements (EMC) of GR-1089-CORE.

OLS and OT are UL® listed and CSA® certified.

Handling and Transportation Constraints

Table 10-12 shows the tolerance ranges for various handling and transportation conditions.

Table 10-12.   Handling and Transportation Tolerance Ranges

Condition	Tolerance Range
Vibration & Shock	Complies with GR-63-CORE, Issue 1, Oct 1995
Temperature (Transport/Storage)	- 40 °C to 70°C (40°F to 158°F)
Relative Humidity (Transport/Storage)	5% to 95%
Storage/Shipment (Altitude)	-200 ft to 40,000 ft (-61m to 12,133m)

Reliability Specifications

Table 10-13 shows the Failures in Time (FIT) rates for OLS circuit packs and units.

Table 10-13.   OLS Circuit Pack/Unit FIT Rates per Bellcore RPP[*]

Description	Code	FIT
SYSCTL	LEA1	3387
SYSMEM	LEA2	7118
TOHCTL	LEA5	2549
ODU (8 λ)	605A	1540
ODU (16 λ)	606A/606B	2500
OMU (8 λ)	505A	1538
OMU (16 λ)	506A	2500
OA	LEA6/LEA7 LEA105	16,848
TLM	LDA1	6625

_____

* Based on Method I of the *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995.

Table 10-14 shows the FIT rates for OT circuit packs, units, and port modules.

Table 10-14.   OT FIT Rates per Bellcore RPP[*]

Description	Code	FIT
OTU (OC-48)	41A(1-16), 41A (1-16)B, 41B, 41BB, 41C(1-16), and 41C(1-16)B	8000
QOTU	41S	1000
OTPM (OC-12)	42A(1-16), 42B	6000
OTPM (OC-3)	43A(1-16), 43B	3000
OTPM (PDH)	44A(1-16), 44B	6000

[*] Based on Method I of the *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995.

Hardware Unavailability

Hardware unavailability is based on *Reliability Prediction Procedure for Electronic Equipment*, Issue 5, December 1995 and a mean-time-to-repair (MTTR) of less than or equal to two hours. Table 10-15 shows OLS channel unavailability.

Table 10-15. Channel Unavailability (min/year/channel)

Description	Value
OLS 2 Line[*] End Terminal	0.003
OLS 2 Line[*] Repeater	0.002
OLS 4 Line[*] End Terminal	0.006
OLS 4 Line[*] Repeater	0.005
OLS 1 Line (Dual Facing) End Terminal	0.003
640 km 4 Line[*] System (2 x 4 Line[*] End Terminals and 7 x 4 Line[*] Repeaters)	0.02
Optical Translator Unit (OTU)	
OC-48 Channel	0.00027
Optical Translator Port Module (OTPM)	
OC-3 Channel	0.00004
OC-12 Channel	0.00015
400-700 Mb/s Channel	0.00015

* Based on ADM protection.

Table 10-16 shows telemetry channel unavailability (min/year/channel) for the OLS.

Table 10-16.   Telemetry Channel Unavailability

Protection	End Terminal	Repeater
Independent	42	49
1 + 1	0.0017	0.0023

Table 10-17 shows silent failure unavailability for OLS.

Table 10-17.   Silent Failure Unavailability

Silent Failure Unavailability	
End Terminal or Repeater	0
Optical Translator	0
OTPM	0

Mean Time Between Maintenance Activities

Mean Time Between Maintenance Activities is based on the Lucent Technologies Reliability Information Notebook, 7th edition. Table 10-18 shows the mean time between maintenance periods.

Table 10-18.   Mean Time Between Maintenance Activity

Equipment	Mean Time (months)
OLS 1 Line End Terminal	84
OLS 1 Line Repeater	80
OLS 2 Line End Terminal	42
OLS 2 Line Repeater	40
OLS 4 Line End Terminal	21
OLS 4 Line Repeater	20
OLS Integrated Bay	19
OT Complementary Shelf (full)	58
OT System Controller Shelf (full, no controller circuit packs)	85
OT Cabinet (fully equipped, 3 shelves)	22

OC-3, OC-12/400-700 Mb/s, OC-48 Input Power

The input power for each optical signal wavelength must meet the ranges given in the tables below, which are verified to 0.7dB accuracy. The input power of the customer maintenance signal (part of the supervisory channel) is covered in "Customer Maintenance Signal" later in this chapter.

For installation and acceptance purposes, use a calibrated power meter. Adjust your calculations to take into account any power meter inaccuracy. Table 10-19 provides input power specifications for OC-48, OC-12, and OC-3 signal wavelengths.

