



WaveStar™ OLS 40G

Release 4.0.2

Applications, Planning, and Ordering Guide

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Contents

About This Document	xxiii
■ Intended Audience	xxiii
■ How to Use This Document.....	xxiii
■ Related Documentation.....	xxv
Drawings	xxvi
Documentation for Related Equipment and Software	xxviii
■ Electronic Documentation	xxx
■ How to Order Documents.....	xxxi
■ Training	xxxii
■ How to Comment on This Document	xxxvi

1	Introduction	
	■ Introduction to WaveStar OLS 40G.....	1-1
	■ What is WaveStar OLS 40G?.....	1-3
	■ WaveStar OLS 40G Functions	1-5
	■ WaveStar OLS 40G Benefits.....	1-6
	■ WaveStar OLS 40G Feature Release Plan.....	1-7

2	Features	
	■ New Features in Release 4.0.2.....	2-1
	Common Management Information Service Element (CMISE)	2-1
	IAOLAN	2-2
	LEA7B Optical Amplifier	2-3
	■ Other System Features	2-4
	16-Wavelength Point-to-Point and Ring Applications	2-4

Automatic Power Shut-down (APSD) and Restart	2-4
Optical Protection Switching	2-5
■ Maintenance Features.....	2-6
CenterLink-CIT.....	2-6
Operations Interface Flexibility	2-6
Operations Domains	2-7
Single-Ended Operations	2-8
Continuous Performance Monitoring.....	2-10
Original Value Provisioning and User-Selectable Thresholds	2-11
Security Features	2-11
■ Physical Features.....	2-12
Front Access	2-12
Equipment Packages	2-12
Easy Installation and Self-tests	2-12

3

Applications

■ Optical Transmission Elements.....	3-1
Optical Amplifier	3-2
Optical Multiplexer Units/Optical Demultiplexer Units.....	3-3
Optical Translator Units.....	3-4
Other Elements	3-6
■ Basic WaveStar OLS 40G Configurations.....	3-7
Applications Without Repeaters	3-7
Applications With Repeaters	3-11
Dual-facing Shelf Applications	3-12
Applications With Multi-Regenerated Spans.....	3-20
Applications With Wavelength Add/Drop (WAD).....	3-21
Alternate Configurations for Regeneration and WAD	3-22

4**Product Description**

- Introduction..... 4-2
- WaveStar OLS 40G Bay/Cabinet Design..... 4-3
- WaveStar OLS 40G Shelf Design 4-5
- WaveStar OLS 40G Shelf Descriptions..... 4-10
 - End Terminal Shelf..... 4-10
 - WaveStar OLS 40G Repeater Shelf..... 4-12
 - OT System Controller Shelf..... 4-13
 - OT Complementary Shelves 1 and 2 4-14
- End Terminal Shelf 1 Configurations..... 4-16
 - 1A-TX End Terminal..... 4-16
 - 1A-TX-THRU End Terminal..... 4-17
 - 1A-RCV End Terminal..... 4-18
 - 1A-RCV-THRU End Terminal..... 4-19
 - Dual Facing (DUAL) End Terminal..... 4-20
 - Single Optical Amplifier 1A-TX End Terminal..... 4-21
 - Single Optical Amplifier 1A-TX-THRU End Terminal . 4-22
 - Single Optical Amplifier 1A-RCV End Terminal..... 4-23
 - Single Optical Amplifier 1A-RCV-THRU End Terminal 4-24
 - Single Optical Amplifier Dual Facing End Terminal.... 4-25
- End Terminal Shelf 2 4-26
 - Purpose of End Terminal Shelf 2 4-26
 - End Terminal Shelf 2 Circuit Packs/Units 4-26
- End Terminal Shelf 2 Configurations..... 4-29
 - 1A-TX End Terminal..... 4-29
 - 1A-RCV End Terminal..... 4-30
 - Dual Facing End Terminal..... 4-31
 - Single Optical Amplifier 1A-TX End Terminal..... 4-32
 - Single Optical Amplifier 1A-RCV End Terminal..... 4-33
 - Single Optical Amplifier Dual Facing End Terminal.... 4-34
- WaveStar OLS 40G Packages..... 4-35

■ WaveStar OLS 40G Integration Cable Engineering	4-49
Integration Cable Descriptions	4-49
Integration Cable Configurations.....	4-50
■ Transmission Circuit Packs	4-53
Optical Amplifier (OA)	4-53
Optical Multiplexer Unit (OMU).....	4-54
Self-Powered OMU (SPOMU).....	4-55
Optical Demultiplexer Unit (ODU)	4-55
Self-Powered ODU (SPODU).....	4-55
Optical Translator Unit (OTU).....	4-55
Quad Optical Translator Unit (QOTU)	4-56
Optical Translator Port Module (OTPM).....	4-58
Telemetry (TLM).....	4-58
Intra-Office Line Relay Pack (IAOLRP).....	4-58
■ Control Circuit Packs.....	4-59
System Controller (SYSCTL)	4-59
System Memory (SYSMEM)	4-59
Tributary Overhead Controller (TOHCTL)	4-59
OT Controller (OTCTL)	4-60
■ Cable Dressing.....	4-60
■ Interconnection Panels.....	4-62
WaveStar OLS 40G Interconnection Panel.....	4-62
OT Interconnection Panel (System Controller Shelf)	4-63
OT Interconnection Panel (Complementary Shelves).....	4-64
WaveStar OLS 40G Cabinet Indicator Strips	4-66
Panels	4-70
OT Shelf Fuse Panel Assembly in Cabinet Configurations.....	4-75
■ Power	4-76
Power Cables	4-76
Power Distribution for End Terminal and Repeater Bay/Cabinet	4-77

WaveStar OLS 40G Integrated Bay (Single) and OT Bay/Cabinet Power Distribution	4-78
Shelf-Level Power Distribution	4-79

5 Operations, Administration, Maintenance, and Provisioning

■ Operations	5-1
Operations Interfaces	5-1
Operations Domains	5-5
IAO LAN	5-9
CMISE	5-12
Release 4.0 Operations Interface Connectivity	5-14
■ Administration	5-19
Version Recognition	5-19
Security	5-19
Equipment Inventory	5-21
System Start-up	5-21
■ Maintenance	5-22
Reactive Maintenance	5-22
Proactive Maintenance	5-22
Remote Maintenance	5-22
Local and Remote Software Copy/Upgrades	5-25
Optical Transmission Maintenance	5-25
Protection Switching for DCC Signal	5-26
Automatic Detection of Facility Failures	5-26
Optical Protection Switching	5-28
Automatic Power Shutdown and Restart (APSD)	5-37
Performance Monitoring	5-43
Provisioning Consistency Audits	5-46
Reports	5-47
Orderwire	5-49
Alarm Correlation	5-49

■ Provisioning.....	5-51
Parameters and Original Value Provisioning.....	5-51
Local or Remote Provisioning	5-51
Preprovisioning Slots	5-52
Provisioning on Circuit Pack Replacement	5-52
Provisionable Parameters Summary.....	5-52
Network Element Configuration	5-52
WaveStar OLS 40G Terminal Provisioning.....	5-53
WaveStar OLS/OT Integration	5-59
■ WaveStar OLS 40G Architecture	5-60

6 System Planning and Engineering

■ Engineering Rules.....	6-2
Lightguide Buildouts (LBO)	6-2
WaveStar OLS 40G Network Topologies.....	6-2
Engineering Rules for Two-OA Applications	6-3
Engineering Rules for Single-OA Applications.....	6-6
Dispersion	6-8
WaveStar OLS/OT Interworking.....	6-8
■ Upgrade Considerations.....	6-10
LBO Considerations	6-10
Upgrading From Release 3.X to Release 4.0	6-11
Network Element Software Upgrade Paths	6-13
■ Floor Plan Layout	6-14
■ Equipment Interconnection.....	6-16
■ Cabling	6-16
LBO Color Types.....	6-22
■ Environmental Considerations	6-26
■ Power Planning	6-27

7**Ordering**

- Ordering WaveStar OLS 40G Equipment 7-2
 - Ordering Lightguide Office Cable 7-2
 - WaveStar OLS 40G Package Descriptions 7-3
 - OT Package Descriptions 7-9
 - Circuit Pack/Unit Descriptions 7-12
- Cables 7-16
 - Intraoffice Electrical Non-transmission Cable Descriptions (WaveStar OLS 40G) 7-16
 - Intraoffice Electrical Non-transmission Cable Descriptions (OT) 7-17
 - Fiber Optic Cables 7-22
 - Power Fuse 7-23
 - Power Meter Adapters 7-23
- Related Framework 7-24
- Related Products 7-25
 - Ordering Cleaning Materials 7-25
 - Ordering METRAL Backplane Replacement Pins 7-25
 - Ordering the External Miscellaneous Discrete Unit (EMDU) 7-29
 - DANTEL Orderwire Shelf 7-31
- WaveStar OLS 40G Circuit Pack/Unit Compatibility 7-32
- Ordering Sample 7-34
 - Sample Network Assumptions 7-36
 - Sample Network Specifications 7-36
 - Sample Worksheets 7-37
 - Sample Cabling Illustrations 7-56
- WaveStar OLS 40G Worksheets 7-58
- WaveStar OLS 40G Super Kits 7-136
 - Integrated Cabinet (Double) Super Kit (ED-8C903-40, G1) 7-136
 - Integrated Bay (Double) Super Kit (ED-8C903-40, G2) 7-136

Integrated Cabinet (Triple 1) Super Kit (ED-8C903-40, G3).....	7-137
Integrated Bay (Triple 1) Super Kit (ED-8C903-40, G4)	7-137
Integrated Cabinet (Triple 2) Super Kit (ED-8C903-40, G5).....	7-138
Integrated Bay (Triple 2) Super Kit (ED-8C903-40, G6).....	7-138
■ Software and Documentation	7-139
■ Conversion Kit	7-141
■ OT Circuit Pack Compatibility.....	7-142
■ WaveStar OLS-to-OT Control Cabling	7-144
WaveStar OLS 40G Cabling for Double and Triple 1 Arrangements (ED-7G028-22).....	7-144
WaveStar OLS 40G Cabling for Triple 2 Arrangement (ED-7G028-22)	7-145

8 Product Support

■ Engineering and Installation Services	8-1
■ Technical Support	8-2
■ Documentation Support.....	8-6
■ Training Support.....	8-6
■ Warranty Support	8-6
■ Account Executive Support	8-6

9 Quality Statements and Technical Specifications

■ WaveStar OLS 40G Quality and Reliability	9-1
Maintainability Specifications	9-2
Warranty.....	9-2
■ Technical Specifications.....	9-3
Optical Connector Interfaces.....	9-3

Transmission Medium	9-3
Lightguide Jumpers	9-3
Optical Safety (BRH Classification).....	9-3
Operating Wavelength.....	9-3
Optical Dispersion	9-3
Optical Return Loss.....	9-4
Optical Reflections Tolerance	9-4
Low Voltage Cut-off.....	9-4
Optical Line Rate.....	9-4
Transmission Standards Compliance.....	9-4
Cable Access	9-4
Power Specifications	9-5
Dimensions.....	9-6
Floor Loading Specifications	9-9
Environmental Specifications	9-10
Handling and Transportation Constraints.....	9-11
Reliability Specifications.....	9-11
Hardware Unavailability.....	9-13
Silent Failure Unavailability	9-14
Mean-Time-Between-Maintenance	9-15
Infant Mortality and Design Life.....	9-16
Optical Signal Output Power from OTU/OTPMs	9-16
OA Output Power	9-19
Outside Plant Loss	9-20
Tone Frequencies	9-21
Optical Signal-to-Noise Ratio (SNR)	9-22
Customer Maintenance Signal	9-22

A
Circuit Pack Sparing

■ Circuit Pack Sparing Lead Time.....	A-1
Sparing Examples	A-2

- Ordering Spare Circuit Packs and Fuses A-7

B Q-LAN Interface

- Q-LAN Functionality B-1
 - Open Systems Interconnection (OSI) B-2
 - Routing Information B-3
 - WaveStar OLS 40G Subnetworks Prior to Release 4.0..... B-5
 - Overall Rules and Guidelines..... B-7
- Provisioning an Existing WaveStar OLS 80G R3.x Network for IS-IS Level-2 Routing..... B-15
 - Installation of a new network with IS-IS Areas B-15
 - In-Service Transition into IS-IS Areas B-19
 - ITM/SC Connections B-23

ACR	Abbreviations and Acronyms	ACR-1
------------	-----------------------------------	-------

GL	Glossary	GL-33
-----------	-----------------	-------

IN	Index	IN-1
-----------	--------------	------

Figures

1 Introduction

Figure 1-1. Simplified WaveStar OLS 40G End Terminal and Repeater Block Diagram	1-4
---	-----

3 Applications

Figure 3-1. WaveStar OLS 40G Single Span with Two-OA Operation	3-8
Figure 3-2. WaveStar OLS 40G Single Span with Single-OA Operation	3-10
Figure 3-3. WaveStar OLS 40G Multiple Span System with Repeaters (two-span system shown)	3-11
Figure 3-4. Single-OA/Single-OA Dual-facing Shelf	3-12
Figure 3-5. Two-OA/Two-OA Dual-facing Shelf	3-13
Figure 3-6. Single-OA/Two-OA Dual-facing Shelf	3-14
Figure 3-7. Two-OA/Single-OA Dual-facing Shelf	3-15
Figure 3-8. Point-to-Point Linear Add/Drop Chain	3-16
Figure 3-9. WaveStar OLS 40G Application Using OTUs	3-17
Figure 3-10. Ring Example	3-18
Figure 3-11. Large Network Example	3-19
Figure 3-12. Multiple WaveStar OLS 40G Systems and OTU/QOTUs as Regenerators (2-fiber Application)	3-20
Figure 3-13. WaveStar OLS 40G With Wavelength Add/Drop (WAD)	3-21
Figure 3-14. 4-Fiber Regenerator	3-22
Figure 3-15. 4-Fiber WAD	3-23
Figure 3-16. Telemetry-thru	3-24

4 Product Description

Figure 4-1. WaveStar OLS 40G Cabinet (Doors Closed)	4-3
---	-----

Figure 4-2. WaveStar OLS 40G Bay Frame	4-4
Figure 4-3. Miscellaneously-Mounted WaveStar OLS 40G Shelf with Front Covers (flat cover shown)	4-6
Figure 4-4. Miscellaneously-mounted OT Shelf with Front Cover (flat cover shown)	4-7
Figure 4-5. WaveStar OLS 40G Cabinet Shelf	4-8
Figure 4-6. WaveStar OLS 40G Integrated Bay Shelves	4-9
Figure 4-7. WaveStar OLS 40G End Terminal Shelf (fully equipped)	4-11
Figure 4-8. WaveStar OLS 40G Repeater Shelf (fully equipped)	4-12
Figure 4-9. Miscellaneously-mounted OT System Controller Shelf (8 OTUs; fully equipped).	4-13
Figure 4-10. Miscellaneously-Mounted Complementary Shelf 1 (12 OTUs; fully equipped).	4-14
Figure 4-11. OT Complementary Shelf Location	4-15
Figure 4-12. 1A-TX End Terminal Configuration (End Terminal Shelf 1)	4-16
Figure 4-13. 1A-TX-THRU End Terminal Configuration (End Terminal Shelf 1)	4-17
Figure 4-14. 1A-RCV End Terminal Configuration (End Terminal Shelf 1)	4-18
Figure 4-15. 1A-RCV-THRU End Terminal Configuration (End Terminal Shelf1).	4-19
Figure 4-16. Dual Facing End Terminal Configuration (End Terminal Shelf 1)	4-20
Figure 4-17. Single Optical Amplifier 1A-TX End Terminal Configuration (End Terminal Shelf 1)	4-21
Figure 4-18. Single Optical Amplifier 1A-TX-THRU End Terminal Configuration (End Terminal Shelf 1)	4-22
Figure 4-19. Single Optical Amplifier 1A-RCV End Terminal Configuration (End Terminal Shelf 1)	4-23
Figure 4-20. Single Optical Amplifier 1A-RCV-THRU End Terminal Configuration (End Terminal Shelf 1)	4-24
Figure 4-21. Single Optical Amplifier Dual Facing End Terminal Configuration (End Terminal Shelf 1)	4-25
Figure 4-22. 1A-TX End Terminal Configuration (End Terminal Shelf 2)	4-29

Figure 4-23. 1A-RCV End Terminal Configuration (End Terminal Shelf 2)	4-30
Figure 4-24. Dual Facing End Terminal Configuration (End Terminal Shelf 2)	4-31
Figure 4-25. Single Optical Amplifier 1A-TX End Terminal Configuration (End Terminal Shelf 2)4-32	
Figure 4-26. Single Optical Amplifier 1A-RCV End Terminal Configuration (End Terminal Shelf 2)4-33	
Figure 4-27. Single Optical Amplifier Dual Facing End Terminal Configura- tion (End Terminal Shelf 2)4-34	
Figure 4-28. End Terminal Cabinet for 4 Bidirectional Optical Lines . . .4-36	
Figure 4-29. Repeater Cabinet for 4 Bidirectional Optical Lines4-37	
Figure 4-30. Dual End Terminal Cabinet (fully equipped)4-38	
Figure 4-31. Dual Repeater Cabinet (fully equipped)4-39	
Figure 4-32. End Terminal and Repeater Cabinet4-40	
Figure 4-33. Bay-Mounted End Terminal and Repeater4-41	
Figure 4-34. OT Cabinet4-42	
Figure 4-35. Bay-Mounted OT4-43	
Figure 4-36. Integrated Bay (Single)4-44	
Figure 4-37. Integrated Bay (Double)4-46	
Figure 4-38. Integrated Bay (Triple 1)4-47	
Figure 4-39. Integrated Bay (Triple 2)4-48	
Figure 4-40. Integrated Bay/Cabinet Double and Triple 1 Cabling Diagram	4-50
Figure 4-41. Integrated Bay/Cabinet Triple 2 Cabling Diagram4-51	
Figure 4-42. QOTU Design4-57	
Figure 4-43. WaveStar OLS 40G Shelf Fiber/Cable Dressing and EMC/ESD Design	4-61
Figure 4-44. OT System Controller Shelf Interconnection Panel and Cabling	4-63
Figure 4-45. OT Complementary Shelf Interconnection Panel and Cabling	4-65
Figure 4-46. Indicator Strip for Dual End Terminal and Dual Repeater Cabinets	4-66
Figure 4-47. Indicator Strip for End Terminal and Repeater Cabinets for 4 Bidirectional Optical Lines	4-66

Figure 4-48. OT Cabinet Indicator Strip	4-69
Figure 4-49. WaveStar OLS 40G Shelf User Panel	4-70
Figure 4-50. WaveStar OLS 40G Fuse Panel	4-71
Figure 4-51. Miscellaneously-Mounted OT Complementary Shelf Fuse/Power Indicating Panel	4-74
Figure 4-52. OT Shelf Fuse Panel	4-75
Figure 4-53. General Power Distribution in a Two-Shelf WaveStar OLS 40G Bay or Cabinet	4-77
Figure 4-54. OT Power Distribution in a Three Shelf Bay or Cabinet .	4-78
Figure 4-55. WaveStar OLS 40G Power Distribution at Shelf Level . .	4-79

5 Operations, Administration, Maintenance, and Provisioning

Figure 5-1. CIT Operations Domain with Standard End Terminals	5-6
Figure 5-2. CIT Operations Domain with Dual-facing End Terminal . . .	5-7
Figure 5-3. OSI Stack Used Between EMS and the Network Element	5-13
Figure 5-4. TOHCTL (LEA102) Block Diagram	5-15
Figure 5-5. OPS Functional Diagram	5-30
Figure 5-6. OPS Circuit Pack Block Diagram	5-33
Figure 5-7. Dual-facing Shelf Configuration	5-36
Figure 5-8. APSD for Optical Line Failure Between Terminals (Two-OA)	5-39
Figure 5-9. Restart on an Optical Line Link Between Terminals (Two-OA)	5-40
Figure 5-10. APSD from Optical Line Failure (Single-OA)	5-41
Figure 5-11. Restarting on an Optical Link Between Terminals (Single-OA)	5-42
Figure 5-12. WaveStar OLS 40G End Terminal Shelves (fully equipped)	5-54
Figure 5-13. WaveStar OLS 40G Architecture without 4-Fiber Telemetry Feed-Through	5-57
Figure 5-14. WaveStar OLS 40G Architecture with 4-Fiber Telemetry Feed-Through	5-58

Figure 5-15. System Control Architecture for WaveStar OLS 40G5-61

6 System Planning and Engineering

- Figure 6-1. WaveStar OLS 40G Two-OA System.6-3
- Figure 6-2. WaveStar OLS 40G Single OA System6-6
- Figure 6-3. WaveStar OLS/OT Interworking6-9
- Figure 6-4. Floor Plan Layout6-15
- Figure 6-5. ST-Type Build-Out Assembly (enlarged)6-17
- Figure 6-6. FC-Type Build-Out Assembly (enlarged)6-18
- Figure 6-7. SC-Type Build-Out Assembly (enlarged)6-19
- Figure 6-8. LC-Type Connector (enlarged)6-20
- Figure 6-9. LBO Location in an End Terminal.6-21
- Figure 6-10. D-Subminiature Connector6-25

7 Ordering

- Figure 7-1. Sample Network Configuration Overview.7-34
- Figure 7-2. Sample Configuration, Section A (Enlarged)7-35
- Figure 7-3. Lightguide Office Cable Depiction7-56
- Figure 7-4. Intra-shelf Fiber Jumpers for 1A-TX End Terminal
(L162).7-57

8 Product Support

- Figure 8-1. Product Support8-4

A Circuit Pack Sparing

Figure A-1. Sparing Chart -- 10-Day Lead Time A-5
Figure A-2. Circuit Pack Sparing Chart -- 64-Day Lead Time A-6

B Q-LAN Interface

Figure B-1. Examples of Subnetworks Configured Before R4.0 B-6
Figure B-2. NSAP Address Structure for IS-IS B-8
Figure B-3. Example of a Level 2 Subdomain B-11
Figure B-4. Double Level 2 Entry in an Area B-12
Figure B-5. Level 2 Nodes in an Area as part of a Level 1 Ring B-13
Figure B-6. Limitations of Forwarding Management Traffic by
 a Node B-24

Tables

3 Applications

Table 3-1.	WaveStar OLS 40G Optical Amplifiers	.3-2
Table 3-2.	WaveStar OLS 40G OMUs/ODUs	.3-3
Table 3-3.	WaveStar OLS 40G OTUs/OTPMs	.3-5

4 Product Description

Table 4-1.	End Terminal Shelf 2 Circuit Pack Slot/Circuit Pack/Unit Code/ Software Compatibility	.4-27
Table 4-2.	User Panel Indicators for WaveStar OLS 40G in SONET Applications	.4-67
Table 4-3.	User Panel Indicators for WaveStar OLS 40G in SDH Applications	.4-68
Table 4-4.	Indicator Strip LEDs for OT (SONET)	.4-69
Table 4-5.	SONET Indicators on WaveStar OLS 40G User Panel (L10 and L11)	.4-72
Table 4-6.	SDH Indicators Present on WaveStar OLS 40G User Panel (L10 and L11)	.4-72
Table 4-7.	Power Cable Color Codes	.4-76

5 Operations, Administration, Maintenance, and Provisioning

Table 5-1.	CIT-TL1 Modem Transmission Standards	.5-3
Table 5-2.	Monitored Condition/Performance Parameter Types	.5-17
Table 5-3.	Monitored Condition/Performance Parameter Types	.5-34
Table 5-4.	OPS Default Specifications	.5-35

6 System Planning and Engineering

Table 6-1.	Optical Amplifiers used in WaveStar OLS 40G	.6-2
Table 6-2.	Engineering rules for Two-OA WaveStar OLS 40G Systems	.6-4

Table 6-3.	Engineering Rules for Single-OA WaveStar OLS 40G Systems using LEA105	6-7
Table 6-4.	Supported Software Upgrade Paths	6-13
Table 6-5.	LBO Color Types	6-22
Table 6-6.	Yellow LBO-to-Green LBO Conversion Specifications	6-24
Table 6-7.	WaveStar OLS 40G Power Planning	6-27

7

Ordering

Table 7-1.	WaveStar OLS 40G Intraoffice Electrical Non-transmission Cables	7-18
Table 7-2.	OT Intraoffice Electrical Non-transmission Cables	7-19
Table 7-3.	WaveStar OLS 40G Power Cables	7-20
Table 7-4.	OT Power Cables	7-21
Table 7-5.	Minicord Single-mode LC to ST II+	7-22
Table 7-6.	Related Cabinet Hardware	7-24
Table 7-7.	Cleaning Materials for Optical Fiber Connectors	7-25
Table 7-8.	METRAL Pin Ordering Information	7-25
Table 7-9.	METRAL Pin Kit/Pin Tool Kit Ordering Information	7-26
Table 7-10.	WaveStar OLS 40G/OT Equipment Locations and Pin Types	7-26
Table 7-11.	Ordering Information for External Miscellaneous Discrete Unit (EMDU)	7-29
Table 7-12.	Slot/Circuit Pack/ Software Compatibility (R4.0-WaveStar OLS 40G)	7-32
Table 7-13.	Dual End Terminal Sample Worksheet (J68982C-1)	7-37
Table 7-14.	Dual Repeater Sample Worksheet (J68982C-1)	7-45
Table 7-15.	OT Bay or Miscellaneously-mounted Application Sample Worksheet (J69000C-1)	7-50
Table 7-16.	Miscellaneously-mounted End Terminal Shelf (J68982C-1)	7-60
Table 7-17.	Miscellaneously-mounted Repeater Shelf (J68982C-1)	7-65
Table 7-18.	Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1)	7-69

Table 7-19.	Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1)	7-75
Table 7-20.	4-Line End Terminal Cabinet Worksheet (J68982C-1)	7-81
Table 7-21.	Dual End Terminal Worksheet (J68982C-1)	7-86
Table 7-22.	4 Bidirectional Line Repeater Worksheet (J68982C-1)	7-92
Table 7-23.	Dual Repeater Worksheet (J68982C-1)	7-96
Table 7-24.	End Terminal and Repeater Combination Worksheet (J68982C-1)	7-101
Table 7-25.	Integrated Bay (Single) Worksheet (J68982D-1)	7-107
Table 7-26.	OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1)	7-118
Table 7-27.	OT Cabinet Worksheet (J69000C-1)	7-124
Table 7-28.	4 Line Repeater-to-Dual Repeater Conversion Worksheet (J68982C-1)	7-130
Table 7-29.	4 Line End Terminal-to-Dual End Terminal Conversion Worksheet (J68982C-1)	7-133
Table 7-30.	New System Software and Documentation Ordering (J-Drawing J68982CS-1)	7-139
Table 7-31.	Additional Release 4.0 Software and Documentation Ordering (J-Drawing J68982CS-1)	7-140
Table 7-32.	Software Upgrade Ordering (J-Drawing J68982CS-1)	7-140
Table 7-33.	Conversion Kit (L310, 4 Line-to-Dual)	7-141
Table 7-34.	OT Slot/Circuit Pack Compatibility (Release 4.0-WaveStar OLS 40G)	7-142
Table 7-35.	Cabling Information for WaveStar OLS 40G Double and Triple 1 Arrangements	7-144
Table 7-36.	Cabling Information for WaveStar OLS 40G Triple 2 Arrangements	7-145
Table 7-37.	Possible LAN Cable Combinations	7-146
Table 7-38.	Integration Cabling Information	7-147

9 Quality Statements and Technical Specifications

Table 9-1.	WaveStar OLS 40G and OT Power Specifications	9-5
Table 9-2.	WaveStar OLS 40G/OT Physical Dimensions	9-6
Table 9-3.	WaveStar OLS 40G/OT Circuit Pack Dimensions	9-7
Table 9-4.	WaveStar OLS 40G/OT Floor Loads	9-9
Table 9-5.	Operating Temperature/Humidity Values	9-10
Table 9-6.	Handling and Transportation Tolerance Ranges	9-11
Table 9-7.	WaveStar OLS 40G/OT Circuit Pack FIT Rates per Bellcore RPP	9-11
Table 9-8.	Channel Unavailability (min/year/channel)	9-13
Table 9-9.	Telemetry Channel Unavailability	9-14
Table 9-10.	Mean-Time-Between-Maintenance Activity	9-15
Table 9-11.	OTU/OTPM Optical Power Output Specifications (1.5 μ)	9-17
Table 9-12.	Optical Signal Specifications for 1.3 μ OTU/OTPM	9-18
Table 9-13.	Output Power (dBm)	9-19
Table 9-14.	Plant Loss Between OA Sites	9-20
Table 9-15.	Tone Frequencies	9-21
Table 9-16.	Optical Interface Specifications	9-22
Table 9-17.	IS-3 Interface Distance Limitations	9-24

A Circuit Pack Sparing

Table A-1.	Circuit Pack FIT Rates for WaveStar OLS 40G/OT	A-3
Table A-2.	Circuit Pack Comcodes	A-7

About This Document

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 copies of the documentation and how to comment on it
- 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; with information on engineering and installation services, technical/documentation support, and training
- Chapter 9, “Quality Statements and Technical Specifications,” contains the Lucent Technologies quality policy, describes the reliability program, and lists technical specifications for WaveStar OLS 40G
- Appendix A, “Circuit Pack Sparing,” provides information on circuit pack sparing for WaveStar™ OLS 40G. Circuit pack comcodes and CLEI codes are also provided.
- The “Glossary” section defines many terms used in this guide
- The “Abbreviations and Acronyms” section lists all abbreviated terms and acronyms associated with WaveStar OLS 40G
- The Index provides page numbers for key words and subject names.

Related Documentation

The following documents provide information about WaveStar OLS 40G:

- Number: 365-575-361
Title: *WaveStar™ OLS 40G Release 4.0.2 User/Service Manual*
Audience: End user maintenance personnel
Content: Detailed system description, technical specifications, operation and maintenance, and user interface descriptive/tutorial information.
- Number: 365-575-362
Title: *WaveStar™ OLS 40G Provisioning Job Aid*
Audience: End user maintenance personnel
Content: Laminated job aid cards used as quick reference, containing detailed provisioning information.
- Number: 365-575-363
Title: *WaveStar™ OLS 40G Threshold-Crossing Alert (TCA) Parameters Provisioning Job Aid*
Audience: End user maintenance personnel
Content: Laminated job aid cards used as quick reference, containing detailed information on TCA parameter provisioning.
- Number: 365-575-364
Title: *WaveStar™ OLS 40G Release 4.0.2 Installation Manual*
Audience: Customers planning to install WaveStar OLS
Content: Customer installation instructions
- Number: 365-575-365
Title: *WaveStar™ OLS 40G Release 4.0.2 Operations Systems Engineering Guide*
Audience: End user maintenance personnel
Content: Operations Systems software commands, messages, and other information

- Comcode: 108 336 744
Title: *WaveStar™ OLS 40G Release 4.0.2 Software Release Description*
Audience: End-user maintenance personnel
Content: Status of problems fixed and known problems for Release 4.0.2-WaveStar OLS 40G software
- 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.
- Number: 5947TS
Title: *WaveStar™ OLS 40G Technical Specifications*
Audience: Engineers involved in system planning, use , or maintenance
Content: Technical specifications and engineering rules on all system components.

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:

365-575-100	<i>FT-2000 OC-48 Lightwave System Applications, Planning, and Ordering Guide</i>
365-575-102	<i>FT-2000 OC-48 Lightwave System User/Service Manual</i>
365-575-115	<i>FT-2000 OC-48 Lightwave System Installation Manual</i>
365-575-230	<i>FT-2000 OC-48 Large Capacity Terminal Applications, Planning, and Ordering Guide</i>
365-575-231	<i>FT-2000 OC-48 Large Capacity Terminal User/Service Manual</i>

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

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. 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:** 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:** 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 4.0.2 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 4.0.2 Installation Manual*

Prerequisites: TR0510, Transmission Principles, self-paced

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
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Altamonte Springs, FL
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Introduction

1

■ Introduction to WaveStar OLS 40G.....	1-1
■ What is WaveStar OLS 40G?	1-3
■ WaveStar OLS 40G Functions.....	1-5
■ WaveStar OLS 40G Benefits	1-6
■ WaveStar OLS 40G Feature Release Plan.....	1-7

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. 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."

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.

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 OTU is required for WaveStar OLS 40G when non-Lucent machines are used.

WaveStar OLS 40G works with the Integrated Transport Management Subnetwork Controller (ITM SC). The ITM SC is an element management system that supports SDH network elements such as the Lucent Technologies SLM-2000, ADM-16, ISM-2000. The ITM SC provides fault, performance, configuration, and security management functions.

WaveStar OLS 40G also works with the synchronous optical network (SONET)-based Integrated Transport Management Subnetwork Controller (ITM SNC). The ITM SNC is an element management system that supports 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, performance, 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.

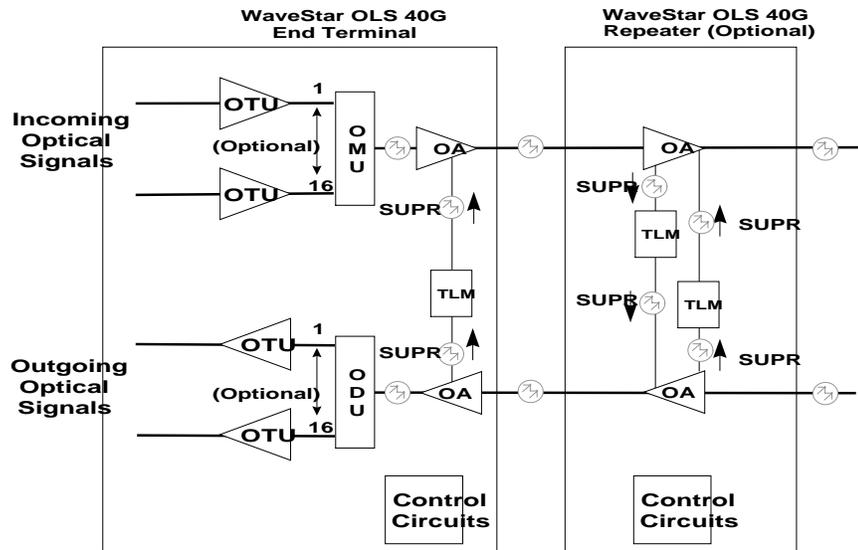
The ITM SNC operates as an enhanced graphical tool and as a general configuration management aid. It provides network element, port, cross-connection, and path provisioning, as well as flow-through from provisioning operations systems (OS) to network elements. The ITM SNC also provides fault management through alarm and event pre-processing within the management subnetwork 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*[®] or higher application that provides access to Lucent Technologies SONET network elements from a personal computer or laptop via a command-based AUI and GUI. CPro-2000 is a user-friendly tool for craft provisioning of SONET-based management 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.



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Figure 1-1. Simplified WaveStar OLS 40G End Terminal and Repeater Block Diagram

WaveStar OLS 40G Functions

WaveStar OLS 40G has the following functions:

- Performs Dense Wavelength Division Multiplexing (DWDM) and demultiplexing of up to sixteen optical lines on one optical fiber on standard single mode fiber (SSMF) or non-zero dispersion-shifted fiber (for example, TrueWave[®]).
- Multiplexes optical signals with a maintenance signal that is used by DWDM
- Amplifies signal using an erbium-doped fiber Optical Amplifier (OA)
- Provides a full suite of OAM&P capabilities, including optical monitoring of individual wavelength channels at the OA output
- If needed, uses Repeater terminals to optically amplify the signal
- Can be economically deployed for applications of a few kilometers to hundreds of kilometers and more.
- Provides both TL1 and CMISE interfaces for maximum operations flexibility available via X.25/IAOLAN interfaces
- Can support 1+1, non-revertive optical protection switching (OPS) for either unidirectional or bidirectional applications
- Functionally integrates the OPS feature with WaveStar OLS 40G OAM&P
- Available to support 2-fiber and 4-fiber, point-to-point and ring configurations
- Supports IS-IS Level 2 routing
- Provides Automatic Power Shut Down and restart for optical safety.

WaveStar OLS 40G 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 and operations systems
- Extends optical channels to thousands of kilometers without the need for SONET/SDH repeaters; replaces multiple repeaters
- Reduces office congestion
- Facilitates Wavelength Add/Drop (WAD)
- Prevents wavelength blocking via Wavelength Interchange
- Available in a variety of topologies, such as point-to-point and ring configurations
- Works with embedded base transmission systems, instantly increases fiber capacity 16-fold or more
- Provides user-settable alarms and control of equipment collocated with WaveStar OLS 40G
- Provides performance monitoring, fault isolation, and preventive maintenance
- Enhanced data rate (10 Mb/s) on the IAOLAN interface
- Handles up to 40 Gb/s of traffic on one optical line
- Single OA or two operation
- Repeater sites between End Terminals to support each span
- High reliability with a 25-year design life
- Year 2000-compliant
- With OPS, customer traffic is protected against fiber cuts or Optical Amplifier (OA) failures.

WaveStar OLS 40G Feature Release Plan

WaveStar OLS 40G 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.

WaveStar OLS 40G 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).

WaveStar OLS 40G 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.

WaveStar OLS 40G Release 3.0.1 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.

WaveStar OLS 40G Release 3.1.1 offered the following:

- 1+1, non-revertive protection switching for customer traffic over point-to-point WaveStar OLS 40G systems using:
 - The Self-Powered Optical Multiplexer Unit (SPOMU) circuit pack
 - The Self-Powered Optical Demultiplexer Unit (SPODU) circuit pack

WaveStar OLS 40G Release 4.0.2 offers these additional new features:

- Improved network management via the Common Management Information Service Element (CMISE) feature
- Faster OS/NE connectivity via the IAOLAN
- Optical monitor test port on the new LEA7B OA for individual wavelength channel monitoring

For information on WaveStar OLS 40G product features, refer to Chapter 2, “Features.”

Features

2

■ New Features in Release 4.0.2.....	2-1
Common Management Information Service Element (CMISE).....	2-1
IAOLAN.....	2-2
LEA7B Optical Amplifier.....	2-3
■ Other System Features.....	2-4
16-Wavelength Point-to-Point and Ring Applications.....	2-4
Automatic Power Shut-down (APSD) and Restart.....	2-4
Optical Protection Switching.....	2-5
■ Maintenance Features.....	2-6
CenterLink-CIT.....	2-6
Operations Interface Flexibility.....	2-6
Operations Domains.....	2-7
Single-Ended Operations.....	2-8
Continuous Performance Monitoring.....	2-10
Original Value Provisioning and User-Selectable Thresholds.....	2-11
Security Features.....	2-11
■ Physical Features.....	2-12
Front Access.....	2-12
Equipment Packages.....	2-12
Easy Installation and Self-tests.....	2-12

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

New Features in Release 4.0.2

The following features are new in Release 4.0.2:

- CMISE interface to the EMS
- IAOLAN interface to the EMS
- Q-LAN interface using IS-IS Level 2 routing
- LEA7B Optical Amplifier

Common Management Information Service Element (CMISE)

The Common Management Information Service Element (CMISE) network management tool is new in Release 4.0.2. Running over OSI (Open System Interconnection), CMISE is supported as the operations interface.

On the Element Management System (EMS) side, Lucent Technologies' ITM-SC is used. ITM-SC uses the CMISE interface to WaveStar OLS 40G.

WaveStar OLS 40G Release 3.1 (and earlier releases) supports TL1 messages over an X.25 communication link. Release 4.0.2 supports both TL1 messages over an X.25 link and CMISE messages over a 10BaseT LAN connection.

IAOLAN

New in Release 4.0.2 is the SONET Intra-office LAN (IAOLAN). Designed for use with CMISE, the IAOLAN provides communications connectivity among network elements within the central office, and optionally with an Operations System (OS). Using the IAOLAN, network elements can communicate Operations Interworking (OI) information whether or not they are connected via STM-N, STS-N, or OC-N interfaces.

To facilitate IAOLAN operation a new circuit pack, the IAOLRP (Intra-Office LAN Relay Pack), is required in the WaveStar OLS 40G shelf for LAN connection in an End Terminal with a LAN interface. The IAOLRP is installed in End Terminal locations requiring LAN access; it is placed in the first empty slot next to the TLM 1A slot.

The IAOLAN provides a significantly increased bandwidth for communications with Operations Support Systems (OSSs). The maximum data rate is increased from 56 Kb/s on the X.25 interface to 10Mb/s on the IAOLAN interface. This improved data rate provides the following benefits:

- Increased speed of download operations
- Serves as a mechanism for future OS software download capabilities
- Potential OS network bottlenecks at gateway network elements (GNEs) are eliminated.

In previous releases, the X.25 port on the WaveStar OLS 40G was used as the primary vehicle for providing OS access to their network elements. This port supports OS messages in the TL1 format and provides Gateway Network Element (GNE) capability, allowing an OS to access remote network elements within the same WaveStar OLS 40G fiber span through a single X.25 connection. The IAOLAN goes beyond this capability with the following enhancements:

- **Fewer data links**– the number of data links required to monitor a network is reduced. Each X.25 link that can be replaced by an IAOLAN link creates cost savings.

- **Size of OI domain is increased**– OS functions are no longer limited to TL1, as the OS can communicate directly with NE applications without relying on an intermediate GNE server application. The size of OI domains is increased, reducing the number of OS access links required to manage a given network.
- **Elimination of intermediate network**– In previous releases, the OS relied on an intermediate X.25 Wide Area Network (WAN) to access the network elements it supported, requiring additional maintenance and administration beyond the OSs and network elements themselves.
- **Performance monitoring enhancement**– The high speed of the IAOLAN makes it practical to collect this information on a regular basis for OSS/EMS performance monitoring trending analysis and/or long term storage.

LEA7B Optical Amplifier

The new LEA7B Optical Amplifier (OA) provides an optical monitor test port at the OA output that, when used with optical spectrum analysis instrumentation, monitors individual wavelength channels.

The LEA7B OA circuit pack also contains a dual 1532 nm/1510 nm filter to support either a 1532 nm or 1510 nm Optical Supervisory Channel (OSC). This dual capability, functional in future releases, will allow the WaveStar OLS 40G system to operate with an optical supervisory channel at either the 1532 nm (currently supported) or 1510 nm wavelength.

Other System Features

Other key system features include the following:

- 16-wavelength point-to-point and ring applications
- Automatic power shut-down (APSD) and restart capability
- Optical Protection Switching

16-Wavelength Point-to-Point and Ring Applications

WaveStar OLS 40G can be deployed in 2-fiber and 4-fiber configurations for point-to-point applications. WaveStar OLS 40G may also be deployed in a dual-facing end terminal configuration. In this configuration, transmission is supported in both the East and West directions, similar to an add/drop multiplexer. When WaveStar OLS 40G is deployed in repeater and dual-facing end terminal configurations, linear add/drop and ring topologies may also be deployed.

To optimize WaveStar OLS 40G for a variety of applications, four optical amplifiers are available for 16 λ applications. These amplifier choices allow selection of the amplifier that best suits the span distance in a given application.

Optical Translator Units (OTUs) and Optical Translator Port Modules (OTPMs) may be used as an interface to SONET/SDH network elements or for signals with data rates from 150 - 750 Mbps (e.g., PDH or data). SONET/SDH products equipped with OLS 40G-compatible optics may be connected directly to the OLS multiplexing/demultiplexing units without the need for an OTU (e.g., FT-2000, FT-2000LCT, SLM-2000, etc; refer to the appropriate product documentation for availability).

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

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

Optical Protection Switching

This feature provides optical protection for the WaveStar OLS 40G, switching traffic between primary and secondary lines in the event of a fiber cut or OA failure on systems of up to eight spans.

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*[®] or *Windows 98*[®] operating system, CenterLink-CIT also provides detailed information and system control for specialized local and remote maintenance and administrative activities.

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:

- **CIT interface:** provides two CIT ports compatible with the ASCII EIA-232-D standard, one configured as data communications equipment (DCE) and one configured as data-terminating equipment (DTE)
- **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.
- **IAOLAN interface:** The IAOLAN interface is new in Release 4.0 and provides a provides a CMISE interface to management systems such as Lucent's ITN-SC.

Operations Domains

For WaveStar OLS 40G releases available prior to release 4.0, the OLS management subnetwork includes all end terminals and repeaters interconnected with each other and managed via the DCC of the same EMS. The management 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. Each subnetwork may contain up to 32 OLS network elements.

In addition to supporting WaveStar OLS 40G systems via the DCC, management capability is extended to a larger domain of network elements using the IAOLAN interface in the management subnetwork beginning with Release 4.0

In Release 4.0, Intermediate System (IS)-IS Level 2 routing is supported by WaveStar OLS 40G. Using this in conjunction with the IAOLAN feature, flexible data communications network (DCNs) can be designed to minimize the number of physical data links between the management system (e.g., Lucent's ITM-SC) and the OLS network while increasing overall robustness of the DCN.

With IS-IS Level 2 routing, each OLS network may be divided into areas following specific guidelines and rules. Each OLS 40G network element may be designated as a level 1 or level 1/2 router. OLS network elements that provide level 1 routing can route DCN messages within an area only. Those that provide Level 1/2 routing can also route messages across areas. The designation of this second level of routing across areas allows the

design of hierarchical DCN which increases management efficiency and DCN robustness for large network deployments.

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 management 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 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)

For releases prior to 4.0, one or more WaveStar OLS 40G network elements can be used as a GNE. The GNE serves as a single interface for all network elements in the same WaveStar OLS 40G management 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 messages. Through the GNE, the operations system can send commands to any network elements in the WaveStar OLS 40G management subnetwork.

The number of GNEs you use depends on your application and operations needs. For example, to reduce the number of operations data communication links between the WaveStar OLS 40G management 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 management subnetwork.

In Release 4.0 and later releases, remote login from CenterLink CIT is supported to OLS network elements in the same area as the OLS to which the CenterLink CIT is physically connected.

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 management subnetwork.

Local Software Copy/Upgrades

WaveStar OLS 40G can upgrade system software while in service. 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 for OLS releases prior to release 4.0 and in the same area for OLS releases 4.0 and later. 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 area 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

■ Optical Transmission Elements.....	3-1
Optical Amplifier	3-2
Optical Multiplexer Units/Optical Demultiplexer Units	3-3
Optical Translator Units	3-4
Other Elements	3-6
■ Basic WaveStar OLS 40G Configurations	3-7
Applications Without Repeaters.....	3-7
Applications With Repeaters	3-11
Dual-facing Shelf Applications	3-12
Applications With Multi-Regenerated Spans.....	3-20
Applications With Wavelength Add/Drop (WAD)	3-21
Alternate Configurations for Regeneration and WAD	3-22

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 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 five types of OAs available in Release 4.0.2 and their associated applications.

Table 3-1. WaveStar OLS 40G Optical Amplifiers

OA Code	Application	Two-OA Operation	Single-OA Operation
LEA7	Long Reach	✓	
LEA7B	Long Reach	✓	
LEA104	Long Span	✓	
LEA105	Short Reach	✓	✓
LEA6*	Long Span	✓	

*. For use in 8 λ applications.

Optical Multiplexer Units/Optical Demultiplexer Units

Two types of 16 λ OMUs and three types of 16 λ ODUs (one 16 λ with supervisory channel, one 16 λ without supervisory channel, and one 16 λ self-powered without supervisory channel) are supported by WaveStar OLS 40G. Eight wavelength OMUs and ODUs are also supported.



NOTE:

When using the OPS feature, the SPOMU and SPODU circuit packs are required.

Optical Multiplexer Units (OMUs) multiplex up to 16 signals together. Optical Demultiplexer Units (ODUs) optically demultiplex the signals, separating the optical input signal 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	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
OMU	505A	8	
ODU	605A	8	

*. For use in OPS configurations.

Optical Translator Units

WaveStar OLS 40G utilizes Optical Translator Units (OTUs and OTPMs) supporting up to sixteen wavelengths and OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, and 150-750 Mb/s bit rates.

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 4.0.2

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, used to transmit to the OLS OMU
41BB	OC-48/STM-16	1.3 μm	OTU, used to transmit from the OLS ODU to a SONET/SDH Network Element receiver
41C(1-16)C	OC-48/STM-16	1.5 μm	OTU. For applications with dispersion of up to 10,900 ps/nm, used to transmit to the OLS OMU
41S			QOTU carrier pack for up to 4 OTPMs of any mix
42A(1-16)	OC-12/STM-4	1.5 μm	OTPM, used to transmit to the OLS OMU
42B	OC-12/STM-4	1.3 μm	OTPM, used to transmit from the OLS ODU to a SONET/SDH Network Element receiver
43A(1-16)	OC-3/STM-1	1.5 μm	OTPM, used to transmit to the OLS OMU
43B	OC-3/STM-1	1.3 μm	OTPM, used to transmit from the OLS ODU to a SONET/SDH Network Element receiver
44A(1-16)	150-750 Mb/s	1.5 μm	LSBB OTPM, used to transmit to the OLS OMU
44B	150-750 Mb/s	1.3 μm	LSBB OTPM, used to transmit from the OLS ODU to a Network Element receiver

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. Two-fiber applications are shown. The OLS 40G may also be equipped for four-fiber applications.

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)
- Couples the supervisory signal into the optical line signal
- Monitors the power of each optical signal in the OA.
- Launches the signal (optical line signal) onto the transmission fiber

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)

* These wavelengths originate from up to sixteen 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. Optical channels, one each wavelength, can carry any combination of OC-48/STM-16, OC-12/STM-4, OC3/STM-1, and 150-750 Mbps signals.

- Optically demultiplexes up to sixteen optical signals from the optical line (performed by the ODU)
- 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, LEA7B, LEA104, or LEA105. See Chapter 6, "System Planning and Engineering" for specific engineering rules.

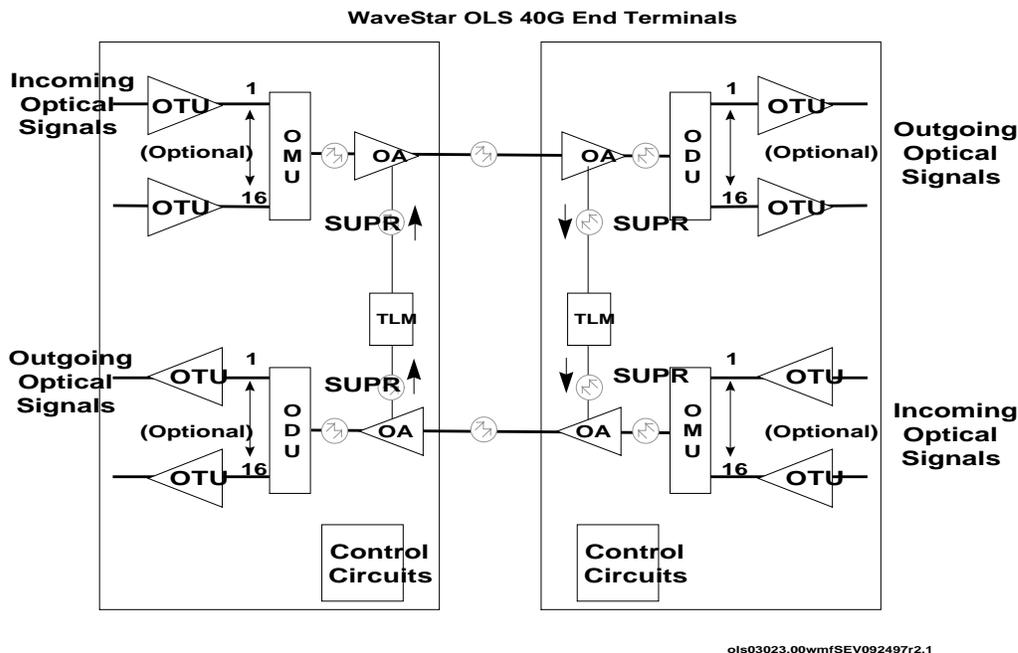


Figure 3-1. WaveStar OLS 40G Single Span with Two-OA Operation *

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

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, 2-fiber application. The OLS may also be deployed in a 4-fiber configuration. 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 is not supported in Single-OA applications.

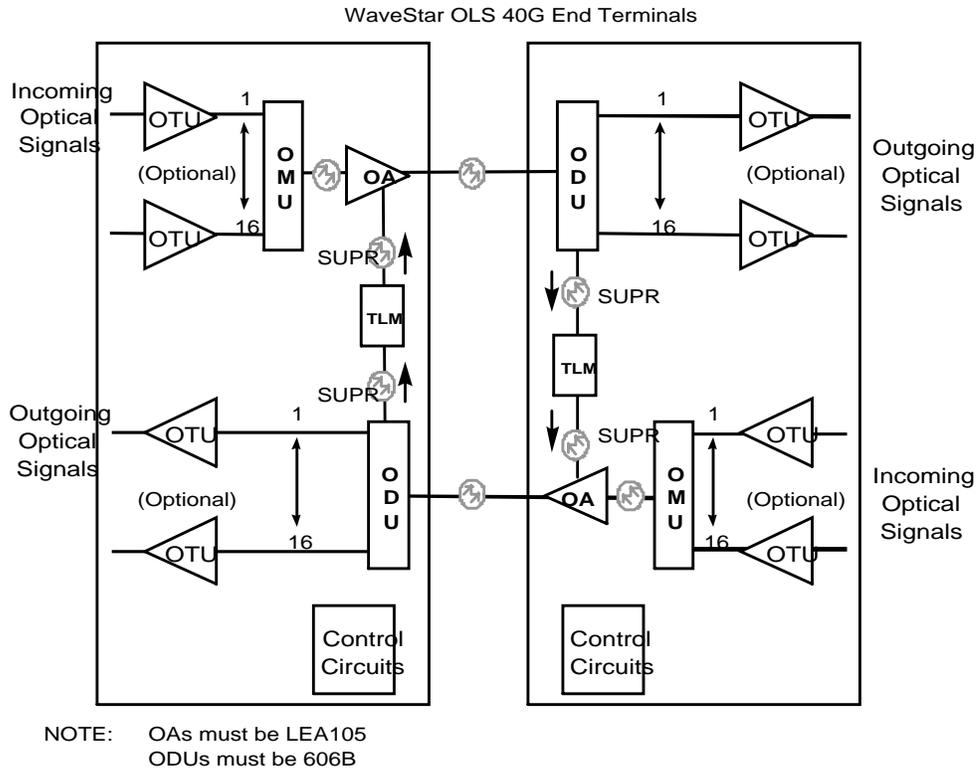
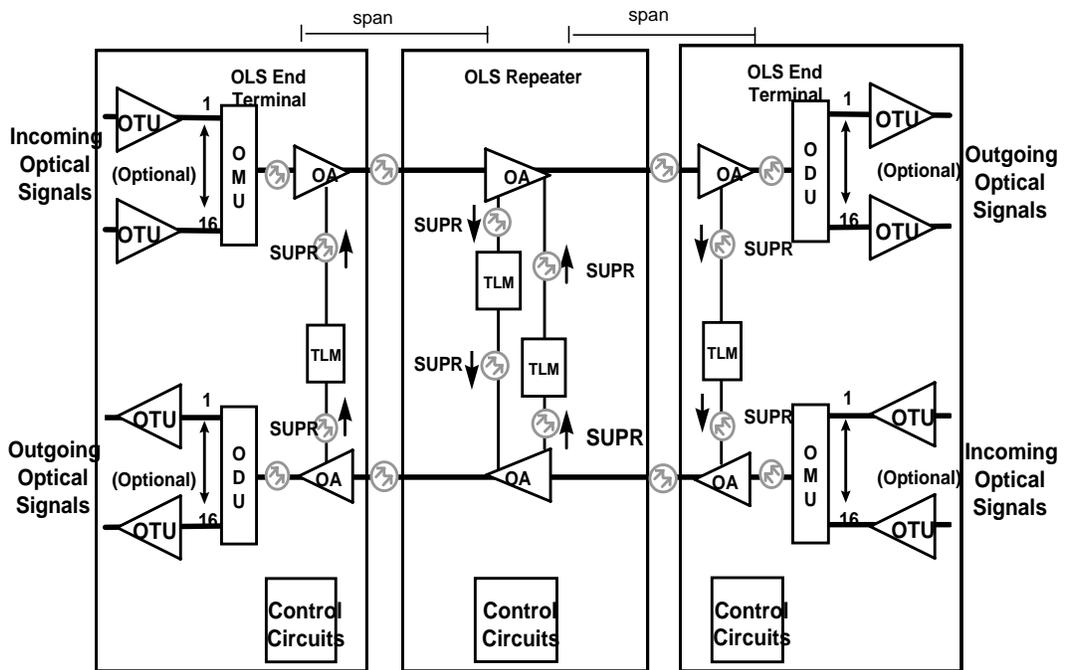


Figure 3-2. WaveStar OLS 40G Single Span with Single-OA Operation *

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

Applications With Repeaters

Figure 3-3 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, LEA7B, or LEA104 OAs, depending on span distance and fiber type. Specific engineering rules appear in Chapter 6, "System Planning and Engineering." Repeaters use the same OAs as the end terminals on either end of the system.



NOTE: OAs must either be all LEA6 or all LEA7

ols03025.00wmf/SEV092497/2.1

Figure 3-3. WaveStar OLS 40G Multiple Span System with Repeaters (two-span system shown)

Note: Additional repeaters may be used to increase the number of spans between end terminals.

Dual-facing Shelf Applications

In two-fiber applications, collocated end terminals with dual-facing shelf capability can be combined both physically and operationally into a single network element. In each of the Two OA, Single OA, or repeatered applications shown previously, a 20-fiber end terminal may be replaced with a dual-facing shelf. The dual-facing shelf can support a two-OA, a single-OA, or repeatered application on one side and another two-OA, single-OA or repeatered application on the other side, thus replacing two 2-fiber end-terminal shelves with one dual-facing shelf. The applications supported on each side are independent and may be different in a dual-facing shelf; the OAs in each direction may be different depending on the span length and number of spans required.

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

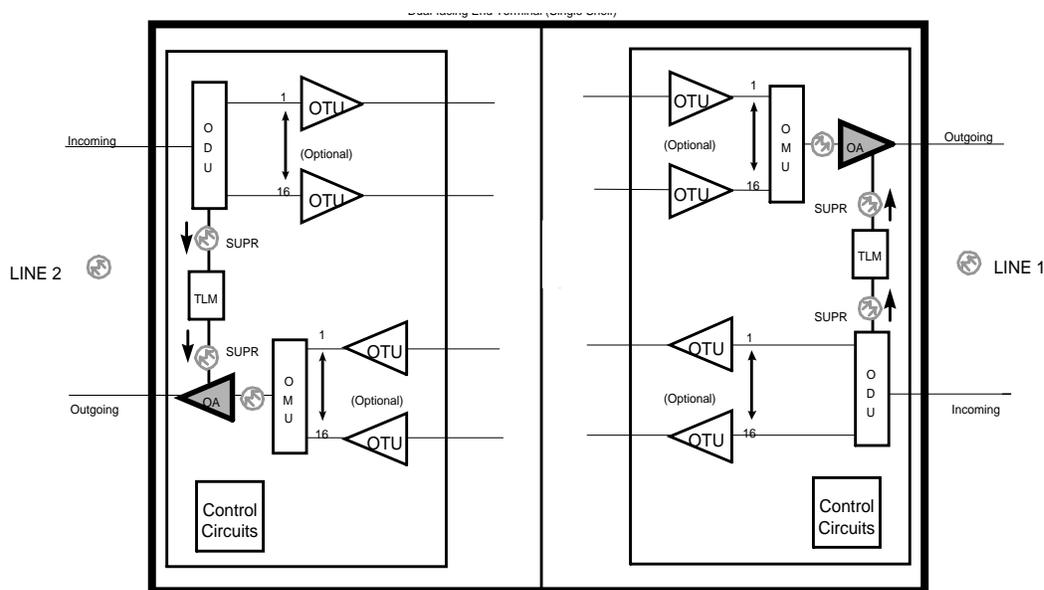
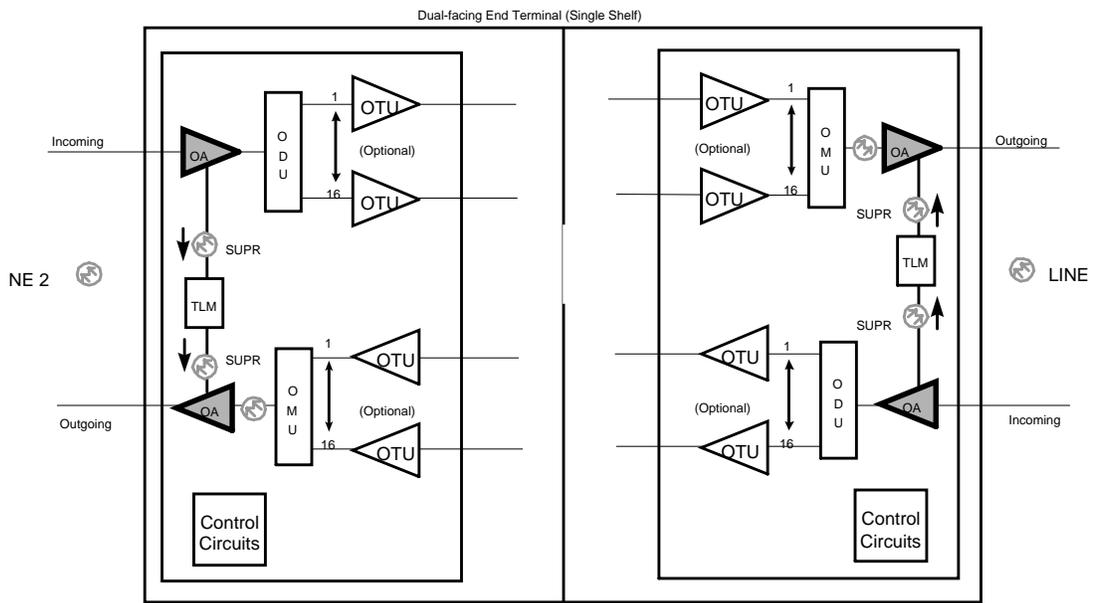


Figure 3-4. Single-OA/Single-OA Dual-facing Shelf*

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

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 two-fiber applications. Additionally, dual-facing shelves allow extension of the operations domain across WAD sites. Telemetry channels may be connected through between two four-fiber end terminals in the same office to extend the management subnetwork size. This capability is useful for end terminal sites where Operations Systems access might otherwise be difficult to provide.

