Lucent Technologies
Bell Labs Innovations

WaveStar™ OLS 40G
Release 3.1.1

Applications, Planning, and Ordering Guide

365-575-350
Issue 2
July 1998

Notice

The information in this document is subject to change without notice. Although every effort has been made to make this document as accurate, complete, and clear as possible, Lucent Technologies and its predecessors assume no responsibility for any errors that may appear in this document.

Federal Communications Commission (FCC) Notification and Repair Information*

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

Security

In rare instances, unauthorized individuals make connections to the telecommunications network. In such an event, applicable tariffs require that the customer pay all network charges for traffic. Lucent Technologies and its predecessors cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

Trademarks

5ESS, LGX, Paradyne, SLC, ST, and TrueWave are registered trademarks of Lucent Technologies.
CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.
COMMON LANGUAGE is a registered trademark Bell Communications Research, Inc.
CSA is a registered trademark of Canadian Standards Association
DACScan is a trademark of Lucent Technologies.
DANTEL is a registered trademark of DANTEL Incorporated.
Fujitsu is a registered trademark of Fujitsu Limited.
MS-DO, Microsoft, Internet Explorer, and Windows 95 are registered trademarks of Microsoft Corporation.
Pentium is a registered trademark of Intel Corporation.
Gateway 2000 is a registered trademark of Gateway 2000.
IBM is a registered trademark of International Business Machines Corporation.
Penril is a registered trademark of Penril Corporation.
ProComm Plus is a registered trademark of Datastorm Technologies Inc.
Toshiba is a registered trademark of Toshiba Corporation
UL is a registered trademark of Underwriters Laboratories Inc.
V-series is a registered trademark of Hayes Microcomputer Products, Inc.
WaveStar is a trademark of Lucent Technologies, Inc.
Zenith is a registered trademark of Zenith Electronics Corporation.

Warranty

The terms and conditions of sale will include a five-year warranty on hardware and a one-year warranty on software.

Document Ordering Information

The ordering number for this document is 365-575-340. To order this document, call 1-880-582-3688 (USA), 1-800-255-1242 (Canada), 1-317-322-6646 (world except Europe, Australia & NZ) or 1-317-322-6416 (Europe, Australia & NZ). RBOC/BOC customers should process document orders or standing order requests through their Company Documentation Coordinator. For more ordering information, refer to “How to Order Documents” in the section titled “About This Document.”

Customer Assistance and Technical Support

The Lucent Technologies Regional Technical Assistance Center (RTAC) provides a technical assistance telephone number that is monitored 24 hours a day. For technical assistance, call 1-800-225-RTAC. You can also call this telephone number to provide comments on Optical Line System (OLS) or to suggest enhancements.

This document was developed by the Customer Training and Information Products organization.

---

* Language of statute.

We'd Like Your Opinion

We'd like your feedback on this document. Your comments can be of great value in helping us improve our documentation. When you have completed this form, please fax it to (978)-960-6835.

Document Title: WaveStar™ OLS 40G Release 3.1.1 Applications, Planning, and Ordering Guide

Document Number: 365-575-350 Issue Number: 2 Publication Date: July 1998

Please check the ways you feel we could improve this document:

- ❑ Improve the preface
- ❑ Improve the table of contents
- ❑ Improve the organization
- ❑ Improve the index
- ❑ Include more figures
- ❑ Add more examples
- ❑ Make it more concise / brief
- ❑ Simplify the ordering information
- ❑ Add more detail
- ❑ Make it less technical
- ❑ Add more / better quick reference aids
- ❑ Change typefaces
- ❑ Other

Please provide details for the suggested improvement.

Please tell us what aspects of this document are most helpful or appealing to you or write any other comments below:

If we may contact you concerning your comments, please fill out the following:

Name: Telephone Number:

Company / Organization: Date:

Address:

Contents

3 Applications

4 Product Description

5 Operations, Administration, Maintenance, and Provisioning

6 System Planning and Engineering

7 Ordering

9 Quality Statements and Technical Specifications

A Circuit Pack Sparing

Figures

1 Introduction

3 Applications

4 Product Description

5 Operations, Administration, Maintenance, and Provisioning

6 System Planning and Engineering

7 Ordering

8 Product Support

A Circuit Pack Sparing

Tables

3 Applications

4 Product Description

5 Operations, Administration, Maintenance, and Provisioning

6 System Planning and Engineering

7 Ordering

9 Quality Statements and Technical Specifications

A Circuit Pack Sparing

About This Document

This guide provides information about the Lucent Technologies WaveStar™ OLS 40G optical networking product.

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 WaveStar OLS 40G.

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. Personnel responsible for 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 WaveStar OLS 40G and related products
- Chapter 2, "Features," describes the major features of WaveStar OLS 40G. 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 WaveStar OLS 40G handles point-to-point, Dual End Terminal, and 4 fiber rings
- Chapter 4, "Product Description," describes WaveStar OLS 40G architecture. After introducing the various WaveStar OLS 40G 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 WaveStar OLS 40G
- Chapter 6, "System Planning and Engineering," summarizes descriptive information used with applications information to plan procurement and deployment of WaveStar OLS 40G
- Chapter 7, "Ordering," contains equipment ordering information for WaveStar OLS 40G
- Chapter 8, "Product Support," describes how Lucent Technologies supports WaveStar OLS 40G. This includes information about engineering and installation services, technical support, documentation support, and training
- Chapter 9, "Quality Statements and Technical Specifications," contains the Lucent Technologies quality policy, describes the reliability program, and lists the technical specifications for WaveStar OLS 40G
- 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 WaveStar OLS 40G:

- Number: 365-575-351

  Title: *WaveStar OLS 40G Release 3.1.1 User/Service Manual*

  Audience: End user maintenance personnel

  Content: Detailed system description, technical specifications, operation and maintenance, and user interface descriptive/tutorial information. The *Provisioning Job Aids* and *TCA Job Aids* are included with this document.

- Number: 365-575-344

  Title: *WaveStar OLS 40G Release 3.1.1 Installation Manual*

  Audience: Customers planning to install WaveStar OLS 40G

  Content: Customer installation instructions

- Number: 365-575-355

  Title: *WaveStar OLS 40G Release 3.1.1 Operations Systems Engineering Guide*

  Audience: End user maintenance personnel

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

- Comcode: 108 334 731

  Title: *WaveStar OLS 40G Release 3.1.1 Software Release Description*

  Audience: End-user maintenance personnel

  Content: Status of problems fixed and known problems for Release 3.1.1-WaveStar OLS 40G software

- Number: 365-575-100

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

  Audience: System planners and engineers

  Content: Ordering information for the FT-2000 OC-48 Lightwave System, including FT-2000 OC-48 Add/Drop-Rings Terminal and the FT-2000 OC-48 Repeater Bay.

- Number: 365-575-102

  Title: *FT-2000 OC-48 Lightwave System User/Service Manual*

  Audience: End user maintenance personnel

  Content: Detailed system description, technical specifications, operation and maintenance, and user interface descriptive/tutorial information (includes information on the FT-2000 OC-48 Add/Drop-Rings Terminal and the FT-2000 OC-48 Repeater Bay)

- Number: 365-575-115

  Title: *FT-2000 OC-48 Lightwave System Installation Manual*

  Audience: Customers planning to install the FT-2000 OC-48 Lightwave System

  Content: Customer installation instructions for the FT-2000 OC-48 Lightwave System, including the FT-2000 OC-48 Add/Drop-Rings Terminal and the FT-2000 OC-48 Repeater Bay

- Number: 2492C

  Title: *Lucent Technologies Fiber Optic Products*

  Audience: Line engineers and technical consultants responsible for system planning and ordering

  Content: Ordering information for fiber optic products.

Drawings

The following drawings, which are shipped with the product, provide information about WaveStar OLS 40G. These drawings are needed for the installation process.

J68982C-1	WaveStar OLS 40G Cabinet (Equipment and Circuit Packs Ordered with Equipment)
J68982D-1	WaveStar OLS 40G Integrated Bay (Equipment and Circuit Packs Ordered with Equipment)
J68982CS-1	WaveStar OLS 40G Cabinet Software and Documentation
J69000C-1	Optical Translator Cabinet (Equipment and Circuit Packs Ordered with Equipment)

SD-5G276-01	WaveStar OLS 40G Application Schematic
SD-6G156-01	Optical Translator Cabinet Application Schematic
SD-5G157-01	WaveStar OLS 40G Integrated Bay Application Schematic
T-5G276-33	WaveStar OLS 40G Interconnection Circuit
T-6G156-33	Optical Translator Interconnection Circuit
T-5G157-33	WaveStar OLS 40G Integrated Bay Interconnection Circuit
T-5G276-30	WaveStar OLS 40G Circuit
T-6G156-30	Optical Translator Circuit
T-6G157-30	WaveStar OLS 40G Integrated Bay Circuit
ED-7G033-30	WaveStar OLS 40G Cabinet Framework
ED-7G044-30	Optical Translator Cabinet Framework
ED-7G048-30	WaveStar OLS 40G Integrated Bay Framework
ED-7G028-20	WaveStar OLS 40G Cable Assembly
ED-7G045-20	OT Cable Assembly
ED-7G028-22	WaveStar OLS 40G Intercabinet Cable Assembly
ED-7G045-22	OT Intercabinet Cable Assembly
ED-7G028-30	WaveStar OLS 40G Shelf Assembly
ED-7G045-30	Optical Translator Shelf Assembly
ED-7G027-30	WaveStar OLS 40G User/Fuse Power Indicating Panel Assembly
ED-7G047-30	OT Fuse/Fuse Power Indicating Panel Assembly
FPD 804-604-161	WaveStar OLS 40G Cabinet Floor Plan Data Sheets
FPD 804-604-162	OT 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.

T-5G276-30	WaveStar OLS 40G Circuit
T-5G276-33	WaveStar OLS 40G Interconnection Circuit
T-6G156-30	Optical Translator Circuit
T-6G156-33	Optical Translator Interconnection Circuit
T-6G157-30	WaveStar OLS 40G Integrated Bay Circuit
T-6G157-33	WaveStar OLS 40G Integrated Bay Interconnection Circuit

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 access to current information.

The CD-ROM containing WaveStar OLS 40G documentation is part of the FT-2000 CD-ROM family. The CD-ROM 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).

How to Order Documents

To order additional copies of this document and / or request placement on the standing order list, send or call in an order as follows:

Customer	Mail Order	Telephone Order *(Monday through Friday)*
Commercial Customers*	Lucent Technologies Customer Information Center Attention: Order Entry Section 2855 N. Franklin Road P.O. Box 19901 Indianapolis, IN 46219	From USA and Canada:1-888-582-3688 24-hour / day toll free FAX: 1-800-566-9568 From Caribbean / Latin America and Canada: Toll: 1-317-322-6646 From Europe, Middle East, an Africa: Toll: 1-317-322-6416 From Asia / Pacific Region, China, Australia, and New Zealand: Toll: 1-317-322-6411 International FAX: 1-317-322-6699
RBOC / BOC	Process through your Company Documentation Coordinator	

* For commercial customers, a check, money order, purchase order number, or charge card number is required with all orders. Make checks payable to Lucent Technologies.

Lucent Technologies entities should use Form IND 1-80.80 FA, available through the Customer Information Center.

One-time orders include a binder (if applicable) and the document contents for the current issue at the time of order. Also, you may ask to be placed on the standing order list for reissues of any documentation. The standing order list for each document provides automatic distribution for all reissues of the document. Regional Bell Operating Companies and Bell

Operating Companies (RBOC/BOC) customers should process document orders or standing order requests through their Company Documentation Coordinator. If you do not have a Company Documentation Coordinator, use the applicable commercial customer telephone number listed on the previous page.

For questions regarding standing orders or to be placed on a standing order list, contact the Lucent Technologies Customer Information Center number using the applicable telephone number listed on the previous page.

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

  Audience: This course is primarily intended for network planners, product managers, project 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 overview of the principles and applications of optical networking and the features of the backbone system for optical networking.

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

- Number: LW2252

  Title: WaveStar OLS 40G/Optical Translator (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: WaveStar OLS 40G / Optical Translator (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 WaveStar OLS 40G 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: WaveStar OLS 40G / Optical Translator (OT) Installation

  Audience: This course is primarily intended for personnel responsible for the installation of the WaveStar OLS 40G equipment

  Content: This course provides students with the knowledge and hands on experience needed to install and test WaveStar OLS 40G / OT equipment. The course is based on the *WaveStar OLS 40G Release 3.1.1 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 *WaveStar OLS 40G Release 3.1.1 Installation Manual*

  Prerequisites: None

- Number: LW2454

  Title: WaveStar OLS 40G / Optical Translator (OT) Installation (Self-paced)

  Audience: This course is primarily intended for personnel responsible for the installation of WaveStar OLS 40G and OT equipment

  Content: This course provides instruction on the equipment architecture, the installation methods and tests, and the content of the *WaveStar OLS 40G Release 3.1.1 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 *WaveStar OLS 40G Release 3.1.1 Installation Manual*

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

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

1-888-LUCENT-8 (select option 2)

Fax: 1-407-767-2677

Or write to:

Lucent Technologies
Customer Training and Information Products
307 North Lake Blvd.
Altamonte Springs, FL
32701

How to Comment on This Document

A customer comment form is located immediately after the title page of this document. Please fill out the form and fax it to the number provided on the form.

If the customer comment form is missing, send or fax comments on this document to:

Lucent Technologies
Customer Training and Information Products
Building 21, Room 3A06
1600 Osgood Street
North Andover, MA 01845

Fax Number: (978) 960-6835

Introduction

1

Introduction

1

This chapter presents a brief overview of the WaveStar OLS 40G optical networking product.

Introduction to WaveStar OLS 40G

Lucent Technologies offers the industry's widest range of transmission systems and related services in order to provide total network solutions. WaveStar OLS 40G, 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, WaveStar OLS 40G provides higher capacity per fiber over longer distances than previously possible, promoting greater economy and efficiency. As a point-to-point system, WaveStar OLS 40G supports a variety of network topologies, including high capacity loop, inter-office, outstate, Short Reach, and Long Span applications. These network topologies are described in Chapter 3, "Applications."

From an operations perspective, the Optical Translator (OT) can now be integrated with WaveStar OLS 40G. This integration provides more detailed maintenance information and control of OT provisioning and administration through existing WaveStar OLS 40G control interfaces. WaveStar OLS 40G with OT provides the following functions:

- Long Reach Wavelength Add/Drop (WAD)
- Multi-vendor compatibility

- Concatenation of multiple WaveStar OLS 40G terminals
- Signal regeneration
- Wavelength blocking prevention via wavelength interchange.

This combined functionality increases the flexibility and cost effectiveness of WaveStar OLS 40G.

Several Lucent terminals have been designed to operate directly with WaveStar OLS 40G. These include the FT-2000 OC-48 Lightwave System, FT-2000 OC-48 Large Capacity Terminal (LCT), and SLM-2000.

NOTE:
An OT is required for WaveStar OLS 40G when non-Lucent machines are used.

WaveStar OLS 40G also works with the Integrated Transport Management Subnetwork Controller (ITM SNC). The ITM SNC is an element management system that supports synchronous optical network (SONET) network elements such as the Lucent Technologies DDM-2000, FiberReach WBS, FT-2000, SLC®-2000, and Fujitsu® Lightwave Multiplexer (FLM). The ITM SNC provides fault, provisioning, configuration, and security management functions via a graphical user interface (GUI). Through these functions, the ITM SNC is able to support communication multiplexing or concentration, guarantee network security, and record all database changes. The ITM SNC also provides a cut-through capability, allowing the ITM SNC user to access a network element through its native command set.

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

WaveStar OLS 40G also works with CPro-2000. CPro-2000 is a *Windows 95*® application that provides access to Lucent Technologies SONET network elements from a PC or laptop via a command-based AUI and GUI. CPro-2000 is a user-friendly tool for craft provisioning of SONET subnetworks.

What is WaveStar OLS 40G?

WaveStar OLS 40G is a flexible, high capacity lightwave system comprised of end terminals that multiplex digitally encoded information (contained in up to sixteen different wavelengths) on one end, transmit the resulting combined signal through the optical fibers, and then demultiplex the information at the other end. Repeater terminals are used to re-amplify the optical signal on an optical line between adjacent end terminal and repeater sites or between adjacent repeater sites.

WaveStar OLS 40G supports applications that need to expand to accommodate increasing amounts of information. WaveStar OLS 40G supports wavelength growth and, when equipped with the OT, a highly flexible form of WAD is also possible. Wavelength growth increases capacity and decreases the need for fibers, especially useful in cases of fiber exhaust. Utilizing DWDM technology, WaveStar OLS 40G can handle transmission of up to sixteen wavelengths over a single fiber; each channel can be equipped in any order. Figure 1-1 shows a block diagram of both a WaveStar OLS 40G End Terminal and Repeater.

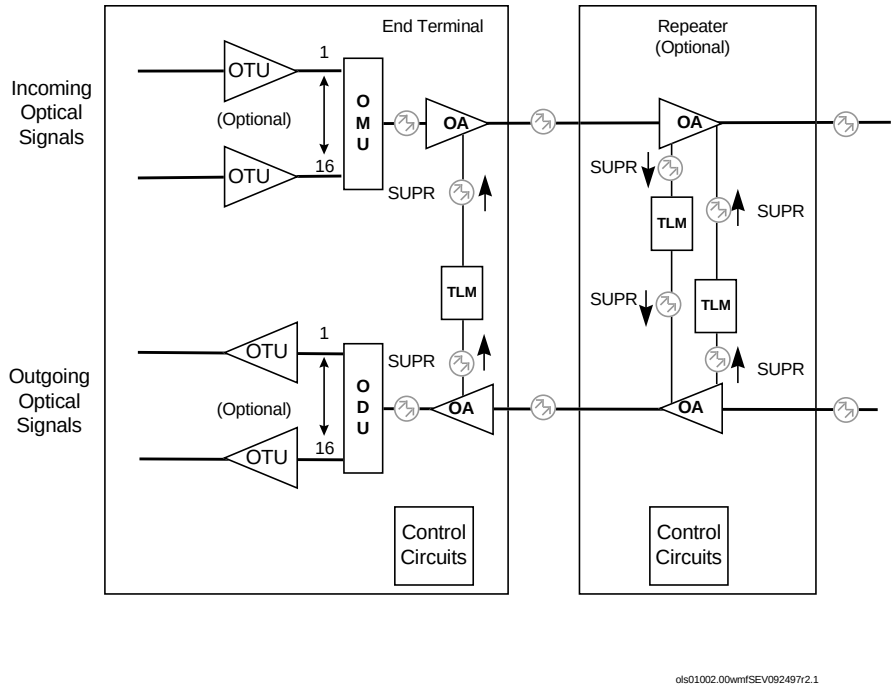


Figure 1-1. Simplified OLS End Terminal and Repeater Block Diagram

OLS Functions

WaveStar OLS 40G has the following functions:

- Receives up to sixteen optical channels
- Performs Dense Wavelength Division Multiplexing (DWDM) of up to sixteen optical lines on one optical fiber
- Multiplexes optical signals with a maintenance signal that is used by DWDM
- Demultiplexes optical signals at the other end of the optical line and passes them on to compatible optical receivers
- Amplifies 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®)
- If needed, uses OLS Repeater terminals to optically amplify the signal
- In Long Span configurations, supports a maximum distance of 600 km (five spans, up to four OLS Repeaters)
- In Long Reach configurations, supports a maximum optical line length of 640 km (eight spans)
- In Short Reach configurations, supports one span with optical line lengths up to 80 km
- Uses a highly flexible form of wavelength add / drop (WAD)
- Concatenates multiple OLSs
- Provides wavelength interchange at network interfaces
- Uses a rich operations, administration, maintenance, and provisioning (OAM&P) feature set.

OLS Benefits

WaveStar OLS 40G has the following benefits:

- Provides a cost-effective solution to fiber-exhaust situations (no need to add more fiber)
- Provides an open system interface with all types of transmission equipment
- Extends wavelength sections to thousands of kilometers
- Reduces office congestion
- Facilitates 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 user-settable alarms and control of equipment collocated with WaveStar OLS 40G
- Bit-rate independent
- Provides performance monitoring, fault isolation, and preventive maintenance
- Handles up to 40 Gb/s of traffic on one optical line
- Single OA operation for Short Reach applications
- Two OA operation for Long Reach and Long Span applications
- OLS Repeater sites between OLS End Terminals to support each span
- Selective add/drop of individual signals using WaveStar OLS 40G WAD facility
- 768 DS3 equivalents (516,096 two-way voice circuits per fiber pair)
- Allows significantly longer spans than earlier systems due to high optical power from the OA circuit packs
- Longer span capability between repeater sites, thereby reducing construction costs
- High reliability with a 25-year design life
- Year 2000-compliant.

- Provides optical protection switching (OPS) for Plesiochronous Digital Hierarchy (PDH) terminal equipment
- With OPS, customer traffic is protected after a fiber cut or Optical Amplifier (OA) failure.

OLS Features Release Plan

OLS Release 1.0 included the following features:

- Up to eight wavelengths at OC-48/STM-16 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 OAs
- Automatic OA 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/STM-16 Optical Translator (OT) for open optical interface to multi-vendor OC-48/STM-16 products
- Fully flexible WAD capability
- Long Reach transmission up to 640 km
- Flexible span engineering (1 to 8 spans).

OLS Release 2.1 offered the following:

- Up to sixteen wavelengths with any mix of OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, or 400-700 Mb/s signal rates.
- Open optical interfaces to multi-vendor OC-3/STM-1, OC-12/STM-4, and 400-700 Mb/s products with the Quad Optical Translator Units (QOTUs)
- Single-OA capability for up to sixteen wavelengths
- OA for Short Reach applications
- Dual-facing Shelf
- CenterLink craft interface terminal
- Enhanced security.

OLS Release 3.0 offered the following:

- Full integration of WaveStar OLS 40G and OT systems
- Telemetry feed-through capability for 4-fiber SONET applications
- 16-wavelength transmission on Long Span routes of up to 120 km per span
- Low speed broadband Optical Translator Port Module (OTPM) supporting 150-750 Mb/s low speed signal rates
- Automatic power shut-down and restart.

OLS Release 3.1.1 offers these additional new features:

- 1+1, non-revertive protection switching for customer traffic over point-to-point OLS systems
- The Self-Powered Optical Multiplexer Unit (SPOMU) circuit pack for use on seven and eight span systems
- The Self-Powered Optical Demultiplexer Unit (SPODU) circuit pack

For information on OLS product features, refer to Chapter 2, “Features.”

Features

2

Features

2

This chapter summarizes the main features of WaveStar OLS 40G.

New Features in Release 3.1.1

The following features are new in Release 3.1.1:

- 1+1, non-revertive optical protection switching (OPS)
- Functional integration of the OPS feature with OLS OAM&P
- Remote operations capabilities for the OPS feature
- Retrieval of faults and conditions for the OPS feature
- Password protected selection of hold-off time function
- Unidirectional and bidirectional protection
- Manual line switching for user controlled toggling between the primary and secondary lines.

The OPS feature is used in 2-fiber, two-OA applications for dual-facing shelf configurations only.

NOTE:
Single-OA applications are not supported with the OPS feature.

Release 3.1.1 Circuit Packs

The OPS feature utilizes the following new circuit packs:

- Optical Protection Switch (OPS)– This circuit pack provides optical protection, switching traffic between primary and secondary lines in the event of a fiber cut or OA failure on systems of up to eight spans. Both the switch and optical splitter for primary and secondary line fibers reside on the same OPS
- Self-powered Optical Multiplexing Unit (SPOMU)– This circuit pack is required in configurations that support seven and eight spans with up to 22 dB loss per span, utilizing a significantly lower insertion loss than the standard OMU. It can also be used in any WaveStar OLS 40G application that supports sixteen wavelengths. Providing filtered inputs, it also eliminates service-affecting conditions caused by the inadvertent addition of wavelengths already in-service
- Self-powered Optical Demultiplexer Unit (SPODU)– This circuit pack operates independently from the OA to guarantee optical demultiplexing performance when an OA circuit pack is replaced. In earlier releases, the ODU was dependent on the presence of a receive-OA pack for power, monitoring, and thermal stability control. This pack provides additional OPS reliability, specifically allowing the removal of failed OA's without adversely affecting traffic.

The OPS, SPODU, and SPOMU circuit packs are installed in OT shelves.

NOTE:
The SPODU circuit pack is required when using OPS. The SPOMU circuit pack is required for seven and eight span systems.

Other System Features

Other key system features include the following:

- 16-wavelength Long Span capability
- WaveStar OLS 40G / OT integration
- Low speed broadband (LSBB) Optical Translator Port Module (OTPM)
- Automatic power shut-down (APSD) and restart capability
- 4-Fiber Telemetry feed-through capability

16-Wavelength Long Span

Developed as an enhancement to older 8-wavelength systems operating on Long Span routes (Nx33 dB systems, where N=1, 2, or 3), the 16-wavelength Long Span feature provides high data capacity transport (up to 40 Gb / s) over fiber spans of up to 120 km. WaveStar OLS 40G uses DWDM technology to transport 16-wavelength channels (maximum data rate of OC-48 / STM-16 per wavelength) over these spans. This feature allows customers to double the capacity of existing 8-wavelength systems.

The 16-wavelength Long Span feature requires the use of a new Optical Amplifier (OA) circuit pack (LEA104) and is used in conjunction with the 16-wavelength Optical Multiplexer Unit (OMU) and Optical Demultiplexer Units (ODU). The LEA104 OA has the following capabilities:

- Supports transmission of up to 16 wavelengths over a maximum of five spans (540 km total reach)
- Supports wavelengths with any combination of OC-48 / STM-16, OC-12 / STM-4, and OC-3 / STM-1
- Supports the present sixteen WaveStar OLS 40G-compatible wavelengths, plus the supervisory channel
- Compatible with OTUs for signal regeneration, pass-through, and add / drop
- Allows the upgrade of existing 8-wavelength systems to 16-wavelength systems.
- Allows software to recognize and provision it based on the system configuration, and to have optimum output levels as determined by developers
- Supports the software implementation of the Automatic Power Shutdown procedure.

From a transmission perspective, WaveStar OLS 40G has historically advanced as follows:

- Release 1.0 provided network operators with a WDM system capable of transporting 8-wavelengths (OC-48/STM-16) over three fiber spans with a target distance of 120 km per span (3x33 dB system). This feature required the LEA6 OA circuit pack
- Release 2.0 provided transport capability of 8 wavelengths (OC-48/STM-16) over a maximum of eight fiber spans with a target distance of 80 km per span. This feature required the LEA7 OA
- Release 2.1 provided transport capability of 16 wavelengths (OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, 400-700 Mb/s, or any combination) over a maximum of seven or eight long fiber spans with a target distance of 80 km per span. This feature also required the LEA7 OA
- Release 3.0 further expanded WaveStar OLS 40G capabilities, providing transport capability of up to sixteen wavelengths (any combination of OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, and 150-750 MB/s) over Long Span fiber spans with a target distance of 120 km per span.
- Release 3.1.1 maintains previous WaveStar OLS 40G capability, requiring the SPOMU circuit pack on systems with seven and eight spans.

WaveStar OLS 40G/OT Integration

Operationally, WaveStar OLS 40G integrates WaveStar OLS 40G and Optical Translator (OT) systems placing control of the OT inside WaveStar OLS 40G control structure. The integration feature provides enhanced operations capabilities for Optical Translator Units (OTUs and QOTUs [Quad OTUs]) which are used optionally in conjunction with WaveStar OLS 40G. Integration also provides more detailed maintenance information and greater control of OT provisioning and administration via the existing WaveStar OLS 40G control interfaces.

A new circuit pack, the OT Controller (OTCTL), has been introduced to integrate the two systems when an OT is used with WaveStar OLS 40G. It is placed in the OT System Controller Shelf between WaveStar OLS 40G System Controller circuit pack (SYSCTL) and the OTUs. It is controlled by the existing SYSCTL and SYSMEM circuit packs in a WaveStar OLS 40G shelf. With the introduction of the OTCTL circuit pack, WaveStar OLS 40G

operations interfaces become the mechanism for obtaining information about the OTUs. Instead of using the original two miscellaneous discrete points for monitoring, more detailed information is made available through TL1 messages at the CIT and X.25 ports.

Low Speed Broadband (LSBB) Optical Translator Port Module (OTPM)

The LSBB OTPM can support transmission rates from 150 Mb/s to approximately 750 Mb/s. Designed for point-to-point transmission of low speed optical signals in applications utilizing DWDM, the LSBB OTPM provides an economical solution to the need for flexible and inexpensive networking access for Short Reach WaveStar OLS 40G applications.

The LSBB OTPM is a port module for the QOTU which can support from one to four OC-3/STM-1, OC-12/STM-4, or LSBB OTPMs in any combination. CenterLink is used to provision remote selection of the two LSBB OTPM operating modes (LOW and HIGH) to support the desired range of transmission rates. LOW mode has an operating range from 150 to 430 Mb/s; HIGH mode has an operating range from 430 to 750 Mb/s. The initial, factory-shipped setting is HIGH.

The LSBB OTPM supports multi-vendor environments, reducing the replacement cost of embedded equipment, by assuring wavelength and signal power compatibility at WaveStar OLS 40G interface.

NOTE:
The LSBB OTPM cannot be used for through-wavelength transmission or cascading WaveStar OLS 40G systems.

The LSBB OTPM provides the following benefits:

- Reduced equipment costs by enabling optical networking without additional multiplexing
- Equipment savings at start-up due to support for a low speed broadband input and elimination of clock and data recovery circuitry
- Sparing equipment savings
- Enables interworking between WaveStar OLS 40G and DDM-2000, as well as other vendors' OC-3/STM-1, OC-12/STM-4 SONET/ATM and 150-750 Mb/s equipment at the photonic layer

Automatic Power Shut-down (APSD) and Restart

The APSD feature is provided as a safety mechanism for WaveStar OLS 40G equipment. It protects against optical surges and exposure to high-powered lasers by automatically reducing output power during an optical power loss (caused by equipment failure, a fiber cut, or a removed connector). Specifically, WaveStar OLS 40G qualifies as a Class 3B system; during a power loss, the OA is brought down to Class 1 levels. Once the system has been repaired or links have been re-established, APSD ensures that normal operation resumes within four to five seconds.

The APSD feature has the following benefits:

- Increases safety levels of equipment use
- Meets IEC requirements
- Facilitates operation at very high levels of optical power for future applications
- Is provisionable for user enabling / disabling at any time

For more information on this feature, refer to Chapter 5, “Operations, Administration, Maintenance, and Provisioning.”

4-Fiber Telemetry Feed-Through

The 4-Fiber Telemetry Feed-through feature extends WaveStar OLS 40G operations domain in 4-fiber SONET ring applications. For 2-fiber applications, the Dual-facing Shelf feature is used to extend the operations domain.

The 4-Fiber Telemetry Feed-through feature has the following benefits:

- The operations domain for network operators and / or OSS is extended beyond a single WaveStar OLS 40G system
- Cost savings in operations coordination between WaveStar OLS 40G systems
- Allows the DCC to go across separate subnetworks via collocated end terminals.

For more information on this feature, refer to Chapter 5, “Operations, Administration, Maintenance, and Provisioning.”

Maintenance Features

WaveStar OLS 40G provides multiple maintenance features that are similar to and compatible with those of other Lucent Technologies 2000 family products. Maintenance features provide a wide range of system information and control, from summary-level status information to detailed reporting. The following sections summarize the major features. Chapter 5, "Operations, Administration, Maintenance, and Provisioning," describes these features in more detail.

CenterLink-CIT

The CenterLink-CIT is a graphical craft interface terminal that provides extensive on-line help as well as security against unauthorized access. Running under the *Windows 95*® operating system, CenterLink-CIT also provides detailed information and system control for specialized local and remote maintenance and administrative activities.

NOTE:
CenterLink-CIT supports one IP address at a time.

Operations Interface Flexibility

WaveStar OLS 40G 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
- 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 WaveStar OLS 40G network elements in a maintenance WaveStar OLS 40G 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.

Operations Domains

WaveStar OLS 40G subnetwork continues to include all dual-facing end terminals and 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. WaveStar OLS 40G, however, comprises two end terminals and the repeaters between them.

WaveStar OLS 40G 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 DCC connectivity between the two types of network elements. The dual-facing shelf feature extends WaveStar OLS 40G operations domain in 2-fiber applications to adjoining WaveStar OLS 40G subnetworks, maintaining communication.

For more information about operations 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 WaveStar OLS 40G network elements in the same WaveStar OLS 40G 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 that can be WaveStar OLS 40G End Terminals or Repeaters.

Capabilities of single-ended operations (operations interworking) include:

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

- Remote network element status (remote alarming, alarm groups, AGNE, remote alarm status, remote office alarms, and parallel telemetry)
- Local and remote software copy / upgrades
- Directory Service Network Element (DS-NE).

Gateway Network Element (GNE)

One or more WaveStar OLS 40G network elements can be used as a GNE. The GNE serves as a single interface to the X.25 message-based operations system for all network elements in the same WaveStar OLS 40G subnetwork.

The GNE receives operations information from these network elements through the 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 WaveStar OLS 40G 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 WaveStar OLS 40G subnetwork and the operations system, you might choose to use one WaveStar OLS 40G 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 network element status information through one or more AGNEs that are defined in the same alarm group.

Remote Login

You can log in remotely from one WaveStar OLS 40G network element to another WaveStar OLS 40G network element when they are in the same WaveStar OLS 40G subnetwork.

Inventorying Capabilities

WaveStar OLS 40G 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 Network Element Status (Through DCC)

Through the supervisory channel DCC interface, a WaveStar OLS 40G network element can receive and transmit summary alarm and status information from and to remote network elements in the same WaveStar OLS 40G. A far-end activity LED on the local WaveStar OLS 40G terminal indicates whether any condition is present in a WaveStar OLS 40G network element elsewhere in the subnetwork.

Local Software Copy/Upgrades

WaveStar OLS 40G can upgrade system software while in service. To upgrade, no control circuit pack changes are required. System monitoring and control are fully functional during software download. The CIT can be used to load software locally, or a modem can be used to download it remotely.

Remote Software Copy/Upgrades

System software contained in one WaveStar OLS 40G (source) can be copied / upgraded to another WaveStar OLS 40G (destination) in the same maintenance subnetwork. System monitoring and control are fully functional during the copying process.

Directory Service Network Element (DS-NE)

Any one node in a WaveStar OLS 40G system can be designated as the “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 WaveStar OLS 40G. No provisioning is required for the DS-NE database; the mapping is configured automatically.

Continuous Performance Monitoring

Continuous performance monitoring allows WaveStar OLS 40G to detect transmission problems before they affect service. WaveStar OLS 40G monitors analog performance on each wavelength of an optical line. WaveStar OLS 40G receives digital performance information on the supervisory channel. Depending on customer needs, thresholds for each parameter can be provisioned.

You can specify a single start time for measuring all twenty-four 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. WaveStar OLS 40G keeps information for the current day and the previous six days. WaveStar OLS 40G also records performance data at fifteen minute intervals, storing data from the previous eight hours.

Original Value Provisioning and User-Selectable Thresholds

WaveStar OLS 40G 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 X.25 interface can be used to modify the value of any parameter.

Security Features

WaveStar OLS 40G provides the following three tiers of security to protect against unauthorized access to the CIT and OS functions:

- Port security
- Network element login security
- Enhanced user login security.

For detailed information, see Chapter 5, “Operations, Administration, Maintenance, and Provisioning.”

Physical Features

WaveStar OLS 40G packaging is designed for ease of use and adaptability. The following information highlights 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 WaveStar OLS 40G. Front access provides greater flexibility, permitting placement of the equipment in physically restricted locations.

Equipment Packages

WaveStar OLS 40G is available in the following packages:

- Cabinets
- Bay frames
- Miscellaneously-mounted.

Easy Installation and Self-tests

WaveStar OLS 40G 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.

A set of automatic turn-up tests is provided to verify that installation cabling is present to and from various circuit packs for each optical line. A manual local test is also provided to verify components are working properly. Since test signal generators and detectors are integrated into the system, external test equipment is not needed.

Applications

3

Applications

3

This chapter describes WaveStar OLS 40G transmission elements, configurations, applications, and the basics of its transmission technology.

For more information about the physical components of WaveStar OLS 40G, see Chapter 4, “Product Description.” For information about Lucent products that are compatible with WaveStar OLS 40G, see the documents referenced in the section “Documentation for Related Equipment and Software” in “About This Document.”

Optical Transmission Elements

WaveStar OLS 40G is a bit rate-independent optical system that can be used in a variety of applications. The following sections describe basic WaveStar OLS 40G transmission elements and configurations that use these elements.

WaveStar OLS 40G uses Optical Amplifiers (OAs), Optical Multiplexer Units (OMUs), Optical Demultiplexer Units (ODUs), and Optical Translator Units (OTUs/OTPMs) as its basic components.

Optical Amplifier

WaveStar OLS 40G Optical Amplifier (OA) is an erbium-doped fiber amplifier (EDFA). OAs generate high optical power which supports longer optical sections and lines between lightwave terminals than traditional lightwave applications. For any given application, one OA code can serve as a power amplifier, pre-amplifier, or repeater.

WaveStar OLS 40G uses one or two-OAs per line at each End Terminal site. Depending on the type of operation, one OA serves as a power amplifier at the transmit end and the other serves as an optional pre-amplifier at the receive end. At Repeater sites, an OA serves as an optical repeater. Each OA can amplify the multiplexed signals, handling up to sixteen wavelengths simultaneously.

Table 3-1 lists the four types of OAs available in Release 3.1.1 and their associated applications.

Table 3-1. WaveStar OLS 40G Optical Amplifiers

OA Code	Application	Two-OA Operation	Single-OA Operation
LEA6	Long Span	✔	
LEA7	Long Reach	✔	
LEA104	Long Span	✔	
LEA105	Short Reach	✔	✔

Optical Multiplexer Units/Optical Demultiplexer Units

Three types of OMUs (8λ and 16λ) and four types of ODUs (one 8λ, one 16λ with supervisory channel, one 16λ without supervisory channel, and one 16λ self-powered without supervisory channel) are supported by WaveStar OLS 40G.

NOTE:
When using the OPS feature, the SPODU circuit pack is required.

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 sixteen separate wavelength signals. Table 3-2 lists the types of optical units supported by WaveStar OLS 40G.

Table 3-2. WaveStar OLS 40G OMUs/ODUs

Unit	Code	Wavelengths	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
SPODU*	BSY1	16	Does not provide supervisory channel output
SPOMU	BSY2	16	Required on seven and eight span systems

*. Required when using the OPS feature. Must be used in place of ODU circuit packs.

Optical Translator Units

Release 3.1.1 provides Optical Translator Units (OTUs and OTPMs) supporting up to sixteen wavelengths and OC-48/STM-16, OC12/STM-4, OC-3/STM-1, and 150-750 Mb/s bit rates. With the integration of WaveStar OLS 40G and OT, the operations capabilities of OTUs and QOTUs (used in conjunction with WaveStar OLS 40G) have been enhanced for greater efficiency in both Short and Long Reach applications.

The OC-48/STM-16 OTUs are standard WaveStar OLS 40G OTUs covering sixteen wavelengths. For OC-12/STM-4, OC-3/STM-1, and 150-750 Mb/s applications, a Quad Optical Translator Unit (QOTU) carrier pack holds up to four Optical Translator Port Modules (OTPMs) in any combination.

Table 3-3 lists the OTUs and OTPMs supported in Release 3.1.1

Table 3-3. WaveStar OLS 40G OTUs/OTPMs

Code	Bit Rate	Wavelength Band	Notes
41A(1-16)C	OC-48 / STM-16	1.5 µm	OTU. For applications with dispersion of up to 6800 ps / nm
41BB	OC-48 / STM-16	1.3 µm	OTU
41C(1-16)C	OC-48 / STM-16	1.5 µm	For applications with dispersion of up to 10,900 ps / nm
41S			QOTU carrier pack for OTPMs
42A(1-16)	OC-12 / STM-4	1.5 µm	OTPM
42B	OC-12 / STM-4	1.3 µm	OTPM
43A(1-16)	OC-3 / STM-1	1.5 µm	OTPM
43B	OC-3 / STM-1	1.3 µm	OTPM
44A(1-16)	150-750 Mb / s	1.5 µm	LSBB OTPM
44B	150-750 Mb / s	1.3 µm	LSBB OTPM

Other Elements

In addition to the transmission elements described above, WaveStar OLS 40G contains telemetry and control circuits, as well as having a collocated external miscellaneous discrete unit (EMDU). These units are described in Chapter 4, “Product Description.”

Basic WaveStar OLS 40G Configurations

WaveStar OLS 40G 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. The information in this section describes basic configurations in which WaveStar OLS 40G can be used.

Applications Without Repeaters

Point-to-point applications may or may not need repeaters. Two types of applications can be applied to this situation. They are:

- Two-OA
- Single-OA.

Two-OA Applications

For Long Span and Long Reach applications, two-OAs are used to prevent signal degradation. Figure 3-1 shows a single, bidirectional WaveStar OLS 40G span. In the transmit direction, a WaveStar OLS 40G End Terminal does the following:

- Combines up to sixteen optical wavelengths* onto a common optical fiber (performed by the OMU)
- Amplifies the light (performed by the OA)
- Launches the signal (optical line signal) onto the transmission fiber
- Couples the supervisory signal into the optical line signal
- Monitors the power of each optical signal in the OA.

At the receive end, a WaveStar OLS 40G End Terminal does the following:

- Receives the low level optical line signal from the optical line and amplifies it (performed by the second OA)
- Optically demultiplexes up to sixteen optical signals from the optical line (performed by the ODU)

* These wavelengths originate from up to sixteen OC-48/STM-16 add/drop multiplexers [ADM]. The receive-end ODU demultiplexes the optical line signal back into sixteen optical wavelengths for transmission to the receive-end ADMs.

- Demultiplexes the supervisory signal from the optical line signal and provides this to the TLM circuit pack
- Monitors the received power of each optical wavelength and the total received optical power.

Depending on the particular span distance, the OAs can be either LEA6, LEA7, LEA104, or LEA105. See Chapter 6, “System Planning and Engineering” for specific engineering rules.

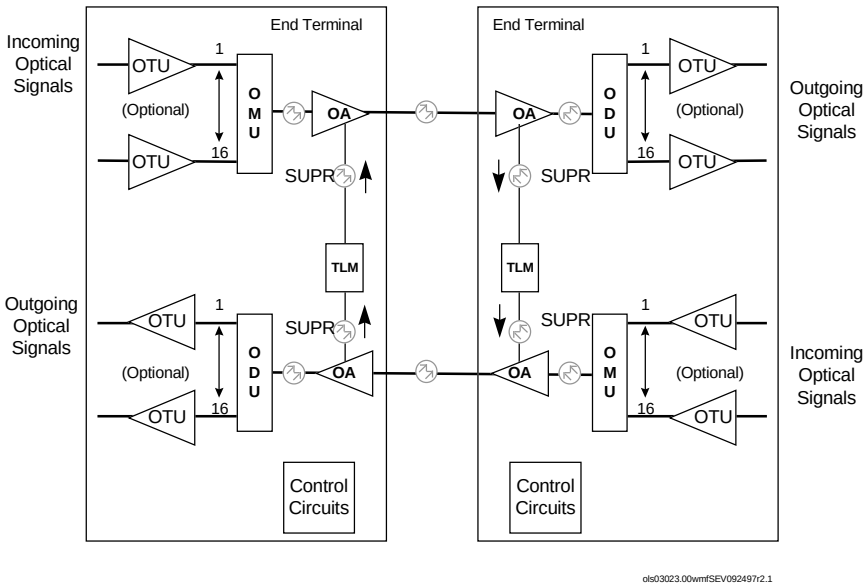


Figure 3-1. WaveStar OLS 40G Single Span with Two-OA Operation

Single-OA Applications

Over shorter span lengths, pre-amplification at the receive-end ODU is not necessary because signal degradation is less prevalent. Figure 3-2 shows a single, bidirectional WaveStar OLS 40G span in a Short Reach application. One OA is used on the transmit side of the optical fiber without an OA on the receive end. Due to the short span length, the LEA105 OA and the 606B ODU are required in these Short Reach applications. Except for the absence of a receive pre-amplifier, the operation of this type of end terminal is the same as other end terminal shelves.

NOTE:
The OPS feature does not support Single-OA applications.

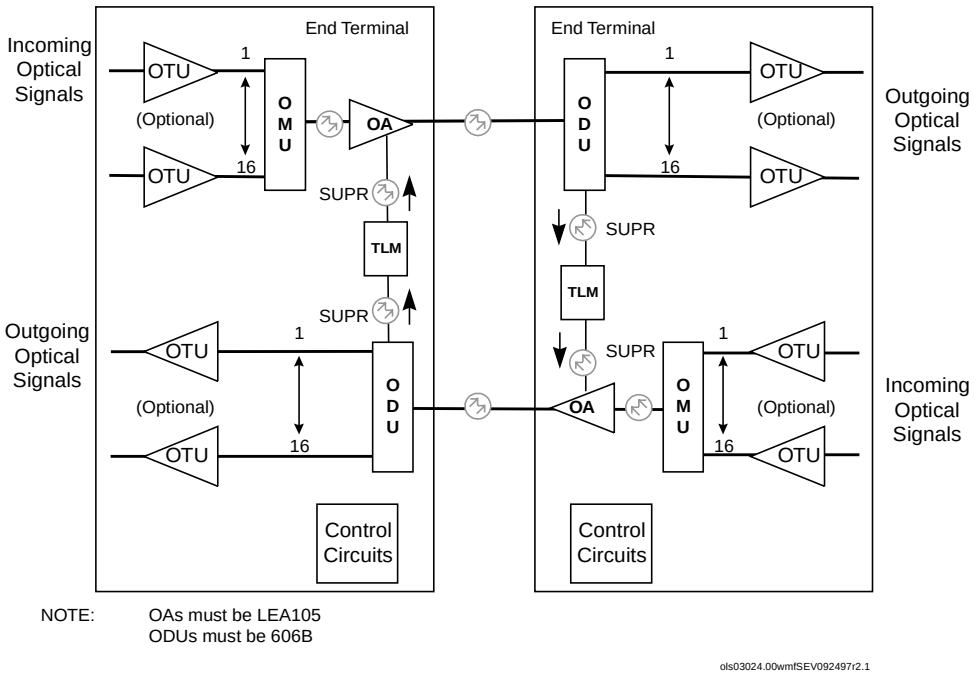


Figure 3-2. WaveStar OLS 40G Single Span with Single-OA Operation

Dual-facing Shelf Applications

With its dual-facing shelf capability, collocated end terminals can be combined both physically and operationally into a single network element. Figure 3-4 illustrates a dual-facing shelf configuration utilizing one OA circuit pack on both bidirectional lines.

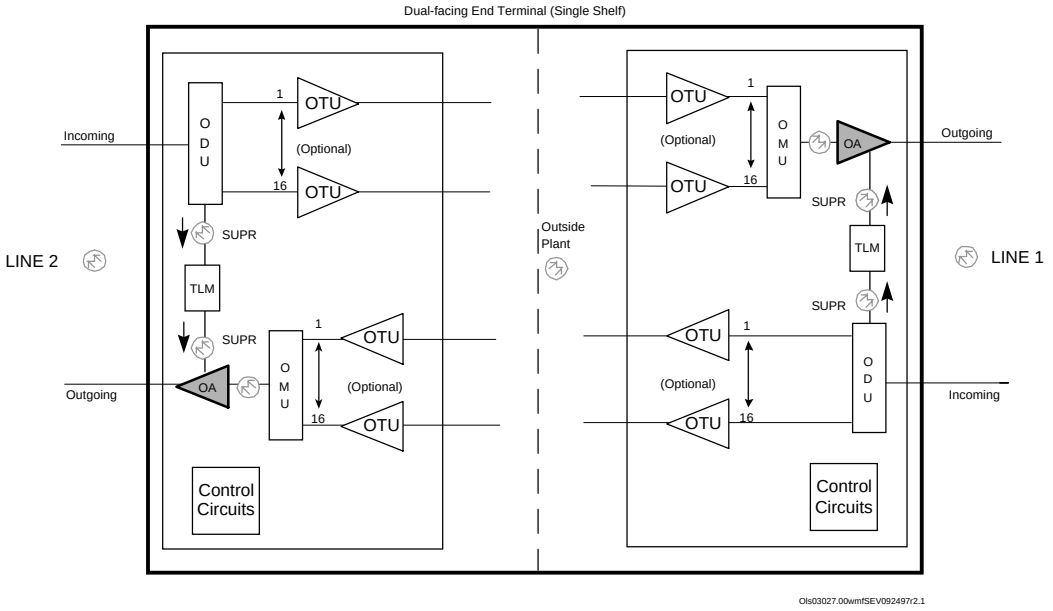


Figure 3-3. Single-OA/Single-OA Dual-facing Shelf

Figure 3-4 illustrates a dual-facing shelf configuration utilizing two OA circuit packs on both bidirectional lines.

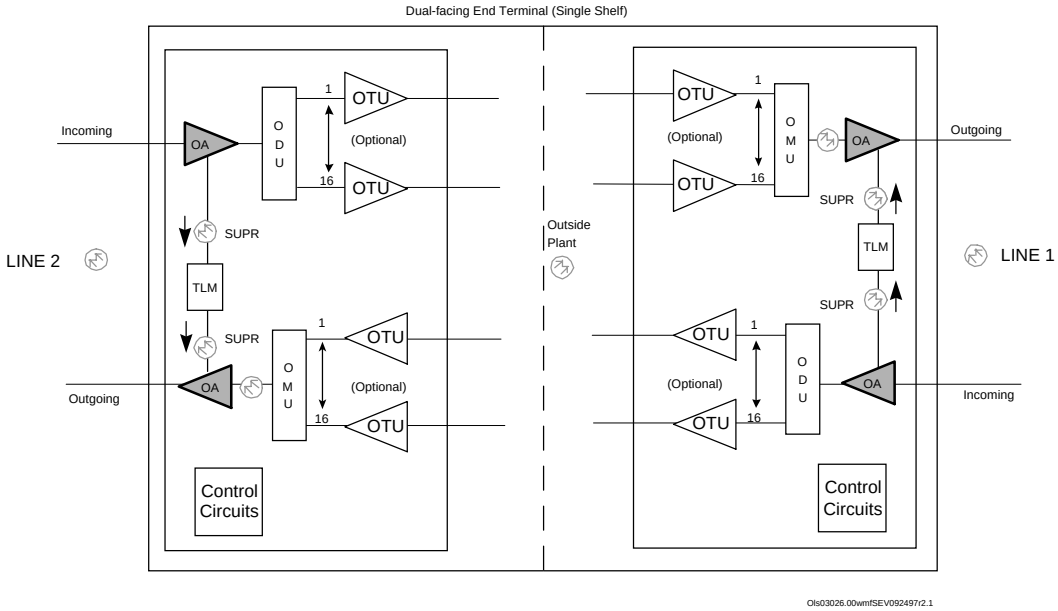


Figure 3-4. Two-OA/Two-OA Dual-facing Shelf

Figure 3-5 illustrates a dual-facing shelf configuration utilizing one OA circuit pack on one bidirectional line and two OA circuit packs on the other.