Table 10-19.   OC-48, OC-12, OC-3 Input Power Specifications

Drop Side Signal	Wavelength (nm)	Power (dBm) (± 0.7 dB)		
		OC-48	OC-12	OC-3
1	1549.32	-4.0	-7.0	-10.0
2	1550.92	-5.3	-8.3	-11.3
3	1552.52	-6.5	-9.5	-12.5
4	1554.13	-7.2	-10.2	-13.2
5	1555.75	-7.7	-10.7	-13.7
6	1557.37	-8.2	-11.2	-14.2
7	1558.98	-8.0	-11.0	-14.0
8	1560.61	-6.5	-9.5	-12.5
9	1548.52	-2.0	-5.0	-8.0
10	1550.12	-4.6	-7.6	-10.6
11	1551.72	-5.8	-8.8	-11.8
12	1553.33	-6.8	-9.8	-12.8
13	1554.94	-7.4	-10.4	-13.4
14	1556.56	-7.9	-10.9	-13.9
15	1558.17	-8.1	-11.1	-14.1
16	1559.79	-7.2	-10.2	-13.2
Supervisory Channel	1532.0			
OTPM	All			

Tone Frequencies

Table 10-20 shows the approximate tone frequencies used for each wavelength.

Table 10-20.   Tone Frequencies

Optical Channel	Wavelength (nm)	Approximate Tone Frequency (KHz)
1	1549.32	5
2	1550.92	7
3	1552.52	9
4	1554.13	11
5	1555.75	15
6	1557.37	17
7	1558.98	19
8	1560.61	21
9	1548.52	23
10	1550.12	24
11	1551.72	25
12	1553.33	26
13	1554.94	27
14	1556.56	28
15	1558.17	29
16	1559.79	30
Supervisory Channel	1532.0	13

Optical Signal-to-Noise Ratio (SNR)

Table 10-21 shows the optical SNR for the OLS.

Table 10-21.   OLS Optical SNR

Condition	System Output SNR
Worst Case Minimum SNR (No pump failure)	20.0 dB
Worst Case Minimum SNR (1 pump failure)	16.5 dB

Customer Maintenance Signal

The customer maintenance signal has a standard IS-3 Intermediate Reach (IR) and Short Reach (SR) interface. This is an STS-3 rate and format signal with a growth increment of one IS-3 per telemetry circuit pack, a scrambled NRZ format line code, and a protection ratio of 0 x 1 (circuit pack plus line). Table 10-22 shows the optical interface specifications for this signal.

Table 10-22. Optical Interface Specifications

Parameter	IS-3
Minimum Wavelength	1270 nm
Maximum Wavelength	1380 nm
Spectral Width	170 nm
Maximum Transmitter Power	- 14.0 dBm
Minimum Transmitter Power	- 20.8 dBm
Maximum Received Power	- 14.0 dBm
Receiver Sensitivity	- 30.8 dBm
Minimum System Gain[*]	10dB
Optical Path Penalty[†]	1.0dB
Connector Loss[‡]	1.5dB
Un-allocated Margin	2.0dB
Minimum Loss Budget	0.0dB
Maximum Loss Budget	5.5dB
Maximum Span Length	Refer to next table

[*] The minimum system gain takes into account aging, temperature, and manufacturing tolerances.

[†] Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path.

[‡] One connector (0.75dB) on each end is assumed.

The IS-3 interface can interwork with an OC-3 interface or an IS-3 interface over multi-mode fiber, subject to the distance limitations in Table 10-23.

Table 10-23.   IS-3 Interface Distance Limitations

Fiber Bandwidth	Distance
1000 MHz-km	3.4 km
800 MHz-km	3.3 km
500 MHz-km	2.7 km
300 MHz-km	1.9 km

The IS-3 interface is dispersion-limited.

Engineering Rules

This section describes the engineering rules for OLS Release 2.1.

Use of LBOs

If outside plant loss is within the nominal range, no LBOs are required. If any span loss is below the specified minimum limit, an LBO is required. Detailed LBO selection guidelines are provided in the LCT Integration Manual.

To adjust signal power distribution among the channels, LBOs should be used at End Terminals.

OLS Network Topologies

Table 10-24 shows the three types of optical amplifiers (OA) used in OLS R2.1. OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates. OLS supports two-OA and single-OA operations.

Table 10-24.   Optical Amplifiers used in OLS

OA Code	Application	Two-OA	Single-OA
LEA6	Long Span	✔	
LEA7	Long Reach	✔	
LEA105	Short Reach	✔	✔

Engineering Rules for Two-OA Applications

Figure 10-1 shows the configuration of a two-OA OLS system where each span is supported by two OAs. The OLS systems carry up to 16 signals on an optical line of up to eight spans. The engineering rules for two-OA systems are shown in Table 10-25.
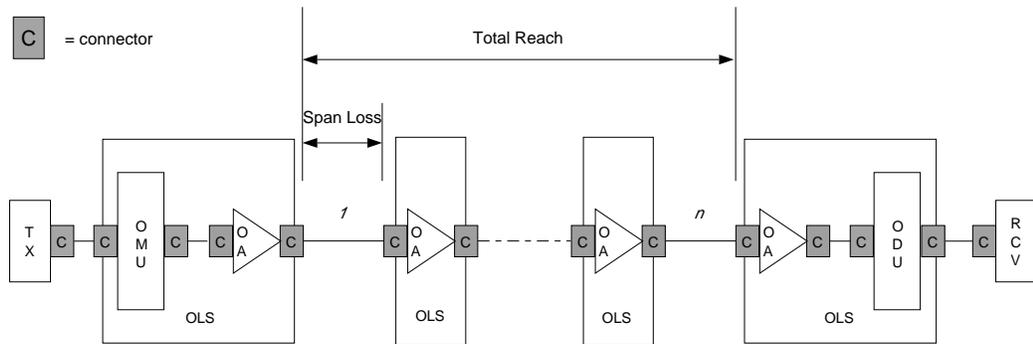
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Figure 10-1.   OLS Two-OA System