Figure 3-5 illustrates a dual-facing shelf configuration utilizing two OA circuit packs on both bidirectional lines.



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

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

Figure 3-6 illustrates a dual-facing shelf configuration utilizing one OA circuit pack on one bidirectional line and two OA circuit packs on the other.

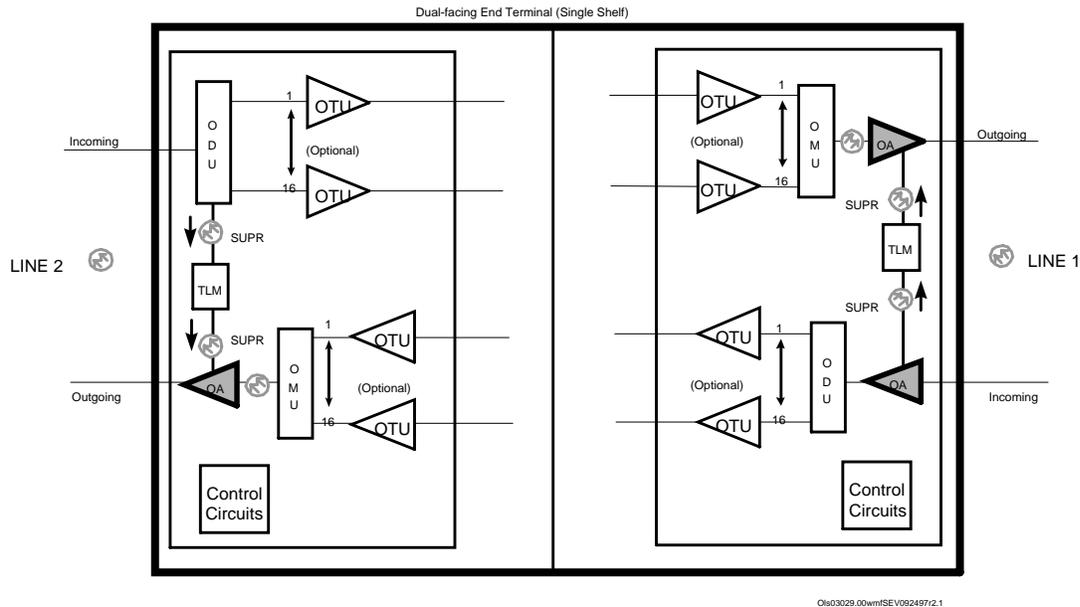


Figure 3-6. Single-OA/Two-OA Dual-facing Shelf*

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

Figure 3-7 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 3-6; the OA circuit pack arrangement has been switched between lines.

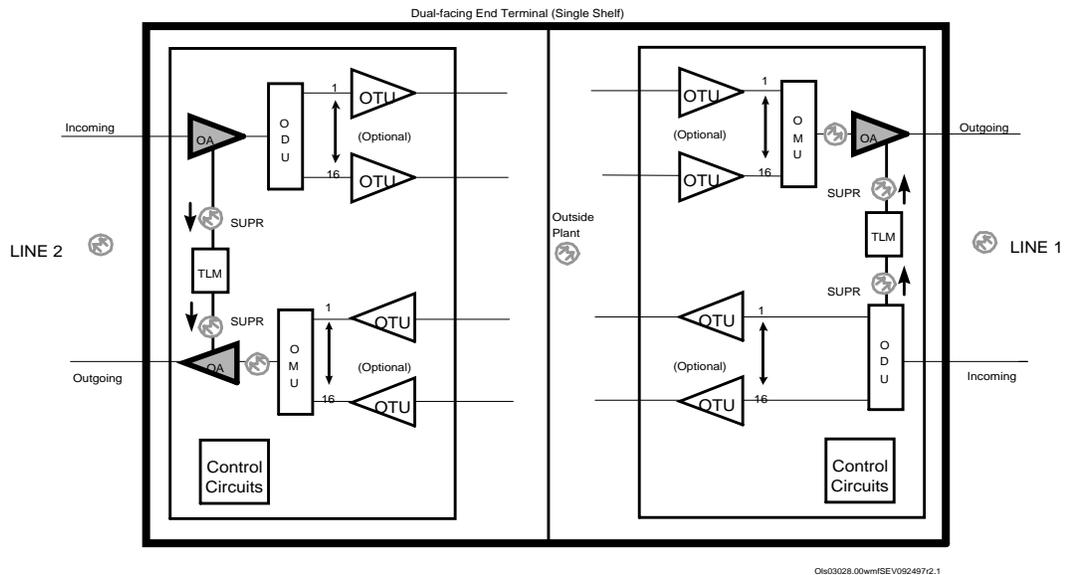


Figure 3-7. Two-OA/Single-OA Dual-facing Shelf*

* In the figure above, (Optional) denotes that OTUs are not required when the transmitter/receiver of the optical channel source are OLS 40G compatible. The label OTU is used here to refer to OC-48/STM-16 OTUs or OC-12/STM-4 OTPMs or OC-3/STM-1 OTPMs or LSBB OTPMs.

When dual-facing end-terminals are used in a point-to-point configuration, the end-to-end configuration can contain up to 32 OLS network elements, as shown in Figure 3-9. Larger applications may be supported using the technique described in Alternate Configurations for Regeneration and Wavelength Add/Drop, but configuring the end terminals for point-to-point configurations.

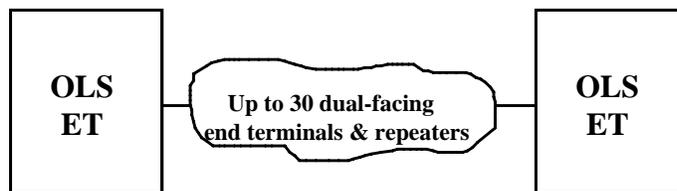


Figure 3-8. Point-to-Point Linear Add/Drop Chain

In this figure, wavelegths 1.3.5.6 and 8 are carrying optical channels that are being expressed through this location. In the west direction, wavelegths 2 and 7 are provided from ADMs using OLS-40G compatible optics. Wavelength 4 uses a OTU to interface to an ADM with a standard interface. In the east direction, wavelegths 2 and 4 are provided from ADMs with OLS-40G compatible optics and wavelength 7 from an ADM with a standard interface.

Ring applications may be created using dual-facing end terminals and repeaters. The figure below shows a simple example.

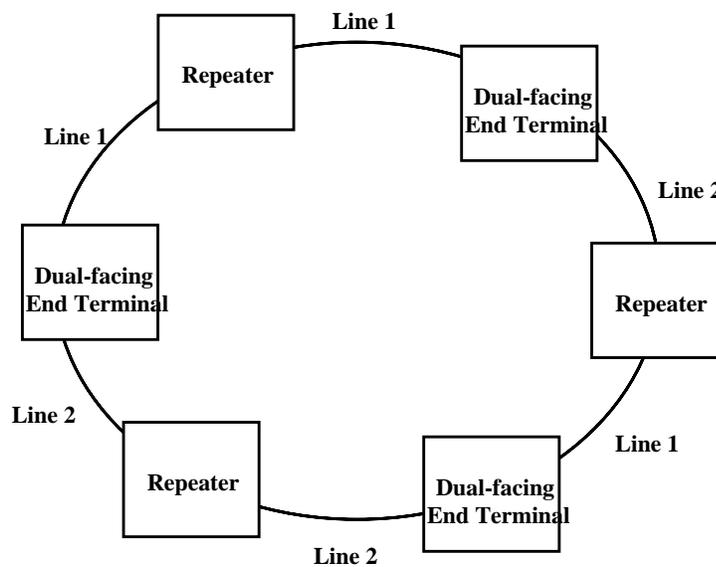


Figure 3-10. Ring Example

Ring applications may contain up to 32 OLS dual-facing end terminals plus repeaters. Larger rings may be deployed by splitting the ring into two or more point-to-point linear add/drop chains of no more than 32 OLS each. Each point-to-point configuration begins and ends with a single facing end terminal and has up to 30 dual-facing end terminals and repeaters in between. (See “Alternate Configurations for Regeneration and Wavelength Add/Drop” later in this section.) The figure below shows a large network example.

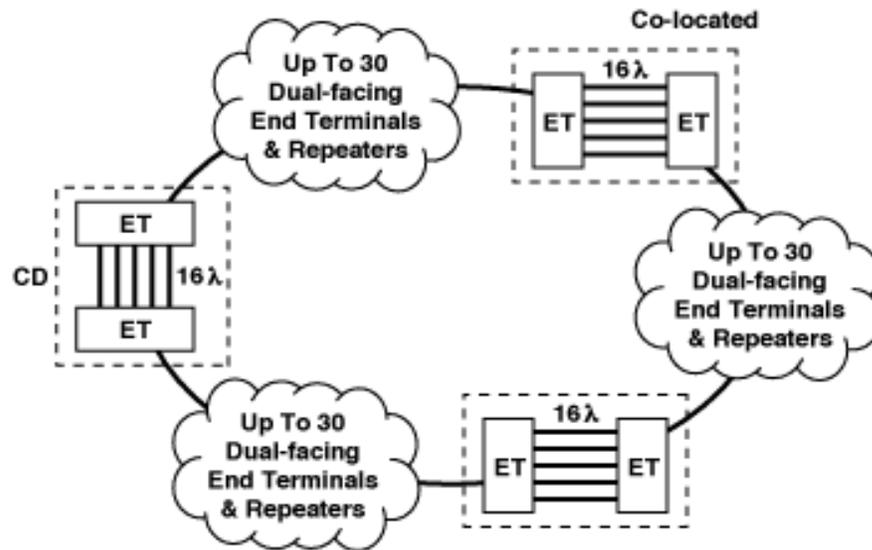


Figure 3-11. Large Network Example

Applications With Multi-Regenerated Spans

Figure 3-12 shows how WaveStar OLS 40G systems can be concatenated for routes extending beyond the eight span capability of the traditional LEA7 OA. To go beyond five spans (LEA6, 8λ or LEA104, 16λ) or eight spans (LEA7 or LEA7B), the optical line signal must be regenerated. Regeneration is performed by OTUs/QOTUs in an OT Bay or Cabinet arrangement or in miscellaneous-mounted OT shelves. Engineering rules appear in Chapter 6, "System Planning and Engineering."

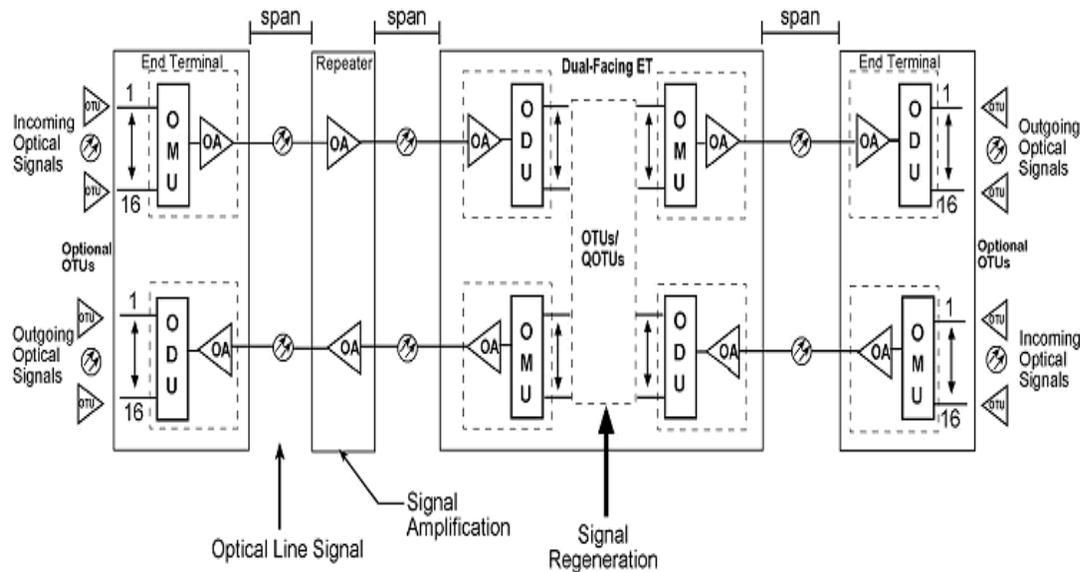
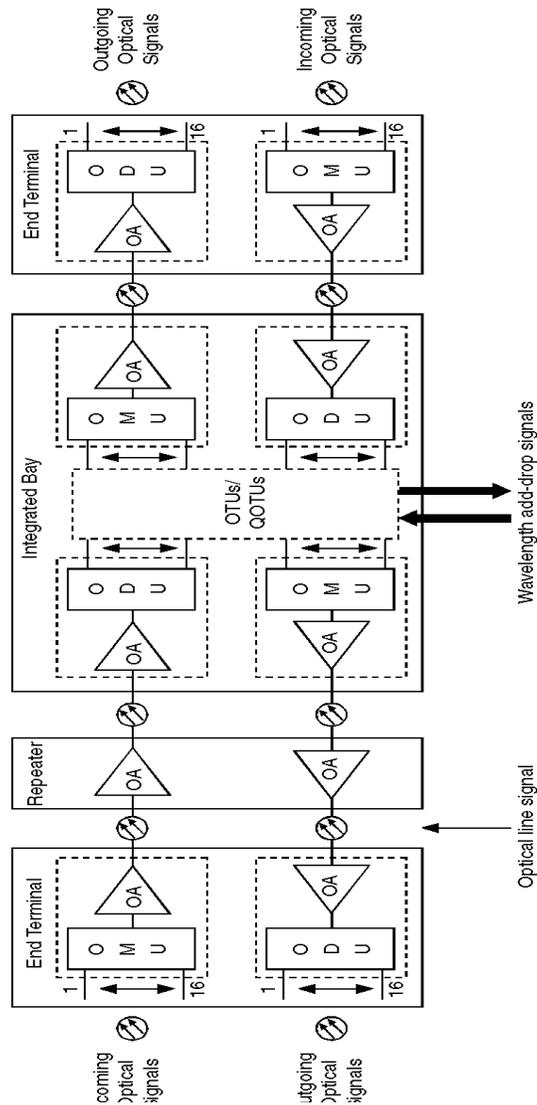


Figure 3-12. Multiple WaveStar OLS 40G Systems and OTU/QOTUs as Regenerators (2-fiber Application)

Applications With Wavelength Add/Drop (WAD)

Figure 3-13 shows a multi-span WaveStar OLS 40G with an intermediate WAD site. This site consists of a 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 3-9 also illustrates wavelength add/drop.



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Figure 3-13. WaveStar OLS 40G With Wavelength Add/Drop (WAD)

Alternate Configurations for Regeneration and WAD

Figure 3-13 and Figure 3-13 show how signals can be regenerated or added/dropped in 4-fiber applications. These configurations may also be used in 2-fiber applications where dual-facing shelves are not supported or desired.

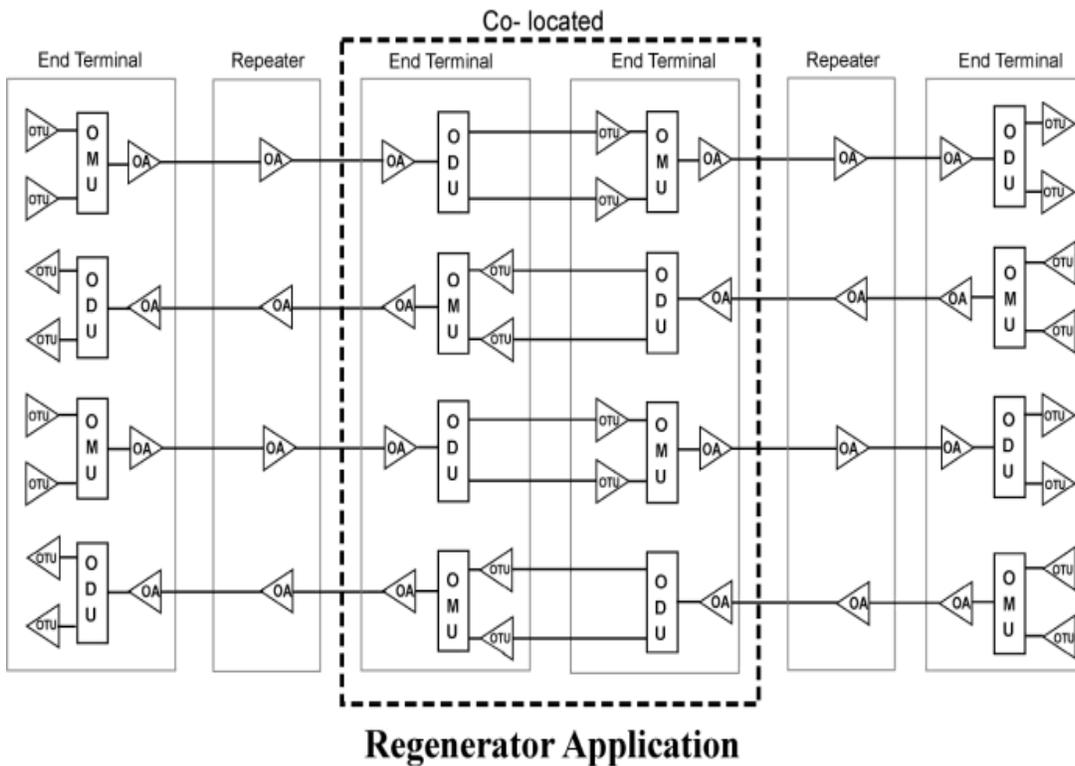


Figure 3-14.4-Fiber Regenerator

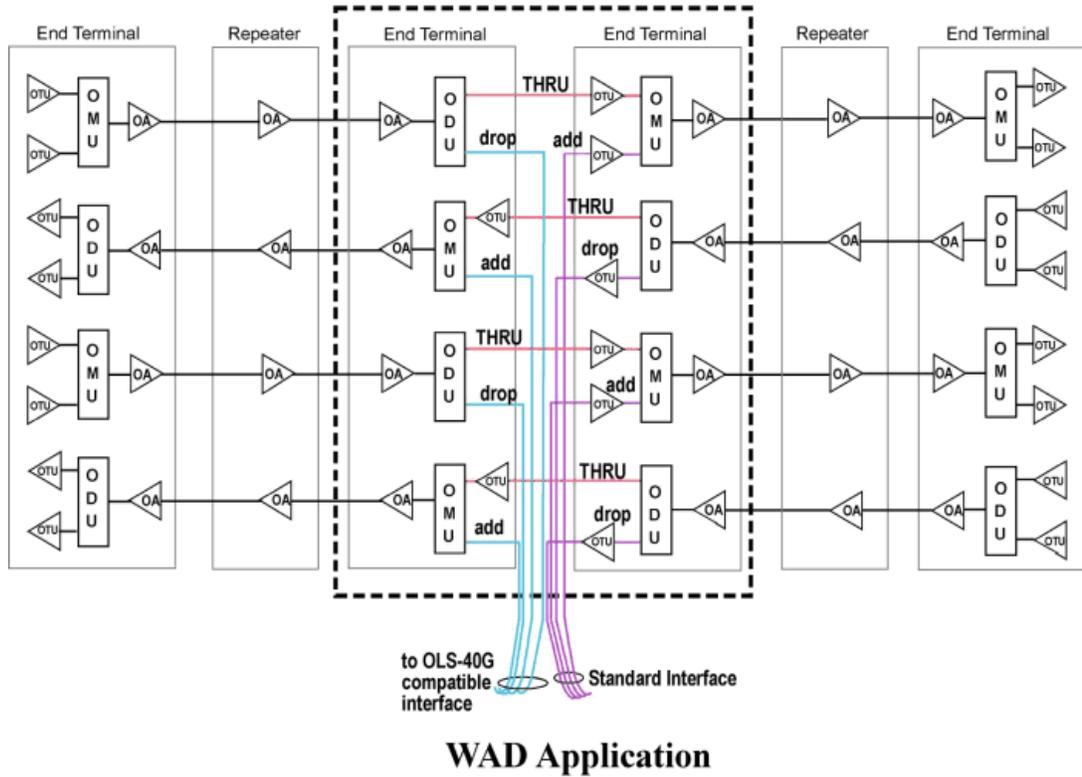


Figure 3-15.4-Fiber WAD

When single-facing terminals are co-located, the DCN may be extended beyond end terminal boundaries by using either an IAOLAN to connect end terminals or by using the telemetry thru feature. The IAOLAN feature requires Release 4.0 or a later release. Telemetry-thru requires Release 3.0 or a later release.

Telemetry-thru can be used to connect two end-terminals where it is not convenient to provide a physical X.25 connection to the location as in Figure 3-13.

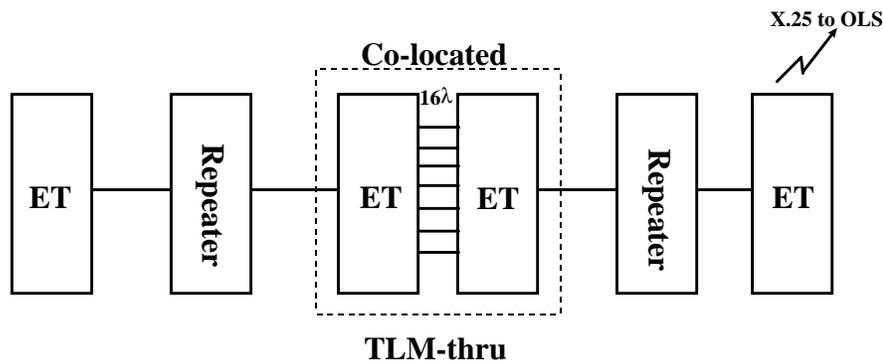


Figure 3-16. Telemetry-thru

There cannot be more than 32 OLS single-facing ETs, repeaters and dual-facing terminals in configurations connected via the telemetry-thru capability. Each single-facing end terminal at the telemetry-thru location counts as one network element for a total of two at that site. Dual-facing end terminals may not be equipped with the telemetry thru feature.

Beginning in Release 4.0, the IAOLAN may also be used at end-terminal (either single or dual-facing) locations to extend data communications. Up to 25 OLS 40G end terminals may be connected to the IAOLAN. In this case, the IS-IS Level 2 engineering rules and guidelines may apply.

Dual-facing and single-facing end terminals may be equipped with the IAOLAN. Single-facing end terminals may be equipped for IAOLAN or TLM-thru, but not for both features at the same time.

Product Description

4

■ Introduction	4-2
■ WaveStar OLS 40G Bay/Cabinet Design.....	4-3
■ WaveStar OLS 40G Shelf Design.....	4-5
■ WaveStar OLS 40G Shelf Descriptions	4-10
End Terminal Shelf	4-10
WaveStar OLS 40G Repeater Shelf	4-12
OT System Controller Shelf	4-13
OT Complementary Shelves 1 and 2.....	4-14
■ End Terminal Shelf 1 Configurations	4-16
1A-TX End Terminal	4-16
1A-TX-THRU End Terminal	4-17
1A-RCV End Terminal	4-18
1A-RCV-THRU End Terminal	4-19
Dual Facing (DUAL) End Terminal	4-20
Single Optical Amplifier 1A-TX End Terminal	4-21
Single Optical Amplifier 1A-TX-THRU End Terminal	4-22
Single Optical Amplifier 1A-RCV End Terminal	4-23
Single Optical Amplifier 1A-RCV-THRU End Terminal.....	4-24
Single Optical Amplifier Dual Facing End Terminal ...	4-25
■ End Terminal Shelf 2	4-26
Purpose of End Terminal Shelf 2	4-26
End Terminal Shelf 2 Circuit Packs/Units	4-26
■ End Terminal Shelf 2 Configurations	4-29
1A-TX End Terminal	4-29
1A-RCV End Terminal	4-30

Dual Facing End Terminal	4-31
Single Optical Amplifier 1A-TX End Terminal.....	4-32
Single Optical Amplifier 1A-RCV End Terminal.....	4-33
Single Optical Amplifier Dual Facing End Terminal....	4-34
■ WaveStar OLS 40G Packages	4-35
■ WaveStar OLS 40G Integration Cable Engineering	4-49
Integration Cable Descriptions	4-49
Integration Cable Configurations	4-50
■ Transmission Circuit Packs	4-53
Optical Amplifier (OA)	4-53
Optical Multiplexer Unit (OMU)	4-54
Self-Powered OMU (SPOMU)	4-55
Optical Demultiplexer Unit (ODU).....	4-55
Self-Powered ODU (SPODU)	4-55
Optical Translator Unit (OTU)	4-55
Quad Optical Translator Unit (QOTU)	4-56
Optical Translator Port Module (OTPM)	4-58
Telemetry (TLM)	4-58
Intra-Office Line Relay Pack (IAOLRP)	4-58
■ Control Circuit Packs	4-59
System Controller (SYSCTL).....	4-59
System Memory (SYSMEM).....	4-59
Tributary Overhead Controller (TOHCTL)	4-59
OT Controller (OTCTL).....	4-60
■ Cable Dressing	4-60
■ Interconnection Panels	4-62
WaveStar OLS 40G Interconnection Panel	4-62
OT Interconnection Panel (System Controller Shelf).....	4-63
OT Interconnection Panel (Complementary Shelves)	4-64
WaveStar OLS 40G Cabinet Indicator Strips	4-66
Panels.....	4-70
OT Shelf Fuse Panel Assembly in Cabinet Configurations	4-75
■ Power	4-76
Power Cables	4-76

Power Distribution for End Terminal and Repeater Bay/Cabinet	4-77
WaveStar OLS 40G Integrated Bay (Single) and OT Bay/Cabinet Power Distribution	4-78
Shelf-Level Power Distribution	4-79

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:

- End Terminal Cabinet for 4 Bidirectional Optical Lines
- Repeater Cabinet for 4 Bidirectional Optical Lines
- Dual End Terminal Cabinet or Bay
- Dual Repeater Cabinet or Bay
- End Terminal and Repeater Cabinet or Bay
- End Terminal Shelf (miscellaneously-mounted)
- Repeater Shelf (miscellaneously-mounted)
- Integrated Bay (Single)
- Integrated Cabinet or Bay (Double)
- Integrated Cabinet or Bay (Triple 1)
- Integrated Cabinet or Bay (Triple 2)

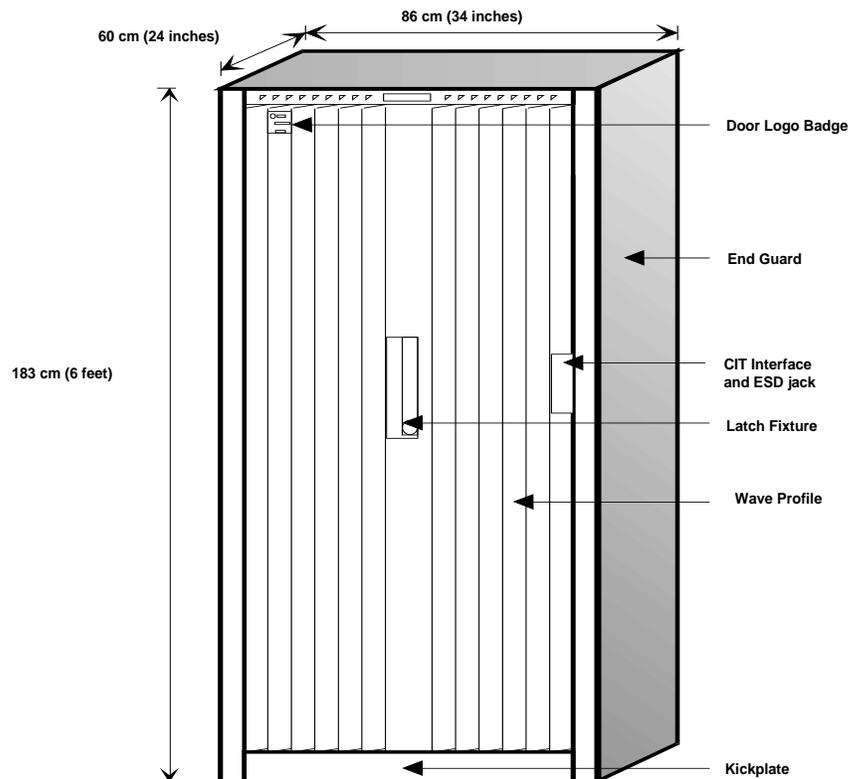
Additional Optical Translator (OT) equipment is available in the following equipment packages:

- 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.”

WaveStar OLS 40G Bay/Cabinet Design

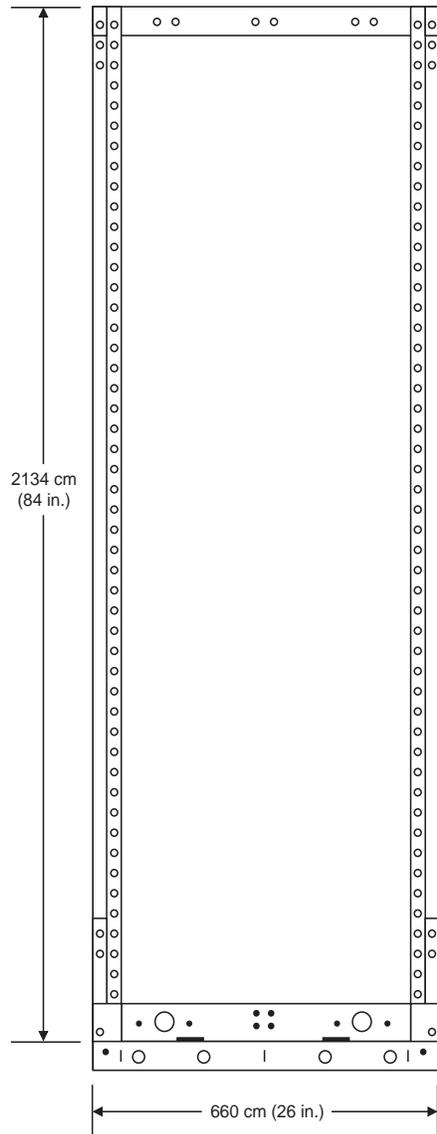
WaveStar OLS 40G Bay and Cabinet shelves are similar to each other but have key differences. Bay-mounted shelves have front covers while cabinet shelves have front doors. In addition, a bay frame arrangement or miscellaneous-mounted unit has heat baffles attached to the shelf, whereas heat baffles are supplied as a physical component of the cabinet (one heat baffle is located between the two shelves). In addition, miscellaneous-mounted shelves are not used in cabinet arrangements. Figure 4-1 shows the WaveStar OLS 40G Cabinet.



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Figure 4-1. WaveStar OLS 40G Cabinet (Doors Closed)

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



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Figure 4-2. WaveStar OLS 40G Bay Frame

WaveStar OLS 40G Shelf Design

WaveStar OLS 40G 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, miscellaneous-mounted units.

Miscellaneous-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 miscellaneous-mounted WaveStar OLS 40G shelf with front covers (bay-mounted shelves are similar).

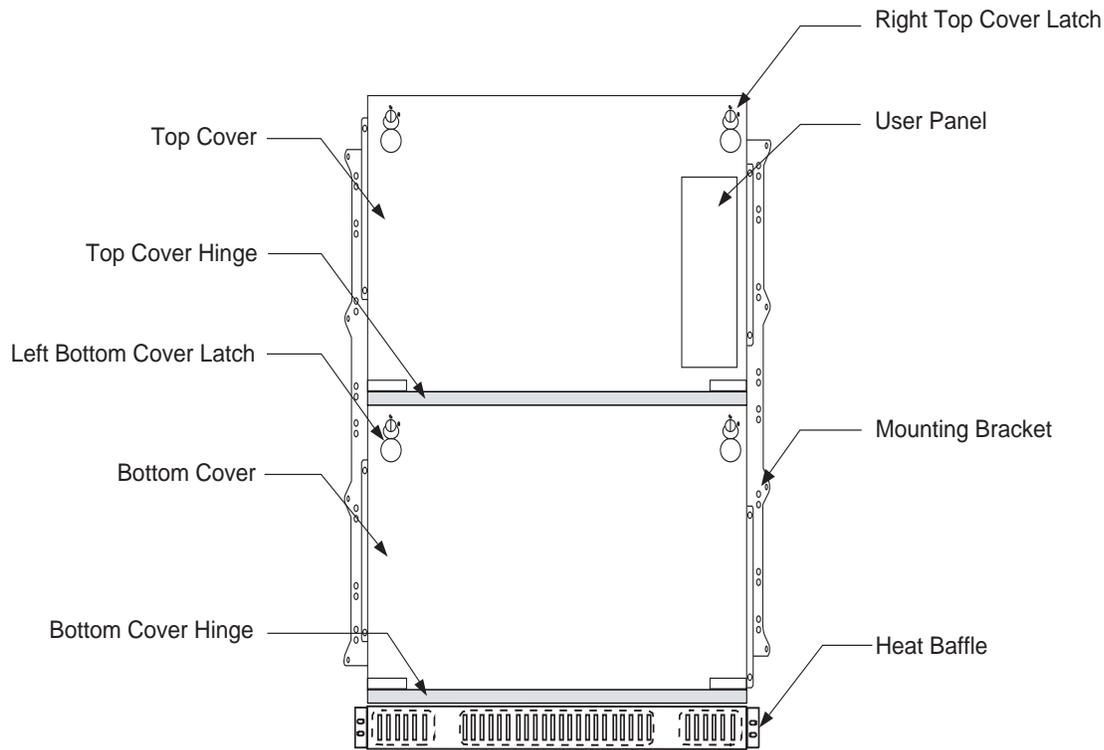
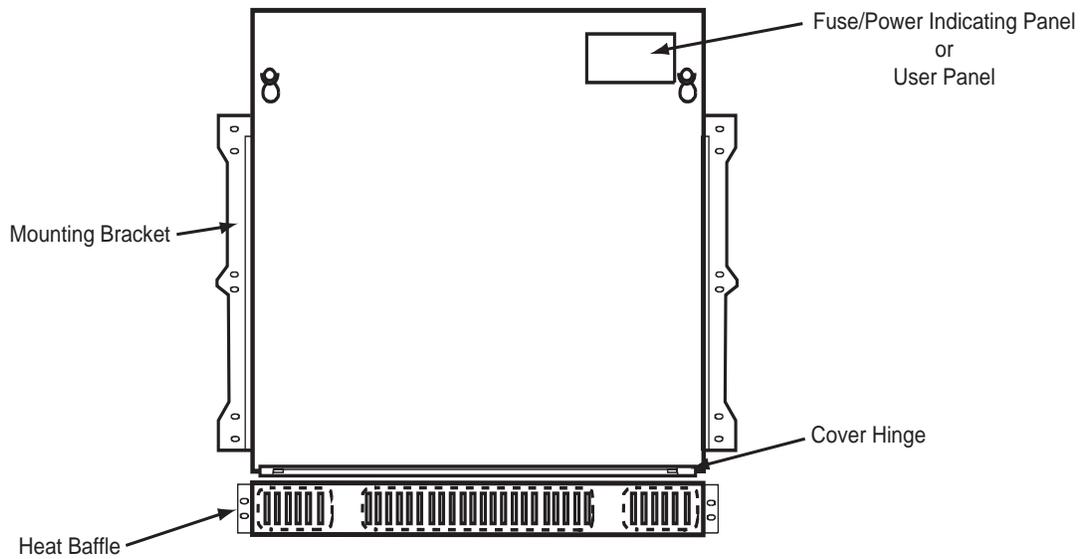


Figure 4-3. Miscellaneous-Mounted WaveStar OLS 40G Shelf with Front Covers (flat cover shown)

Miscellaneous-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 miscellaneous-mounted OT shelf with front cover (bay-mounted shelves are similar).



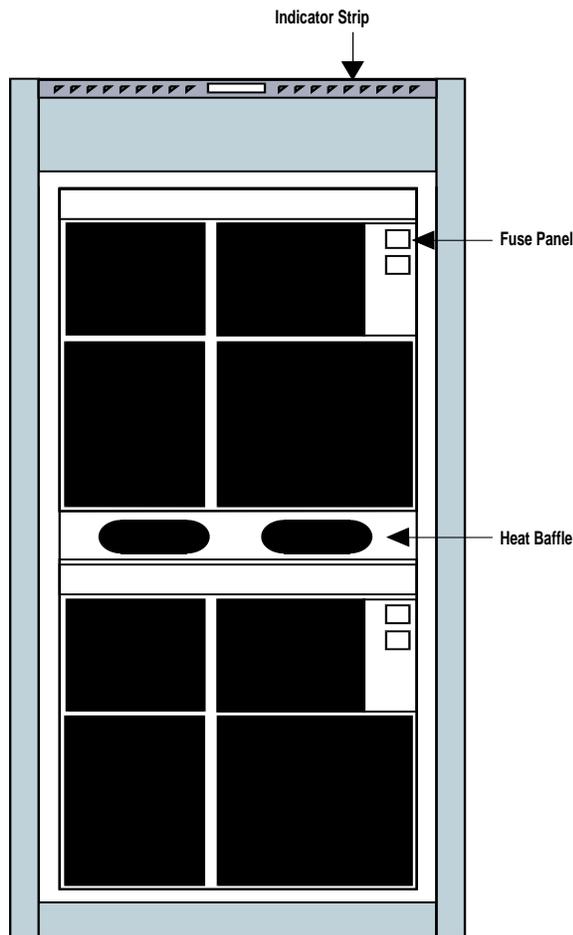
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Figure 4-4. Miscellaneous-mounted OT Shelf with Front Cover (flat cover shown)

WaveStar OLS 40G 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).

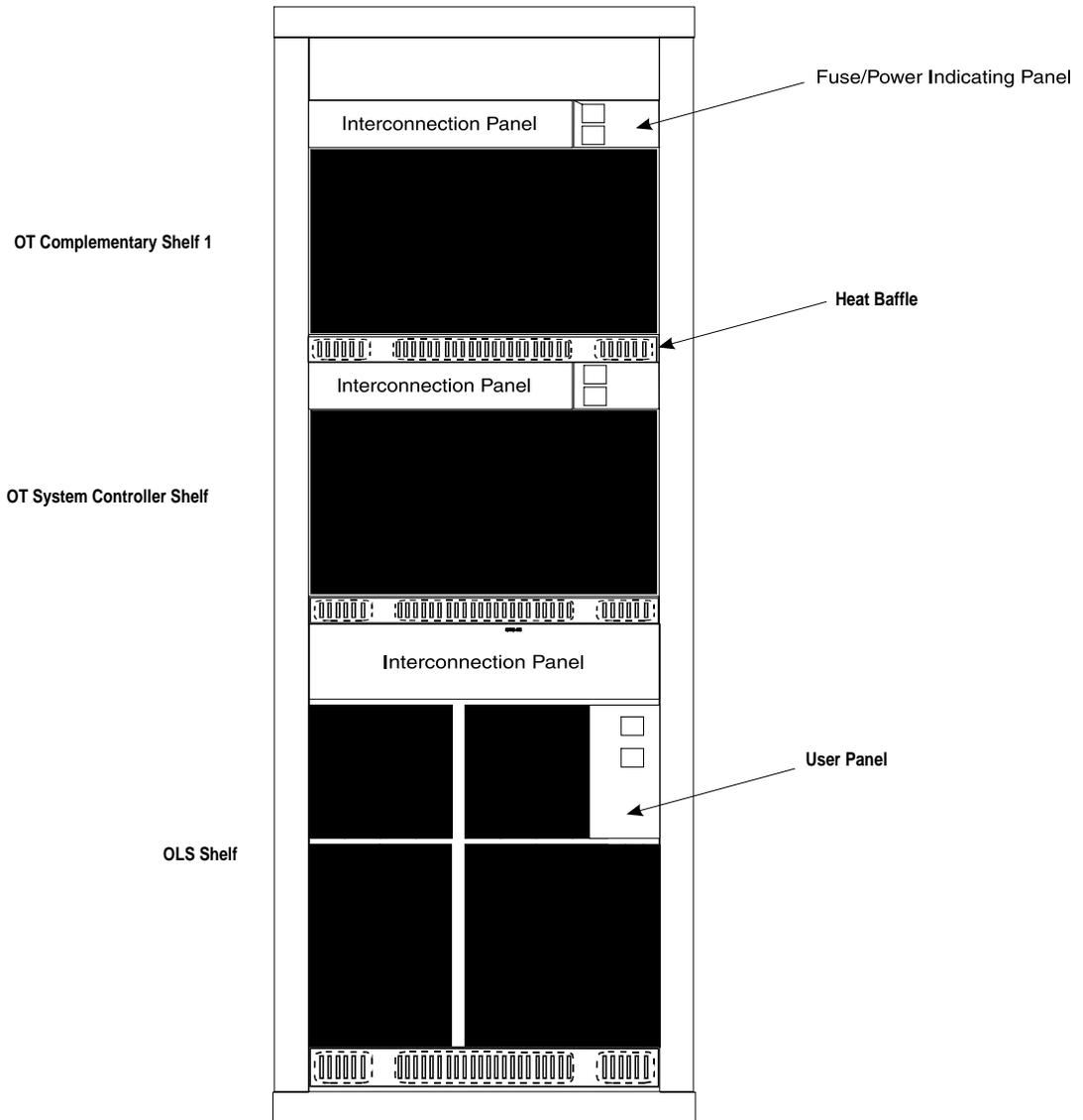
Figure 4-5 shows the WaveStar OLS 40G cabinet shelf (cabinet doors open). Externally, it is similar to the OT Cabinet.



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Figure 4-5. WaveStar OLS 40G Cabinet Shelf

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



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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:

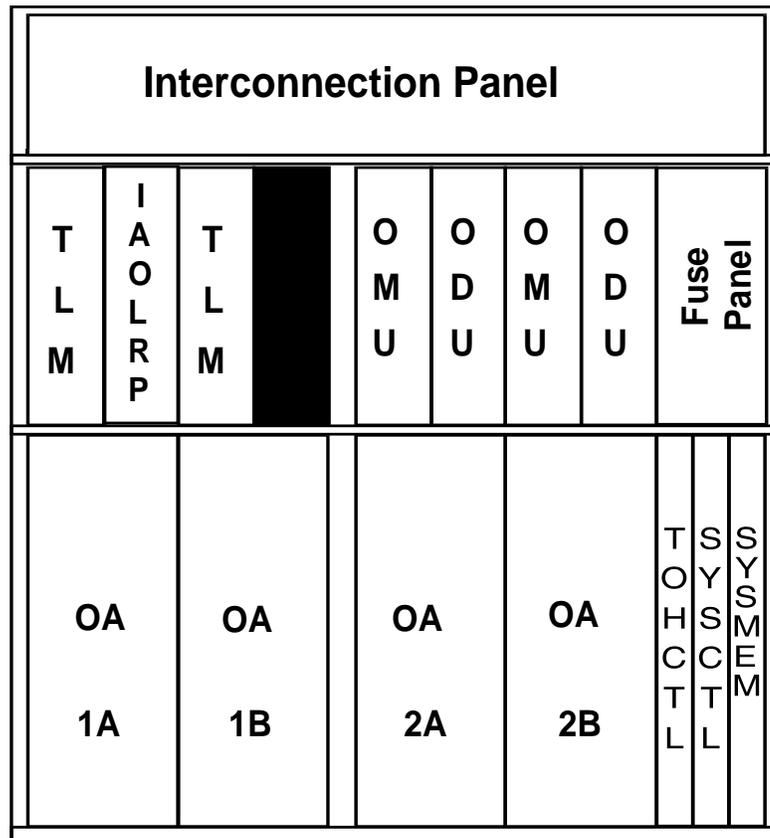
- End Terminal Shelf
- Repeater Shelf
- Optical Translator System Controller Shelf
- Optical Translator Complementary Shelves 1 and 2.

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). The shelf displayed in Figure 4-7 is also equipped with an IAOLRP circuit pack, new in Release 4.0, which allows the shelf to operate over the IAOLAN interface. This circuit pack, as shown, is installed in the TLM slot 1B of an End Terminal which would otherwise remain empty.

For information on circuit packs, refer to “WaveStar OLS 40G Integration Cable Engineering” and “Control Circuit Packs” later in this chapter. See Chapter 5, “Operations, Administration, Maintenance, and Provisioning,” for provisioning information and shelf illustrations.



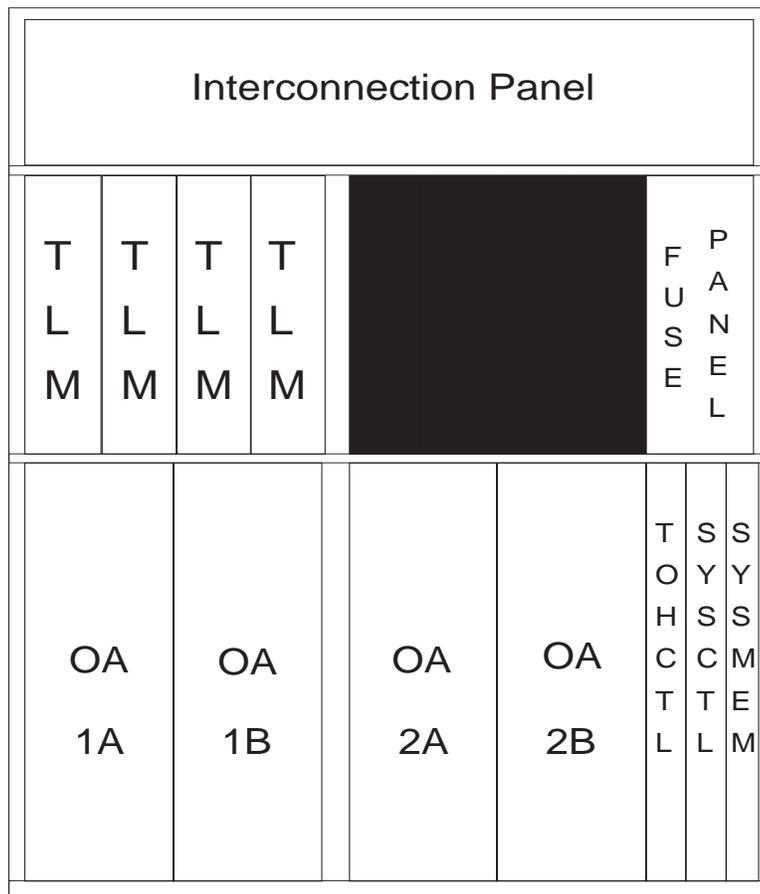
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NOTE: For telemetry thru applications, the IAOLRP is not used; up to two additional TLM Circuit packs are used.

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 “WaveStar OLS 40G Integration Cable Engineering” and “Control Circuit Packs” later in this chapter.



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

OT System Controller Shelf

To accommodate 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 SYS-MEM circuit packs in the WaveStar OLS 40G shelf. For information on circuit packs, refer to “WaveStar OLS 40G Integration Cable Engineering” and “Control Circuit Packs” later in this chapter.

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

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

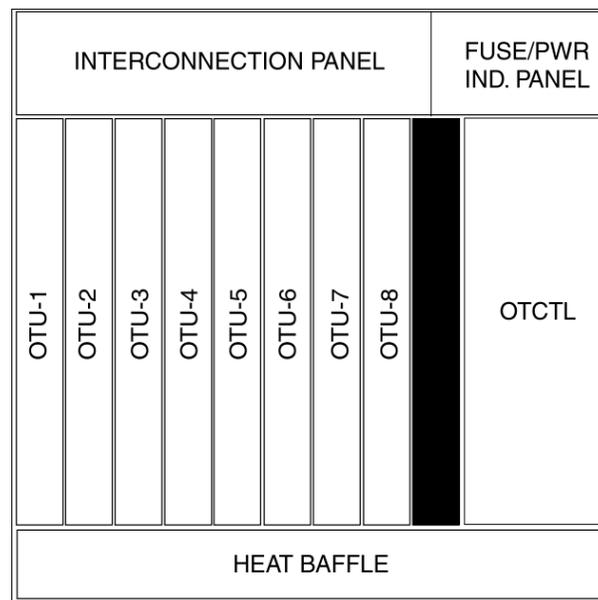


Figure 4-9. Miscellaneous-mounted OT System Controller Shelf (8 OTUs; fully equipped)

OT Complementary Shelves 1 and 2

Each miscellaneous-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 “WaveStar OLS 40G Integration Cable Engineering” 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 miscellaneous-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.

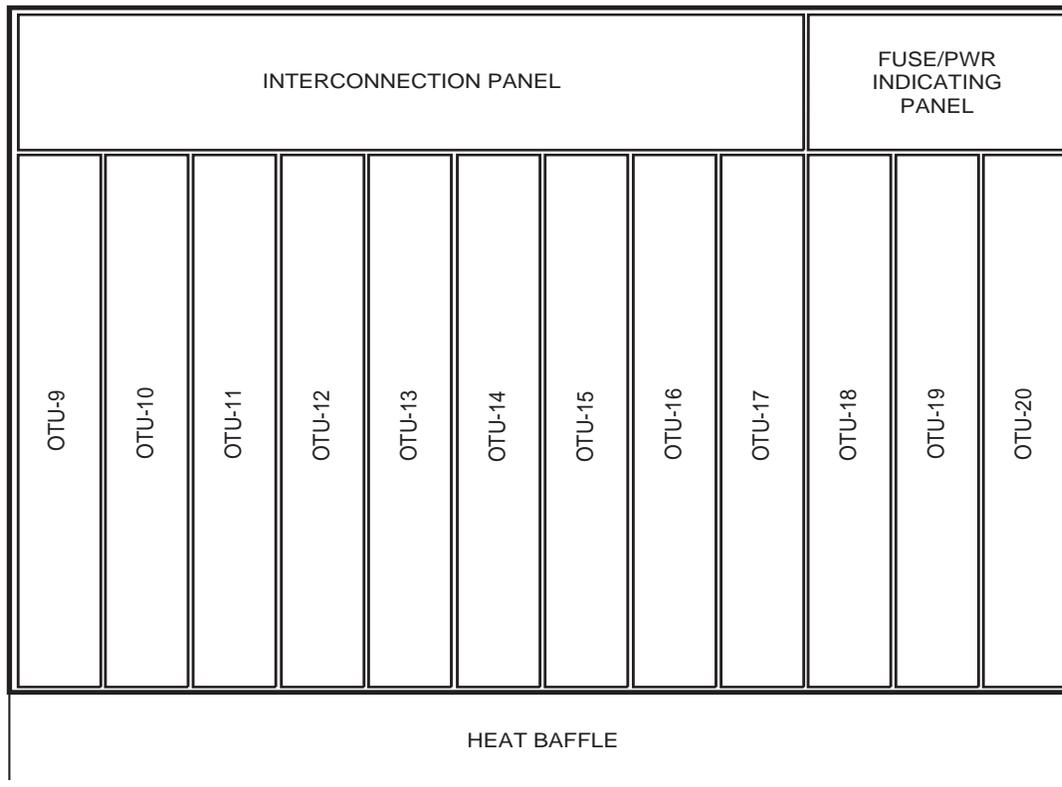


Figure 4-10. Miscellaneous-Mounted Complementary Shelf 1 (12 OTUs; fully equipped)

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. In this case, the OMU and ODU packs are not equipped in the OLS end terminal shelf.

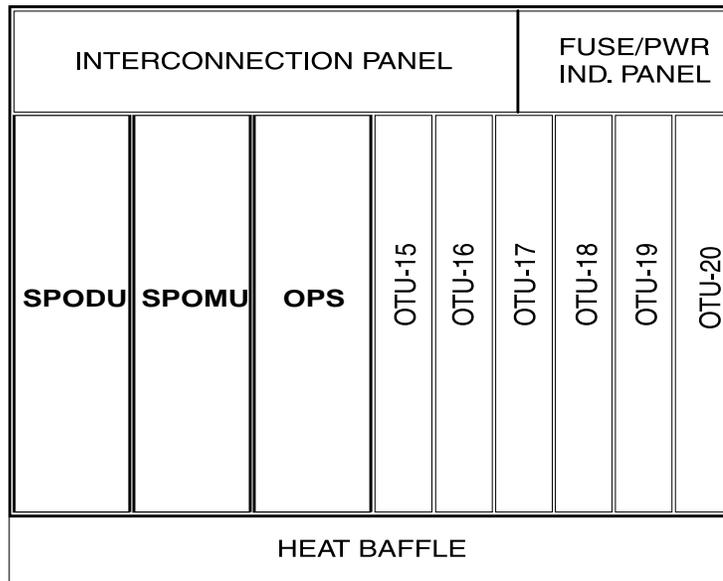


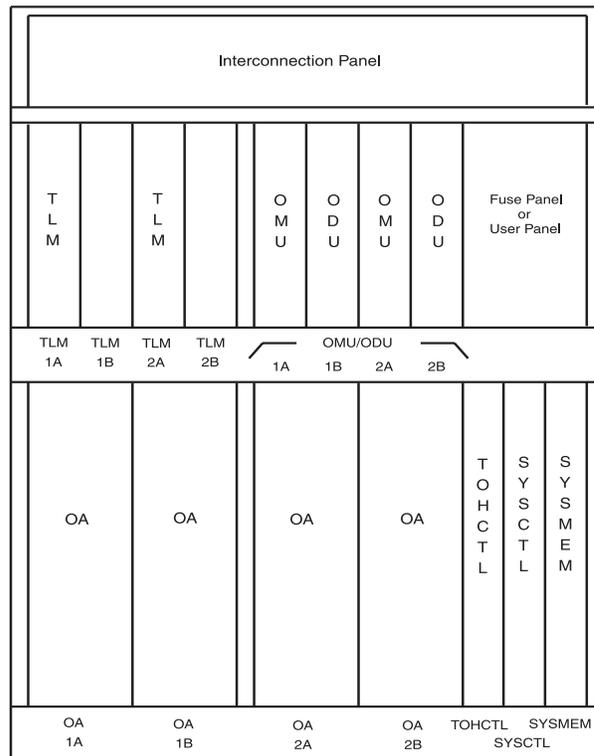
Figure 4-11. OT Complementary Shelf Location

End Terminal Shelf 1 Configurations

This section provides information on end terminal configurations for Shelf 1.

1A-TX End Terminal

The End Terminal Shelf 1 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-TX. Figure 4-12 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 1A and OA 2A slots act as transmitters, and the OA circuit packs in the OA 1B and OA 2B slots act as receivers. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.

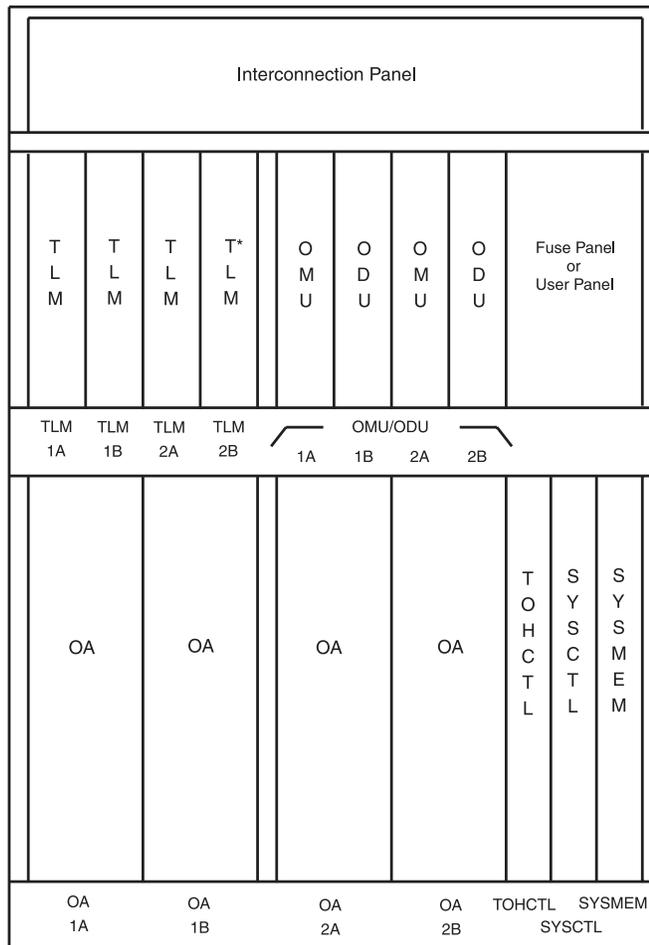


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Figure 4-12. 1A-TX End Terminal Configuration (End Terminal Shelf 1)

1A-TX-THRU End Terminal

The End Terminal Shelf 1 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-TX-THRU. Figure 4-13 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 1A and OA 2A slots act as transmitters, and the OA circuit packs in the OA 1B and OA 2B slots act as receivers. The TLM circuit packs in the TLM 1B and TLM 2B slots are used to extend the data communication channel in 4-fiber ring applications (telemetry feed through).

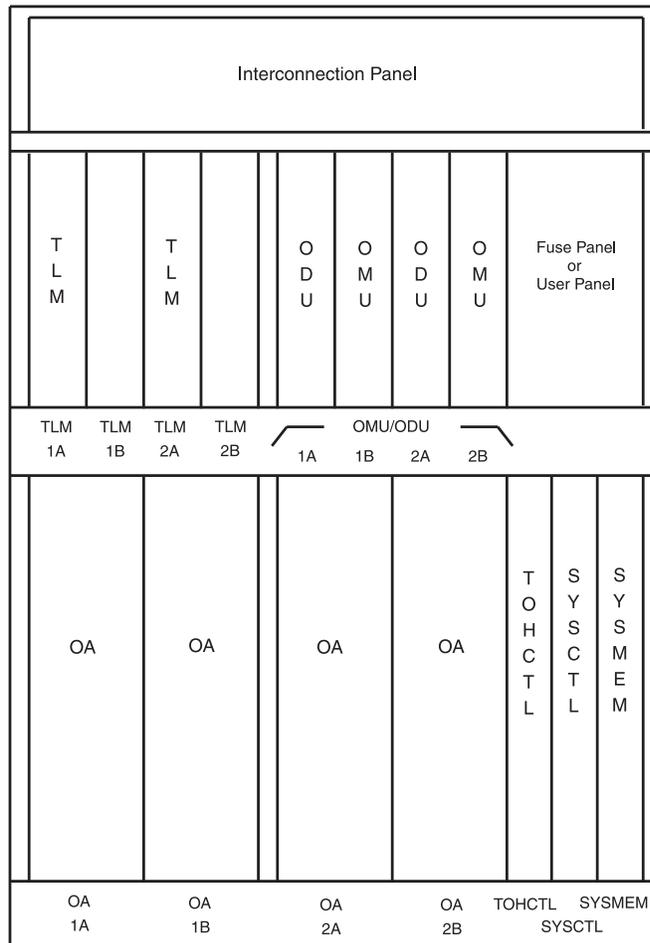


* Required for DCC protection.

Figure 4-13. 1A-TX-THRU End Terminal Configuration (End Terminal Shelf 1)

1A-RCV End Terminal

The End Terminal Shelf 1 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-RCV. Figure 4-14 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 1A and OA 2A slots act as receivers, and the OA circuit packs in the OA 1B and OA 2B slots act as transmitters. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.