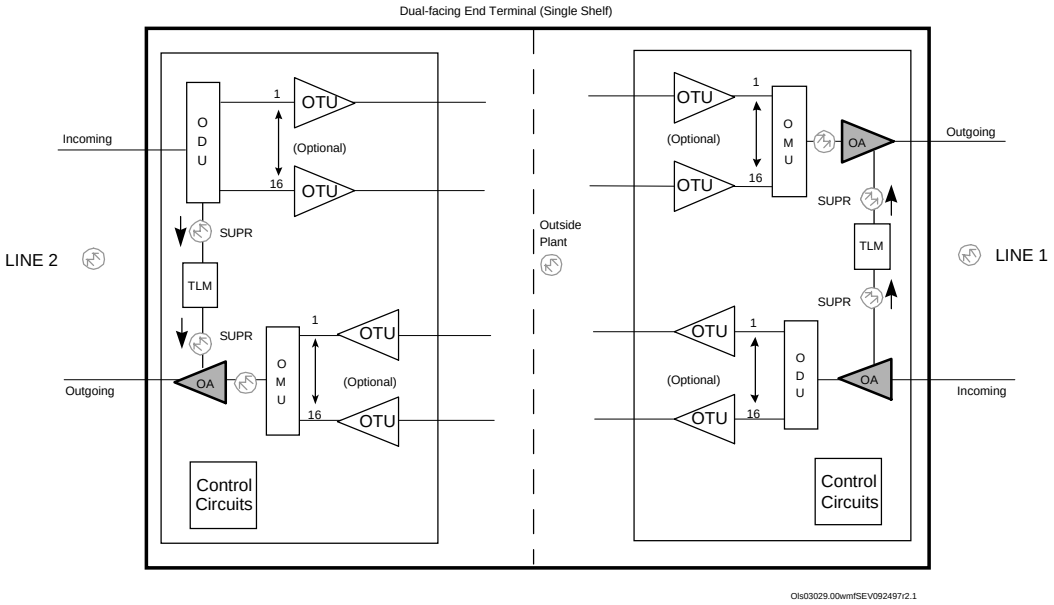


Figure 3-5. Single-OA/Two-OA Dual-facing Shelf

Figure 3-6 illustrates a dual-facing shelf configuration utilizing two OA circuit packs on one bidirectional line and one OA circuit pack on the other. This configuration is similar to the one shown in Figure 3-5; the OA circuit pack arrangement has been switched between lines.

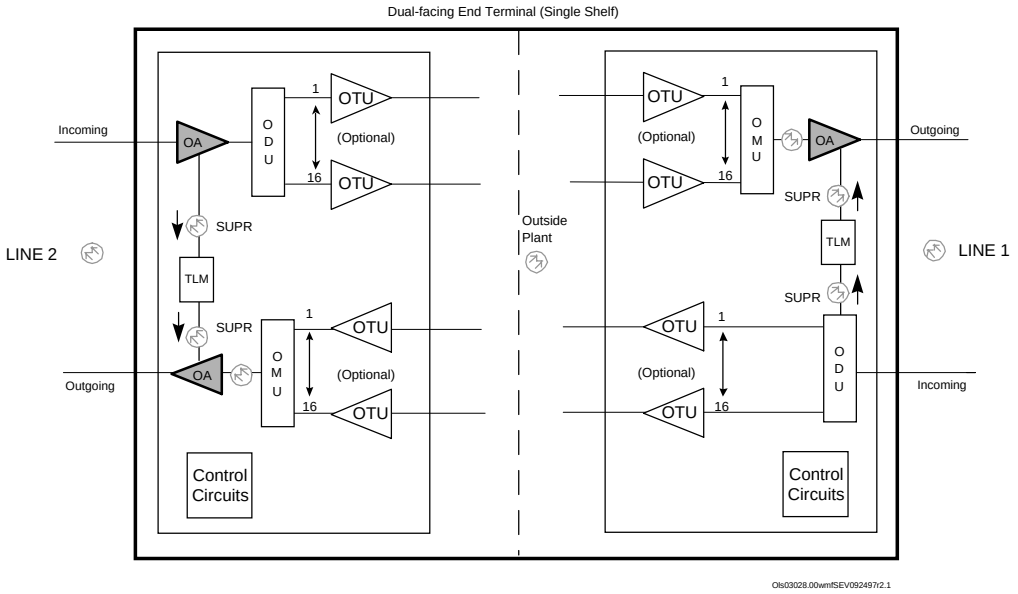


Figure 3-6. Two-OA/Single-OA Dual-facing Shelf

WaveStar OLS 40G can also utilize OTUs in order to provide compatible optics. This allows different bit rate signals to be carried over a single WaveStar OLS 40G.

Figure 3-7 illustrates an WaveStar OLS 40G application designed to carry 2-fiber bidirectional traffic on either path-switched or line-switched rings. In the illustration, all OTUs are associated with the same WaveStar OLS 40G which is configured as a dual-facing shelf. The term, "ADM," refers generically to SONET/SDH ADM equipment. In this figure, wavelength add/drop is also supported.

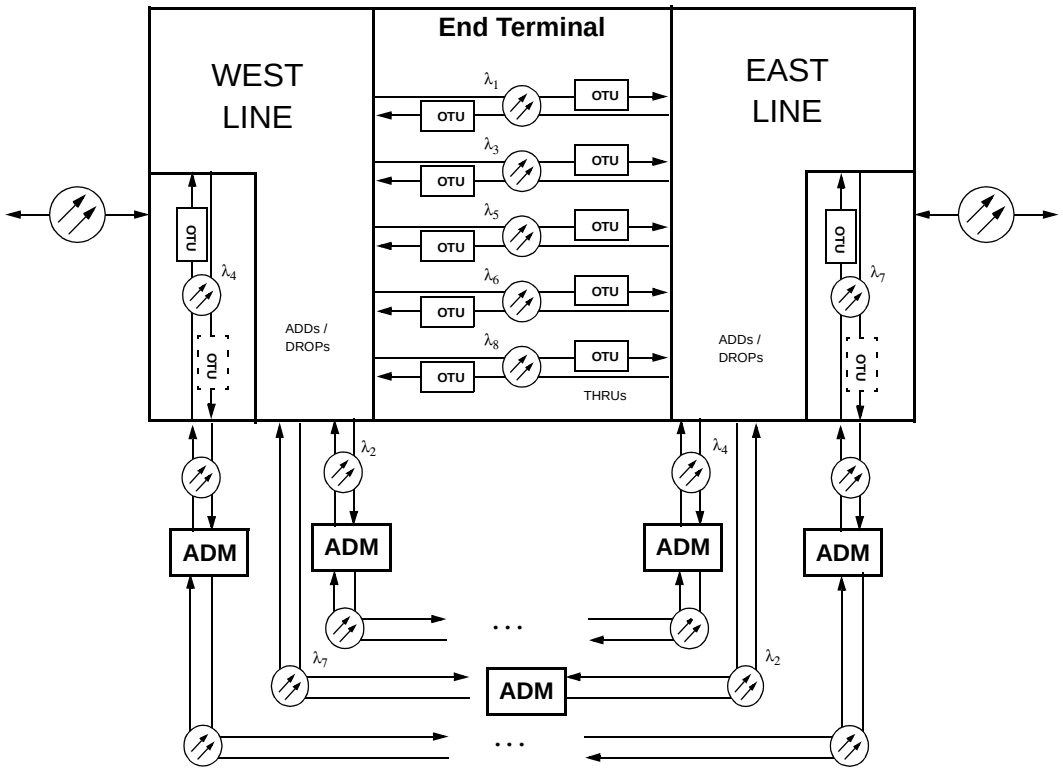


Figure 3-7. WaveStar OLS 40G Application Using OTUs

Applications With Repeaters

Figure 3-8 shows a multi-span WaveStar OLS 40G. For through-transmission of the optical line signal, WaveStar OLS 40G Repeaters are used in the intermediate spans. WaveStar OLS 40G Repeaters contain only OAs and control circuit packs. OMUs and ODUs are not required. Repeaters use LEA6, LEA7, or LEA104 OAs, depending on span distance and fiber type. Specific engineering rules appear in Chapter 6, "System Planning and Engineering."

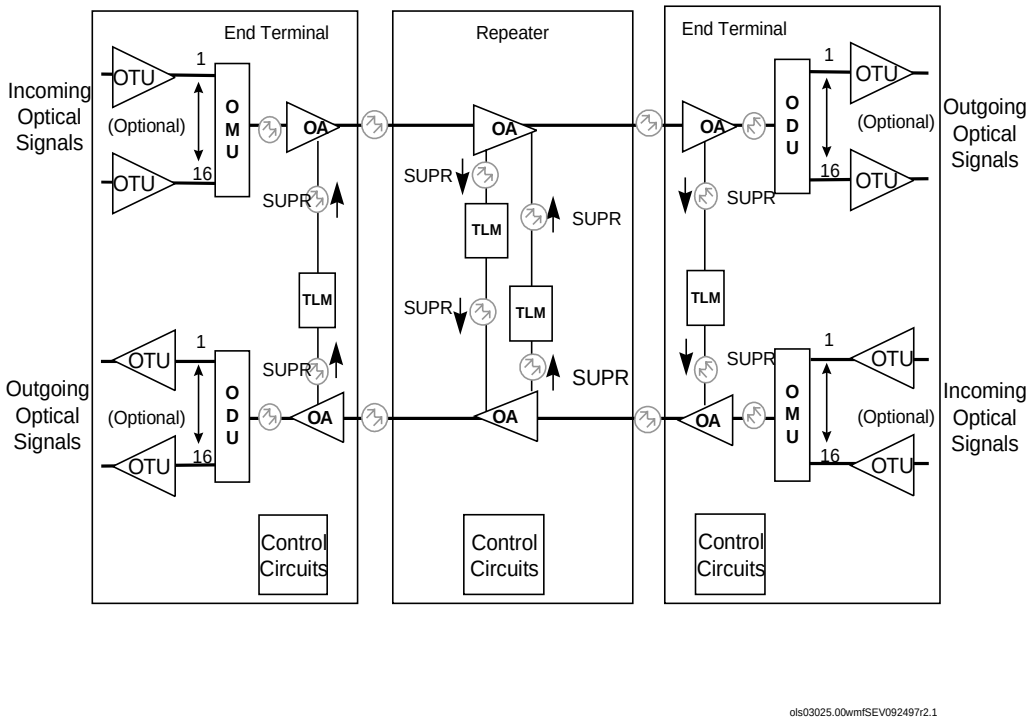


Figure 3-8. WaveStar OLS 40G Multiple Span System with Repeaters (one shown)

Applications With Multi-Regenerated Spans

Figure 3-9 shows a multi-span WaveStar OLS 40G that extends beyond the eight span capability of the LEA7 OA. To go beyond five spans (LEA6, 8λ or LEA104, 16λ) or eight spans (LEA7), the optical line signal must be regenerated. Regeneration is performed by OTUs / QOTUs in an OT Bay or Cabinet arrangement or in miscellaneously-mounted OT shelves. Engineering rules appear in Chapter 6, "System Planning and Engineering."

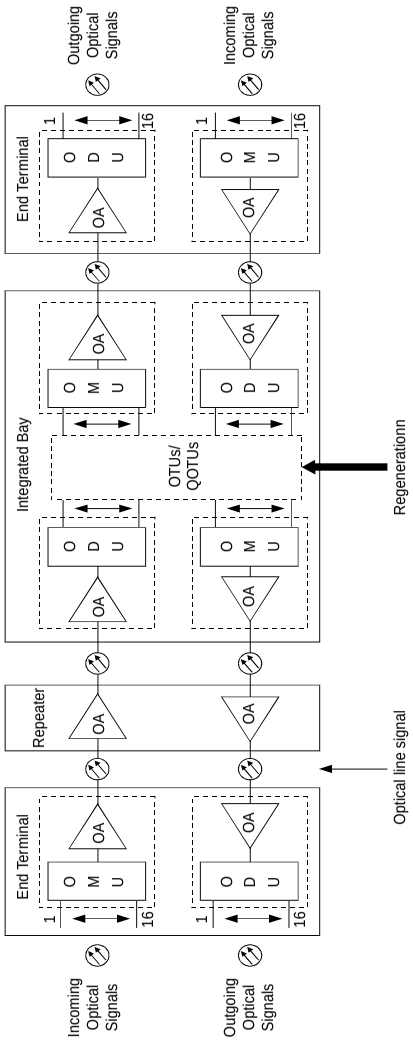


Figure 3-9. Multiple WaveStar OLS 40G Systems and OTU/QOTUs as Regenerators

Applications With Wavelength Add/Drop (WAD)

Figure 3-10 shows a multi-span WaveStar OLS 40G with an intermediate WAD site. This site consists of an WaveStar OLS 40G Integrated Bay configured as dual-facing. It comprises an End Terminal shelf, an OT System Controller Shelf, and one OT Complementary Shelf. Figure 3-7 also illustrates wavelength add/drop.

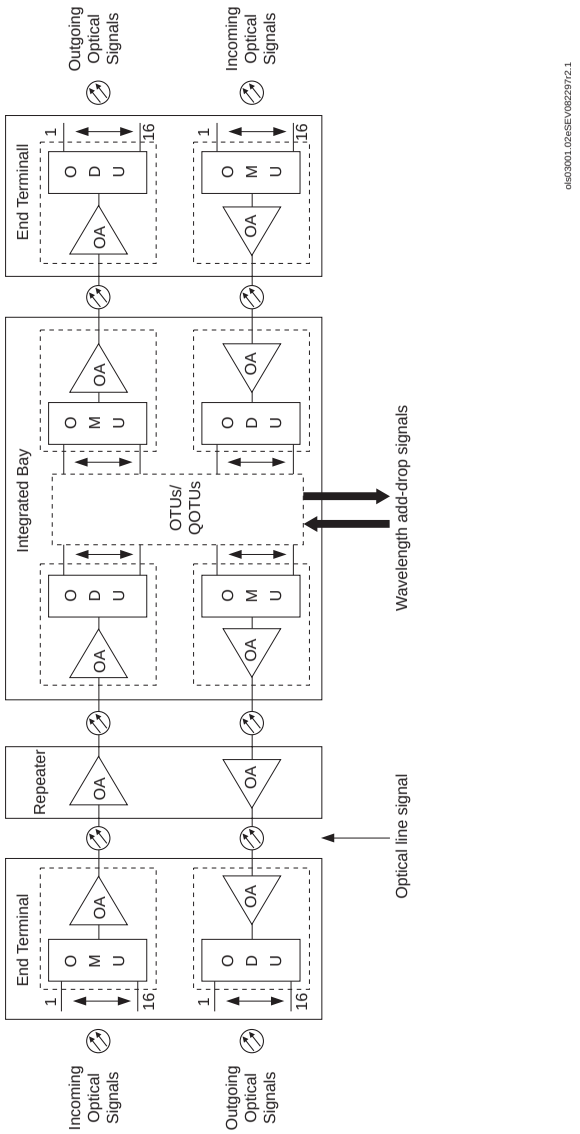


Figure 3-10. WaveStar OLS 40G With Wavelength Add/Drop (WAD)

In applications where it is desirable to carry DCC information between WaveStar OLS 40G systems, an End Terminal Shelf can be provisioned as a dual-facing network element. Dual-facing shelves allow a compact terminal design to handle WAD applications for both two-fiber and four-fiber rings. Additionally, dual-facing shelves allow extension of the operations domain across WAD sites.

Product Description

4

Product Description

4

This chapter describes shelf design, package descriptions, and configuration information for the WaveStar OLS 40G. It also includes package illustrations and information on equipment packages, system control, physical design, transmission, protection, and powering.

Introduction

WaveStar OLS 40G 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 (Single)
- OLS Integrated Cabinet or Bay (Double)
- OLS Integrated Cabinet or Bay (Triple 1)
- OLS Integrated Cabinet or Bay (Triple 2)

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

- 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.

For descriptions and illustrations of these packages, refer to “WaveStar OLS 40G Packages.”

OLS Bay/Cabinet Design

OLS Bay and Cabinet shelves are similar to each other but have key differences. Bay-mounted shelves have front covers while cabinet 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). In addition, miscellaneously-mounted shelves are not used in cabinet arrangements. Figure 4-1 shows the WaveStar OLS 40G Cabinet.

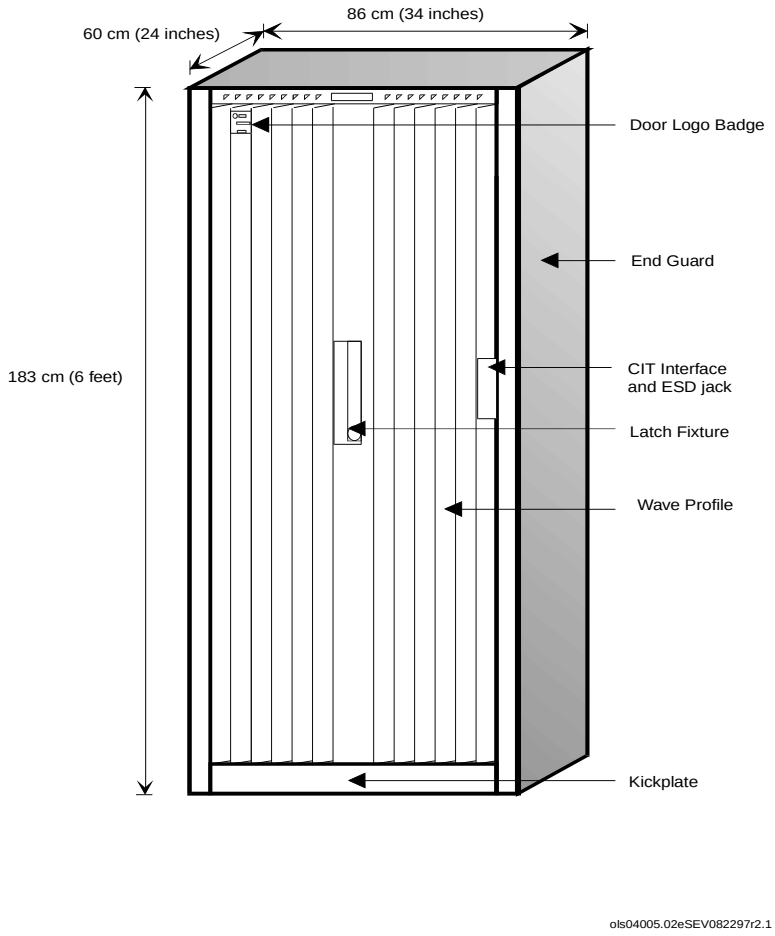
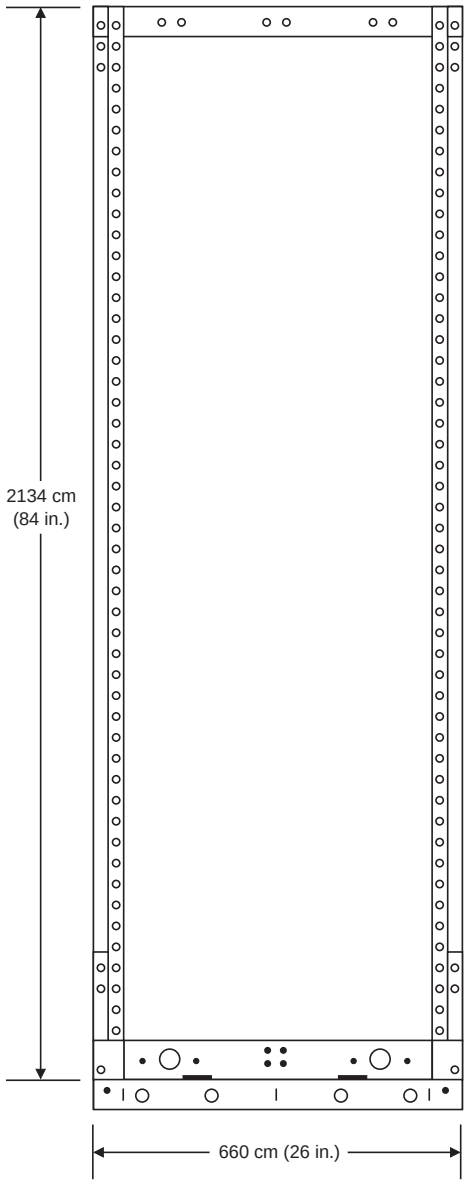


Figure 4-1. OLS Cabinet (Doors Closed)

Figure 4-2 shows a front view of the WaveStar OLS 40G Bay frame.



ols04042.01eSEV082297r2.1

Figure 4-2. WaveStar OLS 40G Bay Frame

WaveStar OLS 40G Shelf Design

WaveStar OLS 40G and OT shelves can be used in a variety of ways. They 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 WaveStar OLS 40G shelves include:

- Two front shelf covers (flat or Newlook-2000)
- Attached heat baffle
- User panel
- Bay mounting brackets.

Figure 4-3 shows a miscellaneously-mounted WaveStar OLS 40G shelf with front covers (bay-mounted shelves are similar).

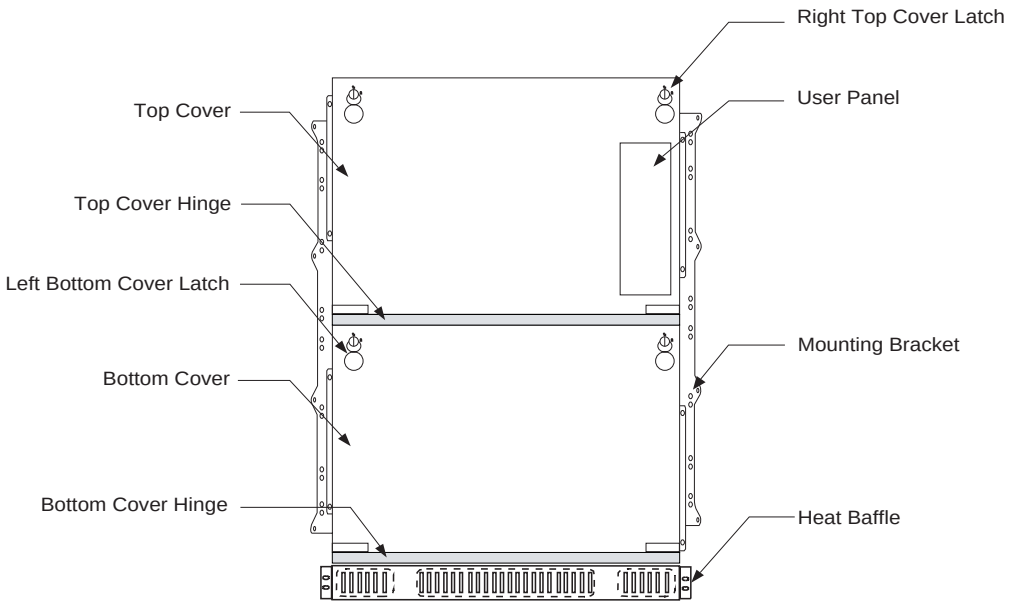


Figure 4-3. Miscellaneously-Mounted WaveStar OLS 40G Shelf with Front Covers (flat cover shown)

Miscellaneously-mounted and bay-mounted OT shelves include:

- One front shelf cover (flat or Newlook-2000)
- 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).

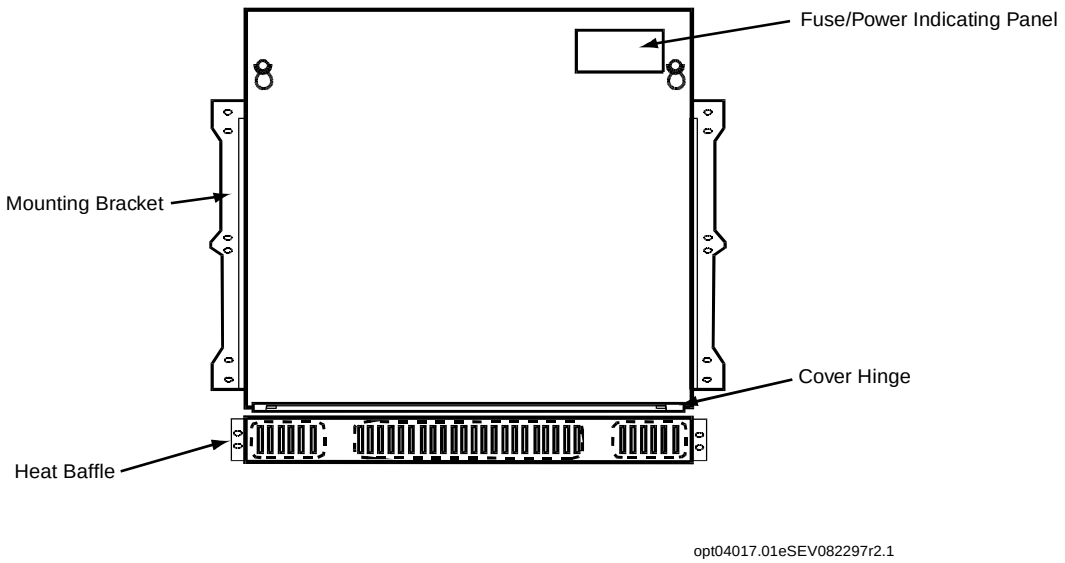
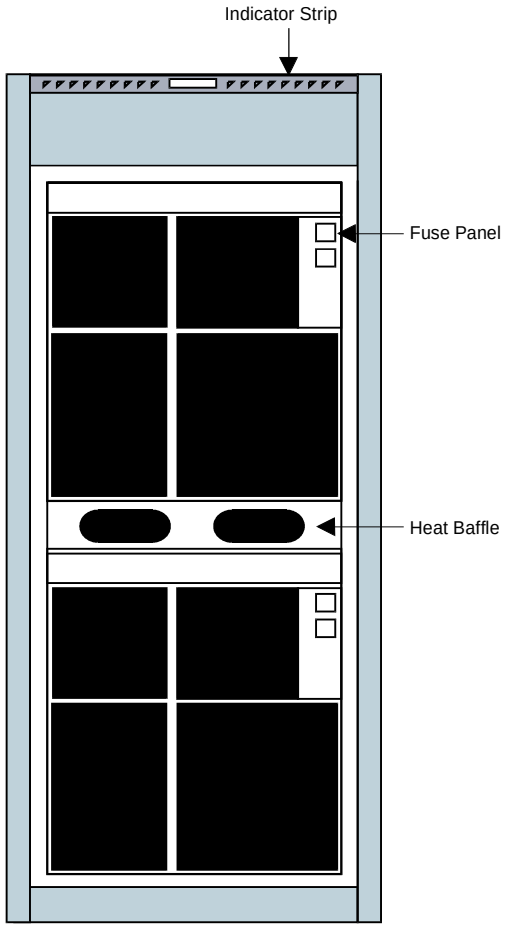


Figure 4-4. Miscellaneously-mounted OT Shelf with Front Cover (flat cover shown)

WaveStar OLS 40G and OT cabinet shelves include:

- Fuse panel
- Alarm and status indicators (provided on an indicator strip at the top of the cabinet, rather than on shelf indicator panels).

Figure 4-5 shows the WaveStar OLS 40G cabinet shelf (cabinet doors open). Externally, both the WaveStar OLS 40G and OT Cabinets are similar.



Ols04041.02wmfSEV012298r3.0

Figure 4-5. WaveStar OLS 40G Cabinet Shelf

Figure 4-6 depicts an unequipped WaveStar OLS 40G Ingtegrated Bay.

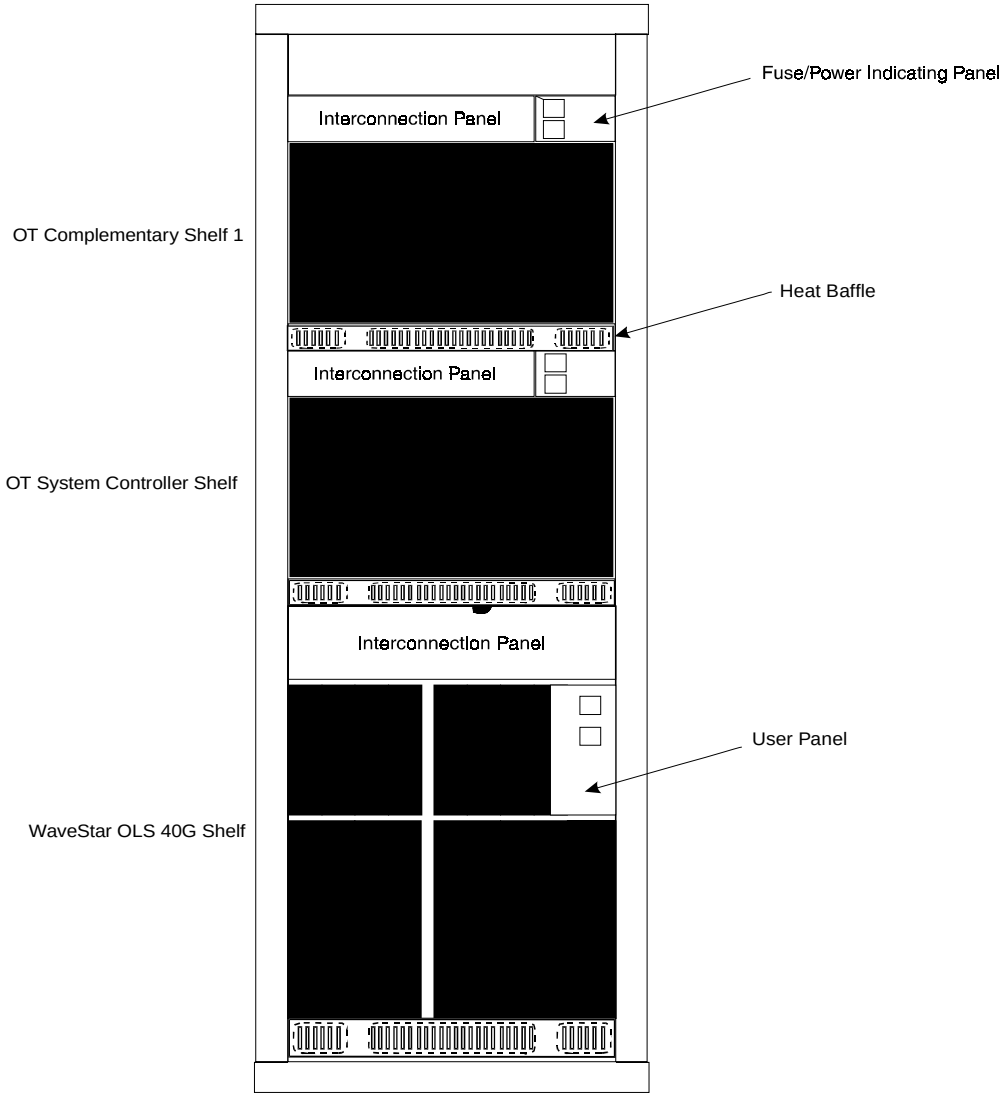


Figure 4-6. WaveStar OLS 40G Integrated Bay Shelves

WaveStar OLS 40G Shelf Descriptions

This section describes the basic types of WaveStar OLS 40G shelves that are equipped with circuit packs. These shelves include the following:

- End Terminal Shelf
- Repeater Shelf
- Optical Translator System Controller Shelf
- Optical Translator Complementary Shelves 1 and 2.

End Terminal Shelf

In WaveStar OLS 40G End Terminal shelves, the Optical Multiplexer Units (OMU) and Optical Demultiplexer Units (ODU) are placed in different order at each end of an WaveStar OLS 40G system to produce different shelf configurations, all of which are provisionable by network element software.

This type of shelf contains telemetry (TLM) circuit packs, OAs, OMUs, and ODUs that provide Dense Wavelength Division Multiplexing (DWDM) of up to sixteen wavelengths per fiber, and system control circuit packs (TOHCTL, SYSCTL, and SYSMEM). For information on circuit packs, refer to “Transmission Circuit Packs” and “Control Circuit Packs” later in this chapter. See Chapter 5, “Operations, Administration, Maintenance, and Provisioning,” for provisioning information and shelf illustrations.

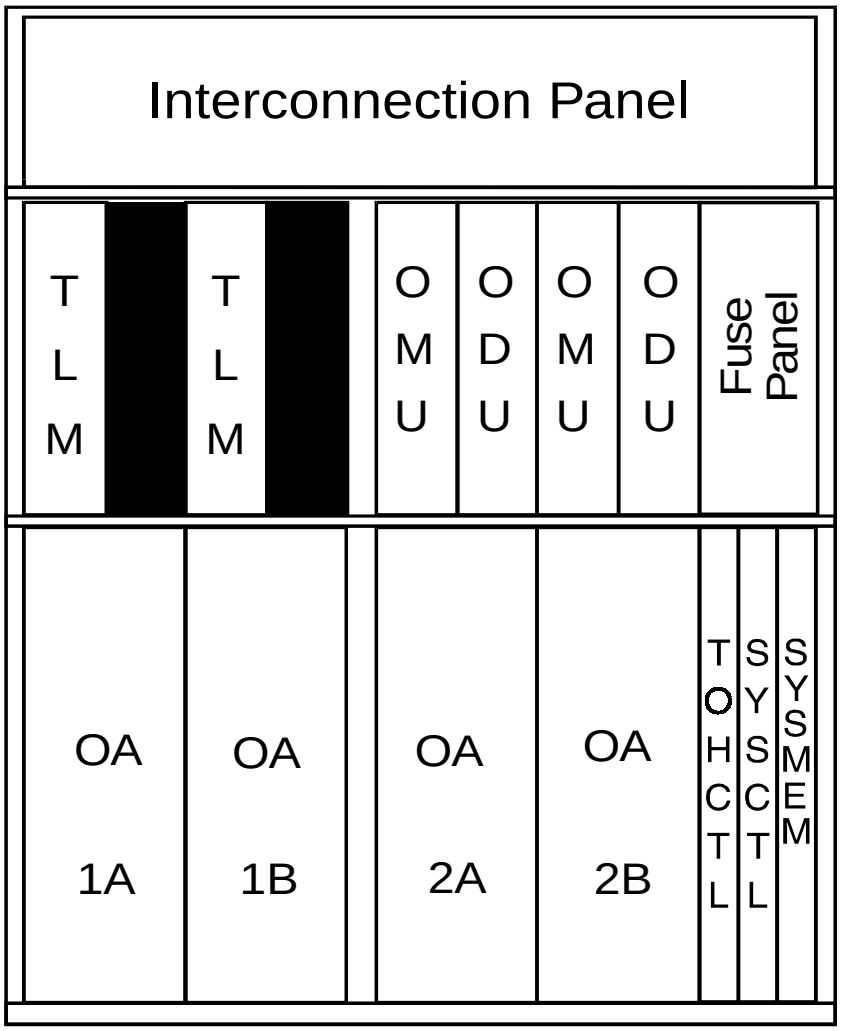


Figure 4-7. WaveStar OLS 40G End Terminal Shelf (fully equipped)

WaveStar OLS 40G Repeater Shelf

The WaveStar OLS 40G Repeater Shelf, shown in Figure 4-8, is similar to the End Terminal Shelf, except that it does not contain an OMU or ODU and it requires two TLM circuit packs per line. The 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 “Control Circuit Packs” later in this chapter.

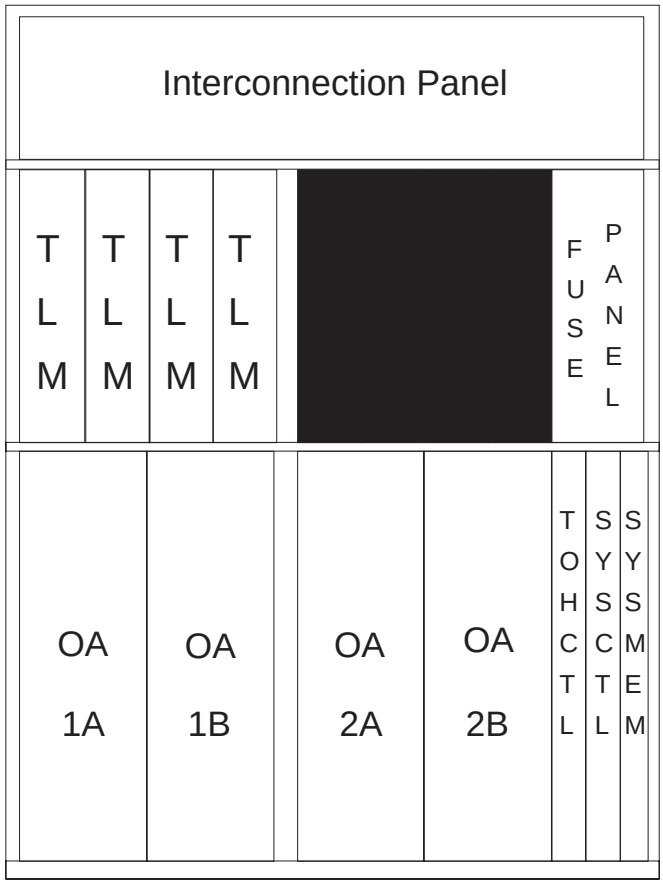


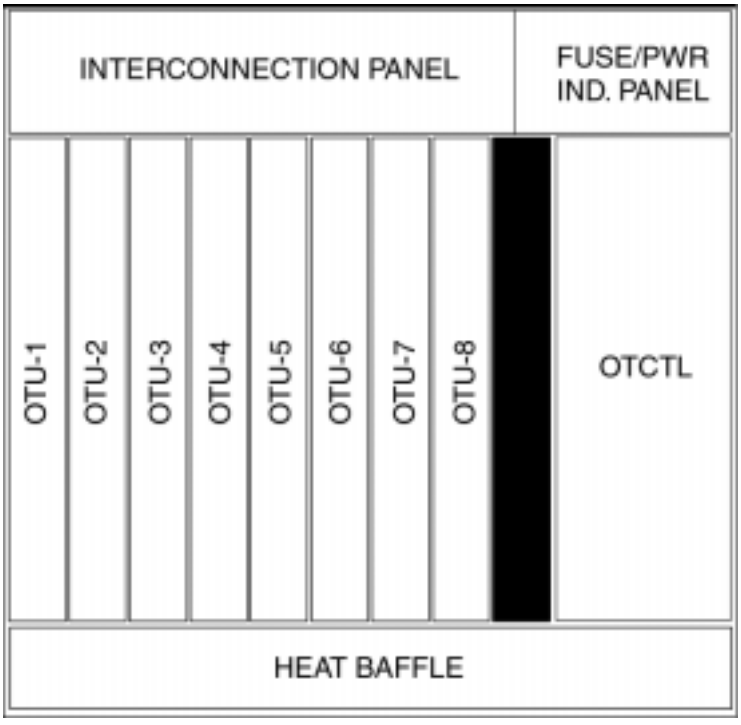
Figure 4-8. WaveStar OLS 40G Repeater Shelf (cabinet; fully equipped)

OT System Controller Shelf

To accommodate WaveStar OLS 40G / OT integration, the OT Controller (OTCTL) circuit pack is inserted into the shelf between the System Controller circuit pack (SYSCTL) and the OTUs. It is controlled by the existing SYSCTL and SYSMEM circuit packs in the WaveStar OLS 40G shelf. For information on circuit packs, refer to "Transmission Circuit Packs" and "Control Circuit Packs" later in this chapter.

In addition to the OTCTL, each miscellaneously-mounted OT System Controller Shelf consists of eight OTU (or four QOTU) circuit pack slots and one empty slot.

Figure 4-9 shows a miscellaneously-mounted OT System Controller Shelf without the front shelf cover.



ols04033.01tifSEV012198r3.0

Figure 4-9. Miscellaneously-mounted OT 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 (one QOTU utilizes two slots), an interconnection panel, a fuse / power indicating panel, a designation label strip, an attached heat baffle, power filters, cables, a front and rear cover, and an indicator strip. For information on circuit packs, refer to "Transmission Circuit Packs" and "Control Circuit Packs" later in this chapter.

The Complementary Shelves each have a fuse / power indicating panel that displays a green-colored Power On (PWR ON) LED. This LED illuminates to indicate that the respective shelf is receiving -48 V power.

Figure 4-10 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 in Shelf 2.

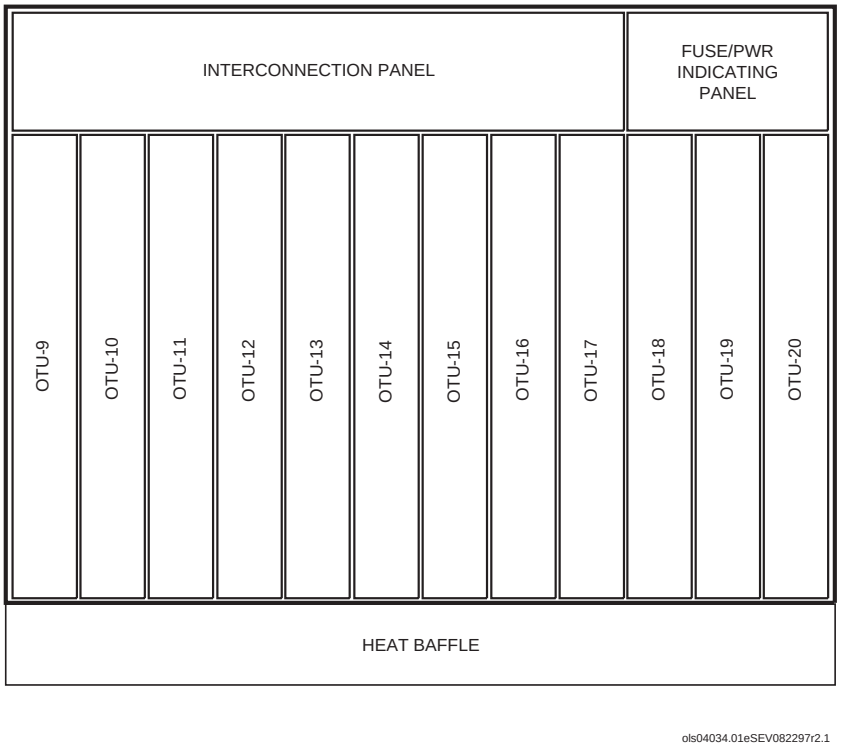


Figure 4-10. Miscellaneously-Mounted Complementary Shelf 1 (12 OTUs; fully equipped)

OPS, SPODU, and SPOMU Circuit Pack Dimensions and Location

The OPS, SPODU, and SPOMU circuit packs are each 8 cm wide (double width). The circuit packs occupy two slots in an OT System Controller or Complementary Shelf. Implementation does not require any changes to the OT shelf.

Figure 4-11 shows one possible location of the new circuit packs in an OT Complementary Shelf.

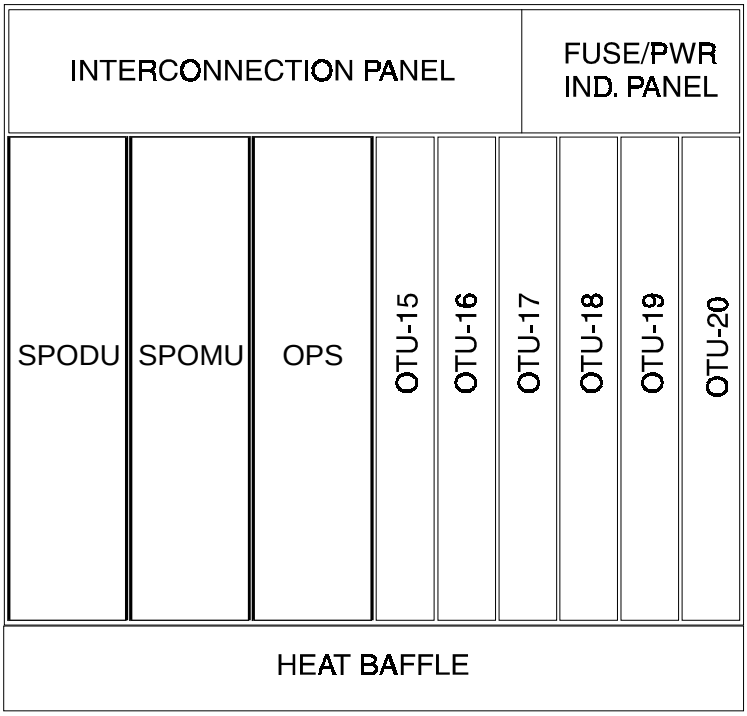


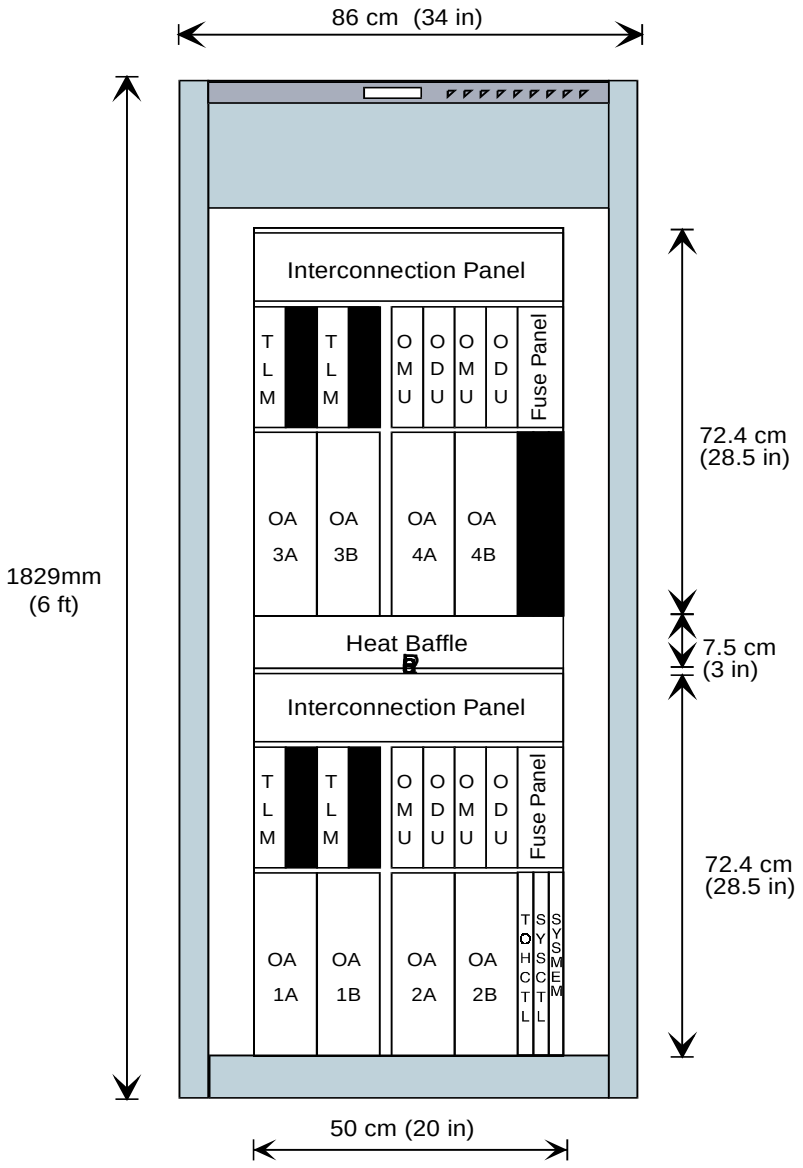
Figure 4-11. OT Complementary Shelf Location

WaveStar OLS 40G Packages

This section describes the different types of WaveStar OLS 40G packages that can be housed in cabinet or bay frame arrangements. All WaveStar OLS 40G network element configurations (except the Integrated Bay) are available in cabinet configurations. Packages include:

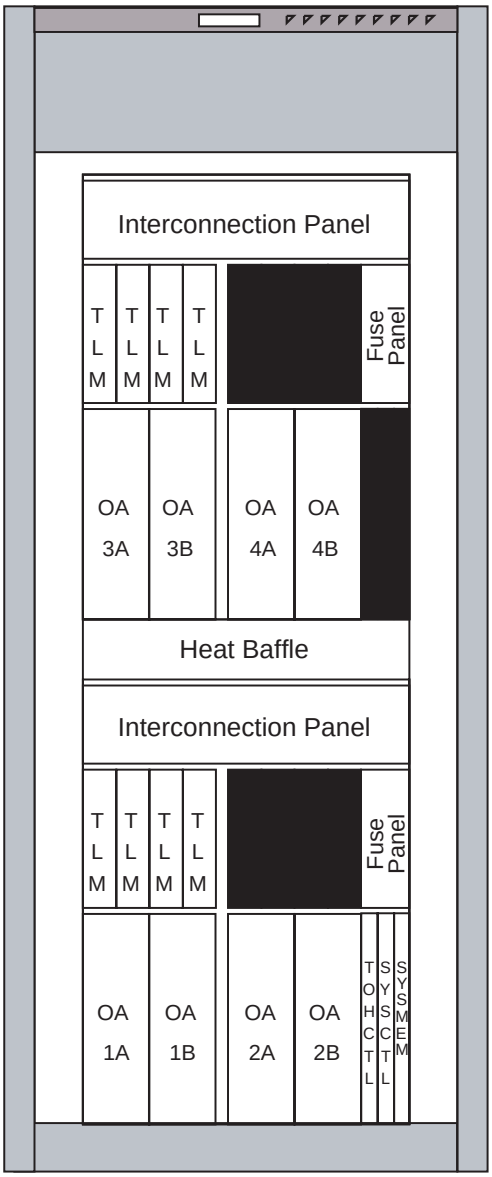
- 4-Line End Terminal or 4-Line Repeater Cabinet— houses two shelves, each shelf having a maximum of two bidirectional optical lines for a total of four bidirectional optical lines per cabinet (See Figure 4-12 and Figure 4-13)
- Dual End Terminal or Dual Repeater Bay or Cabinet— houses two independent shelves, each shelf having a maximum of two bidirectional optical lines (See Figure 4-14 and Figure 4-15)
- End Terminal and Repeater Bay or Cabinet— houses two independent shelves, each shelf having a maximum of two bidirectional optical lines (See Figure 4-16 and Figure 4-17)
- Miscellaneously-mounted Shelf— independent WaveStar OLS 40G shelf similar to a bay-mounted shelf
- OT Bay or Cabinet— houses three shelves, containing a maximum of 32 OTUs or 64 OTPMs per cabinet, depending on bit rate (See Figure 4-18 and Figure 4-19)
- Integrated Bay (Single)— houses two OT shelves (20 OTUs or 40 OTPMs) and one End Terminal shelf in one bay, containing two bidirectional optical lines (See Figure 4-20)
- Integrated Bay or Cabinet (Double)— a two-bay / cabinet arrangement housing one End Terminal Shelf and one unequipped shelf (first bay) and three OT shelves (second bay) (See Figure 4-21)
- Integrated Bay or Cabinet (Triple 1)— a three-bay / cabinet arrangement housing two End Terminal Shelves (first bay), three OT shelves (second bay), and three additional OT shelves (third bay) (See Figure 4-22)
- Integrated Bay or Cabinet (Triple 2)— a three-bay / cabinet arrangement housing one End Terminal Shelf and one unequipped shelf (first bay), three OT shelves (second bay), and three additional OT shelves (third bay) (See Figure 4-23).