Table 10-25.   Engineering rules for Two-OA OLS Systems *

Application	OA Code	Max No. Channels	No. Spans	Span Loss dB		Total Reach (dB) Max	Max Span Distance (km)†	Max Total Reach (km)†
				Min	Max		Fiber Loss= 0.25dB/km	
Long Span	LEA6	8	1	22	35	35	140	140
			2	22	34	68	136	272
			3	22	33	99	132	396
			4	26	31	124	1224	496
			5	26	30	150	120	600
		16	1	22	33	33	132	132
Long Reach	LEA7	16	1	22	33	33	132	132
			2	22	30	60	120	240
			3	22	28	84	112	336
			4	22	27	108	108	432
			5	21	26	130	104	520
			6	21	26	156	104	624
			7	17	22	154	88	616
			8	17	22	176	88	640‡
Short Reach	LEA105	16	1	14	18	18	72	72

---

* OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates.

† Some spans with distances greater than the maximum value can be accommodated by using fiber with lower loss values. Lucent Technologies provides network engineering support to optimize OLS systems for actual networks. Please contact your Lucent Technologies sales representative for more information.

‡ This distance is limited by the dispersion characteristics of standard single-mode fiber (640 km x 17 ps/nm-km=10,900 ps/nm). Longer distances are available with non-zero dispersion-shifted fiber (for example: TrueWave®).

Engineering Rules for Single-OA Applications

For metropolitan, short span applications, Release 2.1 introduces Single Optical Amplifier Operation as a new feature. The receive end of a span may operate without an input OA, providing additional economy.

Figure 10-2 shows the single-OA operation with only one span between End Terminals. Single OA systems use the LEA105 OA, and carry up to 16 channels.
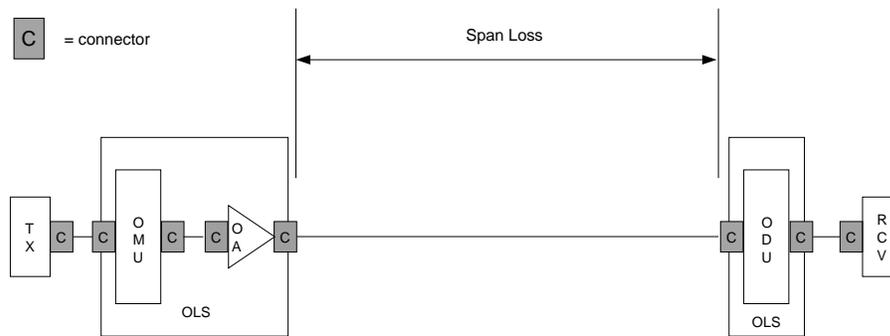
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Figure 10-2.   OLS Single OA System

Table 10-26 displays engineering rules for Single-OA OLS systems.

Table 10-26.   Engineering Rules for Single-OA OLS Systems using LEA105[*][†]

OA Code	Max No. Channels	No. Spans	Span Loss dB		Total Reach (km)	Bit Rates
			min	max	Fiber Loss= 0.25dB/km	
LEA105	16	1	0	12	48	OC-48/12/3, STM-16/4/1, or 400-700 Mb/s
		1	0	12	48	OC-48/12, STM-16/4, or 400-700 Mb/s
		1	0	13	52	OC-48/3 or STM-16/1
		1	0	16	64	0C-12/3, STM-4/1, or 400-700 Mb/s
		1	0	13	52	OC-48 alone
		1	0	16	64	OC-12 alone or 400-700 Mb/s
		1	0	20	80	OC-3 alone

* For standard single-mode fiber (SSMF)
† OLS supports any mix of OC-3/12/48, STM-1/4/16, or 400-700 Mb/s signal rates.

Dispersion

Guidelines for dealing with dispersion are as follows:

With OLS systems having dispersion less than 6800 ps/nm, use of 41AX OTU or Lucent ADMs with an equivalent OLS-compatible transmitter is recommended.

With OLS systems having dispersion between 6800 ps/nm and 10,900 ps/nm, use of 41CX OTUs or Lucent ADMs with an equivalent OLS-compatible transmitter is required for OC-48/STM-16 signals. The 42Ax and 43Ax OTPMs, associated with the QOTUs introduced in Release 2.1, can accommodate dispersions of up to 10,900 ps/nm.

OLS With OT

An Optical Translator Function (OTF) can be used to concatenate OLS systems to increase the distance between SONET/SDH line terminals. An OTF is provided by an OTU (OC-48) or an OTPM that is installed in a QOTU (OC-3, OC-12, or broadband 400-700Mb/s). An OTF can also be used for adding and dropping wavelengths.