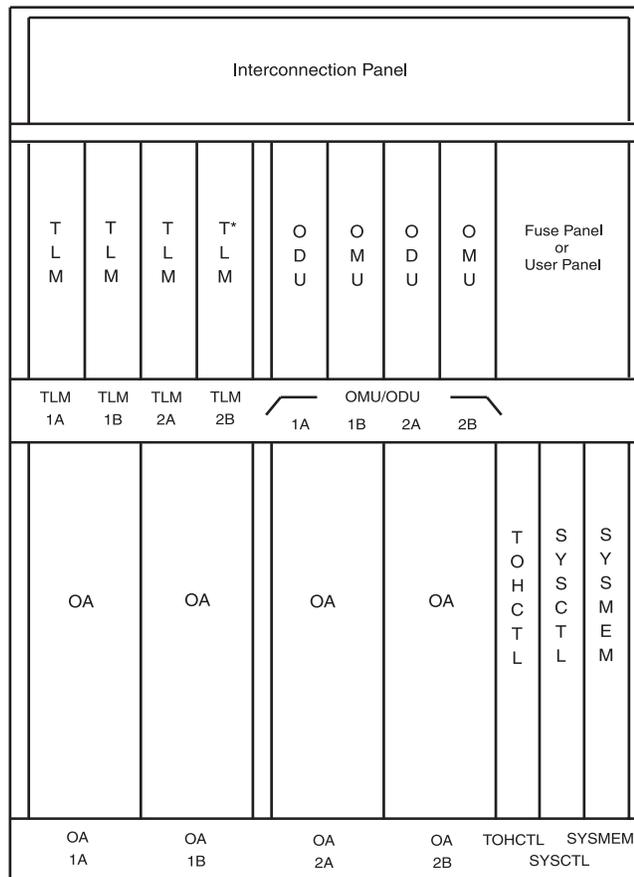


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Figure 4-14. 1A-RCV End Terminal Configuration (End Terminal Shelf 1)

1A-RCV-THRU End Terminal

The End Terminal Shelf 1 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-RCV-THRU. Figure 4-14 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 1A and OA 2A slots act as receivers, and the OA circuit packs in the OA 1B and OA 2B slots act as transmitters. The TLM circuit packs in the TLM 1B and TLM 2B slots are used to extend the data communication channel in 4-fiber ring applications (telemetry feed through).

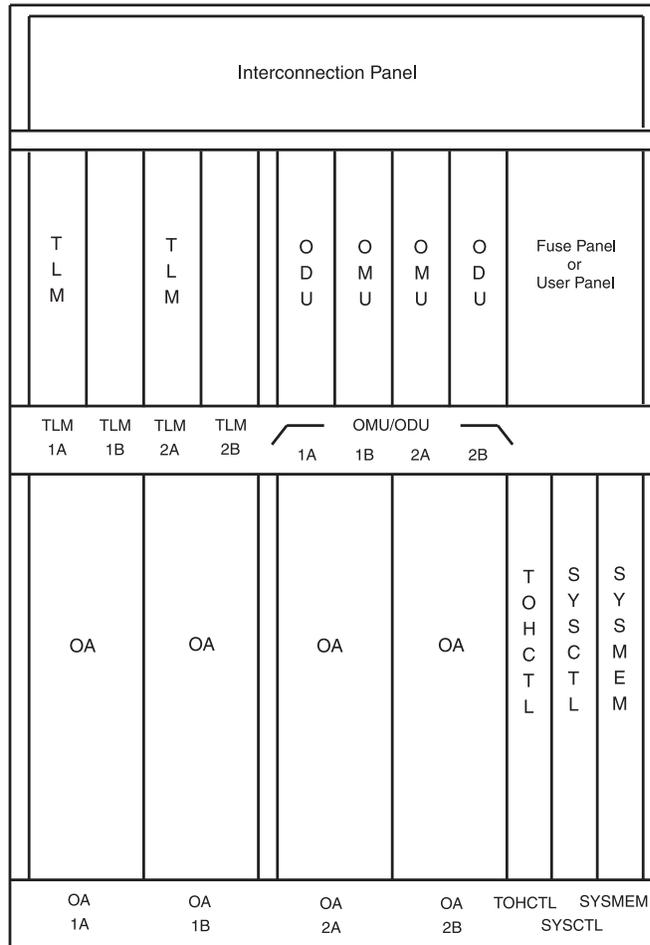


* Required for DCC protection.

Figure 4-15. 1A-RCV-THRU End Terminal Configuration (End Terminal Shelf1)

Dual Facing (DUAL) End Terminal

The End Terminal Shelf 1 may be configured with two OA circuit packs per bidirectional optical line and provisioned as DUAL. DUAL indicates that the end terminal has two sides (side 1 and side 2). Side 1 represents line 1, and side 2 represents line 2. Each side is provisioned separately. Figure 4-16 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. The side 1 (line 1) OMU/ODU 1A/1B slot pair must be equipped as a 1A-RCV end terminal, and the side 2 (line 2) OMU/ODU 2A/2B slot pair must be equipped as a 1A-TX end terminal. The OA circuit packs in slots OA 1B and OA 2A act as transmitters, and the OA circuit packs in slots OA 1A and OA 2B act as receivers. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.

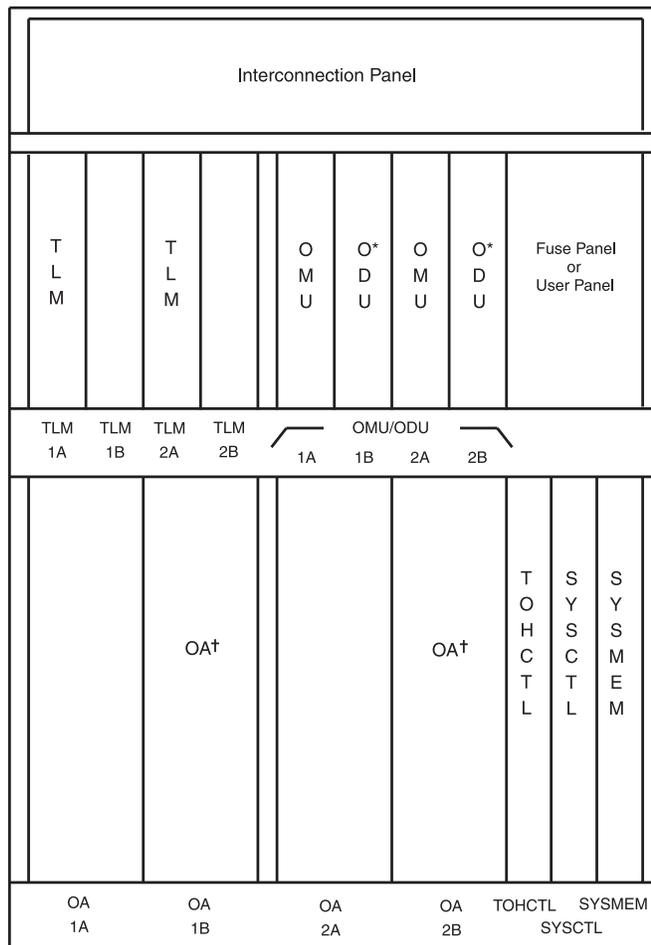


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Figure 4-16. Dual Facing End Terminal Configuration (End Terminal Shelf 1)

Single Optical Amplifier 1A-TX End Terminal

The End Terminal Shelf 1 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-TX. Figure 4-17 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 1B and OA 2B slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.

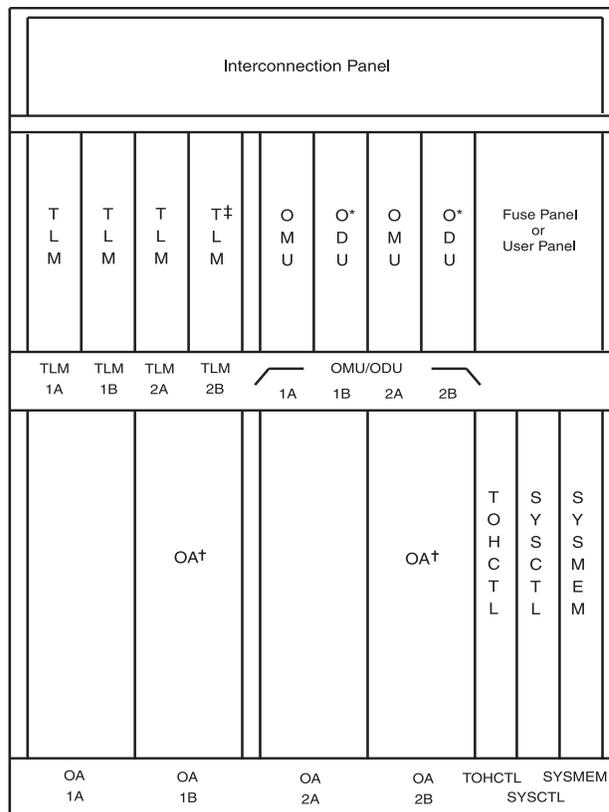


* 606B Optical Demultiplexing Unit only.
 † LEA105 Optical Amplifier Circuit Pack only.

Figure 4-17. Single Optical Amplifier 1A-TX End Terminal Configuration (End Terminal Shelf 1)

Single Optical Amplifier 1A-TX-THRU End Terminal

The End Terminal Shelf 1 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-TX-THRU. Figure 4-18 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 1B and OA 2B slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs. The TLM circuit packs in the TLM 1B and TLM 2B slots are used to extend the data communication channel in 4-fiber ring applications (telemetry feed through).

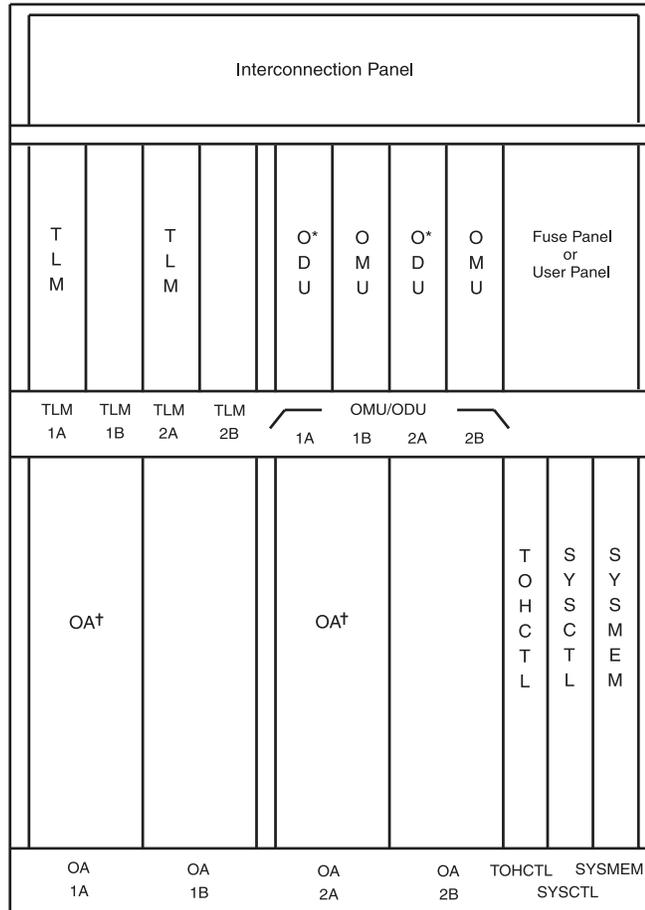


* 606B Optical Demultiplexing Unit only.
 † LEA105 Optical Amplifier Circuit Pack only.
 ‡ Required for DCC protection.
 849939/01.10

Figure 4-18. Single Optical Amplifier 1A-TX-THRU End Terminal Configuration (End Terminal Shelf 1)

Single Optical Amplifier 1A-RCV End Terminal

The End Terminal Shelf 1 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-RCV. Figure 4-19 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 1A and OA 2A slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.



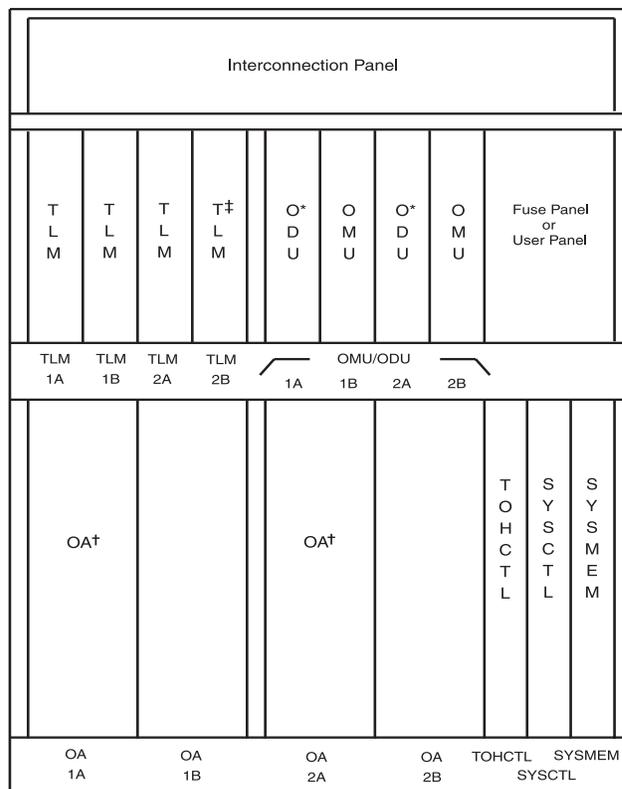
* 606B Optical Demultiplexing Unit only.

† LEA105 Optical Amplifier Circuit Pack only.

Figure 4-19. Single Optical Amplifier 1A-RCV End Terminal Configuration (End Terminal Shelf 1)

Single Optical Amplifier 1A-RCV-THRU End Terminal

The End Terminal Shelf 1 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-RCV-THRU. Figure 4-20 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 1A and OA 2A slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs. The TLM circuit packs in the TLM 1B and TLM 2B slots are used to extend the data communication channel in 4-fiber ring applications (telemetry feed through).

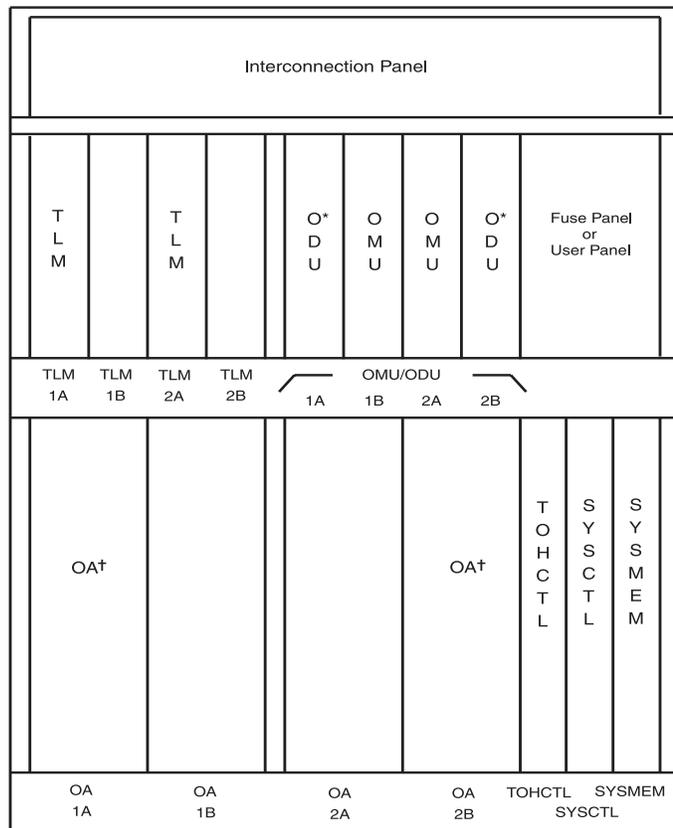


* 606B Optical Demultiplexing Unit only.
† LEA105 Optical Amplifier Circuit Pack only.
‡ Required for DCC protection. 849939/01.11

Figure 4-20. Single Optical Amplifier 1A-RCV-THRU End Terminal Configuration (End Terminal Shelf 1)

Single Optical Amplifier Dual Facing End Terminal

The End Terminal Shelf 1 may be configured with one OA circuit pack per bidirectional optical line and provisioned as DUAL. DUAL indicates that the end terminal has two sides (side 1 and side 2). Side 1 represents line 1, and side 2 represents line 2. Each side is provisioned separately. Figure 4-21 shows the End Terminal Shelf 1 equipped for 2 bidirectional optical lines. The side 1 (line 1) OMU/ODU 1A/1B slot pair must be equipped as a 1A-RCV end terminal, and the side 2 (line 2) OMU/ODU 2A/2B slot pair must be equipped as a 1A-TX end terminal. The OA circuit packs in the OA 1A and OA 2B slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs. The IAOLRP circuit pack in the TLM 1B slot is required for the IAOLAN interface.



* 606B Optical Demultiplexing Unit only.
 † LEA105 Optical Amplifier Circuit Pack only.

Figure 4-21. Single Optical Amplifier Dual Facing End Terminal Configuration (End Terminal Shelf 1)

End Terminal Shelf 2

Purpose of End Terminal Shelf 2

The End Terminal Shelf 2 serves as an interface for up to 32 OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, and/or 150-750 Mb/s drop side signals and 2 bidirectional optical lines (optical lines 3 and 4). Up to 16 drop side signals and a supervisory signal are combined onto a single optical line using dense wavelength division multiplexing and optically amplified.

The End Terminal Shelf 2 is only used in 4-line systems.

The End Terminal Shelf 2 (Figure 4-21) consists of a fully connectorized interconnection panel, a fuse panel, and 15 circuit pack/unit slots. It measures 29 inches high by 20 inches wide by 12 inches deep and fits in a Lucent Technologies *Newlook 2000* cabinet. The End Terminal Shelf 2 is designed according to European Telecommunications Standard Institute (ETSI) standards documented in European Telecommunications Standard (ETS) 300119-4, September 1993.

End Terminal Shelf 2 Circuit Packs/Units

The End Terminal Shelf 2 (Figure 4-21) provides the following circuit pack/unit slots:

- **TLM 3A and 4A:** Two slots are provided for the LDA1 Telemetry Controller (TLM) circuit pack.
- **OMU/ODU 3A, 3B, 4A, and 4B:** Two slots are provided for the 505A or 506A Optical Multiplexing Unit (OMU), and two slots are provided for the 605A, 606A, or 606B Optical Demultiplexing Unit (ODU). The 506A OMU, 606A ODU, and 606B ODU are compatible with Release 2.1.0-OLS and later software. The OMUs and ODUs are units, not circuit packs.

For more information about equipping these circuit pack/unit slots in the End Terminal Shelf 2, refer to “End Terminal Shelf 2 Configurations” in this section.

OA 3A, OA 3B, OA 4A, and OA 4B: Four slots are provided for the LEA6, LEA7, LEA7B, LEA104, or LEA105 Optical Amplifier (OA) circuit pack. The LEA105 OA circuit pack is compatible with Release 2.1 and later software. The LEA104 OA circuit pack is compatible with Release 3.0.1-OLS and later software.

For more information about equipping these circuit pack/unit slots in the End Terminal Shelf 2, refer to “End Terminal Shelf 2 Configurations” in this section.

Table 4-1 also provides circuit pack slot, circuit pack/unit code, and software compatibility information.

The LDA1 TLM circuit packs have one latch assembly at the top of the circuit pack. The 505A OMU and 605A ODU are fastened to the shelf using screws. All circuit packs in the bottom part of the shelf have latch assemblies at the top and bottom of the circuit pack.

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

Table 4-1. End Terminal Shelf 2 Circuit Pack Slot/Circuit Pack/Unit Code/Software Compatibility

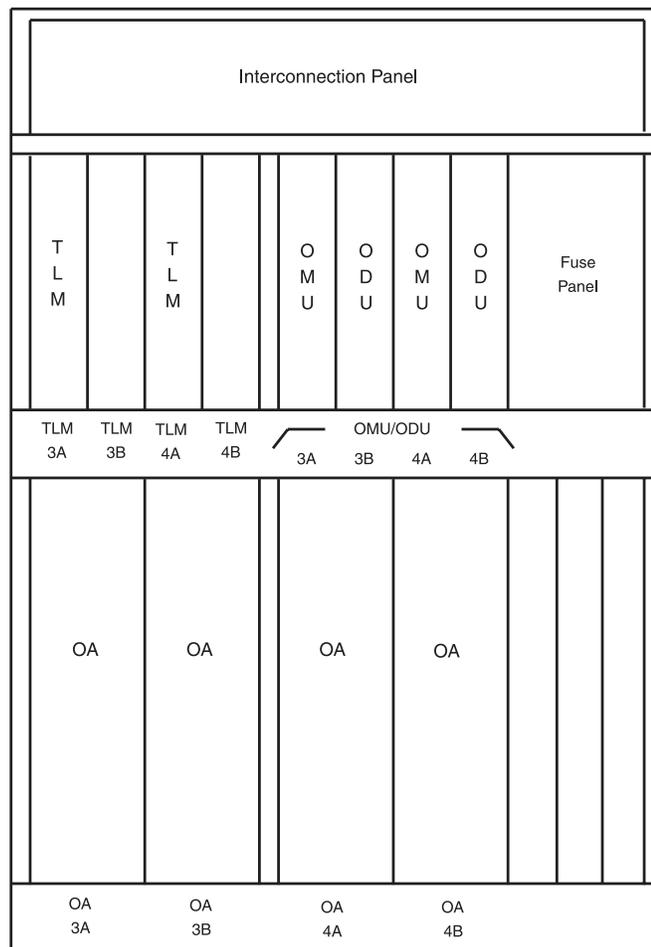
Circuit Pack Slot	Supported Circuit Pack/Unit Codes	Compatible Software					
		R1.0.0 -OLS	R2.0.0 -OLS	R2.1.0 -OLS	R3.0.1 -OLS	R3.1.1 -OLS	R4.0.0 -OLS
TLM 3A and 4A	LDA1 TLM	X	X	X	X	X	X
OMU/ODU 3A	505A OMU	X	X	X	X	X	X
	506A OMU			X	X	X	X
	605A ODU	X	X	X	X	X	X
	606A ODU			X	X	X	X
	606B ODU			X	X	X	X
OMU/ODU 3B	505A OMU	X	X	X	X	X	X
	506A OMU			X	X	X	X
	605A ODU	X	X	X	X	X	X
	606A ODU			X	X	X	X
	606B ODU			X	X	X	X
OMU/ODU 4A	505A OMU	X	X	X	X	X	X
	506A OMU			X	X	X	X
	605A ODU	X	X	X	X	X	X
	606A ODU			X	X	X	X
	606B ODU			X	X	X	X
OMU/ODU 4B	505A OMU	X	X	X	X	X	X
	506A OMU			X	X	X	X
	605A ODU	X	X	X	X	X	X
	606A ODU			X	X	X	X
	606B ODU			X	X	X	X
OA 3A - 4B	LEA6 OA	X	X	X	X	X	X

Circuit Pack Slot	Supported Circuit Pack/Unit Codes	Compatible Software					
		R1.0.0 -OLS	R2.0.0 -OLS	R2.1.0 -OLS	R3.0.1 -OLS	R3.1.1 -OLS	R4.0.0 -OLS
	LEA7 OA	X	X	X	X	X	X
	LEA7B OA	X	X	X	X	X	X
	LEA104 OA				X	X	X
	LEA105 OA			X	X	X	X

End Terminal Shelf 2 Configurations

1A-TX End Terminal

End Terminal Shelf 2 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-TX. Figure 4-22 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 3A and OA 4A slots act as transmitters, and the OA circuit packs in the OA 3B and OA 4B slots act as receivers.

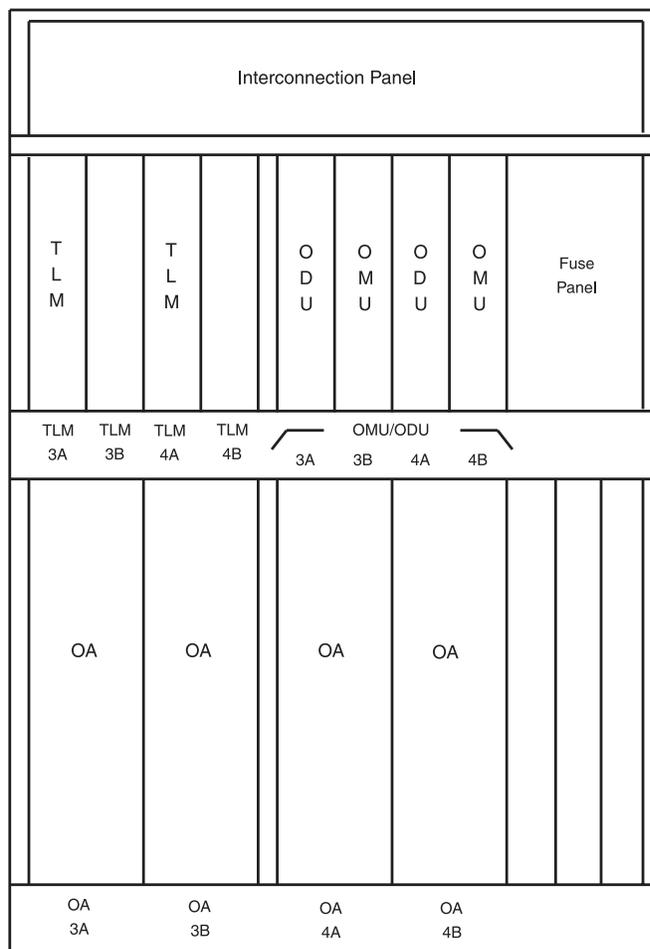


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Figure 4-22. 1A-TX End Terminal Configuration (End Terminal Shelf 2)

1A-RCV End Terminal

The End Terminal Shelf 2 may be configured with two OA circuit packs per bidirectional optical line and provisioned as 1A-RCV. Figure 4-23 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 3A and OA 4A slots act as receivers, and the OA circuit packs in the OA 3B and OA 4B slots act as transmitters.



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Figure 4-23. 1A-RCV End Terminal Configuration (End Terminal Shelf 2)

Dual Facing End Terminal

The End Terminal Shelf 2 may be configured with two OA circuit packs per bidirectional optical line and provisioned as DUAL. DUAL indicates that the end terminal has two sides (side 1 and side 2). Side 1 represents line 3, and side 2 represents line 4. Each side is provisioned separately. Figure 4-24 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. The side 1 (line 3) OMU/ODU 3A/3B slot pair must be equipped as a 1A-RCV end terminal, and the side 2 (line 4) OMU/ODU 4A/4B slot pair must be equipped as a 1A-TX end terminal. The OA circuit packs in slots OA 3B and OA 4A act as transmitters, and the OA circuit packs in slots OA 3A and OA 4B act as receivers.

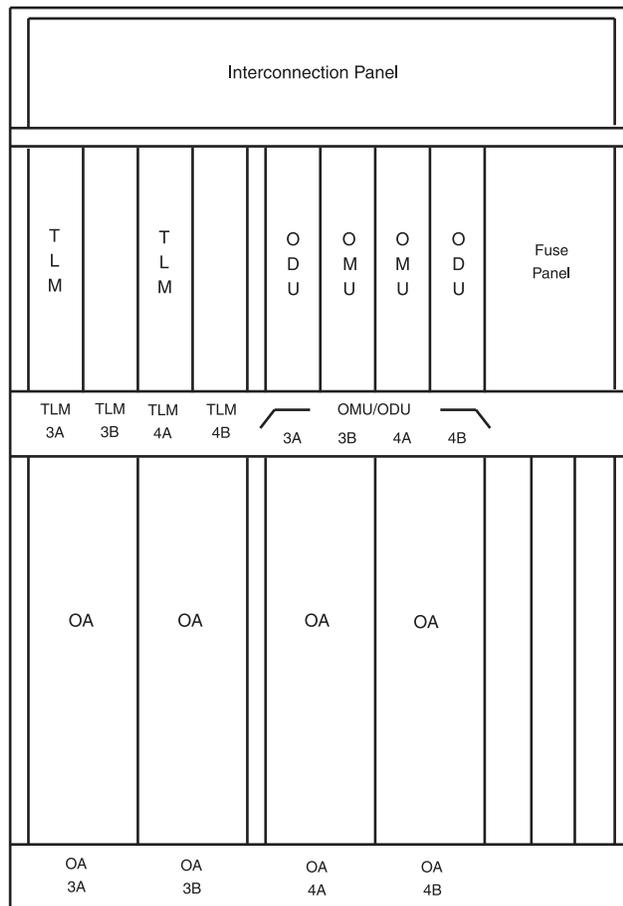
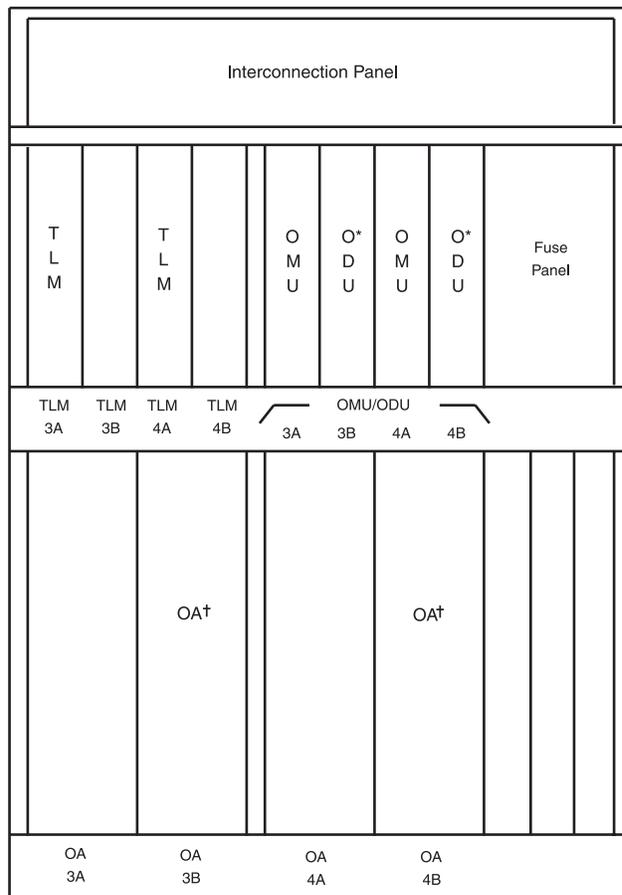


Figure 4-24. Dual Facing End Terminal Configuration (End Terminal Shelf 2)

Single Optical Amplifier 1A-TX End Terminal

The End Terminal Shelf 2 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-TX. Figure 4-25 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the OMU, and the B slot of the slot pair must be equipped with the ODU. The OA circuit packs in the OA 3B and OA 4B slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs.

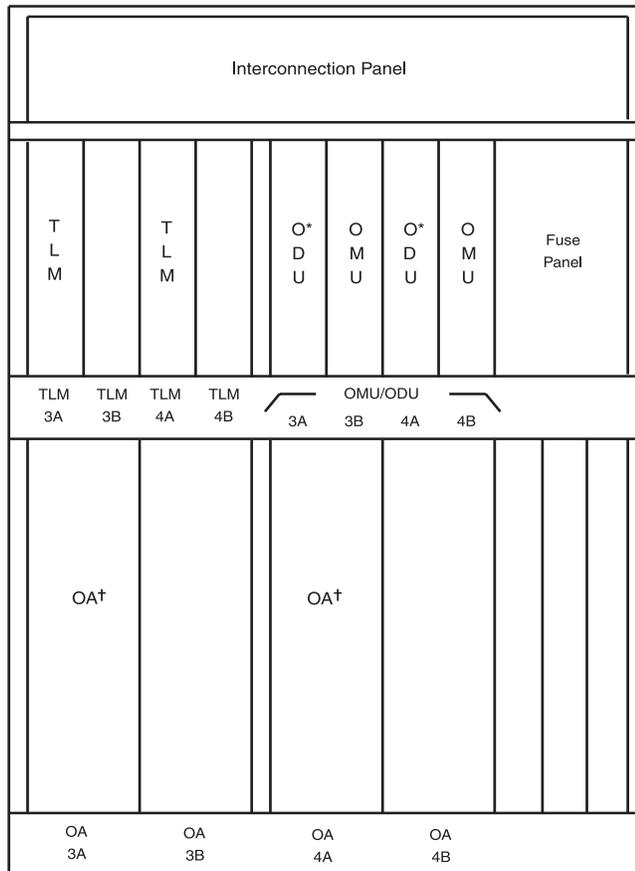


* 606B Optical Demultiplexing Unit only.
 † LEA105 Optical Amplifier Circuit Pack only.
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Figure 4-25. Single Optical Amplifier 1A-TX End Terminal Configuration (End Terminal Shelf 2)

Single Optical Amplifier 1A-RCV End Terminal

The End Terminal Shelf 2 may be configured with one OA circuit pack per bidirectional optical line and provisioned as 1A-RCV. Figure 4-26 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. In this configuration, the A slot of the OMU/ODU slot pair must be equipped with the ODU, and the B slot of the slot pair must be equipped with the OMU. The OA circuit packs in the OA 3A and OA 4A slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs.



* 606B Optical Demultiplexing Unit only.

† LEA105 Optical Amplifier Circuit Pack only.

Figure 4-26. Single Optical Amplifier 1A-RCV End Terminal Configuration (End Terminal Shelf 2)

Single Optical Amplifier Dual Facing End Terminal

The End Terminal Shelf 2 may be configured with one OA circuit pack per bidirectional optical line and provisioned as DUAL. DUAL indicates that the end terminal has two sides (side 1 and side 2). Side 1 represents line 3, and side 2 represents line 4. Each side is provisioned separately. Figure 4-27 shows the End Terminal Shelf 2 equipped for 2 bidirectional optical lines. The side 1 (line 3) OMU/ODU 3A/3B slot pair must be equipped as a 1A-RCV end terminal, and the side 2 (line 4) OMU/ODU 4A/4B slot pair must be equipped as a 1A-TX end terminal. The OA circuit packs in the OA 3A and OA 4B slots act as transmitters. The OA circuit packs must be located in the OA slots that correspond to the OMU/ODU slots that are equipped with ODUs. The OA circuit packs provide temperature control for the corresponding ODUs.

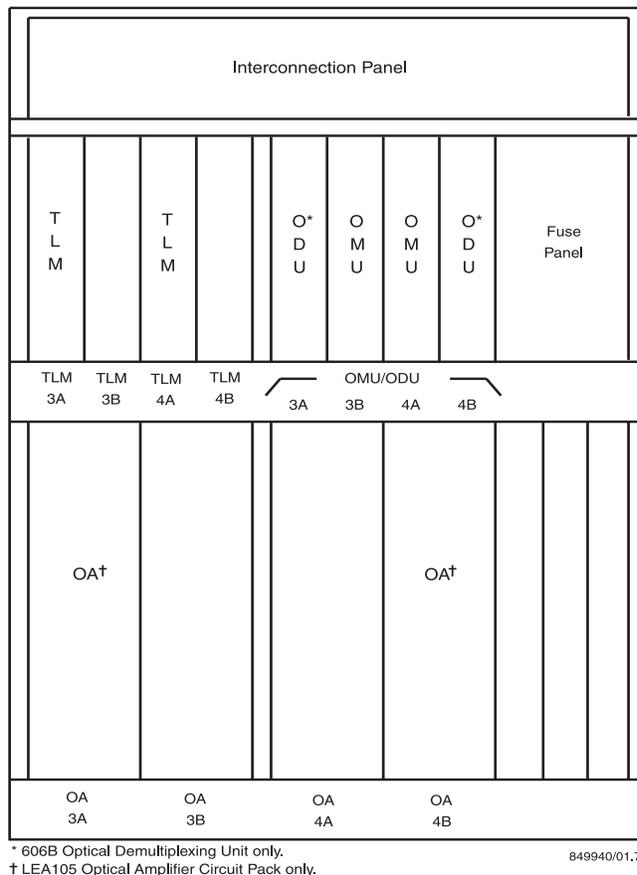


Figure 4-27. Single Optical Amplifier Dual Facing End Terminal Configuration (End Terminal Shelf 2)

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 4-28 and Figure 4-29)
- **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 4-30 and Figure 4-31)
- **End Terminal and Repeater Bay or Cabinet**— houses two independent shelves, each shelf having a maximum of two bidirectional optical lines (See Figure 4-32 and Figure 4-33)
- **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 4-34 and Figure 4-35)
- **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 4-36)
- **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 4-37)
- **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 4-38)
- **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 4-39).

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

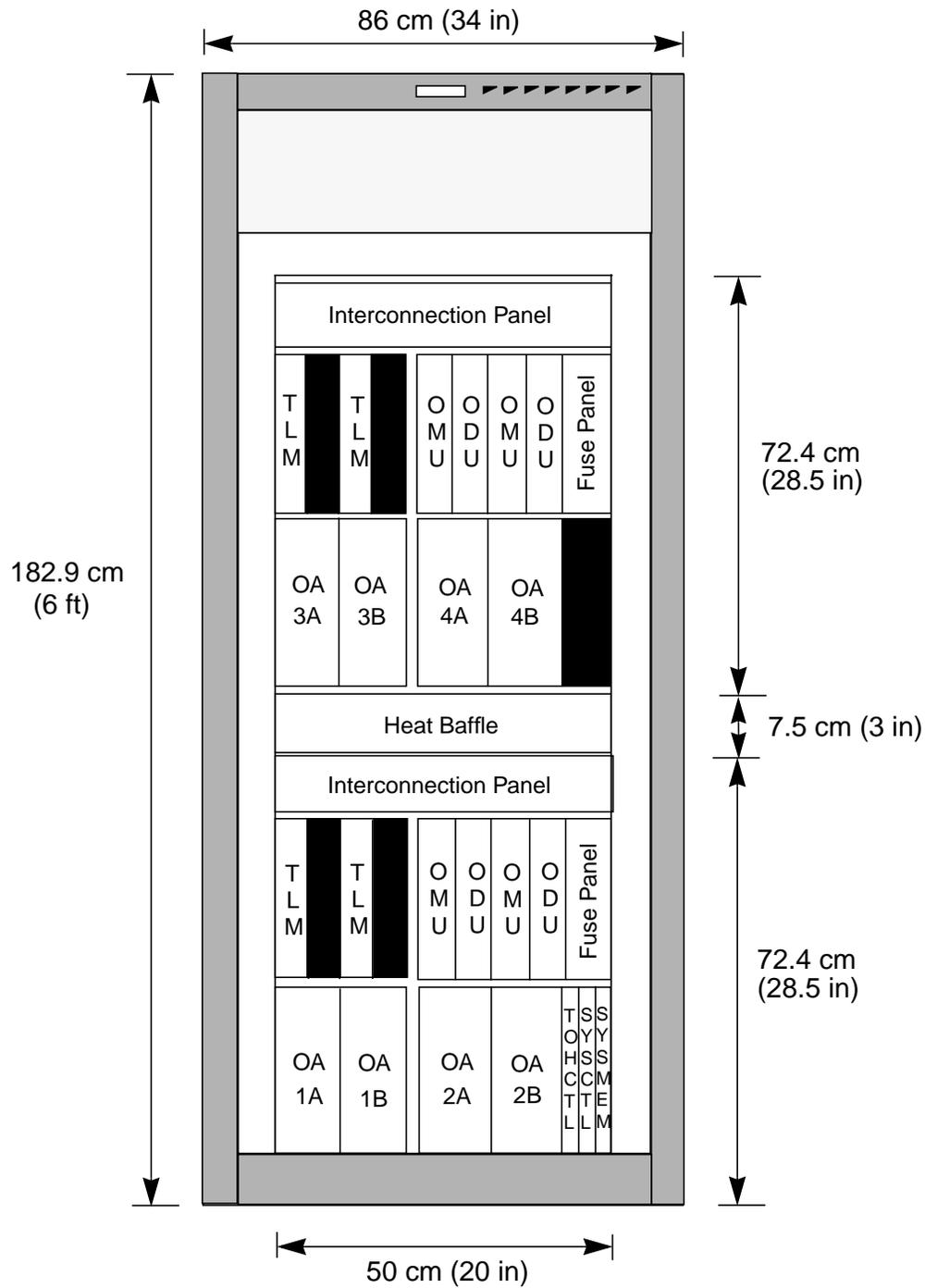


Figure 4-28. End Terminal Cabinet for 4 Bidirectional Optical Lines

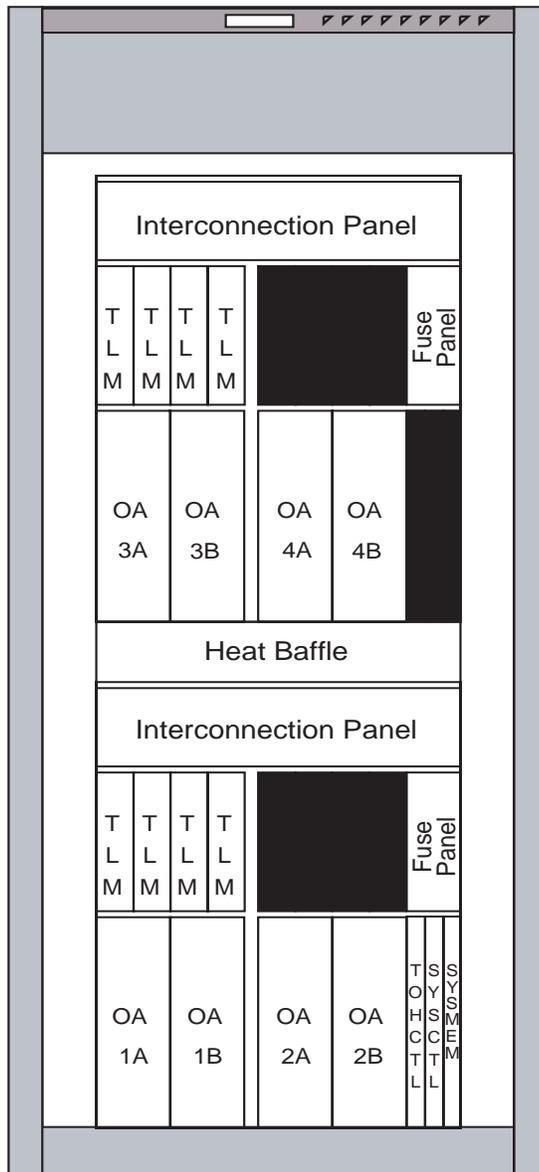


Figure 4-29. Repeater Cabinet for 4 Bidirectional Optical Lines

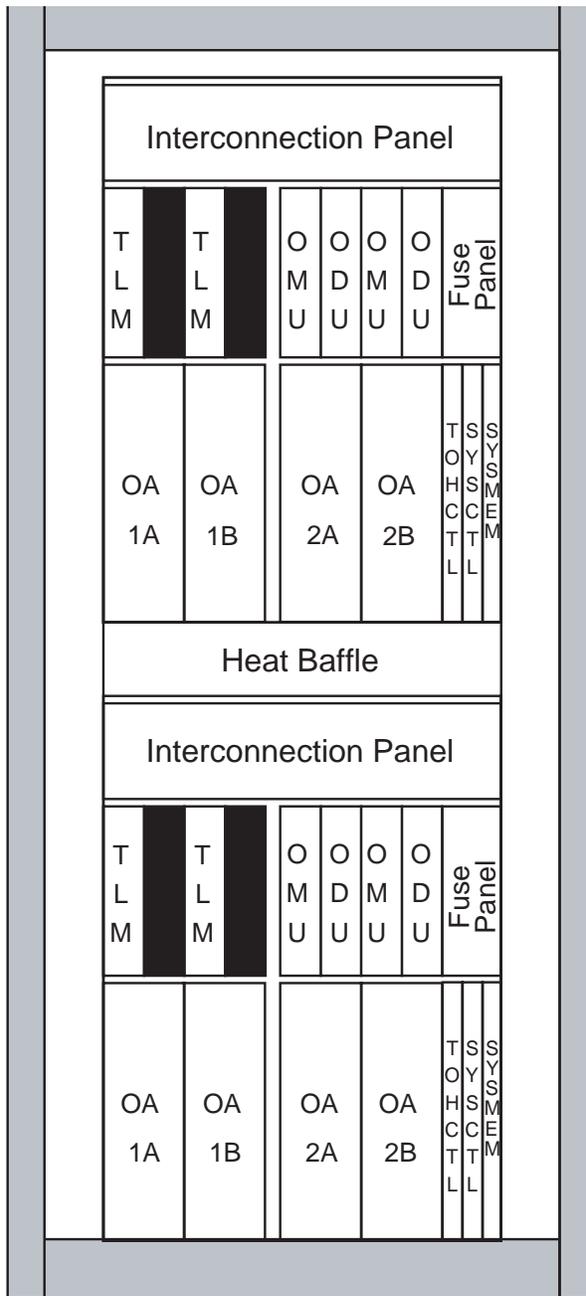


Figure 4-30. Dual End Terminal Cabinet (fully equipped)

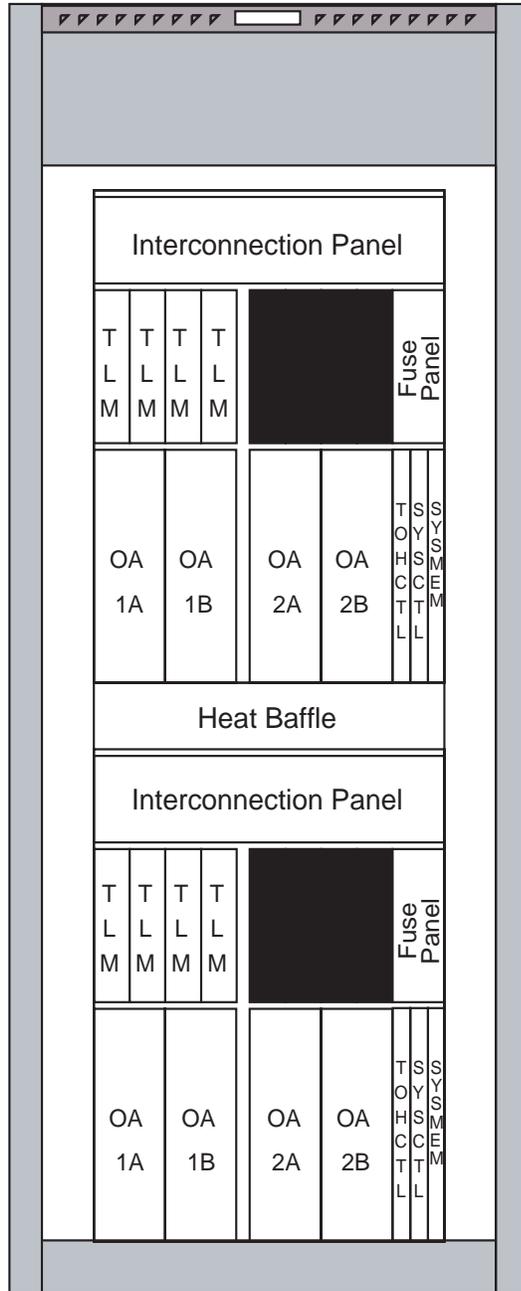


Figure 4-31. Dual Repeater Cabinet (fully equipped)

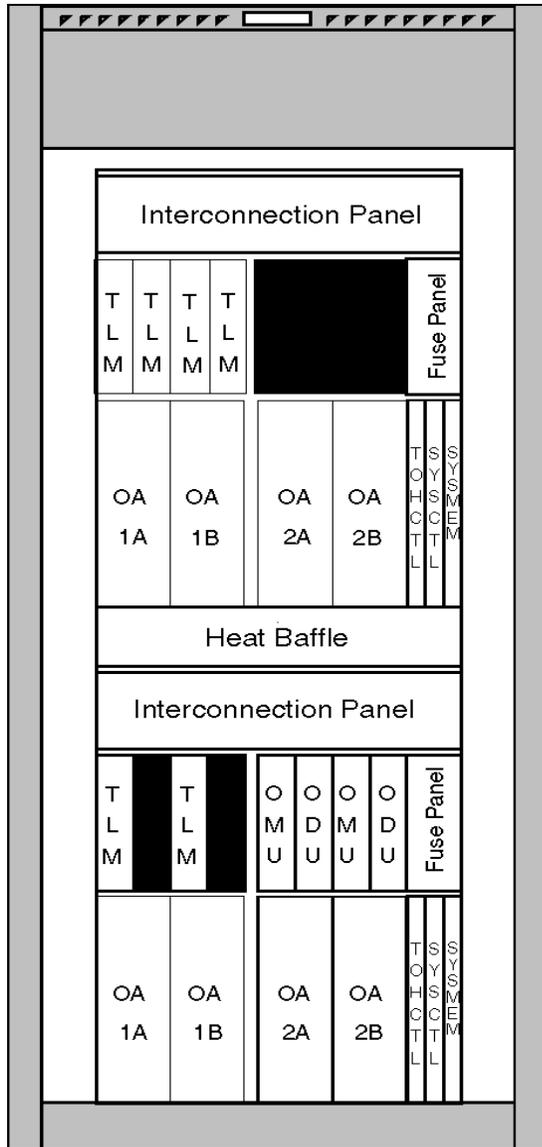


Figure 4-32. End Terminal and Repeater Cabinet

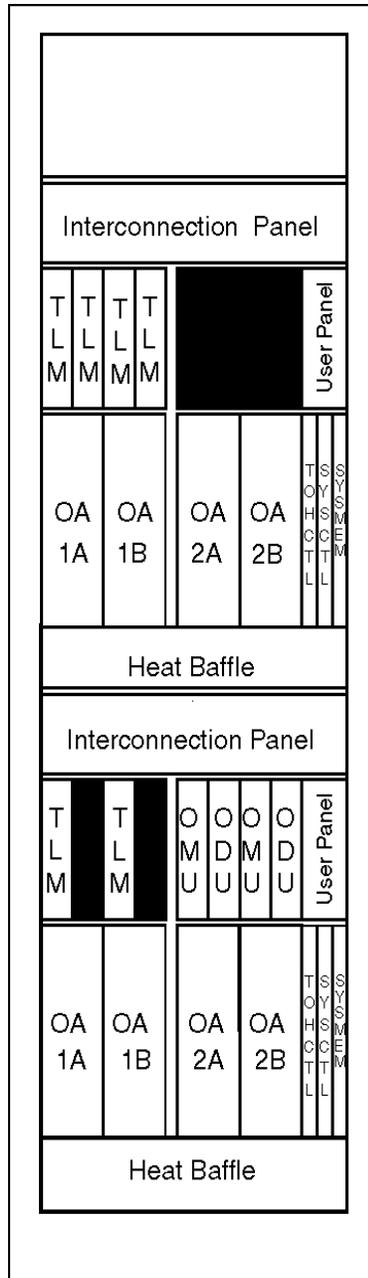


Figure 4-33. Bay-Mounted End Terminal and Repeater

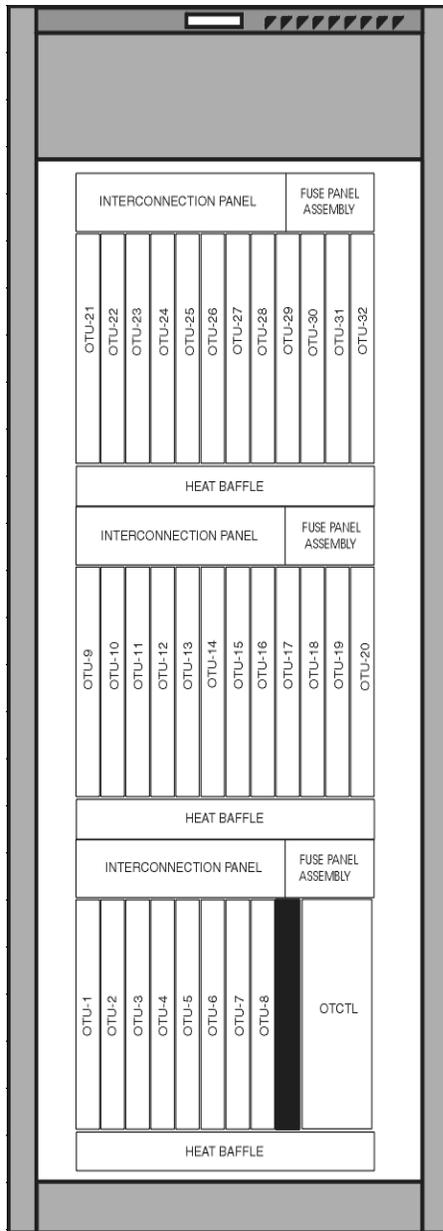


Figure 4-34. OT Cabinet

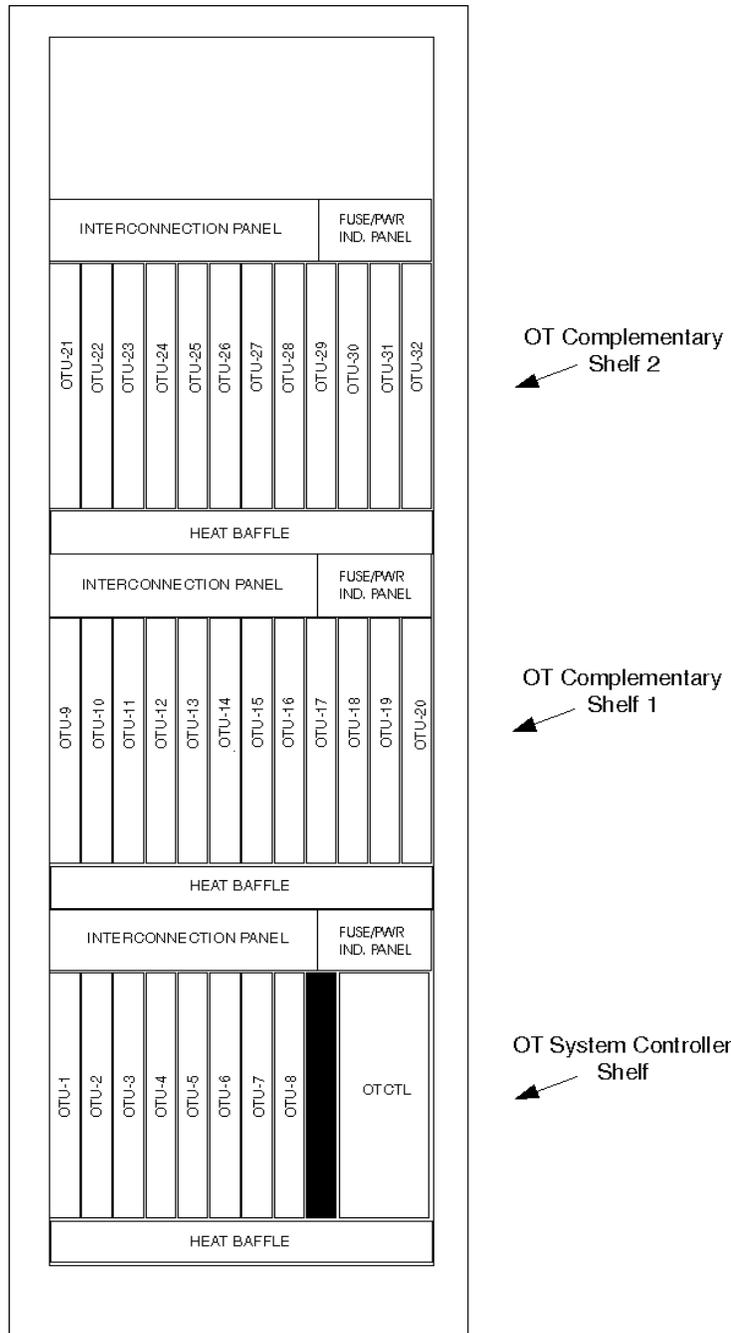


Figure 4-35. Bay-Mounted OT

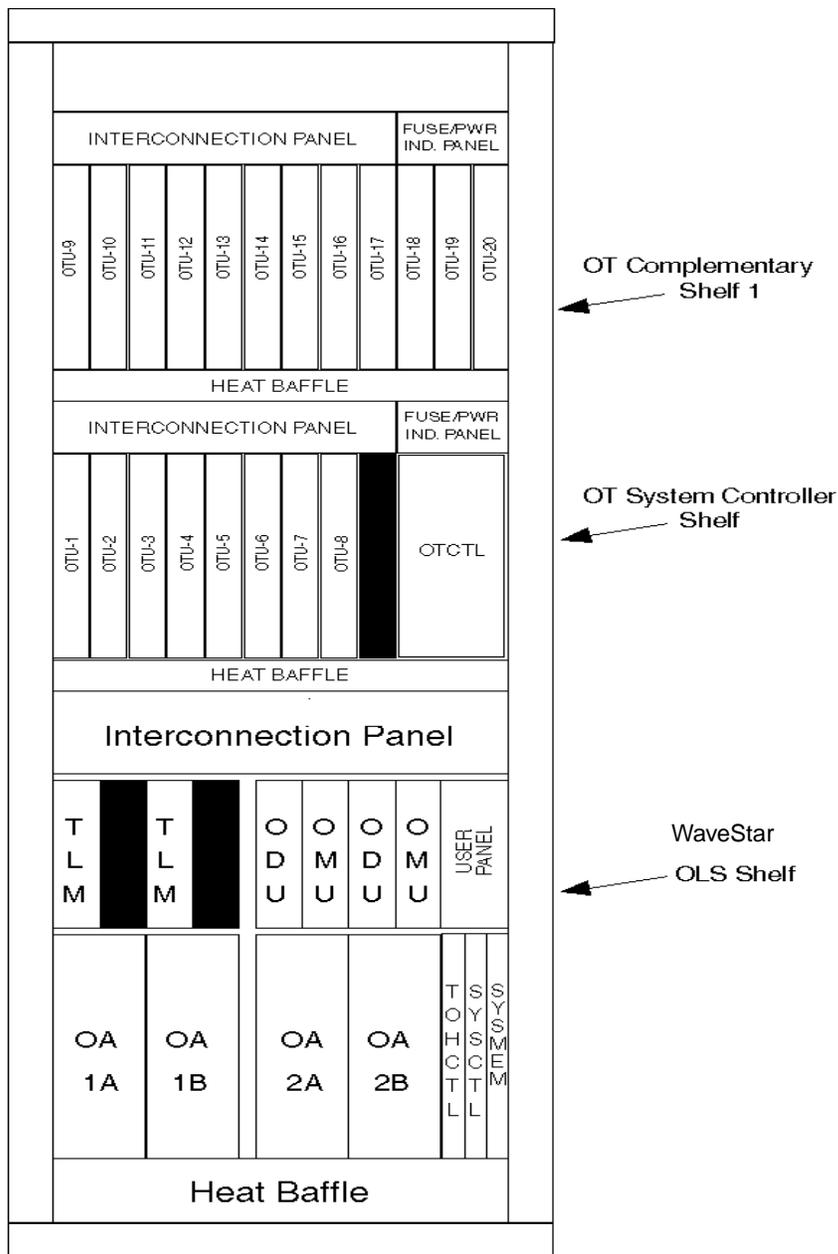


Figure 4-36. Integrated Bay (Single)

Figure 4-37 shows an Integrated Bay (Double). This package consists of a single WaveStar OLS 40G bay (with one equipped shelf) and an OT bay (with three equipped 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 40G interconnection panel
- Allows fault correlation between WaveStar OLS 40G and OT equipment
- Existing WaveStar OLS 40G and OT equipment can be combined with an in-service upgrade (OTCTL circuit packs and control cabling is added)
- Depending on the configuration, WaveStar OLS 40G and OT equipment can be located up to 200 feet apart.