Illustrations of WaveStar OLS 40G packages are included in the following pages. The majority of these illustrations show cabinet arrangements.



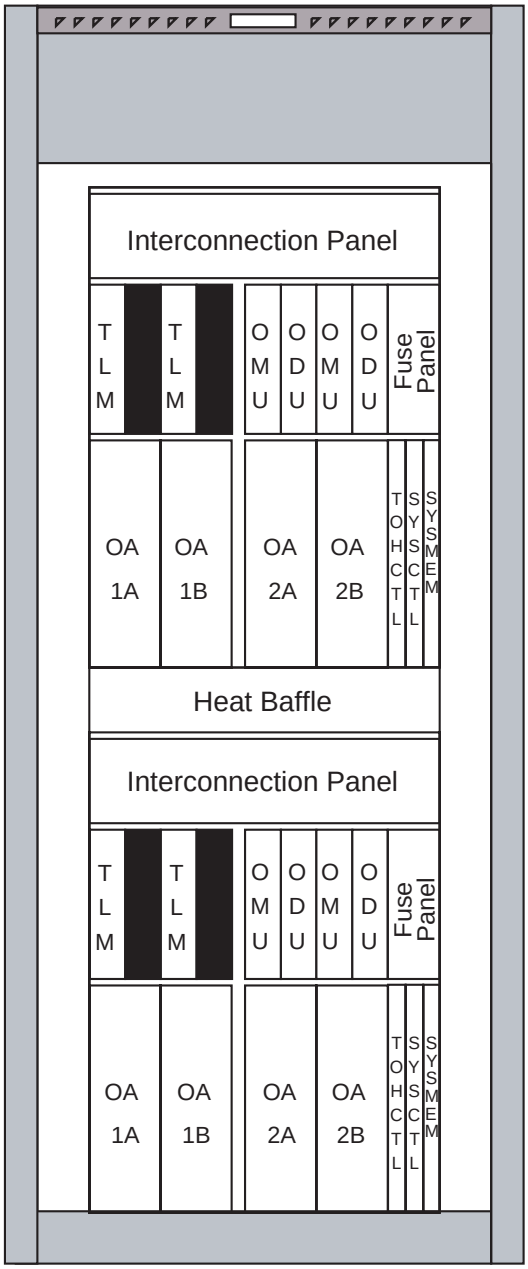
ols04035.01eSEV082297r2.1

Figure 4-12. End Terminal Cabinet for 4 Bidirectional Optical Lines



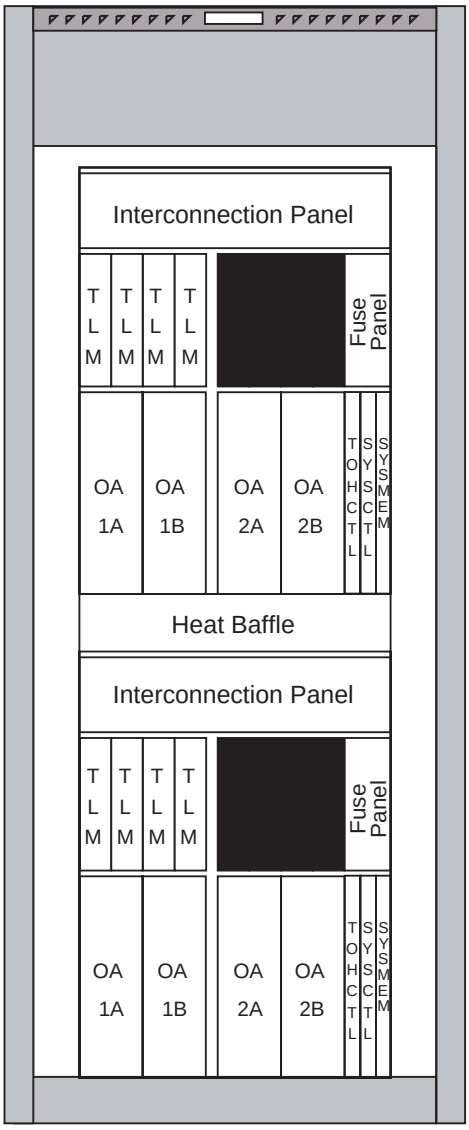
ols04007.01eSEV082297r2.1

Figure 4-13. Repeater Cabinet for 4 Bidirectional Optical Lines



ols04008.02eSEV052298r3.1

Figure 4-14. Dual End Terminal Cabinet (fully equipped)



ols04009.01eSEV082297r2.1

Figure 4-15. Dual Repeater Cabinet (fully equipped)

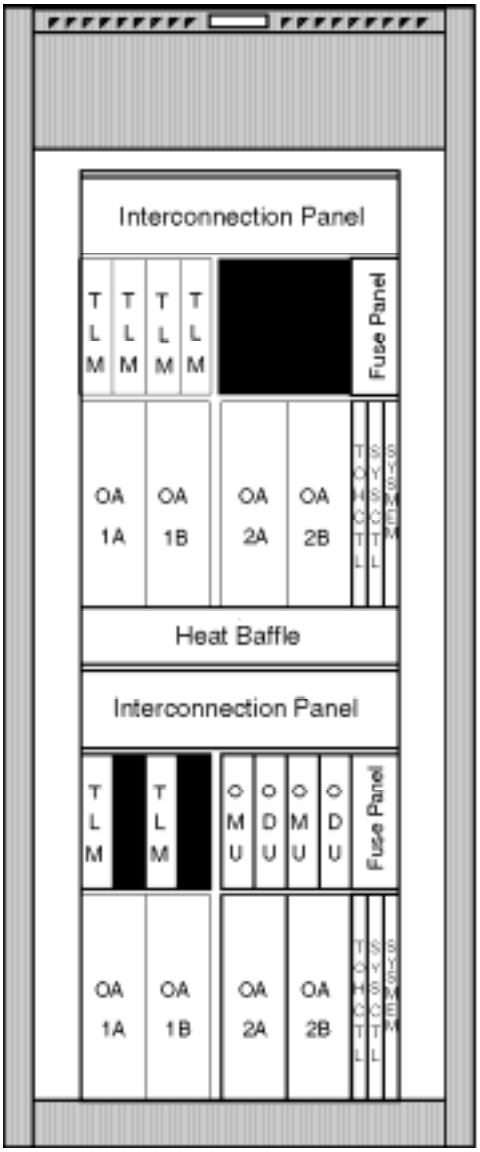


Figure 4-16. End Terminal and Repeater Cabinet

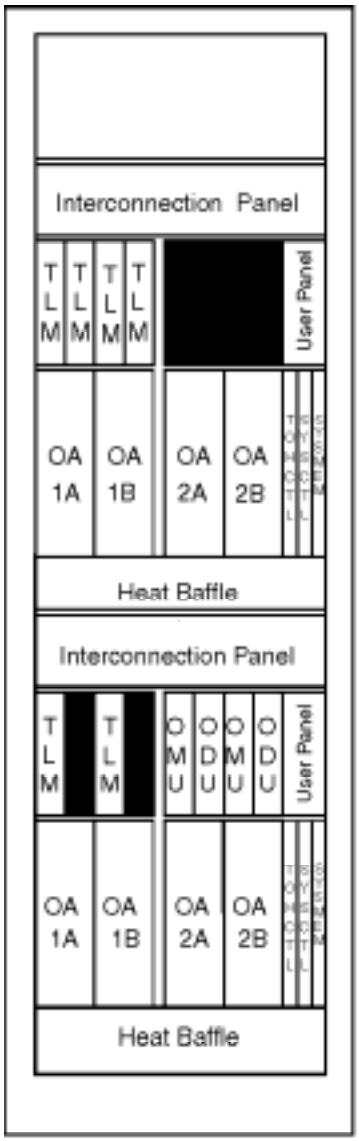


Figure 4-17. Bay-Mounted End Terminal and Repeater

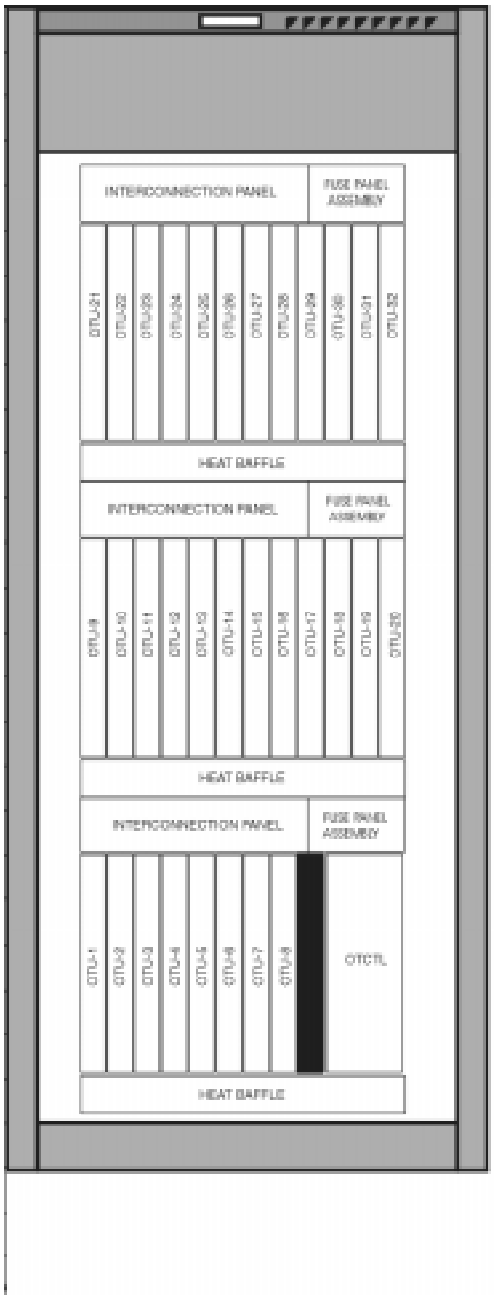


Figure 4-18. OT Cabinet

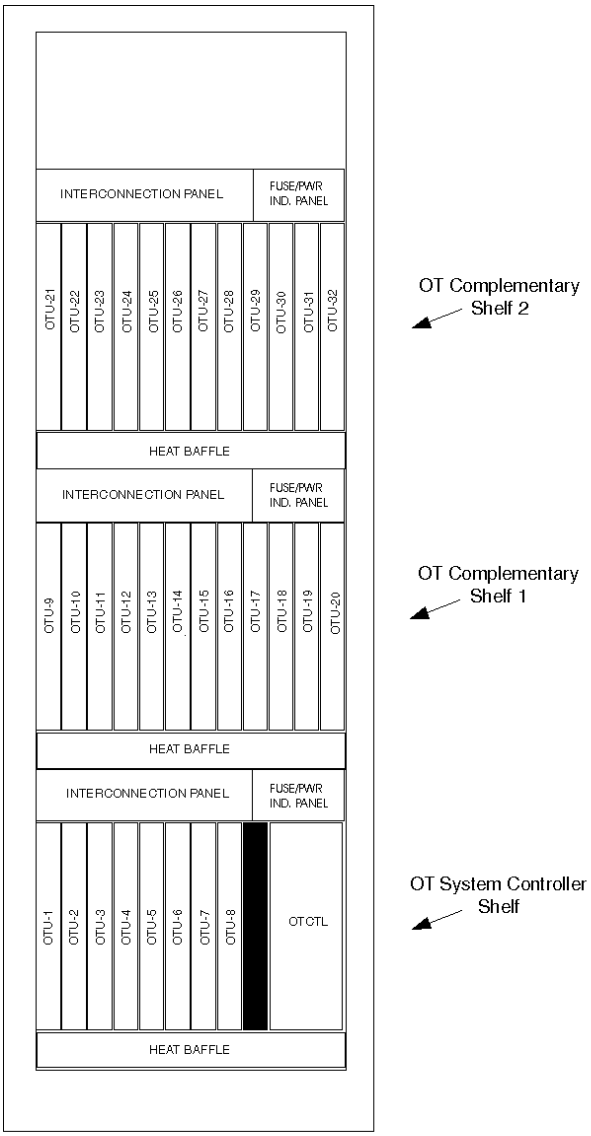
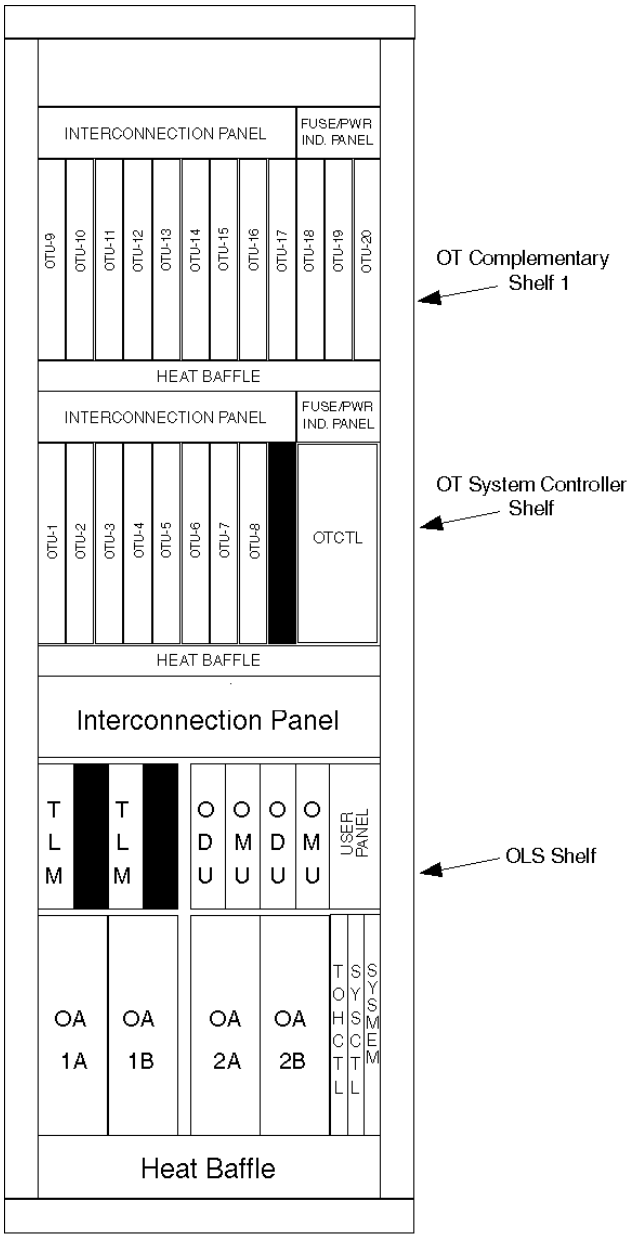


Figure 4-19. Bay-Mounted OT



Ols04024.02tifSEV012198r3.0

Figure 4-20. Integrated Bay (Single)

Figure 4-21 shows an Integrated Bay (Double). This package consists of a single WaveStar OLS 40G Shelf and three OT Shelves and has the following specifications:

- Cabinet or bay-mounted (bay shown)
- One WaveStar OLS 40G Shelf with one or two optical lines controls up to 64 OC-48/STM-16 OTUs or 128 OC-3/STM-1, OC-12/STM-4 OTPMs, or 150-750 Mb/s.
- Appears operationally as a single network element
- User interfaces are provided by the WaveStar OLS 40Ginterconnection panel
- Allows fault correlation between WaveStar OLS 40G and OT equipment
- Existing WaveStar OLS 40G and OT systems can be combined with an in-service upgrade (OTCTL circuit packs and control cabling is added)
- WaveStar OLS 40G and OT equipment can be located up to 100 feet apart.

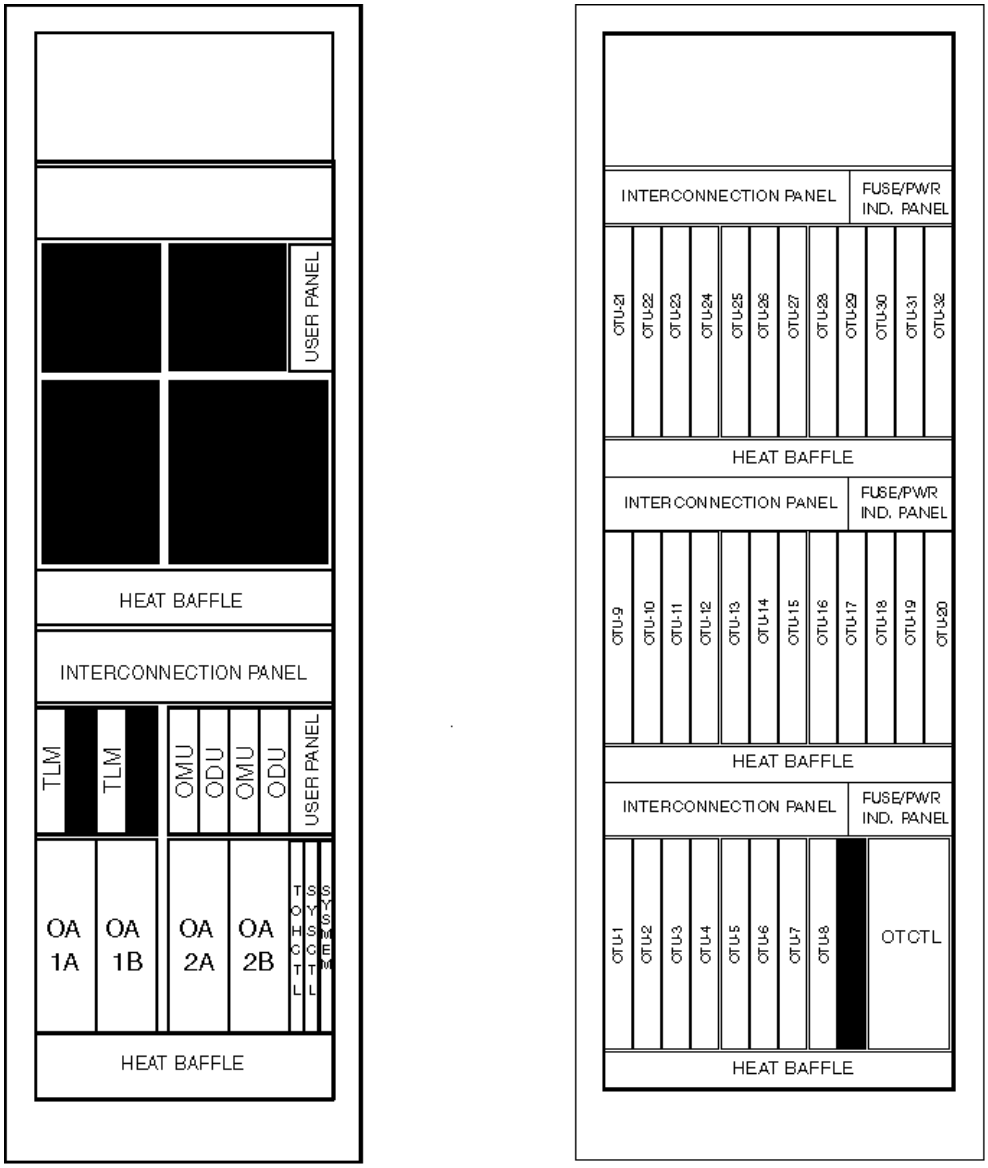
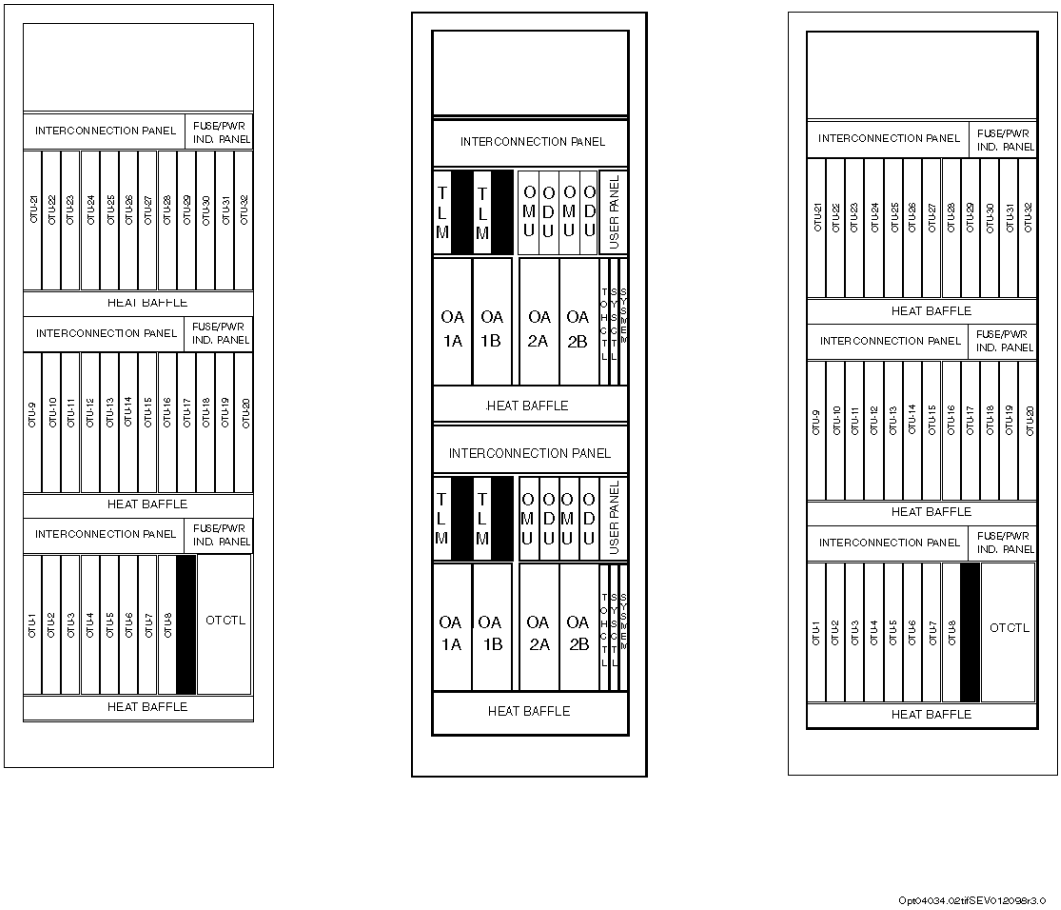


Figure 4-21. Integrated Bay (Double)

Figure 4-22 shows an Integrated Bay (Triple 1) package. This package consists of two separate WaveStar OLS 40G Shelves and two OT bays (three shelves each) and has the following specifications:

- Cabinet or bay-mounted (bay shown)
- Each WaveStar OLS 40G Shelf has two optical lines and controls up to 32 OC-48/STM-16 OTUs or 64 OC-3/STM-1, OC-12/STM-4/150-750 Mb/s OTPMs
- User interfaces are accessed from the WaveStar OLS 40Ginterconnection panel.
- WaveStar OLS 40G and OT equipment can be located up to 100 feet apart.



Opt04034.02tifSEV01209Br3.0

Figure 4-22. Integrated Bay (Triple 1)

Figure 4-23 shows an Integrated Bay (Triple 2) package. This package consists of a single WaveStar OLS 40G Shelf integrated with two OT bays (three shelves each) and has the following specifications:

- Cabinet or bay-mounted (bay shown)
- One WaveStar OLS 40G Shelf with two optical lines controls up to 64 OC-48/STM-16 OTUs or 128 OC-3/STM-1, OC-12/STM-4/150-750 Mb/s OTPMs
- User interfaces are accessed from the WaveStar OLS 40G interconnection panel.
- WaveStar OLS 40G and OT equipment can be located up to 100 feet apart.

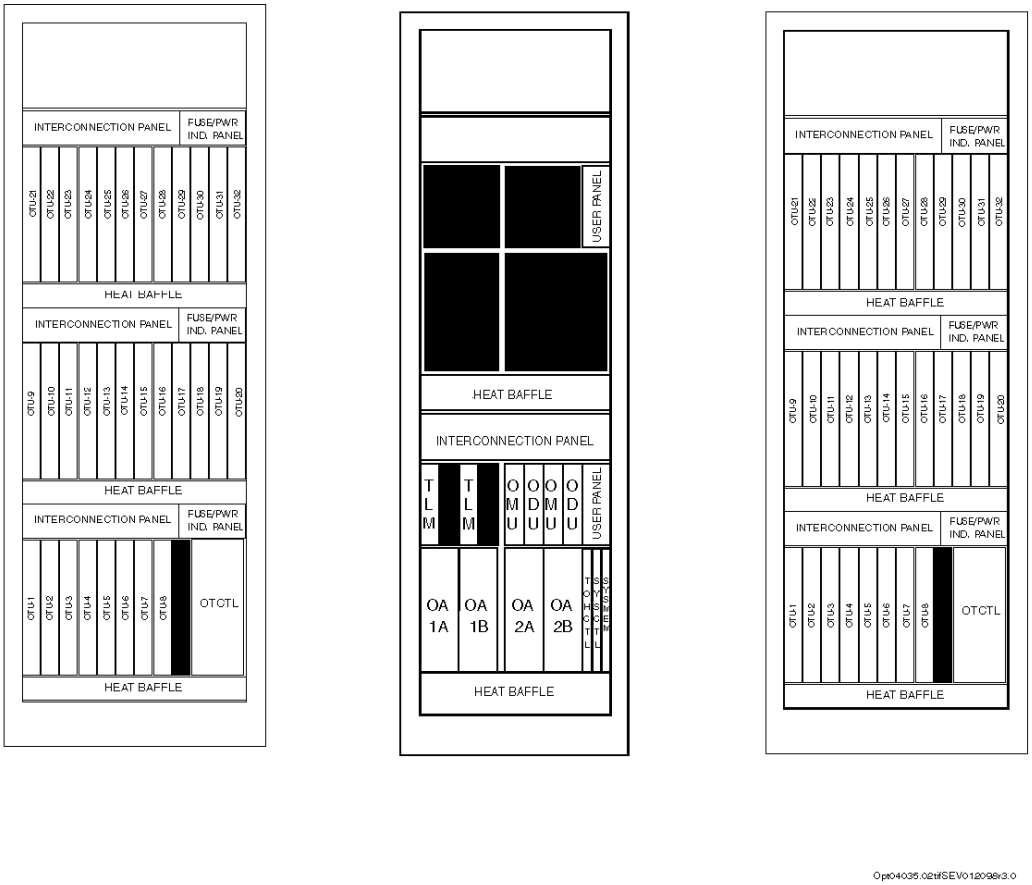


Figure 4-23. Integrated Bay (Triple 2)

Transmission Circuit Packs

The following are transmission circuit packs used in the WaveStar OLS 40G:

- Optical Amplifier (OA)
- Optical Multiplexer Unit (OMU)
- Self-powered OMU (SPOMU)
- Optical Demultiplexer Unit (ODU)
- Self-powered ODU (SPODU)
- Optical Translator Unit (OTU)
- Quad Optical Translator Unit (QOTU)
- Optical Translator Port Module (OTPM)
- Telemetry (TLM).

All circuit pack, unit, and port module assemblies connect to the back-plane. 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 powered optical pump lasers, operating at a wavelength of 980 nm, provide power which is combined with the 1.5 µm signal
- 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) wavelengths 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, WaveStar OLS 40G supports up to five spans (up to four Repeaters) with a maximum distance of 600 km using standard

single mode or non-zero dispersion-shifted fiber (for example: TrueWave). In Long Reach configurations, WaveStar OLS 40G supports up to eight spans with a maximum optical line length of 640 km using standard single-mode or non-zero dispersion-shifted fiber. In Short Reach configurations, WaveStar OLS 40G supports one span with optical line lengths up to 80 km.

WaveStar OLS 40G demultiplexes the signals at the other end of the optical line and passes them on to compatible optical receivers. WaveStar OLS 40G also uses a highly flexible form of WAD.

For details on span length and network topologies and a description of the engineering rules used in building WaveStar OLS 40G 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 control 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.

NOTE:
WaveStar OLS 40G utilizes the LEA104 OA for Long Span, 16-wavelength systems. Long Span, 8-wavelength systems use the LEA6 OA. Long Reach systems require the LEA7 OA while the LEA105 OA is used for Short Reach systems and required for single-OA operation.

Optical Multiplexer Unit (OMU)

Used at the end terminal site, the OMU combines up to sixteen optical wavelengths into one signal called the optical line signal. The two types of OMUs used with WaveStar OLS 40G are:

- 505A (8λ)
- 506A (16λ).

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 with the backplane.

Self-Powered OMU (SPOMU)

The SPOMU circuit pack is required in configurations that support seven and eight spans with up to 22 dB loss per span, utilizing a significantly lower insertion loss than the standard OMU. It can also be used in any WaveStar OLS 40G application that supports sixteen wavelengths. Providing filtered inputs, it also eliminates service-affecting conditions caused by the inadvertent addition of wavelengths already in-service

Optical Demultiplexer Unit (ODU)

The ODU demultiplexes the input optical signal into a maximum of sixteen wavelengths. The three types of ODUs used with WaveStar OLS 40G are:

- 605A (eight wavelength)
- 606A (sixteen wavelength; without supervisory channel output)
- 606B (sixteen wavelength; with supervisory channel output)

NOTE:
The 606B ODU is required for single-OA operation.

Self-Powered ODU (SPODU)

This circuit pack operates independently from the OA to guarantee optical demultiplexing performance when an OA circuit pack is replaced.

NOTE:
The SPODU circuit pack is required when using the OPS feature in Release 3.1.1.

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/STM-16 optical signal that is compatible with WaveStar OLS 40G or a standard SONET ADM terminal
- Monitoring the signal for errors.

WaveStar OLS 40G and OT can be fully integrated. The new control structure provides the following functionality for each installed OTU:

- Equipment version information per OTU (OC-48/STM-16), QOTU, and OTPM (OC-3/STM-1, OC-12/STM-4, 150-750 Mb/s)
- Software download from the SYSCTL/SYSMEM to the OTCTL and through the OTCTL to the OTUs and QOTUs
- Equipment failure indications for OTUs, QOTUs, and OTPMs
- Incoming signal failure indications (LOS, LOF, and AIS) for OTU and OTPM ports
- B1 performance monitoring in 15 minute/daily bins and TCAs for each OTU and OTPM port
- Optical parameter performance monitoring (LBFC/OPT, RCV PWR/OPR, LBC) for the OC-48/STM-16 OTUs. For OC-3/STM-1 and OC-12/STM-4 OTPMs and 150-750 Mb/s LSBB OTPMs, analog performance parameters are not provided (available for factory testing and calibration) and all out-of-range indications are treated as OTPM failures.
- Autonomous TL1 alarm reporting for all OTU, QOTU, and OTPM equipment
- Autonomous TL1 alarm reporting for QOTU and OTPM incoming signal conditions, including the T-x condition types for TCAs
- Incoming signal port state provisioning for all OTU and OTPM ports
- In-service indications (green LED) for OTPM ports.

NOTE:
OTU circuit packs are needed only when WaveStar OLS 40G is used with OT.

Quad Optical Translator Unit (QOTU)

Each QOTU circuit pack occupies two OTU slots in an OT shelf, and contains a maximum of four OC-3/STM-1, OC-12/STM-4, or 150-750 Mb/s OTPMs in any combination.

OTPMs are housed individually in QOTU ports 1, 2, 3, and 4. Figure 4-8 illustrates the port locations on the QOTU.

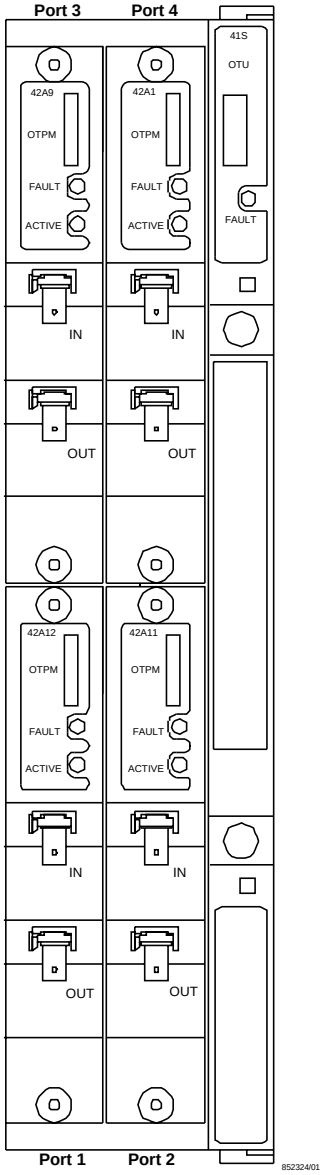


Figure 4-24. QOTU Design

Optical Translator Port Module (OTPM)

The OTPMs perform the same functions as the OTUs for sixteen wavelength OC-3/STM-1, OC-12/STM-4, and 150-750 Mb/s rate signals.

Telemetry (TLM)

The TLM circuit pack provides a supervisory channel on the optical line. This channel is used for fault location and maintenance functions. A fully-equipped End Terminal Shelf requires one TLM circuit pack per line, while a fully-equipped Repeater Shelf requires two TLM circuit packs per line.

The TLM circuit pack hardware also 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.

Control Circuit Packs

Control circuit packs used in WaveStar OLS 40G are as follows:

- System controller (SYSCTL)
- System memory (SYSMEM)
- Tributary overhead controller (TOHCTL)
- OT Controller (OTCTL– used in the OT).

System Controller (SYSCTL)

The SYSCTL circuit pack, together with the SYSMEM, provides the highest level of system control for WaveStar OLS 40G. The SYSCTL circuit pack provides system-level user and operations systems interfaces, performs system-wide maintenance computations and performance monitoring, and supports serial telemetry and X.25 interfaces.

The SYSCTL circuit pack can support two fully-integrated OT System Controller Shelves and up to four Complementary Shelves. An Integrated Bay or Cabinet (Double, Triple 1, or Triple 2) package can be used for full operation.

System Memory (SYSMEM)

The 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 the system state and user-provisioned data. It also contains 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 TOHCTL circuit pack processes the overhead (D1 - D3) of the supervisory channel. The TOHCTL interfaces with the transmission overhead on the TLM circuit pack in order to deliver and receive DCC data. The TOHCTL interfaces with the system controller complex by means of the OALAN.

OT Controller (OTCTL)

As part of WaveStar OLS 40G / OT integration feature, the OTCTL is used to integrate the OTUs into WaveStar OLS 40G control structure. It occupies three slots in the OT System Controller Shelf.

Operationally, the integration of these circuit packs makes the combination of WaveStar OLS 40G and OT appear as a single network element. The OTCTL controls all of the OTUs within the same cabinet or network bay frame via the BCLAN connections provided in the backplane and inter-shelf OT cabling.

Cable Dressing

To keep service and protection fiber and feeder A and B power cables in separate places, they 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 cut-out, depending upon ease of access.

Figure 4-25 shows how the cables are dressed for the End Terminal Shelf. The Repeater Shelf follows the same dressing scheme, except the drop side optical fibers are not used.

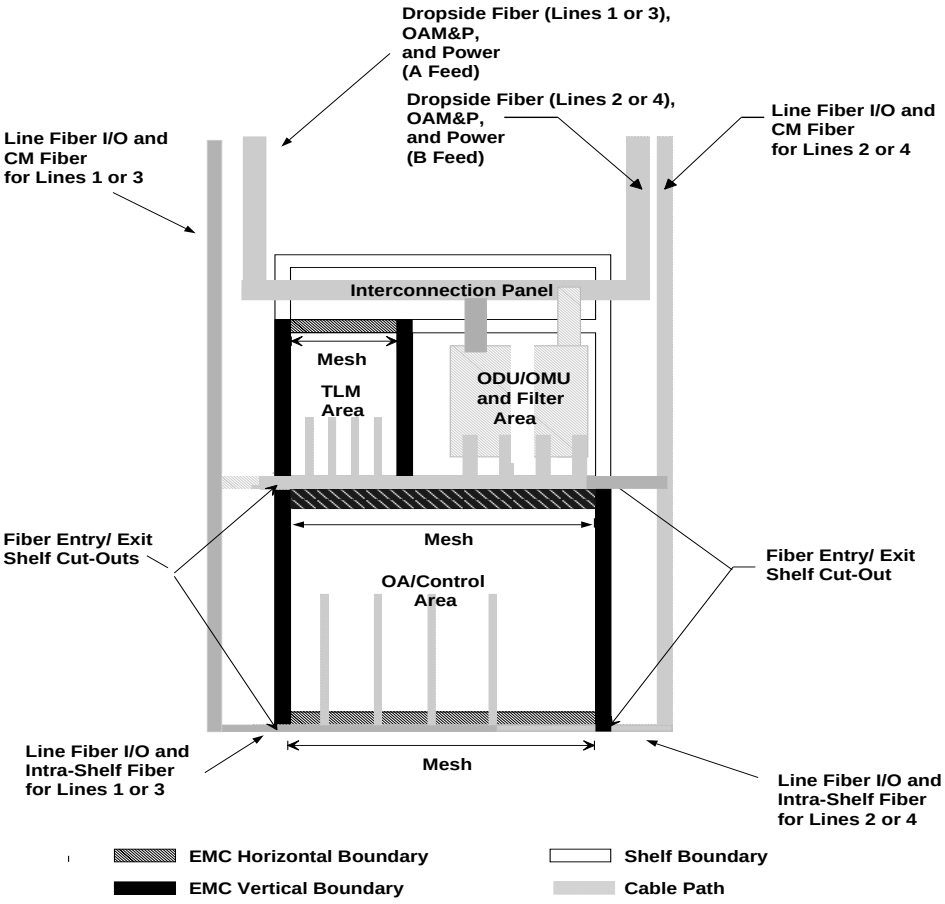


Figure 4-25. WaveStar OLS 40G Shelf Fiber/Cable Dressing and EMC/ESD Design

Interconnection Panels

This section describes the interconnections panels, cabinet indicator strips, and both the fuse and user panels associated with WaveStar OLS 40G and OT shelves.

WaveStar OLS 40G Interconnection Panel

At the top of WaveStar OLS 40G shelf, there is a built-in interconnection panel that is used for OAM&P connections. Each shelf's backplane provides intrashelf interconnection between all circuit packs used in the shelf. The backplane also provides interconnection from the OAM&P interconnectors at the top of the shelf to the various circuit pack connector pins. All access to connections is from the front of the shelf, and a CIT access port is available for the interconnection panel.

Figure 4-26 depicts the interconnection panel as seen from the front of the equipment. Associated cable groups and their connection points are indicated.

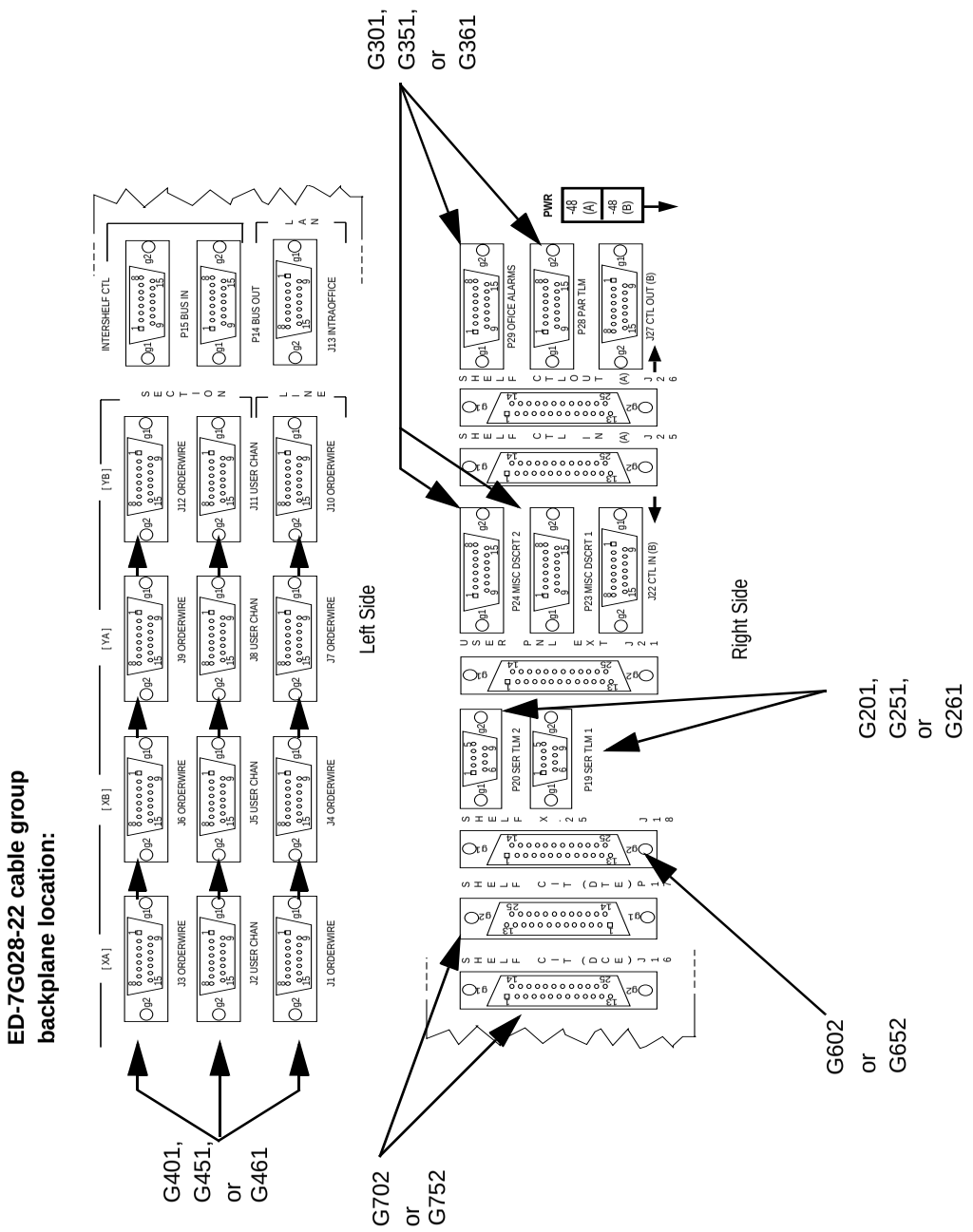


Figure 4-26. WaveStar OLS 40G Interconnection Panel and Cabling

OT Interconnection Panel (System Controller Shelf)

Figure 4-27 depicts an OT System Controller Shelf's interconnection panel as seen from the front of the shelf. Associated cable groups and their connection points are indicated.

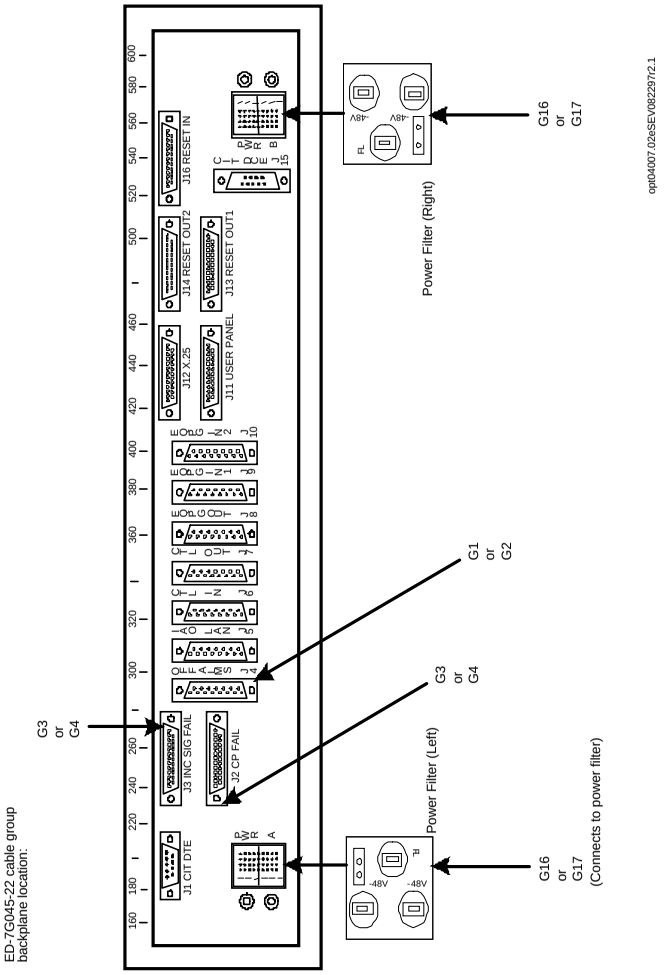


Figure 4-27. OT System Controller Shelf Interconnection Panel and Cabling

OT Interconnection Panel (Complementary Shelves)

Figure 4-28 depicts an OT Complementary Shelf's interconnection panel as seen from the front of the shelf. Associated cable groups and their connection points are indicated.

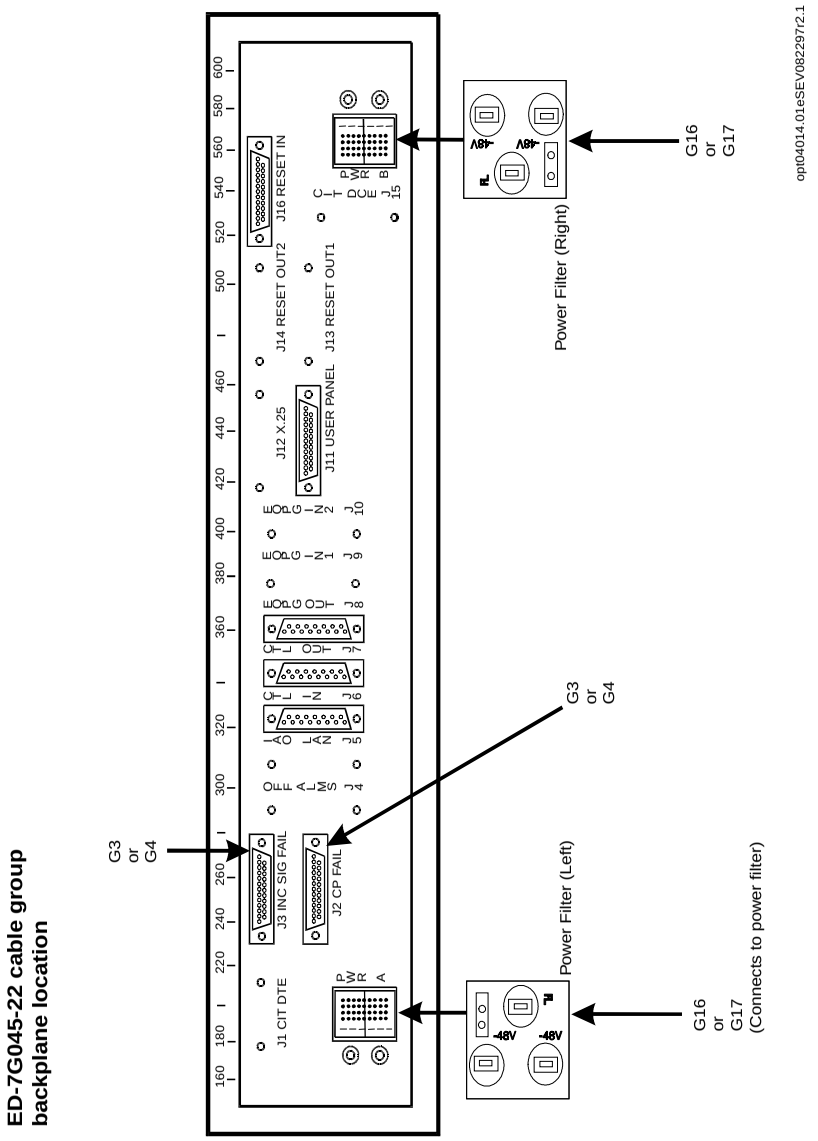
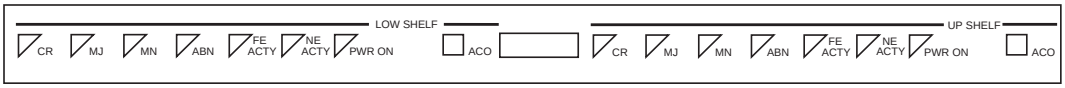


Figure 4-28. OT Complementary Shelf Interconnection Panel and Cabling

WaveStar OLS 40G Cabinet Indicator Strips

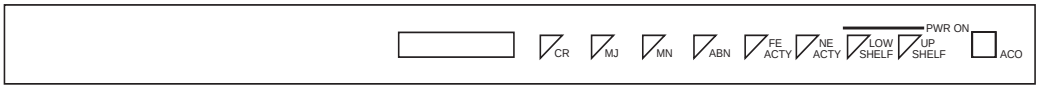
Each WaveStar OLS 40G Cabinet has an indicator strip located in the front along the top front of the cabinet. Connectorized cabling connects the shelves to the indicator strip. Figure 4-29 shows the indicator strip for the Dual End Terminal and Dual Repeater cabinets. Figure 4-30 shows the indicator strip for both the End Terminal and Repeater for four bidirectional optical lines.

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



ols04003.01eSEV082297r2.1

Figure 4-29. Indicator Strip for Dual End Terminal and Dual Repeater Cabinets



ols04004.01eSEV082297r2.1

Figure 4-30. Indicator Strip for End Terminal and Repeater Cabinets for 4 Bidirectional Optical Lines

Table 4-1. User Panel Indicators for WaveStar OLS 40G 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 the lower shelf is receiving -48V power
Power On (Upper Shelf)*	PWR ON UP SHELF	LED	Green	Indicates the upper shelf is receiving -48V power

* Applies only to cabinet applications.

Table 4-2 provides the Synchronous Digital Hierarchy (SDH) equivalents of SONET-specific indicators found on the WaveStar OLS 40G OT Cabinet indicator strip.

Table 4-2. User Panel Indicators for WaveStar OLS 40G 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 the lower shelf is receiving -48V power
Power On (Lower Shelf)*	PWR ON	LED	Green	Indicates the upper shelf is receiving -48V power

* Applies only to cabinet applications.

Each OT Cabinet is equipped with an indicator strip located in the front along the top 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.