NOTE:
All OTFs can be used to concatenate OLS systems except broadband 400-700Mb/s OTPM.

A maximum of twelve OTFs can be used between SONET/SDH line terminals. Figure 10-3 shows OLS systems using OTF for adding or dropping wavelengths (may or may not be needed). The OTF can also be used to concatenate multiple point-to-point OLS systems. Each OLS system can have a different number of spans.

For terminal equipment that does not require OTFs for adding or dropping wavelengths, OTFs can be used to concatenate up to thirteen OLS systems and support up to twelve WAD sites.

For terminal equipment that requires OTFs for adding and dropping wavelengths, OTFs can be used to concatenate up to eleven OLS systems and support up to ten WAD sites.

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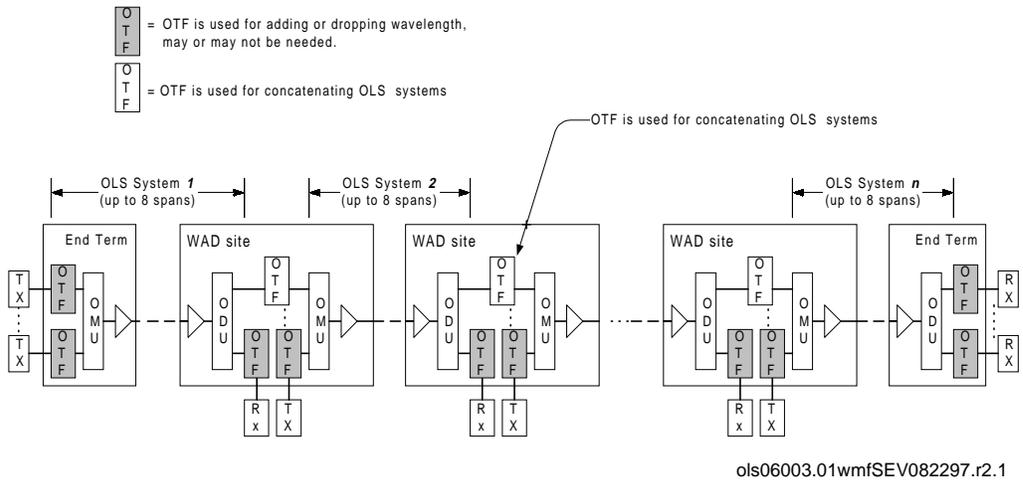
Figure 10-3. OLS with OT

Table 10-27 and Table 10-28 show examples of maximum overall distance in cases where twelve OTFs are used to concatenate thirteen point-to-point OLS systems and each system has the maximum number of spans. For example, when twelve OTFs are used to concatenate thirteen OLS systems with LEA7 OAs (each OLS system has 8 spans with 22 dB loss each), the maximum overall distance is 8320km. These tables also show examples of maximum distance for OLS systems using LEA6 and LEA105 OAs.

Table 10-27. Examples of OTs Used to Concatenate 8-Channel OLS Systems

Description	Example 1	Example 2
	LEA6 OA	LEA6 OA
Per OLS System[*]		
Max. No. Spans	3	5
Max. Span Loss (dB)	33	30
Total Reach (km)[†]	396	600
Per Wavelength		
Max. No. OTFs	12	12
Max. No. Spans	39	65
Max. Overall Distance (km)	5148	7800

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* Data is based on use of standard single-mode fiber (SSMF) and assumes a dispersion rate of 17ps/nm-km.

† Assumes a fiber loss rate of 0.25dB/km.

Table 10-28.   Examples of OTs Used to Concatenate 16-Channel OLS Systems

Description	LEA6 OA Two-OA System	LEA7 OA Two-OA System	LEA105 OA Two-OA System	LEA105 OA Single-OA System
Per OLS System*				
Max. No. Spans	1	8	1	1
Max. Span Loss (dB)	33	22	18	12
Total Reach (km)[†]	132	640	72	48
Per Wavelength				
Max. No. OTFs	12	12	12	12
Max. No. Spans	13	104	13	13
Max Overall Distance (km)	1716	8320	936	624

---

* Data is based on use of either standard single-mode fiber (SSMF) or non-zero dispersion-shifted fiber (for example: TrueWave®). Data assumes a dispersion rate of 17ps/nm-km for SSMF and 4ps/nm-km for non-zero dispersion-shifted fiber.

† Assumes a fiber loss rate of 0.25 dB/km.

Glossary

Numerics

1A-TX

1A-Transmit. A dual or 4-line end terminal whose optical amplifier "A" lines are used in the transmit direction.

1A-RCV

1A-Receive. A dual or 4-line end terminal whose optical amplifier "A" lines are used in the receive direction.

0x1 Line Operation

A 0x1 protection system having one bidirectional service line and no protection line.

1+1 Line Protection

A protection system having two bidirectional lines. The transmitting terminal transmits the same payload on two lines. The receiving terminal monitors two lines and chooses one as the working line, the other as the standby line. When a protection switch occurs, the receiving terminal selects the signal from the standby line causing the standby line to become the working line, and the original working line to become the standby line. The status of the lines remains the same (nonrevertive) after the fault clears.