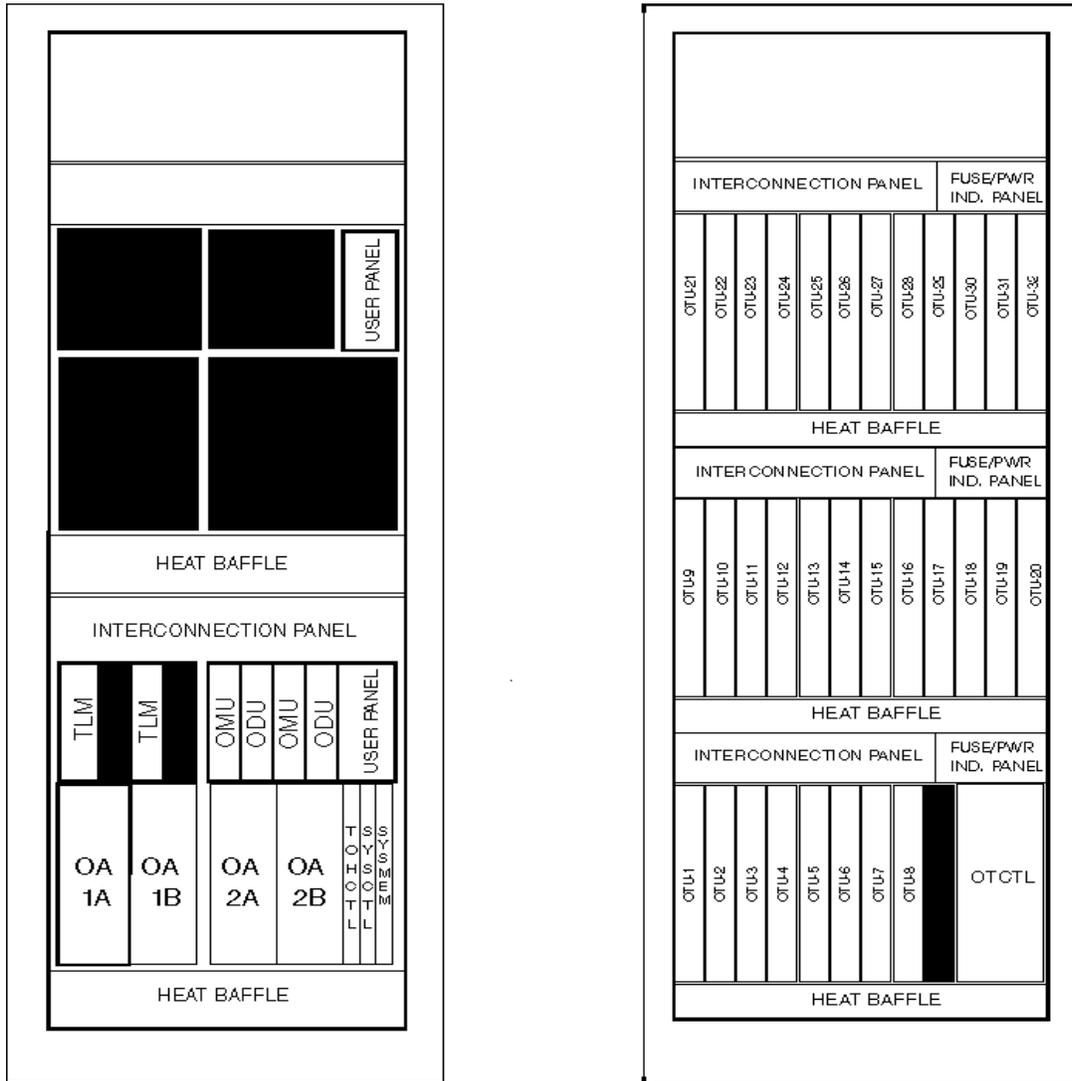
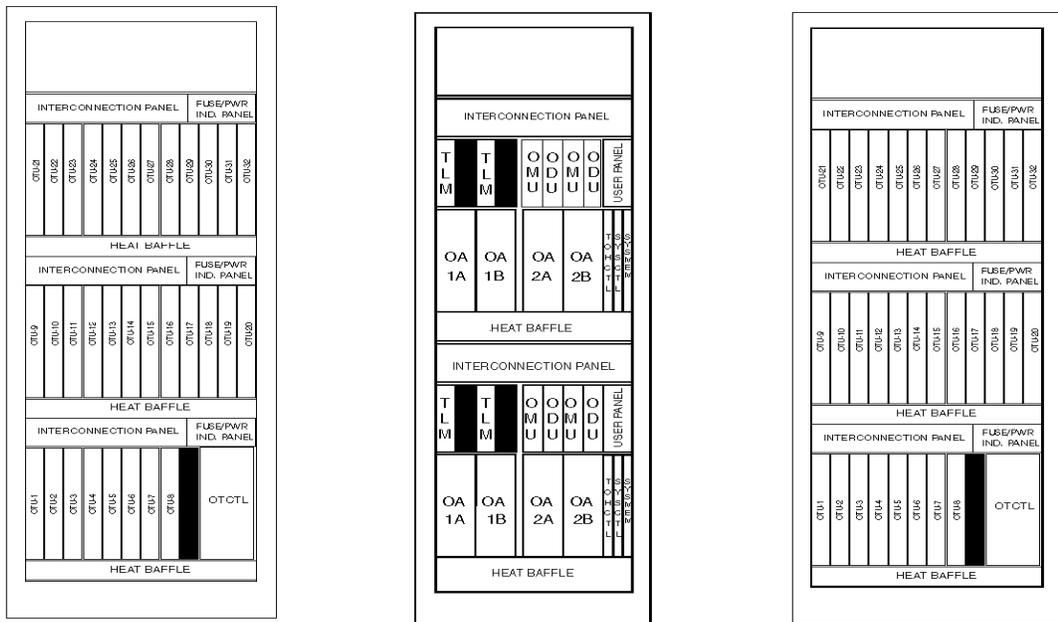


Figure 4-37. Integrated Bay (Double)

Figure 4-38 shows an Integrated Bay (Triple 1) package. This package consists of two separate, bay-mounted 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 40G interconnection panel
- Depending on the configuration, WaveStar OLS 40G and OT equipment can be located up to 200 feet apart.



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Figure 4-38. Integrated Bay (Triple 1)

Figure 4-39 shows an Integrated Bay (Triple 2) package. This package consists of a single, bay-mounted 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
- Depending on the configuration, WaveStar OLS 40G and OT equipment can be located up to 200 feet apart.

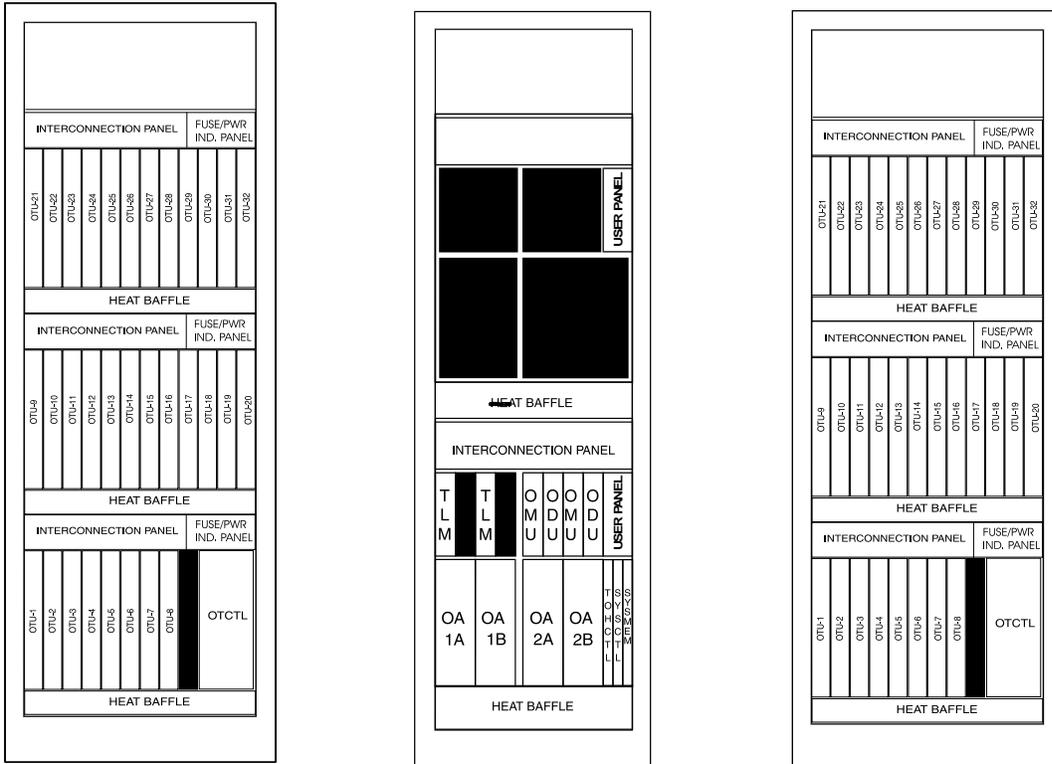


Figure 4-39. Integrated Bay (Triple 2)

WaveStar OLS 40G Integration Cable Engineering

This section describes the integration cables that are used to combine WaveStar OLS 40G equipment with the OT. Engineering rules for each configuration are also described. See Chapter 7, “Ordering,” for information on ordering these cables.

Integration Cable Descriptions

The following three integration cables are used to connect WaveStar OLS 40G equipment to the OT Controller shelves:

- **LAN cable**– supports LAN signals from the WaveStar OLS 40G to either one or two OT bays/cabinets
- **Reset-and-equipage cable**– supports non-switching signals between WaveStar OLS 40G equipment and OT bays/cabinets
- **Dual Reset-and-equipage cable**– provides same functionality as the reset-and-equipage cable with an additional cable branch for OT connections
- **Miscellaneous cable**– provides LED power and other non-switching signals between WaveStar OLS 40G equipment and OT bays/cabinets.

These cables come in several lengths and configurations, depending upon the desired arrangement. These lengths are detailed in the following pages.

Integration Cable Configurations

The integration cabling is used to form the Integrated Bay/Cabinet Double, Triple 1, and Triple 2 packages described earlier. The physical connections are illustrated in the sections that follow.

Integration Cabling for Integrated Bay/Cabinet Double and Triple 1

The physical cable connection for an Integrated Bay/Cabinet Double or Triple 1 equipment packages is shown in Figure 4-40.

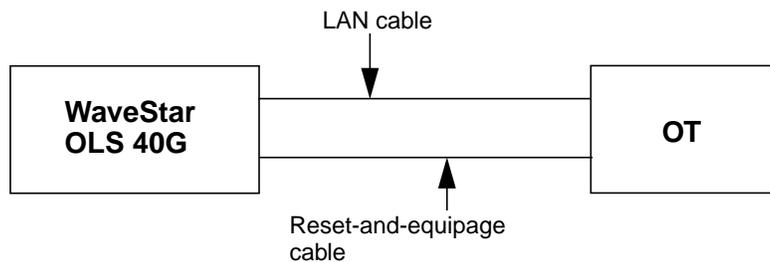


Figure 4-40. Integrated Bay/Cabinet Double and Triple 1 Cabling Diagram

To maintain LAN signal integrity, the maximum distance that is allowed between WaveStar OLS 40G equipment and the OT is 200 feet; the maximum length of the LAN cable is also 200 ft. Contrarily, the reset-and-equipage cable does not limit distance between equipment since switched signals are not present on it. To facilitate engineering and installation, however, the reset-and-equipage cable is offered in the same lengths as the LAN cable.

Integration Cabling for Integrated Bay/Cabinet Triple 2 Triple 2

The physical cable connection for an Integrated Bay/Cabinet Triple 2 equipment package is shown in Figure 4-41.

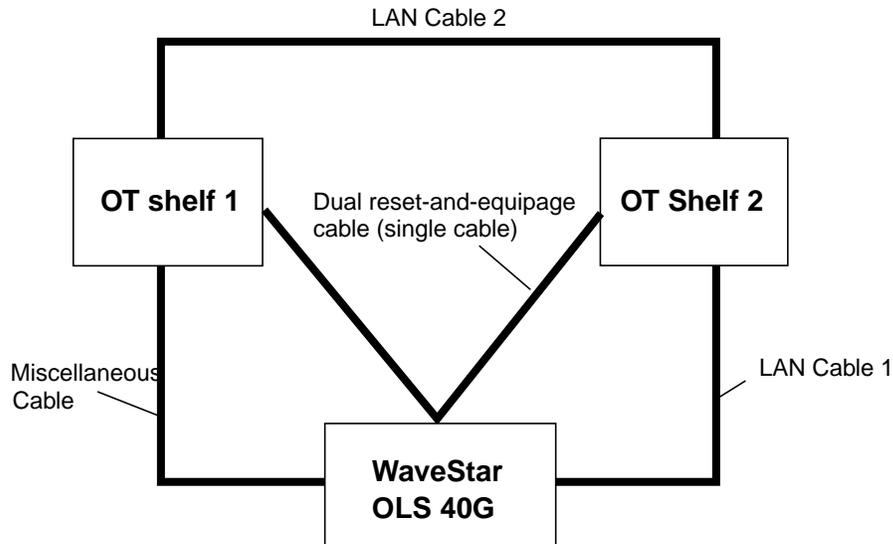


Figure 4-41. Integrated Bay/Cabinet Triple 2 Cabling Diagram

The maximum LAN cable length that is allowed for the Triple 2 arrangement is also 200 ft. Here, as before, LAN cables govern the maximum distances between the WaveStar OLS 40G equipment and OT shelves since the dual reset-and-equipage and miscellaneous cables do not carry switched traffic.



NOTE:

The sum of the lengths of LAN cable 1 and LAN cable 2 must not exceed 200 feet.

As depicted in Figure 4-41, the dual reset-and-equipage cable connects to the WaveStar OLS 40G equipment via a single connector and extends to each OT shelf via two completely independent branches of equal length. For example, the 20 foot dual reset-and-equipage cable (G812) consists of a single connector (for the WaveStar OLS 40G) and two 20 foot branches,

one connecting to OT Shelf 1 and the other to OT Shelf 2. Similarly, the 100 foot cable consists of two 100 foot branches, and the 200 foot cable consists of two 200 foot branches.

It is possible to engineer a configuration in which a single OT is equipped initially and a second OT is added later. To do this, the WaveStar OLS 40G equipment and the OT should be installed with dual reset-and-equipage cable and one of the LAN Cable 1 groups.

⇒ NOTE:

Careful preparation should be taken to insure a proper distance between the WaveStar OLS 40G equipment, OT Shelf 1, and the eventual OT Shelf 2. The appropriate dual reset-and-equipage cable should be chosen based on the maximum distance between the WaveStar OLS 40G equipment and either OT Shelf 1 or OT Shelf 2.

The total cable length of LAN Cable 1 and the eventual LAN Cable 2 should not exceed 200 ft. When installing the WaveStar OLS 40G equipment and OT Shelf 1, the LAN path must be terminated once OT Shelf 1 has been connected. This termination is done using a supplied termination plug located on the backplane of the OT shelf. This plug must remain in place when OT Shelf 1, alone, is being installed.

⇒ NOTE:

The LAN cable connecting OT Shelf 1 to OT Shelf 2 cannot be installed without being terminated.

The unused branch of the dual reset-and-equipage cable can be coiled and stored until needed. Similarly, the miscellaneous cable can have one end installed on the WaveStar OLS 40G and the other left coiled and stored until needed with no special termination required on the other end.

When OT Shelf 2 is installed, the LAN termination plug on OT Shelf 1 is first removed from the backplane. The appropriate LAN Cable 2 group is then installed and the previously unused branch of the dual reset-and-equipage cable is connected to OT Shelf 2. Finally, a miscellaneous cable of appropriate length is installed between the WaveStar OLS 40G equipment and OT Shelf 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)
- Intra-Office Line Relay Pack (IAOLRP).

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.

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 management 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 use the LEA7 or LEA7B 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 OPS configurations . It is not used in non-OPS configurations.

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. It is not used in non-OPS configurations.

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 optical signal that is compatible with WaveStar OLS 40G or a receiver of the optical channel source
- Monitoring the signal for degradation.

The OT control structure provides the following functionality:

- 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 (this is not provided for the LSBB OTPM)
- 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.

This information is reported through the OLS 40G user interface.

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.

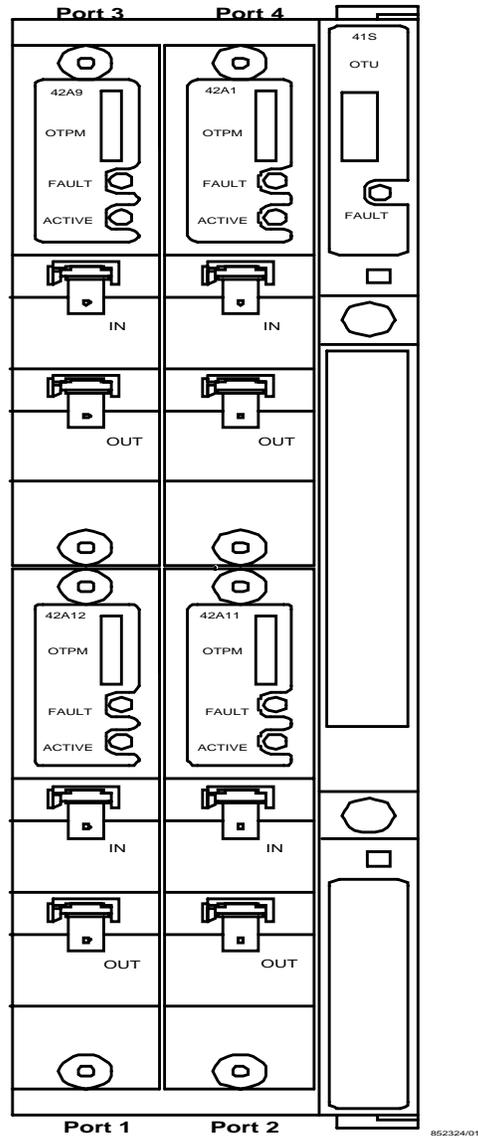


Figure 4-42. QOTU Design

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. When the end terminal uses the telemetry-thru feature, two TLM circuit packs per line are used.

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.

Intra-Office Line Relay Pack (IAOLRP)

The IAOLRP circuit pack, new in Release 4.0, provides a connection to the new IAOLAN interface. This circuit pack is required in WaveStar OLS 40G End Terminal locations where the IAOLAN feature is deployed. It resides in the TLM-1B slot of the End Terminal shelf.



NOTE:

The IAOLRP circuit pack contains no active circuitry.

Control Circuit Packs

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

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

System Controller (SYSCTL)

The SYSCTL circuit pack, together with the SYSTEMEM, 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 (SYSTEMEM)

The SYSTEMEM circuit pack provides memory support for the system controller (SYSCTL) circuit pack. The SYSTEMEM 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 SYSTEMEM 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.

In Release 4.0, the existing TOHCTL circuit pack is replaced with a new TOHCTL (LEA102) circuit pack. Refer to Chapter 5, “Operations, Administration, Maintenance, and Provisioning,” for more information on this circuit pack.

OT Controller (OTCTL)

To facilitate integration of the OT with WaveStar OLS 40G, the OTCTL is used to integrate the OTUs into the 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 4-43 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.

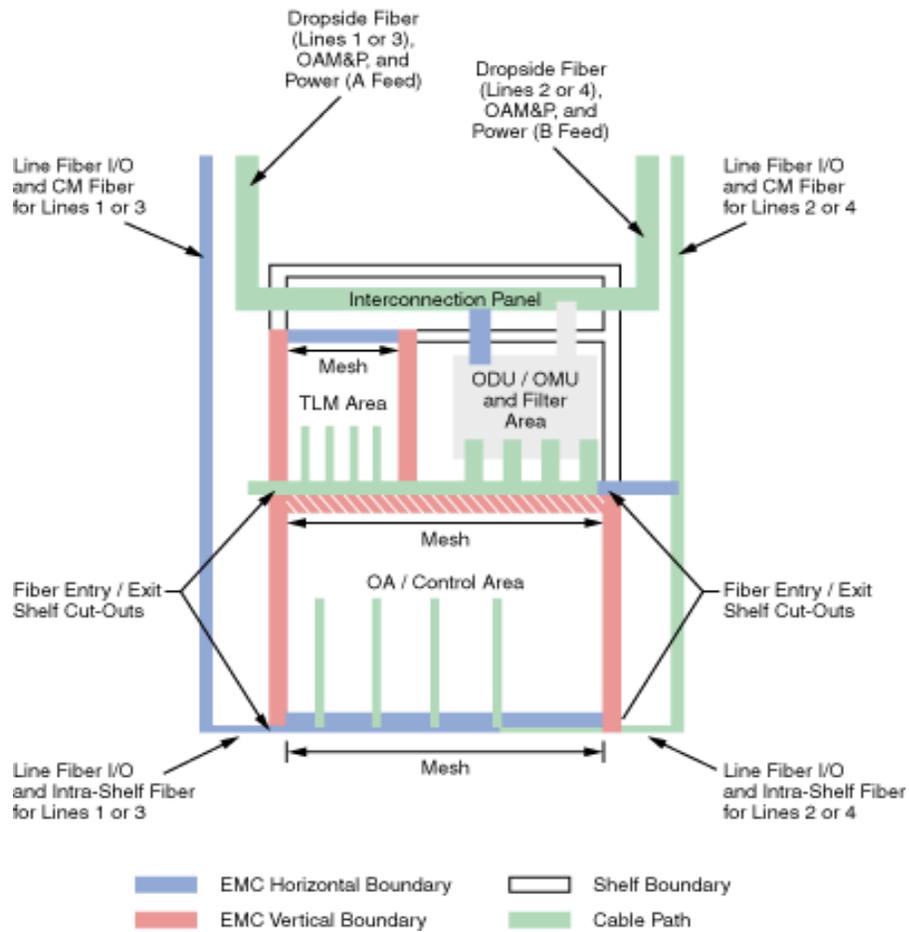


Figure 4-43. WaveStar OLS 40G Shelf Fiber/Cable Dressing and EMC/ESD Design

Interconnection Panels

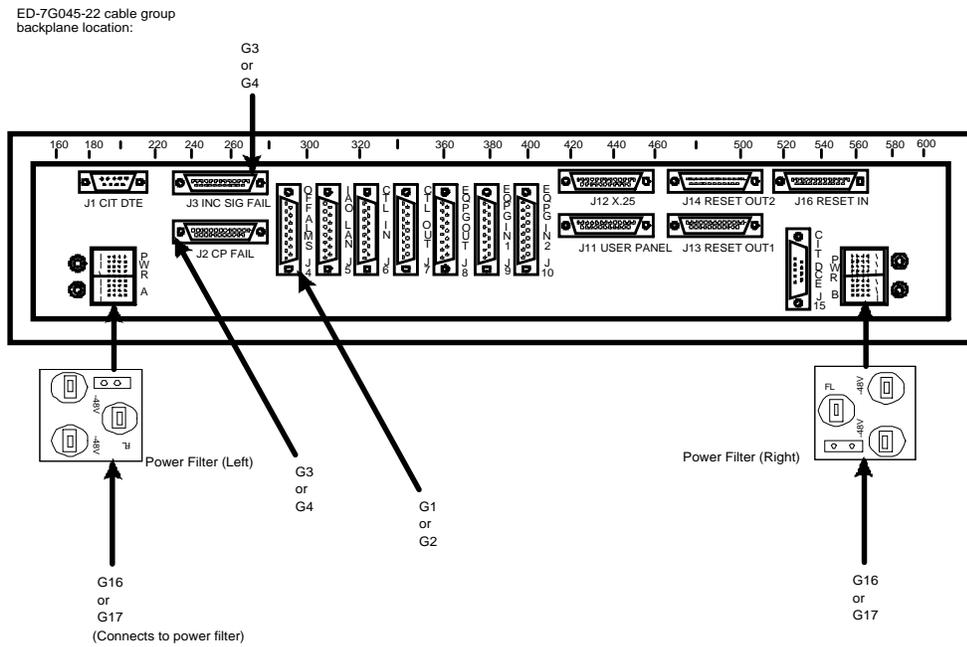
This section describes the interconnection panels, cabinet indicator strips, and both the fuse and user panels associated with WaveStar OLS 40G shelves (including OT).

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.

OT Interconnection Panel (System Controller Shelf)

Figure 4-44 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.



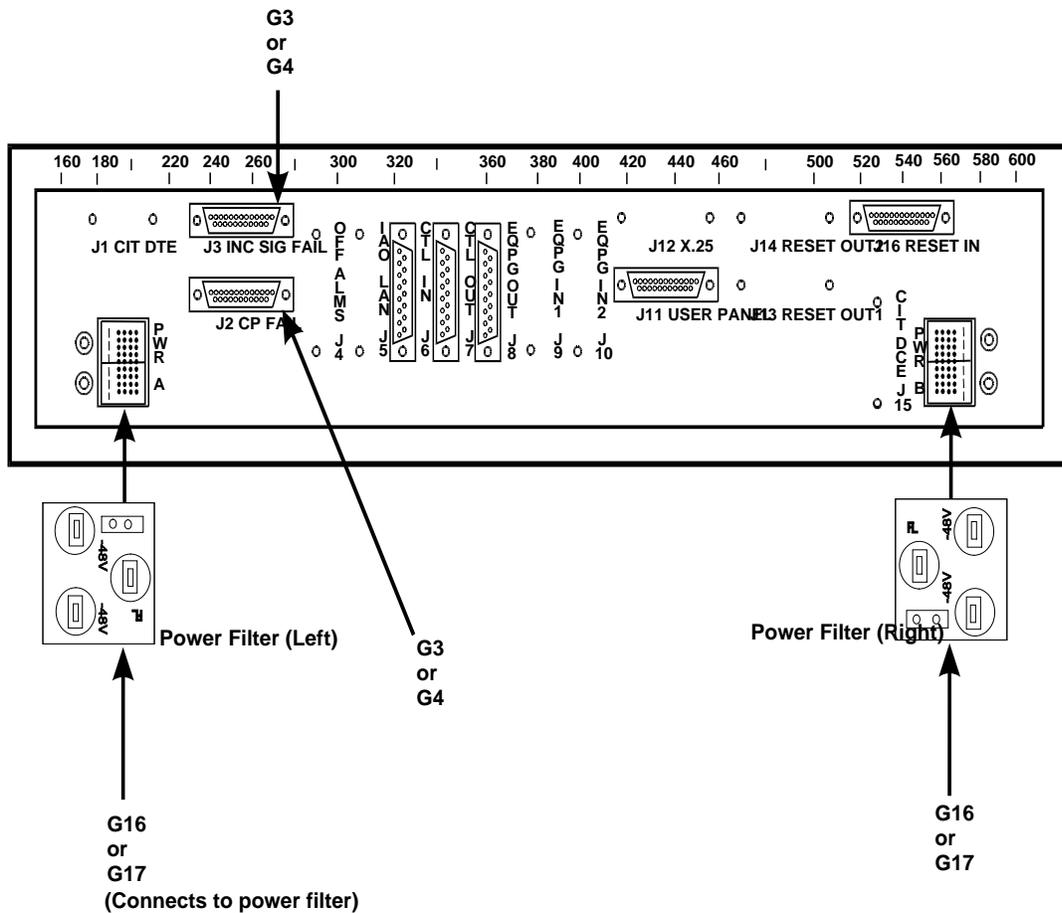
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Figure 4-44. OT System Controller Shelf Interconnection Panel and Cabling

OT Interconnection Panel (Complementary Shelves)

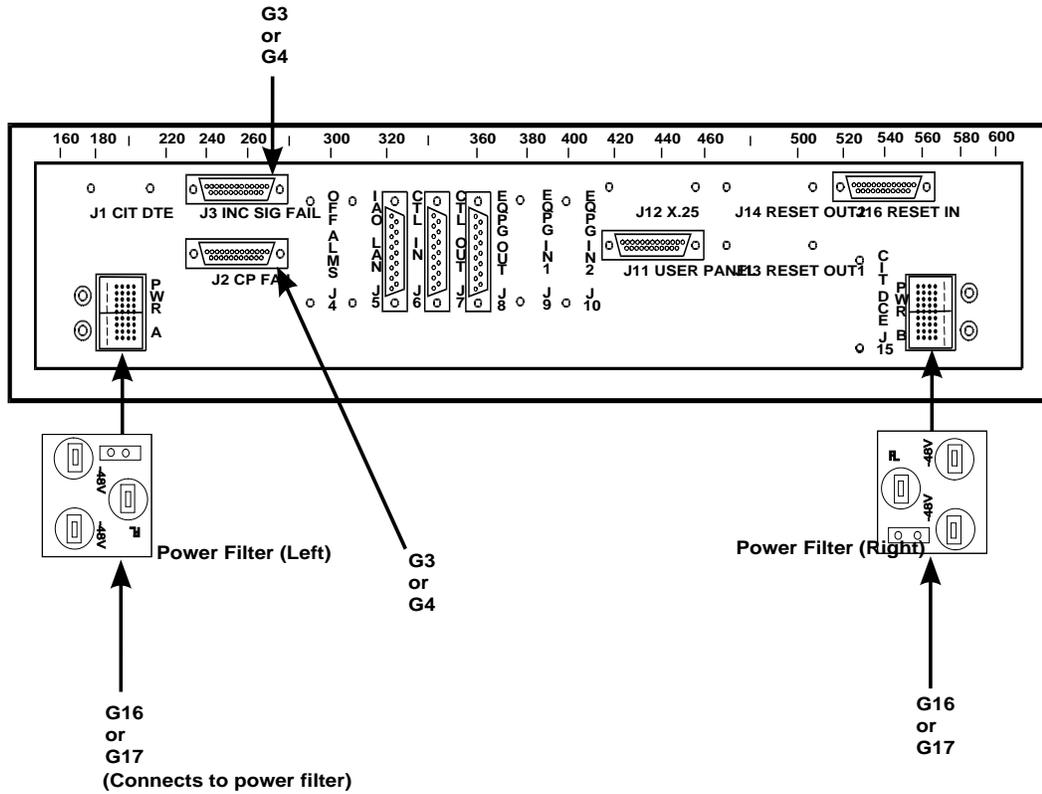
Figure 4-45 depicts an OT Complementary Shelf's interconnection panel as seen from the front of the shelf. Associated cable groups and their connection points are indicated.

**ED-7G045-22 cable group
 backplane location**



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**ED-7G045-22 cable group
 backplane location**



opt04014.01eSEV082

Figure 4-45. 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 4-46 shows the indicator strip for the Dual End Terminal and Dual Repeater cabinets. Figure 4-47 shows the indicator strip for both the End Terminal and Repeater for four bidirectional optical lines.

Refer to Table 4-2 for a list and description of the indicators.

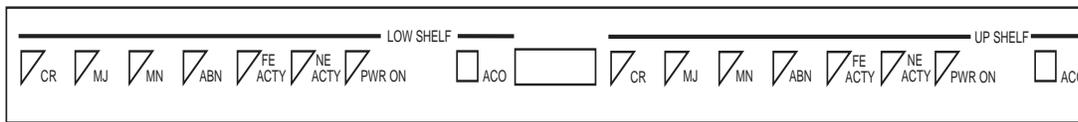


Figure 4-46. Indicator Strip for Dual End Terminal and Dual Repeater Cabinets



Figure 4-47. Indicator Strip for End Terminal and Repeater Cabinets for 4 Bidirectional Optical Lines

Table 4-2. 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.

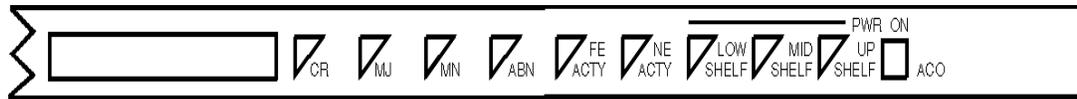
Table 4-3 provides the Synchronous Digital Hierarchy (SDH) equivalents of SONET-specific indicators found on the OT Cabinet indicator strip.

Table 4-3. 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 4-4 for a list and description of the indicators. Connectorized cabling connects the shelves to the indicator strip.



ont05001 00aif193008

Figure 4-48. OT Cabinet Indicator Strip

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

Table 4-4. 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.

WaveStar OLS 40G User Panel

Figure 4-49 shows a diagram of the WaveStar OLS 40G user panel for the miscellaneous-mounted shelf and bay configurations.

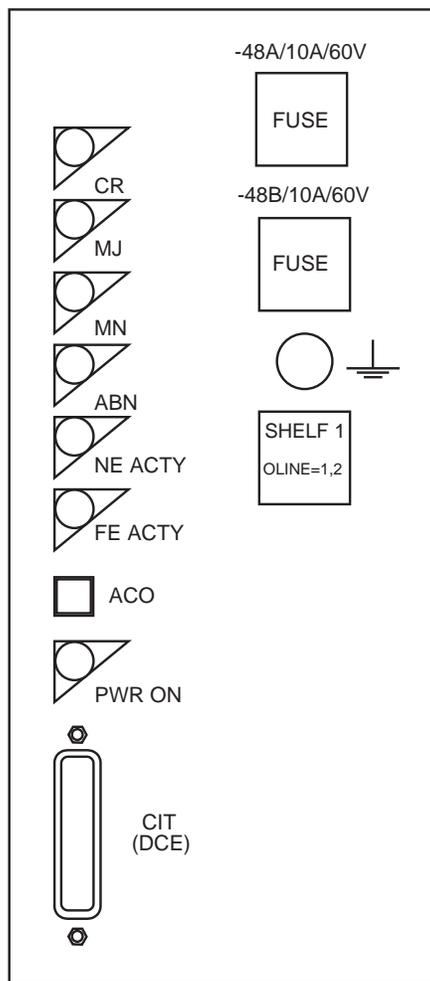


Figure 4-49. WaveStar OLS 40G Shelf User Panel

WaveStar OLS 40G Fuse Panel

WaveStar OLS 40G fuse panel, shown in Figure 4-50, 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.

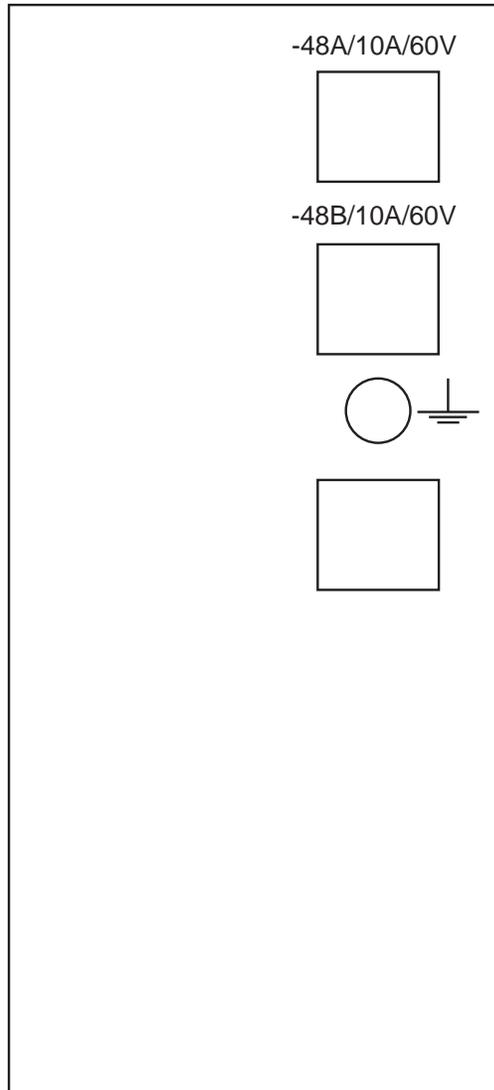


Figure 4-50. WaveStar OLS 40G Fuse Panel

Table 4-5 lists all the indicators that appear on the user panel. Note that only the green Power On (PWR ON) LED is active.

Table 4-5. 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 4-6. 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

Table 4-6. SDH Indicators Present on WaveStar OLS 40G User Panel (L10 and L11) — *Continued*

Indicator Name	Color	Description
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 miscellaneous-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 4-51 shows a diagram of the OT Complementary Shelf fuse/power indicating panel.

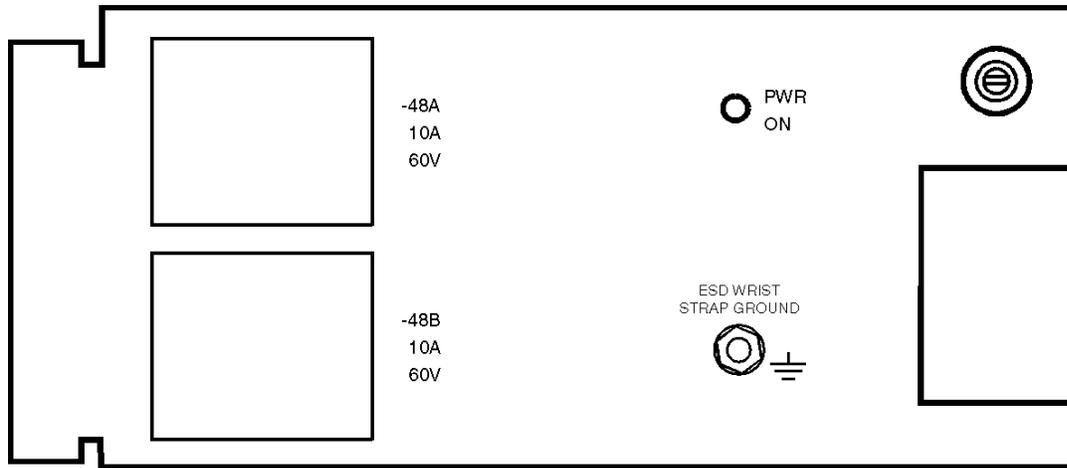
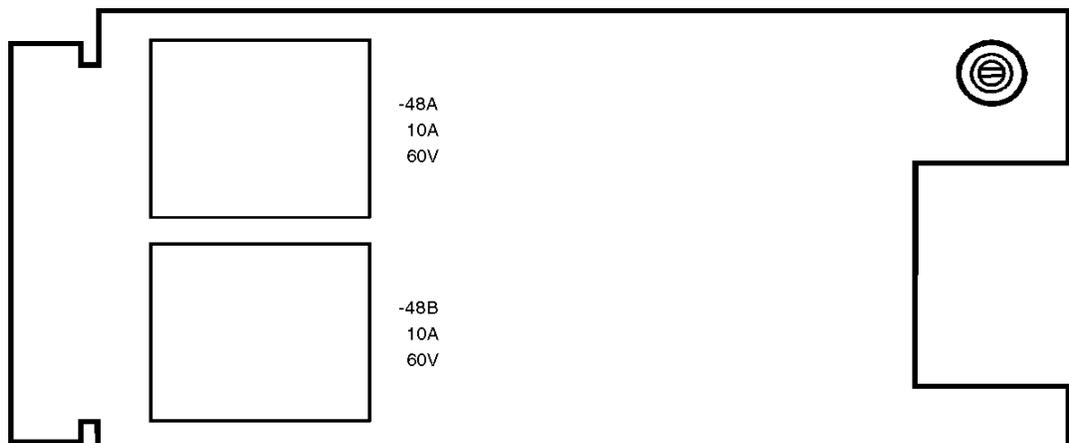


Figure 4-51. Miscellaneously-Mounted OT Complementary Shelf Fuse/Power Indicating Panel

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 4-52 shows a diagram of the fuse panel.



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Figure 4-52. 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

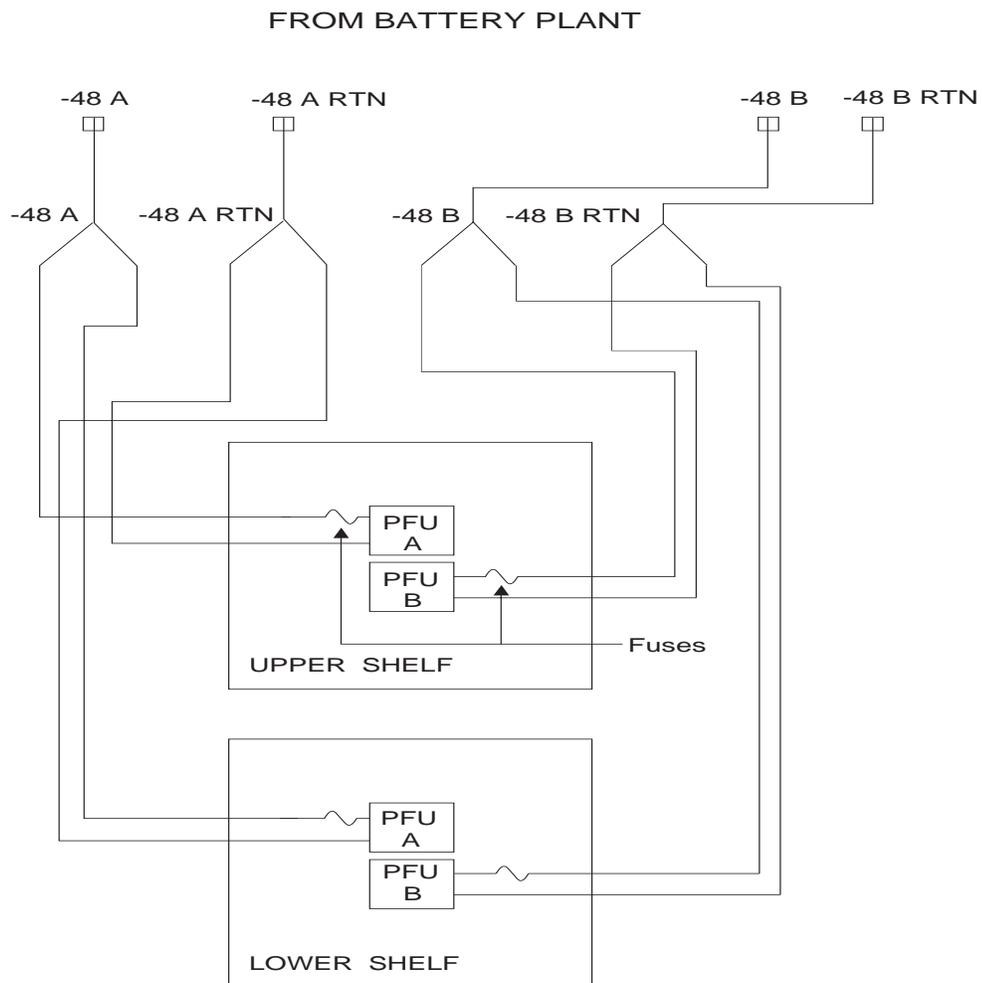
The power feed cable uses stranded, color coded, and keyed connectors. All panel-mounted power connector functions are labeled. Table 4-7 shows the color codes used for power cabling.

Table 4-7. 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 4-53 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.

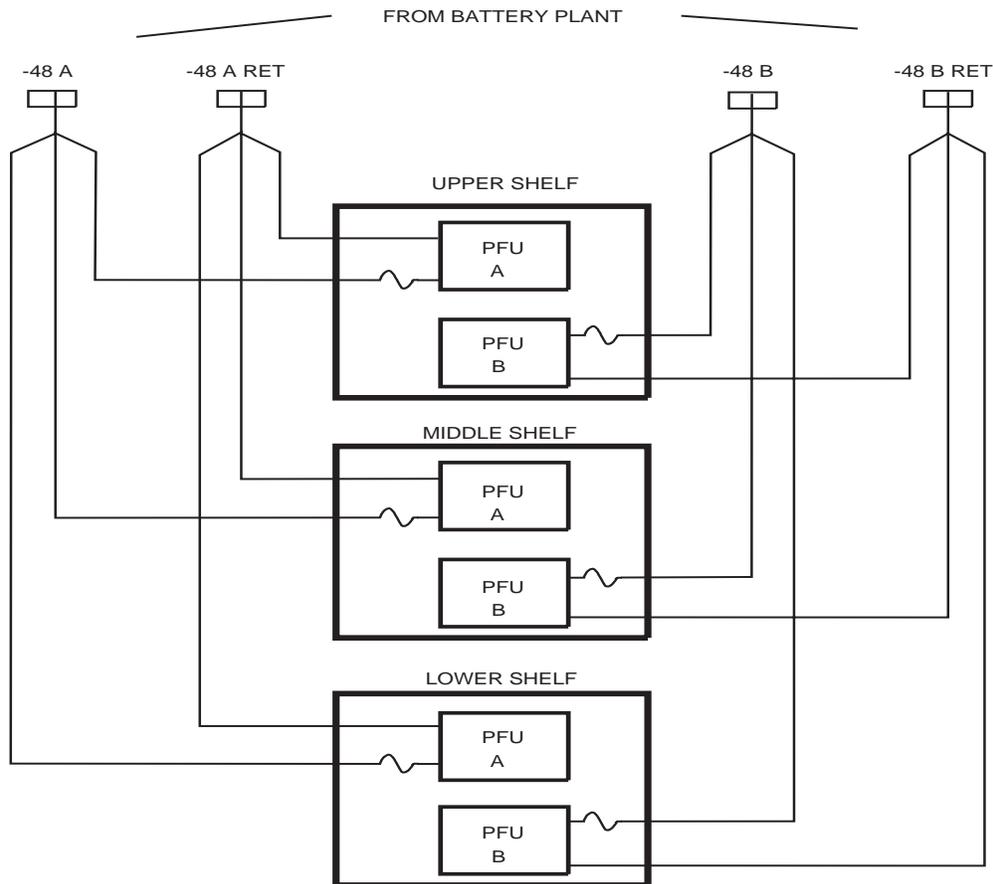


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Figure 4-53. General Power Distribution in a Two-Shelf WaveStar OLS 40G Bay or Cabinet

WaveStar OLS 40G 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 4-54 shows the overall power distribution for a three-shelf installation.



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Figure 4-54. OT Power Distribution in a Three Shelf Bay or Cabinet

Shelf-Level Power Distribution

Figure 4-55 shows a block diagram of WaveStar OLS 40G power distribution at the shelf level.

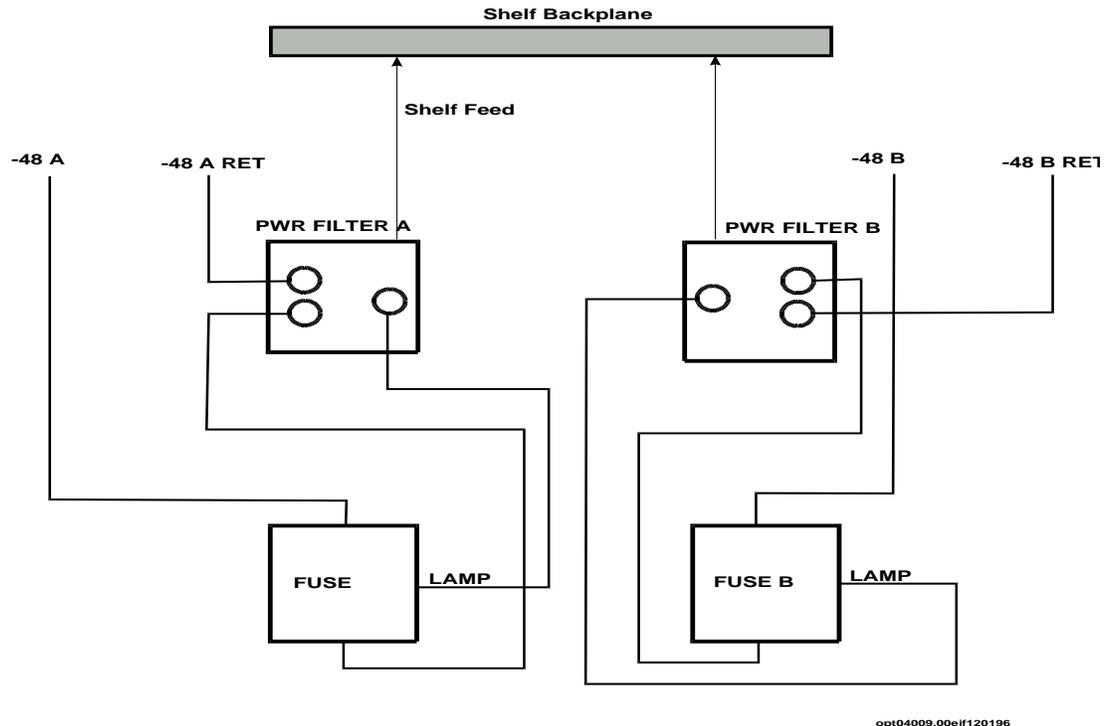


Figure 4-55. WaveStar OLS 40G Power Distribution at Shelf Level

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 -38.5 ± 1 V, the power is cut off until the incoming voltage returns to -43 ± 1 V. WaveStar OLS 40G will experience no damage if the power fluctuates between -38.5 ± 1 V and -43 ± 1 V. If a fuse blows, the fuse cap illuminates to indicate which power feeder has opened.

Backplane and Circuit Pack Interface

All WaveStar OLS 40G (including 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 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.....	5-1
Operations Interfaces.....	5-1
Operations Domains	5-5
IAO LAN	5-9
CMISE.....	5-12
Release 4.0 Operations Interface Connectivity.....	5-14
■ Administration	5-19
Version Recognition.....	5-19
Security	5-19
Equipment Inventory	5-21
System Start-up	5-21
■ Maintenance.....	5-22
Reactive Maintenance	5-22
Proactive Maintenance	5-22
Remote Maintenance.....	5-22
Local and Remote Software Copy/Upgrades.....	5-25
Optical Transmission Maintenance.....	5-25
Protection Switching for DCC Signal	5-26
Automatic Detection of Facility Failures.....	5-26
Optical Protection Switching	5-28
Automatic Power Shutdown and Restart (APSD)	5-37
Performance Monitoring.....	5-43
Provisioning Consistency Audits.....	5-46
Reports	5-47
Orderwire	5-49
Alarm Correlation	5-49

- Provisioning5-51
 - Parameters and Original Value Provisioning5-51
 - Local or Remote Provisioning.....5-51
 - Preprovisioning Slots5-52
 - Provisioning on Circuit Pack Replacement.....5-52
 - Provisionable Parameters Summary5-52
 - Network Element Configuration5-52
 - WaveStar OLS 40G Terminal Provisioning5-53
 - WaveStar OLS/OT Integration.....5-59
- WaveStar OLS 40G Architecture.....5-60

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
- Operations system interface (IAOLAN).

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 NE 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)

In addition to the CMISE interface, new in Release 4.0, WaveStar OLS 40G continues to support 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 management 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 management subnetwork. The WaveStar OLS 40G management subnetwork includes all end terminals and repeaters interconnected with each other and managed via the DCC of the same EMS. The management 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.

In addition to supporting point-to-point WaveStar OLS 40G systems via the DCC, management capability is extended to a larger domain of network elements with the addition of the IAOLAN interface to the management subnetwork.

⇒ NOTE:

In an interworking configuration any network element is reachable via the DCC and/or the IAOLAN. Though different media are used in the same management subnetwork, all network elements still appear as part of the same management domain from the point of view of the EMS.

To illustrate remote access within an operations domain, Figure 5-1 shows CenterLink-CIT logins at various WaveStar OLS 40G sites. A CenterLink-CIT login at an end terminal allows remote access to the other end terminal and all repeaters between them. Here, a CenterLink-CIT login at WaveStar OLS 40G X.1 allows remote logins at sites X.2 and X.3. In Release 4.0 and later releases, this is true when X1, X2 and X3 are in the same level 1 area. Remote login is supported within the same level 1 area only.

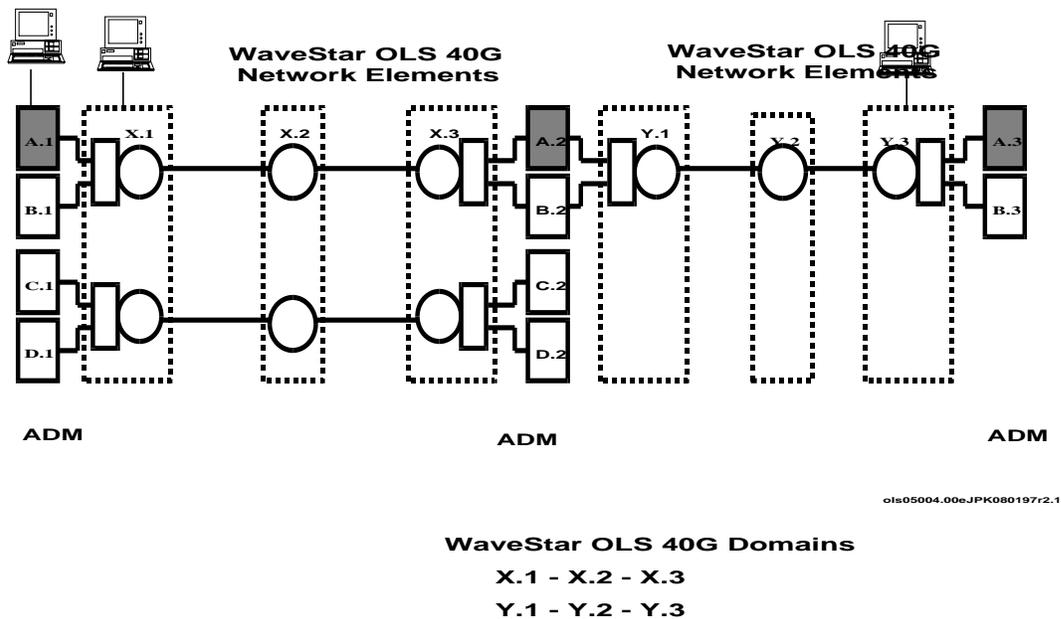


Figure 5-1. CIT Operations Domain with Standard End Terminals

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. In Release 4.0 and later releases, X.1, X.2, X.3, Y.1, Y.2 and Y.3 must be in the same Level 1 area for this to work. Remote login is supported within the same level 1 area only.

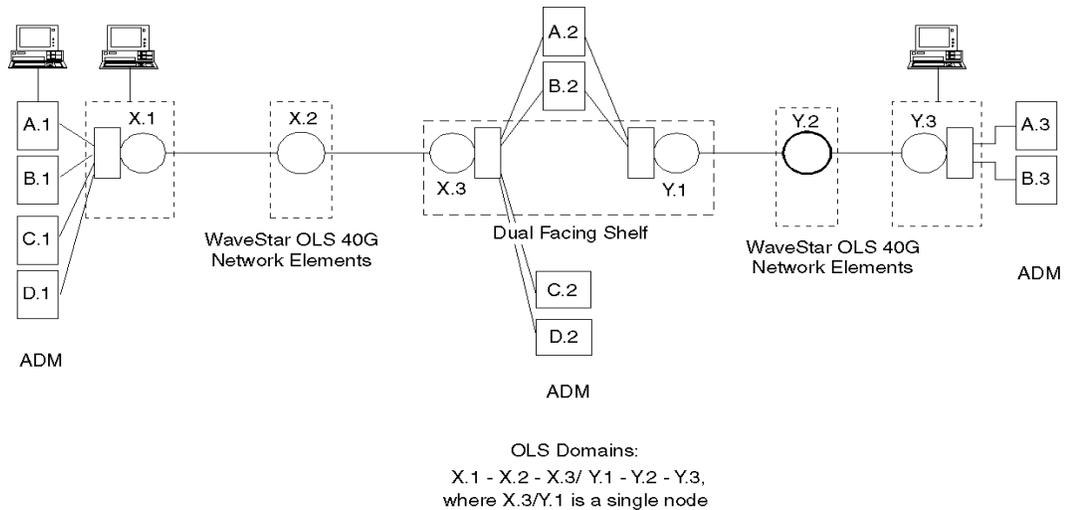


Figure 5-2. CIT Operations Domain with Dual-facing End Terminal

With an IAOLAN connection (described later in the chapter), the operations domain is also extended to include additional WaveStar OLS 40G network elements. The IAOLAN connection is between the End Terminals. This is similar to that shown in Figure 5-2 except there is no dual facing shelf; the connection between X.3 and Y-1 is an IAOLAN. A CenterLink-CIT login at site X.1 also allows remote logins to sites X.2, X.3, Y.1, Y.2, and Y.3 when these nodes are in the same Level 1 area.

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.

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:

An EMDU is listed as an ordering option in the package worksheets found in Chapter 7, "Ordering."

IAO LAN

When IAO LAN is used, robust data communications can be established for the OLS network. The IAO LAN Interface feature using IS-IS Level 2

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

routing enables larger WaveStar OLS 40G Release 4.0 management domains and increases the robustness of the management network. Previously, WaveStar OLS 40G nodes were grouped into clusters 32 nodes or less, each cluster needing at least one connection to the management system. This required data communication facilities between the site where the management system resides (e.g., ITM/SC) and the site where one of the nodes of each cluster resides. To increase reliability of the communication network, additional connections from the management system to each cluster are needed since a data communications route between clusters is not allowed.

With the IAO LAN functionality in Release 4.0 we manage areas not clusters. Areas differ from clusters in that routing between management areas is permissible; thus reducing the number of physical connections needed between the management system and the WaveStar OLS 40G network while increasing survivability of the management network.

With Release 4.0, a single area with up to 50 nodes can be managed. A mechanism for growing the network beyond 50 nodes is to split the network into multiple areas and then establish links between areas. These links are configured WaveStar OLS 40G nodes in an area (referred to as Level 2 nodes) that are responsible for linking the areas. An integrated network composed of IS-IS Level 2 areas will provide a more flexible, cost effective and robust environment to provide access from the ITM/SC to each managed network element. This feature provides the capability for current networks that are less than 32 nodes to grow beyond 32 nodes without requiring the addition of clusters.

IS-IS level 2 requires upfront design of the network areas and requires some additional provisioning. This document describes how the customer can use this feature.

The Open Systems Interconnection (OSI) 7 layer protocol forms the basis for providing the capability of routing of data between the management system and WaveStar OLS 40G nodes located within an area and between areas within an OSI Network.

The Network Layer of the OSI 7 layer stack provides the means to transmit data across a network regardless of network type, topology, or services offered by the underlying network. The networks which connect OSI network elements (NEs) are called subnetworks. The network layer entity is dependent upon the network services offered by the subnetworks it must traverse to reach the destination network layer entity along with the services provided by the underlying data link layer.

The connectionless network service (CLNS) and its corresponding connectionless network protocol (CLNP) provide the following services and functions at the Network Layer: Network Addresses, Quality of Service (QoS) parameters, Error Notification, Segmentation of messages, Routing, and Relaying of messages through Intermediate Systems. The connectionless service provides no error recovery mechanisms and does not guarantee the delivery of data to the End System.

The IS-IS intra domain routing exchange protocol provides information to ISs as to the reachability of the other ISs and the ESs that those ISs can reach, either directly, or through other ISs. The ISs that can route within an area are called Level 1 IS. These ISs know all other Level 1 ISs within the area and the shortest path to each. A Level 2 IS contains routing information about other Level 2 ISs outside the area. The Level 2 IS is responsible for routing from one area to another.

There is a relation between an WaveStar OLS 40G transport network, the DCN that is used for management of this network and the division of a DCN into IS-IS areas:

1. The transport network between NEs is the basis of the WaveStar OLS 80G network and provides DCC channels for management of that network using OSI-protocols.
2. The DCN is a combination of DCC and LAN connections and has a different topology than the transport network, although limited by the DCC facilities that are provided by the transport network.
3. LAN is used for interconnection of nodes that are in the same office. An end system (destination) or intermediate system (router) is referred to as a node in the DCN.
4. Extended routing makes it possible to enlarge the size of the DCN, and is achieved through the use of two levels in the IS-IS routing protocols at the network layer of the OSI stack. To use the extended routing scheme, the DCN is divided into several areas, and an extra interworking level between these areas is used.

CMISE

Figure 5-3 shows the seven layers of communications protocols used in Release 4.0. The communications protocols between the EMS and network element and those between network elements are both OSI 7-layer stacks. They differ in the following areas:

- **Physical layer:** the IAOLAN connects the EMS and network element; the DCC runs between network elements
- **Data link layer:** LLC/MAC is used between the EMS and network element; LAPD is used between network elements.

As part of the application layer, CMISE operates in conjunction with ACSE (Association Control Service Element) and ROSE (Remote Operations Service Element) to define remote operation functions and establish logical associations between network elements and EMSs.

Compared to previous releases where X.25 “short stack” was used in between EMS and the Gateway Network Element (GNE), the network element that directly connects to the EMS now plays a less important role than the GNE. Instead of transferring encapsulated messages from the X.25 link to the 7-layer stack, it simply provides the EMS with access to the DCC network so that the target NE is directly addressed via its Network Service Access Point (NSAP).

⇒ NOTE:

DCC interworking is not supported between different types of network elements. This is because the format of management information sent via the DCC differs between network element types. However, messages may be carried across network elements in the same domain.

The NSAP used in addressing the destination NE in the Network Layer has two basic formats: one for SONET and one for SDH. These formats differing in the 1-octet Network Selector field. ITM-SC recognizes/uses the SONET format for WaveStar OLS 40G network elements.

For interworking needs, the 2-octet “area address” field within the NSAP is provisionable and WaveStar OLS 40G can pass variable length NSAPs from network elements other than WaveStar OLS 40G. The ENT-SYS command page now includes a new name-value pair in the “spec_block” TL1 field to allow provisioning of the 2-octet area address field in the NSAP.

Application Layer:	CMISE (X.710/711) ACSE (X.217/227) ROSE (X.219/229)
Presentation Layer:	X.216/226
Session Layer:	X.215/225
Transport Layer:	TP4 (ISO 8073)
Network Layer:	CLNP (ISO 8473) ES-IS/IS-IS (ISO 9542)
Data Link Layer:	LLC (IEEE 802.2) MAC (IEEE 802.3)
Physical Layer	10BaseT CSMA/CD IAOLAN (IEEE 802.3)

Figure 5-3. OSI Stack Used Between EMS and the Network Element

At the physical level, 10BaseT twisted pair wire is supported. Where ITM-SC and WaveStar OLS 40G are connected locally without going through a WAN, the ITM-SC is instead connected to a hub that provides a number of RJ45 connections for 10BaseT.

Release 4.0 Operations Interface Connectivity

In previous releases, the OI domain had been limited to the set of end terminals plus intermediate repeaters and extended with dual-facing end terminals or the Telemetry Feed-through feature. OI connectivity was provided through the use of the SONET DCC bytes present in the supervisory channel that is multiplexed/demultiplexed in each optical section between WaveStar OLS 40G network elements.

The DCC bytes are (de)multiplexed by the TLM circuit packs, with two TLM circuit packs in each end terminal and four in each repeater. The TLM circuit packs also provide user access to other parts of the SONET overhead such as orderwires (E1 and E2 bytes). The TLM circuit packs route the DCC signals to the TOHCTL circuit pack for OSI stack and application processing. The DCC and other overhead bytes are 1x1 protected on a per-optical section basis. This feature expands the domain of the OI applications to include network elements other than those in the local fiber span by adding hardware and software that provide a 10BaseT, IEEE 802.3 LAN interface.