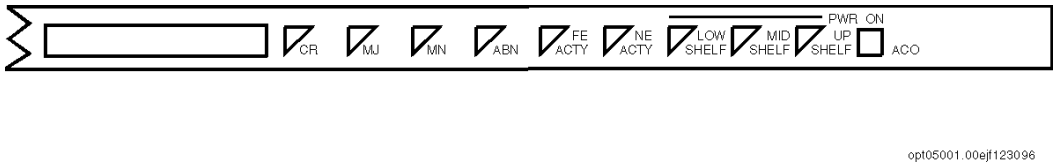


Figure 4-31. OT Cabinet Indicator Strip

Although Table 4-3 lists all the indicators that appear on the indicator strip, only the three Power On (PWR ON) LEDs are active.

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

Indicator Name	Abbrev.	Color	Description
Power On*	PWR ON	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
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

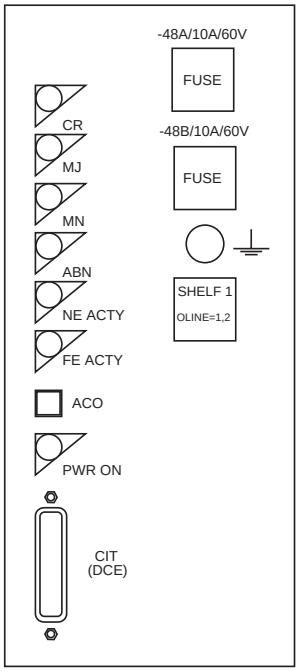
* The indicator panel has three PWR LEDs representing the three shelves installed in the cabinet. The three LEDs are designated as Lower Shelf (LOW SHELF, System Controller Shelf), Middle Shelf (MID SHELF, Complementary Shelf 1), and Upper (UP SHELF, Complementary Shelf 2).
† The ACO switch is functional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

Panels

This section provides information on user, fuse, and power indicating panels for WaveStar OLS 40G and OT.

WaveStar OLS 40G User Panel

Figure 4-32 shows a diagram of the WaveStar OLS 40G user panel for the miscellaneously-mounted shelf and bay configurations.

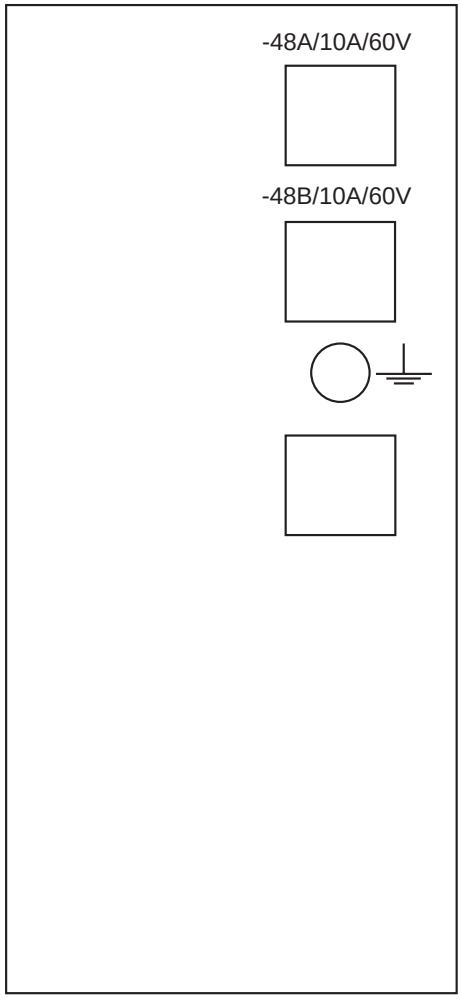


ols04038.01eSEV082297r2.1

Figure 4-32. WaveStar OLS 40G Shelf User Panel

WaveStar OLS 40G Fuse Panel

WaveStar OLS 40G fuse panel, shown in Figure 4-33, displays the fuse indicators for overcurrent protection (A and B feeds) and provides an electrostatic discharge (ESD) jack that is connected to a frame ground.The fuse panel can be replaced in the field.



ols04039.01eSEV082297r2.1

Figure 4-33. WaveStar OLS 40G Fuse Panel

Table 4-4 lists all the indicators that appear on the user panel. Note that only the green Power On (PWR ON) LED is active.

Table 4-4. SONET Indicators on WaveStar OLS 40G User Panel (L10 and L11)

Indicator Name	Abbrev.	Color	Description
Power On	PWR	Green	Indicates 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
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

Table 4-5. SDH Indicators Present on WaveStar OLS 40G User Panel (L10 and L11)

Indicator Name	Color	Description
Power On	Green	Indicates 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 Assembly

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

- Fuse indicators for overcurrent protection (A and B feeds)
- One green Power On (PWR ON) LED that lights up to indicate the shelf is receiving -48 V power
- An electrostatic discharge (ESD) jack that is connected to a frame ground.

Figure 4-34 shows a diagram of the OT Complementary Shelf fuse / power indicating panel.

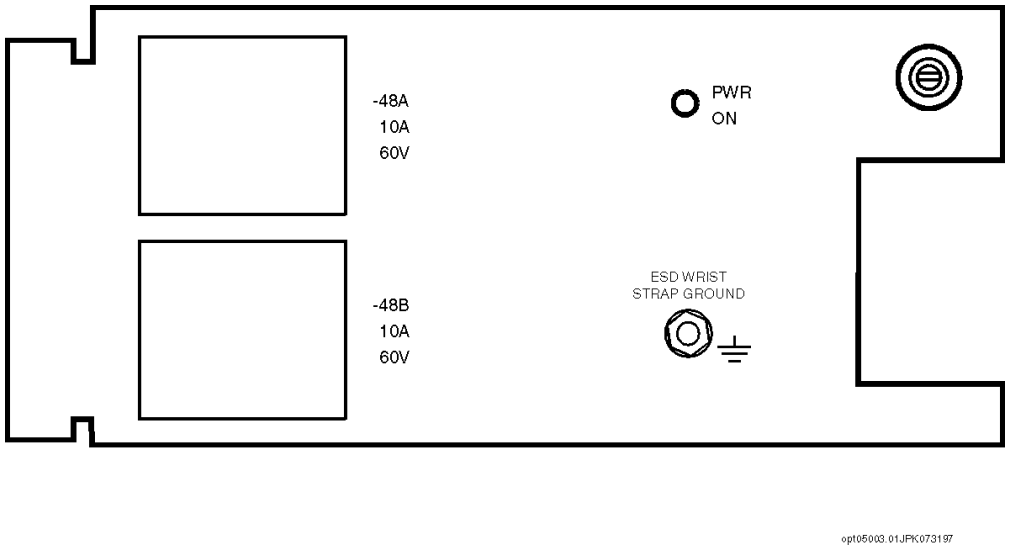


Figure 4-34. Miscellaneously-Mounted OT Complementary Shelf Fuse/Power Indicating Panel

OT Shelf Fuse Panel Assembly in Cabinet Configurations

The OT Shelf fuse panel is used for all OT shelves in cabinet configurations. The fuse panel provides fuse indicators for overcurrent protection (A and B feeds).

Figure 4-35 shows a diagram of the fuse panel.

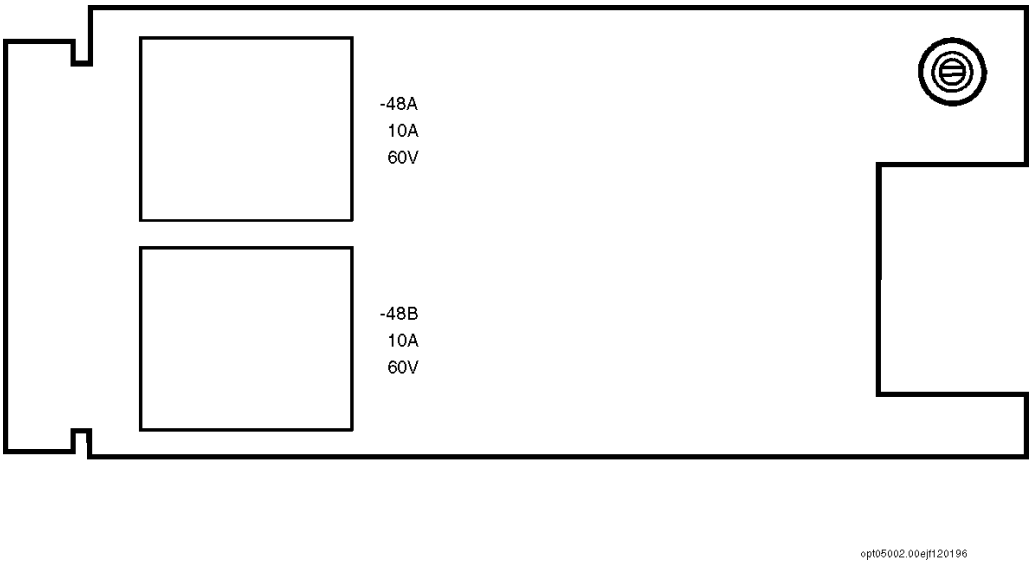


Figure 4-35. OT Shelf Fuse Panel

Power

This section provides information on WaveStar OLS 40G power distribution.

Power distribution 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 with heat dissipated uniformly across the system, thereby avoiding “hot spots.”

WaveStar OLS 40G is powered by -48 V direct current (DC). Power filtering and fusing are performed on the shelf level. DC-to-DC on-board power converters convert power on individual circuit packs.

The OPS, SPODU, and SPOMU circuit packs each have their own power supply and thermal stability, independent of the OA and TLM circuit packs. Redundant power feeders (at the shelf level) and power supplies (power converters at the circuit pack level) are required. The SPOMU and SPODU provide thermal failure indication to WaveStar OLS 40G via the OTCTL circuit pack.

If the OPS experiences a loss of power or if any LOS detection or decision circuitry fails, it latches in its current state.

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 End Terminal and Repeater Bay/Cabinet

Figure 4-36 shows overall two-shelf installation power distribution. Dual -48 V feeders (A and B) provide redundant power. Each installation uses two 8-gauge power cables that branch into two 10-gauge cables (one for each shelf). These power cables terminate directly onto the shelves. Each branch connects to an overcurrent limiter located on the shelves.

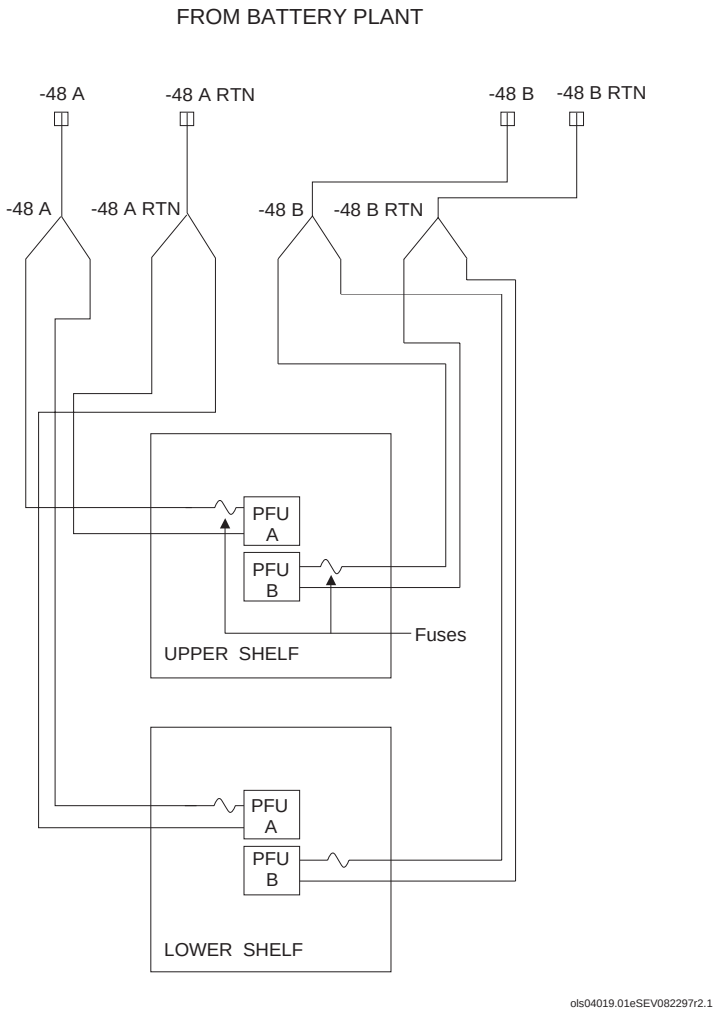


Figure 4-36. General Power Distribution in a Two-Shelf WaveStar OLS 40G Bay or Cabinet

OLS Integrated Bay (Single) and OT Bay/Cabinet Power Distribution

Dual -48 V 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 4-37 shows the overall power distribution for a three-shelf installation.

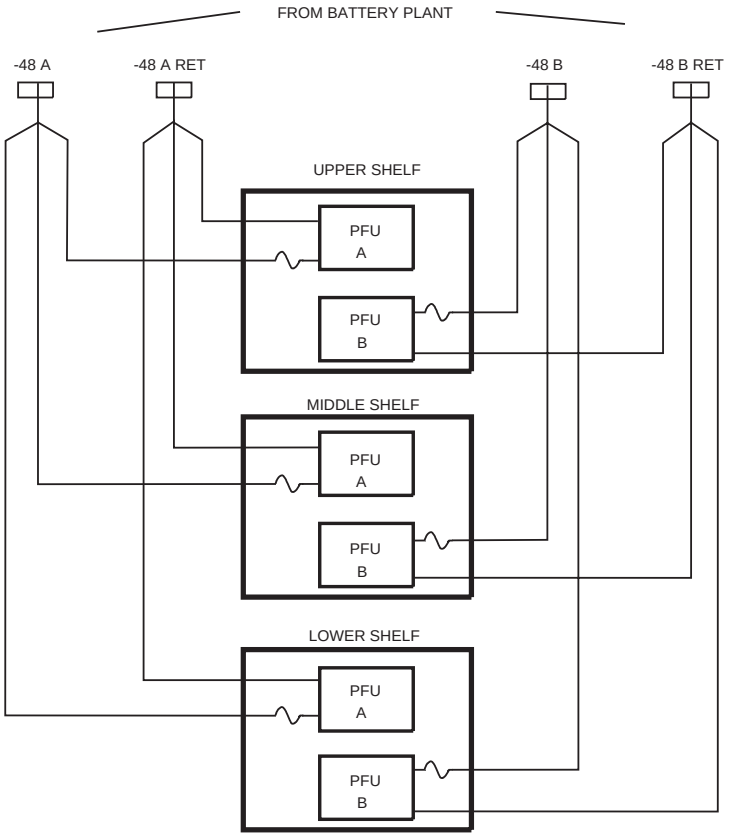


Figure 4-37. OT Power Distribution in a Three Shelf Bay or Cabinet

Shelf-Level Power Distribution

Figure 4-38 shows a block diagram of WaveStar OLS 40G power distribution at the shelf level.

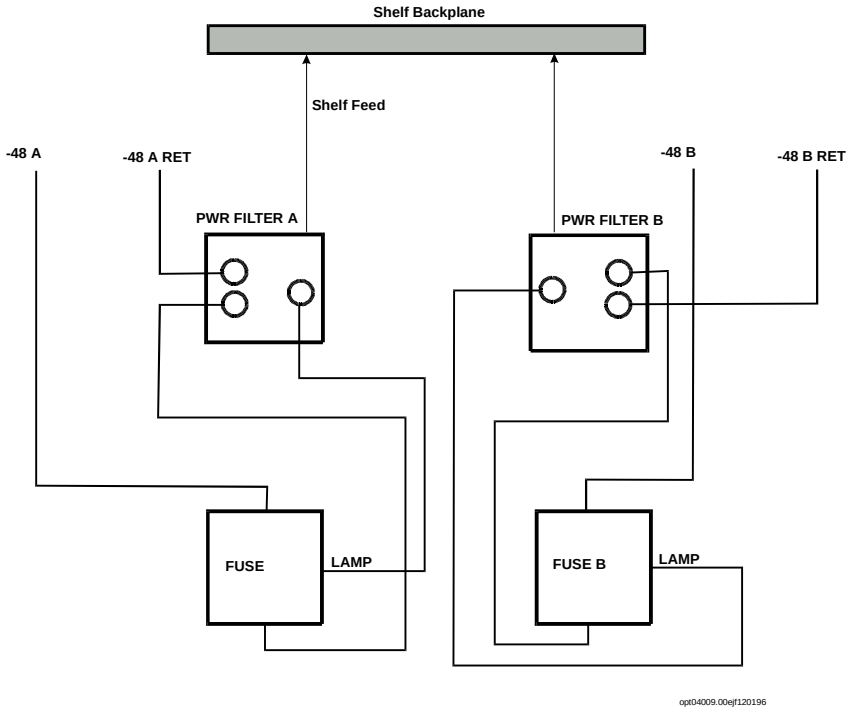


Figure 4-38. WaveStar OLS 40G Power Distribution at Shelf Level

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. WaveStar OLS 40G will experience no damage if the power fluctuates between -38±1.5V and -42.5±1.5V. If a fuse blows, the fuse cap illuminates to indicate which power feeder has opened.

Backplane and Circuit Pack Interface

All WaveStar OLS 40G 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 WaveStar OLS 40G and OT circuit pack is equipped with diodes that provide ORing to 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 follows the fused input, prior to the DC-to-DC conversion. 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 regarding operations, maintenance, administration, and provisioning (OAM&P) of the WaveStar OLS 40G.

Operations

This section describes the hardware and software user interfaces that control the administration, maintenance, and provisioning of WaveStar OLS 40G. Maintenance procedures use Craft Interface Terminals (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

WaveStar OLS 40G supports the following operations interfaces:

- CIT
- Message-based operations system interface (X.25)
- Office alarms
- Parallel telemetry
- User-settable miscellaneous discrete input.

Craft Interface Terminal (CIT)

WaveStar OLS 40G supports CIT local access, remote access using a modem, and remote access using the data communications channel (DCC). WaveStar OLS 40G also provides enhanced security features to protect against unauthorized access to 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 WaveStar OLS 40G 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; it supports one IP address at a time. 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, Version 3 or 4
- Serial port (EIA-232-D) — configured as COM1 or COM2.

NOTE:
A dumb terminal can be connected to the CIT ports on WaveStar OLS 40G for experienced TL1 users. However, CenterLink-CIT is highly recommended.

CIT Access

WaveStar OLS 40G 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 WaveStar OLS 40G 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 WaveStar OLS 40G 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
V.32	4800, 9600
V.32 bis	14,400
V.34	28,800

Message-Based Interface (X.25/TL1)

WaveStar OLS 40G 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 allows access to the local WaveStar OLS 40G terminal (local access capability) and any remote terminals in a maintenance subnetwork using the DCC (GNE capability).

WaveStar OLS 40G 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 types include:

- Maintenance– sends reports on the maintenance status of the system (for example: alarm and event reports)
- Memory administration– sends reports on changes in the provisioning status of equipment (for example: database changes)
- Command response only– sends no autonomous messages (you can manually request information through TL1 commands)
- Other– sends all autonomous messages
- Peer– automatically sets peer as the OS type if the user provisions none of the other OS types (if the OS type is peer, messages are in the form of commands and responses)
- Restoration– sends the same system status reports as the maintenance OS type, except TCAs and user command information.

Operations Domains

The operations domain for WaveStar OLS 40G allows remote access to any WaveStar OLS 40G network element in the same subnetwork. For example, a CenterLink-CIT login at an End Terminal allows remote access to the other end terminal and all repeaters between them. In Figure 5-1, a CenterLink-CIT login at WaveStar OLS 40G X.1 allows remote logins to X.2 and X.3.

.

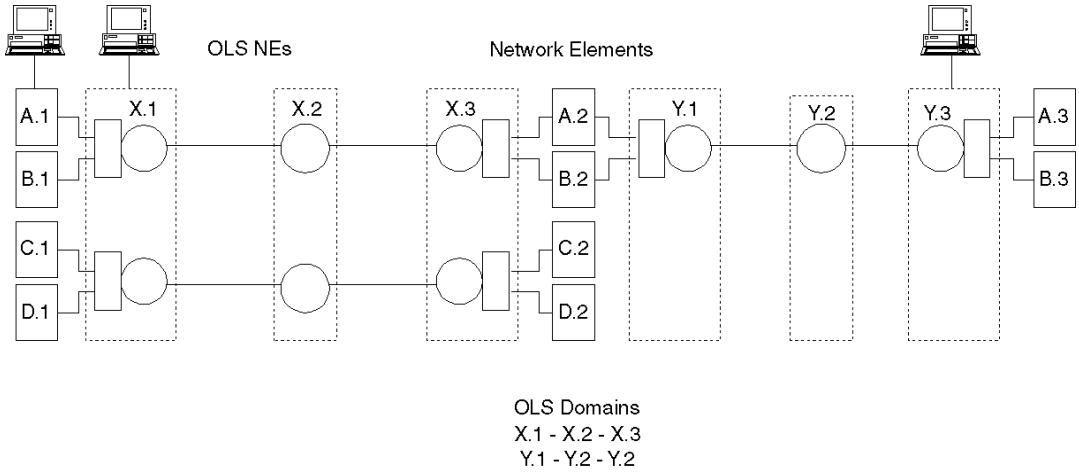


Figure 5-1. CIT Operations Domain with Standard End Terminals

With a dual-facing shelf, the operations domain can be extended to additional WaveStar OLS 40G network elements. Figure 5-2 shows a dual-facing terminal at an intermediate add / drop site; a CenterLink-CIT login at WaveStar OLS 40G X.1 now allows remote logins to X.2, X.3, Y.1, Y.2, and Y.3.

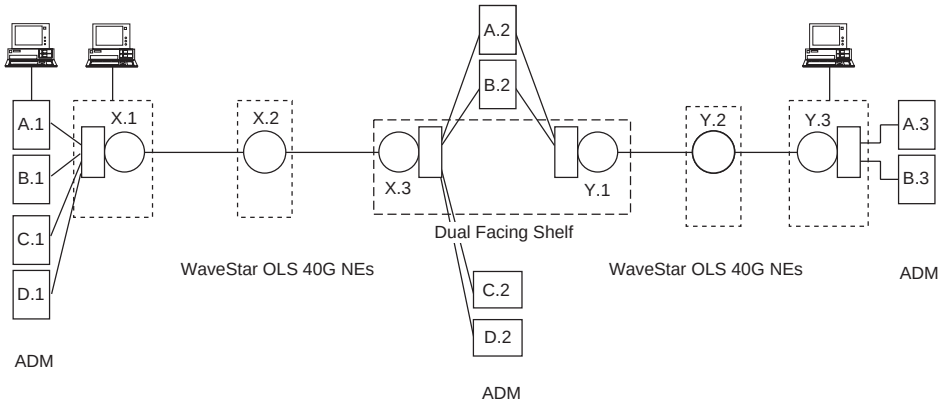


Figure 5-2. CIT Operations Domain with Dual-facing End Terminal

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. Sixteen inputs and four outputs are available. One hundred twenty-eight additional inputs and thirty 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 serial telemetry interface of WaveStar OLS 40G 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 WaveStar OLS 40G through a set of input and output contact closures. One hundred twenty-eight additional user-settable inputs that can monitor external conditions like open doors or high temperature. The additional thirty-two user-settable outputs can control equipment such as external fans and generators.

NOTE:
Previously, an EMDU was required for WaveStar OLS 40G when interworking with the OT. In Release 3.0, an EMDU is not necessary due to the integration of WaveStar OLS 40G and OT. It is, however, listed as an ordering option in the package worksheets found in Chapter 7, “Ordering.”

Circuit Pack Faceplate LEDs

Each circuit pack has a red FAULT LED on its faceplate. A continuously lighted FAULT LED means that WaveStar OLS 40G has isolated a failure in that circuit pack. A flashing FAULT LED has two meanings:

- On a transmission circuit pack, it indicates that an incoming signal to that circuit pack has failed
- On the system memory (SYSMEM) circuit pack, it indicates 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.

In addition to a red FAULT LED, an OTPM circuit pack also has a green LED on its faceplate. This LED indicates that an OTPM port is in-service.

On the OPS, SPOMU, and SPODU circuit packs, new in Release 3.1.1, the following three LEDs appear on each faceplate:

- Red (fault light)– depending on the specified condition, this LED (normally off) either blinks or remains on
- Amber– depending on the specified condition, this LED (normally off) illuminates when a switch from the primary line to the secondary line occurs and remains lit until traffic selection is returned to the primary line
- Green– depending on the specified condition, this LED (normally off) illuminates when the OPS is operating in the bidirectional switching mode.

On-board circuit pack monitoring is provided by hardware-controlled LEDs. Monitoring of both primary and secondary lines by the OPS circuit pack is continuous, regardless of the switch state, and the LED reflects any changes in condition.

Table 5-2 shows a list of monitored conditions for which this fault light remains on.

Table 5-2. Monitored Condition/Performance Parameter Types

Condition	OPS Fault Light
OPS Primary Line LOS*	flashing
OPS Secondary Line LOS	flashing
Internal defect	on
Power converter	on
Fuse failure	on
Single fuse failure -48V feeders	on
Pack reset	on
Pack insertion	on
OPS Primary Line LOS*	flashing

*. Not applicable for SPODU and SPOMU circuit packs

Retrieval of the following data is supported:

- Hold-off time
- Unidirectional and bidirectional switch selection
- Primary Line and Secondary Line switch status
- Primary Line and Secondary Line signal present / LOS indication
- Indication of internal defect on OPS
- Indication of power converter failure on OPS
- Indication of fuse failure on OPS
- Indication of single fuse failure -48V feeders
- Indication of OPS pack reset
- Indication of OPS pack insertion.

External and internal software supports password-protected selection of the following data:

- Hold-off time
- Unidirectional or bidirectional switch selection
- Manual line switching for user controlled toggling between the primary and secondary lines

Remote parameter selection, switching, and switch state monitoring by ITM-SNC is also supported by the integrated WaveStar OLS 40G / OT software control.

Administration

This section provides information on WaveStar OLS 40G administration features.

Version Recognition

WaveStar OLS 40G provides automatic version recognition of all installed hardware and software, reporting 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 codes for each circuit pack are also provided.

The Optical Multiplexer Unit (OMU) and Optical Demultiplexer Unit (ODU) units have four discrete leads that are used by the Optical Amplifier (OA) to determine the circuit pack's version and type.

Security

WaveStar OLS 40G 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 interface. 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 that disables all but administrative logins.

Enhanced User Login Security

The following features control access to the system on an individual user basis:

- Function category– commands are separated into the following four function categories:
  - — Configuration Management (C)
  - — Fault Management (F)
  - — Performance Monitoring (PM)
  - — Security Management (S)
- User authorization levels– five user authorization levels are provided within each function category to control which network element 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.

- Login ID and password assignment– requires the user to enter a valid login ID and password to access the system. WaveStar OLS 40G allows up to one hundred login IDs and passwords. Two of these login IDs are privileged and the remainder are reports-only and general

Users may execute any command within the limits of their authorization level and function category, including all commands on levels below them. For example, a user with Authorization Level 4 in the Security Management function category (S4 status), can execute commands in levels 4, 3, 2 and 1 of Security Management.

- Login aging– enables a privileged user to set individual non-expert logins to be deleted if unused within a certain number of days or by 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

WaveStar OLS 40G 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 a WaveStar OLS 40G subsystem and establishes communications. Start-up is triggered by the following actions:

- A WaveStar OLS 40G 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

This section describes WaveStar OLS 40G maintenance. The objective of WaveStar OLS 40G 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 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 WaveStar OLS 40G 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 performance monitoring are:

- B2 parity errors
- Out of range (OOR) on Laser Bias Current (LBC) and Laser Backface Current (LBFC)
- Single fuse failure on -48 V feeders
- Threshold crossing alert (TCAs).

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

Remote Maintenance

Remote maintenance is provided through DCC links between WaveStar OLS 40G 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 WaveStar OLS 40G network elements that are in the same subnetwork.

WaveStar OLS 40G uses an additional optical signal, the supervisory signal, for communication of maintenance information. This signal (STS-3 format) is generated by the TLM circuit pack and multiplexed onto the optical line at each OA. This signal is demultiplexed at each OA and returned to the TLM circuit pack, providing an add / drop function for it at every WaveStar OLS 40G site. WaveStar OLS 40G uses the DCC channel (D1-D3) within the STS-3 format for WaveStar OLS 40G communication. The customer is provided with the orderwire bytes (E1, E2, F1) and the payload contained in the STS-3 signal.

WaveStar OLS 40G 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 WaveStar OLS 40G 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 WaveStar OLS 40G element to another anywhere in the subnetwork.

Gateway Network Element

You can use one or more WaveStar OLS 40G network elements as a gateway network element (GNE). The GNE serves as a single interface to the local X.25 message-based operations system covering all WaveStar OLS 40G 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 element in the WaveStar OLS 40G subnetwork.

One or more WaveStar OLS 40G terminals can be used as GNEs, but the number used 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 WaveStar OLS 40G terminal as the network GNE. If you need redundancy, then two WaveStar OLS 40G elements could be used as GNEs.

Remote NE Status

Through the DCC, a WaveStar OLS 40G terminal can receive and transport summary alarm and status information from remote WaveStar OLS 40G terminals that are in the same subnetwork.

The remote network element status feature conveys remote summary alarm and status information through the following:

- 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 active alarm severity at other network elements in the subnetwork.

Members of an alarm group exchange remote network element status information through one or more alarm group network elements (AGNEs) that are defined in the same alarm group. The AGNEs and remote network elements use the DCC to receive and report alarm status information from and to all network elements in the alarm group. When an AGNE receives alarm and status information, it rebroadcasts the information to other network elements in the group. The information allows each net-

work element to provide, for example, far-end activity indications and a remote alarm report for all other network elements in the group.

The use of AGNEs makes it unnecessary for each network element in an alarm group to communicate directly with every other network element in the group. This allows DCC resources to be used efficiently.

Local and Remote Software Copy/Upgrades

WaveStar OLS 40G lets you upgrade 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, use the DCE port and installation software distributed with the generic. See the *Software Release Description* for performing an upgrade.

Using CenterLink, you may also copy / upgrade the system software contained in a WaveStar OLS 40G terminal to other local or remote terminals in the same subnetwork. System monitoring and control are fully functional during the copying process.

Optical Transmission Maintenance

WaveStar OLS 40G maintenance is based on the following 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 degradation
- Third tier– use of predetermined threshold values to indicate signal failure conditions.

WaveStar OLS 40G is a bit-rate-independent analog system. The following features 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 WaveStar OLS 40G network element to identify any misconnection of fibers between sites.

Protection Switching for DCC Signal

WaveStar OLS 40G provides automatic protection for the DCC signal. In 2-line (4-fiber) systems, DCC protection is implemented on an optical span basis (between two adjacent WaveStar OLS 40G network elements). In 1-line (2-fiber) closed ring applications, WaveStar OLS 40G 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.

The 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

WaveStar OLS 40G 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 (LOS)– An optical channel LOS is declared when the signal power of the channel (SPR-C) falls below a specified 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 specified absolute level
- Optical Line LOS– If all the optical channels in an optical line and the supervisory channel have LOS, 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 as follows:

- 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 as follows:

- Customer Maintenance Signal (CMS) LOS
- CMS LOF
- CMS SF
- CMS SD.

Fault Isolation

WaveStar OLS 40G continuously monitors circuit packs and incoming signals for defects. When a fault is detected, it 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 WaveStar OLS 40G are stored and made available for reporting, 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. WaveStar OLS 40G 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 WaveStar OLS 40G 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 wavelengths present, OA performance, etc. Therefore, new baselines are required when wavelengths are added or removed. WaveStar OLS 40G automatically measures and provisions the baseline parameters when optical wavelengths transition from the AUTO to IS state. The user is provided with CIT commands to baseline manually when wavelengths are removed. For future reference, the user can also record the reason for the manual baselining.

Optical Protection Switching

Figure 5-3 depicts operation of the OPS circuit packs. On the transmit side, a 1:2 optical splitter device receives an output signal from the SPOMU. It then splits the signal and distributes it to OAs on both the primary and secondary lines. On the receive side, an optical switch receives the OA output of both the primary and secondary lines.

Initially, with no failure conditions present, the optical switch connects the primary receive-OA signal to the SPODU. When a line switch occurs, traffic is switched to the secondary line which then becomes the primary line. Signals continue to be taken from the new primary line until the OPS switches traffic back to the original one as a response to craft administration or when a LOS is detected on the new primary line. The OPS simultaneously monitors the signal on the primary and secondary receive fibers, and does not switch to the secondary line if LOS is detected on both lines.

NOTE:
When operating in bidirectional mode, both end terminals are provisioned as bidirectional. When operating in unidirectional mode, both end terminals are provisioned as unidirectional.

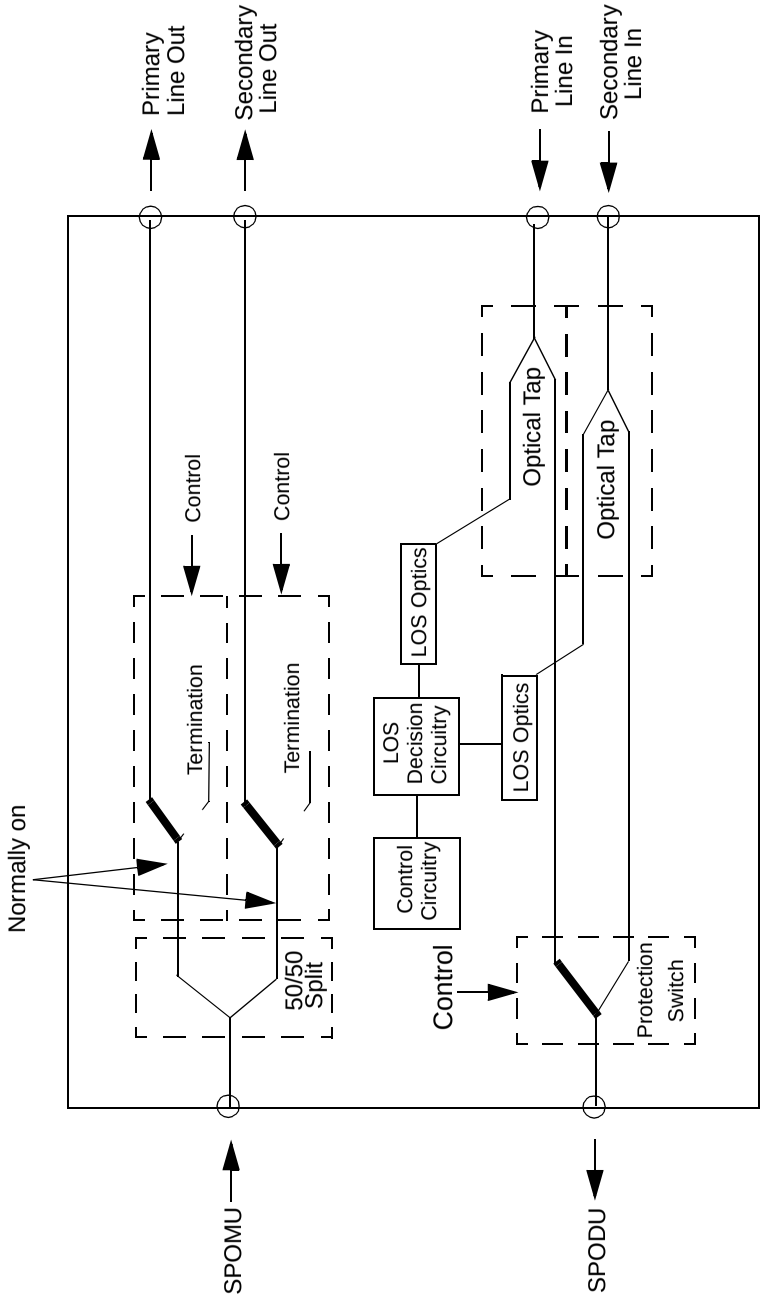


Figure 5-3. OPS Circuit Pack Block Diagram

Protection switching occurs based on channel presence and power as determined by optical monitoring of the received spectrum. The OPS provides LOS detection on the receive-side fiber and switches from the primary to the secondary line only if the primary signal is lost. The time between fault occurrence and connection to the secondary line is ≤50 ms. plus hold-off time.

"Hold-off" time refers to the duration of the delay beginning from the time LOS is initially declared to the time switching begins. During this delay, additional checking is performed to either corroborate the LOS or cancel the pending switch request (if signal has been detected and restored within that interval), and to verify that the signal is present on the secondary line.

Protection switching hold-off time is settable from 0 to 3 seconds with increments of 50 ms to accommodate external protection switching needs. If selected, bidirectional switching occurs as a result of temporarily disrupting transmission to the far end which forces a switch to take place at that end. This disruption lasts for approximately 4 seconds in order to exceed the maximum hold-off time at the far end. As illustrated in Figure 5-4, both the primary and secondary lines require separate OAs and telemetry circuit packs.

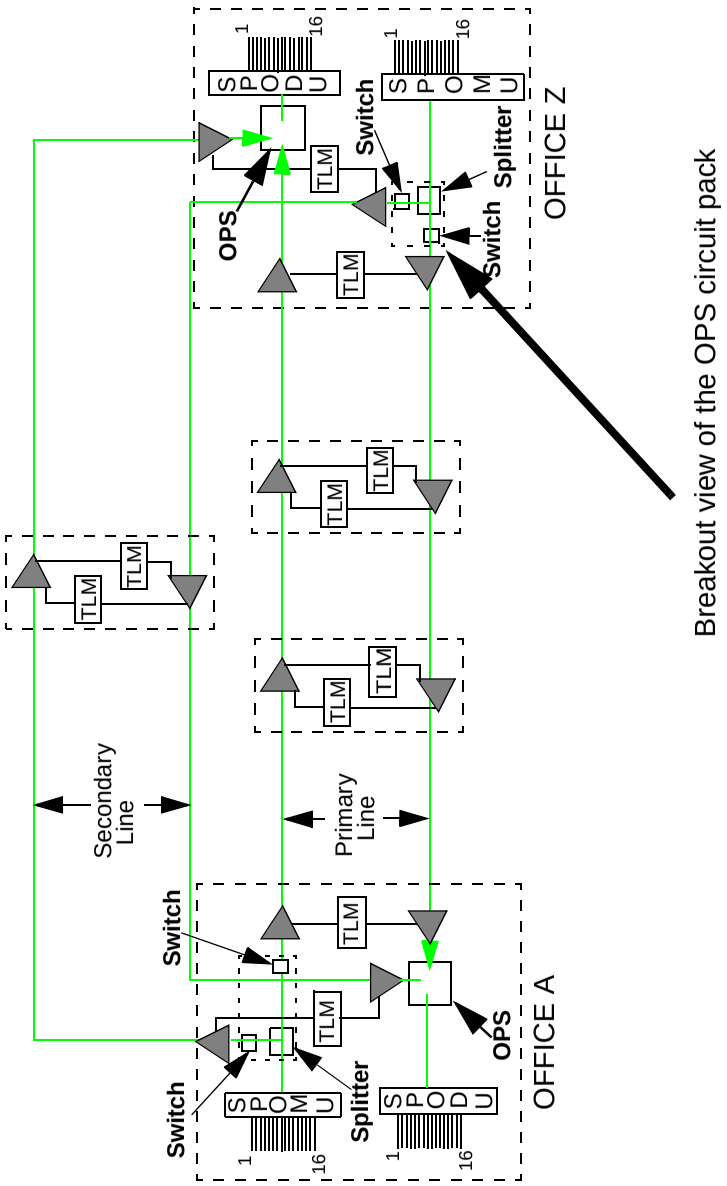


Figure 5-4. OPS Functional Diagram

The OPS, SPOMU, and SPODU circuit packs are functionally supported within the WaveStar OLS 40G OAM&P domain and are recognizable by WaveStar OLS 40G operations interface for equipage reporting. CenterLink commands are used for the retrieval of OPS system parameters and monitored conditions.

Detailed reporting of all conditions is also available from the CIT. This provides individual primary and secondary line LOS status to assist fault isolation, and indicates from which line traffic is currently being selected. In addition, the user software reports all of the monitored condition / performance parameter states shown in Table 5-3.

Table 5-3. Monitored condition/performance parameter types

Condition	OPS Fault Light
Primary Line LOS	Flashing
Secondary Line LOS	Flashing
Internal defect on OPS	On
Power converter on OPS	On
Fuse failure on OPS	On
Single fuse failure -48V feeders	On
OPS Pack insertion	On

Any WaveStar OLS 40G used for the protection line OAs is not populated with OMU / ODU circuit packs since the signal from a single OMU / ODU pair is split or combined by the OPS. WaveStar OLS 40G is provisionable via CenterLink commands for an OPS operating mode to suppress alarms on the missing OMU / ODU pair. OPS provisioning only applies to the dual-facing shelf configuration.

Fault Location/Maintenance

Insertion or removal of the OA on the secondary line does not cause any transmission impairments on the primary line. The OPS, SPODU and SPOMU provide state and fault information to WaveStar OLS 40G via its associated OT shelf and OTCTL pack. Autonomous reporting of the following conditions (from the OPS / OT / WaveStar OLS 40G to an EMS) are supported:

- Primary Line LOS
- Secondary Line LOS
- Internal defect on OPS
- Power converter on OPS
- Fuse failure on OPS
- Single fuse failure -48V feeders
- OPS resets
- OPS pack insertion

In addition, autonomous generation of messages clearing these conditions is also supported.

OPS Default Parameters

Table 5-4 lists OPS default specifications, as shipped from the factory.

Table 5-4. OPS Default Specifications

Specification	Default Setting
Switching line	1
Switching capability	Bidirectional
Hold-off time	0 ms

OPS with Dual-facing Shelf

Both the primary and secondary OA lines originate from the same dual-facing, WaveStar OLS 40G shelf. As seen in Figure 5-5, this arrangement provides single shelf operation while supporting a different number of spans for each line.

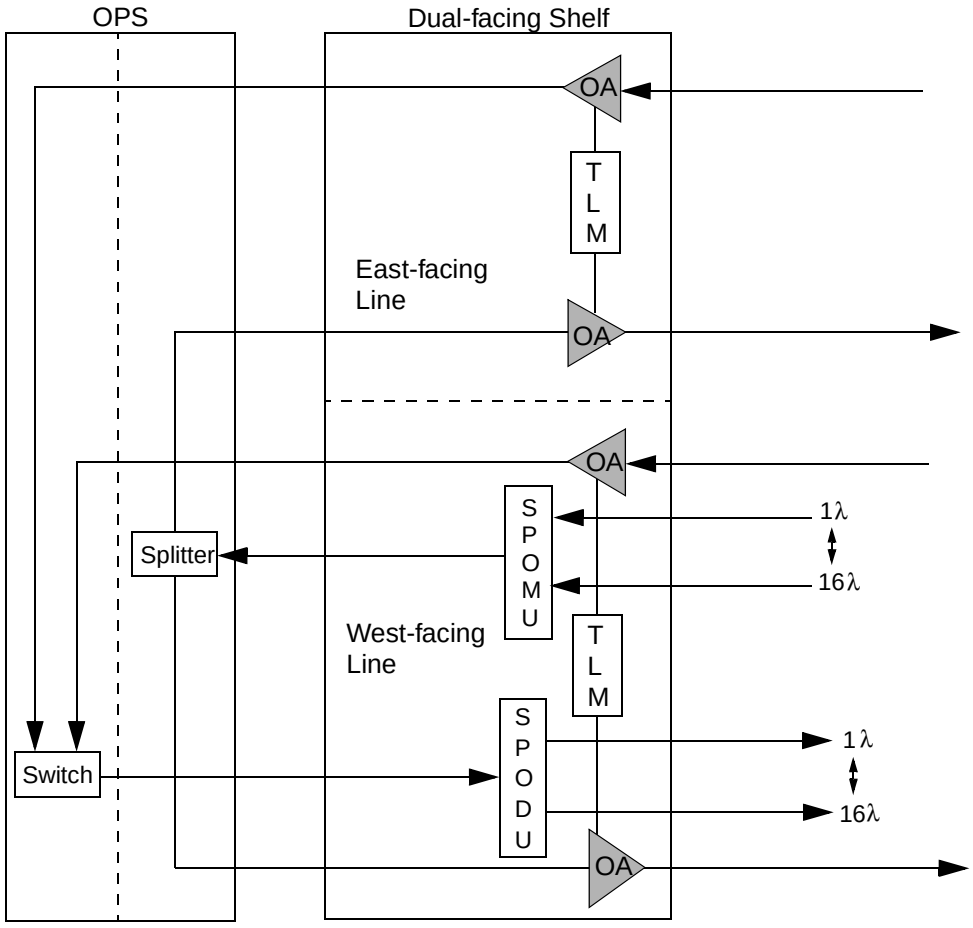


Figure 5-5. Dual-facing Shelf Configuration

The standard application for this feature provides single shelf, two fiber transmission path continuity from east to west between two end terminals. This application uses dual-facing shelves as end terminals, where two dual-facing shelves are connected with repeaters between them. With a dual-facing shelf configuration, the retrieve map ring report indicates the network elements comprising both primary and secondary lines in a ring. In addition, the dual-facing shelf configuration creates a DCC ring, and provides a single point of access for OAM&P in the event of a single line failure.

NOTE:
DCC protection switching is not supported as part of the OPS feature.

This mode of operation requires telemetry packs to be used as they are in standard WaveStar OLS 40G configurations, where the telemetry channel is connected from each OA to its respective TLM pack state. The telemetry signal is not switched, effectively bypassing the OPS. The OPS is not required to pass the telemetry signal to the ODU since the OA provides a direct output feed to the TLM pack.

Automatic Power Shutdown and Restart (APSD)

Release 3.0 utilizes APSD as a safety enhancement for WaveStar OLS 40G equipment. The APSD feature protects against optical surges and possible human exposure to powerful WaveStar OLS 40G output by reducing power to safe, Hazard Level 1. Two high power links exist in a WaveStar OLS 40G system:

- The optical line between adjacent offices
- The link between an OA and the ODU at receive-end OA (in this case, an LBO needs to be installed during system installation to ensure that power levels never exceed Class 3A).

In Release 3.0, APSD timing requirements are as follows:

Shutdown = < 3 seconds

Restart = < 5 seconds.

APSD in Two-OA Operation

The following information describes various network reliability scenarios in which the APSD feature can be used for two-OA operation.

Scenario 1 (Shutdown): Protection on an optical line link between WaveStar OLS 40G terminals.

In Figure 5-6, if a fiber cut occurs in a span between two WaveStar OLS 40G End Terminals or Repeaters, “OA2” in the downstream WaveStar OLS 40G detects a loss of optical power. The downstream terminal then powers down “OA3” to hazard levels within 850 ms of the fiber cut. At the same time, “OA2’ starts operating in a 0 channel setting. The downstream WaveStar OLS 40G sends an APSD-FE message to the upstream terminal to inform it of the condition. Upon detecting the message, the upstream terminal powers down “OA1” below 10 dBm. Powering down of “OA1” and “OA3” is completed within 3 seconds of the fiber cut.

Loss of optical power is declared when the OA detects a loss of all channels (including the telemetry channel) and the telemetry pack detects an incoming SUPR LOS. The OAs downstream from “OA2” also experience channel loss. These amplifiers operate in 0 channel power configuration within one second of a fiber cut occurring. The OAs downstream from “OA4” experience a decrease in incoming power and may or may not declare loss of channels. Simultaneously, the OAs upstream from “OA1” and “OA3” continue to operate in normal mode.

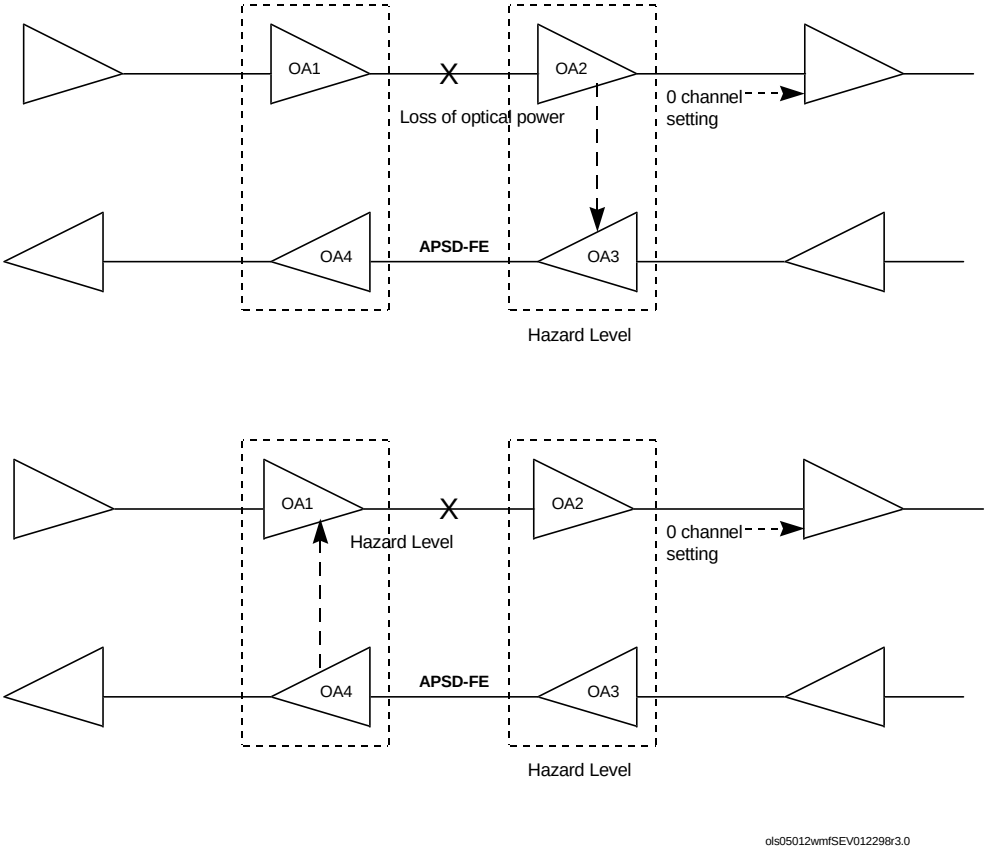


Figure 5-6. APSD for Optical Line Failure Between Terminals (Two-OA)

Scenario 2: Restarting on an optical line link between terminals.

In Figure 5-7, when the link between “OA1” and “OA2” is restored, the downstream WaveStar OLS 40G clears the power loss condition and then notifies the upstream terminal of the correction. The upstream terminal then reverts “OA1” back to normal power. Provided there are no failures upstream, the downstream terminal also turns “OA3” back up. “OA1” and “OA3” adjust to normal power within one second of start-up.