1x1 Line Protection

A protection system having two bidirectional lines, one of which is designated the service line, while the other is designated the protection line. The service line normally carries traffic. When a protection switch occurs, the protection line is selected to carry traffic. When the fault clears, the original service line reverts to its original status as the working line. Also see *Revertive Switching*.

A

ABN

Abnormal (condition)

ACO

Alarm Cutoff — A push-button switch on the indicator strip that can be used to retire an audible office alarm.

AGNE

Alarm Gateway Network Element

AID

Access Identifier — A unique identifier used to address equipment slots and ports, as well as facility tributaries, that are defined for the OLS architecture.

AIS

Alarm Indication Signal — A code transmitted downstream in a digital network indicating that an upstream failure has been detected and alarmed if the upstream alarm has not been suppressed.

Asynchronous

Refers to network elements that are not timed from references traceable to a single Stratum-1 source.

AUTO

Automatic — One possible state of a port or slot. When a port is in the AUTO state and a good signal is detected, the port automatically enters the IS (in-service) state. When a slot is in the AUTO state and a circuit pack is detected, the slot automatically enters the EQ (equipped) state.

B

BCLAN

Board Controller Local Area Network — The internal local area network that provides communications between the Line Controller circuit pack and board controllers on the circuit packs associated with a high speed line.

Bidirectional Switch

Protection switching performed in both the transmit and receive directions.

C

CIT

Craft Interface Terminal — A personal computer that meets OLS minimum requirements and has Interface-2000 software installed.

Closed Ring Network

A network formed of a ring-shaped configuration of systems

CMS

See customer maintenance signal

CO

Central Office

Co-located

Located in the same Central Office

CR

Critical (alarm)

CS&O

Lucent Technologies Customer Support and Operations

Current Value

The value currently assigned to a provisionable parameter.

Customer Maintenance Signal

A 155Mb/s optical signal originating from customer supplied equipment, and used for customer maintenance activities. It is carried as part of the supervisory signal.

CV

Coding Violation

D

DACS

Digital Access and Cross-Connect System

DACS III-2000

One of Lucent Technologies' SONET-ready digital access and cross-connect systems.

DACS IV-2000

One of Lucent Technologies' SONET-ready digital access and cross-connect systems.

Data

A collection of system parameters and their associated values.

dB

Decibels

DCC

Data Communications Channel — The embedded overhead communications channel in the SONET line. This is used for end-to-end communications and maintenance. It carries alarm, control, and status information between network elements in a SONET network.

DCE

Data Communications Equipment — The equipment that provides the signal conversion and coding between the data terminating equipment and the line. The DCE may be separate equipment or a part of the data terminating equipment.

DDM-2000

Lucent Technologies' SONET-ready network multiplexer that can function as a lightwave terminal. It is designed primarily for loop feeder and interoffice applications that will work in existing asynchronous as well as the emerging SONET networks.

Demultiplexing

A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

Dispersion

Time-broadening of a transmitted light pulse

Divergence

When the OA provides unequal amplification of incoming wavelengths, the result is a power divergence between wavelengths.

Doping

The addition of impurities to a substance in order to attain desired properties.

DRAM

Dynamic Random Access Memory

Drop Side Signal

An optical signal suitable for transmission over OLS, an OC-48 signal.

DS3

Digital Signal Level 3 (44.736 Mb/s)

DS-NE

Directory Service 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). There can be one DS-NE per ring.

DTE

Data Terminating Equipment — The equipment that originates data for transmission and accepts transmitted data.

Dual Cabinet

A cabinet in which each shelf is an independent OLS network element.

Dual Ring Interworking

A configuration of two ring networks that share two common nodes. DRI permits a circuit with one termination in one ring and one termination in another ring to survive a loss-of-signal failure of the shared node that is currently carrying service for the circuit.

DUAL

An end terminal configuration that supports east-west transimission.

DWDM

Dense Wave Division Multiplexing

E

EC-1

Electrical Carrier level-1 signal — An STS-1 signal that has been shaped and encoded for transmission over electrical media.

ECI

Equipment Catalog Item

EEPROM

Electrically Erasable Programmable Read-Only Memory

EMC

Electromagnetic Compatibility

EMDU

External Miscellaneous Discrete Unit

EMI

Electromagnetic Interference — High-energy, electrically induced magnetic fields that cause data corruption in cables passing through the fields.

End Terminal

The OLS equipment that terminates ten optical line signals.

EQ

Equipped — A memory administrative state for slots.

Erbium

A soft rare earth element used in metallurgy and nuclear research.

Erbium Doped Fiber Amplifier (EDFA)

An amplifier that performs by having a light signal pass through a section of erbium- doped fiber and using the laser pump diode to amplify the signal.

ES

Errored Seconds — A performance monitoring parameter.

ESD

Electrostatic Discharge

ET

End Terminal — Equipment that terminates optical line signals.

Express Traffic

In a WAD site, wavelengths going between two co-located OLS end terminals without going through an LCT.