In Release 4.0, a new TOHCTL (LEA102) circuit pack replaces the TOHCTL (LEA502) circuit pack. Figure 5-4 shows a high level block diagram of this new circuit pack. The new TOHCTL circuit pack supports the same 1x1 switched supervisory channel DCC access as the earlier TOHCTL circuit pack. It also provides an 802.3 10BaseT LAN interface for WaveStar OLS 40G network elements configured as end terminals. This is accomplished by inserting the IAOLRP circuit pack into the empty slot (labeled "IAOLRP" with list L191) beside the first telemetry circuit pack. The IAOLRP routes the 10BaseT signals from the IAOLAN connector of the interconnection panel to the DCC transmit and receive outputs of the regular TLM circuit pack.

**NOTE:**

The new TOHCTL (LEA102) circuit pack is required with Release 4.0 software.

Based on the configuration in which it is installed (Repeater or End Terminal), the TOHCTL (LEA102) circuit pack automatically determines whether to process the signals from slot TLM-1B or slot IAOLRP as SONET DCC or as IAOLAN-specific.

⇒ NOTE:
To support CMISE-based network management, the TOHCTL (LEA102) circuit pack is required in all WaveStar OLS 40G End Terminals and Repeaters.

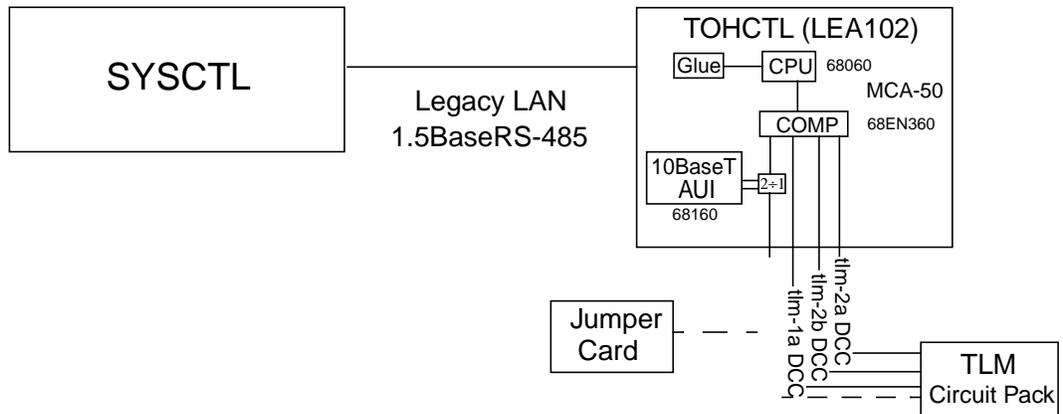


Figure 5-4. TOHCTL (LEA102) Block Diagram

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, 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 circuit pack reset

- Indication of OPS circuit 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-SC is also supported by the integrated WaveStar OLS 40G 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.

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 management 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 management subnetwork.

The GNE receives operations information from these network elements through the DCC and reports that information and its own to the operations system.

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 management 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 management 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 network 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. 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 management 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 an 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

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.

NOTE:

In cases when both primary and secondary lines experience outage, only minor (SDH=deferred) alarms are generated by WaveStar OLS 40G.

In this situation, primary data regarding signal integrity should be obtained from the associated add/drop multiplexers (signal source) instead of WaveStar OLS 40G since these will be able to detect the service outage and report a higher severity alarm.

"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 5-5, both the primary and secondary lines require separate OAs and telemetry circuit packs.

OPS Circuit Packs

The OPS feature utilizes the following 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 Multiplexer Unit (SPOMU)** – This circuit pack is required in OPS configurations.
- **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. It is required in OPS configurations.

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



NOTE:

The OPS, SPOMU, and SPODU circuit packs are only used in OPS configurations.

Figure 5-6 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, but does not switch to the secondary line if LOS is detected on both lines.

⇒ NOTE:

When operating in bidirectional mode, both end terminals must be provisioned as bidirectional. When operating in unidirectional mode, both end terminals must be provisioned as unidirectional.

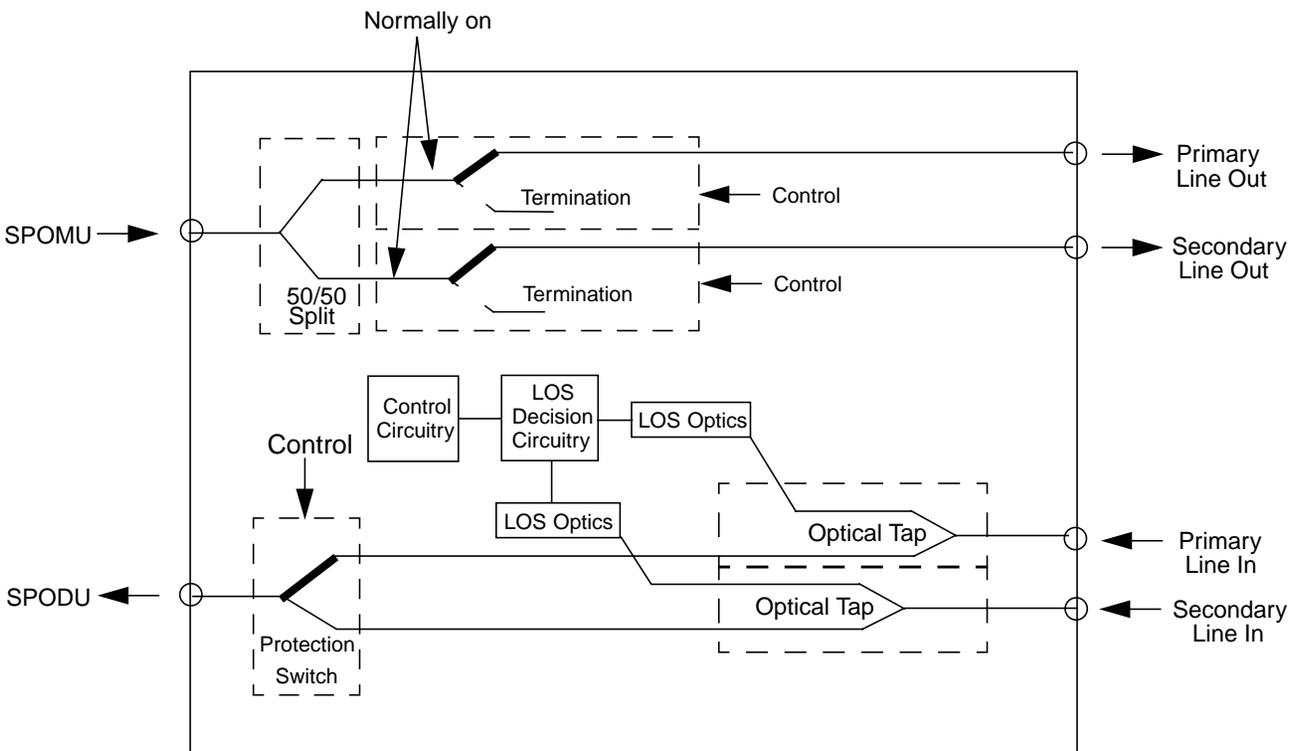


Figure 5-6. OPS Circuit Pack Block Diagram

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. Center-Link 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 circuit pack. Autonomous reporting of the following conditions (from the OPS/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 circuit 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 5-7, this arrangement provides single shelf operation while supporting a different number of spans for each line.

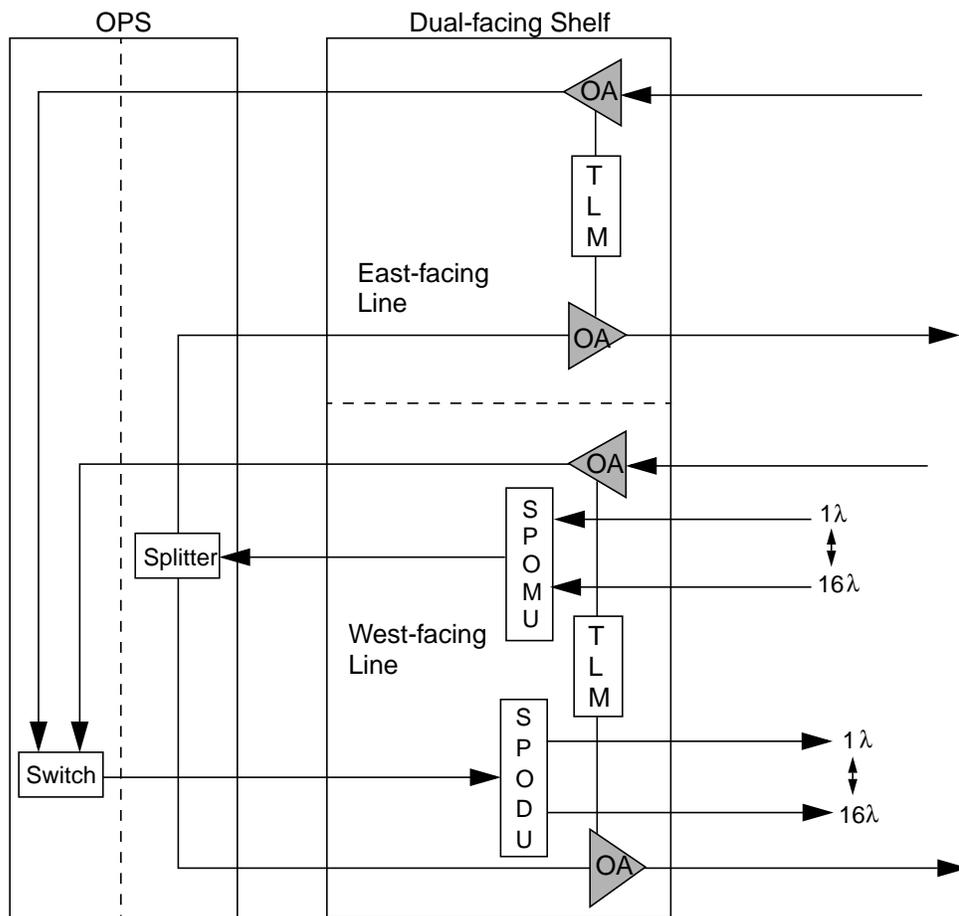


Figure 5-7. Dual-facing Shelf Configuration

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 circuit 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 circuit pack.

Automatic Power Shutdown and Restart (APSD)

WaveStar OLS 40G utilizes APSD as an equipment safety mechanism. The APSD feature protects against optical surges and possible human exposure to powerful WaveStar OLS 40G output by reducing power to Hazard Level 1 on the optical line between adjacent offices.

The following high power links exist in a WaveStar OLS 40G system along which APSD can occur:

**DANGER:**

The link between an OA and the ODU at the receive-end OA should be protected as well. In this case, an LBO needs to be installed during system installation to ensure that power levels never exceed IEC Class 3A).

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 5-8, 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 and 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" to Class 1 levels 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 circuit 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.

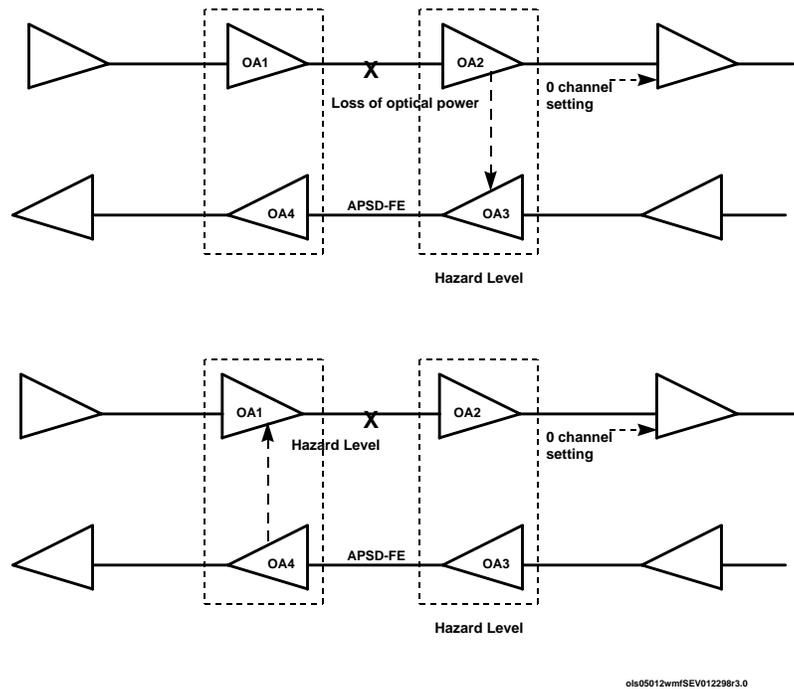
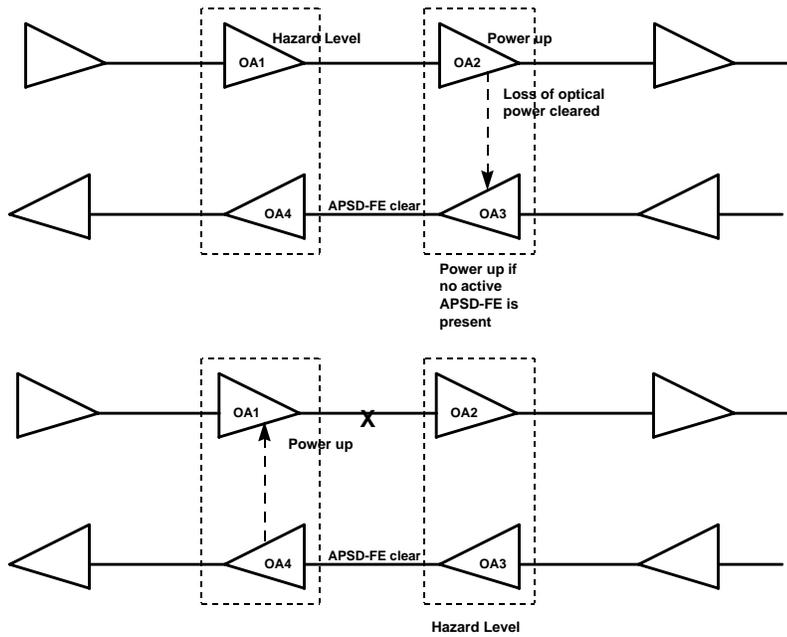


Figure 5-8. APSD for Optical Line Failure Between Terminals (Two-OA)

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

In Figure 5-9, 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.



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Figure 5-9. Restart on an Optical Line Link Between Terminals (Two-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 circuit 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 5-11 illustrates restarting in a single-OA configuration.

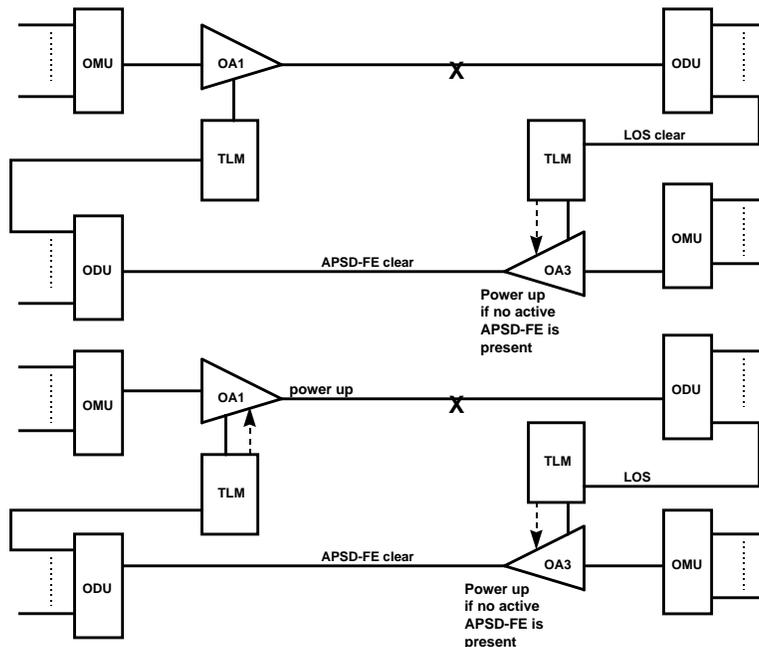


Figure 5-11. Restarting on an Optical Link Between Terminals (Single-OA)

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 at 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 management 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 management 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 the WaveStar OLS 40G integration capability, 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. With OT integration, there is no longer a 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)

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

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.

⇒ 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 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:

- **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 4.0 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.

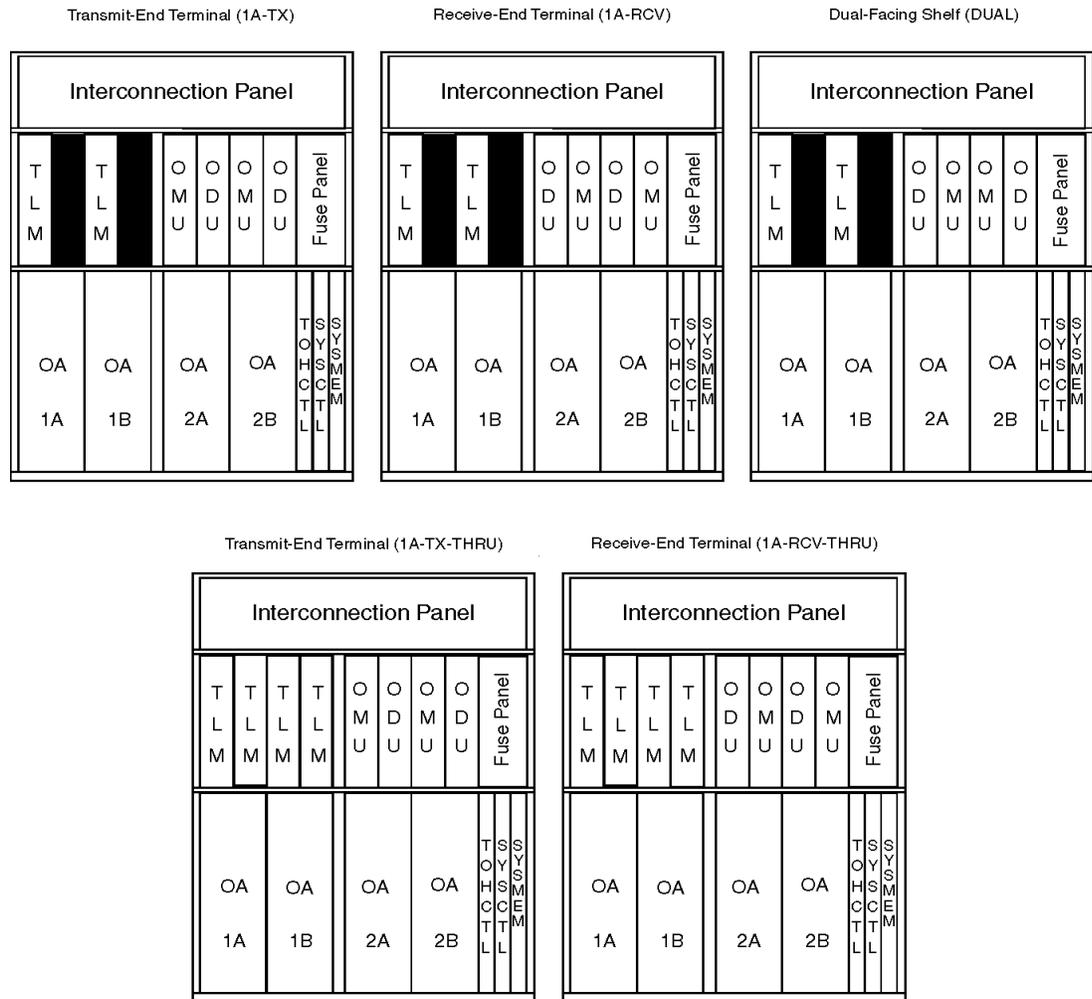
WaveStar OLS 40G Terminal Provisioning

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 5-12 shows WaveStar OLS 40G End Terminal shelves with different configurations.



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Figure 5-12. 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 5-12 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. 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 management subnetwork) through to the other collocated End Terminal (another WaveStar OLS 40G management 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, this feature requires an additional TLM circuit 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 is enhanced to process not only the DCC information routed from the TLM 1A/2A circuit pack but further route the DCC information to the TLM 1B/2B circuit pack. The TLM 1B/2B circuit pack in one End Terminal is

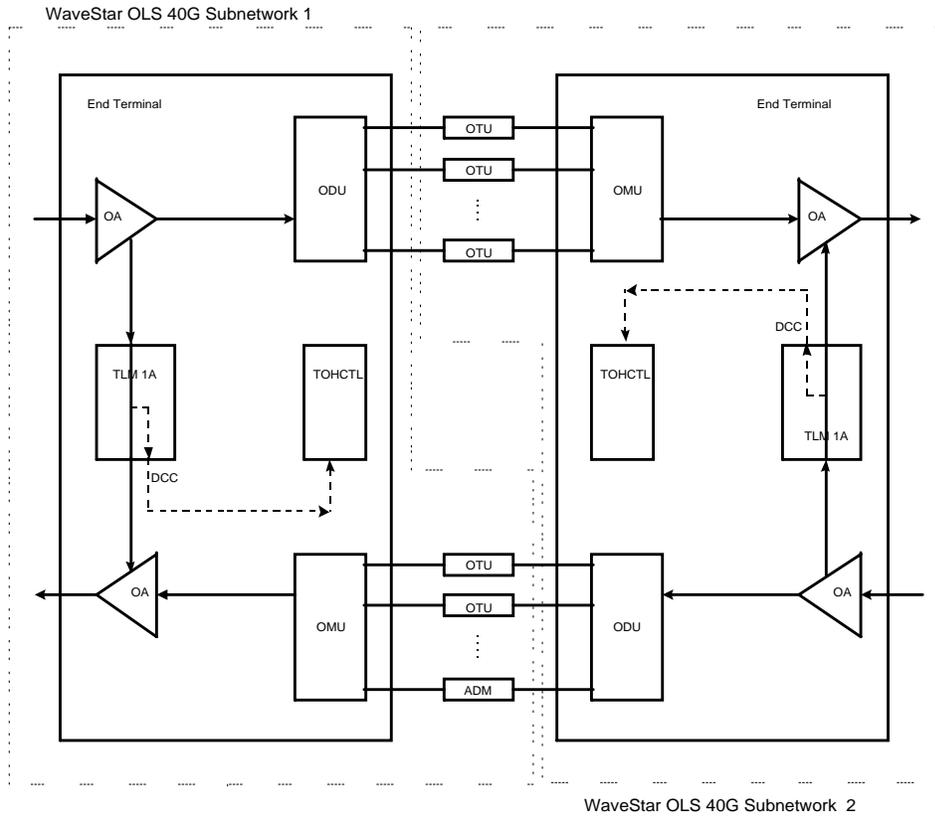
connected via a fiber jumper to the TLM 1B/2B in the other End Terminal for routing the DCC information through. When the DCC information comes out from the other TLM 1B/2B circuit pack to the TOHCTL in the other end terminal, it gets processed by the TOHCTL as needed.

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 5-14, 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 management subnetwork to another collocated End Terminal in another management subnetwork via the fiber jumper connecting the two additional TLM packs. Similarly, the DCC information in the opposite direction takes a symmetric passage.

Figure 5-13 and Figure 5-14 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.

**NOTE:**

OLS end terminals equipped with the 4-Fiber Telemetry Feed-through feature do not support IAOLAN access.



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Figure 5-13. WaveStar OLS 40G Architecture without 4-Fiber Telemetry Feed-Through

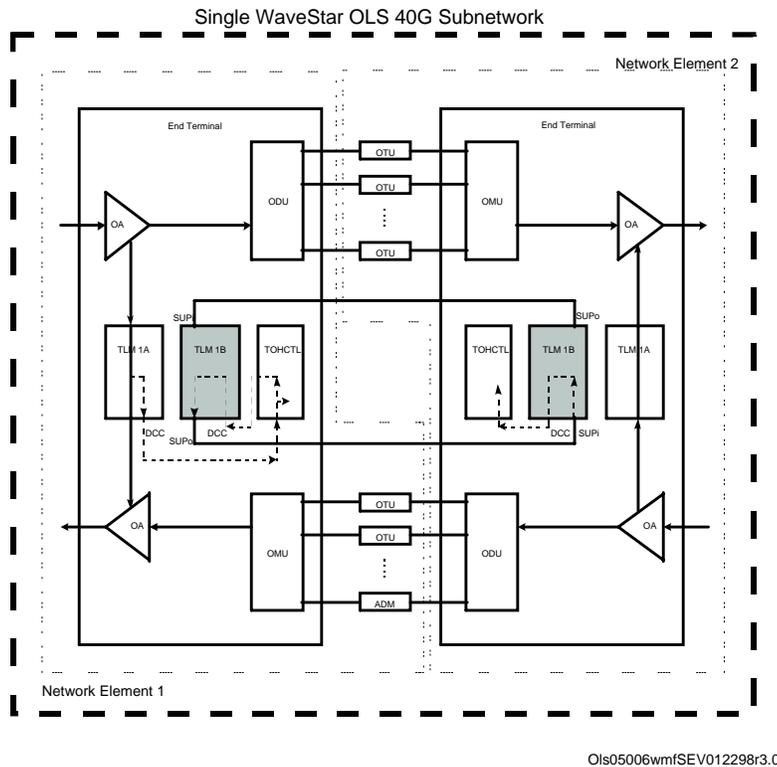


Figure 5-14. WaveStar OLS 40G Architecture with 4-Fiber Telemetry Feed-Through

The 4-Fiber Telemetry Feed-through feature extends the DCC across concatenated WaveStar OLS 40G management 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/OT Integration

The OT Controller (OTCTL) integrates the WaveStar OLS equipment with the OT. 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 the WaveStar OLS equipment and the 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.

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 5-15 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.

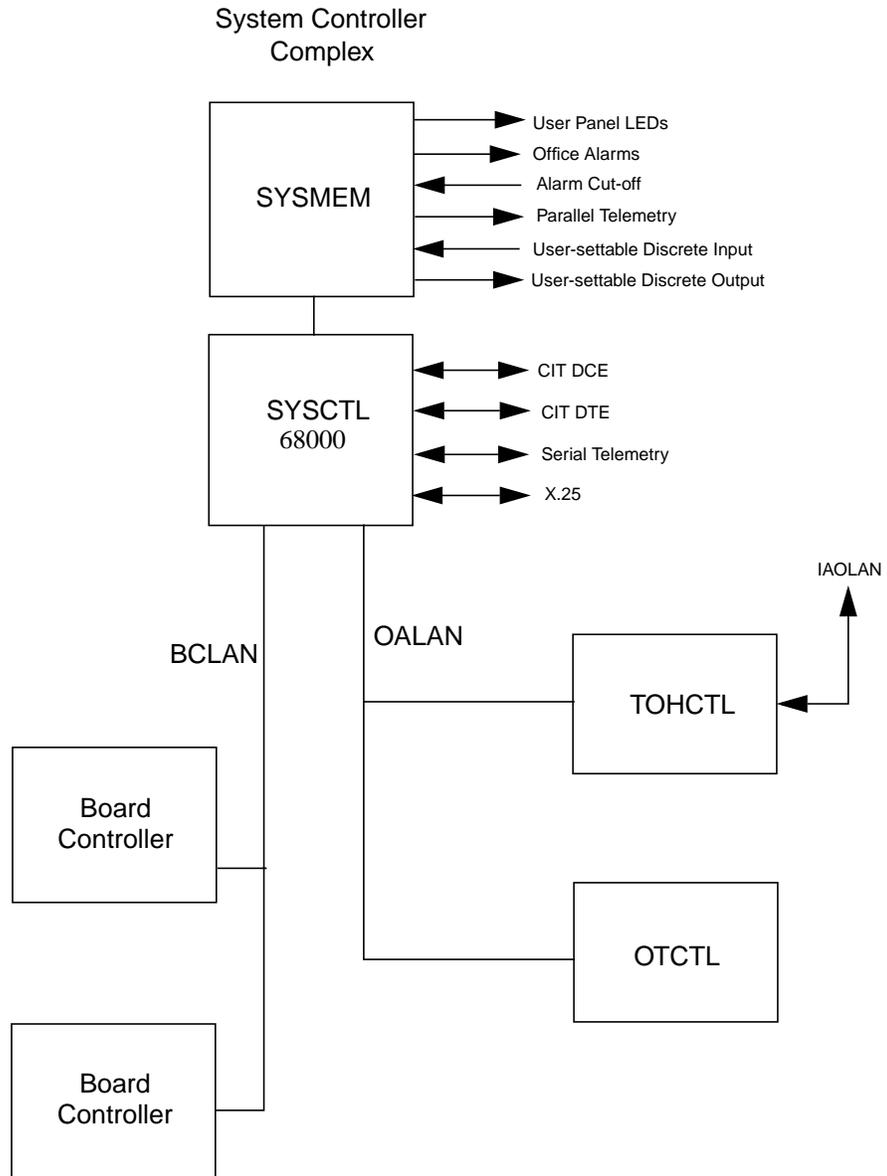


Figure 5-15. System Control Architecture for WaveStar OLS 40G

The board controller contains a micro-controller with supporting circuitry. This controller monitors and controls the OA and TLM circuit packs, isolates faults at the circuit pack level, controls the 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.

System Planning and Engineering

6

■ Engineering Rules.....	6-2
Lightguide Buildouts (LBO)	6-2
WaveStar OLS 40G Network Topologies	6-2
Engineering Rules for Two-OA Applications	6-3
Engineering Rules for Single-OA Applications.....	6-6
Dispersion	6-8
WaveStar OLS/OT Interworking	6-8
■ Upgrade Considerations	6-10
LBO Considerations.....	6-10
Upgrading From Release 3.X to Release 4.0	6-11
Network Element Software Upgrade Paths.....	6-13
■ Floor Plan Layout.....	6-14
■ Equipment Interconnection	6-16
■ Cabling.....	6-16
LBO Color Types	6-22
■ Environmental Considerations	6-26
■ Power Planning.....	6-27

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 Release 4.0 Installation Manual*.

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

WaveStar OLS 40G Network Topologies

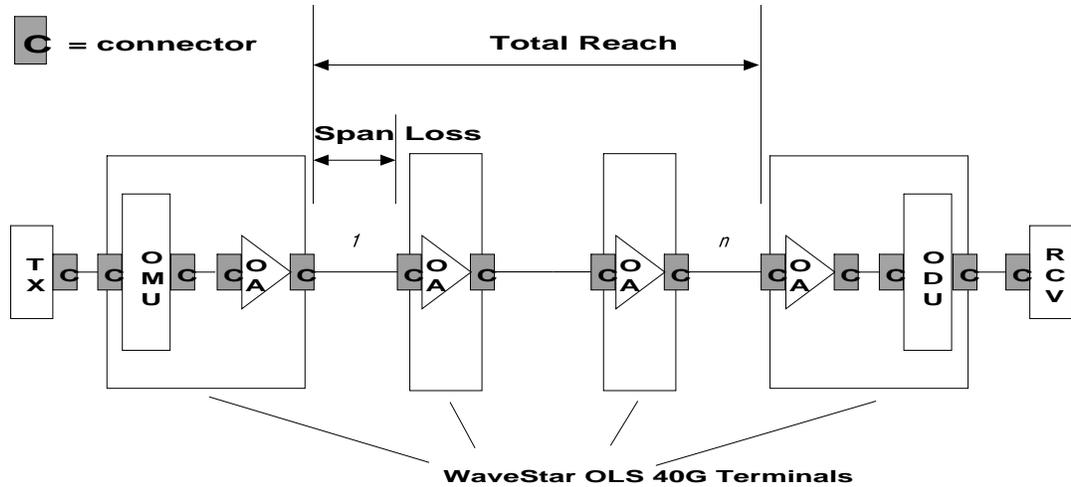
Table 6-1 shows the five types of Optical Amplifiers (OA) used in Release 4.0. WaveStar OLS 40G supports any mix of OC-3/12/48, STM-1/4/16, or 150-750 Mb/s signal rates and supports both two-OA and single-OA operations.

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

OA Code	Application	Two-OA	Single-OA
LEA6	Long Span	✓	
LEA7	Long Reach	✓	
LEA7B	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.



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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, LEA7B	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.

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

Engineering Rules for Optical Protection Switching

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 22 dB of loss (8x22 dB), then Line B must have seven spans at or near 22 dB of loss (7x19 dB). Configurations such as 8x22 dB and 7x17 dB are not supported. (See third bullet, below.)

The following guidelines govern usage of the OPS feature in Release 4.0:

- 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. The A, B, and C settings are described in more details in the *WaveStar™ OLS 40G Installation Manual, Release 4.0*.

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 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 is not supported in 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.

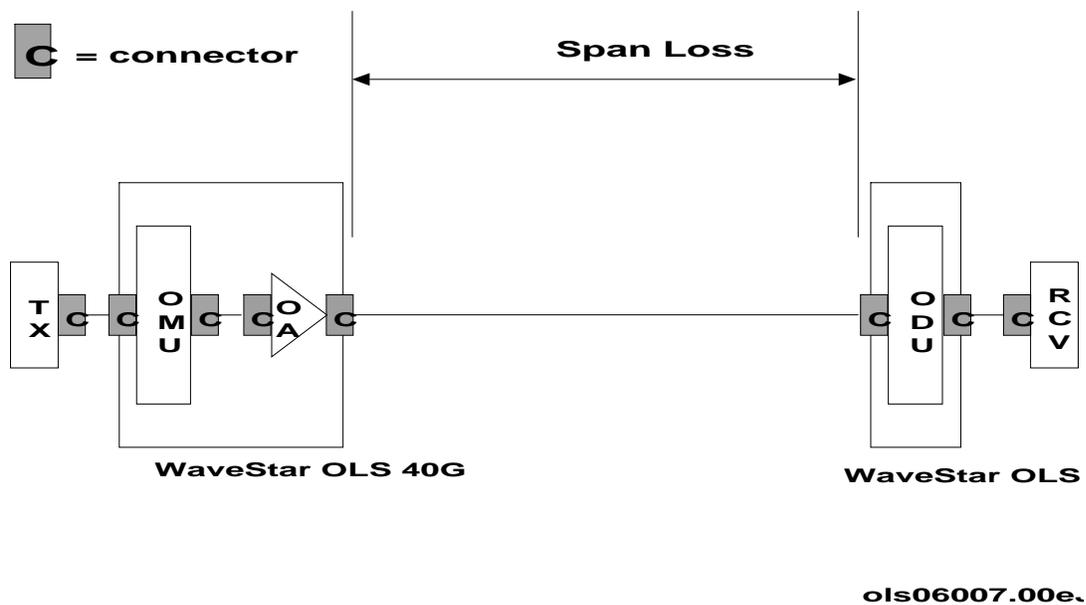


Figure 6-2. WaveStar OLS 40G Single OA System

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.

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 for OC-48/STM-16 signals.

In WaveStar OLS 40G systems with dispersion between 6800 ps/nm and 10,900 ps/nm, use of 41Cx C OTUs or Lucent ADMs with an equivalent WaveStar OLS 40G-compatible transmitter is required for OC-48/STM-16 signals.

The 42Ax, 43Ax, and 44Ax Optical Translator Port Modules (OTPM), associated with the Quad Optical Translator Units (QOTU) and used for OC-3/STM-1, OC-12/STM-4, and 150-750Mbps optical channels, respectively, can accommodate dispersions of up to 10,900 ps/nm.

WaveStar OLS/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.

An optical channel starts at a signal source, such as a SONET/SDH add/drop multiplexer and ends at another signal source. It may pass through multiple OLS systems before being terminated at another signal source. Each optical channel may pass through as many as 16 OTUs before optical channel termination is required independent of how and where the OTUs are used and independent of the number of spans traversed.

⇒ NOTE:

If Lucent Technologies SONET/SDH ADMs are used, the optical channel can pass through 20 OTUs before signal termination is required.

A maximum of sixteen OTUs/OTPMs can be used between SONET/SDH line terminals. Figure 6-3 shows WaveStar OLS 40G systems using OTUs/OTPMs for adding or dropping wavelengths. In this way, OTUs/OTPMs can also be used to concatenate multiple point-to-point WaveStar OLS 40G systems.

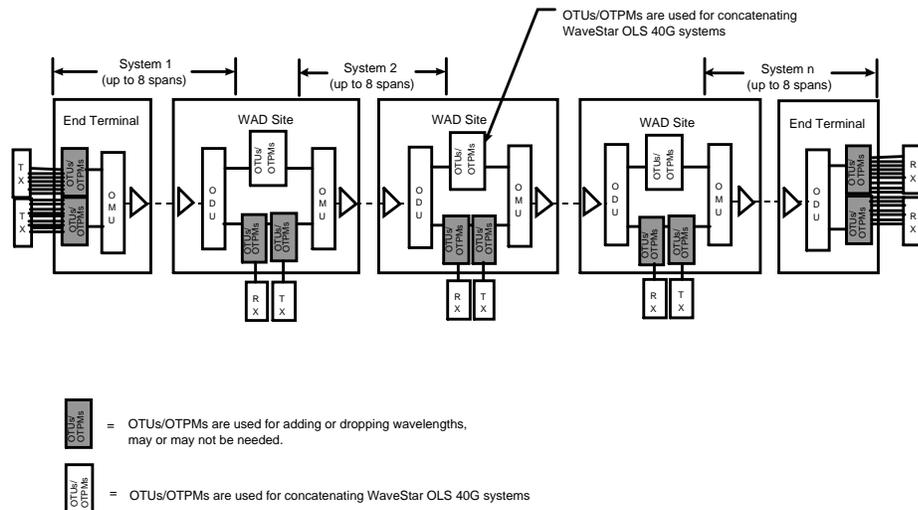


Figure 6-3. WaveStar OLS/OT Interworking

Upgrade Considerations

To upgrade from an existing eight wavelength Release 2.0 WaveStar OLS 40G system to a sixteen wavelength Release 2.1 or later system, the following considerations need to be made during the planning stage:

- Verify that 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 or new OAs may be required.
- The eight wavelength OMU/ODU circuit packs, lightguide cable, and LBOs must be changed to the sixteen wavelength versions.
- To accommodate sixteen wavelengths, WaveStar OLS 40G Release 2.1 or later software is required.

When upgrading to Release 4.0 software, the following points need to be considered regarding the OPS feature:

- Perform upgrade prior to installing the OPS, SPODU, and SPOMU circuit packs (if these packs were not already present).
- Verify that an OTCTL circuit pack is 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 optional SPOMU).

LBO Considerations

Lists L112, L113, and L114 (J68982C-1); lists L112, L114, and L115 (J68982D-1); and lists L124, L125, L126, L134, L135, and L136 (J69000C-1) all apply to systems handling up to 16 wavelengths and are recommended for use with Release 4.0. Use the following rules when installing LBOs associated with an upgrade (see Figure 6-9):

- 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 4.0. 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 4.0, use L125 (J69000C-1) on OTUs and L126 (J69000C-1) on OTPMs.
- 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. L125 (J69000C-1) and L126 (J69000C-1) are required on OTUs and OTPMs, respectively
- If the span loss of your system is not within the 16 wavelength engineering rules, all OA LBOs must be re-installed using lists L112, L113, or L114 following an upgrade to Release 4.0 (it is assumed in this case, that significant system re-engineering has been undertaken)
- When using LBOs on the input of add-side OTUs and OTPMs, select an optical LBO that can attenuate the input signal to a value that is between -12 and -22dB.

Upgrading From Release 3.X to Release 4.0

The Release 3.X to Release 4.0 upgrade utilizes an intermediate software set (component of Release 4.0) to reduce the DCC communication down time during the upgrade process.



NOTE:

The OSI stacks in Releases 3.X and 4.0 of WaveStar OLS 40G are incompatible and do not inter-work with each other. The intermediate software set is introduced solely for the purpose of providing an upgrade path that minimizes DCC communication down time during the upgrade.

The entire management subnetwork must first be transitioned onto this intermediate set in order to ensure that DCC interworking is maintained while the final Release 4.0 upgrade (requiring circuit pack replacement) is in progress.

To upgrade to Release 4.0 via the intermediate software set, the following requirements need to be satisfied:

- The earlier TOHCTL circuit pack used in Release 3.1 and earlier releases needs to be replaced with the new TOHCTL (LEA102) circuit pack

- The new IAOLRP circuit pack needs to be installed in End Terminal locations that require LAN access
- The IAOLAN feature can only be used in End Terminals where there is no circuit pack installed in the TLM 1B slot (this slot would be labeled “IAOLRP” using L191).
- In situations where an End Terminal is converted from a Telemetry Feed-thru configuration (where a circuit pack is present in the TLM 1B slot) to one that utilizes the IAOLAN feature, the Telemetry circuit pack must be removed before installing the IAOLRP circuit pack in the same slot.

The intermediate software set enables the network element to be upgraded from Release 3.X to Release 4.0 software. The following points govern the interoperability of Release 3.X software and the intermediate software set:

- The intermediate software set works with WaveStar OLS 40G Release 3.X hardware including the earlier TOHCTL (LEA5) circuit pack.
- The intermediate software set does *not* work with Release 3.X software.

The following points govern the interoperability of Release 4.0 software and the intermediate software set:

- The intermediate software set does *not* work with the new TOHCTL (LEA102) and IAOLRP circuit packs
- The intermediate software set works with Release 4.0 software.

Network Element Software Upgrade Paths

Nominal WaveStar OLS 40G upgrade paths and exceptions to these paths are shown in Table 6-4.

Table 6-4. Supported Software Upgrade Paths

		Upgrade Release						
		1.0.0	2.0.0	2.1.0	2.1.1	3.0.2	3.1.1	4.0.2
Current Release	1.0.0		✓					
	2.0.0			✓	✓	✓		
	2.1.0				✓			
	2.1.1					✓	✓	
	3.0.2							✓
	3.1.1							✓
	4.0.2							

Floor Plan Layout

Figure 6-4 shows a typical floor plan layout for the WaveStar OLS 40G in a central office. WaveStar OLS 80G is a front access system with rear aisle space of 2 feet that is recommended for allowing 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.

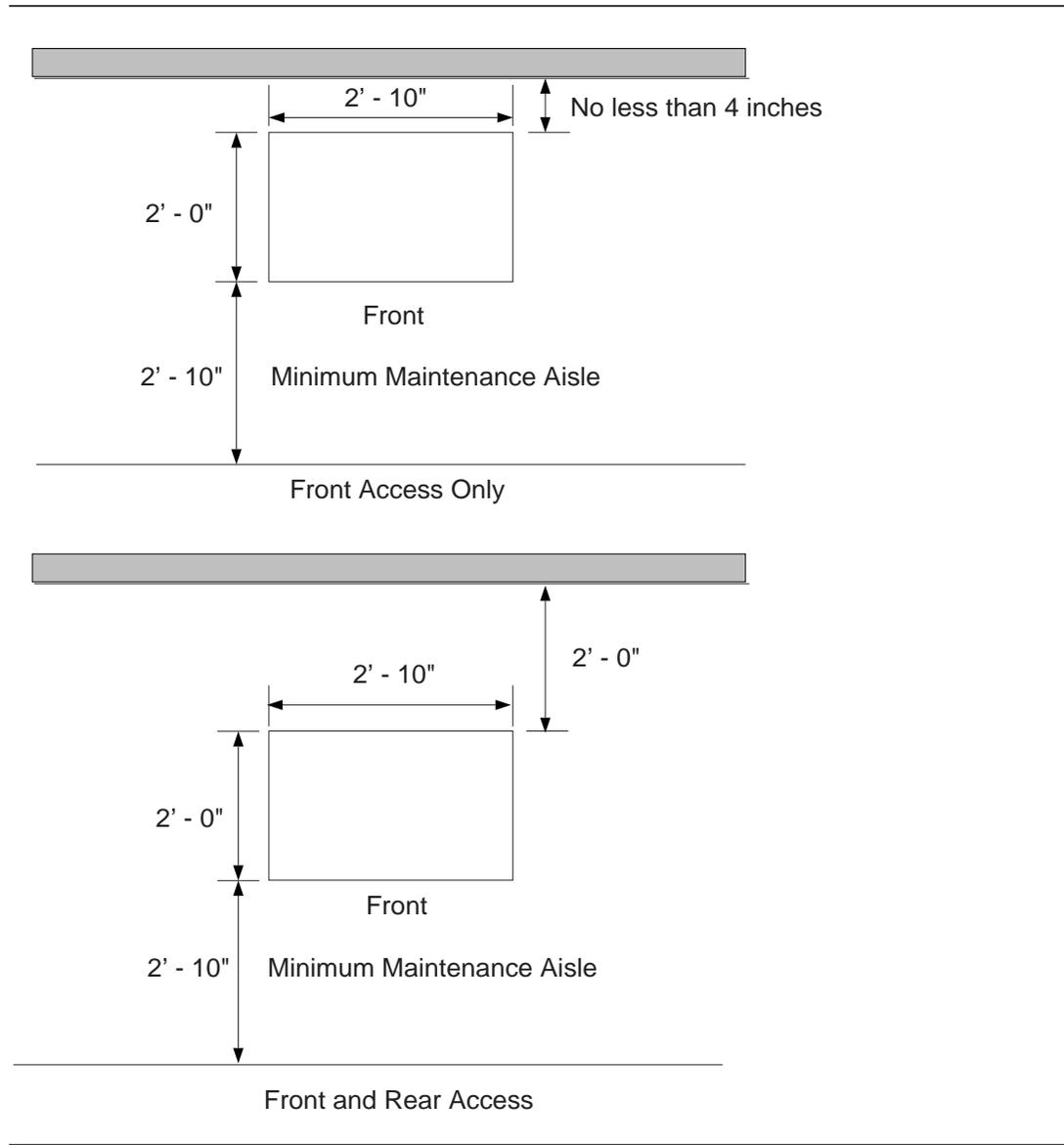


Figure 6-4. Floor Plan Layout

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.

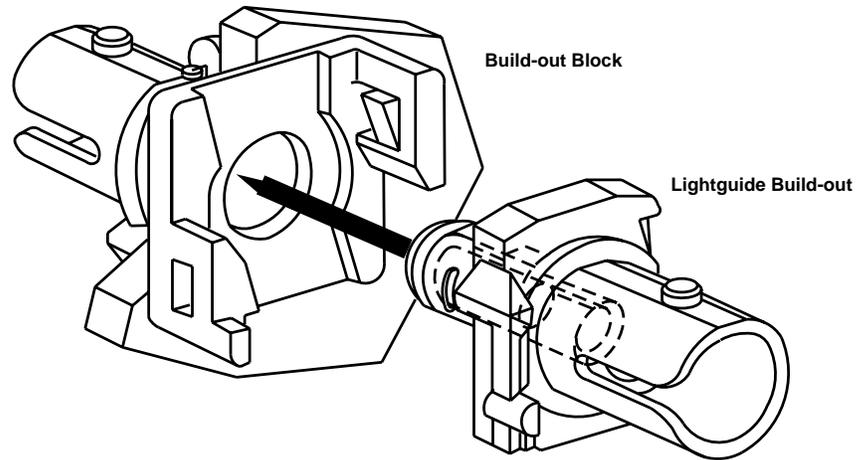
If required, the connector system also provides optical attenuation (optical LBO). All optical interfaces are factory-equipped with ST connectors having 0 dB attenuation. These connectors can be changed and other connector types used.

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. The sixteen wavelength ODU and OMU require the smaller LC-type con-

* Function as both a connector and an LBO.

nectors due to the higher density of optical connections associated with the sixteen wavelength feature.

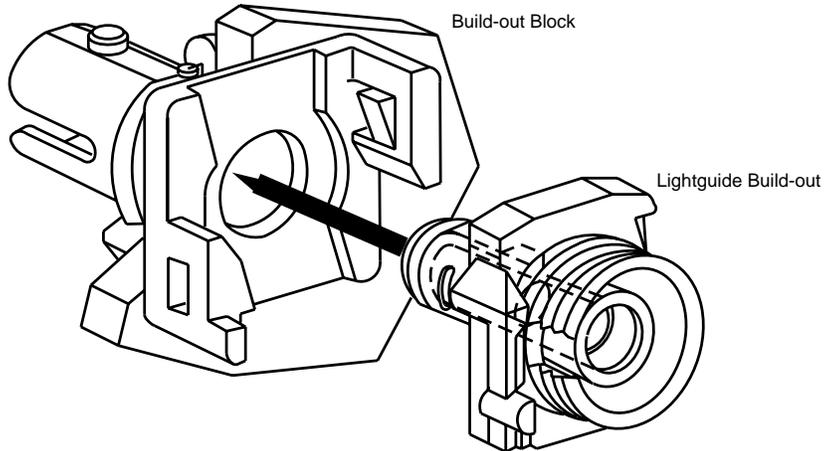
Figure 6-5 shows the build-out block and an ST-type LBO assembly.



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Figure 6-5. ST-Type Build-Out Assembly (enlarged)

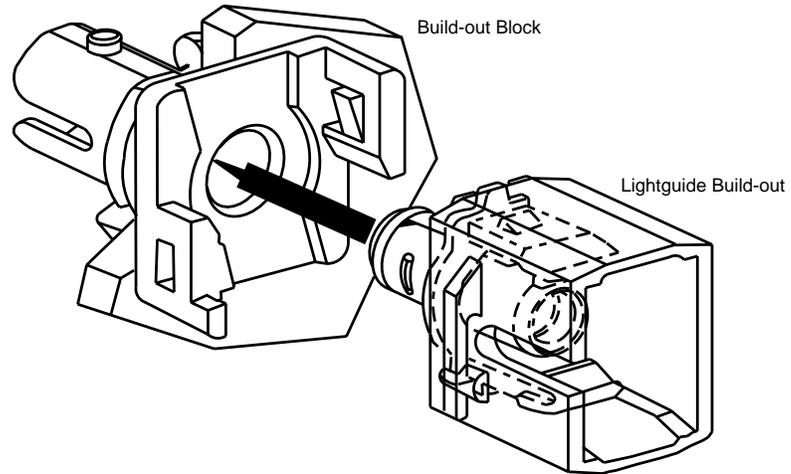
Figure 6-6 shows the buildout block and an FC-type LBO assembly.



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

Figure 6-7 shows the build-out block and SC-type LBO assembly.



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

Figure 6-8 shows an LC-type connector.

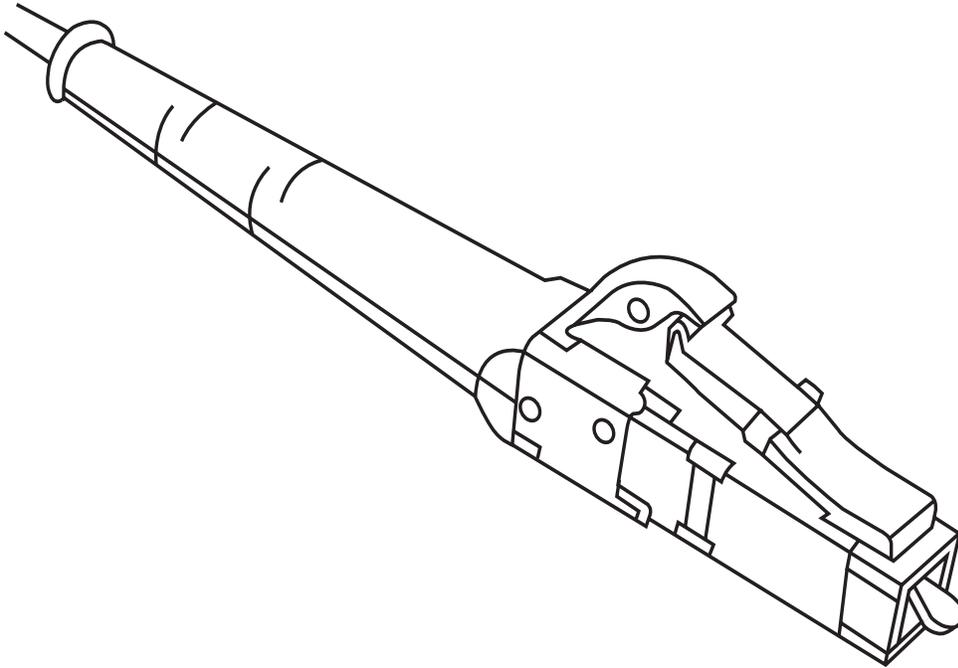


Figure 6-8. LC-Type Connector (enlarged)

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:

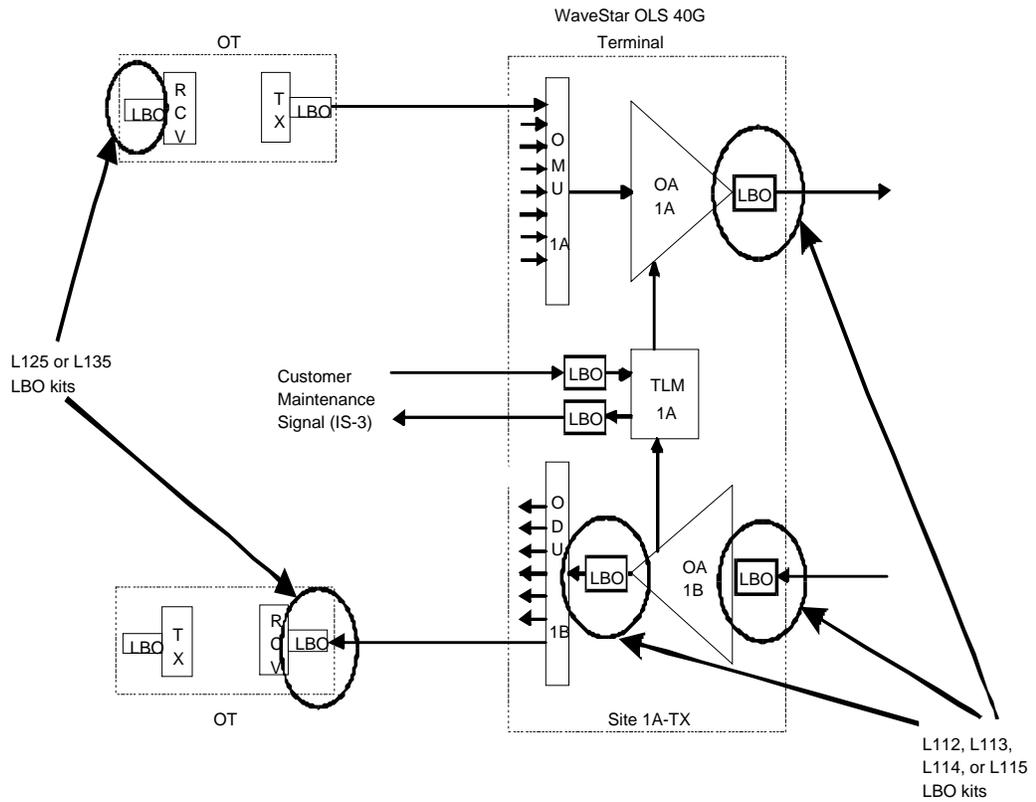
All optical fiber connectors (ST, FC, SC, and LC types), lightguide buildouts, and buildout blocks must be cleaned before initial or sub-

sequent connections are made. Refer to “Related Products” in Chapter 7, “Ordering,” for information on cleaning materials.



NOTE:

Figure 6-9 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.



LBO type depends on configuration and dB loss requirements
(kits contain appropriate quantities for each requirement)

Figure 6-9. LBO Location in an End Terminal

LBO Color Types

Table 6-5 lists specifications of various LBO color types used with WaveStar OLS 40G systems.

Table 6-5. 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 6-5. 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 yellow LBO values, both green and yellow LBO types use elements of the same kind. Power tolerance is, therefore, the same.

Table 6-8 lists information on converting LBOs used in WaveStar OLS 40G Release 2.0 and earlier to those used in later releases, including Release 4.0. Specifically, the table provides specifications for use when converting from yellow LBOs to green LBOs.

Table 6-6. Yellow LBO-to-Green LBO Conversion Specifications

Yellow LBO Value	Comcode (ST Connector)	Actual Attenuation (dB)		Green LBO Value	Comcode (ST Connector)	Actual Attenuation
3.0	107380438	2.7 +/- 0.3	Convert To:	3.0	108053059	3.0 +/- 0.3
5.0	107406183	4.7 +/- 0.3		4.5	108053083	4.5 +/- 0.3
7.0	107107740	6.1 +/- 0.4		6.0	108053117	6.0 +/- 0.3
10.0	107408191	9.0 +/- 0.7		9.0	108053174	9.0 +/- 0.3
15.0	107406209	14.0 +/- 0.7		14.0	108053232	14.0 +/- 0.3
20.0	107406217	18.0 +/- 1.0		18.0	108053265	18.0 +/- 1.0

The OAM&P cables are terminated with D-subminiature connectors, shown in Figure 6-10, 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."

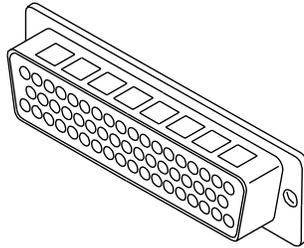


Figure 6-10. D-Subminiature Connector

Environmental Considerations

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

WaveStar OLS 40G complies 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 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 dissipates heat by natural convection cooling and does not require a cooling fan. Table 6-7 presents information on power dissipation and current drains for different system configurations.

Table 6-7. WaveStar OLS 40G 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
Miscellaneous-mounted Shelf:				
Dual End Terminal Shelf	138	NA	1.4	3.2
Dual Repeater Shelf	172	NA	1.8	4.0
Dual Facing Shelf	138	NA	1.4	3.2

Table 6-7. WaveStar OLS 40G 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 WaveStar OLS 40G Equipment 7-2
 - Ordering Lightguide Office Cable..... 7-2
 - WaveStar OLS 40G Package Descriptions 7-3
 - OT Package Descriptions 7-9
 - Circuit Pack/Unit Descriptions..... 7-12
 - Cables 7-16
 - Intraoffice Electrical Non-transmission Cable Descriptions (WaveStar OLS 40G)..... 7-16
 - Intraoffice Electrical Non-transmission Cable Descriptions (OT) 7-17
 - Fiber Optic Cables 7-22
 - Power Fuse..... 7-23
 - Power Meter Adapters 7-23
 - Related Framework..... 7-24
 - Related Products..... 7-25
 - Ordering Cleaning Materials 7-25
 - Ordering METRAL Backplane Replacement Pins 7-25
 - Ordering the External Miscellaneous Discrete Unit (EMDU)..... 7-29
 - DANTEl Orderwire Shelf..... 7-31
 - WaveStar OLS 40G Circuit Pack/Unit Compatibility 7-32
 - Ordering Sample 7-34
 - Sample Network Assumptions 7-36
 - Sample Network Specifications 7-36
 - Sample Worksheets..... 7-37
 - Sample Cabling Illustrations 7-56

■ WaveStar OLS 40G Worksheets	7-58
■ WaveStar OLS 40G Super Kits	7-136
Integrated Cabinet (Double) Super Kit (ED-8C903-40, G1)	7-136
Integrated Bay (Double) Super Kit (ED-8C903-40, G2)	7-136
Integrated Cabinet (Triple 1) Super Kit (ED-8C903-40, G3)	7-137
Integrated Bay (Triple 1) Super Kit (ED-8C903-40, G4)	7-137
Integrated Cabinet (Triple 2) Super Kit (ED-8C903-40, G5)	7-138
Integrated Bay (Triple 2) Super Kit (ED-8C903-40, G6)	7-138
■ Software and Documentation	7-139
■ Conversion Kit	7-141
■ OT Circuit Pack Compatibility	7-142
■ WaveStar OLS-to-OT Control Cabling.....	7-144
WaveStar OLS 40G Cabling for Double and Triple 1 Arrangements (ED-7G028-22)	7-144
WaveStar OLS 40G Cabling for Triple 2 Arrangement (ED-7G028-22).....	7-145

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 Products* 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, 8 λ) 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 16 λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA and TLM inputs and outputs. Refer to Chapter 6, "System Planning and Engineering."

(L113) ST LBO Kit: (R2.1 and later, up to 16 λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for use on OA inputs and outputs only. Refer to Chapter 6, "System Planning and Engineering."

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

(L121) FC LBO Kit: (R1.0 and R2.0, 8 λ) 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, 8 λ) 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 8 λ 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 8 λ and 16 λ 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 16 λ 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 16 λ 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 16 λ 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 16 λ 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.

(L171) WaveStar OLS 40G Integrated Bay/Cabinet (Double) Integration Cabling: provides integration cabling to connect a WaveStar OLS bay/cabinet (with 1 equipped shelf) to an OT bay/cabinet. These cables are used in a 2 bay/cabinet arrangement.

(L172) WaveStar OLS 40G Integrated Bay/Cabinet (Triple 1) Integration Cabling: provides integration cabling to connect a WaveStar OLS bay/cabinet (with 2 equipped shelves) to two OT bays/cabinets. These cables are used in a 3 bay/cabinet arrangement. Labels are also included to indicate bay identity as “Bay 1” or “Bay 2.”