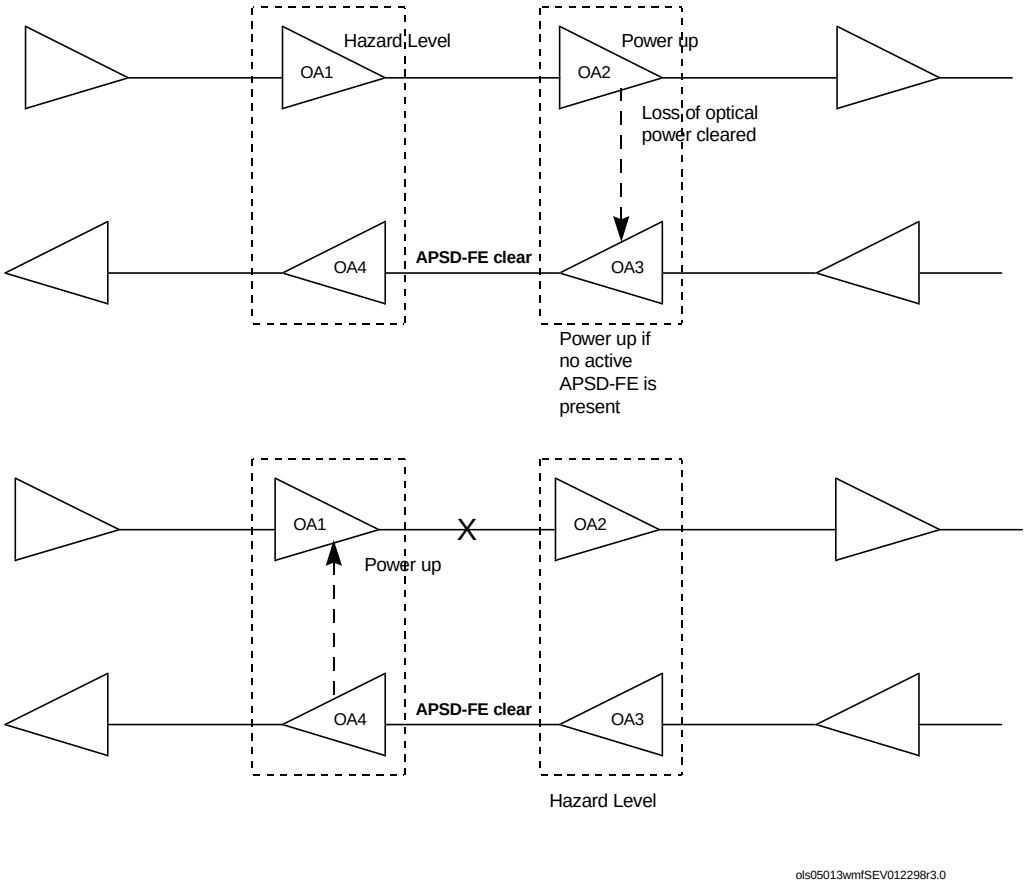


Figure 5-7. Restart on an Optical Line Link Between Terminals (Two-OA)

APSD in Single-OA Operation

The following information describes various network reliability scenarios in which the APSD feature can be used for single-OA operation.

Scenario 1: Protection on an optical line link between terminals

Figure 5-8 shows protection on an optical line link between terminals in a single-OA configuration. Here, optical line LOS stems from supervisory LOS detected by the TLM circuit pack. This could result in false APSD triggers due to failures in the upstream TLM. In Release 3.0, however, these false triggers do not adversely affect overall network reliability.

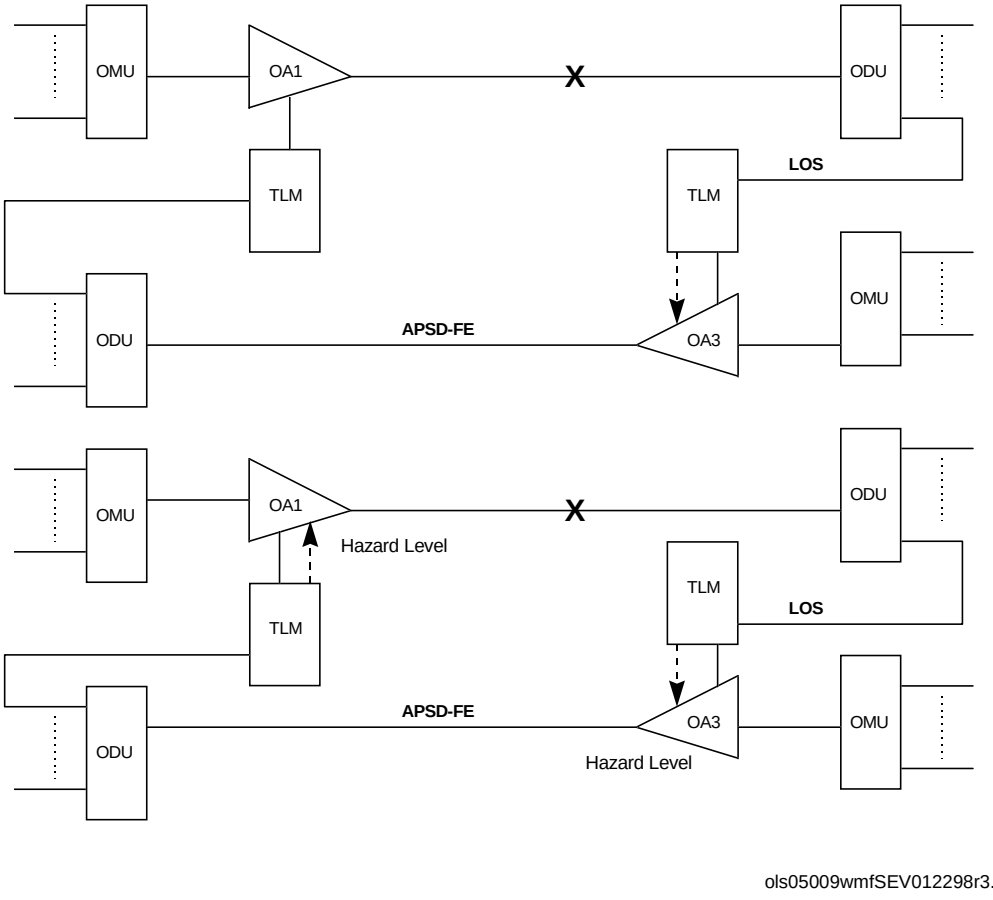


Figure 5-8. APSD from Optical Line Failure (Single-OA)

Scenario 2: Restarting on an optical line link between terminals.

The restart procedure for single-OA configuration is almost identical to Scenario 3. When the link between "OA1" and the ODU is restored, the telemetry pack clears the LOS condition. It also clears the APSD-FE message on the supervisory output. The upstream WaveStar OLS 40G detects the clearing of the message and instructs "OA1" to power up. Provided there is no active APSD-FE message from upstream, the downstream terminal powers up "OA3." Figure 5-9 illustrates restarting in a single-OA configuration.

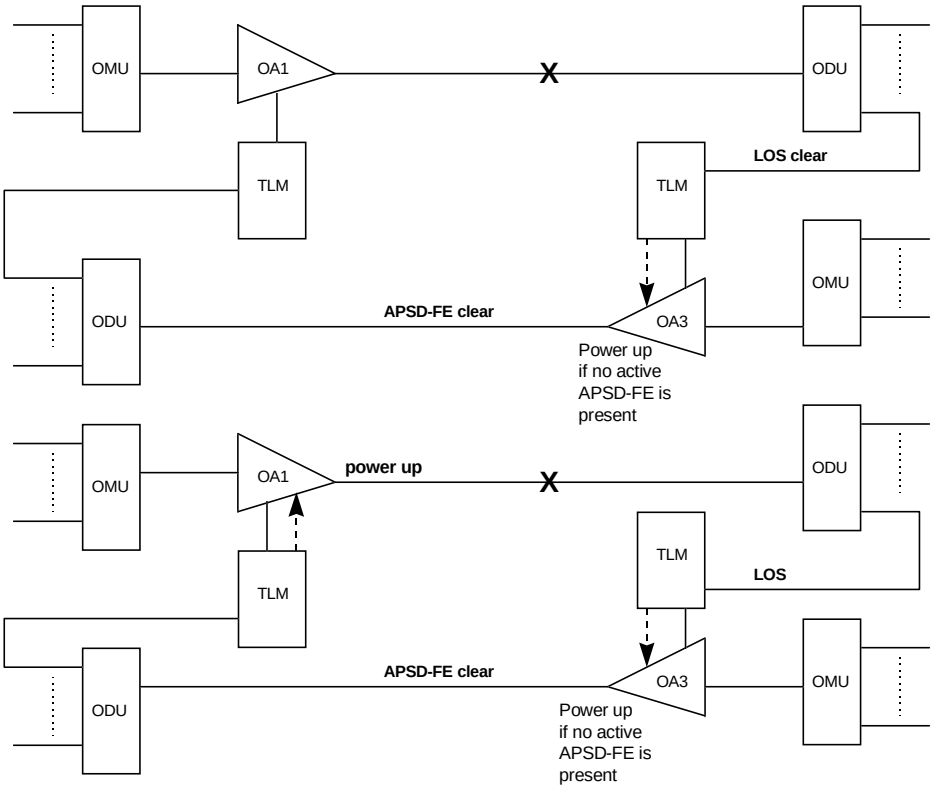


Figure 5-9. Restarting on an Optical Link Between Terminals (Single-OA)

APSD Double Failure Contingencies

The following double failure contingencies exist with the APSD feature:

- If an incoming supervisory channel failure exists at an upstream WaveStar OLS 40G, APSD cannot be activated
- If an incoming supervisory channel with an active RDI condition fails, APSD cannot resume normal operation when it is activated. However, manual resumption of normal operation is possible.

Performance Monitoring

WaveStar OLS 40G 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 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 (SUPR) 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.

Optical parameters for the SUPR include the following:

- 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

Digital parameters for the SUPR include the following:

- 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 Channel/Line Performance Monitoring Parameters

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

- Laser bias currents (LBC-P1, LBC-P2): laser bias currents from 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 from both OA pumps are also monitored and reported as "in range" and "out of range"
- Signal power per channel (SPR-C): signal power per channel is monitored by measurements of tone power on a channel. 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, WaveStar OLS 40G generates a TCA.

Performance Monitoring Data Storage

WaveStar OLS 40G provides a current and 32 previous 15-minute registers and a current and 6 previous 24-hour registers for all accumulated performance parameters. WaveStar OLS 40G 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. WaveStar OLS 40G 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, WaveStar OLS 40G 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

WaveStar OLS 40G 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

WaveStar OLS 40G provides turn-up tests to verify signal path continuity. These tests are a combination of automatic and manual tests designed to ensure that cables are correctly installed. WaveStar OLS 40G 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.

WaveStar OLS 40G also provides self-tests for office alarms, parallel telemetry, and LEDs.

Provisioning Consistency Audits

WaveStar OLS 40G 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, WaveStar OLS 40G audits the following information to ensure 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. WaveStar OLS 40G 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, WaveStar OLS 40G sends an alarm and does not put the change into effect until another change is made to remove the duplication
- End terminal provisioning (1A-TX, 1A-RCV, 1A-TX-THRU, 1A-RCV-THRU, and DUAL)– see “WaveStar OLS 40G Terminal Provisioning” in this chapter for information on provisioning telemetry circuit pack orientation. At start-up and after each ENT-SYS command, WaveStar OLS 40G checks to ensure that all nodes are provisioned as transmit or receive with respect to each other.

Reports

Active Alarms and Status

WaveStar OLS 40G provides a report showing all active alarm and status conditions. Immediately after logging in, WaveStar OLS 40G 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)
- Far-end activity (FE 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

WaveStar OLS 40G 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 WaveStar OLS 40G 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 was 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 listing all the circuit packs that are present. This report also lists the circuit pack version and software generic (if applicable).

State

An on-demand report displays the state of each addressed slot and port in WaveStar OLS 40G. 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)– 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)– the port is not monitored and will not transition to the IS state even if a good signal is detected
- In service (IS)– the port is fully monitored and alarmed.

The possible slot states are:

- Auto (AUTO)– the original value of the circuit pack slot state parameter. AUTO means the slot is available for automatic provisioning
- Equipped (EQ)– the slot is fully monitored and alarmed.

Orderwire

Orderwire provides voice communications through a DANTEL® unit for personnel performing facility maintenance. WaveStar OLS 40G provides an EIA-422, 64 kb / s orderwire interface per optical line for the following:

- Section orderwire
- Line orderwire
- Section user channel.

The overhead controller (OHCTL) circuit packs in the 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, "Ordering," for orderwire shelf ordering information.

Alarm Correlation

With WaveStar OLS 40G/OT integration capability (WaveStar OLS 40G with OT) in Release 3.0, user provisioning is done manually to associate a particular OT port with one or two optical channels. These channels are referred to as "upstream" and "downstream", depending on their relative location in the system. WaveStar OLS 40G/OT integration provides this capability, ending the need to rely on the OS to correlate alarms reported by WaveStar OLS 40G for optical channels and OT ports.

Any alarm condition reported for an optical channel is noted. The report resulting from this test indicates which optical channels are immediately downstream from each OTU or OTPM port in a system and is used to help establish correct optical channel/OT port associations. Each OTU or OTPM port can be associated with the following:

- 1 downstream optical channel (ADD connections- optical channel is in the multiplex direction)
- 1 upstream and 1 downstream optical channel (THRU connection- one optical channel in the multiplex direction and 1 in the demultiplex direction)*
- 1 upstream optical channel (DROP connection - one optical channel in the demultiplex direction)

If an alarm is reported for a particular OTU or OTPM port (for example: equipment failure or incoming signal failure), the port's output is turned off. Normally, this would result in an additional alarm (LOS) reported by the downstream optical channel. However, if the user has provisioned an associated downstream optical channel, reporting of the LOS alarm is suppressed on the downstream optical channel. WaveStar OLS 40G also sends an alarm indication message (AIM) to repeaters and end terminals further downstream in order to suppress any alarms they might generate due to the loss of the optical signal from the OT port.

* This is true only for terminals configured as DUAL. For other cases, only upstream or downstream associations can be provisioned.

NOTE:
The AIM does not pass between End Terminals when they are configured as a Dual-facing Shelf. The next separate WaveStar OLS 40G section this signal passes through will report OT port or optical channel alarms.

For THRU connections made in a Dual-facing Shelf, AIM is transmitted within WaveStar OLS 40G from one optical line to the other (provided that the user has provisioned THRU connections). Likewise, if an AIM or LOS is detected on a particular upstream optical channel, WaveStar OLS 40G would normally either do nothing (AIM) or report the LOS condition. An OTU or OTPM port connected to this optical channel would report an alarm condition in this situation as well (the exact alarm may depend on the type of WaveStar OLS 40G failure, with LOS being most probable). However, if the OTU or OTPM port has an associated upstream optical channel with an active AIM or LOS, the alarm for that port is not reported. The output of the OTU or OTPM port is suppressed (laser turned off) and the alarms of any associated downstream optical channel are also suppressed.

Present WaveStar OLS 40G and OT installations are arranged so that the alarms from each OTU are reported through the downstream WaveStar OLS 40G in an attempt to make it easier for the OS to perform alarm correlation. The transmission paths of carried signals usually take one of the following three possible paths through the WaveStar OLS 40G and OT:

- THRU connection– The signal is processed through the OTU and continues along the line
- ADD connection– The signal is taken from a terminal, processed by an OTU, and then added to the multiplexed line signal
- DROP connection– The signal is processed by an OTU and then drops off the line onto a WAD terminal

Provisioning

Provisioning is the assigning of values to parameters in memory. These parameters, in turn, affect the operation of the network element. WaveStar OLS 40G provides two types of provisioning modes

- Auto-provisioning: network element 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, three complete sets of data (parameters and their values) exist in the system. The first set, located in the nonvolatile memory of the SYSMEM circuit pack, contains the system parameters and their original values (values assigned to parameters at the factory). The second set, also located in the nonvolatile memory of the SYSMEM circuit pack, contains system parameters and their current values (values currently being used by the system). The third set, located in the volatile memory of the SYSCTL circuit pack, contains the system parameters and their current values.

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

Local or Remote Provisioning

WaveStar OLS 40G 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 *WaveStar OLS 40G Release 3.1.1 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 WaveStar OLS 40G 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 WaveStar OLS 40G 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, 1A-TX-THRU, 1A-RCV-THRU, and DUAL)
- 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

WaveStar OLS 40G automatically provisions a network element as an end terminal or a repeater by detecting the presence or absence of the OMU and ODU circuit packs. If both are present, the network element is provisioned as an end terminal. If these circuit packs are absent and the slots are left empty, the network element is provisioned as a repeater.

WaveStar OLS 40G Terminal Provisioning

During configuration of a single bidirectional optical line (not using single-OA operation), End Terminals and Repeaters are connected to the OA circuit packs in the 1A slot to establish the transmit direction. To establish the receive direction, terminals are connected to OAs in the 1B slot. Terminals on opposite ends from each other have opposite OA connections. The order of OMUs and ODUs are also arranged differently.

The telemetry (TLM) circuit pack has the same orientation. The outputs of the TLM packs are connected to the 1A OA circuit pack to establish the transmit direction. The 1A TLM circuit pack in the opposite end terminal is connected to the 1B OA circuit pack to establish the receive direction.

Since it is necessary to provision this circuit pack scheme for fault isolation, the end terminal with the 1A TLM-1A OA connection combined with all repeaters on the line are provisioned as “1A–TX” (transmit). The other end terminal is provisioned as “1A–RCV” (receive). In a 4-line End Terminal, both shelves are used as either 1A-TX or 1A-RCV. Dual-facing shelves handling 2-fiber applications are provisioned as “DUAL”. End terminals equipped with 4-Fiber Telemetry Feed-through have different designations than the existing types; to differentiate them, two new values, “1A-TX-THRU” and “1A-RCV-THRU” are added to the “dirn” parameter in the ENT-SYS-TL1 command.

Figure 5-10 shows WaveStar OLS 40G End Terminal shelves with different configurations.

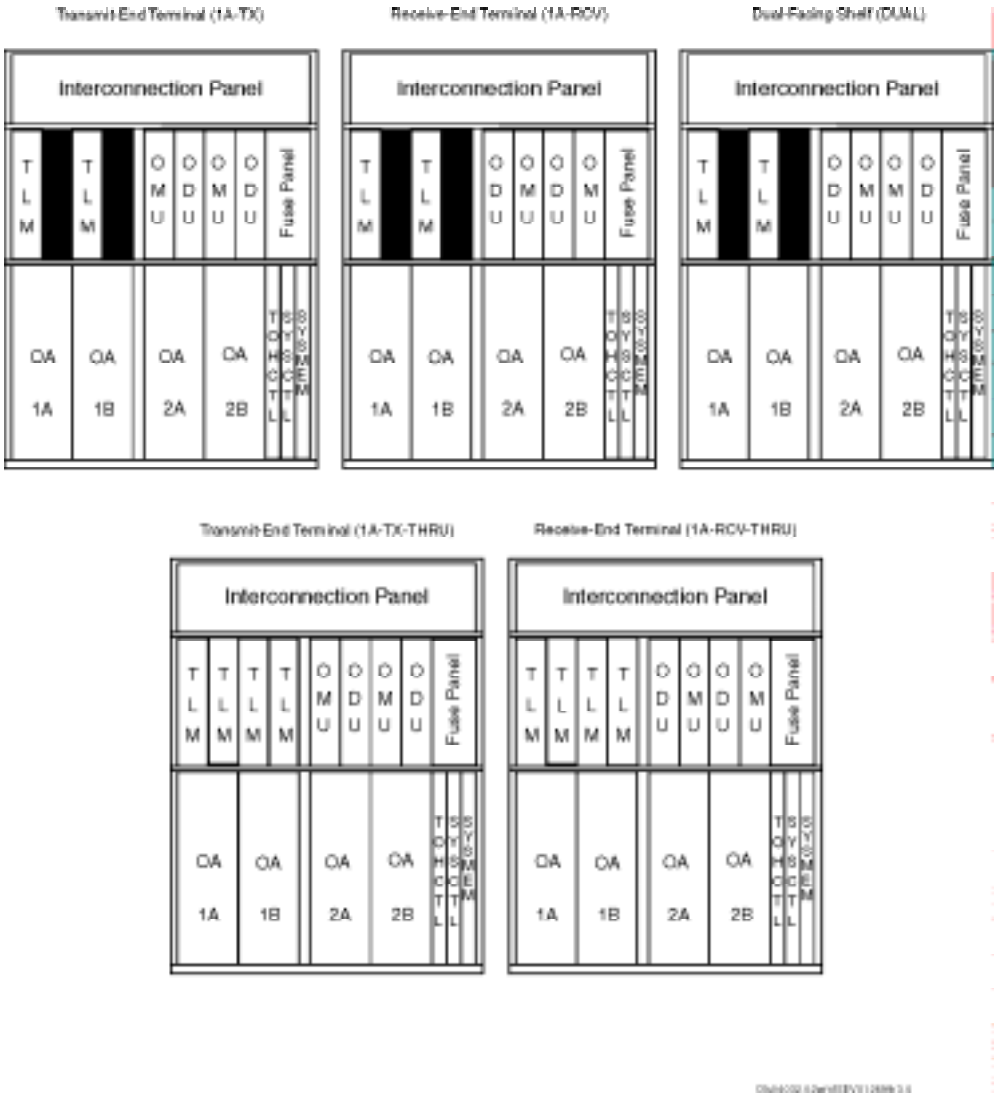


Figure 5-10. WaveStar OLS 40G End Terminal Shelves (fully equipped)

Dual-Facing Shelf

In 2-fiber applications, the Dual-facing Shelf feature is designed to extend the WaveStar OLS 40G operations domain and reduce the number of links between the Operations Support System and WaveStar OLS 40G gateway network elements. Refer back to Figure 5-10 for an illustration of a Dual-facing Shelf (shown at right). The Dual-facing Shelf allows the functions of collocated single-facing shelves to be combined so that only one shelf, recognized as a single network element, is used. In addition to the equipment savings on shelves and SYSCTL/SYSMEM/TOHCTL packs, coordination across the old limit of operations domains (using an Operations Support System [OSS] or orderwire) is no longer necessary. In this application, OA lines 1A and 1B are used as receivers and OA lines 2A and 2B are used as transmitters.

NOTE:
The OPS feature is used in 2-fiber, two-OA applications for dual-facing shelf configurations only. Single-OA applications are not supported.

Refer back to Figure 5-1 and Figure 5-2 for a depiction of the differences between 2-fiber WaveStar OLS 40G operations with and without the Dual-facing Shelf feature.

4-Fiber Telemetry Feed-Through

The same operations principle governing the Dual-facing Shelf applies to the Telemetry Feed-through feature for 4-fiber applications, introduced in Release 3.0. In WAD or regenerator sites with collocated WaveStar OLS 40G End Terminals linked via 4-Fiber Telemetry Feed-through, the operations domain for network operators and/or the OSS is extended beyond a single WaveStar OLS 40G. This allows the DCC to go from one End Terminal (one WaveStar OLS 40G subnetwork) through to the other collocated End Terminal (another WaveStar OLS 40G subnetwork) and also creates savings in operations coordination between WaveStar OLS 40G systems with regard to configuration management and fault management.

From a hardware perspective, the new feature requires an additional TLM pack for each optical line (in the slot of TLM 1B or TLM 2B). From a software perspective, the DCC software on the TOHCTL circuit pack will be enhanced to not only process the DCC information routed from the TLM 1A/2A pack but further route the DCC information to the TLM 1B/2B pack. The TLM 1B/2B pack in one End Terminal is connected via a fiber jumper to the TLM 1B/2B in the other End Terminal for routing the DCC information through.

When the DCC information comes out from the other TLM 1B/2B pack to the TOHCTL pack in the other end terminal, it gets processed by the TOHCTL pack as needed.

In normal situations, the DCC on Optical Line 1 is used. If Optical Line 2 is available and Optical Line 1 fails, the DCC is protection-switched to Optical Line 2. For Optical Line 2, 4-Fiber Telemetry Feed-through works the same way. In Figure 5-12, the shaded blocks represent the additional TLM slots filled with TLM 1B circuit packs, and the dashed lines indicate the passage of DCC information from one WaveStar OLS 40G End Terminal in one WaveStar OLS 40G subnetwork to another collocated End Terminal in another subnetwork via the fiber jumper connecting the two additional TLM packs. Similarly, the DCC information in the opposite direction takes a symmetric passage.

Figure 5-11 and Figure 5-12 illustrate the WaveStar OLS 40G architecture without and with the 4-Fiber Telemetry Feed-through feature, respectively. These figures show only the case of Optical Line 1 in one direction. Only the DCC on one of the two optical lines is used at any one time. The DCC in the other direction works the same way.

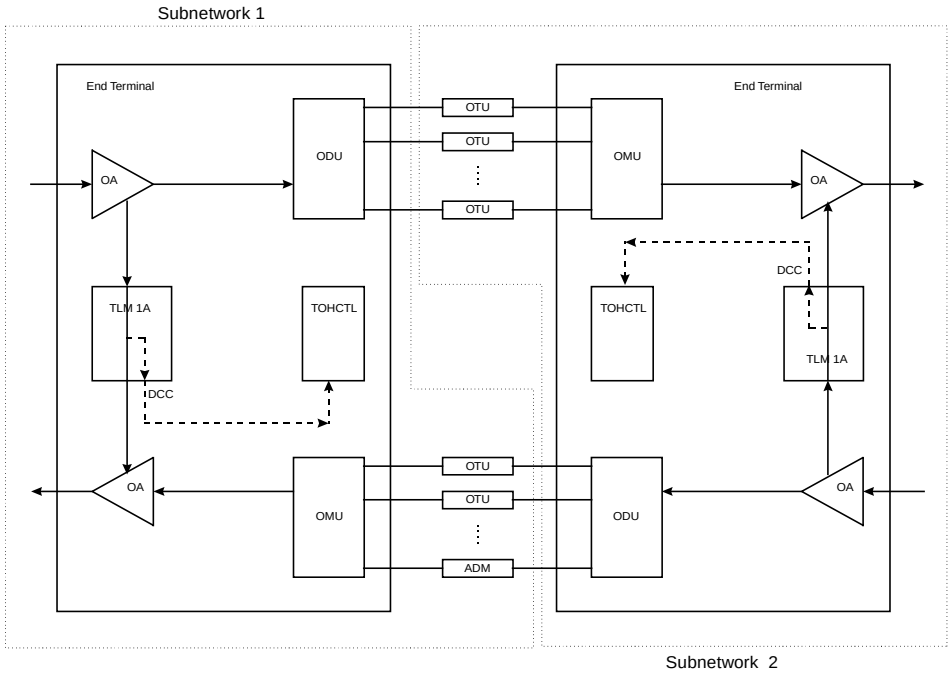


Figure 5-11. WaveStar OLS 40G Architecture without 4-Fiber Telemetry Feed-Through

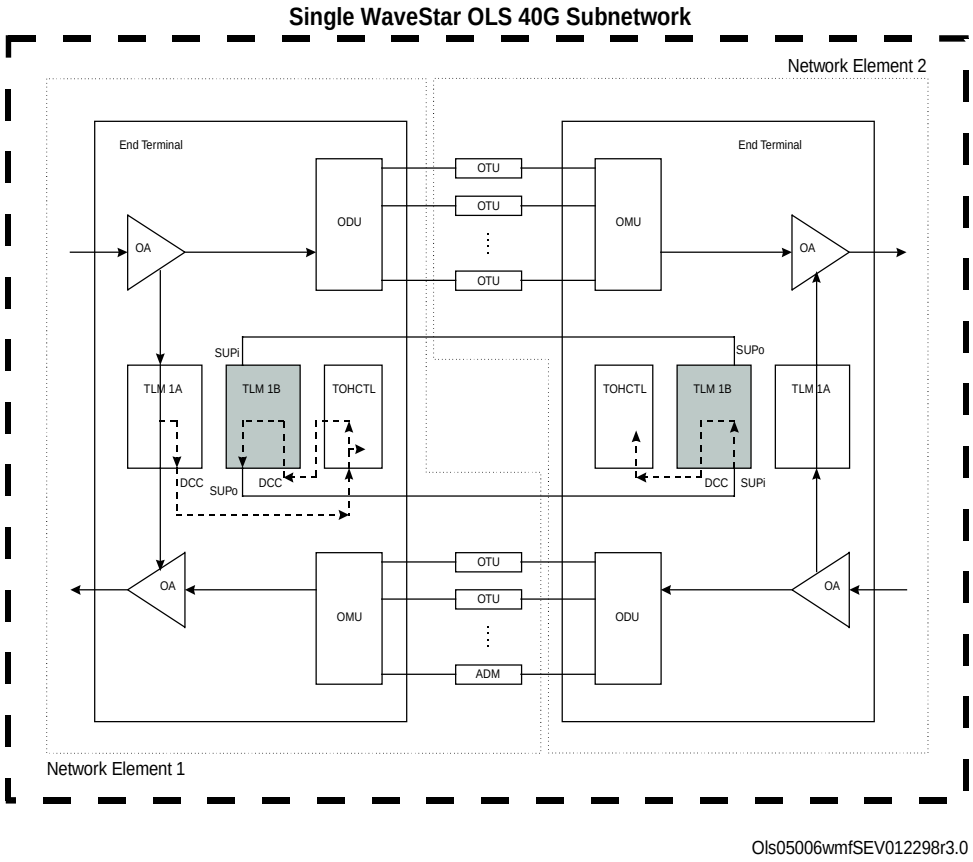


Figure 5-12. WaveStar OLS 40G Architecture with 4-Fiber Telemetry Feed-Through

The 4-Fiber Telemetry Feed-through feature extends the DCC across concatenated WaveStar OLS 40G subnetworks so that the following operations interworking capabilities are available in a much larger scope:

- Remote TL1 access through GNE
- Remote network element status (remote alarming, alarm groups, AGNE)
- Remote software copy
- Directory service network element (DS-NE)
- Network map retrieval (RTRV-MAP-NETWORK).

DCC protection switching still works on a per span basis. Here, the span can be situated on the left side or the right side, or it can be the fiber jumper itself. In the extended operations domain, only one DS-NE exists and it can work without modification.

WaveStar OLS 40G/OT Integration

In Release 3.0, a new circuit pack, the OT Controller (OTCTL), has been introduced to integrate the two systems when the OT is used with WaveStar OLS 40G. Occupying three slots in the OT System Controller Shelf, the OTCTL is controlled by the existing SYSCTL and SYSMEM circuit packs in a WaveStar OLS 40G shelf and integrates the OTUs into the WaveStar OLS 40G control structure. From an operations perspective, the addition of the OTCTL makes WaveStar OLS 40G and OT appear to the user as a single network element.

The WaveStar OLS 40G operations interfaces now become the mechanism for obtaining information about the OTUs. Instead of using the two miscellaneous discrete points for monitoring, more detailed information is available through TL1 messages at the CIT and X.25 ports. The OTCTL controls all of the OTUs within the same cabinet or network bay frame via the BCLAN connections provided in the backplane and inter-shelf OT cabling.

WaveStar OLS 40G Architecture

WaveStar OLS 40G uses a hierarchical control architecture. The control system hierarchy consists of two levels, the system controller complex and the board controller. 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 5-13 shows WaveStar OLS 40G system control architecture. See “Control Circuit Packs” in Chapter 4 for more information.

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.

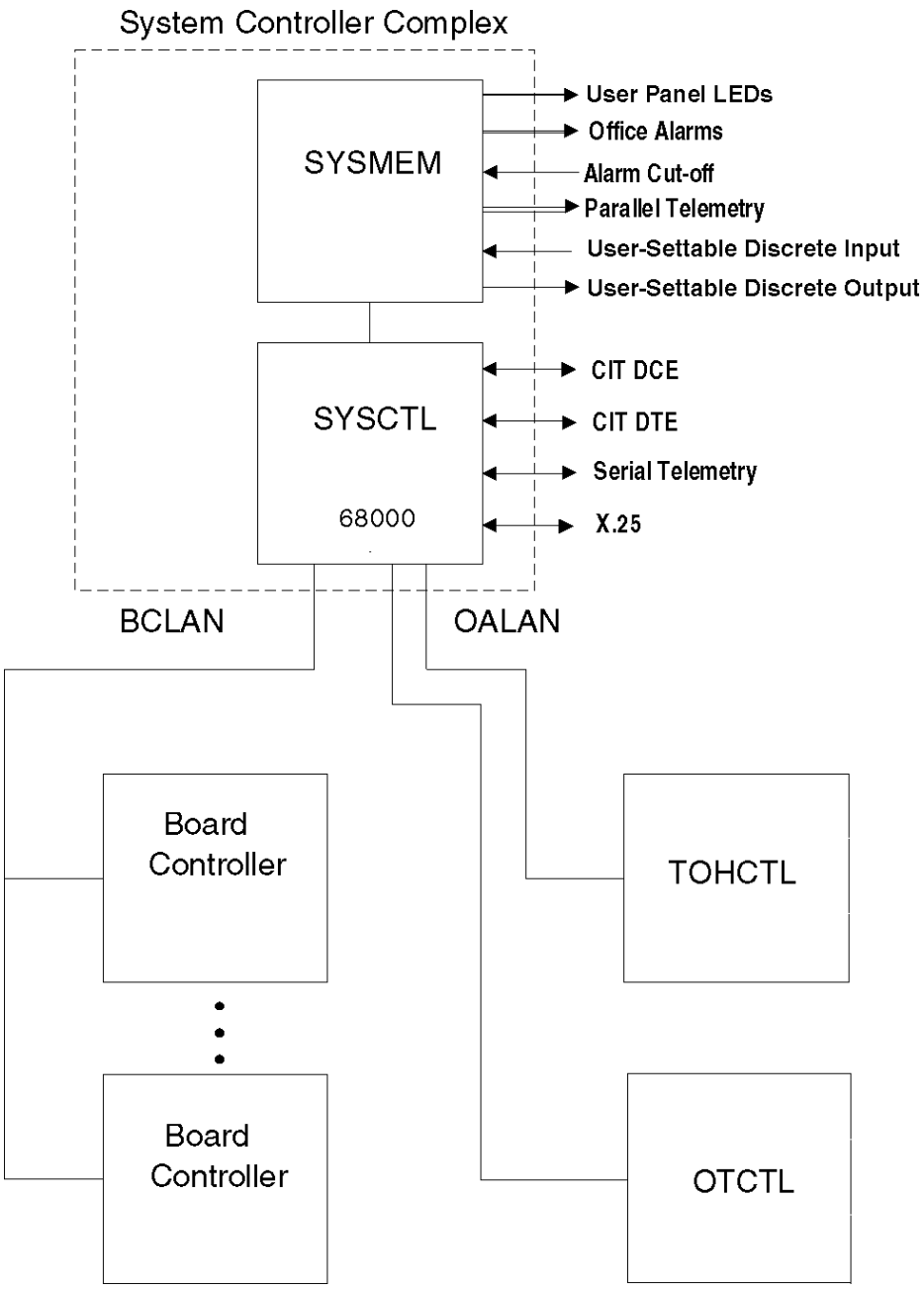


Figure 5-13. System Control Architecture for WaveStar OLS 40G with OT

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).

WaveStar OLS 40G 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.”

System Planning and Engineering

6

System Planning and Engineering

6

This chapter summarizes information needed for applications planning before procurement and deployment of WaveStar OLS 40G.

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 designate a building that will serve as a terminal office or repeater site. This plan should take into consideration the eventual system size and include the following elements:

- Engineering rules
- Floor plan layout
- Equipment interconnection
- Cabling
- Environmental considerations
- Power planning.

Lucent Technologies offers engineering and installation services for planning and installing WaveStar OLS 40G. For more information, refer to Chapter 8, “Product Support.”

Engineering Rules

This section describes the engineering rules for WaveStar OLS 40G.

Lightguide Buildouts (LBO)

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 *WaveStar OLS 40G/Optical Translator (OT) Installation Manual.*

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

WaveStar OLS 40G Network Topologies

Table 6-1 shows the four types of Optical Amplifiers (OA) used in WaveStar OLS 40G. WaveStar OLS 40G supports any mix of OC-3/12/48, STM-1/4/16, or 150-750 Mb/s signal rates. WaveStar OLS 40G supports two-OA and single-OA operations.

Table 6-1. Optical Amplifiers used in WaveStar OLS 40G

OA Code	Application	Two-OA	Single-OA
LEA6	Long Span	✔	
LEA7	Long Reach	✔	
LEA104	Long Span	✔	
LEA105	Short Reach	✔	✔

Engineering Rules for Two-OA Applications

Figure 6-1 shows the configuration of a two OA WaveStar OLS 40G system where each span is supported by two OAs. WaveStar OLS 40G systems carry up to sixteen signals on an optical line of up to eight spans. The engineering rules for two-OA systems are shown in Table 6-2.

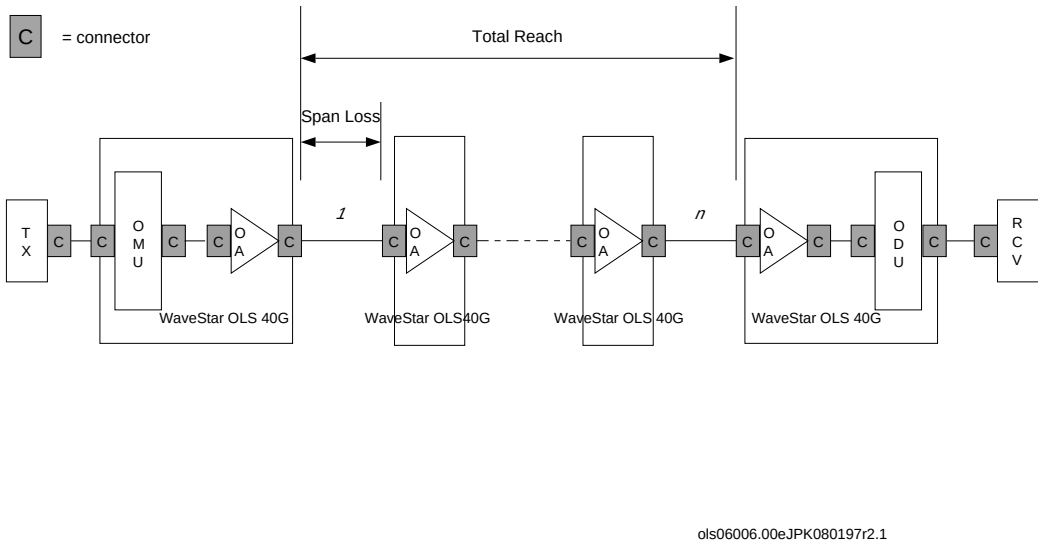


Figure 6-1. WaveStar OLS 40G Two-OA System

Table 6-2. Engineering rules for Two-OA WaveStar OLS 40G 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	124	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**
Long Span††	LEA104	16	1	22	35	35	140	140
			2	22	34	68	136	272
			3	22	33	99	132	396
			4	26	31	124	124	496
			5	23	27	135	108	540
Short Reach	LEA105	16	1	14	18	18	72	72

* WaveStar OLS 40G supports any mix of OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, or 150-750 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 WaveStar OLS 40G for actual networks. Please contact your Lucent Technologies sales representative for more information.

‡ The SPOMU circuit pack is required for seven and eight span systems when using the OPS feature. On these spans, a 3dB LBO is added at the output of each OA, making the effective span loss 25dB.

** 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®).

†† In systems where the LEA104 OA is used, Release 3.0 or later software must be used.

Engineering Rules for Optical Protection Switching

For seven and eight spans, the optical signal-to-noise ratio originally experienced a penalty of 2 dB. In Release 3.1.1, the SPOMU circuit pack contains a lower insertion loss (6 dB) to correct this and is required for 7x22 and 8x22 dB applications.

In Release 3.1.1, only one span difference between primary and secondary lines is supported. In addition, the span loss value for both lines must be nearly the same if not equivalent. For example, if Line A has eight spans with 25 dB of loss (8x25), then Line B must have seven spans at or near 25 dB of loss (7x25). A configuration such as 8x25 and 7x22 is not supported.

The following guidelines govern usage of the OPS feature in Release 3.1.1:

- A maximum of 1 span difference is allowed between primary and secondary lines
- Both lines should operate with the same configuration settings: A, B, or C. The line with the greater number of spans determines the appropriate configuration (A, B, or C); minimum and maximum span loss is thus determined by the engineering rules of this line

  For example, a five-span line paired with a six-span line must be configured for six spans and is limited to the span loss allowed for a six span system. In this example, the five-span system would be modeled in SmartManual as a five-span system of type C. If routing considerations require that the two routes use different configurations and rules, consult Lucent Technologies
- The maximum loss difference per span at start of system life is 3 dB. The span loss needs to be matched for each span starting at the head end and working forward. If the two routes have a different number of spans, the loss of the “extra” span can be set by typical engineering rules
- The maximum differential drift that is tolerated between spans in the route is 3 dB beyond installed start of life losses; this is so if the maximum loss of either span does not exceed the limit set by standard engineering rules for Two-OA applications.

NOTE:
The information in Table 6-2 also governs the OPS feature.

Engineering Rules for Single-OA Applications

For Short Reach applications, WaveStar OLS 40G supports Single OA operation. Over short distances, the receive end of a span can be configured to operate without an input OA, providing economy.

NOTE:
The OPS feature does not support Single-OA operation.

Figure 6-2 shows the single-OA operation with only one span between End Terminals. Single OA systems use the LEA105 OA and carry up to sixteen channels.

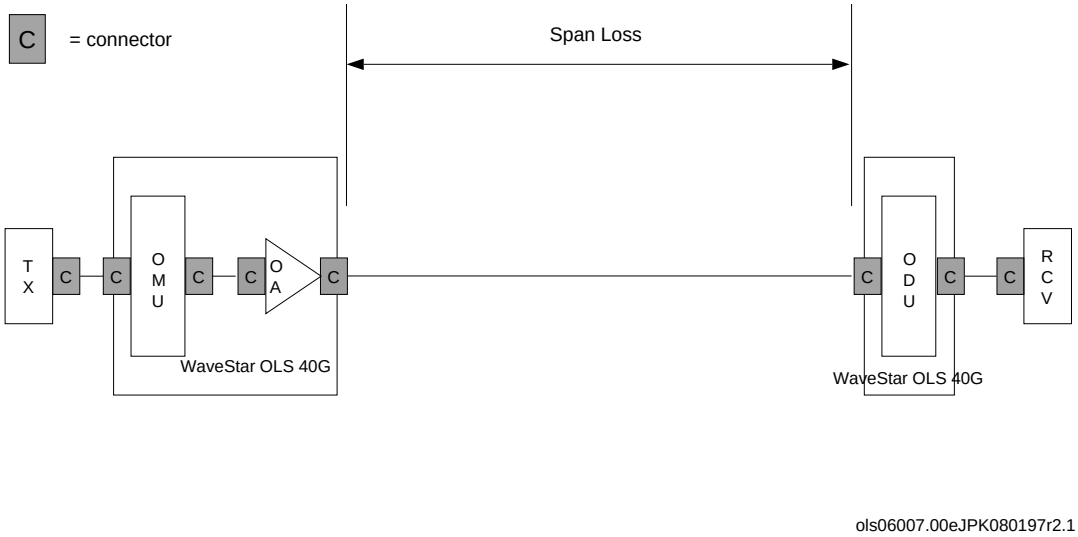


Figure 6-2. WaveStar OLS 40G Single OA System

Table 6-3 displays engineering rules for Single-OA WaveStar OLS 40G systems.

Table 6-3. Engineering Rules for Single-OA WaveStar OLS 40G Systems using LEA105* † ‡

OA Code	Max No. Channels	No. Spans	Span Loss dB		Total Reach (km)	Signals/ Bit Rates
			min	max	Fiber Loss= 0.25dB/km	
LEA105	16	1	0	12	48	OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, or 150-750 Mb/s
		1	0	12	48	OC-48/STM-16, OC-12/STM-4, or 150-750 Mb/s
		1	0	13	52	OC-48/STM-16 or OC-3/STM-1
		1	0	16	64	OC-12/STM-4, OC-3/STM-1, or 150-750 Mb/s
		1	0	13	52	OC-48/STM-16 alone
		1	0	16	64	OC-12/STM-4 alone or 150-750 Mb/s
		1	0	20	80	OC-3/STM-1 alone

* For standard single-mode fiber (SSMF)

† WaveStar OLS 40G supports any mix of OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, or 150-750 Mb/s signal rates.

‡ The OPS feature does not support Single-OA operation.

Long Span WaveStar OLS 40G Configurations

Table 6-4 provides information on Long Span configurations supported in Release 3.1.1.

Table 6-4. Long Span WaveStar OLS 40G Configuration

		Transmission Circuit Packs Required*		
# of Channels	Configuration	OMU	ODU	OA
up to 8	up to 3x33 dB	505A or 506A	605A, 606A, or 606B	LEA6
up to 16	up to 5x27 dB	506A	606A or 606B	LEA104

* See Chapter 7, "Ordering," for circuit pack descriptions.

NOTE:
Since upgrading from an 8-wavelength to a 16-wavelength system is done off-line (traffic switched away from the optical line being upgraded), the order of changing OMU, ODU, and OAs is not critical. Consult the *WaveStar OLS 40G Release 3.1.1 Installation Manual* for the preferred procedure.

Figure 6-3 shows examples of WaveStar OLS 40G equipped with 16-wavelength channels. One direction is depicted.

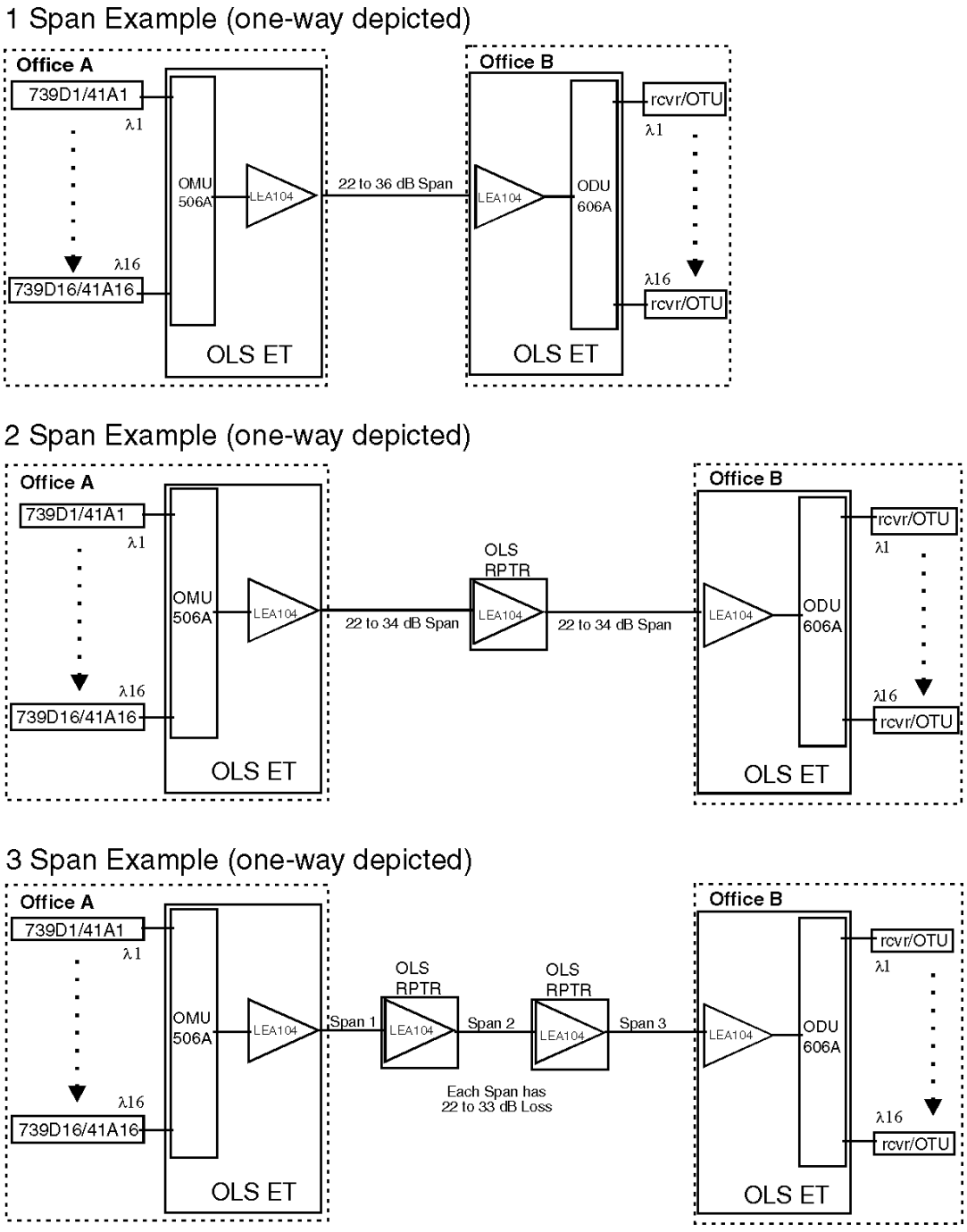


Figure 6-3. WaveStar OLS 40G Systems with 16-Wavelength Channels

Dispersion

In WaveStar OLS 40G systems with dispersion of less than 6800 ps/nm, use of 41AxC OTUs or Lucent Add/Drop Multiplexers (ADM) with an equivalent WaveStar OLS 40G-compatible transmitter is recommended.

In WaveStar OLS 40G systems with dispersion between 6800 ps/nm and 10,900 ps/nm, use of 41CxC OTUs or Lucent ADMs with an equivalent WaveStar OLS 40G-compatible transmitter is required for OC-48/STM-16 signals. The 42Ax and 43Ax Optical Translator Port Modules (OTPM), associated with the Quad Optical Translator Units (QOTU), can accommodate dispersions of up to 10,900 ps/nm.

WaveStar OLS 40G/OT Interworking

OTUs (OC-48/STM-16) and OTPMs that are installed in a QOTU (OC-3/STM-1, OC-12/STM-4, or low speed broadband 150-750 Mb/s) can be used to concatenate WaveStar OLS 40G systems to increase the distance between SONET/SDH line terminals. They can also be used for adding and dropping wavelengths.

NOTE:
All OTPMs and OTUs can be used to concatenate WaveStar OLS 40G systems, except low speed broadband 150-750 Mb/s OTPMs.

A maximum of sixteen OTUs/OTPMs can be used between SONET/SDH line terminals. Figure 6-4 shows WaveStar OLS 40G systems using OTUs/OTPMs for adding or dropping wavelengths (may or may not be needed). The OTUs/OTPMs can also be used to concatenate multiple point-to-point WaveStar OLS 40G systems. Each WaveStar OLS 40G system can have a different number of spans.

For terminal equipment that does not require OTUs/OTPMs for adding or dropping wavelengths, OTUs/OTPMs can be used to concatenate up to seventeen WaveStar OLS 40G systems and support up to sixteen WAD sites. When OTUs/OTPMs are used at end terminals for signals originating from non-Lucent equipment, they can be used to concatenate up to fifteen WaveStar OLS 40G systems and support up to fourteen WAD sites.