F

FE ACTY

Far-End Activity

FEBE

Far-End-Block Error — An indication returned to the transmitting terminal that an errored block has been detected at the receiving terminal. A block is a specified grouping of bits.

FERF

See RDI.

FIT

Failures in Time — Circuit pack failure rates per 10^9 hours as calculated using the method described in *Reliability Prediction Procedure for Electronic Equipment*, Issue 4, September 1992.

G

Ga

Gauge

Gb/s

Gigabits per second

GHz

Gigahertz — 10^9 cycles per second

GNE

Gateway Network Element — A network element that passes information between other network elements and operations systems through a data communication network.

I

IEC

International Electrotechnology Commission or Interexchange Carrier

IR

Intermediate Reach

IS

In Service — A memory administrative state for ports. IS refers to a port that is fully monitored and alarmed.

ITCO

Independent Telephone Company

IXC

Interexchange Carrier

J

Jitter

Jitter is defined as short-term variations of the significant instants of a digital signal from their ideal positions in time.

K

Krypton line

1547.82 nm —wavelength used in a standard laser source.

L

Large Capacity Terminal

A four-fiber OC4-rate multiplexer with add-drop capability. LCTs support standard SONET ring or span protection switching, and can be used with OLS to increase transport capacity.

LBC

Laser bias current

LBFC

Laser backface currents

LBO

Lightguide Build-Out — An equalizer network between the terminals and the DSX panel (or equivalent). It guarantees the proper signal level and shape at the DSX panel (or equivalent).

LCT

FT-2000 OC-48 Lightwave System Large Capacity System

Lead time

The amount of time that passes between placement of a product order and receipt of the product.

LEC

Local Exchange Carrier

LED

Light-Emitting Diode

Line

An optical transmission line. In T1/Bellcore terminology, "line" refers to a transmission medium, together with the associated high speed equipment, required to provide the means of transporting

information between two consecutive Network Elements, one of which originates the line signal while the other terminates the line signal.

Local Traffic

All wavelengths being added/dropped through LCTs or OTs at a WAD site.

LOF

Loss of Frame

Long Reach

The capability to concatenate 7 or 8 spans between end terminals before regeneration is required

LOS

Loss of Signal

M

μm

Micrometer

Menu

A set of possible values for a parameter.

Midspan Meet

The capability to interface between two lightwave terminals of different vendors. This applies to high speed optical interfaces.

MJ

Major (alarm)

MN

Minor (alarm)

MTBF

Mean Time Between Failures

MTBMA

Mean Time Between Maintenance Activities

Multiplexing

The process of combining several distinct digital signals into a single composite digital signal.

N

NE

Network Element

NE ACTY

Near-End Activity

NEBS

Network Equipment-Building System

NGLN

Next Generation Lightwave Network

nm

Nanometer (10^{-9} meters)

NMA

Network Monitoring and Analysis System

NMON

Not Monitored — A memory administrative state for ports.

Nonrevertive switching

In nonrevertive switching, there is a working and a standby line, circuit pack, etc. When a protection switch occurs, the standby line or circuit pack is selected and becomes the working line. The original working line or circuit pack becomes the standby. This status remains in effect when the fault clears, that is, there is no switch back to the original status. Also see **1+1 Line Protection.**

NRZ

Nonreturn to Zero

NSA

Nonservice Affecting

NSAP Address

Network Service Access Point Address — An automatically assigned number that uniquely identifies a Network Element for the purposes of routing DCC messages.

O

O&M

Operation and Maintenance

OALAN

Overhead Access Local Area Network — The internal local area network that provides communications between the System Controller circuit pack and the Overhead Controller circuit pack.

OAM&P

Operations, Administration, Maintenance, and Provisioning

OC, OC-n

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

OC3

Optical Interface Circuit Pack — The FT-2000 OC-48 Lightwave System OC3 Optical Interface circuit pack interfaces with one bidirectional OC-3 signal.

ODU

Optical Demultiplexer — takes the OLS optical signal and separates it into the eight OC-48 signals.

OLS End Terminal

Terminal equipment consisting of a co-located Optical Multiplexer Unit (OMU) and Optical Demultiplexer Unit (ODU) for bidirectional transmission, Optical Amplifiers (OA), and OLS Telemetry packs.

OLS Repeater Terminal

Bidirectional terminal consisting of a pair of Optical Amplifiers (OA) and the corresponding OLS telemetry packs.

OLS Subnetwork

All dual facing end terminals and OLS Repeaters interconnected with each other. In OLS Release 2.1, the dual facing shelf extends the access domain beyond the end terminals.

OLS System

In OLS Release 2.1, two OLS End Terminals and the OLS Repeaters between them.

OMU

Optical Multiplexer Unit— takes up to eight OC-48 signals and combines them into a single signal

OOF

Out-of-Frame

Open Ring Network

Network formed of a point-to-point configuration of systems.

Operations Interface

Any interface providing you with information on the system behavior or control. These include the equipment LEDs, interface strip, CIT, office alarms, and all telemetry interfaces.