(L173) WaveStar OLS 40G Integrated Bay/Cabinet (Triple 2) Integration Cabling: provides integration cabling to connect a WaveStar OLS bay/cabinet (with 1 equipped shelf) to two OT bays/cabinets. These cables are used in a 3 bay/cabinet arrangement. Labels are also included to indicate bay identity as “Bay 1” or “Bay 2.”

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

(L191) Intra-office Line Relay Pack (IAOLRP) Kit: provides labels for the IAOLRP circuit pack used in the WaveStar OLS 40G shelf. This label is placed under the first empty slot next to the TLM-1A slot. Used with L26.

(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, 8 λ) 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 16 λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OA and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L113) ST LBO Kit: (R1.0 and R2.0, 8 λ) 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 16 λ) provides a kit of lightguide build-outs with FC connectors for a single bidirectional line. Includes all necessary LBOs for OA and TLM inputs and outputs. This kit is used in the WaveStar OLS 40G shelf.

(L115) ST LBO Kit: (R2.1 and later, up to 16 λ) provides a kit of lightguide build-outs with ST connectors for a single bidirectional line. Includes all necessary LBOs for OAs only. This kit is used in the WaveStar OLS 40G shelf.

(L121) FC LBO Kit: (R1.0 and R2.0, 8 λ) 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.

(L123) FC LBO Kit: (R1.0 and R2.0, 8 λ) 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.

(L124) ST LBO Kit: (R3.1 and later, 16 λ) provides a kit of lightguide build-outs with ST connectors for use with the OPS circuit pack. Provides all necessary LBOs for a single OPS input and output when working with a SPODU (L474). This kit is used in the OT shelf.

(L131) SC LBO Kit: (R1.0 and R2.0, 8 λ) 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.

(L133) SC LBO Kit: (R1.0 and R2.0, 8 λ) 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.

(L134) FC LBO Kit: (R3.1 and later, 16 λ) provides a kit of lightguide build-outs with FC connectors for use with the OPS circuit pack. Provides all necessary LBOs for a single OPS input and output when working with a SPODU (L474). 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, 8 λ) 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, 8 λ) 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).

(L124) ST LBO Kit: (R3.1 and later, 16 λ) provides a kit of lightguide build-outs with ST connectors for use with the OPS circuit pack. Provides all necessary LBOs for a single OPS input and output when working with a SPODU (L474). This kit is used in the OT shelf.

(L125) ST LBO Kit: (R2.1 and later, 16 λ) 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 (L51, L52).

(L126) ST LBO Kit: (R2.1 and later, 16 λ) provides a kit of lightguide build-outs with ST connectors for use with OTPMs. Provides all necessary LBOs

for a single OTPM input and output when working with an ODU (L51, L52).

(L131) SC LBO Kit: (R1.0 and R2.0, 8 λ) 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).

(L134) FC LBO Kit: (R3.1 and later, 16 λ) provides a kit of lightguide build-outs with FC connectors for use with the OPS circuit pack. Provides all necessary LBOs for a single OPS input and output when working with a SPODU (L474). This kit is used in the OT shelf.

(L135) FC LBO Kit: (R2.1 and later, 16 λ) 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 (L51, L52).

(L136) FC LBO Kit: (R2.1 and later, 16 λ) provides a kit of lightguide build-outs with FC connectors for use with OTPMs. Provides all necessary LBOs for a single OTPM input and output when working with an ODU (L51, L52).

(L140) Style Strip for Lucent ETSI Cabinet: provides two style strips for the Lucent ED- cabinet. OT shelves are placed in this cabinet. One for left side and one for the right side.

(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)

(C107273336) OA, LEA6: (Optical Amplifier) amplifies the optical signal and controls the pump lasers for eight wavelengths in Long Span applications.

(C107742439) OA, LEA7: amplifies the optical signal and controls the pump lasers for both eight and sixteen wavelengths in Long Reach applications.

(C107976367) OA, LEA104: amplifies the optical signal and controls the pump lasers for sixteen wavelengths in Long Span applications.

(C108045394) OA, LEA105: amplifies the optical signal and controls the pump lasers for sixteen wavelengths in Short Reach applications.

(C108309949) OA, LEA7B: In addition to the same functions as the LEA7 OA (Long Reach), this OA contains an optical monitor test port and filters that support either a 1532 nm or 1510 nm Optical Supervisory Channel (OSC).

(C107272569) TLM, LDA1: (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.

(C107822967) IAOLRP, LDA3: (Intra Office Line Relay Pack) provides connection to the IAOLAN interface. This circuit pack is inserted into the IAOLRP slot (labeled with L191) of WaveStar OLS 40G End Terminal shelves. In 4-line systems, this circuit pack is used only in the bottom end terminal shelf; two IAOLRP circuit packs are required in dual end terminal shelf applications. *Required for Release 4.0.*

(C107273328) TOHCTL, LEA5: (Tributary Overhead Controller) processes the SONET section overhead of the supervisory channel. TOHCTL interfaces with the TLM circuit pack to exchange DCC data. This is used with OLS software releases 3.1 and earlier releases.

(C107822819) TOHCTL, LEA102: based on the configuration in which it is installed (Repeater or End Terminal), this circuit pack determines whether to process signals from slot TLM-1B or slot IAOLRP as SONET DCC or as IAOLAN-specific. The TOHCTL interfaces with the TLM circuit pack to exchange DCC data. *Required for Release 4.0.*

(C107272510) SYSCTL, LEA1: (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.

(C107786568) SYSMEM, LEA2: (System Memory) provides memory support for SYSCTL. User provisioned data and system software are stored in EPROMs on the SYSMEM circuit pack.

(C107292187) ODU, 605A: (Optical Demultiplexer Unit) demultiplexes the optical line signal into the eight drop side signals (8 λ).

(C108032814) ODU, 606A: (Optical Demultiplexer Unit) demultiplexes the optical line signal into sixteen drop side signals (16 λ - no supervisory signal).

(C108032822) ODU, 606B: (Optical Demultiplexer Unit) demultiplexes the optical line signal into sixteen drop side signals (16 λ) plus an additional supervisory line signal.

(C107292179) OMU, 505A: (Optical Multiplexer Unit) combines the eight drop side signals (8 λ) into one optical signal called the optical line signal.

(C107727828) OMU, 506A: combines sixteen drop side signals (16 λ) into one optical signal called the optical line signal.

OT (J-Drawing J69000C-1)

(C108022823) 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.

(C108056284) OTCTL, LUD1: (OT Controller) integrates the OTUs into the WaveStar OLS 40G control structure, combining WaveStar OLS 40G and OT into a single network element.

OTPM, 42A(1-16): (Optical Translator Port Module), (See Table 7-18 for individual OTU comcodes)] 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 1.5 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(C108023334) OTPM, 42B: (Optical Translator Port Module) 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 1.3 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

OTPM, 43A(1-16): (Optical Translator Port Module) 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 1.5 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm. (See Table 7-18 for individual OTPM comcodes.)

(C108023359) OTPM, 43B: (Optical Translator Port Module) 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 1.3 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

OTPM, 44A(1-16): (Optical Translator Port Module) 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 1.5 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm. (See Table 7-18 for individual OTPM comcodes.)

(C108089467) OTPM, 44B: (Optical Translator Port Module) 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 1.3 μ m wavelengths on WaveStar OLS 40G systems with total dispersion not exceeding 10,900 ps/nm.

(C108128737) 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 1.3 μ m range for other SONET OC-48/SDH STM-16 receivers.

OTU, 41A(1-16)C: (Optical Translator Unit) 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. (See Table 7-18 for individual OTU comcodes.)

OTU, 41C(1-16)C: (Optical Translator Unit) 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. (See Table 7-18 for individual OTU comcodes)

(C108203795) OPS, LEP1: (Optical Protection Switch) provides optical protection, switching traffic between primary and secondary lines in the event of a fiber cut or OA failure.

(C108209958) SPODU, BSY1: (Self-powered ODU) provides optical demultiplexing performance when independent of an OA. Required in OPS configurations.

(C108226994) SPOMU, BSY2: (Self-powered OMU) provides optical multiplexing and is required in OPS applications.

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.

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 4-44 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 Equip-

ment (DCE) port. The port can be used to load software and perform system diagnostics.

LAN cable– connects the DB-15 appearance on the WaveStar OLS 40G interconnection panel to standard RJ-45 office hub equipment for internet access at the 10 Mb/s rate.

Refer to Chapter 4, “Product Description” for information on WaveStar OLS 40G integration cabling. Ordering information for integration cabling appears later in this chapter.

Intraoffice Electrical Non-transmission Cable Descriptions (OT)

Refer to Figure 4-44 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 B₁ 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	
Line OW, section OW, section user channel cable	8, 10, 11	G401	as required	2850 ft. maximum
		G451	150 ft.	
		G461	250 ft.	
X.25 cable	13	G602	as required	150 ft. maximum
		G652	150 ft.	
1st or 2nd serial telemetry cable	14	G201‡	as required	4000 ft. maximum
		G251	150 ft.	
		G261	250 ft.	
Miscellaneous discrete 1 and 2, office alarm, parallel teleme- try cable	15, 16, 17, 18	G301	as required	
		G351	150 ft.	
		G361	250 ft.	
CIT interface cable	20	G702	as required	150 ft. maximum
		G752	150 ft.	
LAN cable	13	G815	150 ft.	
		G816	300 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	
Office alarm cable	5	G1	as required	
		G2	150 ft.	
Power feeder failure alarm cable [†]		G16	as required	
		G17	150 ft.	
System Controller Shelf incoming signal failure cable	6	G3	as required	4000 ft. maximum
		G4	150 ft.	
System Controller Shelf OT circuit pack failure cable	7	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 1 Incoming signal failure cable	12	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 1 OT circuit pack failure cable	13	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 2 incoming signal failure cable	12	G3	as required	4000 ft. maximum
		G4	150 ft.	
Complementary Shelf 2 OT circuit pack failure cable	13	G3	as required	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	
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 miscellaneous-mounted shelf
B	G4	15 ft.	
A	G23	15 ft.	Used to power an Integrated Bay
B	G24	15 ft.	
A	G11	as required	Used to power 2 shelves in a cabinet
B	G12	as required	
A	G13	as required	Used to power a miscellaneous-mounted shelf
B	G14	as required	
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	
A	1	G5	15 feet	L1, L10, and L14
B	1	G6	15 feet	
A	1	G15	as required	
B	1	G16	as required	
A	2	G7	15 feet	L11, L12, and L13
B	2	G9	15 feet	
A	2	G8	as required	
B	2	G10	as required	

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 miscellaneous-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 4.0 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 and 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

Table 7-8. METRAL Pin Ordering Information

Pin Type (Kit Device Code)	Quantity per kit	Pin Length (mm)
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, LEA102)	20-554	19-66, 85-90, 97-102, 115-138	151-156	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
OA (LEA6, LEA7, LEA7B, 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	
IAOLRP (LDA3)	52-230	19-42, 55-90	91-96	97-102	
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 (SYSTEM)*	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	

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 [†] (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	
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

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

Supplier Name	Supplier Model Name	Supplier Order #	Lucent Comcode*
HARRIS	C-1000 Centurion	594 - T099 (Integrated Bay)	407845049
		594 - T043	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
(R4.0-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
IAOLRP	LDA3	0 or 1
OMU/ODU 1A- 2B*	505A	0 or 1 per slot
	506A	
	605A	
	606A	
	606B	
OA 1A - 2B	LEA6	1 - 4 total
	LEA7, LEA7B	
	LEA104	
	LEA105	
TOHCTL	LEA102	1
SYSCTL	LEA1	1
SYSTEMEM	LEA2	1
End Terminal (Shelf 2)		
TLM 3A	LDA1	0 or 1
TLM 4A	LDA1	0 or 1

**Table 7-12. Slot/Circuit Pack/ Software Compatibility
 (R4.0-WaveStar OLS 40G) — *Continued***

Slot	Supported Pack Codes	Quantity
OMU/ODU 3A - 4B*	505A	0 or 1 per slot
	506A	
	605A	
	606A	
	606B	
OA 3A - 4B	LEA6	0 or 1 per slot
	LEA7, LEA7B	
	LEA104	
	LEA105	
Repeater Shelf (Shelf 1, Miscellaneous or Dual)		
TLM 1A - 2B	LDA1	2 - 4 total
OA 1A - 2B	LEA6	2 - 4 total
	LEA7, LEA7B	
	LEA104	
TOHCTL	LEA102	1
SYSCTL	LEA1	1
SYSTEMEM	LEA2	1
Repeater Shelf (Shelf 2)		
TLM 3A - 4B	LDA1	0 - 4 total
OA 3A - 4B	LEA6	0 - 4 total
	LEA7/LEA7B	
	LEA104	

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

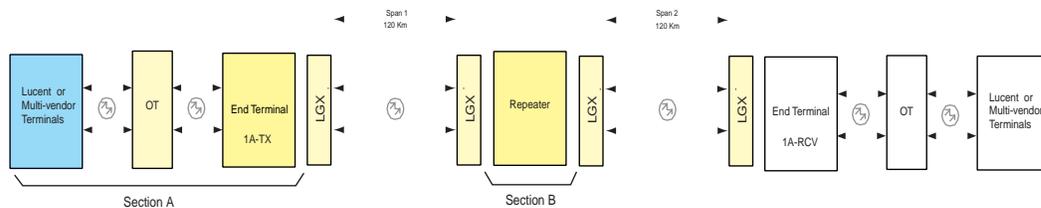


Figure 7-1. Sample Network Configuration Overview

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.

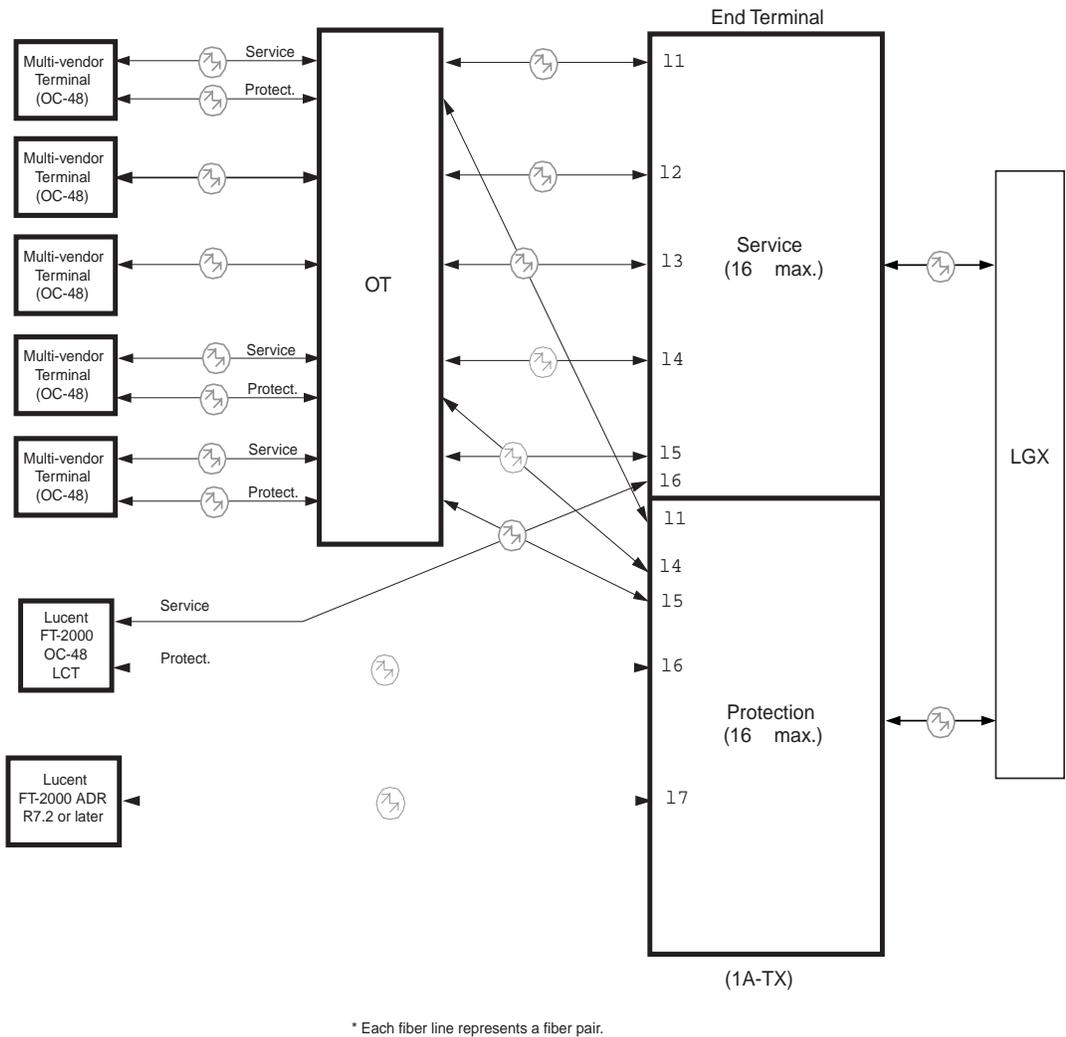


Figure 7-2. Sample Configuration, Section A (Enlarged)

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
- CD-ROM-based software generic
- 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.



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	COMCODE/ LIST/GROUP	REFERENCE
Dual End Terminal	Cabinet Bay	L2 or L14	"WaveStar OLS 40G Package Descriptions"
Dual End Terminal Kit	Quantity <u> 1 </u> (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-through kit*	Quantity _____	L190	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Amplifier circuit pack (OA, LEA104)- Long Span	Quantity <u> 4 </u> (2 per optical line required)	C107976367	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, LEA105)- Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	
Telemetry circuit pack	Quantity <u> 2 </u> (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107273328	This circuit pack is required for handling the supervisory channel. Note that the 4-fiber Telemetry Feed-through feature is not selected. The sample network used here represents a single WaveStar OLS 40G management subnetwork only.
Tributary overhead controller circuit pack YOHCTL, LEA5	Quantity <u> 1 </u> (2 per cabinet required)	C108283328	
System controller circuit pack STSCTL, LEA1	Quantity <u> 1 </u> (2 per cabinet required)	C107272510	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
System memory circuit pack LEA2	Quantity <u> 1 </u> (2 per cabinet required)	C107786568	This ODU supports up to 16λ allowing for future growth. This satisfies the current wavelength capacity of the sample network.
Optical Demultiplexer Unit (ODU, 605A 8λ)	Quantity _____ (1 per optical line required)	C107292187	
Optical Demultiplexer Unit (ODU, 606A 16λ, without supervisory channel)	Quantity <u> 2 </u> (1 per optical line required for two-OA operation)	C108032814	
Optical Demultiplexer Unit (ODU, 606B 16λ, with supervisory channel)	Quantity _____ (1 per optical line required for single-OA operation)	C108032822	
Optical Multiplexer Unit (OMU, 505A 8λ)	Quantity _____ (1 per optical line required)	C107292179	
Optical Multiplexer Unit (OMU, 506A 16λ)	Quantity <u> 2 </u> (1 per optical line required)	C107727828	
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 <u> 2 </u> (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.

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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-fac- ing applications)	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (for two-OA/single-OA, single-OA/two-OA, sin- gle-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 Tech- nologies catalog	Quantity _____ (20 per optical line required for 8λ; 4 additional cables required for the 4-fiber telemetry feed- through feature) Length _____ Comcode _____		<i>Fiber Optic Products catalog 2492C</i>

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
<p>Lightguide office cable (MS1LC-EP-?)</p>	<p>Quantity <u> 80 </u> (40 per optical line required for 16λ; 4 additional cables required for the 4-fiber telemetry feed through feature) Length <u> 53 ft </u> Comcode: <u>107815896,</u> <u>107 132 698</u></p>		<p>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.</p> <p>This cable connects the end terminal to the lightguide cross connect (LGX)</p> <p>The comcodes listed here are the actual codes obtained from the <i>Fiber Optic Products</i> catalog (select code: 2492C)</p> <p>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.”</p>
<p>Non-transmission Cables (ED-7G028-22)</p>			
<p>Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable</p>	<p>Quantity _____ Length _____</p>	<p>G301, G351, G361</p>	<p>Table 7-1</p>

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
X.25 cable	Quantity <u> 1 </u> Length <u> 100 ft </u>	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 <u> 1 </u> Length <u> 20 ft </u>	G702, G752	This cable is used to connect an WaveStar OLS 40G site to an end user's computer running Center-Link software. G702 represents a customized length.
Line OW, section OW, section user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial teleme- try 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 Pack- age 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 7-13. Dual End Terminal Sample Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity <u> 2 </u> (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 <u> 1 </u> Supplier Order #: <u>MT-370-01</u>		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 <u> 1 </u> Supplier Order #: <u>14100500</u>		Table 7-7 (Use telephone number provided) This kit is used for cleaning fiber optic connections (one per office)
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"

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Software	Quantity <u> 1 </u> Comcode _____ (use comcode if ordering an upgrade)	L10, M7R, P7R, M9S, P9S, M10S, P10S,	Table 7-30 and Table 7-32 The lists chosen here include the CD-ROM version of the software (new system) and the right-to-use fees. The CD-ROM contains all customer documentation in electronic form (one copy per office).
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* The 4-fiber Telemetry Feed-through feature does not apply to dual facing, IAOLAN, 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	COMCODE/ LIST/GROUP	REFERENCE
Dual Repeater	Cabinet Bay	L2 L14	"WaveStar OLS 40G Package Descrip- tions"
Dual Repeater Kit	Quantity <u> 1 </u> (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)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA)- Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)- Long Span	Quantity <u> 4 </u> (2 per optical line required)	C107976367	This OA handles 16 wavelength operation up to 3 spans over a dis- tance of 136 km per span. This circuit pack is required for han- dling the supervi- sory channel.
Telemetry circuit pack, TLM, LDA1	Quantity <u> 4 </u> (2 per optical line required)	C107272569	
Tributary overhead controller circuit pack TOHCTL, LEA5	Quantity <u> 1 </u> (2 per cabinet/bay required)	C108283328	
System controller circuit pack SYSCTL, LEA1	Quantity <u> 1 </u> (2 per cabinet/bay required)	C107272510	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
System memory circuit pack SYSTEMEM, LEA2	Quantity <u> 1 </u> (2 per cabinet/bay required)	C107786568	
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity <u> 2 </u> (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 <i>Fiber Optic Products</i> catalog	Quantity <u> 16 </u> (8 per optical line required) Length <u> 53 ft </u> Comcode: <u>107 306 409,</u> <u> 107 306 367</u>		<i>Fiber Optic Products</i> catalog 2492C This cable connects the repeater to the lightguide cross connect (LGX). The comcodes were obtained from the <i>Fiber Optic Products</i> catalog. See “Sample Cabling Illustrations.”
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telemetry cable	Quantity _____ Length _____	G301, G351, G361	Table 7-1

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
X.25 cable	Quantity <u> 1 </u> Length <u> 100 ft. </u>	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 <u> 1 </u> Length <u> 20 ft. </u>	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	
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	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	ST LBOs are standard with Lucent equipment.
ST LBO kit (R2.1 and later)	Quantity <u> 2 </u> (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 <u> 1 </u> Supplier Order #: <u>MT-370-01</u>		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 <u> 1 </u> Supplier Order #: <u>14100500</u>		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	COMCODE/ 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 Order- wire Shelf”
Software	Quantity <u> 1 </u> Comcode _____ (use comcode for upgrades)	L10, M7R, P7R, M9S, P9S, M10S, P10S	Table 7-30, Table 7-31, and Table 7-32 The lists chosen here include the CD-ROM version of the software (new system) and the right-to-use fees. The CD-ROM contains all cus- tomer documenta- tion in electronic form.
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for addi- tional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of soft- ware; use comcode for additional copies)	F	Table 7-30 and Table 7-31

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Miscellaneously-mounted application OT Bay	Quantity _____	L10 or L14	“OT Package Descriptions”
Circuit Packs (J69000C-1)			
OTCTL	Quantity <u> 1 </u>	C108056284	<p>Table 7-34 and “Circuit Pack/Unit Descriptions”</p> <p>The OTCTL is used to communicate between the WaveStar OLS 40G 2G and OT. When it is used, the EMDU and associated cabling from earlier releases is not needed.</p> <p>Two OTU circuit packs are required per wavelength (one per direction). The 41AxC are used in the transmit direction only.</p>
OTU 41A1C	Quantity <u> 2 </u>	C108187949	
OTU 41A2C	Quantity <u> 1 </u>	C108187956	
OTU 41A3C	Quantity <u> 1 </u>	C108187964	
OTU 41A4C	Quantity <u> 2 </u>	C108187972	
OTU 41A5C	Quantity <u> 2 </u>	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	
OTU 41A13C	Quantity _____	C108188061	
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	
OTU 41BB	Quantity <u> 8 </u>	C108128737	
OTU 41C1C	Quantity _____	C108188111	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41C2C	Quantity _____	C108188129	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 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	
OTU 41C13C	Quantity _____	C108188236	
OTU 41C14C	Quantity _____	C108188244	
OTU 41C15C	Quantity _____	C108188251	
OTU 41C16C	Quantity _____	C108188269	
QOTU 41S	Quantity _____	C108022823	
OTPM 42A1	Quantity _____	C108022872	
OTPM 42A2	Quantity _____	C108022898	
OTPM 42A3	Quantity _____	C108022906	
OTPM 42A4	Quantity _____	C108022914	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 42A5	Quantity _____	C108022922	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 42A6	Quantity _____	C108022930	
OTPM 42A7	Quantity _____	C108022948	
OTPM 42A8	Quantity _____	C108022955	
OTPM 42A9	Quantity _____	C108022963	
OTPM 42A10	Quantity _____	C108022971	
OTPM 42A11	Quantity _____	C108022989	
OTPM 42A12	Quantity _____	C108022997	
OTPM 42A13	Quantity _____	C108023003	
OTPM 42A14	Quantity _____	C108023011	
OTPM 42A15	Quantity _____	C108023029	
OTPM 42A16	Quantity _____	C108023037	
OTPM 42B	Quantity _____	C108023334	
OTPM 43A1	Quantity _____	C108023045	
OTPM 43A2	Quantity _____	C108023052	
OTPM 43A3	Quantity _____	C108023060	
OTPM 43A4	Quantity _____	C108023078	
OTPM 43A5	Quantity _____	C108023086	
OTPM 43A6	Quantity _____	C108023094	
OTPM 43A7	Quantity _____	C108023102	
OTPM 43A8	Quantity _____	C108023110	
OTPM 43A9	Quantity _____	C108023128	
OTPM 43A10	Quantity _____	C108023136	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 43A11	Quantity _____	C108023144	Table 7-34 and "Circuit Pack/Unit Descriptions"
OTPM 43A12	Quantity _____	C108023151	
OTPM 43A13	Quantity _____	C108023169	
OTPM 43A14	Quantity _____	C108023177	
OTPM 43A15	Quantity _____	C108023185	
OTPM 43A16	Quantity _____	C108023193	
OTPM 43B	Quantity _____	C108023359	
OTPM 44A1	Quantity _____	C108090459	
OTPM 44A2	Quantity _____	C108090622	
OTPM 44A3	Quantity _____	C108090630	
OTPM 44A4	Quantity _____	C108090648	
OTPM 44A5	Quantity _____	C108090655	
OTPM 44A6	Quantity _____	C108090663	
OTPM 44A7	Quantity _____	C108090671	
OTPM 44A8	Quantity _____	C108090689	
OTPM 44A9	Quantity _____	C108090697	
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089467	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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” 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 (R2.0 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 <u> 10 </u> (1 per OTU or OTPM required)	L122	
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	COMCODE/ LIST/GROUP	REFERENCE
Other			
METRAL pin/tool kit	Quantity <u> 1 </u> Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number pro- vided) One per office.
CLETOP fiber cleaning materials	Quantity <u> 1 </u> Supplier Order # _____		Table 7-7 (Use telephone number pro- vided) 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.

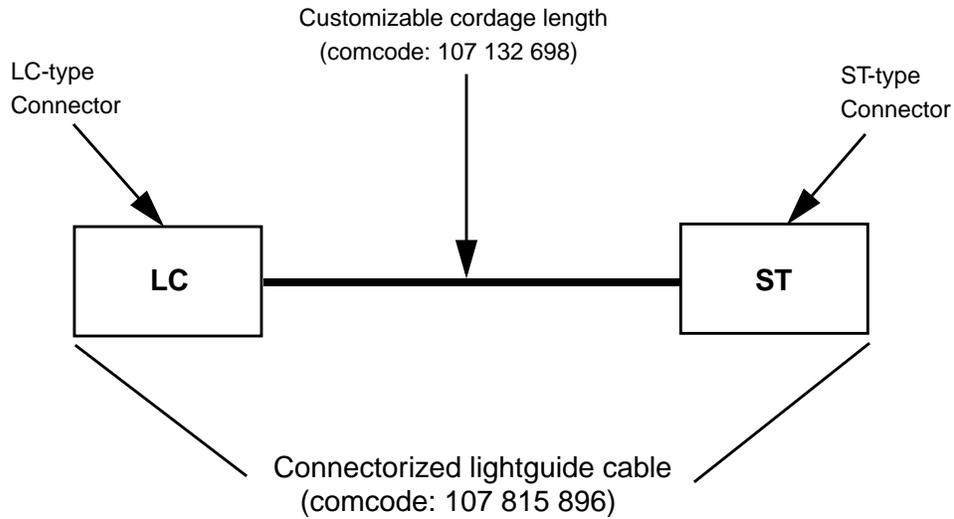
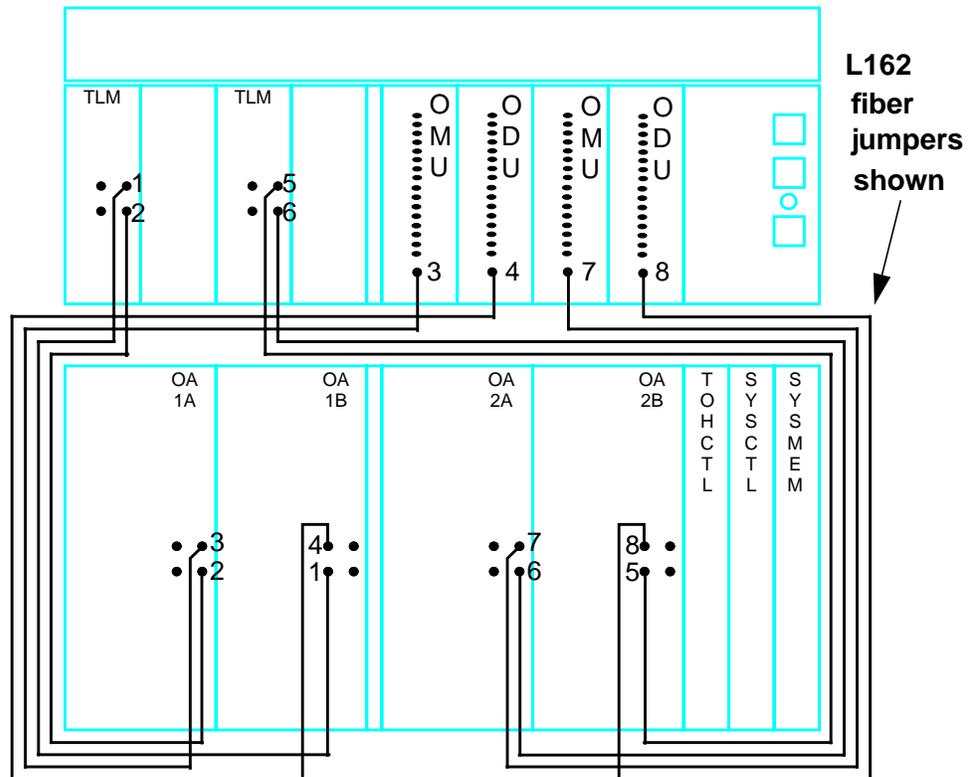


Figure 7-3. Lightguide Office Cable Depiction



- 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 7-136
Integrated Bay (Double, super kit)	Page 7-136
Integrated Cabinet (Triple 1, super kit)	Page 7-137
Integrated Bay (Triple 1, super kit)	Page 7-137
Integrated Cabinet (Triple 2, super kit)	Page 7-138
Integrated Bay (Triple 2, super kit)	Page 7-138
OT Bay or Miscellaneously-mounted Application	Table 7-26

OT Cabinet	Table 7-27
4-Line Repeater-to-Dual Repeater Conversion	Table 7-28
4-Line End Terminal-to-Dual End Terminal Conversion	Table 7-29

- 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	COMCODE/ 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- through kit*	Quantity _____	L190	
Intra-office Line Relay Pack (IAOLRP) kit	Quantity _____	L191	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Telemetry circuit pack, TLM, LDA1	Quantity _____ (1 per optical line required; 2 addi- tional packs per shelf needed for the 4-fiber Telemetry Feed- through feature)	C107272569	
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	
Tributary overhead control- ler circuit pack, TOHCTL, LEA5	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack SYSCTL, LEA1	Quantity _____ (1 per shelf required)	C107272510	
System memory circuit pack SYSTEM, LEA2	Quantity _____ (1 per shelf required)	C107786568	
Optical Demultiplexer Unit (ODU, 605A 8λ)	Quantity _____ (1 per optical line required)	C107292187	
Optical Demultiplexer Unit ODU 606A, 16λ, without supervisory channel	Quantity _____ (1 per optical line required for two-OA operation)	C108032814	
Optical Demultiplexer Unit ODU 606B 16λ, with super- visory channel	Quantity _____ (1 per optical line required for single- OA operation)	C108032822	"Circuit Pack/Unit Descriptions"
Optical Multiplexer Unit OMU 505A 8λ	Quantity _____ (1 per optical line required)	C107292179	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Multiplexer Unit OMU 506A 16λ	Quantity _____ (1 per optical line required)	C107727828	
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 16λ 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- through feature) Length _____ Comcode _____		<i>Fiber Optic Products Catalog 2492C</i>

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4- fiber Telemetry Feed- through feature) 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, sec- tion user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
LAN cable	Quantity _____ Length _____	G815, G816	
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 ear- lier)	Quantity _____ (1 per optical line required)	L121	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L131	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
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 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)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* The 4-fiber Telemetry Feed-through feature does not apply to dual-facing, IAOLAN, 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	COMCODE/ LIST/GROUP	REFERENCE
Miscellaneously-mounted Repeater Shelf	Quantity _____	L10 or L11	“WaveStar OLS 40G Package Descriptions”
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, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	“Circuit Pack/Unit Descriptions”

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE	
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439		
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367		
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required)*	C108045394		
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949		
Telemetry circuit pack TLM, LDA1	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107272569		
Tributary overhead controller circuit pack TOHCTL, LEA5	Quantity _____ (1 per shelf required)	C107273328		
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819		"Circuit Pack/Unit Descriptions"
System controller circuit pack SYSCTL, LEA1	Quantity _____ (1 per shelf required)	C107272510		
System memory circuit pack SYSMEM, LEA2	Quantity _____ (1 per shelf required)	C107786568		

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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 _____		<i>Fiber Optic Products Catalog 2492C</i>
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	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	“WaveStar OLS 40G Package Descrip- tionss”
FC LBO kit (R2.0 and ear- lier)	Quantity _____ (1 per optical line required)	L121	

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
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 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)

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

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* 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 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
(J69000C-1)**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Miscellaneously-mounted OT System Controller Shelf	Quantity _____	L11	"OT Package Descriptions"
Style Strip for Lucent ETSI Cabinet	Quantity _____	L140	
Circuit Packs (J69000C-1)			

**Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTCTL	Quantity _____	C108056284	Table 7-34 and “Circuit Pack/Unit Descriptions”
OPS	Quantity _____	C108203795	
SPODU	Quantity _____	C108209958	
SPOMU	Quantity _____	C108226994	
OTU 41A1C	Quantity _____	C108187949	
OTU 41A2C	Quantity _____	C108187956	
OTU 41A3C	Quantity _____	C108187964	
OTU 41A4C	Quantity _____	C108187972	
OTU 41A5C	Quantity _____	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	
OTU 41A13C	Quantity _____	C108188061	
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	
OTU 41BB	Quantity _____	C108128737	

**Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41C1C	Quantity _____	C108188111	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTU 41C2C	Quantity _____	C108188129	
OTU 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	
OTU 41C13C	Quantity _____	C108188236	
OTU 41C14C	Quantity _____	C108188244	
OTU 41C15C	Quantity _____	C108188251	
OTU 41C16C	Quantity _____	C108188269	
QOTU 41S	Quantity _____	C108022823	
OTPM 42A1	Quantity _____	C108022872	
OTPM 42A2	Quantity _____	C108022898	
OTPM 42A3	Quantity _____	C108022906	
OTPM 42A4	Quantity _____	C108022914	
OTPM 42A5	Quantity _____	C108022922	
OTPM 42A6	Quantity _____	C108022930	

**Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 42A7	Quantity _____	C108022948	
OTPM 42A8	Quantity _____	C108022955	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 42A9	Quantity _____	C108022963	
OTPM 42A10	Quantity _____	C108022971	
OTPM 42A11	Quantity _____	C108022989	
OTPM 42A12	Quantity _____	C108022997	
OTPM 42A13	Quantity _____	C108023003	
OTPM 42A14	Quantity _____	C108023011	
OTPM 42A15	Quantity _____	C108023029	
OTPM 42A16	Quantity _____	C108023037	
OTPM 42B	Quantity _____	C108023334	
OTPM 43A1	Quantity _____	C108023045	
OTPM 43A2	Quantity _____	C108023052	
OTPM 43A3	Quantity _____	C108023060	
OTPM 43A4	Quantity _____	C108023078	
OTPM 43A5	Quantity _____	C108023086	
OTPM 43A6	Quantity _____	C108023094	
OTPM 43A7	Quantity _____	C108023102	
OTPM 43A8	Quantity _____	C108023110	
OTPM 43A9	Quantity _____	C108023128	
OTPM 43A10	Quantity _____	C108023136	
OTPM 43A11	Quantity _____	C108023144	
OTPM 43A12	Quantity _____	C108023151	

**Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
 (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 43A13	Quantity _____	C108023169	
OTPM 43A14	Quantity _____	C108023177	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 43A15	Quantity _____	C108023185	
OTPM 43A16	Quantity _____	C108023193	
OTPM 43B	Quantity _____	C108023359	
OTPM 44A1	Quantity _____	C108090459	
OTPM 44A2	Quantity _____	C108090622	
OTPM 44A3	Quantity _____	C108090630	
OTPM 44A4	Quantity _____	C108090648	
OTPM 44A5	Quantity _____	C108090655	
OTPM 44A6	Quantity _____	C108090663	
OTPM 44A7	Quantity _____	C108090671	
OTPM 44A8	Quantity _____	C108090689	
OTPM 44A9	Quantity _____	C108090697	
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089467	

**Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet
 (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L124	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L125	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L126	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L134	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L135	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	

Table 7-18. Miscellaneously-mounted OT System Controller Shelf Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L129	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L130	

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Miscellaneously-mounted OT Complementary Shelf: 1 2	Quantity _____ Quantity _____	L12 L13	“OT Package Descriptions”
Style Strip for Lucent ETSI Cabinet	Quantity _____	L140	
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	C108056284	Table 7-34 and “Circuit Pack/Unit Descriptions”
OPS	Quantity _____	C108203795	
SPODU	Quantity _____	C108209958	
SPOMU	Quantity _____	C108226994	
OTU 41A1C	Quantity _____	C108187949	
OTU 41A2C	Quantity _____	C108187956	
OTU 41A3C	Quantity _____	C108187964	
OTU 41A4C	Quantity _____	C108187972	
OTU 41A5C	Quantity _____	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	

**Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2
 Worksheet (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	
OTU 41A13C	Quantity _____	C108188061	
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	
OTU 41BB	Quantity _____	C108128737	
OTU 41C1C	Quantity _____	C108188111	
OTU 41C2C	Quantity _____	C108188129	
OTU 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	

**Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2
 Worksheet (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE	
OTU 41C13C	Quantity _____	C108188236		
OTU 41C14C	Quantity _____	C108188244		
OTU 41C15C	Quantity _____	C108188251		
OTU 41C16C	Quantity _____	C108188269		
QOTU 41S	Quantity _____	C108022823		
OTPM 42A1	Quantity _____	C108022872		
OTPM 42A2	Quantity _____	C108022898		
OTPM 42A3	Quantity _____	C108022906		
OTPM 42A4	Quantity _____	C108022914		
OTPM 42A5	Quantity _____	C108022922		
OTPM 42A6	Quantity _____	C108022930		
OTPM 42A7	Quantity _____	C108022948		
OTPM 42A8	Quantity _____	C108022955		Table 7-34 and "Circuit Pack/Unit Descriptions"
OTPM 42A9	Quantity _____	C108022963		
OTPM 42A10	Quantity _____	C108022971		
OTPM 42A11	Quantity _____	C108022989		
OTPM 42A12	Quantity _____	C108022997		
OTPM 42A13	Quantity _____	C108023003		
OTPM 42A14	Quantity _____	C108023011		
OTPM 42A15	Quantity _____	C108023029		
OTPM 42A16	Quantity _____	C108023037		
OTPM 42B	Quantity _____	C108023334		

**Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2
Worksheet (J69000C-1) — *Continued***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 43A1	Quantity _____	C108023045	
OTPM 43A2	Quantity _____	C108023052	
OTPM 43A3	Quantity _____	C108023060	
OTPM 43A4	Quantity _____	C108023078	
OTPM 43A5	Quantity _____	C108023086	
OTPM 43A6	Quantity _____	C108023094	
OTPM 43A7	Quantity _____	C108023102	
OTPM 43A8	Quantity _____	C108023110	
OTPM 43A9	Quantity _____	C108023128	
OTPM 43A10	Quantity _____	C108023136	
OTPM 43A11	Quantity _____	C108023144	
OTPM 43A12	Quantity _____	C108023151	
OTPM 43A13	Quantity _____	C108023169	Table 7-34 and "Circuit Pack/Unit Descriptions"
OTPM 43A14	Quantity _____	C108023177	
OTPM 43A15	Quantity _____	C108023185	
OTPM 43A16	Quantity _____	C108023193	
OTPM 43B	Quantity _____	C108023359	
OTPM 44A1	Quantity _____	C108090459	
OTPM 44A2	Quantity _____	C108090622	
OTPM 44A3	Quantity _____	C108090630	
OTPM 44A4	Quantity _____	C108090648	
OTPM 44A5	Quantity _____	C108090655	

**Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2
 Worksheet (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 44A6	Quantity _____	C108090663	
OTPM 44A7	Quantity _____	C108090671	
OTPM 44A8	Quantity _____	C108090689	
OTPM 44A9	Quantity _____	C108090697	
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089467	
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	

**Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2
Worksheet (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L124	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L125	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L126	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L134	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L135	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L129	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L130	
Other			
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31

Table 7-19. Miscellaneously-mounted OT Complementary Shelf 1 or 2 Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of soft- ware; use comcode for additional copies)	F	Table 7-30 and Table 7-31

Table 7-20. 4-Line End Terminal Cabinet Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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- through kit*	Quantity _____	L190	
Intra-office Line Relay Pack (IAOLRP) kit	Quantity _____	L191	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	

**Table 7-20. 4-Line End Terminal Cabinet Worksheet
(J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	"Circuit Pack/Unit Descriptions"
Telemetry circuit pack TLM, LDA1	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107272569	
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	
Tributary overhead controller circuit pack TOHCTL, LEA5	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack SYSCTL, LEA1	Quantity _____ (1 per shelf required)	C107272510	
System memory circuit pack SYSMEM, LEA2	Quantity _____ (1 per shelf required)	C107786568	
Optical Demultiplexer Unit (ODU 8λ- 605A)	Quantity _____ (1 per optical line required)	C107292187	

**Table 7-20. 4-Line End Terminal Cabinet Worksheet
(J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Demultiplexer Unit (ODU 16λ, without supervi- sory channel— 606A)	Quantity _____ (1 per optical line required for two- OA operation)	C108032814	
Optical Demultiplexer Unit (ODU 16λ, with supervi- sory channel— 606B)	Quantity _____ (1 per optical line required for single- OA operation)	C108032822	
Optical Multiplexer Unit (OMU 8λ— 505A)	Quantity _____ (1 per optical line required)	C107292179	
Optical Multiplexer Unit (OMU 16λ— 506A)	Quantity _____ (1 per optical line required)	C107727828	
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 16λ 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	COMCODE/ 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-through fea- ture) Length _____ Comcode _____		<i>Fiber Optic Products Cata- log 2492C</i>
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4- fiber Telemetry Feed-through fea- ture) Length _____ Comcode _____		<i>Fiber Optic Products Catalog 2492C</i>
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, sec- tion user channel cable	Quantity _____ Length _____	G401, G451, G461	
1st or 2nd serial telemetry cable	Quantity _____ Length _____	G201, G251, G261	
LAN cable	Quantity _____ Length _____	G815, G816	

**Table 7-20. 4-Line End Terminal Cabinet Worksheet
 (J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L116	
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"

**Table 7-20. 4-Line End Terminal Cabinet Worksheet
(J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
METRAL pin/tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number pro- vided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use telephone number pro- vided)
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description (additional)</i>	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual (paper)</i>	Quantity _____ Comcode _____ (ordered with diskette version of software; use com- code for additional copies)	F	Table 7-30 and Table 7-31

* The 4-fiber Telemetry Feed-through feature does not apply to dual-facing, IAOLAN, 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	COMCODE/ LIST/GROUP	REFERENCE
Dual End Terminal	Cabinet Bay	L2 or L14	"WaveStar OLS 40G Package Descriptions"

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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-through kit*	Quantity _____	L190	
Intra-office Line Relay Pack (IAOLRP) kit	Quantity _____	L191	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	“Circuit Pack/Unit Descriptions”
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	
Telemetry circuit pack TLM, LDA1	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107272569	

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	"Circuit Pack/Unit Descriptions"
Tributary overhead controller circuit pack TOHCTL, TOHCL, LEA5	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack SYSCTL, LEA1	Quantity _____ (1 per shelf required)	C107272510	
System memory circuit pack SYSMEM, LEA2	Quantity _____ (1 per shelf required)	C107786568	
Optical Demultiplexer Unit ODU 8λ– 605A	Quantity _____ (1 per optical line required)	C107292187	
Optical Demultiplexer Unit ODU 16λ, without supervi- sory channel– 606A	Quantity _____ (1 per optical line required for two-OA operation)	C108032814	
Optical Demultiplexer Unit ODU 16λ, with supervisory channel– 606B	Quantity _____ (1 per optical line required for single- OA operation)	C108032822	
Optical Multiplexer Unit (OMU 8λ– 505A)	Quantity _____ (1 per optical line required)	C107292179	
Optical Multiplexer Unit (OMU 16λ– 506A)	Quantity _____ (1 per optical line required)	C107727828	

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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 applications)	Quantity _____ (1 per shelf required)	L164	
Lightguide jumper kit (for 16λ 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- through feature) Length _____ Comcode _____		<i>Fiber Optic Products Catalog 2492C</i>

Table 7-21. Dual End Terminal Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (40 per optical line required for 16λ; 4 additional cables required for the 4- fiber Telemetry Feed- through) Length _____ Comcode _____		
Non-transmission Cables (ED-7G028-22)			
Miscellaneous discrete 1 and 2, office alarm, parallel telem- etry 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	
LAN cable	Quantity _____ Length _____	G815, G816	
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 7-21. Dual End Terminal Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L112	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L116	
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	COMCODE/ LIST/GROUP	REFERENCE
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* The 4-fiber Telemetry Feed-through feature does not apply to dual facing, IAOLAN, 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	COMCODE/ 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, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	“Circuit Pack/Unit Descriptions”

**Table 7-22. 4 Bidirectional Line Repeater Worksheet
 (J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE	
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439		
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367		
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required)*	C108045394		
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949		
Telemetry circuit pack TLM, LDA1	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107272569		
Tributary overhead controller circuit pack (TOHCTL, LEA5)	Quantity _____ (1 per shelf required)	C107273328		
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819		"Circuit Pack/Unit Descriptions"
System controller circuit pack (SYSCTL, LEA1)	Quantity _____ (1 per shelf required)	C107272510		
System memory circuit pack (SYSTEMEM, LEA2)	Quantity _____ (1 per shelf required)	C107786568		

**Table 7-22. 4 Bidirectional Line Repeater Worksheet
(J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	“WaveStar OLS 40G Package Descriptions”
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 _____		<i>Fiber Optic Products Catalog 2492C</i>
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	

Table 7-22. 4 Bidirectional Line Repeater Worksheet
(J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
SC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L116	
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	COMCODE/ LIST/GROUP	REFERENCE
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		“DANTEL Orderwire Shelf”
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of software; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* 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 7-23. Dual Repeater Worksheet (J68982C-1)

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Dual Repeater	Cabinet Bay	L2 L14	“WaveStar OLS 40G Package Descriptions”
Dual Repeater Kit	Quantity _____ (1 required per shelf)	L104	

Table 7-23. Dual Repeater Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required)*	C108045394	
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Telemetry Feed-through feature)	C107272569	
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack (SYSCTL)	Quantity _____ (1 per shelf required)	C107272510	

Table 7-23. Dual Repeater Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
System memory circuit pack (SYSMEM)	Quantity _____ (1 per shelf required)	C107786568	
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 _____		<i>Fiber Optic Products Catalog 2492C</i>
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	
LBO Kits			
ST LBO kit (R2.0 and earlier)	Quantity _____ (1 per optical line required)	L111	“WaveStar OLS 40G Package Descrip- tions”

Table 7-23. Dual Repeater Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
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)
DANTELEMDU kit or HARRISEMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11 (Use telephone number provided)

Table 7-23. Dual Repeater Worksheet (J68982C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		“DANTEL Order- wire Shelf”
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description (additional)</i>	Quantity _____ Comcode _____ (use comcode for additional copies)		Table 7-31
<i>User Service Manual (paper)</i>	Quantity _____ Comcode _____ (ordered with diskette version of software; use com- code for additional copies)	F	Table 7-30 and Table 7-31

* 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 7-24. End Terminal and Repeater Combination Worksheet
(J68982C-1)**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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- through kit*	Quantity _____	L190	
Intra-office Line Relay Pack (IAOLRP) kit	Quantity _____	L191	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	

Table 7-24. End Terminal and Repeater Combination Worksheet
(J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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-through)	C107272569	"Circuit Pack/Unit Descriptions"
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack (SYSCTL)	Quantity _____ (1 per shelf required)	C107272510	
System memory circuit pack (SYSTEMEM)	Quantity _____ (1 per shelf required)	C107786568	
Optical Demultiplexer Unit (ODU 8λ– 605A)	Quantity _____ (1 per optical line required)	C107292187	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel– 606A)	Quantity _____ (1 per optical line required for two-OA operation)	C108032814	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel– 606B)	Quantity _____ (1 per optical line required for single-OA operation)	C108032822	"Circuit Pack/Unit Descriptions"

Table 7-24. End Terminal and Repeater Combination Worksheet
(J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Multiplexer Unit (OMU 8λ– 505A)	Quantity _____ (1 per optical line required)	C107292179	
Optical Multiplexer Unit (OMU 16λ– 506A)	Quantity _____ (1 per optical line required)	C107727828	
Lightguide Jumper Kits			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required [for End Termi- nal 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 Termi- nal])	L162	
Lightguide jumper kit (for 16λ systems, single-OA operation)	Quantity _____ (1 per optical line required [for End Termi- nal])	L163	
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			

Table 7-24. End Terminal and Repeater Combination Worksheet
(J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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-through feature on an End Terminal) Length _____ Comcode _____		<i>Fiber Optic Products Catalog 2492C</i>
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-through on End Terminal) 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 7-24. End Terminal and Repeater Combination Worksheet
(J68982C-1) — *Continued*

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
LAN cable	Quantity _____ Length _____	G815, G816	
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L113	
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)

**Table 7-24. End Terminal and Repeater Combination Worksheet
 (J68982C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ 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 _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for addi- tional copies)		Table 7-31
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of soft- ware; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* 4-fiber Telemetry Feed-through does not apply to dual facing, IAOLAN, or 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 7-25. Integrated Bay (Single) Worksheet
 (J68982D-1)**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Integrated Bay (Single)	Quantity _____	L1	"WaveStar OLS 40G Pack- age Descrip- tions"
SDH kit for SDH Wave- Star OLS 40G application	Quantity _____ (1 required per WaveStar OLS 40G shelf)	L108	
4-fiber Telemetry Feed- through kit*	Quantity _____	L190	
Intra-office Line Relay Pack (IAOLRP) kit	Quantity _____	L191	
Circuit Packs/Units (J68982C-1)			
Optical Amplifier circuit pack (OA, LEA6)-Long Span	Quantity _____ (2 per optical line required)	C107273336	"Circuit Pack/Unit Descriptions"
Optical Amplifier circuit pack (OA, LEA7)-Long Reach	Quantity _____ (2 per optical line required)	C107742439	
Optical Amplifier circuit pack (OA, LEA104)-Long Span	Quantity _____ (2 per optical line required)	C107976367	
Optical Amplifier circuit pack (OA, LEA105)-Short Reach	Quantity _____ (1 or 2 per optical line required) [†]	C108045394	
Optical Amplifier circuit pack (OA, LEA7B)- Long Reach	Quantity _____	C108309949	

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 additional packs per shelf needed for the 4-fiber Teleme- try Feed-through fea- ture)	C107272569	“Circuit Pack/Unit Descriptions”
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	
Tributary overhead con- troller circuit pack (TOHCTL, LEA5)	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller circuit pack (SYSCTL, LEA1)	Quantity _____ (1 per shelf required)	C107272510	
System memory circuit pack (SYSMEM, LEA2)	Quantity _____ (1 per shelf required)	C107786568	
Optical Demultiplexer Unit (ODU 8λ– 605A)	Quantity _____ (1 per optical line required)	C107292187	
Optical Demultiplexer Unit (ODU 16λ, without supervisory channel– 606A)	Quantity _____ (1 per optical line required for two-OA operation)	C108032814	
Optical Demultiplexer Unit (ODU 16λ, with supervisory channel– 606B)	Quantity _____ (1 per optical line required for single-OA operation)	C108032822	
Optical Multiplexer Unit (OMU 8λ– 505A)	Quantity _____ (1 per optical line required)	C107292179	

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Optical Multiplexer Unit (OMU 16λ– 506A)	Quantity _____ (1 per optical line required)	C107727828	
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	C108056284	Table 7-34 and “Circuit Pack/Unit Descriptions”
OPS	Quantity _____	C108203795	
SPODU	Quantity _____	C108209958	
SPOMU	Quantity _____	C108226994	
OTU 41A1C	Quantity _____	C108187949	
OTU 41A2C	Quantity _____	C108187956	
OTU 41A3C	Quantity _____	C108187964	
OTU 41A4C	Quantity _____	C108187972	
OTU 41A5C	Quantity _____	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	
OTU 41A13C	Quantity _____	C108188061	
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41BB	Quantity _____	C108128737	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTU 41C1C	Quantity _____	C108188111	
OTU 41C2C	Quantity _____	C108188129	
OTU 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	
OTU 41C13C	Quantity _____	C108188236	
OTU 41C14C	Quantity _____	C108188244	
OTU 41C15C	Quantity _____	C108188251	
OTU 41C16C	Quantity _____	C108188269	
QOTU 41S	Quantity _____	C108022823	
OTPM 42A1	Quantity _____	C108022872	
OTPM 42A2	Quantity _____	C108022898	
OTPM 42A3	Quantity _____	C108022906	
OTPM 42A4	Quantity _____	C108022914	
OTPM 42A5	Quantity _____	C108022922	
OTPM 42A6	Quantity _____	C108022930	
OTPM 42A7	Quantity _____	C108022948	

**Table 7-25. Integrated Bay (Single) Worksheet
 (J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 42A8	Quantity _____	C108022955	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 42A9	Quantity _____	C108022963	
OTPM 42A10	Quantity _____	C108022971	
OTPM 42A11	Quantity _____	C108022989	
OTPM 42A12	Quantity _____	C108022997	
OTPM 42A13	Quantity _____	C108023003	
OTPM 42A14	Quantity _____	C108023011	
OTPM 42A15	Quantity _____	C108023029	
OTPM 42A16	Quantity _____	C108023037	
OTPM 42B	Quantity _____	C108023334	
OTPM 43A1	Quantity _____	C108023045	
OTPM 43A2	Quantity _____	C108023052	
OTPM 43A3	Quantity _____	C108023060	
OTPM 43A4	Quantity _____	C108023078	
OTPM 43A5	Quantity _____	C108023086	
OTPM 43A6	Quantity _____	C108023094	
OTPM 43A7	Quantity _____	C108023102	
OTPM 43A8	Quantity _____	C108023110	
OTPM 43A9	Quantity _____	C108023128	
OTPM 43A10	Quantity _____	C108023136	
OTPM 43A11	Quantity _____	C108023144	
OTPM 43A12	Quantity _____	C108023151	
OTPM 43A13	Quantity _____	C108023169	
OTPM 43A14	Quantity _____	C108023177	
OTPM 43A15	Quantity _____	C108023185	

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 43A16	Quantity _____	C108023193	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 43B	Quantity _____	C108023359	
OTPM 44A1	Quantity _____	C108090459	
OTPM 44A2	Quantity _____	C108090622	
OTPM 44A3	Quantity _____	C108090630	
OTPM 44A4	Quantity _____	C108090648	
OTPM 44A5	Quantity _____	C108090655	
OTPM 44A6	Quantity _____	C108090663	
OTPM 44A7	Quantity _____	C108090671	
OTPM 44A8	Quantity _____	C108090689	
OTPM 44A9	Quantity _____	C108090697	
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089467	
Lightguide Jumper Kits (for WaveStar OLS 40G Shelf)			
Lightguide jumper kit (for 8λ systems)	Quantity _____ (1 per optical line required)	L161	“WaveStar OLS 40G Pack- age Descrip- tions”
Lightguide jumper kit (for 16λ systems, two-OA operation)	Quantity _____ (1 per optical line required)	L162	

**Table 7-25. Integrated Bay (Single) Worksheet
 (J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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 Technol- ogies catalog	Quantity _____ (20 per optical line required for 8λ; 4 addi- tional cables required for the 4-fiber Telem- etry Feed-through fea- ture) Length _____ Comcode _____		<i>Fiber Optic Products Cata- log 2492C</i>
Lightguide office cable (MS1LC-EP-?)	Quantity _____ (36 per optical line required for 16λ; 4 additional cables required for the 4-fiber Telemetry Feed- through feature) Length _____ Comcode _____		
Non-transmission Cables (ED-7G028-22)			

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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	
LAN cable	Quantity _____ Length _____	G815, G816	
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			
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	

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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	"WaveStar OLS 40G Package Descriptions" and "OT Package Descriptions"
FC LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required)	L114	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per optical line required; for OAs only)	L115	
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 required)	L125	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L124	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L134	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L135	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L126	

**Table 7-25. Integrated Bay (Single) Worksheet
 (J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	
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 tele- phone number provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use tele- phone number provided)
DANTEL orderwire shelf	Quantity _____ Comcode _____ Supplier Order # _____		"DANTEL Orderwire Shelf"
Software	Quantity _____ Comcode _____ (use comcode for upgrades)	M7R, P7R, M9S, P9S, M10S, P10S, L10	Table 7-30 and Table 7-32
<i>Software Release Description</i> (additional)	Quantity _____ Comcode _____ (use comcode for addi- tional copies)		Table 7-31

**Table 7-25. Integrated Bay (Single) Worksheet
(J68982D-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
<i>User Service Manual</i> (paper)	Quantity _____ Comcode _____ (ordered with diskette version of soft- ware; use comcode for additional copies)	F	Table 7-30 and Table 7-31

* 4-fiber Telemetry Feed-through does not apply to dual facing, IAOLAN, 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. OT Bay or Miscellaneously-mounted Application Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Miscellaneously-mounted Application OT Bay	Quantity _____	L10 or L14	"OT Package Descriptions"
Style Strip for Lucent ETSI Cabinet	Quantity _____	L140	
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	C108056284	Table 7-34 and "Circuit Pack/Unit Descriptions"
OPS	Quantity _____	C108203795	
SPODU	Quantity _____	C108209958	
SPOMU	Quantity _____	C108226994	
OTU 41A1C	Quantity _____	C108187949	
OTU 41A2C	Quantity _____	C108187956	
OTU 41A3C	Quantity _____	C108187964	
OTU 41A4C	Quantity _____	C108187972	
OTU 41A5C	Quantity _____	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	

**Table 7-26. OT Bay or Miscellaneously-mounted Application Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41A13C	Quantity _____	C108188061	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	
OTU 41BB	Quantity _____	C108128737	
OTU 41C1C	Quantity _____	C108188111	
OTU 41C2C	Quantity _____	C108188129	
OTU 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	
OTU 41C13C	Quantity _____	C108188236	
OTU 41C14C	Quantity _____	C108188244	
OTU 41C15C	Quantity _____	C108188251	
OTU 41C16C	Quantity _____	C108188269	
QOTU 41S	Quantity _____	C108022823	
OTPM 42A1	Quantity _____	C108022872	