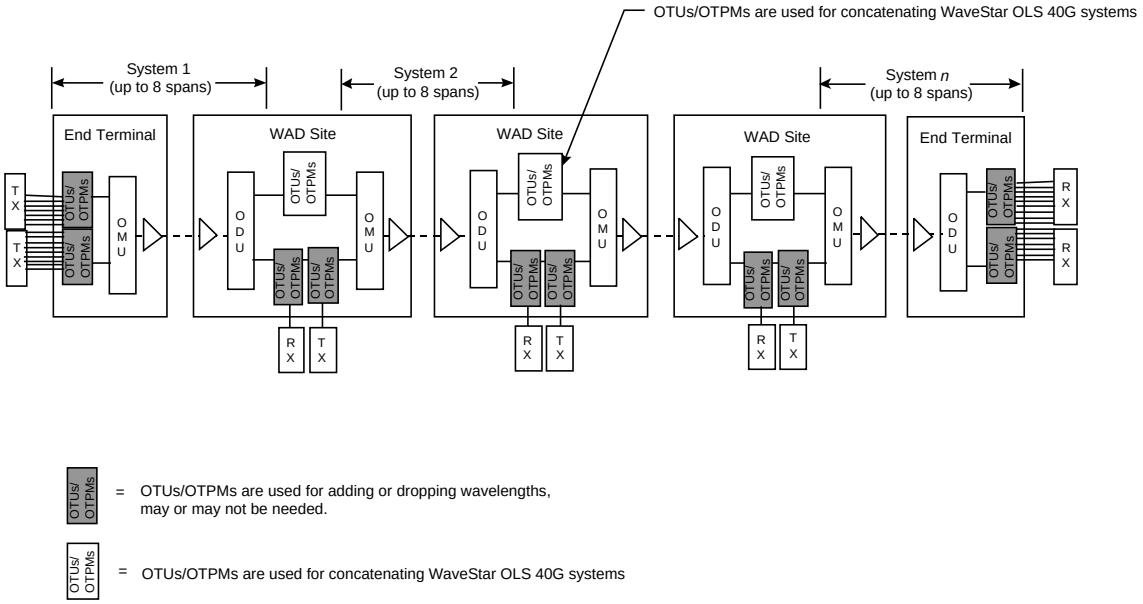


Figure 6-4. WaveStar OLS 40G/OT Interworking

Table 6-5 and Table 6-6 show examples of maximum overall distance in cases where sixteen OTUs/OTPMs are used to concatenate seventeen point-to-point WaveStar OLS 40G systems and each system has the maximum number of spans. For example, when sixteen OTUs/OTPMs are used to concatenate seventeen WaveStar OLS 40G systems with LEA7 OAs (each WaveStar OLS 40G system has eight spans with 22 dB loss each), the maximum overall distance is 11,968 km. These tables also show examples of maximum distance for WaveStar OLS 40G systems using LEA6 and LEA105 OAs.

Table 6-5. Examples of OTUs Used to Concatenate 8-Channel WaveStar OLS 40G Systems

Description	Example 1: LEA6 OA	Example 2: LEA6 OA
Per WaveStar OLS 40G System*		
Max. No. Spans	3	5
Max. Span Loss (dB)	33	30
Total Reach (km)†	396	600
Per Wavelength		
Max. No. OTUs/OTPMs	16	16
Max. No. Spans	51	85
Max. Overall Distance (km)	6732	10,200

* 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 OTUs Used to Concatenate 16-Channel WaveStar OLS 40G Systems

Description	LEA6 OA Two-OA System	LEA7 OA Two-OA System	LEA105 Two-OA System	LEA105 Single-OA System	LEA104 Two-OA System
Per WaveStar OLS 40G System*					
Max. # Spans	1	8	1	1	3
Max. Span Loss (dB)	33	22	18	12	33
Total Reach (km)†	132	640	72	48	396
Per Wavelength					
Max. # OTUs / OTPMs	16	16	16	16	16
Max. # Systems	17	17	17	17	17
Max. # Spans	17	136	17	17	51
Max Overall Distance (km)	2244	11,968	1224	816	6732

* 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 eight wavelength Release 2.0 WaveStar OLS 40G to a sixteen wavelength Release 2.1 or later WaveStar OLS 40G, the following considerations need to be made during the planning stage:

- Verify the span loss of the existing eight wavelength system is within the engineering rules of the sixteen wavelength system. If it is not within the rules, re-engineering is needed
- The eight wavelength OMU/ODU circuit packs must be changed to sixteen wavelength OMU/ODU circuit packs
- To accommodate sixteen wavelengths, WaveStar OLS 40G Release 2.1 or later software is required.

When upgrading from Release 3.0 to Release 3.1.1 software, the following points need to be considered:

- Perform upgrade prior to installing the OPS, SPODU, and SPOMU circuit packs
- An OTCTL circuit pack needs to be installed and operating on your system
- Two OT System Controller shelves and two OT Complementary Shelves may be needed to support a fully loaded WaveStar OLS 40G system (thirty-two OC-48 OTUs, one OPS, one SPODU, and one SPOMU).

LBO Considerations

Lists L112, L114, L122, and L132 apply to systems handling up to 16 wavelengths and are recommended for use with Release 3.1.1. Use the following rules when installing LBOs associated with an upgrade (see Figure 6-10):

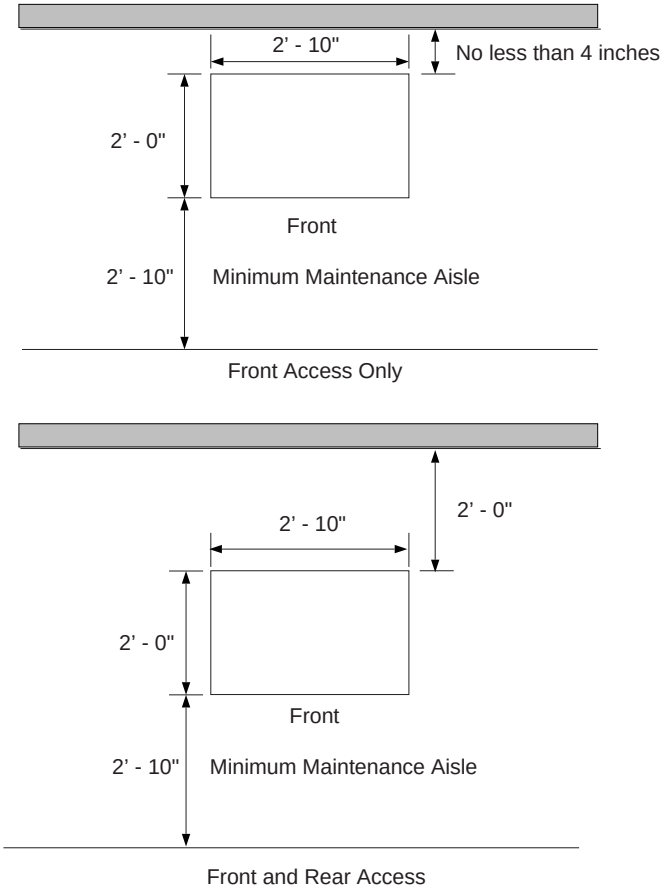
- If your system utilizes a L50 ODU and a L60 OMU and currently handles up to 8 wavelengths, LBOs on OA, OTUs, and ODUs already in service do not need to be changed either during or after an upgrade to Release 3.1.1. No new kit is required
- If your system utilizes a L50 ODU and a L60 OMU and you are adding up to 8 wavelengths of new capacity following an upgrade to Release 3.1.1, use L122 and L132 LBO kits on OTUs.

- If you are upgrading to a L61 OMU and a L51 or L52 ODU to handle 16 wavelengths, LBOs must be re-installed on all OTUs previously in-service. L122 and L132 LBO kits are required.
- If the span loss of your system is not within the 16 wavelength engineering rules, all OA LBOs must be re-installed using L112 and L114 following an upgrade to Release 3.1.1 (it is assumed in this case, that significant system re-engineering has been undertaken)

NOTE:
When removing wavelengths, the dBm output of the OA decreases, requiring adjustment to LBO settings.

Floor Plan Layout

Figure 6-5 shows a typical floor plan layout for the WaveStar OLS 40G and OT in a central office. Both the WaveStar OLS 40G 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 and 804-604-162) for explicit details.



ols06001.01eSEV082297r2.1

Figure 6-5. Floor Plan Layout

Equipment Interconnection

WaveStar OLS 40G 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 WaveStar OLS 40G in controlled environment vaults, concrete huts, or other locations, where space is limited and equipment must be placed close to the wall.

NOTE:
All external interconnection cabling uses industry standard connectors.

Cabling

The following are major classes of signals cabled to WaveStar OLS 40G:

- Optical channels (drop side signals)
- OAM&P electrical signals
- Customer maintenance (CM) optical signals
- Optical line signals.

Optical interfaces (TLM, ODU, OMU, and OA) are designed to provide connections through a front-mounted connector system. The connector system supports the use of the following four types of connectors:

- ST®*
- FC*
- SC*
- LC.

If required, the connector system also provides optical attenuation (optical LBO). All optical interfaces are factory-equipped with ST connectors having 0 dB attenuation. These connectors can be changed and other connector types used.

In addition, a kit with LBO values from 3 to 10 dB is shipped with the ODU. The correct LBO value must be chosen after the system is installed.

* Function as both a connector and an LBO.

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

Figure 6-6 shows the build-out block and an ST-type LBO assembly.

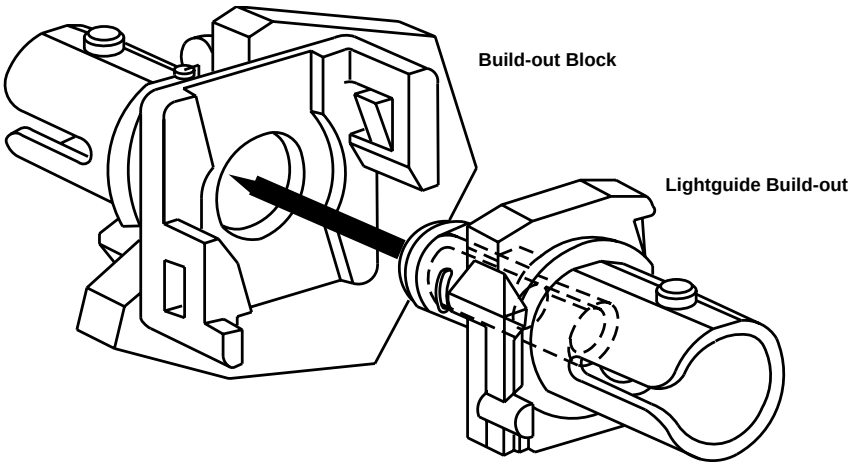
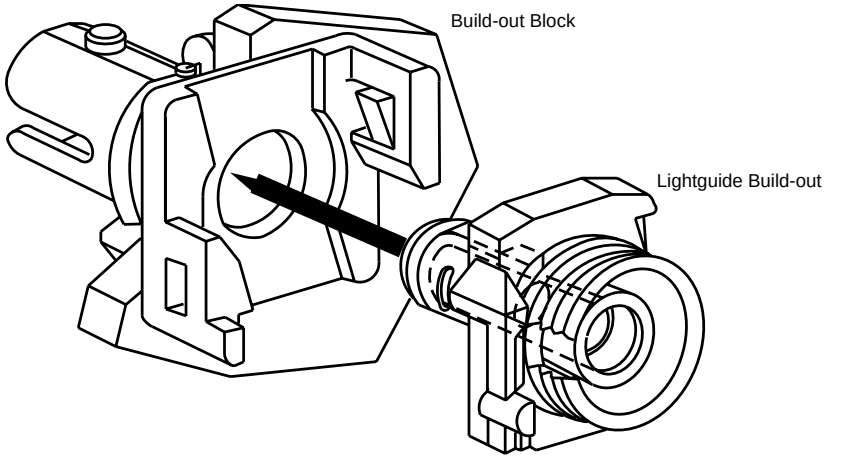


Figure 6-6. ST-Type Build-Out Assembly (enlarged)

Figure 6-7 shows the buildout block and an FC-type LBO assembly.



ols06003.00eJF070196r1.0

Figure 6-7. FC-Type Build-Out Assembly (enlarged)

Figure 6-8 shows the build-out block and SC-type LBO assembly.

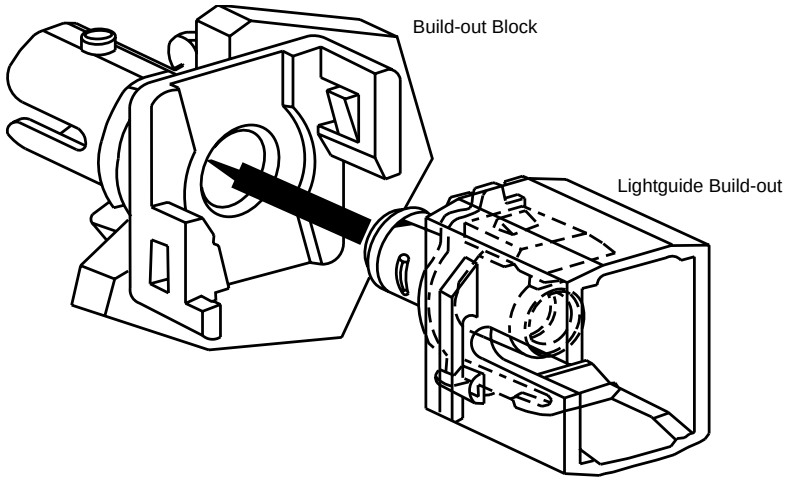
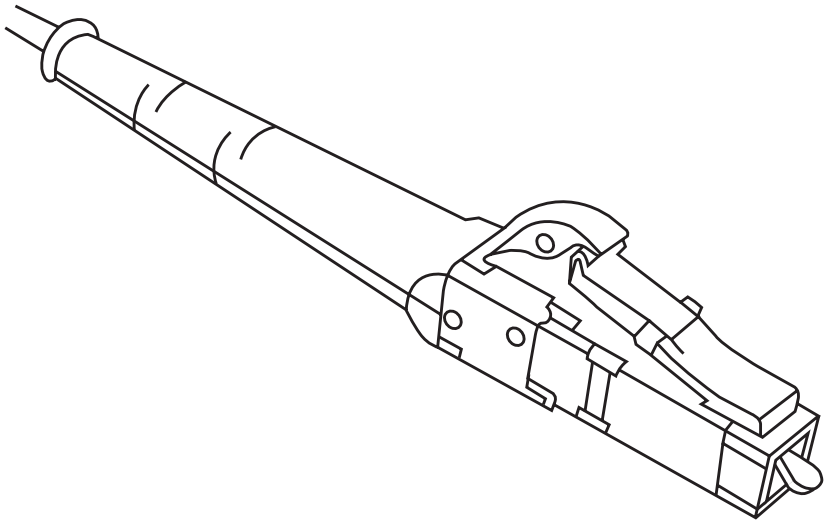


Figure 6-8. SC-Type Build-Out Assembly (enlarged)

Figure 6-9 shows an LC-type connector.



ols06006.00eSEV082297r2.1

Figure 6-9. LC-Type Connector (enlarged)

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

When ST, FC, SC or LC connectors are used together, hybrid jumpers must be used. A hybrid jumper has different types of connectors at either end. The connectors at both ends of the jumper must match the panel-mounted connectors. ST connectors are available for use with the LBO cross-connect panel and can be installed when WaveStar OLS 40G is installed.

NOTE:
All optical fiber connectors (ST, FC, SC, and LC types), lightguide buildouts, and buildout blocks must be cleaned before initial or subsequent connections are made. Refer to “Related Products” in Chapter 7, “Ordering,” for information on cleaning materials.

Figure 6-10 provides a depiction of LBO kit usage in an End Terminal. Refer to “LBO Considerations” earlier in this chapter for information on using LBO kits.

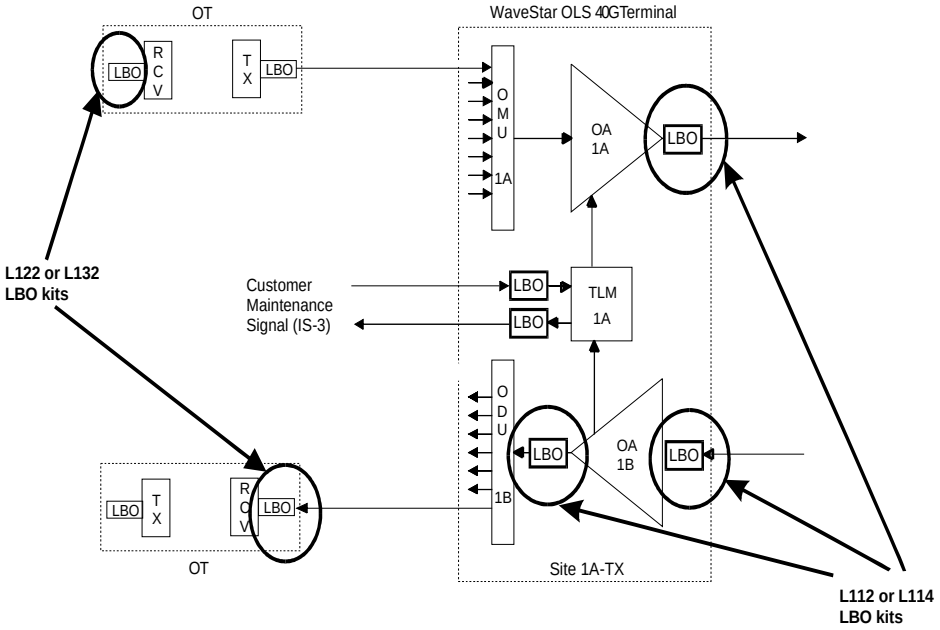


Figure 6-10. LBO Location in an End Terminal

LBO Color Types

Table 6-7 lists specifications of various LBO color types used with WaveStar OLS 40G systems.

Table 6-7. LBO* Color Types

LBO Color	Fiber Use†	Attenuation Values (dB)	Connectors Supported	Wavelength at Nominal Attenuation (nm)	LBO Body Marking	Attenuator Element (dB)	Optical Power Limits (dBm)‡
White	SM-SM	0	ST and FC	No restriction			Connector limited
	SM-MM						
	MM-MM						
	MM-MM	5,10,15,17.5	ST	1310	Nominal value	Clear for 5	≤ 20
						Tinted for 10, 15, 17.5	≤ 5
Blue	SM-SM	0	SC	No restriction			Connector limited
	SM-MM						
	MM-MM						
	MM-MM	5,10,15,17.5	SC	1310	Nominal value	Clear for 5	≤ 20
						Tinted for 10, 15, 17.5	≤ 5
Yellow**	SM-SM	3, 5, 7, 10, 15, 20	ST, FC, and SC	1310 to 1550	Nominal value	Clear for ≤ 10	≤ 20
						Tinted for ≥ 15	≤ 5

Table 6-7. LBO* Color Types — *Continued*

LBO Color	Fiber Use†	Attenuation Values (dB)	Connectors Supported	Wavelength at Nominal Attenuation (nm)	LBO Body Marking	Attenuator Element (dB)	Optical Power Limits (dBm)‡
Green††	SM-SM	3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 12.5, 13, 13.5, 14, 14.5, 15, 16, 18, 20	ST and FC	1550	Nominal value	Clear	≤ 20
		3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10	SC	1550	Nominal value	Clear	≤ 20
Gray	SM-MM	5, 7, 10, 12, 15, 17, 20	ST and FC	1550	Nominal value	Tinted	≤ 5

* Maximum reflectance = -30 dB

† SM= Single-mode, MM= Multi-mode

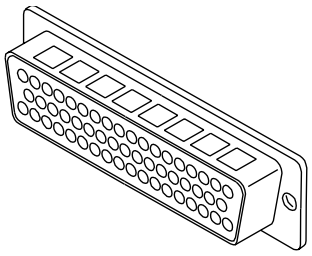
‡ These optical power values are conservative estimates.

** The yellow LBOs have nominal values appropriate to both 1310 and 1550 nm. Worst case tolerance on attenuation is +/- 15% of nominal attenuation.

†† Green LBOs are highly recommended for 16 wavelength systems due to their finer granularity. These LBOs have nominal values appropriate to 1550 nm. Tolerance is +/- 0.3 dB of nominal attenuation for 3 to 15 dB values, +/-0.5 dB for the 16dB value, and +/-1 dB for 18 or 20 dB values.

NOTE:
Except for 15 dB and 20 dB values with the yellow LBOs, both green and yellow LBO types use elements of the same kind. Therefore, power tolerance is the same.

The OAM&P cables are terminated with D-subminiature connectors, shown in Figure 6-11, 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 6-11. D-Subminiature Connector

Environmental Considerations

WaveStar OLS 40G and OT Shelves and Cabinets comply with the environmental compatibility requirements in *GR-63-CORE, Issue 1, October 1995* and *GR-1089-CORE, Issue 1, November 1994* documents.

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. WaveStar OLS 40G and OT shelves, circuit packs, and cable treatments are designed to satisfy the requirements of *GR-1089-CORE, Issue 1, November 1994*.

WaveStar OLS 40G 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 WaveStar OLS 40G 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.

WaveStar OLS 40G and OT dissipate heat by natural convection cooling and do not require a cooling fan. Table 6-8 presents information on power dissipation and current drains for different WaveStar OLS 40G and OT configurations.

Table 6-8. WaveStar OLS 40G/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				
End Terminal 4 Bidirectional Optical Lines	252	20.2	2.6	5.9
Repeater 4 Bidirectional Optical Lines	320	25.6	3.3	7.5
Dual End Terminal	276	22.1	2.9	6.5
Dual Repeater	344	27.6	3.6	8.0
End Terminal & Repeater	310	24.8	3.2	7.3
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

Table 6-8. WaveStar OLS 40G/OT Power Planning — *Continued*

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
	Maximum Power Dissipation		**Current Drains per Feeder****	
	Watts	**Watts per Square Foot**	**Nominal at -48V (List 1††)**	**Maximum (List 2‡‡)**
J68982D-1 Equipment Package				
Integrated Bay (Single)	552	78.4	5.8	12.9
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
Integrated Bay/Cabinet (Double), (ED-8C903-40 Super Kit)				
Bay / Cabinet	138	11.1	1.5	3.3
OT Bay / Cabinet	646	91.8	6.7	15.1
Integrated Bay/Cabinet (Triple 1), (ED-8C903-40 Super Kit)				
Bay / Cabinet	276	22.1	2.9	6.5
OT Bay / Cabinet 1	646	91.8	6.7	15.1
OT Bay / Cabinet 2	646	91.8	6.7	15.1
Integrated Bay/Cabinet (Triple 2), (ED-8C903-40 Super Kit)				
Bay / Cabinet	138	11.1	1.5	3.3
OT Bay / Cabinet 1	646	91.8	6.7	15.1
OT Bay / Cabinet 2	646	91.8	6.7	15.1

* 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.

** 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 on the following:

- Ordering WaveStar OLS 40G equipment
- Ordering Optical Translator (OT) equipment
- Ordering related products that operate with the WaveStar OLS 40G and OT
- Lucent Technologies software release ratings
- Slot, circuit pack, and software compatibility.

Ordering WaveStar OLS 40G Equipment

The OLS order comprises equipment, cables, circuit packs, software, and customer documentation. The equipment necessary to form different application packages is grouped together into both J-drawing and "super-kit" ED list and group numbers. This section contains the ordering information you need to develop your WaveStar OLS 40G applications.

NOTE:
For information on ordering spare circuit packs, refer to Appendix A, "Circuit Pack Sparing."

Ordering Lightguide Office Cable

When ordering lightguide office cable, use the *Lucent Technologies Fiber Optic Product*s catalog (select code: 2492C). To order copies of this catalog, use the following information:

Non-Lucent personnel: contact the National Telemarketing Center, 1-800-344-0223, ext. 3023

Lucent personnel: contact the Lucent Technologies Ordering Center (LTOC), 1-800-458-1761

The catalog is also available on-line at the following address:

http://www.wr.lucent.com/ncs/fiberoptics/catalog/

WaveStar OLS 40G Package Descriptions

J-Drawing J68982C-1 (WaveStar OLS 40G Cabinet and Bay Equipment)

(L1) 4 Bidirectional Line End Terminal or Repeater Cabinet: provides a 2 shelf cabinet equipped with a heat baffle, fuse panel, power filters, indicator strip, cables, rear cover, and door. For an End Terminal application, L101 is required in addition. For a Repeater application, L102 is required in addition. Refer to Chapter 4, “Product Description,” for application illustrations.

(L2) Dual End Terminal or Dual Repeater Cabinet: provides a 2 shelf cabinet equipped with a heat baffle, fuse panel, power filters, indicator strip, cables, rear cover, and door for use in Dual End Terminal, Dual Repeater, or End Terminal and Repeater combination applications. For a Dual End Terminal application, L103 is required in addition. For a Dual Repeater application, L104 is required in addition. For an End Terminal and Repeater combination application, L105 is required in addition. Refer to Chapter 4, “Product Description,” for application illustrations.

(L10) Miscellaneously-mounted Shelf with Newlook-2000 covers: provides a miscellaneously-mounted WaveStar OLS 40G shelf, heat baffle, and Newlook-2000 covers. For an End Terminal shelf, L106 is required in addition. For a Repeater shelf, L107 is required in addition.

(L11) Miscellaneously-mounted Shelf with flat covers: provides a miscellaneously-mounted WaveStar OLS 40G shelf, heat baffle, and flat covers. For an End Terminal shelf, L106 is required in addition. For a Repeater shelf, L107 is required in addition. Refer to Chapter 4, “Product Description,” for application illustrations.

(L14) Dual End Terminal or Dual Repeater Bay: provides a two-shelf bay equipped with heat baffles, fuse panel, power filters, user panels, and cables for use in Dual End Terminal, Dual Repeater, or End Terminal and Repeater combination applications. For a Dual End Terminal application, L103 is required in addition. For a Dual Repeater application, L104 is required in addition. For an End Terminal and Repeater combination application, L105 is required in addition. Refer to Chapter 4, “Product Description,” for application illustrations.

(L101) 4 Bidirectional Line End Terminal Cabinet Label Kit: provides the necessary labels for a 4 bidirectional line End Terminal cabinet application. Used with L1.

(L102) 4 Bidirectional Line Repeater Cabinet Label Kit: provides the necessary labels for a 4 bidirectional line Repeater cabinet application. Used with L1.

(L103) Dual End Terminal Label Kit: provides the necessary labels for a Dual End Terminal application. Used only with L2 and L14 applications that have two End Terminal shelves.

(L104) Dual Repeater Label Kit: provides the necessary labels for a Dual Repeater application. Used only with L2 and L14 applications that have two Repeater shelves.

(L105) End Terminal and Repeater Combination Label Kit: provides the necessary labels for an End Terminal and Repeater combination application. Used only with L2 and L14 applications that have combined End Terminal and Repeater shelves.

(L106) Miscellaneously-mounted End Terminal Shelf Label Kit: provides the necessary labels for a miscellaneously-mounted End Terminal shelf application. Used with L10 and L11.

(L107) Miscellaneously-mounted Repeater Shelf Label Kit: provides the necessary labels for a miscellaneously-mounted Repeater shelf application. Used with L10 and L11.

(L108) SDH Label Kit for End Terminal and Repeater: *For international SDH applications only.* Provides the user panel label for SDH bay-mounted or miscellaneously-mounted End Terminal or Repeater applications. For an End Terminal shelf, L106 is required in addition. For a Repeater shelf, L107 is required in addition.

(L111) ST LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L60), ODU (L50), and TLM inputs and outputs. Refer to Chapter 6, “System Planning and Engineering.”

(L112) ST LBO Kit: (R2.1 and later, up to 16λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L61), ODU (L51), and TLM inputs and outputs. Refer to Chapter 6, “System Planning and Engineering.”

(L114) FC LBO Kit: (R2.1 and later, up to 16λ) provides a kit of lightguide build-outs with FC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L61), ODU (L51), and TLM inputs and outputs. Refer to Chapter 6, "System Planning and Engineering."

(L121) FC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with FC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU, (L60), ODU (L50), and TLM inputs and outputs. Refer to Chapter 6, "System Planning and Engineering."

(L131) SC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with SC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L60), ODU (L50), and TLM inputs and outputs. Refer to Chapter 6, "System Planning and Engineering."

(L161) Lightguide Jumper Kit: provides 50-inch ST-to-ST lightguide jumpers and associated labels required for intrashelf connections on a single bidirectional line. Connection is made between OA and TLM (ST-to-ST) and between OA and OMU / ODU (ST-to-LC).

In end terminal applications, L161 is used only with 8λ OMU (L60) and ODU (L50), non-dual facing applications for two-OA and single-OA operation.

In repeater applications, L161 can be used for both 8λ and 16λ applications. Refer to Chapter 3, "Applications," for illustrations of different OA configurations.

(L162) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels required for intrashelf connections on a single bidirectional line. Connection is made between OA and TLM (ST-ST) and OA and OMU / ODU (ST-LC).

L162 is used only with 16λ OMU (L61) and ODU (L51, L52), non-dual facing applications for two-OA operation. Refer to Chapter 3, "Applications," for illustrations of different OA configurations.

(L163) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels required for intrashelf connections on a single bidirectional line. Connection is made between OA and TLM (ST-to-ST), between OA and OMU / ODU (ST-to-LC), and between TLM to ODU.

L163 is used only with 16λ OMU (L61) and ODU (L51, L52), non-dual facing applications for single-OA operation. Refer to Chapter 3, "Applications," for illustrations of different OA configurations.

(L164) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST lightguide jumpers and associated labels required for intrashelf connections on up to two bidirectional lines. Connection is made between OA and TLM (ST-to-ST) and between OA and OMU / ODU (ST-to-LC).

L164 is used only with 16λ OMU (L61) and ODU (L51, L52) applications for two-OA / two-OA dual-facing operation. Refer to Chapter 3, "Applications," for illustrations of different OA configurations.

(L165) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels required for intrashelf connections on a single shelf. Connection is made between OA and TLM (ST-to-ST) and between OA and OMU / ODU (ST-to-LC).

L165 is used only with 16λ OMU (L61) and ODU (L51, L52) applications for two-OA / single-OA, single-OA / two-OA, and single OA / single-OA dual-facing operation. Refer to Chapter 3, "Applications," for illustrations of different OA configurations.

(L190) 4-fiber Telemetry Feed-thru Kit: provides labels for the 4-fiber Telemetry Feed-thru feature for an End Terminal. These labels are taped over the existing label indicating the telemetry circuit pack slots within the shelf.

(L300) DANTEL EMDU: provides one DANTEL External Miscellaneous Discrete Unit kit.

(L301) HARRIS EMDU: provides one HARRIS External Miscellaneous Discrete Unit kit.

(L310) 4-Line to Dual System Conversion Kit: provides necessary hardware to convert a 4 bidirectional cabinet system (L1) to a dual cabinet system (L2).

J-Drawing J68982D-1 (Integrated Bay Equipment)

(L1) Integrated Bay: provides a three-shelf bay including an End Terminal shelf, an OT System Controller Shelf, an OT Complementary Shelf 1, heat baffles, fuse / power indicating panel, power filters, user panels, and cables. Refer to Chapter 4, "Product Description," for application illustrations.

(L108) SDH kit for SDH WaveStar OLS 40G Application: *For international SDH applications only.* Provides the user panel label for the WaveStar OLS 40G shelf.

(L111) ST LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L60), ODU (L50), and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L112) ST LBO Kit: (R2.1 and later, up to 16λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L61), ODU (L51, L52), and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L113) ST LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with ST connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50). This kit is used in the OT shelf.

(L114) FC LBO Kit: (R2.1 and later, up to 16λ) provides a kit of lightguide build-outs with FC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L61), ODU (L51, L52), and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L121) FC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with FC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L60), ODU (L50), and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L122) ST LBO Kit: (R2.1 and later, 16λ) provides a kit of lightguide build-outs with ST connectors for use with OTUs and OTPMs. Provides all necessary LBOs for a single OTU / OTPM input and output when working with an ODU (L51, L52). This kit is used in the OT shelf.

(L123) FC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with FC connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50). This kit is used in the OT shelf.

(L131) SC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with SC connectors for a single bidirectional line. Includes all necessary LBOs for OA, OMU (L60), ODU (L50), and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L132) FC LBO Kit: (R2.1 and later, up to 16λ) provides a kit of lightguide build-outs with FC connectors for each OTU and OTPM. Provides all necessary LBOs for a single OTU / OTPM input and output when working with an ODU (L51, L52). This kit is used in the OT shelf.

(L133) SC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with SC connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50). This kit is used in the OT shelf.

(L161) Lightguide Jumper Kit: provides 50-inch ST-to-ST lightguide jumpers and associated labels required for intrashelf connections on a single bidirectional line.

(L162) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels that are required for intrashelf connections on a single bidirectional line.

(L163) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels that are required for intrashelf connections on a single bidirectional line.

(L164) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST lightguide jumpers and associated labels that are required for intrashelf connections on one shelf.

(L165) Lightguide Jumper Kit: provides 50-inch ST-to-ST and LC-to-ST, and 20-inch LC-to-ST lightguide jumpers and associated labels that are required for intrashelf connections on one shelf.

(L501) HARRIS EMDU: provides one HARRIS External Miscellaneous Discrete Unit kit.

OT Package Descriptions

J-Drawing J69000C-1 (Optical Translator System)

(L1) OT Cabinet: provides a cabinet with three shelves, two heat baffles, fuse panels, power filters, indicator strip, designation label strips, cables, rear cover (flat cover only), and doors.

(L10) Miscellaneously-mounted OT Shelves: provides three miscellaneously-mounted shelves. Each shelf is 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 (flat cover only).

(L11) Miscellaneously-mounted System Controller OT Shelf: provides one System Controller Shelf 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 (flat cover only).

(L12) Miscellaneously-mounted Complementary OT Shelf 1: 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 (flat cover only). This shelf should only be ordered to upgrade a system that contains L11.

(L13) Miscellaneously-mounted Complementary OT Shelf 2: 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 (flat cover only). This shelf should only be ordered to upgrade a system that contains L11 and L12.

(L14) OT Bay: provides three miscellaneously-mounted shelves. Each shelf is 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 (flat cover only) mounted in an ED-8C800-50, G1 network bay frame.

(L111) ST LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with ST connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50).

(L121) FC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with FC connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50).

(L122) ST LBO Kit: (R2.1 and later, 16λ) provides a kit of lightguide build-outs with ST connectors for use with OTUs and OTPMs. Provides all necessary LBOs for a single OTU / OTPM input and output when working with an ODU (L51, L52).

(L131) SC LBO Kit: (R1.0 and R2.0, 8λ) provides a kit of lightguide build-outs with SC connectors for use with OTUs. Provides all necessary LBOs for a single OTU input and output when working with an ODU (L50).

(L132) FC LBO Kit: (R2.1 and later, 16λ) provides a kit of lightguide build-outs with FC connectors for use with OTUs and OTPMs. Provides all necessary LBOs for a single OTU / OTPM input and output when working with an ODU (L51, L52).

(161) OT Shelf Label Kit: provides OT shelf labels for Integrated Cabinet or Bay Triple 1 and Triple 2 applications.

(L300) DANTEL EMDU: provides one DANTEL External Miscellaneous Discrete Unit kit.

(L301) HARRIS EMDU: provides one HARRIS External Miscellaneous Discrete Unit kit.

See ”Power Fuse” for descriptions of the individual circuit packs and units.

Circuit Pack/Unit Descriptions

This section defines the circuit packs used in WaveStar OLS 40G. For more information on circuit packs and units, refer to Chapter 4, “Product Description.”

WaveStar OLS 40G (J-Drawing J68982C-1)

(L20) OA: (Optical Amplifier, LEA6) amplifies the optical signal and controls the pump lasers for eight wavelengths in Long Span applications.

(L21) OA: (Optical Amplifier, LEA7) amplifies the optical signal and controls the pump lasers for both eight and sixteen wavelengths in Long Reach applications.

(L22) OA: (Optical Amplifier, LEA104) amplifies the optical signal and controls the pump lasers for sixteen wavelengths in Long Span applications.

(L23) OA: (Optical Amplifier, LEA105) amplifies the optical signal and controls the pump lasers for sixteen wavelengths in Short Reach applications.

(L25) TLM: (Telemetry) 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.

(L30) TOHCTL: (Tributary Overhead Controller) processes the SONET section overhead of the supervisory channel. TOHCTL interfaces with the TLM circuit pack to exchange DCC data.

(L35) SYSCTL: (System Controller) 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.

(L40) SYSMEM: (System Memory) provides memory support for SYSCTL. User provisioned data and system software are stored in EPROMs on the SYSMEM circuit pack.

(L50) ODU: (Optical Demultiplexer Unit) demultiplexes the optical line signal into the eight drop side signals (8λ).

(L51) ODU: demultiplexes the optical line signal into sixteen drop side signals (16λ, no supervisory signal).

(L52) ODU: demultiplexes the optical line signal into sixteen drop side signals (16λ) plus an additional supervisory line signal.

(L60) OMU: (Optical Multiplexer Unit) combines the eight drop side signals (8λ) into one optical signal called the optical line signal.

(L61) OMU: combines sixteen drop side signals (16λ) into one optical signal called the optical line signal.

OT (J-Drawing J69000C-1)

(L49) QOTU 41S: (Quad Optical Translator Unit) 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.

(L50) OTCTL: (OT Controller) integrates the OTUs into the WaveStar OLS 40G control structure, combining WaveStar OLS 40G and OT into a single network element.

(L51-L66) OTPM 42A(1-16): (Optical Translator Port Module) these modules electrically regenerate a single input OC-12/STM-4 optical signal and insert the tone required by WaveStar OLS 40G onto that signal. The sixteen 42Ax OTPM codes support the sixteen 1.5µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L67) OTPM 42B: electrically regenerates a single input OC-12/STM-4 optical signal and removes the tone required by WaveStar OLS 40G from that signal. The 42B OTPM code supports 1.3µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L71-L86) OTPM 43A(1-16): these modules electrically regenerate a single input OC-3/STM-1 optical signal and insert the tone required by WaveStar OLS 40G onto that signal. The sixteen 43Ax OTPM code supports 1.5µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L87) OTPM 43B: electrically regenerates a single input OC-3/STM-1 optical signal and removes the tone required by WaveStar OLS 40G from that signal. The 43B OTPM code supports 1.3µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L141-L156) OTPM 44A(1-16): these modules electrically regenerate a single input low speed broadband 150-750 Mb/s optical signal and insert the tone required by WaveStar OLS 40G onto that signal. The sixteen 44Ax OTPM codes supports 1.5µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L157) OTPM 44B: electrically regenerates a single input low speed broadband 150-750 Mb/s optical signal and removes the tone required by WaveStar OLS 40G from that signal. The 44B OTPM code supports 1.3µm wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L229) OTU 41BB: (Optical Translator Unit) electrically regenerates a single input OC-48/STM-16 optical signal and removes the tone required by WaveStar OLS 40G from that signal. The 41BB OTU code regenerates OC-48/STM-16 signals in the 1.3µm range for other SONET OC-48/SDH STM-16 receivers.

(L21-L28, L89-L96) OTU 41A(1-16)C: these circuit packs electrically regenerate a single input OC-48/STM-16 optical signal and insert the tone required by WaveStar OLS 40G onto that signal. These sixteen codes support sixteen wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 6800 ps/nm.

(L41-L48, L99-L106) OTU 41C(1-16)C: these circuit packs electrically regenerate a single input OC-48/STM-16 optical signal and insert the tone required by WaveStar OLS 40G onto that signal. These sixteen codes support sixteen wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(L470) OPS: (Optical Protection Switch) provides optical protection, switching traffic between primary and secondary lines in the event of a fiber cut or OA failure.

(L474) SPODU: (Self-powered ODU) provides optical demultiplexing performance when independent of an OA.

(L478) SPOMU: (Self-powered OMU) provides optical multiplexing performance on seven and eight span systems with up to 22 dB loss per span. This circuit pack utilizes a significantly lower insertion loss than the standard OMU.

WaveStar OLS 40G (J-Drawing J68982D-1)

For the Integrated Bay (J-Drawing J68982D-1), the same circuit packs in WaveStar OLS 40G (J-Drawing J68982C-1) and OT (J-Drawing J69000C-1) apply. However, OTU and OTPM circuit pack list numbers are different. Refer to Table 7-25.

Cables

This section contains information on the cables required for WaveStar OLS 40G equipment.

Intraoffice Electrical Non-transmission Cable Descriptions (WaveStar OLS 40G)

Refer to Figure 4-25 in Chapter 4, "Product Description," for a depiction of backplane cable connections by group number. The following intraoffice cables are used in WaveStar OLS 40G:

Line orderwire cable– provides voice communication (E2 byte) between adjacent WaveStar OLS 40G network elements.

Section orderwire cable– provides voice communication (E1 byte) between adjacent WaveStar OLS 40G network elements.

Section user channel cable– provides access to overhead section user channel bits.

X.25 cable– provides access to an OS interface.

Serial telemetry cable– connects WaveStar OLS 40G to a serial telemetry interface.

Miscellaneous discrete cable– connects WaveStar OLS 40G to a user definable set of monitor points.

Office alarm cable– connects WaveStar OLS 40G to the office alarms.

Parallel telemetry cable– connects WaveStar OLS 40G to a parallel telemetry interface.

CIT DTE Interface cable– provides a remote interface to WaveStar OLS 40G that is functionally similar to the CIT Data Communications Equipment (DCE) port. The port can be used to load software and perform system diagnostics.

Intraoffice Electrical Non-transmission Cable Descriptions (OT)

Refer to Figure 4-26 and Figure 4-27 in Chapter 4, "Product Description," for a depiction of backplane cable connections by group number. The following intraoffice cables are used in the OT:

Office alarm cable– connects the OT to the office alarms.

Incoming signal failure cable– connects 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– connects 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.

Power feeder failure alarm cable– connects a power filter on an OT to an EMDU.

Table 7-1. WaveStar OLS 40G Intraoffice Electrical Non-transmission Cables

Cable	T-5G276-33 Figure*	ED-7G028-22 Cable Drawing†			Remarks
		Group	Length	Comcode	
Line OW, section OW, section user channel cable	8, 10, 11	G401	as required	105419519	2850 ft. maximum
		G451	150 ft.		
		G461	250 ft.		
X.25 cable	13	G602	as required	105419469	150 ft. maximum
		G652	150 ft.		
1st or 2nd serial telemetry cable	14	G201‡	as required	105428924	4000 ft. maximum
				105393888	
		G251	150 ft.		
		G261	250 ft.		

Table 7-1. WaveStar OLS 40G Intraoffice Electrical Non-transmission Cables — *Continued*

Cable	T-5G276-33 Figure*	ED-7G028-22 Cable Drawing†			Remarks
		Group	Length	Comcode	
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	15, 16, 17, 18	G301	as required	105419469	
		G351	150 ft.		
		G361	250 ft.		
CIT interface cable	20	G702	as required	105419469	150 ft. maximum
	20	G752	150 ft.		

* The T-5G276-33 figure is shipped with the WaveStar OLS 40G product and is needed for the installation process

† Refer to Chapter 4, "Product Description," for a depiction of backplane cable connections by ED-7G028-22 group number

‡ Use group 201 to connect from serial TLM 1 to the External Miscellaneous Discrete Unit.

Table 7-2. OT Intraoffice Electrical Non-transmission Cables

Cable	T-6G156-33 Figure*	ED-7G045-22 Cable Drawing			Remarks
		Group	Length	Comcode	
Office alarm cable	5	G1	as required	105419519	
		G2	150 ft.		
Power feeder failure alarm cable†		G16	as required	108058389	
		G17	150 ft.		
System Controller Shelf incoming signal failure cable	6	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		
System Controller Shelf OT circuit pack failure cable	7	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		

Table 7-2. OT Intraoffice Electrical Non-transmission Cables — *Continued*

Cable	T-6G156-33 Figure*	ED-7G045-22 Cable Drawing			Remarks
		Group	Length	Comcode	
Complementary Shelf 1 Incoming signal failure cable	12	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		
Complementary Shelf 1 OT circuit pack failure cable	13	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		
Complementary Shelf 2 incoming signal failure cable	12	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		
Complementary Shelf 2 OT circuit pack failure cable	13	G3	as required	107009318	4000 ft. maximum
		G4	150 ft.		

* The T-5G276-33 figure is shipped with the WaveStar OLS 40G product and is needed for the installation process

† Power feeder failure alarm cable is used when an EMDU is present.

The items in Table 7-3 and Table 7-4 provide the assembly and wiring required for one 8-gauge, -48V power feeder.

Table 7-3. WaveStar OLS 40G Power Cables*

-48V Power Feeder Type	ED-9C103-22 Cable Drawing			Description
	Group	Length	Comcode	
A	G1	15 ft.		Used to power 2 shelves in a bay or cabinet
B	G2	15 ft.		
A	G3	15 ft.		Used to power a miscellaneously-mounted shelf
B	G4	15 ft.		
A	G23	15 ft.		Used to power an Integrated Bay
B	G24	15 ft.		
A	G11	as required	406961391	Used to power 2 shelves in a cabinet
B	G12	as required	406961417	
A	G13	as required	406961391	Used to power a miscellaneously-mounted shelf
B	G14	as required	406961417	
A	G25	100 ft.		Used to power an Integrated Bay
B	G26	100 ft.		

* Use Figure 1 for T-5G276-33.

Table 7-4. OT Power Cables

-48V Power Feeder Type	T5G156-33 Figure	ED-9C103-22 Cable Drawing			List (Provided with)
		Group	Length	Comcode	
A	1	G5	15 feet		L1, L10, and L14
B	1	G6	15 feet		
A	1	G15	as required	406961391	
B	1	G16	as required	406961417	
A	2	G7	15 feet		L11, L12, and L13
B	2	G9	15 feet		
A	2	G8	as required	406961391	
B	2	G10	as required	406961417	

Fiber Optic Cables

Table 7-5 provides a list of standard length fiber optic cables and their associated comcodes for use with WaveStar OLS 40G. The customizable cable length is also listed.

Table 7-5. Minicord Single-mode LC to ST II+

Length (ft.)	Comcode
1.67	108 108 705
4.2	108 108 713
10	108 108 853
25	108 108 887
50	108 108 937
75	108 108 945
100	108 108 960
custom	107 815 896

Refer to the *Lucent Technologies Fiber Optic Products* catalog (select code: 2492C) when ordering lightguide office cable. Additional comcodes are available from: 1-888-fiber-help. To order copies of this catalog, use the following information:

Non-Lucent personnel: contact the National Telemarketing Center, 1-800-344-0223, ext. 3023

Lucent personnel: contact the Lucent Technologies Ordering Center (LTOC), 1-800-458-1761

The catalog is also available on-line at the following address:

http://www.wr.lucent.com/ncs/fiberoptics/catalog/

Power Fuse

The power fuse has a capacity of 10 amperes. When ordering this item, use the following comcode:

Fuse: 405749920

Power Meter Adapters

For testing purposes, an adapter needs to be attached to optical power meter equipment (EXfo) in order to measure the intensity of OA pump lasers. This adapter consists of a fiber jumper with an LC connector block (comprised of two LC connectors) on one end and an ST connector on the other end. The LC connector block attaches to the WaveStar OLS 40G and the ST connector attaches to the power meter.

When ordering the LC connector block, use the following comcode:

LC connector block: 108 072 489

Related Framework

The following points provide an overview of WaveStar OLS 40G Cabinet hardware and framework.

- The OLS provides front access for all office and user interfaces. All interoffice cables and fiber connections are possible from the front of the system.
- 120V AC power is needed near the cabinet to power a PC or charge a portable PC.
- Table 7-6 provides ordering information for recommended cable racking systems and end guards for WaveStar OLS 40G.

To order framework for the miscellaneously-mounted shelf, use the *Seismic Network Bay Frame Application, Planning and Ordering Guide* (065-215-200).

Table 7-6. Related Cabinet Hardware

Framework	Number	Group
Cable rack	ED-5D779-70	1B and G2 required per cabinet
End guard	ED-5D786-70	1A 2 required per cabinet

Related Products

This section provides information on products used with WaveStar OLS 40G.

Ordering Cleaning Materials

All optical fiber connectors (ST, FT, LC, and SC), lightguide buildouts, and buildout blocks or equivalents should be cleaned before initial connections or re-connections are made (see the *WaveStar OLS 40G Release 3.1.1 User/Service Manual* for complete cleaning information). Table 7-7 lists cleaning materials recommended for all optical fiber connectors. Order these materials directly from Speer Fiber Optics at 1-908-359-1173. The company address is: 18 Pierson Drive, Belle Mead, NJ, 08502.

Table 7-7. Cleaning Materials for Optical Fiber Connectors

Vendor	Product Description	Supplier Order #
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 7-8 through Table 7-9 provide information on pin types and pin replacement kits for WaveStar OLS 40G. Order these materials directly from Berg Electronics at 1-717-938-6711. The company address is: 825 Old Trail Road, Etters, PA, 17319.

Table 7-8. METRAL Pin Ordering Information

Pin Type (Kit Device Code)	Quantity per kit	Pin Length (mm)
88929-102	25	5.75 / 4.3
88929-106	25	5.75 / 13.6
88929-119	25	8.00 / 4.3
88930-101	25	Blade

Table 7-9. METRAL Pin Kit/Pin Tool Kit Ordering Information

Product Name	Supplier Order #
METRAL pin replacement tool kit	MT-370-01

Table 7-10. WaveStar OLS 40G/OT Equipment Locations and Pin Types

Circuit Pack Slot	Backplane Location	Rows Using Pin Type: 88929-102	Rows Using Pin Type: 88929-106	Rows Using Pin Type: 88929-119	Rows Using Pin Type: 88930-101
WaveStar OLS 40G Equipment					
SYSMEM (LEA2)	20-604	1-18, 25-72, 97-156	19-24, 85-96	157-162	
SYSCTL (LEA1)	20-584	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, LEA7, LEA104, LEA105)	20-534, 20-434, 20-330, 20-230	1-12, 109-114, 121-150	151-156	157-162	
TLM (LDA1)	52-180, 52-230, 52-280, 52-330	19-42, 55-90	91-96	97-102	

Table 7-10. WaveStar OLS 40G/OT Equipment Locations and Pin Types — *Continued*

Circuit Pack Slot	Backplane Location	Rows Using Pin Type: 88929-102	Rows Using Pin Type: 88929-106	Rows Using Pin Type: 88929-119	Rows Using Pin Type: 88930-101
OMU / ODU (505A / 605A)	52-382, 52-430, 52-478, 52-526	1-24, 73-96		97-102	
USER PNL	45-557	1-12			
PWR A	50-597				1-12
PWR B	44-597				1-12
OT Equipment					
OTCTL (SYSMEM)*	20 - 605	1 - 72 85 - 156		157 - 162	
OTCTL (SYSCTL)*	20 - 565	1 - 72 85 - 156		157 - 162	
OTCTL (TOHCTL)*	20 - 525	1 - 12 19 - 66 85 - 156		157 - 162	
OTU† (System Controller Shelf)	20 - 163 20 - 203 20 - 243 20 - 283 20 - 323 20 - 363 20 - 405 20 - 445 20 - 485‡	1 - 12 85 - 156		157 - 162	

Table 7-10. WaveStar OLS 40G/OT Equipment Locations and Pin Types — *Continued*

Circuit Pack Slot	Backplane Location	Rows Using Pin Type: 88929-102	Rows Using Pin Type: 88929-106	Rows Using Pin Type: 88929-119	Rows Using Pin Type: 88930-101
OTU (Complementary Shelf 1 and 2)	20 - 163 20 - 203 20 - 243 20 - 283 20 - 323 20 - 363 20 - 405 20 - 445 20 - 485 20 - 525 20 - 565 20 - 605	1 - 12 85 - 156		157 - 162	
PWR A	39 - 184				1 - 12
PWR B	39 - 570				1 - 12

* The OTCTL circuit pack occupies the SYSCTL, SYSMEM, and TOHCTL slots in the backplane.