Operations Interworking

The capability to access, operate, provision, and administer remote systems through craft interface access from any site in a SONET network or from a centralized operations system.

Optical Channel

A OC-48 wavelength within an optical line signal. There are eight such wavelengths, or channels, in one line signal.

Optical Line Build-out (LBO)

An attenuator placed between FT-2000 OC-48 Lightwave systems and the LGX (or equivalent). It guarantees the optical level will be below the receiving equipment's maximum received power requirements.

Optical Line ID

A portion of the supervisory signal that identifies optical lines to prevent misconnections between sites.

Optical Line Signal

A multiplexed optical signal containing eight wavelengths or channels.

Optical Line System

A lightwave transmission system that multiplexes up to eight wavelengths, transmits the resulting multiplexed signal, and then demultiplexes the signal at the other end.

Optical Section

See Span.

Optical Translator (OT)

A unit that electrically regenerates any incoming OC48/OC12/OC3 wavelength in the 1.3-1.5 micrometer range into a specific outgoing OC48/OC12/OC3 wavelength.

Optical WAD

See Wavelength Add/Drop.

Orderwire

A section of the supervisory signal that is used for communication between sites.

Original Value Provisioning

The original values are preprogrammed at the factory. These values can be overridden using local or remote provisioning.

OS

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

OTPM

Optical Translator Port Module

OTU

Optical translator unit

P

Parallel Telemetry

A set of alarms and status information reported to an operations center.

Parameter

A characteristic of the system that affects its operation.

Platform

In OLS, a platform is a family of equipment and software configurations designed to support a particular application.

PM

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

POH

Path Overhead — Overhead assigned to and transported with the payload until the payload is demultiplexed. It is used for functions that are necessary to transport the payload.

Preprovisioning

The capability to provision a slot before installing a circuit pack.

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.

Protection Switching

The switching of traffic from a malfunctioning line to one that is working.

PROTN

Protection

Provisioning

Assigning a value to a system parameter.

PWR

Power

R

RCV

Receive

RDI

Remote defect indicator — [Previously called far-end-receive failure (FERF)] An indication returned to a transmitting terminal that the receiving terminal has detected an incoming section failure.

Repeater Terminal

In OLS, a bidirectional terminal consisting of a pair of optical amplifiers and the corresponding telemetry packs.

Reactive Maintenance

Refers to discovering defects/failures and then clearing them.

Regeneration

The process of reconstructing a digital signal to eliminate the effects of noise and distortion.

Revertive Switching

In revertive switching, there is a service and protection line or circuit pack. When a protection switch occurs, the protection line or circuit pack is selected. When the fault clears, service reverts to the original service line. See 1x1 Line Protection.

RF

Radio Frequency

RFI

Remote failure indication — (Previously called yellow signals.) A signal that alerts upstream STS-1 path terminating equipment that a down stream failure has been alarmed along the STS-1 path. This action prevents multiple alarms from being activated for the same failure and ensures that craft will be dispatched to the correct location of the failure.

RPP

Reliability Prediction Procedure

RT

Remote Terminal

RTAC

Regional Technical Assistance Center

S

SA

Service Affecting

SD

Signal Degrade

SDH

Synchronous Digital Hierarchy — a European standard

SEFS

Severely Errored Frame Seconds — A performance-monitoring parameter.

SES

Severely Errored Seconds — A performance-monitoring parameter.

SESP

P-bit Severely Errored Seconds — A performance-monitoring parameter.

SF

Signal Fail

Short Reach

The capability to concatenate up to 3 spans between end terminals before regeneration is required

Single-ended Operations

The single-ended operations capability provides operations support from a single location to remote network elements (NEs) in the same SONET subnetwork. With this capability you can perform operations, administration, maintenance, and provisioning on a centralized basis. The remote NEs can be those that are specified for the current release.

Site Address

The unique address for each regenerator or terminal in a repeatered span.

SNR

Signal to Noise ratio; the relative strength of signal compared to noise.

SONET

Synchronous Optical Network

Span

An uninterrupted bidirectional fiber section between two network elements.

Span Growth

A type of growth in which one wavelength is added to all lines before the next wavelength is added.

Span Loss

Loss (in dB) of optical power due to the span transmission medium (includes fiber loss and splice losses).

SPE

Synchronous Payload Envelope — A 125-microsecond frame structure composed of STS path overhead and bandwidth for the payload.

STM-n

Synchronous Transport Module level n — the basic building block of SDH.

STS, STS-n

Synchronous Transport Signal — The basic logical building block signal with a rate of 51.840 Mb/s for an STS-1 signal and a rate of n times 51.840 Mb/s for an STS-n signal.

STS-1E

Now referred to as EC-1. A signal typically carried by coaxial cables from one equipment location to another. The term EC-1 refers to the organization and data rate of the signal and also to the voltage template the signal must conform to and the impedances for which the voltage template is valid.

STS1E

Interface Circuit Pack — The FT-2000 OC-48 Lightwave System STS1E Interface circuit pack interfaces with up to three bidirectional STS-1 signals.