**Table 7-26. OT Bay or Miscellaneously-mounted Application Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 42A2	Quantity _____	C108022898	
OTPM 42A3	Quantity _____	C108022906	
OTPM 42A4	Quantity _____	C108022914	
OTPM 42A5	Quantity _____	C108022922	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 42A6	Quantity _____	C108022930	
OTPM 42A7	Quantity _____	C108022948	
OTPM 42A8	Quantity _____	C108022955	
OTPM 42A9	Quantity _____	C108022963	
OTPM 42A10	Quantity _____	C108022971	
OTPM 42A11	Quantity _____	C108022989	
OTPM 42A12	Quantity _____	C108022997	
OTPM 42A13	Quantity _____	C108023003	
OTPM 42A14	Quantity _____	C108023011	
OTPM 42A15	Quantity _____	C108023029	
OTPM 42A16	Quantity _____	C108023037	
OTPM 42B	Quantity _____	C108023334	
OTPM 43A1	Quantity _____	C108023045	
OTPM 43A2	Quantity _____	C108023052	
OTPM 43A3	Quantity _____	C108023060	
OTPM 43A4	Quantity _____	C108023078	
OTPM 43A5	Quantity _____	C108023086	
OTPM 43A6	Quantity _____	C108023094	
OTPM 43A7	Quantity _____	C108023102	

**Table 7-26. OT Bay or Miscellaneously-mounted Application Worksheet
 (J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 43A8	Quantity _____	C108023110	Table 7-34 and “Circuit Pack/Unit Descriptions”
OTPM 43A9	Quantity _____	C108023128	
OTPM 43A10	Quantity _____	C108023136	
OTPM 43A11	Quantity _____	C108023144	
OTPM 43A12	Quantity _____	C108023151	
OTPM 43A13	Quantity _____	C108023169	
OTPM 43A14	Quantity _____	C108023177	
OTPM 43A15	Quantity _____	C108023185	
OTPM 43A16	Quantity _____	C108023193	
OTPM 43B	Quantity _____	C108023359	
OTPM 44A1	Quantity _____	C108090459	
OTPM 44A2	Quantity _____	C108090622	
OTPM 44A3	Quantity _____	C108090630	
OTPM 44A4	Quantity _____	C108090648	
OTPM 44A5	Quantity _____	C108090655	
OTPM 44A6	Quantity _____	C108090663	
OTPM 44A7	Quantity _____	C108090671	
OTPM 44A8	Quantity _____	C108090689	
OTPM 44A9	Quantity _____	C108090697	
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	

**Table 7-26. OT Bay or Miscellaneously-mounted Application Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089467	
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L124	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L125	

**Table 7-26. OT Bay or Miscellaneously-mounted Application Worksheet
(J69000C-1) — Continued**

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L126	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L134	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L135	"OT Package Descriptions"
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	
Other			
METRAL pin/tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use tele- phone num- ber provided)
CLETOP fiber cleaning materials	Quantity _____ Supplier Order # _____		Table 7-7 (Use tele- phone num- ber provided)

Table 7-27. OT Cabinet Worksheet (J69000C-1)

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OT Cabinet	Quantity _____	L1	"OT Package Descriptions"
Style Strip for Lucent ETSI Cabinet	Quantity _____	L140	
Circuit Packs (J69000C-1)			
OTCTL	Quantity _____	C108056284	Table 7-34 and "Circuit Pack/Unit Descriptions"
OPS	Quantity _____	C108203795	
SPODU	Quantity _____	C108209958	
SPOMU	Quantity _____	C108226994	
OTU 41A1C	Quantity _____	C108187949	
OTU 41A2C	Quantity _____	C108187956	
OTU 41A3C	Quantity _____	C108187964	
OTU 41A4C	Quantity _____	C108187972	
OTU 41A5C	Quantity _____	C108187980	
OTU 41A6C	Quantity _____	C108187998	
OTU 41A7C	Quantity _____	C108188004	
OTU 41A8C	Quantity _____	C108188012	
OTU 41A9C	Quantity _____	C108188020	
OTU 41A10C	Quantity _____	C108188038	
OTU 41A11C	Quantity _____	C108188046	
OTU 41A12C	Quantity _____	C108188053	

Table 7-27. OT Cabinet Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTU 41A13C	Quantity _____	C108188061	Table 7-34 and "Circuit Pack/Unit Descriptions"
OTU 41A14C	Quantity _____	C108188079	
OTU 41A15C	Quantity _____	C108188087	
OTU 41A16C	Quantity _____	C108188095	
OTU 41BB	Quantity _____	C108128737	
OTU 41C1C	Quantity _____	C108188111	
OTU 41C2C	Quantity _____	C108188129	
OTU 41C3C	Quantity _____	C108188137	
OTU 41C4C	Quantity _____	C108188145	
OTU 41C5C	Quantity _____	C108188152	
OTU 41C6C	Quantity _____	C108188160	
OTU 41C7C	Quantity _____	C108188178	
OTU 41C8C	Quantity _____	C108188186	
OTU 41C9C	Quantity _____	C108188194	
OTU 41C10C	Quantity _____	C108188202	
OTU 41C11C	Quantity _____	C108188210	
OTU 41C12C	Quantity _____	C108188228	
OTU 41C13C	Quantity _____	C108188236	
OTU 41C14C	Quantity _____	C108188244	
OTU 41C15C	Quantity _____	C108188251	
OTU 41C16C	Quantity _____	C108188269	
QOTU 41S	Quantity _____	C108022823	
OTPM 42A1	Quantity _____	C108022872	

Table 7-27. OT Cabinet Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE	
OTPM 42A2	Quantity _____	C108022898		
OTPM 42A3	Quantity _____	C108022906		
OTPM 42A4	Quantity _____	C108022914		
OTPM 42A5	Quantity _____	C108022922		
OTPM 42A6	Quantity _____	C108022930		
OTPM 42A7	Quantity _____	C108022948		
OTPM 42A8	Quantity _____	C108022955		Table 7-34 and "Circuit Pack/Unit Descriptions"
OTPM 42A9	Quantity _____	C108022963		
OTPM 42A10	Quantity _____	C108022971		
OTPM 42A11	Quantity _____	C108022989		
OTPM 42A12	Quantity _____	C108022997		
OTPM 42A13	Quantity _____	C108023003		
OTPM 42A14	Quantity _____	C108023011		
OTPM 42A15	Quantity _____	C108023029		
OTPM 42A16	Quantity _____	C108023037		
OTPM 42B	Quantity _____	C108023334		
OTPM 43A1	Quantity _____	C108023045		
OTPM 43A2	Quantity _____	C108023052		
OTPM 43A3	Quantity _____	C108023060		
OTPM 43A4	Quantity _____	C108023078		
OTPM 43A5	Quantity _____	C108023086		
OTPM 43A6	Quantity _____	C108023094		

Table 7-27. OT Cabinet Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE	
OTPM 43A7	Quantity _____	C108023102		
OTPM 43A8	Quantity _____	C108023110		
OTPM 43A9	Quantity _____	C108023128		
OTPM 43A10	Quantity _____	C108023136		
OTPM 43A11	Quantity _____	C108023144		
OTPM 43A12	Quantity _____	C108023151		
OTPM 43A13	Quantity _____	C108023169		
OTPM 43A14	Quantity _____	C108023177		Table 7-34 and "Circuit Pack/Unit Descriptions"
OTPM 43A15	Quantity _____	C108023185		
OTPM 43A16	Quantity _____	C108023193		
OTPM 43B	Quantity _____	C108023359		
OTPM 44A1	Quantity _____	C108090459		
OTPM 44A2	Quantity _____	C108090622		
OTPM 44A3	Quantity _____	C108090630		
OTPM 44A4	Quantity _____	C108090648		
OTPM 44A5	Quantity _____	C108090655		
OTPM 44A6	Quantity _____	C108090663		
OTPM 44A7	Quantity _____	C108090671		
OTPM 44A8	Quantity _____	C108090689		
OTPM 44A9	Quantity _____	C108090697		

Table 7-27. OT Cabinet Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
OTPM 44A10	Quantity _____	C108090705	
OTPM 44A11	Quantity _____	C108090713	
OTPM 44A12	Quantity _____	C108090721	
OTPM 44A13	Quantity _____	C108090739	
OTPM 44A14	Quantity _____	C108090747	
OTPM 44A15	Quantity _____	C108090754	
OTPM 44A16	Quantity _____	C108090762	
OTPM 44B	Quantity _____	C108089762	
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	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L124	
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L125	

Table 7-27. OT Cabinet Worksheet (J69000C-1) — Continued

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
ST LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L126	
SC LBO kit (R2.0 and earlier)	Quantity _____ (1 per OTU required)	L131	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OPS required)	L134	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTU required)	L135	
FC LBO kit (R2.1 and later)	Quantity _____ (1 per OTPM required)	L136	
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 7-28. 4 Line Repeater-to-Dual Repeater Conversion Worksheet
 (J68982C-1) ***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Conversion kit [†]	Quantity _____ (1 per conversion required)	L310	Table 7-33 [‡]
Dual Repeater kit	Quantity _____ (1 per cabinet required)	L104	“WaveStar OLS 40G Package Descriptions”
Circuit Packs (J68982C-1)			
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 addi- tional packs per shelf needed for the 4- fiber Telemetry Feed- through feature)	C107272569	“Circuit Pack/Unit Descriptions”
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller cir- cuit pack (SYSCTL)	Quantity _____ (1 per shelf required)	C107272510	
System memory cir- cuit pack (SYSMEM)	Quantity _____ (1 per shelf required)	C107786568	
Lightguide Jumper Kits			
Lightguide jumper kit	Quantity _____ (1 per optical line required)	L161	“WaveStar OLS 40G Package Descriptions”

**Table 7-28. 4 Line Repeater-to-Dual Repeater Conversion Worksheet
 (J68982C-1) — Continued ***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Lightguide Office Cable			
Lightguide office cable (FS1EP-EP-?) "?" indicates length	Quantity _____ (8 per optical line required)		<i>Fiber Optic Products Catalog 2492C</i>
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"

Table 7-28. 4 Line Repeater-to-Dual Repeater Conversion Worksheet
(J68982C-1) — *Continued* *

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
METRAL pin/tool kit	Quantity _____ Supplier Order # _____		Table 7-8 and Table 7-9 (Use telephone number provided)
CLETOP fiber clean- ing 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 7-33 provides ordering information for the underlying components in the conversion kit.

**Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet
 (J68982C-1) ***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Conversion kit [†]	Quantity _____ (1 per conversion required)	L310	Table 7-33 [‡]
Dual End Terminal kit	Quantity _____ (1 per cabinet required)	L103	
Circuit Packs (J68982C-1)			
Telemetry circuit pack	Quantity _____ (1 per optical line required; 2 addi- tional packs per shelf needed for the 4-fiber Telemetry Feed- through feature)	C107272569	“Circuit Pack/Unit Descriptions”
IAOLRP	Quantity _____ (1 per shelf required for Release 4.0)	C107822967	
Tributary overhead controller circuit pack (TOHCTL)	Quantity _____ (1 per shelf required)	C107273328	
TOHCTL	Quantity _____ (1 per shelf required for Release 4.0)	C107822819	
System controller cir- cuit pack (SYSCTL)	Quantity _____ (1 per shelf required)	C107272510	
System memory cir- cuit pack (SYSTEM)	Quantity _____ (1 per shelf required)	C107786568	

**Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet
 (J68982C-1) — Continued***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
Lightguide Office Cable			
Lightguide office cable (FS1EP-EP-?) "?" indicates length"	Quantity _____ (20 per optical line required [8λ]; 36 per optical line required [16λ]) Comcode _____		<i>Fiber Optic Products Catalog 2492C</i>
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 telem- etry cable	Quantity _____ Length _____	G201, G251, G261	
LAN cable	Quantity _____ Length _____	G815, G816	
Other			
DANTEL EMDU kit or HARRIS EMDU kit	Quantity _____ Comcode _____ Supplier Order # _____	L 300 or L301	Table 7-11

**Table 7-29. 4 Line End Terminal-to-Dual End Terminal Conversion Worksheet
 (J68982C-1) — Continued***

DESCRIPTION	SELECTION/ QUANTITY	COMCODE/ LIST/GROUP	REFERENCE
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)

* 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 7-33 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 7-26 to order WaveStar OLS 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
- L171 integration cabling.

Use Table 7-16 and Table 7-26 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
- L171 integration cabling.

Use Table 7-16 and Table 7-26 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
- L172 integration cabling.

Use Table 7-16 and Table 7-26 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
- L172 integration cabling.

Use Table 7-16 and Table 7-26 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 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
- L173 integration cabling.

Use Table 7-16 and Table 7-26 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
- L173 integration cabling.

Use Table 7-16 and Table 7-26 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)

Software and Documentation

Table 7-30 provides list numbers for new system orders of WaveStar OLS 40G Release 4.0 software and documentation. The CD-ROM contains the software, electronic documentation, and peripheral software tools.

**Table 7-30. New System Software and Documentation Ordering
(J-Drawing J68982CS-1)**

List No.	Description
M7R	Application software right-to-use fee (new system, Release 4.0)
P7R	Operating system software right-to-use fee (new system, Release 4.0)
F	<i>WaveStar OLS 40G Release 4.0 User Service Manual</i> (North American version, paper copy)
L10	WaveStar OLS 40G Release 4.0 cmd set/NE software f(CD-ROM)

The information in Table 7-31 is used when ordering additional copies of Release 4.0 software and documentation.

Table 7-31. Additional Release 4.0 Software and Documentation Ordering (J-Drawing J68982CS-1)

User Service Manual Comcode	Software Release Description Comcode	CD-ROM Comcode
108 336 926	108 336 744	108 336 728

Table 7-32 provides list numbers for upgrade orders of WaveStar OLS 40G software.

Table 7-32. Software Upgrade Ordering (J-Drawing J68982CS-1)

Release	List No. (CD-ROM)
3.1.1 - 4.0.0	L10, J1S, K1S
3.0.1 - 4.0.0	L10, M9S, P9S

The WaveStar OLS 40G Release 4.0 CD-ROM contains the following:

- CD-ROM Browser
- CenterLink Online Tour
- CenterLink-CIT software
- Intermediate software set
- Release 4.0.0-WaveStar OLS 40G Cmd Set/NE software
- Release 4.0.0-WaveStar OLS 40G SmartManual
- User documentation
- Microsoft Internet Explorer 4.0
- Adobe Acrobat Reader 3.0.1
- Personal Web Server 1.0a

Conversion Kit

Table 7-33 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 7-33. 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 7-34 apply to the specified shelves in all OT applications.

**Table 7-34. OT Slot/Circuit Pack Compatibility
 (Release 4.0-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	LUD1	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
	SPODU	BSY1	0 - 1
	SPOMU	BSY2	0 - 1
	OPS	LEP1	0 - 1
Complementary Shelf 2	OTU (21-32)	41A(1-16)C, 41BB, and 41C(1-16)C	
		41S	

**Table 7-34. OT Slot/Circuit Pack Compatibility
(Release 4.0-WaveStar OLS 40G)**

Shelf	Slot	Supported Pack Codes	Quantity
		42A(1-16), 42B, 43A(1-16), 43B, 44A(1-16), and 44B*	0 - 24
	SPODU	BSY1	0 - 1
	SPOMU	BSY2	0 - 1
	OPS	LEP1	0 - 1

* OTPM circuit packs are installed into 41S slots.

WaveStar OLS-to-OT Control Cabling

This section describes the cables that are used to connect WaveStar OLS 40G and OT equipment. The resulting connections form Integrated Bay/Cabinet packages in Double, Triple 1, and Triple 2 arrangements.

WaveStar OLS 40G Cabling for Double and Triple 1 Arrangements (ED-7G028-22)

Table 7-35 lists different cable lengths used to support a WaveStar OLS bay/cabinet connected to an OT bay/cabinet configuration.

Table 7-35. Cabling Information for WaveStar OLS 40G Double and Triple 1 Arrangements

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 Cabling for Triple 2
Arrangement (ED-7G028-22)**

Another integrated arrangement, the Triple 2, consists of a WaveStar OLS shelf connected to two OT Controller Shelves in a 3-bay arrangement. Table 7-36 lists cable lengths for this configuration.

Table 7-36. Cabling Information for WaveStar OLS 40G Triple 2 Arrangements

Cable Type (ED-7G028-22)	Length	Group #
LAN Cable 1 (WaveStar OLS 40G-to-OT)	20 ft	G801
	100 ft	G851
	180 ft	G855
LAN Cable 2 (WaveStar OLS 40G-to-OT)	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 7-37.

Table 7-37. 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 WaveStar OLS 40G, OT 1, and the eventual OT 2. 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 OT 1 or OT 2.

The OT integration cables are orderable by ED and Group number and can also be ordered as kits. Table 7-38 lists the various kits and associated cable lengths that are available.

Table 7-38. Integration Cabling Information

Kit # (J68982C-1)	Application	Cable* (ED-7G028-22)	Quantity	Cable
L171	WaveStar OLS 40G Integrated Bay/ Cabinet (Double) package	G853	1	LAN
		G854	1	Reset-and-Equipage
L172†	WaveStar OLS 40G Integrated Bay/ Cabinet (Triple 1) package	G853	2	LAN
		G854	2	Reset-and-Equipage
L173†	WaveStar OLS 40G Integrated Bay/ Cabinet (Triple 2) package	G855	1	LAN
		G805	1	Miscellaneous
		G806	1	LAN
		G814	1	Dual Reset-and-Equipage

* These cables are standard with L171, L172, and L173 kits.

† L172 and L173 contain a single label kit (comcode: 848123089) that provides correct identification of OT bays. If 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 kits L171, L172, and L173, order individually using the ED and Group numbers found in Table 7-35, Table 7-36, and Table 7-37.
- If an Integrated Bay/Cabinet-Double equipment package is installed initially and it later becomes necessary to add the additional OT bay/cabinet, 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

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- Engineering and Installation Services 8-1
 - Technical Support 8-2
 - Documentation Support 8-6
 - Training Support..... 8-6
 - Warranty Support..... 8-6
 - Account Executive Support..... 8-6

This chapter describes how Lucent Technologies supports 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 Global Technical Support Information Platform (GTSIP) customer support tools, that currently supports many transmission products, including WaveStar OLS 40G. GTSIP 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, GTSIP 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 GTSIP, contact your local account executive.

Once connected to GTSIP, the user specifies which product to access and GTSIP 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. GTSIP users achieve proficiency quickly because of the consistency of menu selections among products.

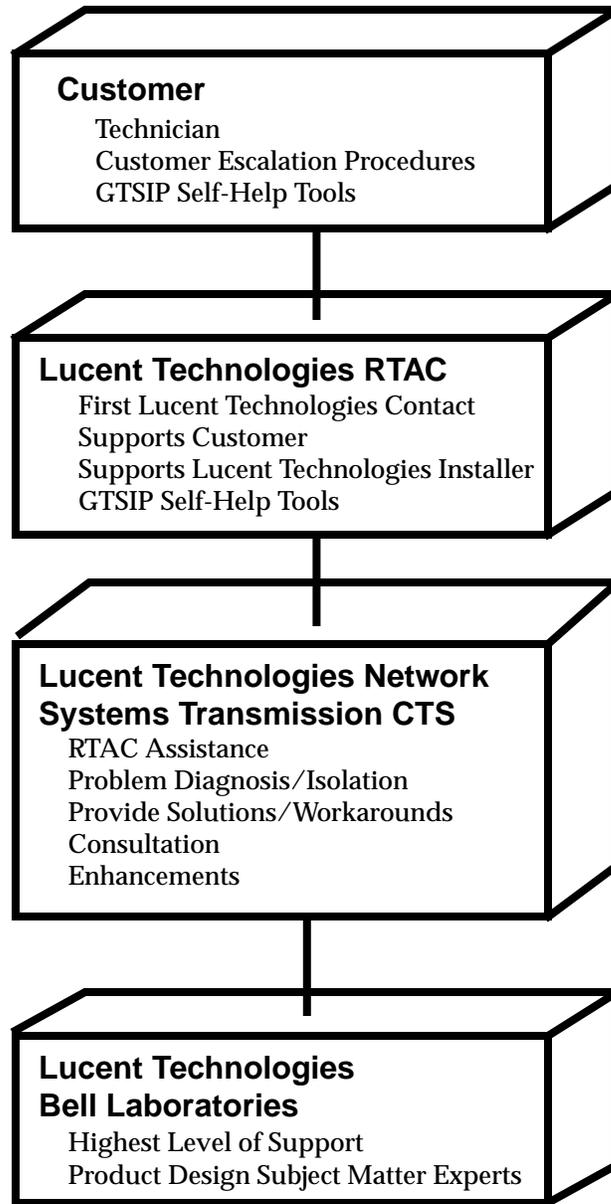


Figure 8-1. Product Support

The following GTSIP tools are available to the user:

Diagnostic dictionary	<p>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.</p> <p>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.</p>
News and bulletins	<p>Immediately after a user logs into the GTSIP 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.</p>
Compatibility data	<p>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 GTSIP responds with page-formatted lists of circuit packs compatible with the selected software generic.</p>
GTSIP user's guide	<p>GTSIP 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.</p>

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 GTSIP 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

■ WaveStar OLS 40G Quality and Reliability.....	9-1
Maintainability Specifications	9-2
Warranty	9-2
■ Technical Specifications.....	9-3
Optical Connector Interfaces	9-3
Transmission Medium	9-3
Lightguide Jumpers.....	9-3
Optical Safety (BRH Classification)	9-3
Operating Wavelength	9-3
Optical Dispersion	9-3
Optical Return Loss	9-4
Optical Reflections Tolerance	9-4
Low Voltage Cut-off	9-4
Optical Line Rate	9-4
Transmission Standards Compliance	9-4
Cable Access	9-4
Power Specifications.....	9-5
Dimensions	9-6
Floor Loading Specifications.....	9-9
Environmental Specifications.....	9-10
Handling and Transportation Constraints	9-11
Reliability Specifications	9-11
Hardware Unavailability	9-13
Silent Failure Unavailability	9-14
Mean-Time-Between-Maintenance	9-15
Infant Mortality and Design Life	9-16

Optical Signal Output Power from OTU/OTPMs	9-16
OA Output Power	9-19
Outside Plant Loss	9-20
Tone Frequencies.....	9-21
Optical Signal-to-Noise Ratio (SNR)	9-22
Customer Maintenance Signal	9-22

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 the WaveStar OLS 40G occurs, the system cuts off when a power filter input of -38.5 V DC \pm 1 V is detected. The system restarts when a power filter input of -43 V DC \pm 1 V is detected.

Optical Line Rate

WaveStar OLS 40G supports an optical line rate of up to 40 Gb/s.

Transmission Standards Compliance

WaveStar OLS 40G meets single-mode interoffice digital fiber optic systems requirements and objectives as specified in *Bellcore TR 253* and *TR 499*.

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 9-1 shows WaveStar OLS 40G and OT power specifications.

Table 9-1. 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 9-2 lists the physical dimensions of WaveStar OLS 40G and OT components.

Table 9-2. 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 9-3 lists the dimensions of WaveStar OLS 40G and OT circuit pack.

Table 9-3. 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)
SYSTEM	14 in. (35.6 cm)	0.8 in. (2.0 cm)	8 in. (20.0 cm)
OA (All)	14 in. (35.6 cm)	4 in. (10.0 cm)	8 in. (20.0 cm)
TOHCTL (LEA102)	14 in. (35.6 cm)	0.8 in. (2.0 cm)	8 in. (20.0 cm)
TOHCTL (LEA5)	14 in. (35.6 cm)	0.8 in. (2.0 cm)	8 in. (20.0 cm)
IAOLRP	9 in. (22.8 cm)	2 in. (5.0 cm)	8 in. (20.0 cm)
OMU (All)	9 in. (22.8 cm)	2 in. (5.0 cm)	6 in. (15.0 cm)
ODU (All)	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)

Equipment	Height	Width	Depth
OTUs 41A(1-16)C, 41BB, 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 9-4 shows floor loads for WaveStar OLS 40G and OT.

Table 9-4. 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 Miscellaneously mounted System Controller Shelf	64			
Fully-equipped Miscellaneously mounted Complementary Shelf	74			
3-Shelf OT Bay	342	45.0		

* Miscellaneously-mounted shelves do not have an absolute weight per square foot. Because they can be installed in different equipment arrangements, their weight per square foot is subject to change.

Environmental Specifications

Table 9-5 shows the various temperatures and humidity levels at which WaveStar OLS 40G can operate.

Table 9-5. 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 9-6 shows WaveStar OLS 40G tolerance ranges for various handling and transportation conditions.

Table 9-6. Handling and Transportation Tolerance Ranges

Condition	Tolerance Range
Vibration & Shock	Complies with <i>GR-63-CORE, Issue 1, Oct 1995</i>
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 9-7 lists failures-in-time (FIT) rates for WaveStar OLS 40G and OT circuit packs.

Table 9-7. WaveStar OLS 40G/OT Circuit Pack FIT Rates per Bellcore RPP*

Description	Code	FIT
WaveStar OLS 40G		
SYSCTL	LEA1	3387
SYSTEM	LEA2	7118
TOHCTL	LEA5	2549
TOHCTL (LEA102)	LEA102	2500
IAOLRP	LDA3	1000
ODU (8 λ)	605A	1540
ODU (16 λ)	606A	3443
ODU (16 λ)	606B	3694

Table 9-7. WaveStar OLS 40G/OT Circuit Pack FIT Rates per Bellcore RPP* — Continued

Description	Code	FIT
WaveStar OLS 40G		
OMU (8 λ)	505A	1538
OMU (16 λ)	506A	2141
OA	LEA6, LEA7, LEA7B, 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 9-8 shows WaveStar OLS 40G and OT channel unavailability.

Table 9-8. 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 9-9 shows telemetry channel unavailability (min/year/channel) for WaveStar OLS 40G.

Table 9-9. 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 9-10 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 9-10. 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 Output Power from OTU/OTPMs

The output power of each optical signal wavelength from an OTU/OTPM must meet the ranges given in Table 9-11, which are verified to 0.7 dB accuracy. The table provides output 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 1.5 μ 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 power of the customer maintenance signal (part of the supervisory channel) coming into the WaveStar OLS 40G 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 9-11. OTU/OTPM Optical Power Output Specifications (1.5 μ)

Signal*	Wavelength (nm)	Power (dBm) (\pm 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
Supervisory Channel	1532.0				

* Each signal (1-16) is handled by a respective 41A(1-16)C, 141C(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 1.3 μ range exiting the ODU.

Table 9-12. Optical Signal Specifications for 1.3 μ 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

⇒ NOTE:

When using LBOs on the input of add-side OTUs and OTPMs, select an optical LBO that can attenuate the input signal to a value that is between -12 and -22dB.

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 9-13 lists output power values, assuming a 0 dB output lightguide build-out (LBO).

Table 9-13. Output Power (dBm)

No. of Optical Channels Equipped	LEA6 OA	LEA7/LEA7B OA	LEA104 OA	LEA105 OA
0	11.9	11.9	11.9	8.1
1	12.4	12.4	12.4	8.6
2	12.4	12.4	12.4	9.1
3	13.8	13.8	13.8	10.8
4	14.5	14.5	14.5	11.8
5	15.2	15.2	15.2	12.7
6	15.8	15.8	15.8	13.3
7	16.0	16.0	16.0	13.9
8	16.5	16.5	16.5	14.1
9	-	16.5	17.0	14.6
10	-	16.5	17.5	15.1
11	-	16.5	17.9	15.5
12	-	16.5	18.3	15.7
13	-	16.5	18.6	15.7
14	-	16.5	18.9	15.7
15	-	16.5	19.0	15.7
16	-	16.5	19.0	15.7

Outside Plant Loss

Table 9-14 shows minimum and maximum plant loss values for the OA.

Table 9-14. Plant Loss Between OA Sites

OA Standard Performance	Loss Between OA Sites	
	Min (dB)	Max (dB)
Long Span Systems (five-span) (LEA104, LEA6)	26	30
Long Reach Systems (eight-span) (LEA7, LEA7B)	17	22
Short Reach Systems (one-span) (LEA105)	14	18

Tone Frequencies

Table 9-15 shows approximate tone frequencies used for each wavelength.

Table 9-15. 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 an 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 9-16 shows the optical interface specifications for this signal.

Table 9-16. 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

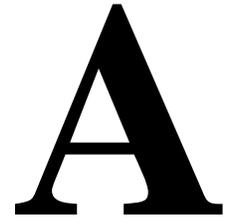
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- * The minimum system gain represents aging, temperature, and manufacturing tolerances.
 - † Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path.
 - ‡ One connector (0.75dB) on each end is assumed.

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 9-17.

Table 9-17. IS-3 Interface Distance Limitations

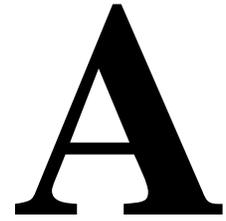
Fiber Bandwidth (MHz-km)	Distance (km)
1000	3.4
800	3.3
500	2.7
300	1.9

Circuit Pack Sparing



-
- Circuit Pack Sparing Lead Time.....A-1
 - Sparing Examples.....A-2
 - Ordering Spare Circuit Packs and Fuses.....A-7

Circuit Pack Sparing



This section provides information on circuit pack sparing for WaveStar™ OLS 40G. Circuit pack comcodes and CLEI codes 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
SYSTEMEM	LEA2	1149
TOHCTL	LEA5	969
TOHCTL (LEA102)	LEA102	1000
IAOLRP	LDA3	500
ODU (8λ)	605A	374
OMU (8λ)	505A	354
ODU (16λ)	606A	403
ODU (16λ)	606B	430
OMU (16λ)	506A	247
OA	LEA6, LEA7, LEA7B, LEA104, LEA105	4724
TLM	LDA1	1414

Table A-1. Circuit Pack FIT Rates for WaveStar OLS 40G/OT

Description	Code	FIT*
OT		
OTCTL	LUD1	802
OPS	LEP1	2486
SPODU	BSY1	1509
SPOMU	BSY2	1509
OTU	41A(1-16)C	1425
	41BB	1329
	41C(1-16)C	1425
QOTU	41S	705
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.

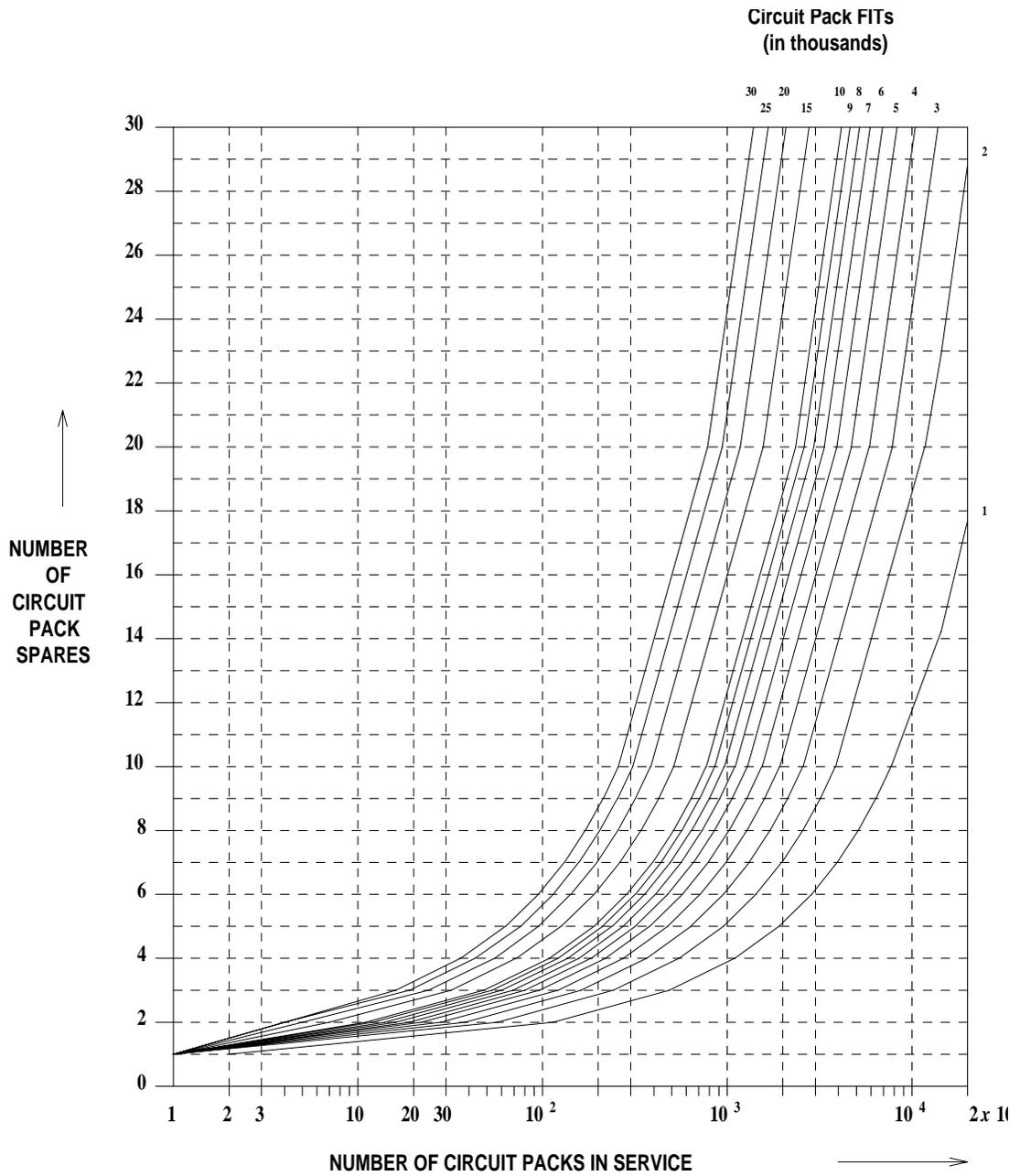
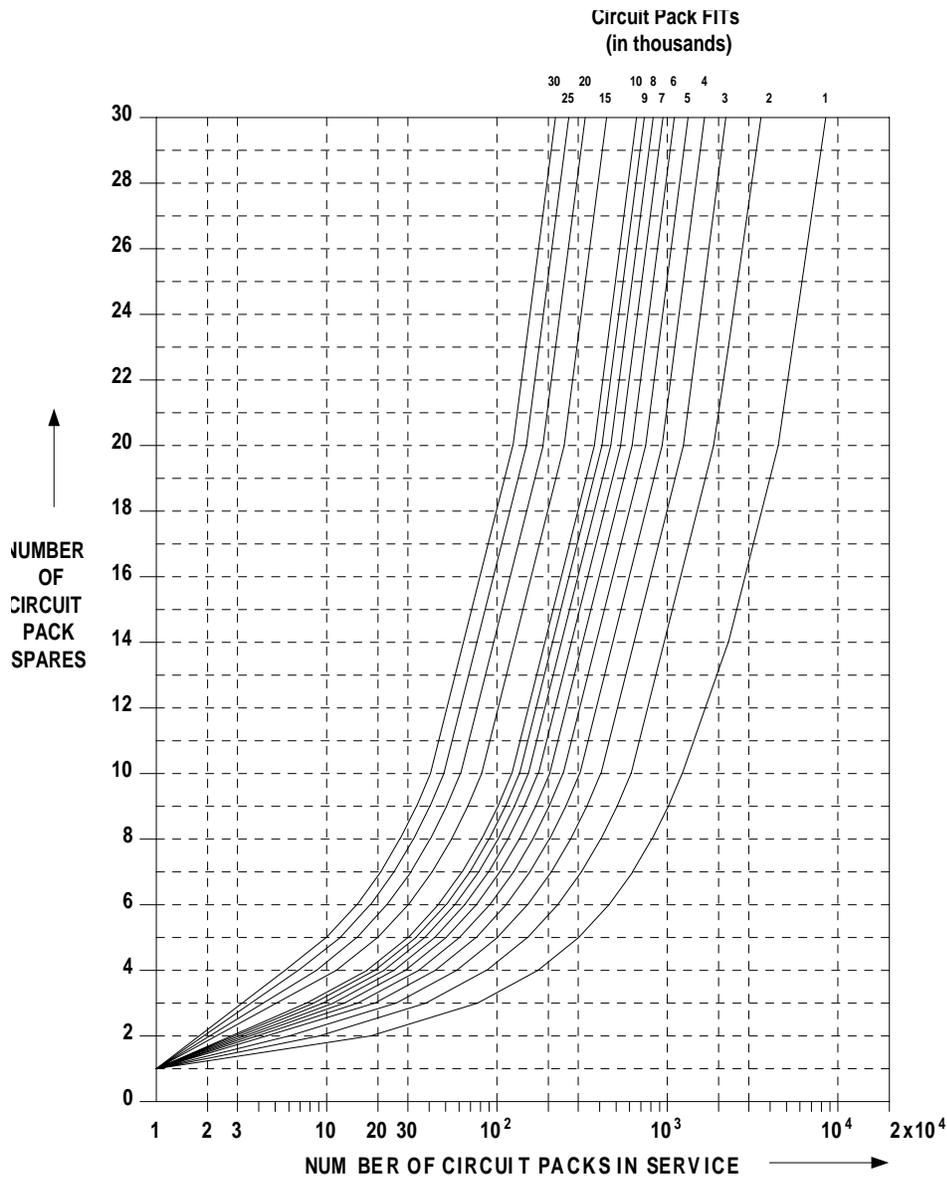


Figure A-1. Sparing Chart -- 10-Day Lead Time



ols07002.01eSEV082297r2.1

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	C107272510	SNC3SH0A
SYSMEM	LEA2	C107786568	SNC3TJTA
TOHCTL	LEA5	C107273328	SNC2S00B
TOHCTL	LEA102	C107822819	SNPQB3HA
TLM	LDA1	C107272569	SNC2R00B
IAOLRP	LDA3	C107822967	SNPQB5JA
OMU (8 λ)	505A	C107292179	SNC2JL0A
ODU (8 λ)	605A	C107292187	SNC2KL0A
OMU (16 λ)	506A	C107727828	SNC5ED0D
ODU (16 λ)	606A	C108032814	FHUM2B0G
ODU (16 λ)	606B	C108032822	FHUM2BAG
OA (Long Span)	LEA6	C107273336	SNC2U00B
OA (Long Reach)	LEA7	C107742439	SNC7RROC
OA (Long Span)	LEA104	C107976367	SNPQB18AAA
OA (Short Reach)	LEA105	C108045394	SNPQB2EA
OA (Long Reach)	LEA7B	C108309949	SNC7RR3C

Table A-2. Circuit Pack Comcodes * — *Continued*

Circuit Pack	Code	Comcode	CLEI
OT			
OTCTL	LUD1	C108056284	LGR1JN0EAA
OPS	LEP1	C108203795	SNSPALDE
SPODU	BSY1	C108209958	SNCBL60D
SPOMU	BSY2	C108226994	SNCBM07D
OTU	41A1C	C108187949	SNOTABAA
OTU	41A2C	C108187956	SNOTACAA
OTU	41A3C	C108187964	SNOTADAA
OTU	41A4C	C108187972	SNOTAEAA
OTU	41A5C	C108187980	SNOTAFAA
OTU	41A6C	C108187998	SNOTAGAA
OTU	41A7C	C108188004	SNOTAHAA
OTU	41A8C	C108188012	SNOTAJAA
OTU	41A9C	C108188020	SNOTAKAA
OTU	41A10C	C108188038	SNOTALAA
OTU	41A11C	C108188046	SNOTAMAA
OTU	41A12C	C108188053	SNOTANAA
OTU	41A13C	C108188061	SNOTAPAA
OTU	41A14C	C108188079	SNOTARAA
OTU	41A15C	C108188087	SNOTASAA
OTU	41A16C	C108188095	SNOTATAA
OTU	41BB	C108128737	SNP2V0XD
OTU	41C1C	C108188111	SNOTBBAA
OTU	41C2C	C108188129	SNOTBCAA
OTU	41C3C	C108188137	SNOTBDAA

Table A-2. Circuit Pack Comcodes * — *Continued*

Circuit Pack	Code	Comcode	CLEI
OTU	41C4C	C108188145	SNOTBEAA
OTU	41C5C	C108188152	SNOTBFAA
OTU	41C6C	C108188160	SNOTBGAA
OTU	41C7C	C108188178	SNOTBHAA
OTU	41C8C	C108188186	SNOTBJAA
OTU	41C9C	C108188194	SNOTBKAA
OTU	41C10C	C108188202	SNOTBLAA
OTU	41C11C	C108188210	SNOTBMAA
OTU	41C12C	C108188228	SNOTBNAA
OTU	41C13C	C108188236	SNOTBPAA
OTU	41C14C	C108188244	SNOTBRAA
OTU	41C15C	C108188251	SNOTBSAA
OTU	41C16C	C108188269	SNOTBTAA
QOTU	41S	C108022823	SNC6101E
OTPM	42A1	C108022872	SNC670RE
OTPM	42A2	C108022898	SNC670SE
OTPM	42A3	C108022906	SNC670TE
OTPM	42A4	C108022914	SNC670UE
OTPM	42A5	C108022922	SNC670VE
OTPM	42A6	C108022930	SNC670WE
OTPM	42A7	C108022948	SNC670XE
OTPM	42A8	C108022955	SNC670YE
OTPM	42A9	C108022963	SNC670GE
OTPM	42A10	C108022971	SNC670HE
OTPM	42A11	C108022989	SNC670JE

Table A-2. Circuit Pack Comcodes * — *Continued*

Circuit Pack	Code	Comcode	CLEI
OTPM	42A12	C108022997	SNC670KE
OTPM	42A13	C108023003	SNC670LE
OTPM	42A14	C108023011	SNC670ME
OTPM	42A15	C108023029	SNC670NE
OTPM	42A16	C108023037	SNC670PE
OTPM	42B	C108023334	SNC670ZE
OTPM	43A1	C108023045	SNC660RE
OTPM	43A2	C108023052	SNC660SE
OTPM	43A3	C108023060	SNC660TE
OTPM	43A4	C108023078	SNC660UE
OTPM	43A5	C108023086	SNC660VE
OTPM	43A6	C108023094	SNC660WE
OTPM	43A7	C108023102	SNC660XE
OTPM	43A8	C108023110	SNC660YE
OTPM	43A9	C108023128	SNC660GE
OTPM	43A10	C108023136	SNC660HE
OTPM	43A11	C108023144	SNC660JE
OTPM	43A12	C108023151	SNC660KE
OTPM	43A13	C108023169	SNC660LE
OTPM	43A14	C108023177	SNC660ME
OTPM	43A15	C108023185	SNC660NE
OTPM	43A16	C108023193	SNC660PE
OTPM	43B	C108023359	SNC660ZE
OTPM	44A1	C108090459	SNP2TYED
OTPM	44A2	C108090622	SNP2TYFD

Table A-2. Circuit Pack Comcodes * — *Continued*

Circuit Pack	Code	Comcode	CLEI
OTPM	44A3	C108090630	SNP2TYGD
OTPM	44A4	C108090648	SNP2TYHD
OTPM	44A5	C108090655	SNP2TYJD
OTPM	44A6	C108090663	SNP2TYKD
OTPM	44A7	C108090671	SNP2TYLD
OTPM	44A8	C108090689	SNP2TYMD
OTPM	44A9	C108090697	SNP2TYND
OTPM	44A10	C108090705	SNP2TYPD
OTPM	44A11	C108090713	SNP2TYRD
OTPM	44A12	C108090721	SNP2TYSD
OTPM	44A13	C108090739	SNP2TYTD
OTPM	44A14	C108090747	SNP2TYUD
OTPM	44A15	C108090754	SNP2TYVD
OTPM	44A16	C108090762	SNP2TYWD
OTPM	44B	C108089467	SNP2TYXD

* Optical Translator Units (OTUs), Optical Translator Port Modules (OTPMs), the Quad Optical Translator Unit (QOTU), and Optical Amplifier (OA) circuit packs require a list number when ordered as spares.

Q-LAN Interface

B

-
- Q-LAN Functionality B-1
 - Open Systems Interconnection (OSI) B-2
 - Routing Information..... B-3
 - WaveStar OLS 40G Subnetworks Prior to
Release 4.0 B-5
 - Overall Rules and Guidelines B-7
 - Provisioning an Existing WaveStar OLS 80G R3.x
Network for IS-IS Level-2 Routing B-15
 - Installation of a new network with IS-IS Areas B-15
 - In-Service Transition into IS-IS Areas B-19
 - ITM/SC Connections B-23

Q-LAN Interface

B

This appendix provides a detailed description of the functionality of the Q-LAN Interface feature.

Q-LAN Functionality

The Q-LAN Interface feature using IS-IS Level 2 routing enables larger WaveStar OLS 40G Release 4.0 management domains and increases the robustness of the management network. Previously, WaveStar OLS 80G nodes were grouped into clusters of 32 nodes or less, each cluster needing at least one connection to the management system. This required data communication facilities between the site where the management system resides (e.g., ITM/SC) and the site where one of the nodes of each cluster resides. To increase reliability of the communication network, additional connections from the management system to each cluster are needed since a data communications route between clusters is not allowed.

With the Q-LAN functionality in Release 4.0 we manage areas not clusters. Areas differ from clusters in that routing between management areas is permissible; thus reducing the number of physical connections needed between the management system and the WaveStar OLS 80G network while increasing survivability of the management network.

With Release 4.0, a single area with up to 50 nodes can be managed. A mechanism for growing the network beyond 50 nodes is to split the network into multiple areas and then establish links between areas. These links are configured WaveStar OLS 80G nodes in an area (referred to as Level 2 nodes) that are responsible for linking the areas. An integrated network composed of IS-IS Level 2 areas provides a more flexible, cost effective and robust environment to provide access from the ITM/SC to

each managed network element. This feature provides the capability for current networks that are less than 32 nodes to grow beyond 32 nodes without requiring the addition of clusters.

IS-IS level 2 requires upfront design of the network areas and requires some additional provisioning. This appendix describes how you can use this feature.

Open Systems Interconnection (OSI)

The Open Systems Interconnection (OSI) 7-layer protocol forms the basis for providing the capability of routing data between the management system and WaveStar OLS 80G nodes located within an area and between areas within an OSI network.

The Network Layer of the OSI 7-layer stack provides the means to transmit data across a network regardless of network type, topology, or services offered by the underlying network. The networks that connect OSI network elements (NEs) are called subnetworks. The network layer entity is dependent on the network services offered by the subnetworks it must traverse to reach the destination network layer entity along with the services provided by the underlying data link layer.

The connectionless network service (CLNS) and its corresponding connectionless network protocol (CLNP) provide the following services and functions at the Network Layer: Network Addresses, Quality of Service (QoS) parameters, Error Notification, Segmentation of messages, Routing, and Relaying of messages through Intermediate Systems. The connectionless service provides no error recovery mechanisms and does not guarantee the delivery of data to the End System.

The IS-IS intra domain routing exchange protocol provides information to ISs as to the reachability of the other ISs and the ESs that those ISs can reach, either directly, or through other ISs. The ISs that can route within an area are called Level 1 IS. These ISs know all other Level 1 ISs within the area and the shortest path to each. A Level 2 IS contains routing information about other Level 2 ISs outside the area. The Level 2 IS is responsible for routing from one area to another.

There is a relation between an WaveStar OLS 80G transport network, the DCN that is used for management of this network, and the division of a DCN into IS-IS areas:

The transport network between NEs is the basis of the WaveStar OLS 80G network and provides DCC channels for management of that network using OSI-protocols.

The DCN is a combination of DCC and LAN connections and has a different topology than the transport network, although limited by the DCC facilities that are provided by the transport network.

LAN is used for interconnection of nodes that are in the same office. An end system (destination) or intermediate system (router) is referred to as a node in the DCN.

Extended routing makes it possible to enlarge the size of the DCN, and is achieved through the use of two levels in the IS-IS routing protocols at the network layer of the OSI stack. To use the extended routing scheme, the DCN is divided into several areas, and an extra interworking level between these areas is used.

Routing Information

The network routing protocols of the OSI are based on a class of routing protocols called (SPF) Shortest Path First protocols. OSI routes packets using IS-IS (Intermediate System to Intermediate System) and/or ES-IS (End System to Intermediate system) routing protocols. These protocols are based on the concept that if all the Level 1 nodes can discover the connectivity with their neighbors and if all the nodes in the area can exchange this information dynamically with all the other nodes in the area, then all the nodes in the area have knowledge of the network topology and can communicate with each other. Level 2 nodes can discover connectivity to all Level 1 and Level 2 nodes in its area in addition to all other Level 2 nodes in the OSI network .

The routing protocol performs two functions. First, it actively tests the status of all neighbor nodes. (i.e. state of the link between the two nodes) by periodically exchanging short messages that ask whether the neighbor is reachable and alive. If the neighbor replies, then the link is marked as "up" else the link is marked as "down". Secondly, it periodically propagates the link status information to all other nodes. It periodically broadcasts to all the other nodes in the network a message that lists the status of each of its links. If the underlying networks do not support broadcast, delivery is done by forwarding the individual copies of the message point-to-point. In the Wavestar OLS 80G systems, the LAN subnetwork is a broadcast network while the supervisory datalink is a point-to-point sub-

network. Whenever a link status message arrives, a node uses the information to update its map of the network, by marking links “up” and “down”. Whenever link status changes, the node recomputes routes by applying the well-known “Dijkstra shortest path algorithm” to the resulting graph. It computes the shortest paths to all destinations from a single source.

ES-IS protocol is relevant for End Systems and Intermediate Systems routing. It allows ESs and ISs attached to the same subnetwork to dynamically discover each others existence and availability.

The IS-IS routing protocol is a link state dynamic routing protocol that detects and learns the best routes to reachable destinations. IS-IS can quickly perceive changes in the topology of a domain, and after a short convergence period, calculates new routes. To accomplish this the IS-IS uses the following packets:

IIH - Hello messages that ISs use to discover, initialize, and maintain adjacencies with neighboring ISs.

LSP -Link State Packets: The IS uses this to keep the link state database information current.

SNP - Sequence Number packets to keep the routing database synchronized and to ensure that each adjacent IS knows which are the most recent link state packets (LSP) from each other router.

IIH message allows an IS to determine the existence of other ISs and to establish adjacencies. The IS maintains a local hello timer for each link and a holding timer for each adjacency. Each time the hello timer expires, a hello message is sent over the link to any adjacent IS. When the hello message is received the recipient establishes or updates the adjacency information. This information remains current for the amount of time in the holding timer. If the holding timer expires, the link is brought down. This is the primary scheme with which neighbors, as well as a newly booted node in the network, learn about each other. The same scheme is used when a node in the network becomes “incomunicado.”

Each L1 and L2 IS node maintains a link state database. The primary element of the database is the link state update. A link state update is the node’s internal representation of the set of LSPs received from another node. The node is responsible for building its own LSPs and processing other ISs LSPs to maintain the database. The L1 database contains the information about the nodes (NSAPs) in the IS area of the network. The L2

database contains information about areas and reachable addresses. With information from the databases, the Dijkstra routing algorithm calculates the shortest paths to all destinations and builds the routing tables. To ensure that each L1 and L2 IS contains the complete set of LSPs from all nodes, LSPs are flooded throughout the network. Flooding is a mechanism that an L1 or L2 IS uses to propagate an LSP to all L1 or L2 ISs. An L1 IS floods LSPs to L1 ISs only. An L1/L2 IS floods both L1 and L2 LSPs.

An L1-only IS node contains the level 1 routing table. An L1/L2 IS contains L1 routing table and all L2 routing tables. The routing table entries are built from the information in the link state database.

WaveStar OLS 40G Subnetworks Prior to Release 4.0

Figure B-1 depicts subnetworks that are configured based on the capabilities of WaveStar OLS 80G prior to the networking feature provided by Release 4.0. Each subnetwork is defined by an ET to ET connection including subtending repeaters. Subnetworks are extended through the use of Dual End Terminals or use of the TLM Feed Through feature.

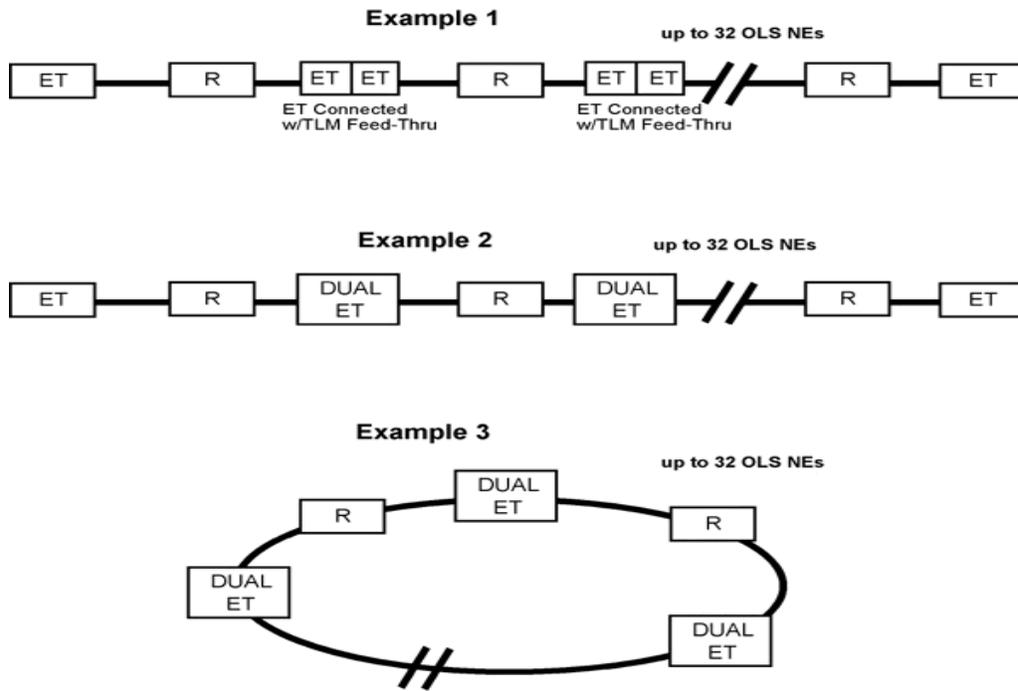


Figure B-1. Examples of Subnetworks Configured Before R4.0

Overall Rules and Guidelines

A “rule” is a pre-condition for proper network layer routing, including protection against single failures.



NOTE:

All rules are mandatory.

A “guideline” is a recommended condition that will add robustness to the data communications network in the event of equipment failures and/or transmission failures.

Rule R05

Wavestar OLS 80G Level 1 nodes interconnect only with Wavestar OLS 80G nodes and the ITM-SC. Only OLS 80G nodes can be in the Level 1 area.

Rule R10

Wavestar OLS 80G Level 2 nodes can route messages to other areas if the following NSAP address rules are obeyed:

1. The length of the SEL field in the NSAP is 1 byte.
2. The length of the System Id field in the NSAP is 6 bytes.
3. The length of the Area Address field in the NSAP is 13 bytes.

Wavestar OLS 80G nodes cannot interwork with nodes that have not chosen the same constants.

OLS 80G supports fixed length (13 bytes) format for the Area Address field. However it will support network layer interworking with other Network Elements in the network that support variable length area address fields (between 3 and 13 bytes).

NSAP Address Structure for IS-IS

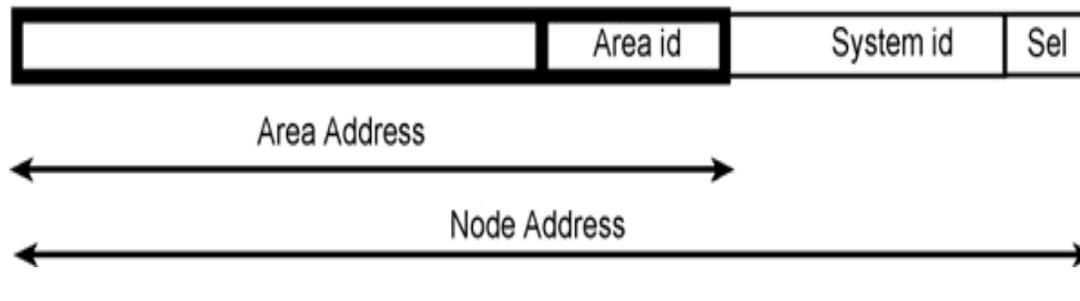


Figure B-2. NSAP Address Structure for IS-IS

Rule R15

An area must have a unique area address within the OSI network.

Rule R20

An area must have a unique area address within the WaveStar OLS 80G network. The default area address (AreaId = 0000) must not be used in an OSI-domain that is divided in areas.

Guideline G25

The management network should only be divided into areas when the network is expected to grow too large for a single area. The extra effort for engineering, administration and installation would not improve the network robustness.

Rule R30

In an IS-IS Level 2 network, all WaveStar OLS 80G nodes in the network must run WaveStar OLS 80G Release 4.0 software or later and shall not be downgraded to a pre-Release 4.0 software release.

Rule R35

The number of areas, nodes per area, nodes in the level-2 subdomain, etc. is limited. Stay within the limits that are specified in Table B-1 below.

Table B-1. Limitations for OSI-Networks Divided into IS-IS Areas

Network Parameter	IS-IS Divided Network Limits
Maximum number of nodes per area	50
Maximum number of hops between nodes (to allow end-to-end communication) (Maximum number of hops between ITM-SC and node)	32
Maximum hops in a ring or LAPD chain. (Note: maximum of 32 nodes)	31
Maximum number of LAN hops between nodes (to allow end-to-end) communication	15
Maximum number of ITM-SC connections (associations)* that can be forwarded by a node	200
Maximum number of ITM-SC connections (associations)* that can be forwarded by a designated node	100
Maximum number of ITM-SC connections (associations)* that can be forwarded by a DSNE	100
Maximum number of nodes per LAN	25
Maximum number of LANs per area	10
Maximum number of areas in the OSI DCN network	20
Maximum number of nodes in the L2 subdomain	60
Maximum number of nodes per LAN that are part of the L2 subdomain	10
Maximum number of areas per LAN	5
Maximum number of L2 LANs in the L2 subdomain	15

* Each OLS accepts only one association from the ITM-SC manager. The association is a live end to end connection between the ITM-SC and all the NEs that it is managing

Guideline G40

For networks up to 50 nodes, it is preferred to use an undivided OSI-network with DYNAMIC routing from ITM-SC towards the ITM-SC LAN. Full re-routing capabilities over all physical routes are then automatically available and DCN provisioning is not needed (default settings can be used), which implies easier network design and installation for maximum network robustness.

Guideline G45

For newly installed networks, it is preferred to use IS-IS areas above IS-IS clusters.

Advantages of IS-IS areas are:

- A second route to all managed NEs is possible (avoid single point of failure).
- This is a standardized mechanism.
- No Bridges and 2Mb/s links are needed to create a virtual LAN between two ITM-SC access points. (DCC links between two areas can be used instead.)
- Better utilization of ITM-SC possible. (connection to all nodes in the OSI-network possible).

Guideline G50

For newly installed networks that are intended to grow above 50 nodes, it is preferred to use IS-IS areas above an undivided OSI-network.

Rule R55

A single level-2 subdomain must be established that interconnects all areas of the WaveStar OLS 80G network. (see Figure B-3).