† The OPS, SPOMU, and SPODU circuit packs and the QOTU carrier pack use the OTU slots in either Complementary or System Controller shelves

‡ This slot is intentionally left blank.

Ordering the External Miscellaneous Discrete Unit (EMDU)

EMDUs provide user-settable functions for the control and monitoring of equipment collocated with WaveStar OLS 40G. Refer to Chapter 5, “Operations, Administration, Maintenance, and Provisioning” for more information.

NOTE:
You must use ED-7G028-22, G201 cable to connect an EMDU to the first serial telemetry port, SER TLM1 (P19).

These units are optional. 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 that are also listed.

Contact Harris, Inc., Network Support Products at 972-235-5292. The company address is:

1850 No. Greenview Ave.
M/S 184
Richardson, TX 75081

Contact Dantel, Inc. at 1-209-292-1111. The company address is:

2991 No. Argyle Ave.
Fresno, CA
93727-1321

Table 7-11 lists the available types of EMDUs. Note that these do not represent the EMDU kit. This table acts as an EMDU model number reference only. For kits, order by using the list number shown in the worksheets.

Table 7-11. Ordering Information for External Miscellaneous Discrete Unit (EMDU)

Supplier Name	Supplier Model Name	Supplier Order #	Lucent Comcode*
DANTEL	Alarm Control Block	Model No. 46220-00	407567924
	Mounting Bar	A25-00508-01	406863621
HARRIS	C-1000 Centurion	594 - T099 (Integrated Bay) 594 - T043	407845049 407567932
	Strip Terminal		407809003

* It is recommended that you use the Lucent Technologies comcode number when ordering.

DANTEL Orderwire Shelf

The DANTEL orderwire shelf provides a 64 kb/s interface to WaveStar OLS 40G. It is shipped separately and does not mount in a WaveStar OLS 40G Cabinet.

The orderwire shelf is optional and is available from either Lucent Technologies or DANTEL, Inc. To order the shelf from Lucent Technologies, use the following information:

Lucent comcode: 407790286 Kit, DANTEL interface voice-data orderwire

To order the shelf from Dantel, use the following information:

DANTEL Part #: D18-05547-04

WaveStar OLS 40G Circuit Pack/Unit Compatibility

Table 7-12 provides information on the compatibility of WaveStar OLS 40G equipment and software.

Table 7-12. Slot/Circuit Pack/ Software Compatibility (R3.1.1-WaveStar OLS 40G)

Slot	Supported Pack Codes	Quantity
End Terminal (Shelf 1, Miscellaneous or Dual)		
TLM 1A	LDA1	0 or 1
TLM 2A	LDA1	0 or 1
OMU/ODU 1A- 2B*	505A	0 or 1
	506A	
	605A	
	606A	
	606B	

Table 7-12. Slot/Circuit Pack/ Software Compatibility (R3.1.1-WaveStar OLS 40G) — *Continued*

Slot	Supported Pack Codes	Quantity
OA 1A - 2B	LEA6	0 - 4
	LEA7	
	LEA104	
	LEA105	
TOHCTL	LEA5	1
SYSCTL	LEA1	1
SYSMEM	LEA2	1
End Terminal (Shelf 2)		
TLM 3A	LDA1	0 or 1
TLM 4A	LDA1	0 or 1
OMU / ODU 3A - 3B*	505A	0 or 1
	506A	
	605A	
	606A	
	606B	
OA 3A - 4B	LEA6	0 or 1
	LEA7	
	LEA104	
	LEA105	
Repeater Shelf (Shelf 1, Miscellaneous or Dual)		
TLM 1A - 2B	LDA1	0 - 4
OA 1A - 2B	LEA6	0 - 4
	LEA7	
OA	LEA104	
	LEA105	

Table 7-12. Slot/Circuit Pack/ Software Compatibility (R3.1.1-WaveStar OLS 40G) — *Continued*

Slot	Supported Pack Codes	Quantity
TOHCTL	LEA5	1
SYSCTL	LEA1	1
SYSMEM	LEA2	1
Repeater Shelf (Shelf 2)		
TLM 3A - 4B	LDA1	0 - 4
OA 3A - 4B	LEA6	0 - 4
	LEA7	
	LEA104	
	LEA105	

* Equipment units (NOT circuit packs) go into these slots. Refer to SD5G276-01 and SD6G157-01 WaveStar OLS 40G application schematics.

Ordering Sample

This section contains examples of completed worksheets used to order equipment for a hypothetical network configuration. This information is provided as an illustrative aid to help you with the ordering procedure for WaveStar OLS 40G equipment.

Figure 7-1 depicts the network configuration used for this example. Note that both Lucent-specific and multi-vendor terminals are indicated by the same box. This is meant to show how signals coming into an End Terminal can originate from either Lucent-specific or multi-vendor equipment

NOTE:
When using either multi-vendor equipment or an FT-2000 ADR Release 7.1 or earlier, an OT is required to convert signals to WaveStar OLS 40G compatible optics.

The sample worksheets correspond to sections A and B in the figure.

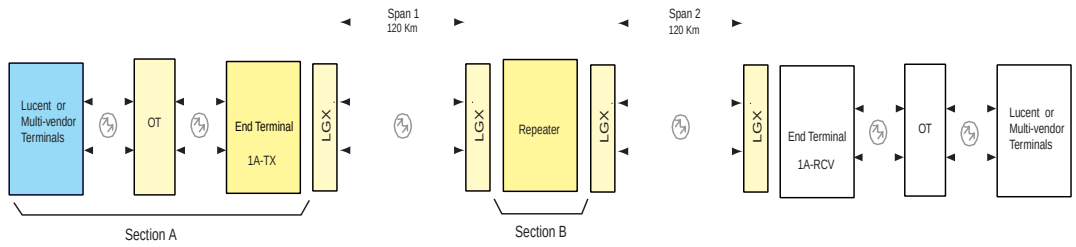


Figure 7-1. Sample Network Configuration Overview

Figure 7-2 shows an enlarged view of Section A with further details of the network. Note how Lucent terminals do not require the OT for transmitting signals to an WaveStar OLS 40G.

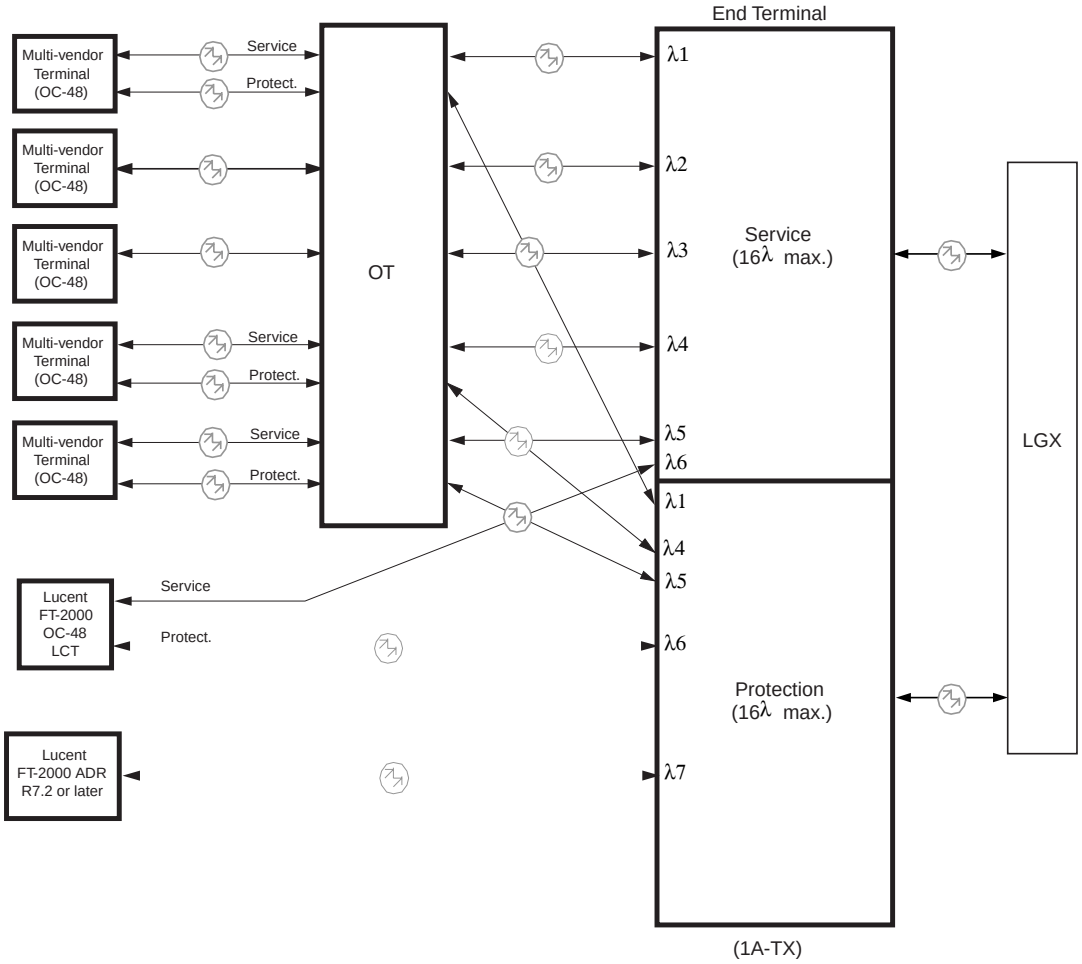


Figure 7-2. Sample Configuration, Section A (Enlarged)

Sample Network Assumptions

The following assumptions are used for the purpose of this example:

- An End Terminal bay, an Repeater bay, and an OT bay are required (bay frames allow for future expansion of the network)
- North American SONET version used
- 16 wavelength capability
- 2 bidirectional lines
- Release 3.1.1 software running (CD-ROM version)
- OC-48 signal transmission only
- No customer maintenance signal is used; supervisory signal is present
- OTCTL circuit pack is used; no external miscellaneous discrete unit (EMDU) is needed

Sample Network Specifications

For this configuration, the following network specifications are used:

- Number of spans: 2
- Distance per span: 120 km
- Number of wavelengths used (future growth is planned): 11 (6 service, 5 protection)
- Distance between OT and End Terminal (Section A): 50 ft
- Distance between CIT and WaveStar OLS 40G: 20 ft
- Distance between WaveStar OLS 40G and network hub (LAN) connection panel: 100 ft
- Distance between End Terminal and Lightguide Cross Connect: 53 ft
- Distance between Lightguide Cross Connect (LGX) and Repeater: 53 ft

When considering span lengths and associated equipment (for example: Optical Amplifier circuit packs), refer to Chapter 6, “System Planning and Engineering” for system engineering rules.

Sample Worksheets

The following worksheets are used to order components found in Section A and B of the network. Ordered items and explanations for each entry are shown in bold face text; these items are also circled to show how an actual worksheet can be filled out.

NOTE:
Depending on distance specifications, number of spans and wavelengths used in the system, and the physical deployment of the application, only certain components are needed from various equipment groups.

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Dual End Terminal	Cabinet Bay	L2 or L14	"WaveStar OLS 40G Package Descriptions"
Dual End Terminal Kit	Quantity ___1___ (1 required per shelf)	L103	
SDH kit for SDH WaveStar OLS 40G application (used with L14)	Quantity _____ (1 required per shelf in addition to L103)	L108	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA, LEA104)- Long Span	Quantity ___4___ (2 per optical line required)	L22	This OA handles 16 wavelength operation up to 3 spans over a distance of 136 km per span. The sample network utilizes 2 spans over a length below this maximum number. Therefore, this OA is used.
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Telemetry circuit pack	Quantity ___2___ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-thru feature)	L25	This circuit pack is required for handling the supervisory channel. Note that the 4-fiber Telemetry Feed-thru feature is not selected. The sample network used here represents a single WaveStar OLS 40G subnetwork only.
Tributary overhead controller circuit pack	Quantity ___1___ (2 per cabinet required)	L30	
System controller circuit pack	Quantity ___1___ (2 per cabinet required)	L35	
System memory circuit pack	Quantity ___1___ (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 ___2___ (1 per optical line required for two-OA operation)	L51	This ODU supports up to 16λ allowing for future growth. This satisfies the current wavelength capacity of the sample network.
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 ___2___ (1 per optical line required)	L61	This OMU supports up to 16λ, allowing for future growth.

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity ___2___ (1 per optical line required)	L162	This jumper kit supports 16λ and two-OA operation; the span distance in the sample network is long enough to require two OA circuit packs per line.
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 applications)	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (for two-OA / single-OA, single-OA / two-OA, single-OA / single-OA dual-facing applications)	Quantity _____ (1 per shelf required)	L165	
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber telemetry feed thru feature) Length _____ Comcode _____		*Fiber Optic Products* catalog 2492C

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide office cable (MS1LC-EP-?)	Quantity 80 (40 per optical line required for 16λ; 4 additional cables required for the 4-fiber telemetry feed thru feature) Length 53 ft Comcode: 107815896, 107 132 698		These cables support 16λ. Note that the maximum amount per line has been ordered even though only 11 wavelengths are actually being used in the sample network. The remaining cables are held in preparation for future growth. This cable connects the end terminal to the lightguide cross connect (LGX) The comcodes listed here are the actual codes obtained from the *Fiber Optic Products* catalog (select code: 2492C) Here, the MS1LC-EP-? code represents a single-mode product. The cordage length can be customized and is connectorized with LC and ST assemblies to form the overall cable with the comcode that was entered. See "Sample Cabling Illustrations."

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity 1 Length 100 ft	G602, G652	This cable connects a designated WaveStar OLS 40G site to an X.25 hub controlled by the OSS, turning the site into a gateway network element. G602 represents a customized length.
CIT interface cable	Quantity 1 Length 20 ft	G702, G752	This cable is used to connect an WaveStar OLS 40G site to an end user's computer running CenterLink software. G702 represents a customized length.
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity_____ Length _____	G201, G251, G261	

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity 2 (1 per optical line required)	L112	ST LBOs are standard with Lucent equipment.
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
METRAL pin/tool kit	Quantity 1 Supplier Order #: MT-370-01		Table 7-8 and Table 7-9 (Use telephone number provided) This kit is needed for any repairs made to backplane pin connectors (one per office)
CLETOP fiber cleaning materials	Quantity 1 Supplier Order #: 14100500		Table 7-7 (Use telephone number provided) This kit is used for cleaning fiber optic connections (one per office)

Table 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order #: _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
Software	Quantity ___1___ Comcode _____ (use comcode if ordering an upgrade)	L2, L3, L4, L8, M6S, P6S M2S, P2S, M4S, P4S, M5S, P5S	Table 7-31 and Table 7-33 The lists chosen here include the CD-ROM version of the Release 3.1.1 software (new system) and the right-to-use fees. The CD-ROM contains all customer documentation in electronic form (one copy per office).
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

* The 4-fiber Telemetry Feed-thru feature does not apply to dual facing or any Single-OA applications.

† A particular Short Reach 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 7-14. Dual Repeater Sample Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Dual Repeater	Cabinet Bay	L2 L14	"WaveStar OLS 40G Package Descriptions"
Dual Repeater Kit	Quantity ___1___ (1 required per shelf)	L104	
SDH kit for SDH WaveStar OLS 40G application (used with L14)	Quantity _____ (1 required per shelf in addition to L104)	L108	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)- Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)- Long Span	Quantity ___4___ (2 per optical line required)	L22	This OA handles 16 wavelength operation up to 3 spans over a distance of 136 km per span.
Telemetry circuit pack	Quantity ___4___ (2 per optical line required)	L25	This circuit pack is required for handling the supervisory channel.
Tributary overhead controller circuit pack	Quantity ___1___ (2 per cabinet / bay required)	L30	
System controller circuit pack	Quantity ___1___ (2 per cabinet / bay required)	L35	
System memory circuit pack	Quantity ___1___ (2 per cabinet / bay required)	L40	

Table 7-14. Dual Repeater Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity 2 (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions" On a repeater site, this kit supports both 8 and 16 wavelength operation.
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies *Fiber Optic Products* catalog	Quantity 16 (8 per optical line required) Length 53 ft Comcode: 107 306 409, 107 306 367		*Fiber Optic Products* catalog 2492C This cable connects the repeater to the lightguide cross connect (LGX). The comcodes were obtained from the *Fiber Optic Products* catalog. See "Sample Cabling Illustrations."

Table 7-14. Dual Repeater Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity 1 Length 100 ft.	G602, G652	This cable connects a designated WaveStar OLS 40G site to an X.25 hub controlled by the OSS, turning the site into a gateway network element. G602 represents a customized length.
CIT interface cable	Quantity 1 Length 20 ft.	G702, G752	This cable is used to connect a WaveStar OLS 40G site to an end user's computer running CenterLink software. G702 represents a customized length.
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity_____ Length _____	G201, G251, G261	

Table 7-14. Dual Repeater Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity 2 (1 per optical line required)	L112	ST LBOs are standard with Lucent equipment.
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
METRAL pin/tool kit	Quantity 1 Supplier Order #: MT-370-01		Table 7-8 and Table 7-9 (Use telephone number provided) This kit is needed for any repairs made to backplane pin connectors. It is ordered directly from the supplier (one per office).
CLETOP fiber cleaning materials	Quantity 1 Supplier Order #: 14100500		Table 7-7 (Use telephone number provided) This kit is used for cleaning fiber optic connections (one per office).

Table 7-14. Dual Repeater Sample Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
Software	Quantity ____1____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L8, M6S, P6S, M2S, P2S, M4S, P4S, M5S, P5S	Table 7-31, Table 7-32, and Table 7-33 The lists chosen here include the CD-ROM version of the Release 3.1.1 software (new system) and the right-to-use fees. The CD-ROM contains all customer documentation in electronic form.
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted application OT Bay	Quantity _____	L10 or L14	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTCTL	Quantity 1	L50	Table 7-36 and "Circuit Pack / Unit Descriptions" The OTCTL is used to communicate between the WaveStar OLS 2G and OT. When it is used, the EMDU and associated cabling from earlier releases is not needed. Two OTU circuit packs are required per wavelength (one per direction). The 41AxC are used in the transmit direction only.
OTU 41A1C	Quantity 2	L21	
OTU 41A2C	Quantity 1	L22	
OTU 41A3C	Quantity 1	L23	
OTU 41A4C	Quantity 2	L24	
OTU 41A5C	Quantity 2	L25	
OTU 41A6C	Quantity _____	L26	
OTU 41A7C	Quantity _____	L27	
OTU 41A8C	Quantity _____	L28	
OTU 41A9C	Quantity _____	L89	
OTU 41A10C	Quantity _____	L90	
OTU 41A11C	Quantity _____	L91	
OTU 41A12C	Quantity _____	L92	
OTU 41A13C	Quantity _____	L93	
OTU 41A14C	Quantity _____	L94	
OTU 41A15C	Quantity _____	L95	
OTU 41A16C	Quantity _____	L96	
OTU 41BB	Quantity 8	L229	
OTU 41C1C	Quantity _____	L41	
OTU 41C2C	Quantity _____	L42	

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41C3C	Quantity _____	L43	The 41BB circuit packs are used on the receive end. Two 41AxC packs are required if both service and protection lines are used. The Lucent LCT terminal and ADR terminal (Release 7.2 or later) do not require OTU circuit packs.
OTU 41C4C	Quantity _____	L44	
OTU 41C5C	Quantity _____	L45	
OTU 41C6C	Quantity _____	L46	
OTU 41C7C	Quantity _____	L47	
OTU 41C8C	Quantity _____	L48	
OTU 41C9C	Quantity _____	L99	
OTU 41C10C	Quantity _____	L100	
OTU 41C11C	Quantity _____	L101	
OTU 41C12C	Quantity _____	L102	
OTU 41C13C	Quantity _____	L103	
OTU 41C14C	Quantity _____	L104	
OTU 41C15C	Quantity _____	L105	
OTU 41C16C	Quantity _____	L106	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	
OTPM 42A2	Quantity _____	L52	
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A5	Quantity _____	L55	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	
OTPM 43A7	Quantity _____	L77	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A11	Quantity _____	L81	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____ Length _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____ Length _____	G3 or G4	
Office alarm cable	Quantity _____ Length _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____ Length _____	G16 or G17	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L111	"OT Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
ST LBO kit (R2.1 and later)	Quantity 10 (1 per OTU or OTPM required)	L122	ST LBOs are standard with Lucent equipment. Order one kit per line, order two additional kits as spares. This kit supports 16λ.
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	

Table 7-15. OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Other			
METRAL pin/tool kit	Quantity 1 Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided) One per office.
CLETOP fiber cleaning materials	Quantity 1 Supplier Order # _____		Table 7-7 (Use telephone number provided) One per office.

Sample Cabling Illustrations

This section provides descriptive illustrations of various connections and comcode components. These components are used in the sample network but represent actual orderable items.

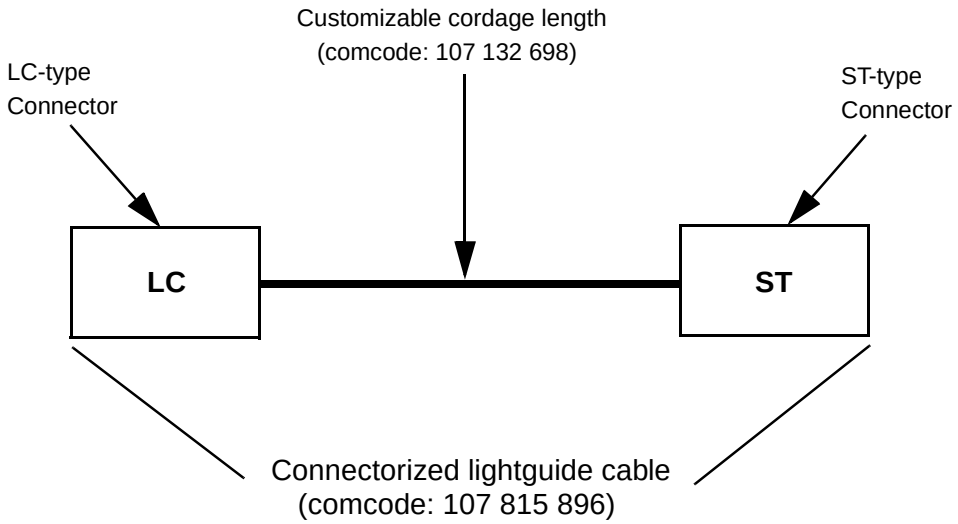
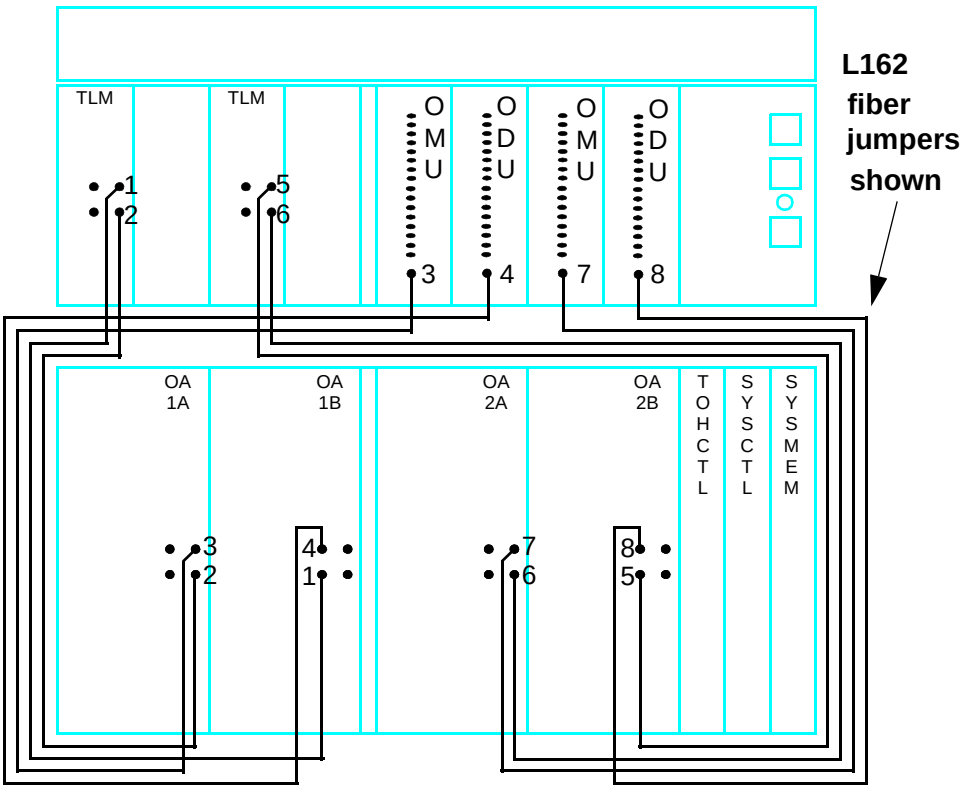


Figure 7-3. Lightguide Office Cable Depiction



Point 1, TLM connects to Point 1, OA 1B-RCV (Service Line)
Point 2, TLM connects to Point 2, OA 1A-TX (Service Line)
Point 3, OMU connects to Point 3, OA 1A-TX (Service Line)
Point 4, ODU connects to Point 4, OA 1B-RCV (Service Line)
Point 5, TLM connects to Point 5, OA 2B-RCV (Protection Line)
Point 6, TLM connects to Point 6, OA 2A-TX (Protection Line)
Point 7, OMU connects to Point 7, OA 2A-TX (Protection Line)
Point 8, ODU connects to Point 8, OA, 2B-RCV (Protection Line)

Figure 7-4. Intra-shelf Fiber Jumpers for 1A-TX End Terminal (L162)

WaveStar OLS 40G Worksheets

This section provides worksheets for ordering WaveStar OLS 40G packages. The worksheets list circuit packs and the associated number per line, along with other equipment such as cables, software, and lightguide build-outs (LBO) that are needed to form each package. Enter your selection, along with desired quantity and cable lengths, and enter the appropriate ordering comcode number (where applicable).

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

Miscellaneously-mounted End Terminal Shelf	Table 7-16
Miscellaneously-mounted Repeater Shelf	Table 7-17
Miscellaneously-mounted OT System Controller Shelf	Table 7-18
Miscellaneously-mounted OT Complementary Shelf 1 or 2	Table 7-19
End Terminal Cabinet, 4 line	Table 7-20
Dual End Terminal Cabinet or Bay	Table 7-21
Repeater Cabinet, 4 line	Table 7-22
Dual Repeater Cabinet or Bay	Table 7-23
End Terminal and Repeater Combination	Table 7-24
Integrated Bay (Single)	Table 7-25

Integrated Cabinet (Double, super kit)	Page 7-130
Integrated Bay (Double, super kit)	Page 7-130
Integrated Cabinet (Triple 1, super kit)	Page 7-131
Integrated Bay (Triple 1, super kit)	Page 7-131
Integrated Cabinet (Triple 2, super kit)	Page 7-132
Integrated Bay (Triple 2, super kit)	Page 7-132
OT Bay or Miscellaneously-mounted application	Table 7-27
OT Cabinet	Table 7-28
4 Line End Terminal-to-Dual End Terminal Conversion	Table 7-29
4 line Repeater-to-Dual Repeater Conversion	Table 7-26

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 7-16. Miscellaneously-mounted End Terminal Shelf (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted End Terminal Shelf	Quantity _____ Newlook-2000 covers Flat covers	 L10 or L11	"WaveStar OLS 40G Package Descriptions"
Miscellaneously-mounted End Terminal Kit	Quantity _____ (1 required per shelf)	L106	
SDH kit for SDH WaveStar OLS 40G application	Quantity _____ (1 required per shelf in addition to L106)	L108	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Long Span	Quantity_____ (2 per optical line required)	L22	

Table 7-16. Miscellaneously-mounted End Terminal Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	"Circuit Pack / Unit Descriptions"
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-thru feature)	L25	
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per shelf required)	L30	
System controller circuit pack (SYSCTL)	Quantity _____ (1 per shelf required)	L35	
System memory circuit pack (SYSMEM)	Quantity _____ (1 per shelf 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	
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	

Table 7-16. Miscellaneously-mounted End Terminal Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
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 (for two-OA / single-OA, single-OA / two-OA, single-OA / single-OA dual-facing applications)	Quantity _____ (1 per shelf required)	L165	
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		

Table 7-16. Miscellaneously-mounted End Terminal Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11

Table 7-16. Miscellaneously-mounted End Terminal Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Order-wire Shelf"
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use com-code for additional copies)	E	Table 7-31 and Table 7-32

* The 4-fiber Telemetry Feed-thru feature does not apply to dual-facing or any Single-OA applications.

† A particular Short Reach 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 7-17. Miscellaneously-mounted Repeater Shelf (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted Repeater Shelf	Quantity_____	L10 or L11	"WaveStar OLS 40G Package Descrip-tions"
Miscellaneously-mounted Repeater Kit	Quantity_____ (1 required per shelf)	L107	
SDH kit for SDH WaveStar OLS 40G application	Quantity_____ (1 required per shelf in addition to L107)	L108	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required) Comcode _____	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA) (16λ)– Long Reach	Quantity _____ (2 per optical line required) Comcode _____	L21	
Optical Amplifier circuit pack (OA) (16λ)– Long Span	Quantity _____ (2 per optical line required) Comcode _____	L22	
Telemetry circuit pack	Quantity _____ (2 per optical line required) Comcode _____	L25	
Tributary overhead controller circuit pack	Quantity _____ (1 per shelf required) Comcode _____	L30	
System controller circuit pack	Quantity _____ (1 per shelf required) Comcode _____	L35	
System memory circuit pack	Quantity _____ (1 per shelf required) Comcode _____	L40	

Table 7-17. Miscellaneously-mounted Repeater Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descrip-tionss"
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (1 per shelf required) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, sec-tion user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	

Table 7-17. Miscellaneously-mounted Repeater Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)

Table 7-17. Miscellaneously-mounted Repeater Shelf (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted OT System Controller Shelf	Quantity _____	L11	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	L50	Table 7-36 and "Circuit Pack / Unit Descriptions"
OPS	Quantity _____	L470	
SPODU	Quantity _____	L474	
SPOMU	Quantity _____	L478	
OTU 41A1C	Quantity _____	L21	
OTU 41A2C	Quantity _____	L22	
OTU 41A3C	Quantity _____	L23	
OTU 41A4C	Quantity _____	L24	
OTU 41A5C	Quantity _____	L25	
OTU 41A6C	Quantity _____	L26	
OTU 41A7C	Quantity _____	L27	
OTU 41A8C	Quantity _____	L28	
OTU 41A9C	Quantity _____	L89	
OTU 41A10C	Quantity _____	L90	
OTU 41A11C	Quantity _____	L91	
OTU 41A12C	Quantity _____	L92	
OTU 41A13C	Quantity _____	L93	
OTU 41A14C	Quantity _____	L94	
OTU 41A15C	Quantity _____	L95	
OTU 41A16C	Quantity _____	L96	
OTU 41BB	Quantity _____	L229	
OTU 41C1C	Quantity _____	L41	
OTU 41C2C	Quantity _____	L42	

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41C3C	Quantity _____	L43	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTU 41C4C	Quantity _____	L44	
OTU 41C5C	Quantity _____	L45	
OTU 41C6C	Quantity _____	L46	
OTU 41C7C	Quantity _____	L47	
OTU 41C8C	Quantity _____	L48	
OTU 41C9C	Quantity _____	L99	
OTU 41C10C	Quantity _____	L100	
OTU 41C11C	Quantity _____	L101	
OTU 41C12C	Quantity _____	L102	
OTU 41C13C	Quantity _____	L103	
OTU 41C14C	Quantity _____	L104	
OTU 41C15C	Quantity _____	L105	
OTU 41C16C	Quantity _____	L106	
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	

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A8	Quantity _____	L58	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A14	Quantity _____	L84	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____	G3 or G4	
Office alarm cable	Quantity _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____	G16 or G17	
LBO Kits (J69000C-1)			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L111	"OT Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L122	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted OT Complementary Shelf: 1 2	 Quantity _____ Quantity _____	 L12 L13	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	L50	Table 7-36 and "Circuit Pack / Unit Descriptions"
OPS	Quantity _____	L470	
SPODU	Quantity _____	L474	
SPOMU	Quantity _____	L478	
OTU 41A1C	Quantity _____	L21	
OTU 41A2C	Quantity _____	L22	
OTU 41A3C	Quantity _____	L23	
OTU 41A4C	Quantity _____	L24	
OTU 41A5C	Quantity _____	L25	
OTU 41A6C	Quantity _____	L26	
OTU 41A7C	Quantity _____	L27	
OTU 41A8C	Quantity _____	L28	
OTU 41A9C	Quantity _____	L89	
OTU 41A10C	Quantity _____	L90	
OTU 41A11C	Quantity _____	L91	
OTU 41A12C	Quantity _____	L92	
OTU 41A13C	Quantity _____	L93	
OTU 41A14C	Quantity _____	L94	
OTU 41A15C	Quantity _____	L95	
OTU 41A16C	Quantity _____	L96	
OTU 41BB	Quantity _____	L229	
OTU 41C1C	Quantity _____	L41	
OTU 41C2C	Quantity _____	L42	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41C3C	Quantity _____	L43	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTU 41C4C	Quantity _____	L44	
OTU 41C5C	Quantity _____	L45	
OTU 41C6C	Quantity _____	L46	
OTU 41C7C	Quantity _____	L47	
OTU 41C8C	Quantity _____	L48	
OTU 41C9C	Quantity _____	L99	
OTU 41C10C	Quantity _____	L100	
OTU 41C11C	Quantity _____	L101	
OTU 41C12C	Quantity _____	L102	
OTU 41C13C	Quantity _____	L103	
OTU 41C14C	Quantity _____	L104	
OTU 41C15C	Quantity _____	L105	
OTU 41C16C	Quantity _____	L106	
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	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A8	Quantity _____	L58	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A13	Quantity _____	L83	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____	G3 or G4	
Office alarm cable	Quantity _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____	G16 or G17	
LBO Kits (J69000C-1)			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L111	"OT Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L122	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	
Other			
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
End Terminal Cabinet	Quantity _____	L1	"WaveStar OLS 40G Package Descriptions"
4-Line End Terminal Kit	Quantity _____ (1 required per cabinet)	L101	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L22	
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	
Telemetry circuit pack (TLM)	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-thru feature)	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	

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Optical Demultiplexer Unit (ODU 8λ)	Quantity _____ (1 per optical line required)	L50	"Circuit Pack / Unit Descriptions"
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 Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
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 applications)	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (for two-OA / single-OA, single-OA / two-OA, single-OA / single-OA dual-facing applications)	Quantity _____ (1 per shelf required)	L165	

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		
Non-transmission Cable (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
METRAL pin/tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

* The 4-fiber Telemetry Feed-thru feature does not apply to dual-facing or any Single-OA applications.

† A particular Short Reach 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 7-21. Dual End Terminal Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Dual End Terminal	Cabinet Bay	L2 or L14	"WaveStar OLS 40G Package Descriptions"
Dual End Terminal Kit	Quantity _____ (1 required per shelf)	L103	
SDH kit for SDH WaveStar OLS 40G application (used with L14)	Quantity _____ (1 required per shelf in addition to L103)	L108	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L22	
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-thru feature)	L25	
Tributary overhead controller circuit pack	Quantity _____ (2 per cabinet required)	L30	
System controller circuit pack	Quantity _____ (2 per cabinet required)	L35	

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
System memory circuit pack	Quantity _____ (2 per cabinet required)	L40	"Circuit Pack / Unit Descriptions"
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	
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required)	L61	
Lightguide Jumper Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
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 applications)	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (for two-OA / single-OA, single-OA / two-OA, single-OA / single-OA dual-facing applications)	Quantity _____ (1 per shelf required)	L165	

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru) Length _____ Comcode _____		
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Order-wire Shelf"

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

* The 4-fiber Telemetry Feed-thru feature does not apply to dual facing or any Single-OA applications.

† A particular Short Reach 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 7-22. 4 Bidirectional Line Repeater Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
4 Bidirectional Line Repeater	Cabinet	L1	"WaveStar OLS 40G Package Descriptions"
Repeater Kit	Quantity _____ (1 required per shelf)	L102	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)- Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L22	
Telemetry circuit pack	Quantity _____ (2 per optical line required)	L25	
Tributary overhead controller circuit pack	Quantity _____ (1 per cabinet required)	L30	
System controller circuit pack	Quantity _____ (1 per cabinet required)	L35	
System memory circuit pack	Quantity _____ (1 per cabinet required)	L40	
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"

Table 7-22. 4 Bidirectional Line Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (8λ per optical line required) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Non-transmission Cable (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	

Table 7-22. 4 Bidirectional Line Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11

Table 7-22. 4 Bidirectional Line Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Order-wire Shelf"
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use com-code for additional copies)	E	Table 7-31 and Table 7-32

Table 7-23. Dual Repeater Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Dual Repeater	Cabinet Bay	L2 L14	"WaveStar OLS 40G Package Descrip-tions"
Dual Repeater Kit	Quantity _____ (1 required per shelf)	L104	
SDH kit for SDH WaveStar OLS 40G application (used with L14)	Quantity _____ (1 required per shelf in addition to L104)	L108	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)- Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L22	
Telemetry circuit pack	Quantity _____ (2 per optical line required)	L25	
Tributary overhead control-ler circuit pack	Quantity _____ (2 per cabinet / bay required)	L30	
System controller circuit pack	Quantity _____ (2 per cabinet / bay required)	L35	
System memory circuit pack	Quantity _____ (2 per cabinet / bay required)	L40	

Table 7-23. Dual Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descrip-tions"
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (8 per optical line required) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, sec-tion user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	

Table 7-23. Dual Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
Other			
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11 (Use telephone number provided)
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"

Table 7-23. Dual Repeater Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
End Terminal/Repeater	Cabinet Bay	L2 L14	"WaveStar OLS 40G Package Descriptions"
End Terminal/Repeater Kit	Quantity _____	L105	
SDH kit for SDH WaveStar OLS 40G application (used with L14)	Quantity _____ (1 required per shelf in addition to L105)	L108	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L20	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)- Long Span	Quantity _____ (2 per optical line required)	L22	
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	
Telemetry circuit pack	Quantity _____ (1 per optical line required [End Terminal shelf]; 2 per optical line required [Repeater shelf]; 2 additional packs per End Terminal shelf needed for 4-fiber Telemetry Feed-thru)	L25	
Tributary overhead controller circuit pack	Quantity _____ (2 per cabinet/bay required)	L30	

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
System controller circuit pack	Quantity _____ (2 per cabinet / bay required)	L35	"Circuit Pack / Unit Descriptions"
System memory circuit pack	Quantity _____ (2 per cabinet / bay 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	
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line required [End Terminal shelf only])	L61	
Lightguide Jumper Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required [for End Terminal or Repeater])	L161	"WaveStar OLS 40G Package Descriptions"
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required [for End Terminal])	L162	

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide jumper kit (for 16λ systems, single-OA operation)	Quantity _____ (1 per optical line required [for End Terminal])	L163	"WaveStar OLS 40G Package Descriptions"
Lightguide jumper kit (for 16λ systems, two-OA / two-OA dual-facing applications)	Quantity _____ (1 per shelf required [for End Terminal])	L164	
Lightguide jumper kit (for two-OA / single-OA, single-OA / two-OA, single-OA / single-OA dual-facing applications)	Quantity _____ (1 per shelf required [for End Terminal])	L165	
Lightguide Office Cable			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ End Terminal; 8 per optical line for a Repeater; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature on an End Terminal) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ End Terminal; 8 per optical line for Repeater; 4 additional cables required for the 4-fiber Telemetry Feed-thru on End Terminal) Length _____ Comcode _____		

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	"WaveStar OLS 40G Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Other			
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M2S, P2S, M4S, P4S, M5S, P5S, M4R, P4R	Table 7-31 and Table 7-33

Table 7-24. End Terminal and Repeater Combination Worksheet (J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

* 4-fiber Telemetry Feed-thru does not apply to dual facing or any Single-OA applications.

† A particular Short Reach 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 7-25. Integrated Bay (Single) Worksheet (J68982D-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Integrated Bay (Single)	Quantity _____	L1	"WaveStar OLS 40G Package Descriptions"
SDH kit for SDH WaveStar OLS 40G application	Quantity _____ (1 required per WaveStar OLS 40G shelf)	L108	
4-fiber Telemetry Feed-thru kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA)-Long Span	Quantity_____ (2 per optical line required)	L20	"Circuit Pack / Unit Descriptions"
Optical Amplifier circuit pack (OA)-Long Reach	Quantity _____ (2 per optical line required)	L21	
Optical Amplifier circuit pack (OA)-Long Span	Quantity _____ (2 per optical line required)	L22	
Optical Amplifier circuit pack (OA)-Short Reach	Quantity _____ (1 or 2 per optical line required)†	L23	
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-thru feature)	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	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel)	Quantity _____ (1 per optical line required for two-OA operation)	L51	"Circuit Pack / Unit Descriptions"
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)	L60	
Optical Multiplexer Unit (OMU 16λ)	Quantity _____ (1 per optical line)	L61	
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	L250	Table 7-36 and "Circuit Pack / Unit Descriptions"
OPS	Quantity _____	L670	
SPODU	Quantity _____	L674	
SPOMU	Quantity _____	L678	
OTU 41A1C	Quantity _____	L601	
OTU 41A2C	Quantity _____	L602	
OTU 41A3C	Quantity _____	L603	
OTU 41A4C	Quantity _____	L604	
OTU 41A5C	Quantity _____	L605	
OTU 41A6C	Quantity _____	L606	
OTU 41A7C	Quantity _____	L607	
OTU 41A8C	Quantity _____	L608	
OTU 41A9C	Quantity _____	L609	
OTU 41A10C	Quantity _____	L610	
OTU 41A11C	Quantity _____	L611	
OTU 41A12C	Quantity _____	L612	
OTU 41A13C	Quantity _____	L613	
OTU 41A14C	Quantity _____	L614	
OTU 41A15C	Quantity _____	L615	
OTU 41A16C	Quantity _____	L616	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41BB	Quantity _____	L229	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTU 41C1C	Quantity _____	L651	
OTU 41C2C	Quantity _____	L652	
OTU 41C3C	Quantity _____	L653	
OTU 41C4C	Quantity _____	L654	
OTU 41C5C	Quantity _____	L655	
OTU 41C6C	Quantity _____	L656	
OTU 41C7C	Quantity _____	L657	
OTU 41C8C	Quantity _____	L658	
OTU 41C9C	Quantity _____	L659	
OTU 41C10C	Quantity _____	L660	
OTU 41C11C	Quantity _____	L661	
OTU 41C12C	Quantity _____	L662	
OTU 41C13C	Quantity _____	L663	
OTU 41C14C	Quantity _____	L664	
OTU 41C15C	Quantity _____	L665	
OTU 41C16C	Quantity _____	L666	
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	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A8	Quantity _____	L258	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTPM 42A9	Quantity _____	L259	
OTPM 42A10	Quantity _____	L260	
OTPM 42A11	Quantity _____	L261	
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 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A16	Quantity _____	L286	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	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Lightguide Jumper Kits (for WaveStar OLS 40G Shelf)			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
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 applications)	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			
Lightguide office cable (MS1EP-EP-?) "?" indicates length. Specify length required from the Lucent Technologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		*Fiber Optic Products* Catalog 2492C
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4-fiber Telemetry Feed-thru feature) Length _____ Comcode _____		

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____	G3 or G4	
Office alarm cable	Quantity _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____	G16 or G17	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
LBO Kits			
For WaveStar OLS 40G shelf:			"WaveStar OLS 40G Package Descriptions" and "OT Package Descriptions"
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
For OT shelf:			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L113	
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L123	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L133	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L122	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	

Table 7-25. Integrated Bay (Single) Worksheet (J68982D-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Other			
HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L501	Table 7-11
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	L2, L3, L4, L5, L6 M4R, P4R, M2S, P2S, M4S, P4S, M5S, P5S	Table 7-31 and Table 7-33
Software Release Description (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-32
User Service Manual (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	E	Table 7-31 and Table 7-32

* 4-fiber Telemetry Feed-thru does not apply to dual facing or any Single-OA applications.

† A particular Short Reach 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 7-26. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Conversion kit†	Quantity_____ (1 per conversion required)	L310	Table 7-35‡
Dual Repeater kit	Quantity_____ (1 per cabinet required)	L104	"WaveStar OLS 40G Package Descriptions"
Circuit Packs (J68982C-1)			
Telemetry circuit pack	Quantity_____ (2 per optical line required)	L25	"Circuit Pack / Unit Descriptions"
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	
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity_____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
Lightguide Office Cable			
Lightguide office cable (FS1EP-EP-?) "?" indicates length	Quantity_____ (8 per optical line required)		*Fiber Optic Products* Catalog 2492C

Table 7-26. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)

Table 7-26. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)

* 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 7-35 provides ordering information for the underlying components in the conversion kit.

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Miscellaneously-mounted Application OT Bay	Quantity _____	L10 or L14	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	L50	Table 7-36 and "Circuit Pack / Unit Descriptions"
OPS	Quantity _____	L470	
SPODU	Quantity _____	L474	
SPOMU	Quantity _____	L478	
OTU 41A1C	Quantity _____	L21	
OTU 41A2C	Quantity _____	L22	
OTU 41A3C	Quantity _____	L23	
OTU 41A4C	Quantity _____	L24	
OTU 41A5C	Quantity _____	L25	
OTU 41A6C	Quantity _____	L26	
OTU 41A7C	Quantity _____	L27	
OTU 41A8C	Quantity _____	L28	
OTU 41A9C	Quantity _____	L89	
OTU 41A10C	Quantity _____	L90	
OTU 41A11C	Quantity _____	L91	
OTU 41A12C	Quantity _____	L92	
OTU 41A13C	Quantity _____	L93	
OTU 41A14C	Quantity _____	L94	
OTU 41A15C	Quantity _____	L95	
OTU 41A16C	Quantity _____	L96	
OTU 41BB	Quantity _____	L229	
OTU 41C1C	Quantity _____	L41	
OTU 41C2C	Quantity _____	L42	

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41C3C	Quantity _____	L43	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTU 41C4C	Quantity _____	L44	
OTU 41C5C	Quantity _____	L45	
OTU 41C6C	Quantity _____	L46	
OTU 41C7C	Quantity _____	L47	
OTU 41C8C	Quantity _____	L48	
OTU 41C9C	Quantity _____	L99	
OTU 41C10C	Quantity _____	L100	
OTU 41C11C	Quantity _____	L101	
OTU 41C12C	Quantity _____	L102	
OTU 41C13C	Quantity _____	L103	
OTU 41C14C	Quantity _____	L104	
OTU 41C15C	Quantity _____	L105	
OTU 41C16C	Quantity _____	L106	
QOTU 41S	Quantity _____	L49	
OTPM 42A1	Quantity _____	L51	
OTPM 42A2	Quantity _____	L52	
OTPM 42A3	Quantity _____	L53	
OTPM 42A4	Quantity _____	L54	

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A5	Quantity _____	L55	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	
OTPM 43A7	Quantity _____	L77	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A11	Quantity _____	L81	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____ Length _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____ Length _____	G3 or G4	
Office alarm cable	Quantity _____ Length _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____ Length _____	G16 or G17	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L111	"OT Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L122	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	

Table 7-27. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Other			
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)

Table 7-28. OT Cabinet Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OT Cabinet	Quantity _____	L1	"OT Package Descriptions"
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	L50	Table 7-36 and "Circuit Pack / Unit Descriptions"
OPS	Quantity _____	L470	
SPODU	Quantity _____	L474	
SPOMU	Quantity _____	L478	
OTU 41A1C	Quantity _____	L21	
OTU 41A2C	Quantity _____	L22	
OTU 41A3C	Quantity _____	L23	
OTU 41A4C	Quantity _____	L24	
OTU 41A5C	Quantity _____	L25	
OTU 41A6C	Quantity _____	L26	
OTU 41A7C	Quantity _____	L27	
OTU 41A8C	Quantity _____	L28	
OTU 41A9C	Quantity _____	L89	
OTU 41A10C	Quantity _____	L90	
OTU 41A11C	Quantity _____	L91	
OTU 41A12C	Quantity _____	L92	
OTU 41A13C	Quantity _____	L93	
OTU 41A14C	Quantity _____	L94	
OTU 41A15C	Quantity _____	L95	
OTU 41A16C	Quantity _____	L96	
OTU 41BB	Quantity _____	L229	
OTU 41C1C	Quantity _____	L41	
OTU 41C2C	Quantity _____	L42	

Table 7-28. OT Cabinet Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTU 41C3C	Quantity _____	L43	Table 7-36 and "Circuit Pack / Unit Descriptions"
OTU 41C4C	Quantity _____	L44	
OTU 41C5C	Quantity _____	L45	
OTU 41C6C	Quantity _____	L46	
OTU 41C7C	Quantity _____	L47	
OTU 41C8C	Quantity _____	L48	
OTU 41C9C	Quantity _____	L99	
OTU 41C10C	Quantity _____	L100	
OTU 41C11C	Quantity _____	L101	
OTU 41C12C	Quantity _____	L102	
OTU 41C13C	Quantity _____	L103	
OTU 41C14C	Quantity _____	L104	
OTU 41C15C	Quantity _____	L105	
OTU 41C16C	Quantity _____	L106	
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	

Table 7-28. OT Cabinet Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 42A8	Quantity _____	L58	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 43A8	Quantity _____	L78	
OTPM 43A9	Quantity _____	L79	
OTPM 43A10	Quantity _____	L80	
OTPM 43A11	Quantity _____	L81	
OTPM 43A12	Quantity _____	L82	
OTPM 43A13	Quantity _____	L83	

Table 7-28. OT Cabinet Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
OTPM 43A14	Quantity _____	L84	Table 7-36 and "Circuit Pack / Unit Descriptions"
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	
OTPM 44A13	Quantity _____	L153	
OTPM 44A14	Quantity _____	L154	
OTPM 44A15	Quantity _____	L155	
OTPM 44A16	Quantity _____	L156	
OTPM 44B	Quantity _____	L157	

Table 7-28. OT Cabinet Worksheet (J69000C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G045-22)			
Incoming signal failure cable	Quantity _____ Length _____	G3 or G4	Table 7-2, Table 7-3, and Table 7-4
OTU circuit pack failure cable	Quantity _____ Length _____	G3 or G4	
Office alarm cable	Quantity _____ Length _____	G1 or G2	
Power feeder failure alarm cable	Quantity _____ Length _____	G16 or G17	
LBO Kits (J69000C-1)			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L111	"OT Package Descriptions"
FC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L122	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU or OTPM required)	L132	
Other			
CLETOP fiber cleaning materials	Quantity _____ Supplier _____		Table 7-7 (Use telephone number provided)
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)

Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet (J68982C-1) *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Conversion kit†	Quantity_____ (1 per conversion required)	L310	Table 7-35‡
Dual End Terminal kit	Quantity_____ (1 per cabinet required)	L103	
Circuit Packs (J68982C-1)			
Telemetry circuit pack	Quantity_____ (1 per optical line required)	L25	"Circuit Pack / Unit Descriptions"
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	
Lightguide Office Cable			
Lightguide office cable (FS1EP-EP-?) "?" indicates length"	Quantity_____ (20 per optical line required [8λ]; 36 per optical line required [16λ]) Comcode _____		*Fiber Optic Products* Catalog 2492C

Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cable (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity_____ Length _____	G201, G251, G261	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
METRAL pin/tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)

Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)

* 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 7-35 provides ordering information for the underlying components in the conversion kit.