Subnetwork

A group of interconnected/interrelated network elements. The most common connotation is a SONET network in which the network elements have data communications channel connectivity.

Supervisory Signal

An optical signal originating with the telemetry circuit pack that is used to communicate maintenance information.

Synchronous

Refers to network elements that are timed from references traceable to a single Stratum-1 source.

Synchronous Network

The synchronization of transmission systems with payloads to a master (network clock that can be traced to a single reference clock).

SYSCTL

System Controller circuit pack.

SYSMEM

System Memory circuit pack.

T

T1X1 and T1M1

The ANSI committees responsible for telecommunications standards.

TA

Technical Advisory

TABS

Telemetry Asynchronous Byte Serial (Protocol)

TCA

Threshold-Crossing Alert — A condition set when a counter exceeds a user-selected high or low threshold. A TCA does not generate an alarm but is available on demand through the CIT.

THz

Terrahertz (10^{12} Hz)

TID

Target Identifier — A provisionable parameter used to identify an FT-2000 OC-48 Lightwave network element. Typically, the TID is the common language location identifier (CLLI™) of the FT-2000 1x1 End Terminal, FT-2000 Add/Drop-Rings Terminal, and FT-2000 Repeater Bays.

TL1

Transaction Language 1 — A machine-to-machine communications language that is a subset of CCITT's human-machine language.

TLM
Telemetry circuit pack

TOHCTL
Tributary Overhead Controller.

Tone
An AM signal in the 5 - 30 kHz range that is superimposed on the drop side signal for power measurements.

TrueWave® Fiber
Non–zero dispersion-shifted fiber manufactured by Lucent Technologies (previously referred to as DEB fiber).

TSO
Technical Support Organization

TX
Transmit

U

UAS
Unavailable Seconds

Upgrade
An upgrade is the addition of new capabilities (features). This requires new software and may require new hardware.

V

Value
A number, text string, or other menu selection associated with a parameter.

W

Wavelength Add/Drop (WAD)
The process of adding and dropping wavelengths to provide more efficient transmission. For example, a central office contains two or more OLS end terminals, some wavelengths can be added and dropped locally while others go express between the end terminals by means of OTs.

Wavelength Blocking

At a WA/D site with branching, if a wavelength goes express between two co-located OLS end terminals, that wavelength can only be added or dropped at the third co-located end terminal. Wavelength interchange permits the wavelength on the third end terminal to be converted into an available wavelength at the other two end terminals.

Wavelength Growth

A type of growth in which all eight wavelengths are added to a single line before more lines are added.

Wavelength Interchange

The ability to change the wavelength associated with an OC-48 signal into another wavelength.

Wavelength Section

The path followed by an STS48 from its creation to its termination.

Wideband Communications

Voice, data, and/or video communications at digital rates from DS0 to DS1 rates (64Kb/s to 1544Kb/s)

X

X.25

Communications protocol.

Z

Zero Code Suppression

A technique used to reduce the number of consecutive zeros in a line-codes signal (B3ZS for DS3 signals).

Index

Complementary Shelves, 4-16
FIT rates, 9-7

P

package descriptions, 7-62, 7-66
packages
  for Optical Line System, 4-2
packages, OLS, 4-18
panels
  fuse, 4-59
  fuse/power indicating, 4-58
  user, 4-55
parallel telemetry
  interface, 2-5
parameters
  line, 5-18
  optical, 5-17
  provisionable, 5-24
performance
  monitoring
    continuous, 2-9
  thresholds, 2-9
physical dimensions, 6-20, 10-7
planning
  considerations, 6-1
  network, 6-1
plant loss, 10-5
port module, 4-36
port states
  auto (AUTO), 5-22
  in service (IS), 5-22
  not monitored (NMON), 5-22
power, 4-58, 4-59
  bus, 4-63
  cables, 4-62, 7-75
  dissipation, 6-20
  distribution
    philosophy, 4-60
    shelf level, 4-63
  for circuit packs, 4-64
  planning, 6-20
  specifications, 6-20, 10-6, 10-7
power distribution, 4-64
power planning, 6-20
proactive maintenance, 5-11
procedures
  maintenance, 2-4

protocol. See X.25
provisionable parameters, 5-24
provisioning, 5-23
  CIT parameters
    local and remote, 5-24
  consistency audits, 5-20
  map, 5-24
  performing on a centralized basis, 2-6, GL-14

R

reactive maintenance, 5-11
registers
  description, 5-19
reliability, 4-60, 9-1
  specifications, 10-15
remote
  alarms, 2-7
    in same subnetwork, 5-13
  login, 2-6, 2-7
  NE status, 5-13
  software copy, 5-12
remote access
  alarm report, 5-12
  CIT, 5-12
  indicator strip, 5-12
  operations system, 5-12
repeater shelf
  description, 4-13
report
  addressed slot
    state of, 5-22
  alarm and status, 5-21
  history, 5-21
  performance monitoring register values, 5-21
  version/equipment list, 5-22
requirements, 4-9
  Bellcore, 4-9

S

security
  guest login, 5-10
  login aging, 5-10
  login ID, 5-9
  network element login, 5-9

T