Table 7-30. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Conversion kit†	Quantity_____ (1 per conversion required)	L310	Table 7-35‡
Dual Repeater kit	Quantity_____ (1 per cabinet required)	L104	"WaveStar OLS 40G Package Descriptions"
Circuit Packs (J68982C-1)			
Telemetry circuit pack	Quantity_____ (2 per optical line required)	L25	"Circuit Pack / Unit Descriptions"
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	
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity_____ (1 per optical line required)	L161	"WaveStar OLS 40G Package Descriptions"
Lightguide Office Cable			
Lightguide office cable (FS1EP-EP-?) "?" indicates length	Quantity_____ (8 per optical line required) Comcode _____		*Fiber Optic Products* Catalog 2492C

Table 7-30. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1
X.25 cable	Quantity _____ Length _____	G602, G652	
CIT interface cable	Quantity _____ Length _____	G702, G752	
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
METRAL pin / tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)

Table 7-30. 4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	LIST/ GROUP	REFERENCE
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number provided)

* 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 7-35 provides ordering information for the underlying components in the conversion kit.

WaveStar OLS 40G Super Kits

This section contains ordering information for WaveStar OLS 40G super kits. Use the ED number (shown in the heading) when ordering these kits. Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately. The components of each super kit are listed.

Integrated Cabinet (Double) Super Kit (ED-8C903-40, G1)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L2 and L103
- One J-Drawing J69000C-1, L1
- Cables for connecting two cabinets
- System controller* circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

Integrated Bay (Double) Super Kit (ED-8C903-40, G2)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L14
- One J-Drawing J69000C-1, L14
- Associated cables for connecting two bays
- System controller* circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

*. System controller circuit packs: L30, L35, L40 (J-Drawing J68982C-1) and L50 (J-Drawing J69000C-1)

Integrated Cabinet (Triple 1) Super Kit (ED-8C903-40, G3)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L2 and L10
- Two J-Drawing J69000C-1, L1
- One L161 cables for connecting three cabinets
- System controller* circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

Integrated Bay (Triple 1) Super Kit (ED-8C903-40, G4)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L14
- Two J-Drawing J69000C-1, L14
- One J-Drawing J69000C-1, L161
- Associated cables for connecting three bays
- System controller* circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

Integrated Cabinet (Triple 2) Super Kit (ED-8C903-40, G5)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L2
- One J-Drawing J68982C-1, L103
- Two J-Drawing J69000C-1, L1
- One J-Drawing J69000C-1, L161
- Associated cables for connecting three bays
- System controller* circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

Integrated Bay (Triple 2) Super Kit (ED-8C903-40, G6)

This is a super kit that includes the following:

- One J-Drawing J68982C-1, L14
- One J-Drawing J68982C-1, L101
- Two J-Drawing J69000C-1, L14
- One J-Drawing J69000C-1, L161
- Associated cables for connecting three bays
- System controller† circuit packs.

Use Table 7-16 and Table 7-27 to order WaveStar OLS 40G and OT circuit packs and cables separately.

*. System controller circuit packs: L30, L35, L40 (J-Drawing J68982C-1) and L50 (J-Drawing J69000C-1)

†. System controller circuit packs: L30, L35, L40 (J-Drawing J68982C-1) and L50 (J-Drawing J69000C-1)

Software and Documentation

Table 7-31 provides list numbers for new system orders of WaveStar OLS 40G Release 3.1.1 software and documentation. The optional CD-ROM contains the software, electronic documentation, and peripheral software tools.

Table 7-31. New System Software and Documentation Ordering (J-Drawing J68982CS-1)

List No.	Description
M5R	Application software right-to-use fee (new system)*
P5R	Operating system software right-to-use fee (new system)*
L7	– R3.1.1-WaveStar OLS 40G cmd set / NE software (3.5" diskettes) – *WaveStar OLS 40G Release 3.1.1 Software Release Description* (North American version, paper copy)
E	*WaveStar OLS 40G Release 3.1.1 User Service Manual* (North American version, paper copy)
L8	– R3.1.1-WaveStar OLS 40G cmd set / NE software (CD-ROM) – R3.1.1-WaveStar OLS 40G SmartManual – N. America user documentation – CD-ROM Browser – CenterLink Online Tour – Microsoft Internet Explorer 3.0.2 – Adobe Acrobat Reader 3.0.1 – Personal Web Server 1.0a

* Right-to-use lists must be ordered with either floppy or CD-ROM media.

The information in Table 7-32 is used when ordering additional copies of Release 3.1.1 software and documentation.

Table 7-32. Additional Software and Documentation Ordering (J-Drawing J68982CS-1)

User Service Manual Comcode	Software Release Description Comcode	3.5" Diskettes Comcode	CD-ROM Comcode
108 286 501	108 334 731	108 334 715	108 334 723

Table 7-33 provides list numbers for upgrade orders of WaveStar OLS 40G software.

Table 7-33. Software Upgrade Ordering (J-Drawing J68982CS-1)

Release	List No. (CD-ROM)	List No. (3.5" Diskettes)
2.1.1 - 3.1.1	L8, M6S, P6S	L7, E, M6S, P6S

Table 7-33 lists the comparative content of CD-ROM and 3.5” diskette media in OLS Release 3.1.1.

Table 7-34. Release 3.1.1 Comparative Media Content

Description	CD-ROM	3.5” Diskette
CD-ROM Browser	✔	
CenterLink Online Tour	✔	
3.1.1-OLS software	✔	✔
3.1.1-OLS SmartManual*	✔	✔
N.America user documentation	✔	
Microsoft Internet Explorer 3.0.2	✔	
Adobe Acrobat Reader 3.0.1	✔	
Personal Web Server 1.0a	✔	✔

* Available only on CD-ROM.

Conversion Kit

Table 7-35 contains information on the conversion kit for WaveStar OLS 40G. The kit is used with conversions from 4 bidirectional line cabinet equipment to dual terminal cabinet equipment.

Table 7-35. Conversion Kit (L310, 4 Line-to-Dual)

Description	Drawing	Group	Quantity	Comcode
Bus Termination	ED-7G028-20	G-6	2	
User Panel Extension Cable for Upper Shelf (3')	ED-7G028-20	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	
WaveStar OLS 40G Indicator Strip Assembly			1	847419652
481A Circuit Module			1	107678864

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 (R3.1.1-WaveStar OLS 40G)

Shelf	Slot	Supported Pack Codes	Quantity
System Controller Shelf	OTU (1-8)	41A(1-16)C, 41BB, and 41C(1-16)C	
		41S	0 - 4
		42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), and 44B*	0 - 16
	OTCTL	OTCTL	0 - 1
Complementary Shelf 1	OTU (9-20)	41A(1-16)C, 41BB, and 41C(1-16)C	
		41S	
		42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), and 44B*	0 - 24
Complementary Shelf 2	OTU (21-32)	41A(1-16)C, 41BB, and 41C(1-16)C	
		41S	
		42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), and 44B*	0 - 24

* OTPM circuit packs are installed into 41S slots.

WaveStar OLS 40G-to-OT Control Cabling

This section describes the cables that are used to connect WaveStar OLS 40G and OT shelves. Engineering rules for each configuration are also described.

WaveStar OLS 40G/Single OT Shelf (ED-7G028-22)

Table 7-37 lists different cable lengths used to support the WaveStar OLS 40G / Single OT Shelf configuration.

Table 7-37. Cabling Information for WaveStar OLS 40G/Single OT Shelf

Cable Type (ED-7G028-22)	Length	Group #
LAN	20 ft.	G801
	100 ft.	G851
	200 ft.	G853
Reset-and-equipage	20 ft.	G802
	100 ft.	G852
	200 ft.	G854

WaveStar OLS 40G/Two OT Controller Shelves (ED-7G028-22)

The most complex WaveStar OLS 40G / OT arrangement is a WaveStar OLS 40G associated with two OT Controller Shelves. Table 7-38 lists cable lengths for the WaveStar OLS 40G / Two OT Controller Shelves configuration.

Table 7-38. Cabling Information for WaveStar OLS 40G/ Two OT Controller Shelves

Cable Type (ED-7G028-22)	Length	Group #
LAN Cable 1	20 ft	G801
	100 ft	G851
	180 ft	G855
LAN Cable 2	20 ft	G806
	100 ft	G807
	180 ft	G809
Dual Reset-and-Equipage	20 ft	G812
	100 ft	G813
	180 ft	G814
Miscellaneous	20 ft	G803
	100	G804
	200	G805

NOTE:
The sum of the lengths of LAN cable 1 and LAN cable 2 must not exceed 200 feet.

Possible LAN cable combinations that are permitted with this configuration are listed in Table 7-39.

Table 7-39. Possible LAN Cable Combinations

LAN Cable 1	LAN Cable 2	Total Length	Permitted?
G801	G806	40 ft	Yes
G801	G807	120 ft	Yes
G801	G809	200 ft	Yes
G851	G806	120 ft	Yes
G851	G807	200 ft	Yes
G851	G809	280 ft	No
G855	G806	200 ft	Yes
G855	G807	280 ft	No
G855	G809	360 ft	No

NOTE:
Careful preparation should be taken to insure a proper distance between the WaveStar OLS 40G, OT1, and the eventual OT2. The total cable length of LAN Cable 1 and the eventual LAN Cable 2 should not exceed 200 ft.

The appropriate dual reset-and-equipage cable should be chosen based on the maximum distance between the WaveStar OLS 40G and either OT1 or OT2.

The OT integration cables are orderable by ED and Group number and can also be ordered as kits. Table 7-40 lists the various kits that are available and associated cable lengths.

Table 7-40. Integration Cabling Information

Kit # (J68982C-1)	Application	Cable (ED-7G028-22)	Quantity	Cable
L171	1 WaveStar OLS 40G Shelf and 1 OT Bay	G853	1	LAN
		G854	1	Reset-and-Equipage
L172*	2 WaveStar OLS 40G Shelves and 2 OT Bays	G853	2	LAN
		G854	2	Reset-and-Equipage
L173*	1 WaveStar OLS 40G Shelf and 2 OT Bays	G855	1	LAN
		G805	1	Miscellaneous
		G806	1	LAN
		G814	1	Dual Reset-and-Equipage

* L172 and L173 contain a single label kit (comcode: 848123089) that provides correct identification of OT bays. If a WaveStar OLS 40G is upgraded to integrate a second OT bay, this label kit must be ordered. If the cables are ordered by ED and Group number, this label kit must also be ordered for any application integrating two OT bays.

Consider the following points when ordering integration cabling:

- If specific cable lengths are needed that are not provided in the kits, order individually using the ED and Group numbers found in Table 7-37, Table 7-38, and Table 7-39.
- If a WaveStar OLS 40G with single OT Shelf is installed initially and later it becomes necessary to add the second OT Shelf, order the appropriate upgrade cables (LAN 2, Miscellaneous, and Dual Reset-and-Equipage cables) by ED and Group number. These cables replace the Reset-and-Equipage cable that was already installed.

Product Support

8

Product Support

8

This chapter describes how Lucent Technologies supports the WaveStar OLS 40G. 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 will provide you with the quality technical support you need to get your job done. Each segment of the CS&O organization regards servicing the customer as its highest priority and understands your obligation to maintain quality service for your customer.

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

testing and turning over a working system. When the CS&O organization provides job records and installs the equipment, operationally effective 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 both 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 cut-over. Once approved by Lucent Technologies' rigorous Quality Assurance Test group, the system is turned over to the customer.

The Quality Assurance Test 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 twenty-four 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 WaveStar OLS 40G 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 in 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, that currently supports many transmission products, including WaveStar OLS 40G. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. Residing on a dedicated time-share computer that is accessible over toll free lines and available 24 hours a day, seven days a week, COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. For information on how to access COACH, contact your local account executive.

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.

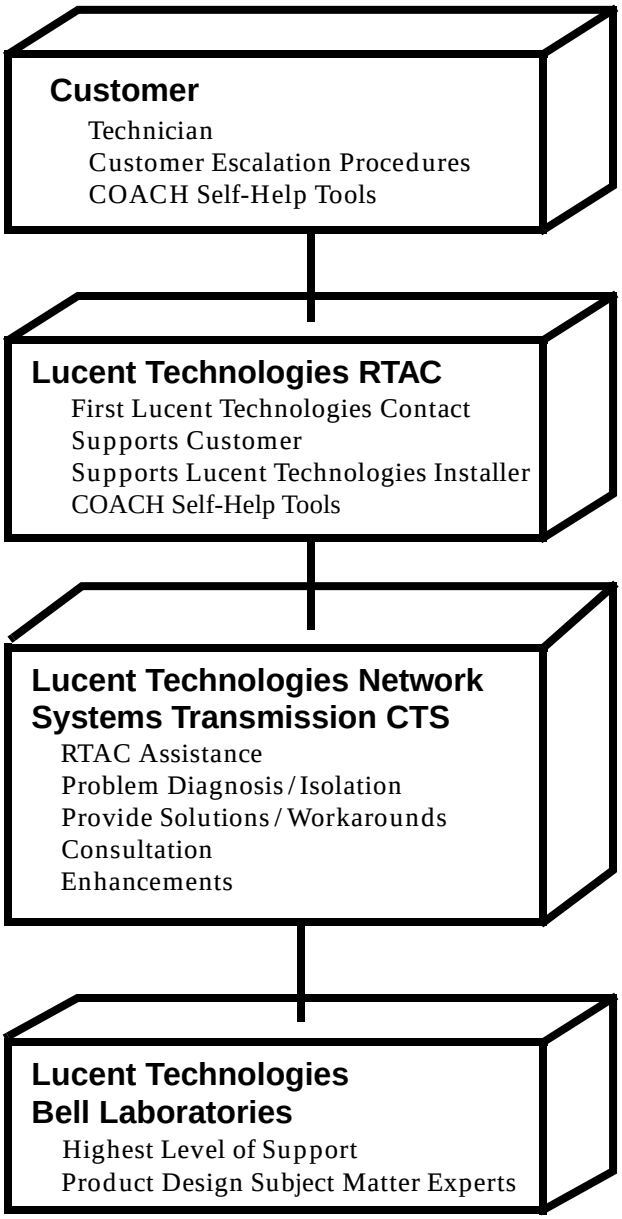


Figure 8-1. Product Support

The following 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 logs into the COACH tools, the news and bulletins tool displays 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 tool permits 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. This eliminates the time-consuming delays experienced in the distribution of printed documentation.
COACH user's guide	COACH supplies an on-line version of its user's guide. The guide includes instructions on using the customer support tools and updates the previous version of the guide to incorporate any new changes.

CTS strives to provide proactive and responsive technical customer support for all of its products. Through the combined efforts of the individual customer support groups and COACH tools, CTS provides you with the best possible technical 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 to make suggestions about this 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” preface.

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

If you encounter difficulties in any area of product support, your local account executive serves as a single point of contact.

Quality Statements and Technical Specifications

9

Quality Statements and Technical Specifications

9

This chapter contains quality statements and technical specifications for the WaveStar OLS 40G and the Optical Translator (OT). Bellcore *Technical Reference 253* (TR 253) is the basis for this information.

WaveStar OLS 40G Quality and Reliability

Reliability is a key ingredient of a product's life cycle, beginning with the earliest planning stage and continuing into a wide range of functional areas. These areas include product architecture, design and simulation, documentation, prototyping, design change control, manufacturing and product testing (including 100% screening), product quality assurance, product field performance, and product field return management. Each stage in 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 the following guidelines:

- 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 WaveStar OLS 40G is further enhanced by the following processes:

- 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”.

Maintainability Specifications

WaveStar OLS 40G requires no periodic maintenance. Continuous performance monitoring allows WaveStar OLS 40G to detect problems before they become service-affecting.

Warranty

The terms and conditions of sale include a five-year warranty on WaveStar OLS 40G with OT hardware and a one-year warranty on software.

Technical Specifications

This section contains technical specifications for WaveStar OLS 40G.

Optical Connector Interfaces

WaveStar OLS 40G Optical Amplifier (OA), telemetry circuit packs (TLM), Optical Multiplexer Units (OMU), Optical Demultiplexer Units (ODU), 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 WaveStar OLS 40G:

- Standard single-mode fiber (SSMF)
- Non-zero dispersion-shifted fiber (for example: TrueWave®).

Lightguide Jumpers

Single-mode lightguide jumpers are used on the OA 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)

WaveStar OLS 40G meets the Class 1 optical safety standard.

Operating Wavelength

The operating wavelength range for WaveStar OLS 40G is 1550 nm ± 6 nm.

Optical Dispersion

Refer to “Engineering Rules” in Chapter 6, “System Planning and Engineering”.

Optical Return Loss

The optical return loss for WaveStar OLS 40G is > 40 dB.

Optical Reflections Tolerance

The OA ports within WaveStar OLS 40G tolerate up to -27 db of reflectance.

Low Voltage Cut-off

If a period of low voltage coming into WaveStar OLS 40G occurs, the system cuts off when a power filter input of -38.5 V DC ± 1.5 V is detected. The system restarts when a power filter input of -42.5 V DC ± 1.5 V is detected.

Optical Line Rate

WaveStar OLS 40G supports an optical line rate of up to 40 Gb/s.

Capacity

WaveStar OLS 40G has a capacity of 768 DS3 equivalents (516,096 two-way voice circuits per fiber pair), allowing up to four fiber pairs per cabinet.

Transmission Standards Compliance

WaveStar OLS 40G meets single-mode interoffice digital fiber optic systems requirements and objectives as specified in TR 253 and TR 499. Table 9-1 shows OA spacing for WaveStar OLS 40G.

Table 9-1. Minimum and Maximum OA Spacing

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

WaveStar OLS 40G uses connectorized cabling that utilizes commercially available connectors. All customer access is front-oriented.

Power Specifications

For power planning information on WaveStar OLS 40G and OT, refer to Chapter 6, “System Planning and Engineering.” Table 9-2 shows WaveStar OLS 40G and OT power specifications.

Table 9-2. WaveStar OLS 40G 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 9-3 lists the physical dimensions of WaveStar OLS 40G and OT components.

Table 9-3. WaveStar OLS 40G/OT Physical Dimensions

Equipment	Height	Width	Depth
WaveStar OLS 40G			
Cabinet*	72.0 in. (183 cm)	34.0 in. (86 cm)	24.0 in. (61 cm)
Shelf (Cabinet)	28.5 in. (72.4 cm)	19.6 in. (50 cm)	11.0 in. (28.0 cm)
Heat Baffle (Cabinet)	3.0 in. (7.5 cm)	19.6 in. (50 cm)	11.0 in. (28.0 cm)
Shelf (Miscellaneously-mounted)	31 in. (80 cm)	19.6 in. (50 cm)	11.0 in. (28.0 cm)
OT			
OT Cabinet	72.0 in. (183.0 cm)	34.0 in. (86.0 cm)	24.0 in. (61.0 cm)
OT Shelf (Cabinet)	17.7 in. (45.0 cm)	19.6 in. (50.0 cm)	11.0 in. (28.0 cm)
OT Heat Baffle (Cabinet)	3.0 in. (7.5 cm)	19.6 in. (50.0 cm)	11.0 in. (28.0 cm)
OT Shelf (Miscellaneously-mounted)	20.7 in. (52.5 cm)	19.6 in. (50.0 cm)	11.0 in. (28.0 cm)

* The color of WaveStar OLS 40G cabinets and miscellaneously-mounted shelves is central office white. The color of cabinet end guards, cable racks, and lower door frame is office soft blue.

Table 9-4 lists the dimensions of WaveStar OLS 40G and OT circuit pack.

Table 9-4. WaveStar OLS 40G/OT Circuit Pack Dimensions

Equipment	Height	Width	Depth
WaveStar OLS 40G			
SYSCTL	14 in. (35.6 cm)	1.2 in. (3.0 cm)	8 in. (20.0 cm)
SYSMEM	14 in. (35.6 cm)	0.8 in. (2.0 cm)	8 in. (20.0 cm)
OA	14 in. (35.6 cm)	4 in. (10.0 cm)	8 in. (20.0 cm)
TOHCTL	14 in. (35.6 cm)	0.8 in. (2.0 cm)	8 in. (20.0 cm)
OMU	9 in. (22.8 cm)	2 in. (5.0 cm)	6 in. (15.0 cm)
ODU	9 in. (22.8 cm)	2 in. (5.0 cm)	6 in. (15.0 cm)
TLM	9 in. (22.8 cm)	2 in. (5.0 cm)	8 in. (20.0 cm)
OT			
OTCTL	13.2 in. (33.6 cm)	4.8 in. (12 cm)	9.3 in. (23.6 cm)
OPS	13.2 in. (33.6 cm)	3.2 in. (8.0 cm)	9.3 in. (23.6 cm)
SPODU	13.2 in. (33.6 cm)	3.2 in. (8.0 cm)	9.3 in. (23.6 cm)
SPOMU	13.2 in. (33.6 cm)	3.2 in. (8.0 cm)	9.3 in. (23.6 cm)
OTUs 41A(1-16)C, 41BB, and 41C(1-16)C	13.2 in. (33.6 cm)	1.6 in. (4.0 cm)	9.3 in. (23.6 cm)
QOTU 41S	13.2 in. (33.6 cm)	3.2 in. (8.0 cm)	9.3 in. (23.6 cm)
OTPMs 42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), 44B	15.3 in. (13.5 cm)	1.2 in. (3.0 cm)	8.1 in. (20.6 cm)

Floor Loading Specifications

Table 9-5 shows floor loads for WaveStar OLS 40G and OT.

Table 9-5. WaveStar OLS 40G/OT Floor Loads

Configuration	End Terminal		Repeater	
	Weight (lbs)	Weight per sq. ft.	Weight	Weight per sq. ft.
WaveStar OLS 40G				
Miscellaneously-mounted Shelf	95		90	
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		
OT				
Fully-equipped OT Cabinet	700	56.0		
Fully-equipped Miscel-laneouslymounted Sys-tem Controller Shelf	64			
Fully-equipped Miscel-laneouslymounted Complementary Shelf	74			
3-Shelf OT Bay	342	45.0		

Environmental Specifications

Table 9-6 shows the various temperatures and humidity levels at which WaveStar OLS 40G can operate.

Table 9-6. 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.)

* Short-term refers to a period of up to 96 consecutive hours and a total of 15 days in one year.

† Non-condensing.

The following environmental specifications pertain to WaveStar OLS 40G and OT:

- Earthquake and vibration, fire resistance, and airborne contaminant requirements meet *GR-63-CORE Issue 1, October 1995* standards
- Electrostatic, electromagnetic, electrical grounding, and safety requirements meet *GR-1089-CORE Issue 1, November 1994* standards
- Electromagnetic compatibility (EMC) requirements meet *GR-1089-CORE*
- UL® listed and CSA® certified.

Handling and Transportation Constraints

Table 9-7 shows WaveStar OLS 40G tolerance ranges for various handling and transportation conditions.

Table 9-7. 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 9-8 lists failures-in-time (FIT) rates for WaveStar OLS 40G and OT circuit packs.

Table 9-8. WaveStar OLS 40G/OT Circuit Pack FIT Rates per Bellcore RPP*

Description	Code	FIT
WaveStar OLS 40G		
SYSCTL	LEA1	3387
SYSMEM	LEA2	7118
TOHCTL	LEA5	2549
ODU (8 λ)	605A	1540
ODU (16 λ)	606A	3443
ODU (16 λ)	606B	3694
OMU (8 λ)	505A	1538
OMU (16 λ)	506A	2141

Table 9-8. WaveStar OLS 40G/OT Circuit Pack FIT Rates per Bellcore RPP* — *Continued*

Description	Code	FIT
WaveStar OLS 40G		
OA	LEA6, LEA7, LEA104, and LEA105	16,848
TLM	LDA1	6625
OT		
OTCTL	LUD1	2723
OPS	LEP1	8795
SPODU	BSY1	5864
SPOMU	BSY2	5864
OTU (OC-48 / STM-16)	41A(1-16)C, 41C(1-16)C	7272
OTU (OC-48 / STM-16)	41BB	6772
QOTU	41S	2129
OTPM (OC-12 / STM-4)	42A(1-16), 42B	6000
OTPM (OC-3 / STM-1)	43A(1-16), 43B	3000
OTPM (LSBB, 150-750 Mb / s)	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 9-9 shows WaveStar OLS 40G and OT channel unavailability.

Table 9-9. Channel Unavailability (min/year/channel)

Description	Value
WaveStar OLS 40G	
1 Line (Dual Facing) End Terminal	0.003
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)	0.02
OT	
OC-48 / STM-16 Channel (OTU)	0.00027
OC-12 / STM-4 Channel (OTPM)	0.00015
LSBB, 150-750 Mb / s Channel (OTPM)	0.00015
OC-3 / STM-1 Channel (OTPM)	0.00004

* Based on ADM protection.

Table 9-10 shows telemetry channel unavailability (min / year / channel) for WaveStar OLS 40G.

Table 9-10. Telemetry Channel Unavailability

Protection	End Terminal	Repeater
Independent	42	49
1 + 1	0.0017	0.0023

Silent Failure Unavailability

There is no silent failure unavailability for End Terminals, Repeaters, the OT, or OTPMs.

Mean-Time-Between-Maintenance

Table 9-11 shows the mean-time-between-maintenance activity for WaveStar OLS 40G. These values are based on the *Lucent Technologies Reliability Information Notebook, 7th edition, August 1995.*

Table 9-11. Mean-Time-Between-Maintenance Activity

Equipment	Mean Time (months)
WaveStar OLS 40G	
2 Line End Terminal	42
2 Line Repeater	40
4 Line End Terminal	21
4 Line Repeater	20
Integrated Bay (Single)	19
Integrated Bay / Cabinet (Double)	14
Integrated Bay / Cabinet (Triple 1)	7
Integrated Bay / Cabinet (Triple 2)	9
OT	
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

WaveStar OLS 40G equipment has an infant mortality rate of ≤ 1.6 multiplied by the steady state failure rate. The equipment's design life is 25 years.

Optical Signal Input Power

The input power for each optical signal wavelength must meet the ranges given in Table 9-12, which are verified to 0.7 dB accuracy. The table provides input power specifications for OC-48/STM-16, OC-12/STM-4/, low speed broadband (LSBB) 150-750 Mb/s, and OC-3/STM-1 signal wavelengths. This table reflects optical signal power in the 1.5µ range entering the OMU. This signal power can originate from either Lucent Technologies, WaveStar OLS 40G-compatible terminals or non-Lucent terminals. For non-Lucent terminals, the appropriate signal characteristics enter the OMU from an OTU or OTPM located between the OMU and the originating terminal.

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 9-12. Optical Signal Power Specifications (1.5μ)

Drop Side Signal*	Wavelength (nm)	Power (dBm) (± 0.7 dB)			
		OC-48/ STM-16	OC-12/ STM-4/	LSBB 150-750 Mb/s	OC-3/ STM-1
1	1549.32	-4.0	-7.0	-7.0	-10.0
2	1550.92	-5.3	-8.3	-8.3	-11.3
3	1552.52	-6.5	-9.5	-9.5	-12.5
4	1554.13	-7.2	-10.2	-10.2	-13.2
5	1555.75	-7.7	-10.7	-10.7	-13.7
6	1557.37	-8.2	-11.2	-11.2	-14.2
7	1558.98	-8.0	-11.0	-11.0	-14.0
8	1560.61	-6.5	-9.5	-9.5	-12.5
9	1548.52	-2.0	-5.0	-5.0	-8.0
10	1550.12	-4.6	-7.6	-7.6	-10.6
11	1551.72	-5.8	-8.8	-8.8	-11.8
12	1553.33	-6.8	-9.8	-9.8	-12.8
13	1554.94	-7.4	-10.4	-10.4	-13.4
14	1556.56	-7.9	-10.9	-10.9	-13.9
15	1558.17	-8.1	-11.1	-11.1	-14.1
16	1559.79	-7.2	-10.2	-10.2	-13.2
Supervi-sory Channel	1532.0				
OTPM	All				

* Each drop-side signal handled by a respective 41A(1-16)C, 41C(1-16)C, 42A(1-16), 43A(1-16), and 44A(1-16) circuit pack.

Table 9-16 provides optical signal specifications for optical signal power in the 1.3µ range exiting the ODU.

Table 9-13. Optical Signal Specifications for 1.3µ OTU/OTPM

Circuit Pack Code	Wavelength Range (nm)		Power Range (dBm)	
	min	max	min	max
41BB	1280	1335	-2.0	+2.5
42B	1280	1335	-2.5	+2.0
43B	1280	1335	-7.0	0
44B (low setting)	1280	1335	-7.0	0
44B (high setting)	1280	1335	-2.5	+2.0

OA Output Power

OA output power depends on the number of equipped input wavelengths, the channel rate of each wavelength, the number of spans, and the OA type; it is adjusted automatically by software whenever these variables change. Provided as a general guideline for OA power levels, Table 9-14 lists output power values, assuming a 0 dB output lightguide build-out (LBO).

Table 9-14. OA Output Power *

No. of Equipped WaveStar OLS 40G Wavelengths	Output Power (dBm) for 8-Wavelength Systems	Output Power (dBm) for 16-Wavelength 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 ± 0.5

* Output power for the LEA104, 16-channel OA reaches 19 dBm. Refer to Chapter 6, “System Planning and Engineering,” for engineering rules.

Outside Plant Loss

Table 9-15 shows minimum and maximum plant loss values for the OA.

Table 9-15. Plant Loss Between OA Sites

OA Standard Performance	Loss Between OA Sites	
	Min (dB)	Max (dB)
Long Span Systems (five-span)	26	30
Long Reach Systems (eight-span)	17	22
Short Reach Systems (one-span)	14	18

Tone Frequencies

Table 9-16 shows approximate tone frequencies used for each wavelength.

Table 9-16. 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)

The worst case minimum SNR without a pump failure that WaveStar OLS 40G system output can tolerate is 20.0 db. The worst case minimum with one pump failure is 16.5 db.

Customer Maintenance Signal

The customer maintenance signal has a standard IS-3 Intermediate Reach (IR) and Short Reach (SR) interface. It 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 9-17 shows the optical interface specifications for this signal.

Table 9-17. 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*	10 dB
Optical Path Penalty†	1.0 dB
Connector Loss‡	1.5 dB
Un-allocated Margin	2.0 dB
Minimum Loss Budget	0.0 dB
Maximum Loss Budget	5.5 dB
Maximum Span Length	See Chapter 6, “System Planning and Engineering” for engineering rules

* The minimum system gain represents 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 is dispersion-limited and can interwork with an OC-3/STM-1 interface or an IS-3 interface over multi-mode fiber, subject to the distance limitations in Table 9-18.

Table 9-18. IS-3 Interface Distance Limitations

Fiber Bandwidth (MHz-km)	Distance (km)
1000	3.4
800	3.3
500	2.7
300	1.9

Circuit Pack Sparing

A

Circuit Pack Sparing

A

This section provides information on circuit pack sparing for WaveStar OLS 40G. Comcodes and CLEI codes for WaveStar OLS 40G and OT circuit packs are also provided. Note that these numbers are subject to change.

Circuit Pack Sparing Lead Time

Lead time, also called turnaround time, is the elapsed time from the point a circuit pack is known to fail at a given service location to the point when a repaired or new one arrives at the location where spare circuit packs are stocked (centralized or local). This replenishment facilitates a spare circuit pack level consistent with the circuit pack population that is in-service. You can use sparing information for 10-day and 64-day lead times for up to 20,000 circuit packs in-service.

Lead time should not be confused with Mean Time to Repair (typically, two to four 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 to help you determine how many spare circuit packs or units to order for WaveStar OLS 40G. The following procedure shows how to use Table A-1, Figure A-1, and Figure A-2 in this chapter to determine how many spare circuit packs to order to maintain 99.9% service continuity for either a 10-day or 64-day lead time.

1. Refer to Table A-1 and determine the circuit pack FIT rate. For example, the circuit pack FIT rate for SYSMEM (LEA2) is 1600.
2. Select the chart corresponding to one of the following lead times:
   - 10-day lead time– Figure A-1
   - 64-day lead time– Figure A-2
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, 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, with 100 circuit packs in service at Location A, the FIT rate is 1149 and the lead time is 10 days (see Figure A-1). In this case, you would need to order and stock two spare circuit packs at Location A.

Table A-1. Circuit Pack FIT Rates for WaveStar OLS 40G/OT

Description	Code	FIT*
WaveStar OLS 40G		
SYSCTL	LEA1	1374
SYSMEM	LEA2	1149
TOHCTL	LEA5	969
ODU (8λ)	605A	374
OMU (8λ)	505A	354
ODU (16λ)	606A	403
ODU (16λ)	606B	430
OMU (16λ)	506A	247
OA	LEA6, LEA7, LEA104, LEA105	4724
TLM	LDA1	1414
OT		
OTCTL	LUD1	802
OPS	LEP1	2486
SPODU	BSY1	1509
SPOMU	BSY2	1509
OTU	41A(1-16)C, 41BB, and 41C(1-16)C	2000
QOTU	41S	300
OTPM (OC-12/STM-4)	42A(1-16), 42B	1500
OTPM (OC-3/STM-1)	43A(1-16), 43B	1000
OTPM (LSBB, 150-750 Mb/s)	44A(1-16), 44B	1500

* Based on the Lucent Technologies *Reliability Information Notebook*, 7th Edition, August 1995.

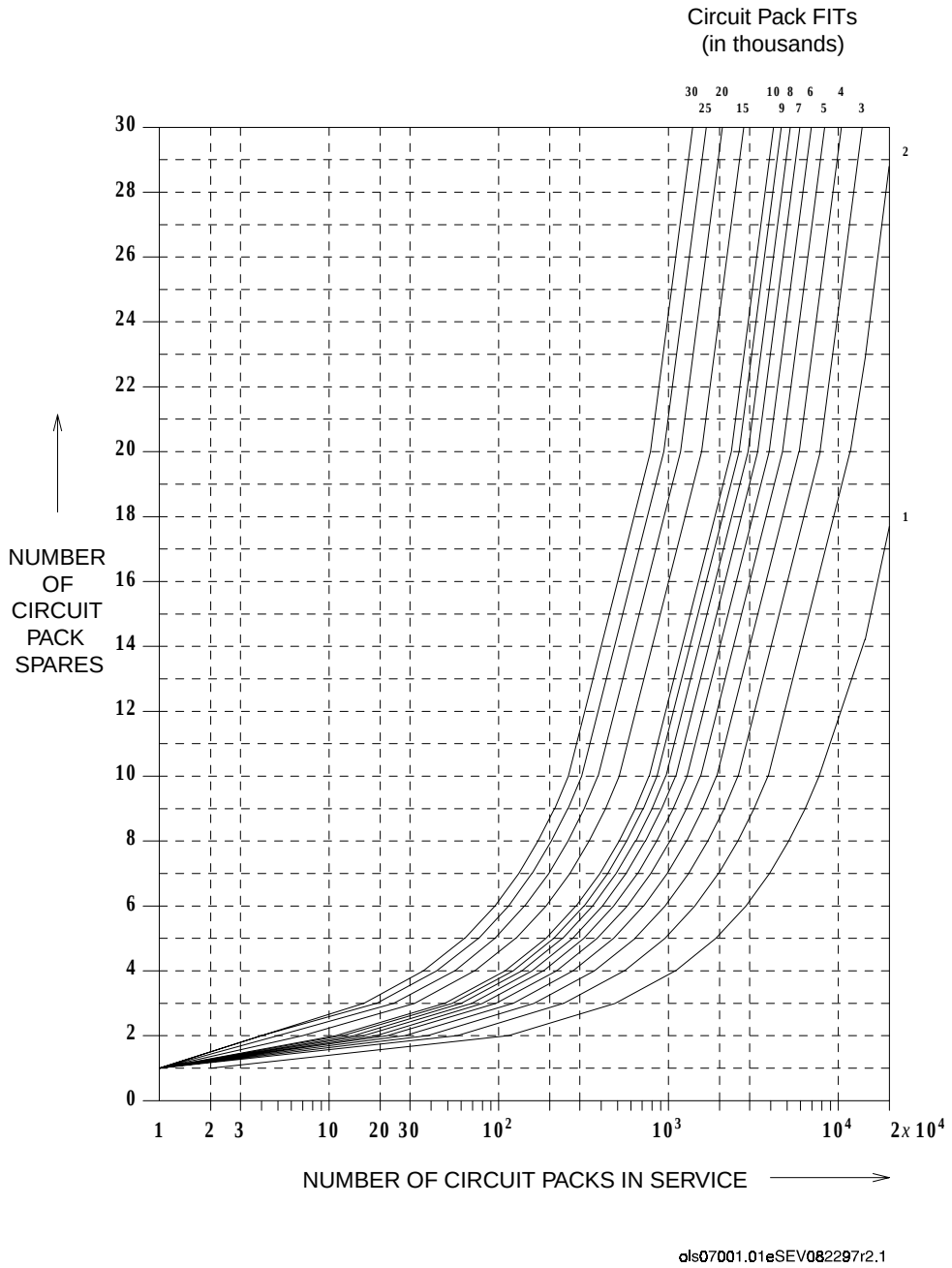


Figure A-1. Sparing Chart -- 10-Day Lead Time

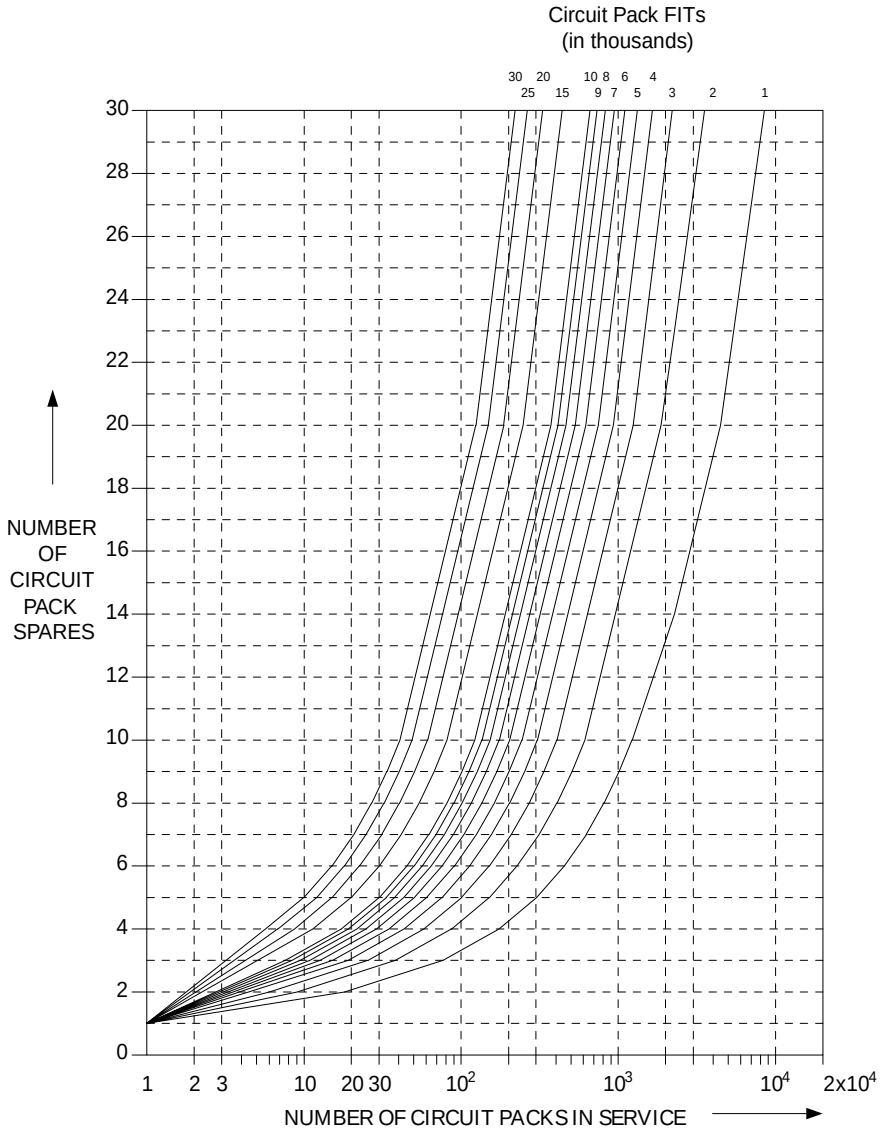


Figure A-2. Circuit Pack Sparing Chart -- 64-Day Lead Time

Ordering Spare Circuit Packs and Fuses

Table A-2 provides comcodes for ordering spare circuit packs.

Table A-2. Circuit Pack Comcodes

Circuit Pack	Code	Comcode	CLEI
WaveStar OLS 40G			
SYSCTL	LEA1	107272510	SNC3SH0A
SYSMEM	LEA2	107786568	SNC3TJTA
TOHCTL	LEA5	107273328	SNC2S00B
TLM	LDA1	107272569	SNC2R00B
OMU (8λ)	505A	107292179	SNC2JL0A
ODU (8λ)	605A	107292187	SNC2KL0A
OMU (16λ)	506A	107727828	SNC5ED0D
ODU (16λ)	606A	108032814	FHUM2B0G
ODU (16λ)	606B	108032822	FHUM2BAG
OA (Long Span)	LEA6	107273366	SNC2U00B
OA (Long Reach)	LEA7	107742439	SNC7RROC
OA (Long Span)	LEA104	107976367	SNPQB18AAA
OA (Short Reach)	LEA105	108045394	SNPQB2EA
OT			
OTCTL	LUD1	108056284	LGR1JN0EAA
OPS	LEP1	108203795	SNSPALDE
SPODU	BSY1	108209958	SNCBL60D
SPOMU	BSY2	108226994	SNCBM07D
OTU	41A1C	108187949	SNOTABAA
OTU	41A2C	108187956	SNOTACAA

Table A-2. Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI
OTU	41A3C	108187964	SNOTADAA
OTU	41A4C	108187972	SNOTAEAA
OTU	41A5C	108187980	SNOTAFAA
OTU	41A6C	108187998	SNOTAGAA
OTU	41A7C	108188004	SNOTAHAA
OTU	41A8C	108188012	SNOTAJAA
OTU	41A9C	108188020	SNOTAKAA
OTU	41A10C	108188038	SNOTALAA
OTU	41A11C	108188046	SNOTAMAA
OTU	41A12C	108188053	SNOTANAA
OTU	41A13C	108188061	SNOTAPAA
OTU	41A14C	108188079	SNOTARAA
OTU	41A15C	108188087	SNOTASAA
OTU	41A16C	108188095	SNOTATAA
OTU	41BB	108128737	SNP2V0XDAB
OTU	41C1C	108188111	SNOTBBAA
OTU	41C2C	108188129	SNOTBCAA
OTU	41C3C	108188137	SNOTBDAA
OTU	41C4C	108188145	SNOTBEAA
OTU	41C5C	108188152	SNOTBFAA
OTU	41C6C	108188160	SNOTBGAA
OTU	41C7C	108188178	SNOTBHAA
OTU	41C8C	108188186	SNOTBJAA
OTU	41C9C	108188194	SNOTBKAA
OTU	41C10C	108188202	SNOTBLAA

Table A-2. Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI
OTU	41C11C	108188210	SNOTBMAA
OTU	41C12C	108188228	SNOTBNAA
OTU	41C13C	108188236	SNOTBPAA
OTU	41C14C	108188244	SNOTBRAA
OTU	41C15C	108188251	SNOTBSAA
OTU	41C16C	108188269	SNOTBTAA
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
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

Table A-2. Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI
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
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

Table A-2. Circuit Pack Comcodes — *Continued*

Circuit Pack	Code	Comcode	CLEI
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

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.

1A-TX-THRU
1A-Transmit (Telemetry Feed-through).

1A-RCV-THRU
1A-Receive (Telemetry Feed-through).

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 WaveStar OLS 40G 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.

APSD
Automatic Power Shutdown — A safety procedure automatically performed by WaveStar OLS 40G when a loss of optical power occurs. APSD powers down the Optical Amplifier to safe, Class 1 levels then restarts it once the system has been repaired or links have been re-established.

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 Line
A transmission path consisting of 2 fibers that handle traffic in both the transmit and receive directions.

Bidirectional Switch
Protection switching performed in both the transmit and receive directions.

C

CIT
Craft Interface Terminal — A personal computer that meets WaveStar OLS 40G 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

Collocated
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

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 WaveStar OLS 40G, an OC-48 / STM-16 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 WaveStar OLS 40G network element.

Dual-facing Shelf
Operations capability for 2-fiber applications which allows the DCC to go from one End Terminal (one subnetwork) through to the other collocated end terminal (separate subnetwork), thereby extending WaveStar OLS 40G operations domain.

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 Wavelength 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
WaveStar OLS 40G equipment that terminates optical line signals. It consists of a collocated Optical Multiplexer Unit (OMU) and Optical Demultiplexer Unit (ODU) for bidirectional transmission, Optical Amplifiers (OA), and Telemetry packs.

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 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

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.

H

Hazard Level
Output power level of a WaveStar OLS 40G system or device that poses safety risks to personnel. For 1550 nm wavelengths, hazard levels are defined as follows:
Level 1= ≤ 10 dBm
Level 3A= ≤ 17 dBm,
Level 3B= ≤ 27 dBm
Level 4 = > 27 dBm.

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 4-fiber, OC-48/STM-16 multiplexer with add-drop capability. LCTs support standard SONET ring or span protection switching, and can be used with WaveStar OLS 40G to increase transport capacity.

LBC
Laser bias current

LBFC
Laser backface currents

LBO
Lightguide Build-Out — An adapter for the lightguide fiber jumpers between the LGX, WaveStar OLS 40G, and OT equipment. It is also used on equipment within the network element. It performs

signal attenuation and guarantees the proper signal level to WaveStar OLS 40G and OT equipment.

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

LGX
Lightguide cross-connect.

Line
1. 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 originates the line signal while the other terminates it. **2.** "Line" also indicates a fiber pair. When used in this document, the following is assumed: 1 line = 2 fibers, 4 line = 8 fibers.

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

Long Span
Single span between terminal sites with a distance greater than 80 km.

LOS
Loss of Signal

LSBB
Low Speed Broadband. Refers to 150-750 Mb/s signal rates.

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

nm
Nanometer (10^{-9} meters)

NMA
Network Monitoring and Analysis System

NMON
Not Monitored — A memory administrative state for ports.

Non-revertive switching
In non-revertive switching, a working and stand-by line exist on the network. When a protection switch occurs, the standby line is selected to support traffic, thereby becoming the working line. The original working line then becomes the stand-by line. This status remains in effect even when the fault clears. That is, there is no automatic switch back to the original status. Also see **1+1 Line Protection.**

NRZ
Non-return 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.

ODU
Optical Demultiplexer — takes WaveStar OLS 40G optical signal and separates it into sixteen OC-48 / STM-16 signals.

OLS
Optical Line System

OMU
Optical Multiplexer Unit— takes up to sixteen OC-48/STM-16 signals and combines them into a single signal

OOF
Out-of-Frame

OPS
Optical Protection Switching/Optical Protection Switch

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 / STM-16 wavelength within an optical line signal. There are sixteen such wavelengths, or channels, in one line signal.

Optical Line Build-out (LBO)
An attenuator placed between FT-2000 OC-48 / STM-16 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 sixteen wavelengths or channels.

Optical Network
A medium for transmitting and switching voice, video, and data traffic over fiber optic cabling with the use of lasers. Traffic is converted into and exists in the form of light.

Optical Protection Switching
A protection feature used in WaveStar OLS 40G systems that switches optical traffic from a primary, operating line to a secondary, back-up line in the event of an OA failure or a fiber cut. The OPS feature is used in 2-fiber, two-OA applications for dual-facing shelf configurations only.

Optical Section

See Span.

Optical Translator (OT)
A unit that electrically regenerates any incoming OC-48/STM-16, OC-12/STM-4, and OC-3/STM-1 wavelength in the 1.3 and 1.5 micrometer ranges into a specific outgoing wavelength of the same, respective rate.

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.

OTCTL
Optical Translator Controller

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 WaveStar OLS 40G, 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 WaveStar OLS 40G, 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.

SPODU
Self-powered Optical Demultiplexing Unit

SPOMU
Self-powered Optical Multiplexing Unit

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.

Telemetry Feed-through
Operations capability for 4-fiber applications which allows the DCC to go from one End Terminal (one subnetwork) through to the other collocated end terminal (separate subnetwork), thereby extending WaveStar OLS 40G operations domain.

THz
Terrahertz (10^{12} Hz)

THRU
Telemetry Feed-through end terminal designation.

TID
Target Identifier — A provisionable parameter used to identify an FT-2000 OC-48 / STM-16 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 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 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 sixteen 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 / STM-16 signal into another wavelength.

Wavelength Section
The path followed by an STS48 from its creation to its termination.

WaveStar OLS 40G
A lightwave transmission system that multiplexes up to sixteen wavelengths, transmits the resulting multiplexed signal, and then demultiplexes the signal at the other end.

WaveStar OLS 40G Subnetwork
All dual-facing end terminals and Repeaters interconnected with each other. The dual-facing shelf feature extends the access domain beyond the end terminals.

WaveStar OLS 40G System
Two End Terminals and WaveStar OLS 40G Repeaters between them.

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

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W

X