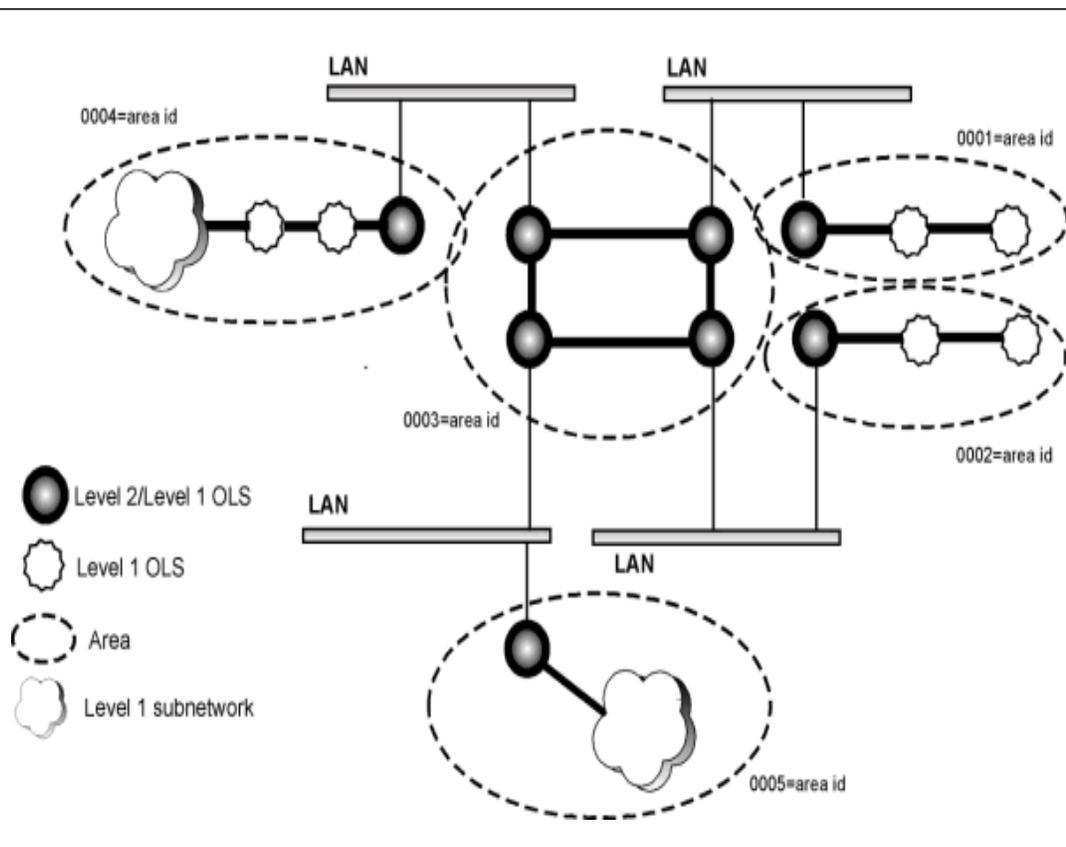


Figure B-3. Example of a Level 2 Subdomain

Guideline G60

A single point of failure for interconnection of the areas is avoided by:

- Using a ring-topology for the level-2 subdomain where feasible.
- Using a ring-topology within each area where feasible
- Using a double entrance into each area from the ITM/SC and from other areas, such that the entries into the area cannot be disconnected by a single failure within an area. (see Figure B-4)

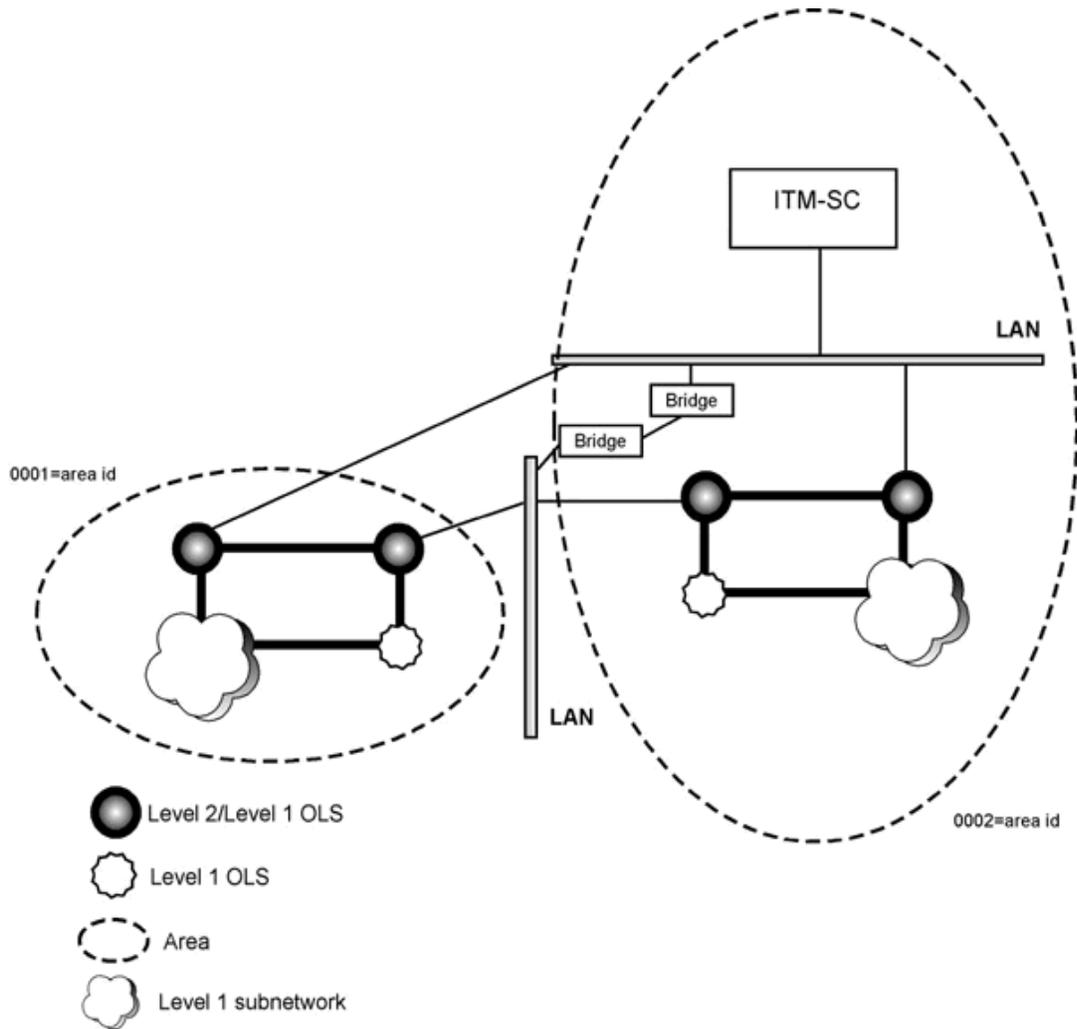


Figure B-4. Double Level 2 Entry in an Area

Guideline G65

Level-2 nodes in an area should be part of a level-1 ring. (see Figure B-5)

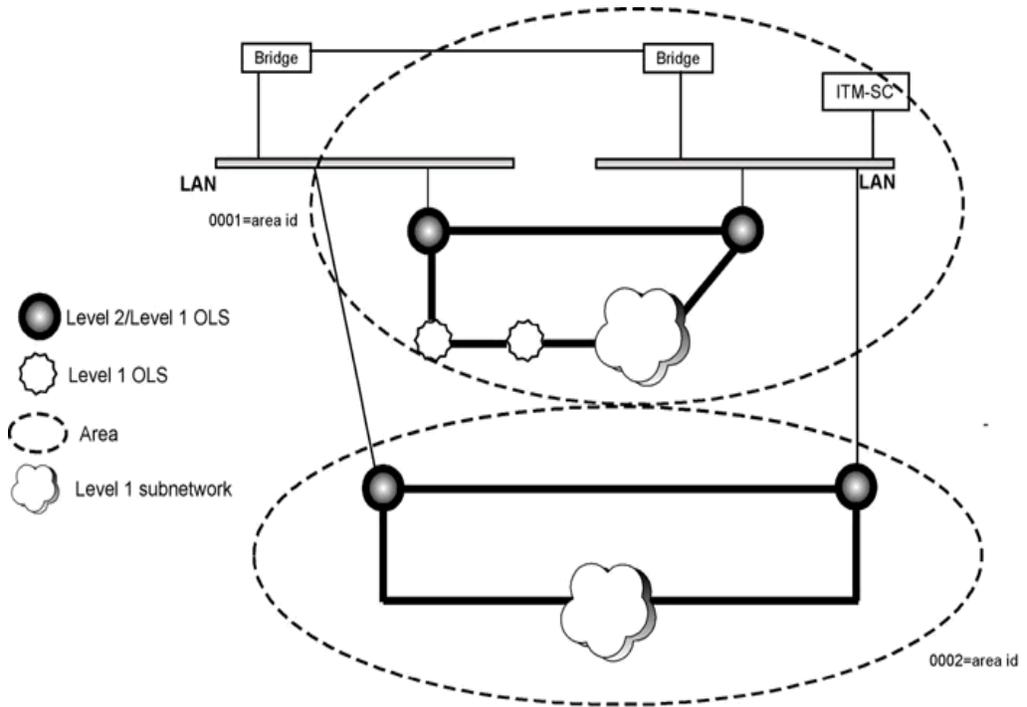


Figure B-5. Level 2 Nodes in an Area as part of a Level 1 Ring

Rule R70

The valid number of level-2 nodes in a ring is:

- None
- One
- All nodes in the ring

Rule R75

For a ring of level-2 nodes, two valid area topologies exist:

- All nodes in the ring are part of the same area.
- Each node in this ring is part of a different area.

Rule R80

Assign one and only one node as a DSNE in an area. Directory services are then available between the WaveStar OLS 80G nodes in the area. All WaveStar OLS 80G s in an area must have the same primary area address (AreaId and NSAP format).

Guideline G85

Do not apply extra functions like, DSNE or Designated Router to a node that must forward many ITM-SC associations. For those nodes, do not provision them as DSNEs and change the Designated Router Priority to a low value.

Rule R90

Remote Copy and Remote Login cannot be done across areas. These actions can only be performed in the same area as the DSNE which controls these functions for these nodes.

Rule R95

If a span (ET – Regen(s) – ET) is configured with multiple area addresses, the CenterLink access is limited to one area within the span.

Rule R100

All the OLS R4.0 nodes will have to be provisioned as IS-IS level 2 nodes, if DCN network engineering demands that Areas be split across OLS spans. For example, if 5 nodes in an OLS R4.0 span are designated as belonging to Area A1 and the other 4 nodes in the OLS R4.0 span are designated as belonging to Area 2, then all these 9 nodes will have to be designated as IS-IS level 2 nodes, so as not to violate the requirement that all IS-IS level 2 nodes have to be interconnected.

Provisioning an Existing WaveStar OLS 80G R3.x Network for IS-IS Level-2 Routing

Installation of a new network with IS-IS Areas

When installation of a new network is started, an area plan must be available. This plan must identify each WaveStar OLS 80G and each ITM-SC, each area address and the level-2 characteristics of each NE and obey the rules and guidelines provided in this document. During installation at the site of the NE, the area address, level-2 characteristics and LAN parameters must be provisioned via CenterLink. ITM/SC must establish a connection with the WaveStar OLS 80G NEs via the NSAP that includes the “new” provisioned area address. The ITM-SC area address must be provisioned and activated before connections with the WaveStar OLS 80G NEs are established. The operator shall not leave the site until proper connection between the NEs and the manager are confirmed.

Rule R105

Network planning should include area planning and the WaveStar OLS 80G should be provisioned with its area address before connecting it to the ITM-SC.

Rule R110

Prior to installation/changing/upgrading/enlarging of the network is started, a DCN-plan must be available. This plan must include at least:

- A topology picture of the planned OSI-DCN, consisting of all nodes (including all OLSs and all ITM-SCs) and how they are interconnected via LAN, DCC, (transparent) bridge interconnections between LANs.
- Indication how the OSI-DCN is divided in OSI-networks, clusters and/or areas. Per OSI-network/ cluster/area a list must be produced that includes:
 - The number of nodes. (each OLS ET, Dual ET, Repeater, ITM-SC count as one node)
 - The number of LANs.
 - Which WaveStar OLS 80G node is the DSNE

- The number of areas.
- The number of nodes in the Level-2 subdomain.
- The number of LANs in the Level-2 subdomain.

- Indication of all DCN characteristics per WaveStar OLS 80G node:
 - Software release (OLS)
 - Short address is not used by OLS.
 - Name of the ITM-SCs (two in case of Geographic Redundancy) that must manage the NE/node.
 - Node site/location/name/type
 - Only when IS-IS areas are used
 - IS-IS level (1 or 2)
 - Area number (0000 - ffff)
 - Only for the nodes that are connected to a LAN:
 - LAN IS-IS level
 - DR priority (0 – 127, default = 64) – the higher the priority, the more traffic that gets routed through the node.

- Indication of all DCN characteristics per ITM-SC:
 - DYNAMIC Routing on the ITM-SC LAN.
 - LAN IS-IS Level for the nodes on the ITM-SC LAN.*
 - site/location/name/server-type.
 - The number of managed NEs
 - The maximum number of ITM-SC connections that are forwarded through a single node in the network, in case of a single failure. This includes the connections of all ITM-SCs that are part of this DCN-network or cluster.
 - Percentage of activated Performance Monitoring that is allowed.

- Indication of all DCN characteristics per LAN:

*. The node IS-IS Level overrides the LAN IS-IS level if they are provisioned differently.

- The number of nodes.
- The number of areas
- The number of Level 2 nodes

Rule R115

Build the OSI-network/cluster by enlarging it step by step, during installation activities at the site where the NEs are located. Up to the moment of including a node in the OSI-DCN, the OSI facility of that node is isolated by one of the following actions:

- Remove the LAN/fiber connections or interface units
- OLS: Rebooting of the TOHCTL

⇒ NOTE:

Sequence is important in order to confirm connectivity at each site before leaving the site.

Rule R120

After connection of all DCC/LAN interfaces, the operator shall not leave the site, until proper remote management via those interfaces is confirmed via an ITM-SC connection.

Guideline G125

Wait at least 5 minutes between activities that change the topology of the OSI-DCN.

- The activities that are mentioned in **Rule R115** change the topology of the OSI-DCN, by enabling/disabling links that connect a node to the OSI-DCN. After such a change, all nodes in the related OSI routing domains must flush the topology change through the routing domain and must re-calculate and adapt its Routing Information Base (RIB). Much of those activities within a short time interval will have a bad influence on the stability and performance of the OSI-DCN.
- There may be transient instabilities within the network (loss of ITM-SC connections). No corrective action should be take if this instability is fairly brief and the ITM-SC connections are re-established within 20 minutes.

Rule R130

- Follow all rules and guidelines as specified during all installation work. This includes at least:
- No fall back on an earlier release than WaveStar OLS 80G R4.0 is possible .
- Extend or Reduce the level-2 subdomain, without creating more than one level-2 subdomain, while always interconnecting all areas.
- Extend or Reduce an area, without creating more than one area-partition with the same area number.
- There must be at least one node, preferably two, on the LAN with the same area address as the ITM-SC that is attached to that LAN.

Rule R135

No SW copy/download or MIB download shall be active during the transition procedure. These activities are interrupted by the reset mechanisms that are part of the DCN provisioning.

Rule R140

The area address of an ITM-SC manager shall be provisioned, before the first NE is created for management by this manager. Avoid transition work and re-connection of ITM-SC to all its managed NEs in a later stage.

Rule R145

The DCC and LAN connections of a node shall be disabled, until all DCN provisioning for this node is performed. Connection of nodes with invalid IS-IS parameters would imply an invalid network and routing can be disabled in other parts of the network.

Rule R150

When a clustered or small OSI-network must be transferred into a network divided in IS-IS areas, a transition plan must be available that must obey the rules and guidelines provided below.

How and when ITM-SC connectivity and/or remote login connectivity must be checked.

- Between every step the expected connectivity from ITM-SC to the nodes must be checked, to make sure that subsequent steps of the procedure will be possible.

How and when DCC/LAN connections are changed.

- In most cases, the physical re-arrangements can be done after transition of the related cluster(s).

Guideline G155

Use temporary area numbers during the transition scenario in order to avoid having an area that is split into two parts with the same area number. This applies to any point in the network where one node connects to several other nodes and that part of the network must change to a new area number.

Guideline G160

The rules for rings and for avoiding area partitioning can not always be followed between all steps of the transition procedure, resulting in temporary “single point of failures” in the OSI-network. Limit this situation to parts of the network and to certain time-intervals as follows:

- Divide the procedure in intervals in which a sub-part of the network is handled, like a LAN and/or a ring.
- When feasible, change all nodes in a ring to level-2, before starting to change area-numbers of nodes that must be connected from ITM-SC via that ring. This allows for level-2 rerouting.
- Adapt the AreaId clockwise and/or counter-clockwise through the ring. Otherwise more than one ring-segment with the same AreaId would exist.

Rule R165

Go clockwise and/or counter-clockwise through the ring or from one end to the other in a linear configuration when changing the AreaId. This avoids isolating nodes.

In-Service Transition into IS-IS Areas

The IS-IS level-2 functionality can only be introduced in existing networks, once all NEs are upgraded to the WaveStar OLS 80G Release 4.0 or later. The rules for step by step introduction of IS-IS level-2 in an existing net-

work are provided below. A transition plan that describes all steps of the transition procedure should be available, before starting the transition work. The goals are to:

- When possible, do all the provisioning work from the ITM-SC, so that no travelling to the NEs is needed.
- the network re-arrangement work shall not be service affecting,

To meet those goals, the network must be preserved where all nodes in the network can make connections to each other and management of the WaveStar OLS 80G NEs can be done from any point in the network. The connections between ITM-SC and the managed NEs must be maintained during the introduction of areas in the network. The connection between ITM-SC and one or more NEs is temporarily lost at any step of the transition procedure, due to NE-controller recoveries and address (NSAP) change. Such connections will normally be re-established within 15 to 30 minutes. The connections must be re-established before the next node in the network is provisioned with new IS-IS parameters.

Rule R170

Network planning should include area planning and the Wavestar OLS 80G should be provisioned with its area address before connecting it to the ITM-SC.

Rule R175

Prior to installation/changing/upgrading/enlarging of the network is started, a DCN-plan must be available. This plan must include at least:

- A topology picture of the planned OSI-DCN, consisting of all nodes (including all OLSs and all ITM-SCs) and how they are interconnected via LAN, DCC, (transparent) bridge interconnections between LANs.
- Indication how the OSI-DCN is divided in OSI-networks, clusters and/or areas. Per OSI-network/ cluster/area a list must be produced that includes:
 - The number of nodes. (each OLS ET, Dual ET, Repeater, ITM-SC count as one node)
 - The number of LANs
 - Which WaveStar OLS 80G node is the DSNE
 - The number of areas.

- The number of nodes in the Level-2 subdomain
- The number of LANs in the Level-2 subdomain.
- Indication of all DCN characteristics per WaveStar OLS 80G node:
 - Software release (OLS)
 - Short address is not used by OLS
 - Name of the ITM-SCs (two in case of Geographic Redundancy) that must manage the NE/node
 - Node site/location/name/type
 - Only when IS-IS areas are used:
 - IS-IS level (1 or 2)
 - Area number (0000 - ffff)
 - Only for the nodes that are connected to a LAN:
 - LAN IS-IS level
 - DR priority (0 – 127, default = 64) – the higher the priority, the more traffic that gets routed through the node.
- Indication of all DCN characteristics per ITM-SC:
 - DYNAMIC Routing on the ITM-SC LAN
 - LAN IS-IS Level for the nodes on the ITM-SC LAN
 - site/location/name/server-type.
 - The number of managed NEs
 - The maximum number of ITM-SC connections that are forwarded through a single node in the network, in case of a single failure. This includes the connections of all ITM-SCs that are part of this DCN-network or cluster
 - Percentage of activated Performance Monitoring that is allowed.
- Indication of all DCN characteristics per LAN:
 - The number of nodes.
 - The number of areas
 - The number of Level 2 nodes

Rule R180

Build the OSI-network/cluster by enlarging it step by step, during installation activities at the site where the NEs are located. Up to the moment of including a node in the OSI-DCN, the OSI facility of that node is isolated by one of the following actions:

- Remove the LAN/fiber connections or interface units
- OLS: Rebooting of the TOHCTL

Rule R185

After connection of all DCC/LAN interfaces, the operator shall not leave the site, until proper remote management via those interfaces is confirmed via an ITM-SC connection.

Guideline G190

Wait at least 5 minutes between activities that change the topology of the OSI-DCN.

- The activities that are mentioned in **Rule R175** change the topology of the OSI-DCN, by enabling/disabling links that connect a node to the OSI-DCN. After such a change, all nodes in the related OSI routing domains must flush the topology change through the routing domain and must re-calculate and adapt its Routing Information Base (RIB). Much of those activities within a short time interval will have a bad influence on the stability and performance of the OSI-DCN.
- There may be transient instabilities within the network (loss of ITM-SC connections). No corrective action should be take if this instability is fairly brief and the ITM-SC connections are re-established within 20 minutes.

Rule R195

Follow all rules and guidelines as specified during all installation work. This includes at least:

- No fall back on an earlier release than WaveStar OLS 80G R4.0 is possible .
- Extend or Reduce the level-2 subdomain, without creating more than one level-2 subdomain, while always interconnecting all areas.

- Extend or Reduce an area, without creating more than one area-partition with the same area number.
- There must be at least one node, preferably two, on the LAN with the same area address as the ITM-SC that is attached to that LAN.

Rule R200

The area address of an ITM-SC manager shall be provisioned before the first NE is created for management by this manager. Avoid transition work and re-connection of ITM-SC to all its managed NEs in a later stage.

ITM/SC Connections

An ITM/SC manager has a live end-to-end connection (association) with all of the NEs it is managing. The attachment of the ITM/SCs to the network must be done in the center of its management domain. In a network that is divided in IS-IS areas, this implies that:

Guideline G205

The physical connection (point of attachment) of the ITM/SC to the WaveStar OLS 80G network should be done independently from how the WaveStar OLS 80G network is divided in areas.

Guideline G210

ITM-SCs should be connected to the backbone of the OSI network. Rerouting capabilities and limitations for forwarding of much data is expected to have high attention for the backbone.

Guideline G215

Place ITM-SC in the center of its management domain, with access via more than one node on the LAN (see Figure B-6).

⇒ NOTE:

In the case of re-routing due to a protection situation a lot of extra ITM-SC connections may be forwarded through a node and the number of hops for the re-routed ITM-SC connections will increase. The “maximum number of forwarded ITM-SC connections” and the “maximum number of hops between ITM-SC and its managed NE”, in case of a single network failure, must be identified for this guideline.

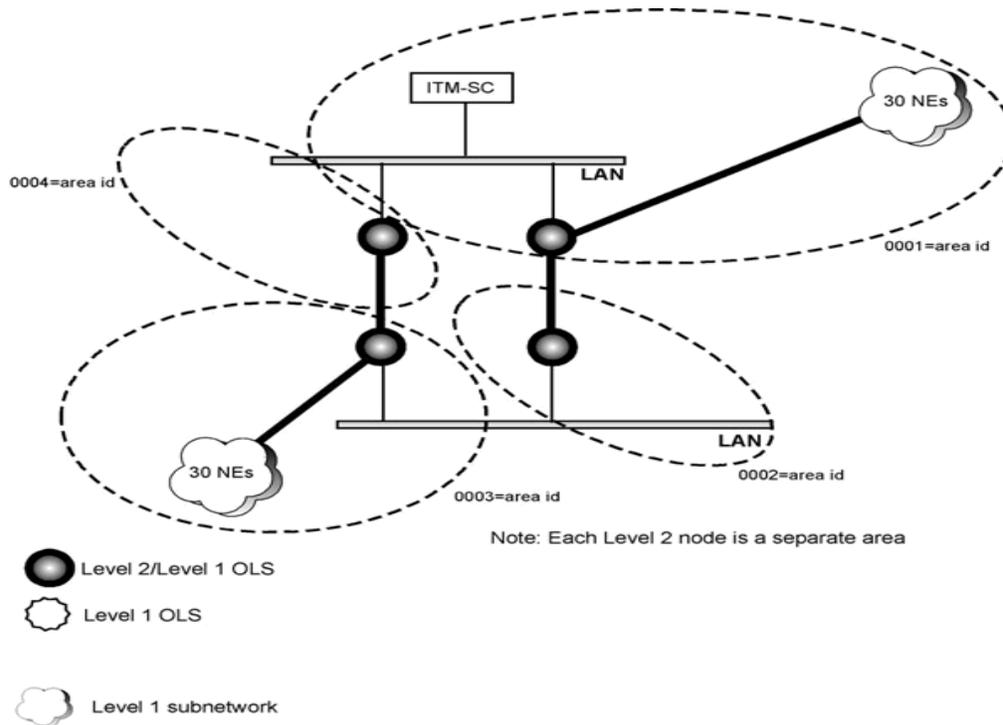


Figure B-6. Limitations of Forwarding Management Traffic by a Node

Guideline G220

When positioning the ITM/SC in the network, be aware that most traffic to and from ITM/SC will be directly routed through the IS on the LAN that is part of the shortest path to the managed WaveStar OLS 80G.

Rule R225

At least one of the ISs on the ITM/SC LAN must be in the same area as the ITM/SC so that this IS can establish an adjacency with the ITM/SC.

Guideline G230

Two of the ISs on the ITM/SC LAN should be in the same area as the ITM/SC to avoid a single point of failure. If one of those ISs fails, there is still an IS-adjacency with the ITM/SC.

Abbreviations and Acronyms

Numerics

1A-TX

1A-Transmit

1A-RCV

1A-Receive

1A-TX-THRU

1A-Transmit (Telemetry Feed-through)

1A-RCV-THRU

1A-Receive (Telemetry Feed-through)

5ESS

Number 5 Electronic Switching System

5TAD

Five Tributary Add/Drop subrack (WaveStar™ ADM 16/1)

9TAD

Nine Tributary Add/Drop subrack (WaveStar™ ADM 16/1)

12NC

12-digit Numerical Code

A

AAU

Alarm Adapter Unit (RR)

ABN

Abnormal (condition)

ABS

Absent

AC

Alternating Current

ACO

Alarm Cut-Off

ACT

Active

ACU

Alarm Collection Unit (RR)

ADM

Add/Drop Multiplexer

ADM-155C

Add-Drop Multiplexer 155 Mb/s Compact Subrack (ADM-155C)

ADR

Add/Drop-Ring

AGNE

Alarm Gateway Network Element

AID

Access Identifier

AIS

Alarm Indication Signal

AIMS

Acknowledged Information Transfer Service: Confirmed mode of operation of the LAPD protocol.

ALS

Automatic Laser Shutdown

AMI

Alternate Mark Inversion

ANSI

American National Standards Institute

APD

Avalanche PhotoDiode

APS

Automatic Protection Switch

AS&C

Alarm, Status, and Control

APSD

Automatic Power Shutdown

AS

Alarm Suppression assembly

ASCII

American Standard Code for Information Interchange

ASN.1

Abstract Syntax Notation 1

ATC

Auxiliary Transmission Channel

ATM

Asynchronous Transfer Mode

ATPC

Automatic Transmit Power Control

AU

Administrative Unit

AU PTR

Administrative Unit Pointer

AU4AD

Administrative Unit 4 Assembler/Disassembler

AUG

Administrative Unit Group

AUTO

Automatic

AVAIL

Available

B

B3ZS

Bipolar 3-Zero Substitution

B8ZS

Bipolar 8-Zero Substitution

BBTR

Backplane Bus Transceiver

BC

Board Controller

BCC

Board Controller Complex

BCLAN

Board Controller Local Area Network

BDFB

Battery Distribution and Fuse Bay

BER

Bit Error Rate

BIN

Binary

BISDN

Broadband Integrated Services Digital Network

BITS

Building Integrated Timing Supply

BLD OUT LG

Build-Out Lightguide

BLK

Blank

BLSR

Bidirectional Line-Switched Ring

BOC

Bell Operating Company

BUSTR

BUS Transmitter and Receiver

C

C

Container

CAC

Circuit Access Code

CAS	Channel Associated Signalling
CAT	CATastrophic
CC	Cross-Connection Cross-Connect (WaveStar™ ADM 16/1)
CCITT	Comité Consultatif International Télégraphique & Téléphonique
CCS	Common Channel Signaling
CCT	Cross-Connection Type
CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications
CID	Circuit Identifier
CIT or CIT-PC	Craft Interface Terminal
CL	Clear
CLEI	Common Language Equipment Identifier
CLLI	Common Language Location Identifier
CM	Communications Module
CM	Configuration Management
CMI	Coded Mark Inversion
CMIP	Common Management Information Protocol. OSI standard protocol for OAM&P information exchange.
CMISE	Common Management Information Service Element

CMS

Customer Maintenance Signal

CO

Central Office

CONN PCB

Connector Printed Circuit Board

COV

Central Office Video

CP

Circuit Pack

CPE

Customer Premises Equipment

CR

Critical (alarm)

CRC

Cyclical Redundancy Check

CSMA/CD

Carrier Sense Multiple Access with Collision Detection

CS&O

Lucent Technologies Customer Support and Operations

CSU

Channel Service Unit

CTL

System Controller (ISM)

CTS

Customer Technical Support within Lucent Technologies

CV

Coding Violation

D

DACS/DCS

Digital Access Cross-Connect System

dB

Decibels

DC	Direct Current
DCC	Data Communications Channel
DCE	Data Communications Equipment
DCF	Data Communications Function
DCN	Data Communications Network
DDF	Digital Distribution Frame
DIL	Dual In Line
DPLL	Digital Phase Locked Loop
DP-RING	Dedicated Protection Ring
DR	Digital Radio
DRI	Dual Ring Interworking
DPS	Data communication Packet Switch (ISM)
DRAM	Dynamic Random Access Memory
DRIP	Dual Ring Interworking on Protection
DS0, DS1, DS3	Digital Signal Levels 0, 1, 3
DS-n	Digital Signal, Level n
DS-NE	Directory Service Network Element
DSX	Digital Cross-Connect Frame

DTCU
Distant Terminal Channel Unit

DTE
Data Terminating Equipment

DTMF
Dual Tone Multifrequency

DUS
Do not Use for Synchronization

DWDM
Dense Wavelength Division Multiplexing

E

EBER
Equivalent Bit Error Rate

EC
Echo Cancellor

EC-1, EC-n
Electrical Carrier, Levels 1 and n

ECC
Embedded Control Channel

ECI
Equipment Catalog Item

EEPROM
Electrically Erasable Programmable Read-Only Memory

EIA
Electronic Industries Association

EM
Event Management

EMC
Electromagnetic Compatibility

EMI
Electromagnetic Interference

EMS
Element Management System

EPROM
Erasable Programmable Read-Only Memory

EPT
Event-per-Time

EQ
Equipped

EQPT
Equipment

ES
Errored Seconds

ES
End System

ESD
Electrostatic Discharge

ESF
Extended Super Frame (DS1 signal format)

ESPG
Elastic Store & Pointer Generator

ET
End Terminal

ETSI
European Telecommunications Standards Institute

EVT
Event

EXM
Extended Switching Module

F

FAS
Frame Alignment Signal

FAW
Frame Alignment Word

FC
Full Contact Connector

FCC
Federal Communications Commission

FDDI
Fiber Distributed Data Interface

FE
Far End

FEBE
Far-End Block Error

FEP
Front End Processor

FEPROM
Flash EPROM

FIT
Failure in Time

G

GB
Gigabytes

Gb/s
Gigabits per second

GHz
Gigahertz — 10^9 cycles per second

GNE
Gateway Network Element

GR
Geographic Redundancy

GR-XXX
Bellcore General Requirement-XXX

H

HDB3
High Density Bipolar 3

HDLC
High-Level Data Link Control

HE
Host Exchange

HMI
Human Machine Interface

HO
High Order

HPA
Higher Order Path Adaptation

HPC
Higher Order Path Connection

HPT
Higher Order Path Termination

HP-UX
Unix Operating System for Hewlett Packard platform

HS
High Speed

HW
Hardware

Hz
Hertz

IAF
Intelligent Alarm Filtering

IAO LAN
Intraoffice Local Area Network

ICB
Interconnection Box

ICP
InterConnection Panel

ID
Identifier

IEC
International Electrotechnical Committee

IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
IFT	InterFace Terminal
I/O	Input/Output
IMF	Infant Mortality Factor
INTFC	Interface
IPS	Interprocessor Status
IS	In Service
IS-3	Interconnect Signal-3
ISDN	Integrated Services Digital Network
ISM	Intelligent Synchronous Multiplexer
ITCO	Independent Telephone Company
ITM	Integrated Transport Management
ITM-NM	Integrated Transport Management Network Module
ITM-SC	Integrated Transport Management Subnetwork Controller
ITM SNC	Integrated Transport Management SubNetwork Controller
ITM SNC	Integrated Transport Management SubNetwork Controller
ITU	International Telecommunications Union

ITU-R

International Telecommunications Union — Radio standardization sector. Formerly known as CCIR: Comité Consultatif International Radio; International Radio Consultative Committee.

ITU-T

International Telecommunications Union — Telecommunication standardization sector. Formerly known as CCITT: Comité Consultatif International Télégraphique & Téléphonique; International Telegraph and Telephone Consultative Committee.

IXC

Interexchange Carrier

K

Kb/s

Kilobits per second

L

LAN

Local Area Network

LATA

Local Access and Transport Area

LBA

Lightwave Booster Amplifier

LBC

Laser Bias Current

LBFC

Laser Backface Currents

LBO

Lightguide Build-Out

LBO

Line Build-Out

LBP

LAN Bridge Port

LCN

Local Communications Network

LCT

Large Capacity Terminal

LDI	Linear Drop/Insert (Add/Drop)
LEC	Local Exchange Carrier
LED	Light-Emitting Diode
LEN	Local Exchange Node
LGX	Lightguide Cross-Connect
LH	Long Haul
LMP	LAN Management Port
LNC	Line Controller (SLM)
LNE	Logical Network Element
LO	Low Order
LOC	Line Overhead Controller (SLM)
LOF	Loss of Frame
LOM	Loss Of Multiframe
LOP	Loss of Pointer
LOS	Loss of Signal
LPA	Lower order Path Adaptation Lightwave Pre-Amplifier
LPBK	Loopback

LPC

Lower Order Path Connection

LPT

Lower Order Path Termination

LPU

Line Port Unit (ISM)

LPU155

Line Port Unit 155 Mb/s (ADM-155C)

LRX

Line Receiver (SLM)

LS

Low Speed

LSBB

Low-Speed Broadband. Refers to 150-750 Mb/s signal rates

LTA

Line Terminal Application (SLM)

LTE

Line Terminating Equipment

LTX

Line Transmitter (SLM)

LTX/EML

Line Transmitter with Electro-absorption Modulated Laser (SLM)

M

μm

Micrometer

MB

Megabytes

Mb/s

Megabits per second

MAF

Management Application Function

MCF

Message Communications Function

MCOND

Maintenance Condition

MD

Mediation Device

MDI

Miscellaneous Discrete Input

MDO

Miscellaneous Discrete Output

MDS

Metallic Digital Server

MDSCU

Metallic Digital Server Channel Unit

MEC

Manufacturer Executable Code

MEF

Maintenance Entity Function (in NE)

MEM

Memory

MF

Mediation Function

MFS

Multi-Frame Synchronization signal

MIB

Management Information Base

MIPS

Millions of Instructions Per Second

MJ

Major (alarm)

MMI

Man-Machine Interface

MML

Human-Machine Language

MN

Minor (alarm)

MO

Managed Object

MS	Multiplexer Section
ms	Millisecond
MS-SPRING	Multiplexer Section Shared Protection Ring
MSOH	Multiplexer Section OverHead
MSP	Multiplexer Section Protection
MST	Multiplexer Section Termination
MTBF	Mean Time Between Failures
MTBMA	Mean Time Between Maintenance Activities
MTIE	Maximum Time Interval Error
MTPI	Multiplexer Timing Physical Interface
MTS	Multiplex Timing Source
MTTR	Mean Time To Repair

N

NA	Not Applicable
NCC	Network Communication Controller
NE	Network Element
NEBS	Network Equipment-Building System

NEE	Network Element Equivalent
NEF	Network Element Function
NEM	Network Element Manager
nm	Nanometer (10^{-9} meters)
NMA	Network Monitoring and Analysis System
NMA-F	Network Monitoring and Analysis-Facility
NMC	Network Maintenance Center
NMON	Not Monitored
NMS	Network Management System
NMU	Network Mediation Unit
NNE	Non-SDH Network Element
NNI	Network Node Interface
NOMC	Network Operation Maintenance Channel
NORM	Normal
NPI	Null Pointer Indication
NPPA	Non-Preemptible Protection Access
NRZ	Nonreturn to Zero
NSA	Non-Service Affecting

NSAP Address

Network Service Access Point Address (used in the OSI network layer 3)

NTF

No Trouble Found

NVM

Non-Volatile Memory

O

O&M

Operation and Maintenance

OA

Optical Amplifier

OALAN

Overhead Access Local Area Network

OAM&P

Operations, Administration, Maintenance, and Provisioning

OC, OC-n

Optical Carrier

OC-1

Optical Carrier, Level 1 Signal (51.84 Mb/s)

OC-3

Optical Carrier, Level 3 Signal (155 Mb/s)

OC-3c (STS-3c)

Optical Carrier, Level 3 Concatenated Signal (155.52 Mb/s)

OC-12

Optical Carrier, Level 12 Signal (622.08 Mb/s)

OC-48

Optical Carrier, Level 48 (2488.32 Mb/s) (2.5 Gb/s)

OC-192

Optical Carrier, Level 192 (9953.28 Mb/s) (10 Gb/s)

ODF

Optical Distribution Frame

ODU

Optical Demultiplexing Unit

OI	Operations Interworking
OI	Optical Interface (WaveStar™ ADM 16/1)
OILU	Optical Line Interface Unit
OLS	Optical Line System
OMU	Optical Multiplexing Unit
OMU	Optical Multiplexing Unit
OOF	Out-of-Frame
OOS	Out-of-Service
OPS/INE	Operations System for Intelligent Network Elements
ORM	Optical Remote Module
OS	Operations System
OSB	Optical Splice Box
OSF	Open Software Foundation Operations System Function
OSI	Open Systems Interconnect
OSMINE	Operations Systems Modifications for the Integration of Network Elements
OT	Optical Translator
OT	Optical Translator

OTCTL
Optical Translator Controller

OTCTL
Optical Translator Controller

OTPM
Optical Translator Port Module

OTPM
Optical Translator Port Module

OTU
Optical Translator Unit

OTU
Optical Translator Unit

OW
Orderwire

P

PABX
Private Automatic Branch Exchange

PAD
Packet Assembler/Disassembler

PB-PCT
Paddle Board — Peripheral Control and Timing Link

PCB
Printed Circuit Board

PCM
Pulse Code Modulation

PCT-Link
Peripheral Control and Timing-Link

PCTFI
Peripheral Control and Timing Facility Interface

PDH
Plesiochronous Digital Hierarchy

PI
Physical Interface
Plesiochronous Interface (WaveStar™ ADM 16/1)

PM	Performance Monitoring
PMA	Performance Monitoring Application
PMD	Polarization Mode Dispersion
POH	Path Overhead
POP	Point of Presence
POTS	Plain Old Telephone Service
PP	Pointer Processing
PPC	Pointer Processor and Cross-connect (ISM)
PRC	Primary Reference Clock
PRI	Primary
PROTN	Protection
PROV	Provisioned
PSA	Partially Service Affecting
PSDN	Public Switched Data Network
PSF	Power Supply Filter
PSN	Packet-Switched Network
PSTN	Public Switched Telephone Network

PT

Protected Terminal
Power supply filter and Timing circuit pack (WaveStar™ ADM 16/1)

PTE

Path Terminating Equipment

PTY

Parity

PVC

Permanent Virtual Circuit

PWR

Power

PWR ON

Power On

Q

QAF

Q Adapter Function (in NE)

QL

Quality Level

QOS

Quality of Service

QOTU

Quad Optical Translator Unit

QOTU

Quad Optical Translator Unit

QRSS

Quasi-Random Signal Source

R

RA

Regenerator Application (SLM)

RAM

Random Access Memory

RCU

Rigid Connect Unit (SLM)

RCV	Receive
RCVR	Receiver
RDDU	RCVR Data Distribution Unit (RR)
RDI	Remote Defect Indication
RDSV	Running Digital Sum Violations
REGEN	Regenerator (SLM)
REI	Remote Error Indicator
RF	Radio Frequency
RFI	Remote Failure Indication
RGU	ReGenerator Unit (SLM)
ROC	Regenerator Overhead Controller (SLM)
RPP	Reliability Prediction Procedure
RPS	Ring Protection Switching Radio Protection Switching System
RR	Radio Relay
RSM	Remote Switching Module
RSOH	Regenerator Section OverHead; part of SOH
RST	Regenerator Section Termination

RT
Remote Terminal

RTAC
Regional Technical Assistance Center

RTRV
Retrieve

RTV
Remote Terminal Video

RU
Relay Unit (RR)

RZ
Return to Zero

S

SA
Service Affecting

SA
Section Adaptation
Synchronous Adapter (WaveStar™ ADM 16/1)

SAI
Station Alarm Interface

SC
Square coupled Connector
System Controller (WaveStar™ ADM 16/1)

SCC
Smart Communication Channel

SCI
Station Clock Input

SCO
Station Clock Output

SCT
System Controller (for SLM LTA and REGEN Network Elements)

SD
Signal Degrade
Space Diversity

SDH	Synchronous Digital Hierarchy
SDH-TE	SDH — Terminal Equipment
SDS	Standard Directory Service based on ANSI T1.245
SEC	Secondary
SEC	SDH Equipment Clock
SEF	Support Entity Function (in a Network Element)
SEMF	Synchronous Equipment Management Function
SES	Severely Errored Seconds
SF	Super Frame (DS1 signal format)
SH	Short Haul
SI	Synchronous Interface (WaveStar™ ADM 16/1)
SIB	Subrack Interface Box
SLM	Synchronous Line Multiplexer Signal Label Mismatch
SLN	A 12-character circuit pack serial number
SM-2000	Switching Module - 2000 generation
SML	Service Management Level
SMN	SDH Management Network

SMS	SDH Management Subnetwork
SNC/I	SubNetwork Connection (protection) / Inherent monitoring
SNC/NI	SubNetwork Connection/Non-Intrusive Monitoring
SNR	Signal-to-Noise Ratio
SOH	Section Overhead
SONET	Synchronous Optical Network
SPB2M	Subrack Protection for 2 Mb/s Board (ADM-155C)
SPE	Synchronous Payload Envelope
SPI	SDH Physical Interface Synchronous-Plesiochronous Interface (WaveStar™ ADM 16/1)
SSM	Synchronization Status Marker
SSU_L	Synchronization Supply Unit — Local
SSU_T	Synchronization Supply Unit — Transit
STBY	Standby
STC	System Controller (for SLM ADM News)
STM-16	Synchronous Transport Module 16
STM-1, STM-n	Synchronous Transport Module, Levels 1 and n
STRING	Stretched Ring

STS
Synchronous Transport Signal

STS-1, STS-n
Synchronous Transport Signal, Levels 1 and n

STS-3c
Synchronous Transport, Level 3 Concatenated Signal

SU
Supervisory Unit (RR)

SUPV
Supervision Unit (ADM-155C)

SUPV_SVC
Supervision with Service Channel Unit (ADM-155C)

SVC
Switched Virtual Circuit

SWR
Switch Receive unit (SLM)

SWT
Switch Transmit unit (SLM)

SYNC
Synchronizer

SYSCTL
System Controller circuit pack

SYSCTL
System Controller circuit pack

SYSTEMEM
System Memory circuit pack

SYSTEMEM
System Memory circuit pack

T

TA
Technical Advisory

TABS
Telemetry Asynchronous Byte Serial (Protocol)

TARP	Target Identifiers Address Resolution Protocol
TBD	To Be Determined
TBOS	Telemetry Byte-Oriented Serial (Protocol)
TCA	Threshold-Crossing Alert
TCM	Trellis Code Modulation
TDEV	Timing Deviation
TDM	Time Division Multiplexing
TERM	Terminal Multiplexer
TGU	Timing Generator Unit
THz	Terahertz (10^{12} Hz)
TI	Timing Interface (WaveStar™ ADM 16/1)
TID	Target Identifier
TIRKS	Trunks Integrated Records Keeping System
TL1	Transaction Language 1
TLM	Telemetry Circuit Pack
TLM	Telemetry Circuit Pack
TLP	Terminal with Line Protection
TMN	Telecommunications Management Network

TOC	Tributary Overhead Controller (SLM)
TOHCTL	Tributary Overhead Controller
TOHCTL	Tributary Overhead Controller
TPU	Tributary Port Unit
TPU-PCT	Tributary Port Unit — Peripheral Control and Timing link
TPU2	Tributary Port Unit 2 Mb/s (ADM-155C)
TPU34/45	Tributary Port Unit 34/45 Mb/s (ADM-155C)
TPU155	Tributary Port Unit 155 Mb/s (ADM-155C)
TR	Technical Requirement
TRF	Transfer Unit (ADM-155C)
TSA	Time Slot Assignment
TSI	Time Slot Interchange
TSO	Technical Support Organization
TTP	Trail Termination Point
TU	Tributary Unit
TU PTR	Tributary Unit Pointer
TUG	Tributary Unit Group
TX	Transmit

U

UAS

Unavailable Seconds

UITS

Unacknowledged Information Transfer Service. Unconfirmed mode of LAPD operation.

ULDT

Ultra Long Distance Transmission

UNEQ

Path Unequipped

UPS

Uninterruptible Power Supply

UPSR

Unidirectional Path-Switched Ring

USAM

User-Settable Alarm Monitoring

UTC

Universal Coordinated Time

V

V

Volts

VAC

Volts Alternating Current

VC

Virtual Container

VDC

Volts Direct Current

VF

Voice frequency

VM

Violation Monitor

VMR

Violation, Monitor, and Removal

VRT

Virtual Remote Terminal

VT
Virtual Tributary

VT1.5
Virtual Tributary, Level 1.5

VT-G
Virtual Tributary Group

W

WAD
Wavelength Add/Drop

WAN
Wide Area Network

WaveStar OLS 40G
WaveStar Optical Line System 40G

WBS
Wideband Shelf

WDCS
Wideband Digital Cross-Connect System

WDM
Wavelength Division Multiplexing

WRT
Wait to Restore Time

WS
Work Station

WSF
Work Station Facility

WYSIWYG
What You See Is What You Get

X

X.25
A ITU standard defining the connection between a terminal and a public packet-switched network

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.

Alarm Storm

Short intervals during operations in which many messages are generated and traffic bottlenecks occur. Alarm storms are especially prevalent when a single TL1 GNE serves many remote NEs and bandwidth is strained.

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 transmission.

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

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.

SYSTEM

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

access
 cable, 4-60, 9-4
 CIT port, 4-62, 5-3
 front, 2-12, 6-14
 OAM&P cables, 4-60
 operations system, 5-62
Account Executive Support, 8-6
administration, 5-19
 performing on a centralized basis, 2-8, GL-15
AGNE, 5-24
AIM, 5-50
alarm
 correlation, 5-49
 groups, 2-9
alarm gateway network element, 5-24
alarm indication message, 5-50
alarms
 group, 5-23
 levels, 5-47
 report, 5-23
Applications, 3-1
 single-OA, 3-9
 two-OA, 3-7
 with multi-regenerated spans, 3-18
 with repeaters, 3-11
 with WAD, 3-21
 without repeaters, 3-7
applications, 3-11, 3-12
 list of, 1-3
APSD, 2-4, 5-37
 double failure contingencies, 5-43
 protection
 OA/ODU link within end terminal, 5-39
 optical line link between OLS terminals, 5-38
 restarting
 optical line link between OLS end terminals, 5-39
 optical line link between OLS terminals, 5-42
 single-OA operation, 5-41
 timing, 5-37
APSD, benefits, 2-5
architecture
 OLS system control, 5-60
authorization level
 expert, 5-20
 general, 5-20
 privileged, 5-20

 reports only, 5-20
automatic
 version recognition, 2-9, 5-19
automatic power shutdown and restart, 5-37
automatic protection
 types of, 5-26
autonomous messages, 5-45

B

backplane, 4-79, 4-80
baselining, 5-28
bay, 4-6
BCLAN, 5-62
benefits
 of OLS, 1-6
bit rates, 3-4
board controller, 5-62
 communication, 5-62
board controller local area network, 5-62
BRH classification, 9-3
bulletins, 8-5

C

cabinet
 indicator strip, 4-68
cabinets
 description, 4-5, 4-66
 dimensions, 9-6
 indicator strip, 4-66
cables, 4-63, 4-65
 access, 4-60, 9-4
 dressing, 4-60
 D-subminiature connectors, 6-25
 fiber and power feeder
 access, 4-60
 fiber optic, 7-22
 nontransmission
 description, 7-16, 7-17
 OAM&P
 access, 4-60
 OT, 7-17
 power, 7-21
cabling, 4-68, 6-16, 7-56
capacity, 9-4

- CD-ROM, 5-2
- CD-ROM, content, 7-139
- CenterLink-CIT, 2-6, 5-2, 5-3
 - remote access, 5-5, 5-7, 5-8
 - V.32 transmission, 5-3
- circuit packs
 - FIT rates, A-3
- circuit, 4-56
- circuit pack, A-1, B-1
 - dimensions, 9-7
- circuit pack, dimensions, 4-15
- circuit packs, 5-31, A-7
 - backplane interface, 4-80
 - CLEI codes, 2-9, A-7
 - compatibility, 7-142
 - control, 4-59
 - OT Controller, 4-60
 - System Controller, 4-59
 - System Memory, 4-59
 - Tributary Overhead Controller, 4-59
 - dimensions, 9-7
 - diode oring, 4-80
 - faceplate LED, 5-16
 - filtering, 4-80
 - fuses, 4-80
 - OTUs, 4-55
 - powering, 4-80
 - preprovisioning, 5-52
 - sparing graphs, A-2
 - transmission, 4-49, 4-53
 - OA, 4-53
- CIT, 5-2, 5-27
 - access, 4-62, 5-3
 - access through DCE port, 2-6, 5-3
 - access through DTE port, 2-6, 5-3
 - CenterLINK, 5-2
 - functions, 5-2
 - modems, 5-3
 - security, 5-2
- CIT-PC
 - functions, 5-2
- CLEI codes, 2-9, A-7
- CMISE, 2-1
- COACH
 - tools, 8-5
- comcodes, A-1, B-1
- compactness, 2-12
- compatibility
 - circuit packs, 7-142
 - software, 7-32

- compatibility data, 8-5
- Complementary Shelves
 - miscellaneously mounted, 4-14
- compliance
 - transmission standards, 9-4
- conditions, 5-22
- connectionless network protocol (CLNP), B-2
- connectionless network service (CLNS), B-2
- connectors
 - types of, 6-16
- considerations, 6-10
- constraints, handling and transportation, 9-11
- control
 - architecture, 5-60
- conversion kit, 7-141
- CPro-2000, 1-2
- craft access
 - remote, 2-8
- craft interface terminal, 5-2
- CS&O, 8-1
- customer maintenance signal synchronization, 6-2
- Customer Support and Operations, 8-1
- cut-off, low voltage, 4-79, 9-4

D

- Dantel, Inc.
 - EMDU, 5-9
- data communication links
 - reduce number of, 2-9, 5-24
- DCC, 3-13
 - capabilities, 5-23
 - craft interface terminal (CIT) remote access, 5-23
 - network element status, 2-9
 - types of protection switching, 5-26
- DCC protection switching, OPS, 5-37
- default parameters, OPS, 5-35
- dense wave division multiplexing, 1-5
- dense wavelength division multiplexing, 1-3
- descriptions
 - OLS packages, 7-3
- design life, 9-15
- diagnostic dictionary, 8-5
- dimensions, 9-6
 - cabinet, 9-6
 - circuit packs, 9-7
 - equipment, 9-6
- diode oring

circuit packs, 4-80
 directory service network element, 2-10
 Directory Service Network Element. See DS-NE
 discrete
 interface
 user-settable, 2-6
 dispersion
 optical, 9-3
 Documentation
 electronic, xxviii
 Documentation
 related equipment
 software, xxvi
 documentation
 commenting on, xxxiv
 list numbers, 7-139
 ordering, xxix
 related, xxiii
 support, 8-6
 domains
 operations, 2-7
 Drawings
 OLS
 OT, xxiv
 drawings
 list of, xxiv
 dual facing shelf, 5-55
 dual-facing shelf, 3-11, 3-12, 3-13, 3-14, 3-15, 5-7, 5-8,
 5-50, 5-55, GL-12
 dual-facing shelves, 3-13, 5-37
 DWDM, 1-3, 1-5

E

EDFA, 3-2
 electromagnetic compatibility, 9-10
 electrostatic discharge, 6-26
 EMDU, 5-9
 Dantel, Inc., 5-9
 Harris Corp., 5-9
 EMS, 5-5
 EMS, OPS, 5-35
 enclosures
 for OLS, 4-5
 End Terminal Provisioning, 5-53
 End Terminal Shelf 1
 shelf configurations, 4-16
 End Terminal Shelf 1 Configurations

1A-RCV End Terminal, 4-18
 1A-RCV-THRU End Terminal, 4-19
 1A-TX End Terminal, 4-16
 1A-TX-THRU End Terminal, 4-17
 Dual Facing End Terminal, 4-20
 single OA 1A-RCV End Terminal, 4-23
 single OA 1A-RCV-THRU End Terminal, 4-24
 single OA 1A-TX End Terminal, 4-21
 single OA 1A-TX-THRU End Terminal, 4-22
 single OA Dual Facing End Terminal, 4-25
 End Terminal Shelf 2
 Circuit packs/units, 4-26
 Purpose, 4-26
 shelf configurations, 4-29
 End Terminal Shelf 2 Configurations
 1A-RCV end terminal, 4-30
 1A-TX end terminal, 4-29
 dual facing end terminal, 4-31
 single OA 1A-RCV end terminal, 4-33
 single OA 1A-TX end terminal, 4-32
 single OA dual facing end terminal, 4-34
 engineering
 services, 8-1
 engineering rules, 6-2, 6-3, 6-6
 optical protection switching, 6-5
 environmental
 considerations, 6-26
 specifications, 9-10
 EPROM
 SYSTEM circuit pack, 4-59
 equipment
 interconnection, 6-16
 inventory, 5-21
 equipment packages, 2-12, 4-2
 erbium, 3-2
 external miscellaneous discrete unit, 5-9

F

factory setting, 6-16
 failure
 facility, 5-26
 customer maintenance signal, 5-27
 optical, 5-26
 supervisory signal, 5-27
 fault
 automatic diagnostics, 5-27
 fault isolation, 5-27

FC connector, 6-16
features
 low voltage cut-off, 9-4
 maintenance, 2-6
 physical, 2-12
 security, 2-11
 summary, 2-1-??
fiber
 fiber optic products catalog, 7-2
filtering
 circuit packs, 4-80
 OA, 4-53
 shelf level, 4-79
FIT rates, A-3
floor
 loading specifications, 9-9
 plan layout, 6-14
FT-2000 OC-48 LCT, 1-2
Fujitsu, 1-2
fuse panel, 4-75
 description, 4-71
fuse/power indicating panel, 4-73
fuses, 4-79, A-7
 circuit packs, 4-80

G

gateway network element. See GNE
GNE, 2-8, 5-4, 5-24
 access to SONET maintenance subnetwork, 5-24
 redundancy, 2-9, 5-24
 and TL1, 2-8
graphical user interface, 1-2

H

Hardware Warranty, 8-6
hardware warranty, 8-6
Harris Corp.
 EMDU, 5-9
heat baffle
 Miscellaneously Mounted Application, 4-6
history
 report, 5-47
hold-off time, 5-28
hold-off time, settability, 5-29

I

IAOLAN, 2-2, 5-8
 benefits, 2-2
IAOLRP, 4-10, 4-58
illustrations, 7-56
indicator
 OLS user panel
 SDH, 4-72
 SONET, 4-72
indicator strip, 4-66, 4-68
 OLS cabinet, 4-66
 OT
 SONET, 4-69
 remote access, 5-23
indicators
 fuse/power indicating panel, 4-73
 indicator strip, 4-68
installation, 2-12
 services, 8-1
 test types, 5-45
integrated bay, 4-9
Integration
 OLS with OT, 2-4
interconnection
 equipment, 6-16
 panel, 4-62
interconnection panel
 OLS, 4-62
 OT Complementary Shelves, 4-64
 OT System Controller shelf, 4-63
interface
 backplane, 4-80
 backplane and circuit pack, 4-80
 circuit pack, 4-80
 message-based (X.25/TL1), 5-4
 miscellaneous discrete, 5-9
 office alarms, 5-9
 operations, 2-6, 5-1
 parallel telemetry, 5-9
into OT interconnection panel, 4-63, 4-65
IS-IS Level-2 Routing, B-15
ITM SNC, 1-2
ITM-SNC, 5-18

J

jumpers
lightguide, 9-3

L

LANs, 5-62
Large Capacity Terminal, 1-2
latching, OPS, 4-76
LBO, 6-2, 6-16, 6-21
color types, 6-22
LBO conversion, yellow-to-green, 6-24
LC connector, 6-16
LEA104, 3-11, 4-54
LEA105, 3-9
LEA6, 3-11
LEA7, 3-11
LEA7B, 2-3
LED
FAULT, 5-16
LEDs
fuse/power indicating panel, 4-73
indicator strip, 4-69
miscellaneously mounted
Complementary Shelves, 4-14
LEDs, on release 3.1 circuit packs, 5-16
Level 2 Nodes, B-13
lightguide
connectors, 9-3
lightguide build-out, 6-2
lightguide build-out (LBO), 6-10
lightguide jumpers, 9-3
line parameters, 5-44
local area networks
internal
and controllers, 5-62
login
ID, 5-20
password, 5-20
remote, 2-9
login security
features, 5-20
Long Reach, 9-20
LEA7, 3-2
Long Span, 4-54, 9-20

16 wavelength, 2-4
LEA104, 3-2
LOS, 5-35, 5-42
LOS, with OPS, 5-28, 5-32
low voltage cut-off, 9-4

M

maintenance
objectives, 5-22
optical transmission, 5-25
performing on a centralized basis, 2-8, GL-15
proactive, 5-22
reactive, 5-22
remote, 5-22
mean-time-between-maintenance, 9-15
message-based
interface (X.25/TL1), 5-4
Microsoft
Internet Explorer, 5-2
Windows 95, 5-2
miscellaneously mounted
Complementary Shelf 1, 7-10
Complementary Shelf 2, 7-10
Complementary Shelves, 4-14
System Controller Shelf, 4-13, 7-10
Miscellaneously Mounted Application, 7-9
multimode
lightguide jumpers, 9-3

N

network
planning considerations, 6-1
rules and guidelines, B-7
network element
remote status, 2-9
network rules and guidelines, B-3
Network System Bay Framework, 4-5
new features, release 3.1, 2-1
Newlook 2000, 4-5
news, 8-5
NSAP Address Structure for IS-IS, B-8

O

- OA, 3-2, 3-9
 - functions, 4-54
- OA circuit pack
 - description, 3-2, 4-54
- OAM&P, 4-62, 5-1
- ODU, 4-55
- ODU units
 - description, 4-55
 - fastening in shelf, 4-54
- office alarms
 - interface, 2-6
- OLS
 - bay design, 4-3
 - benefits, 1-6
 - cabinet design, 4-3
 - features release plan, 1-7
 - functions, 1-5
 - integrated bay, 3-21
 - introduction, 1-1-1-9
 - new features, 2-4
 - optical transmission elements, 3-1
 - packages, 4-35
 - quality and reliability, 9-1
 - self-tests, 2-12
 - shelf design, 4-5
 - software, 7-139
 - system control architecture, 4-59
- OMU, 3-3, 4-54
- OMU units
 - description, 4-54
 - fastening in shelf, 4-54
- OMU/ODU population, OPS, 5-34
- Open Systems Interconnection (OSI), B-2
- operating wavelengths, 9-3
- operations
 - domains, 5-5
 - interface, 5-1
 - interfaces
 - list of, 2-6
 - message-based (X.25 protocol), 5-4
 - office alarms, 5-9
 - parallel telemetry, 5-9
 - performing on a centralized basis, 2-8, GL-15
 - remote, 2-8
 - single-ended, 2-8, GL-15
 - system
 - remote access, 5-23
 - TCA transmission, 5-45
- operations system (OS). See OS or operations, system
- OPS, 1-5, 5-32
- optical
 - connectors, 9-3
 - dispersion, 9-3
 - line ID, 5-25
 - reflections tolerance, 9-4
 - safety, 9-3
- Optical Amplifier, 3-2
 - LEA7B, 2-3
- Optical Amplifier (OA) circuit pack.
 - See OA circuit pack
- optical demultiplexer unit, 4-55
- Optical Demultiplexer Unit (ODU). See ODU units
- Optical Demultiplexer Unit/ODU, 3-3
- optical isolator
 - OA, 4-53
- optical line ID, 5-25
- optical line signal, 4-54
- Optical Line System. See OLS
- Optical Multiplexer Unit, 3-3
- optical multiplexer unit, 4-54
- Optical Multiplexer Unit (OMU).
 - See OMU units
- optical parameters, 5-44
- optical protection switch, 5-31
- optical protection switching, 5-28
- optical splitter, 5-32
 - OA, 4-53
- Optical Translator Port Module, 4-58
- Optical Translator Unit, 3-4
- Optical Translator Unit (OTU). See OTUs
- Ordering, 7-34, 7-36
- ordering, 7-45, 7-96, A-7
 - cables
 - nontransmission, 7-16
 - power, 7-20, 7-21
 - circuit packs, A-7
 - fiber optic cabling, 7-22
 - Miscellaneously Mounted Application, 7-50, 7-69, 7-75, 7-118
 - OLS and OT packages, 7-58
 - OT Cabinet, 7-124
 - software, 7-50, 7-118
- ordering worksheets, 7-58
- orderwire, 5-49
 - voice communications, 5-49
- original values

- factory assigned, 5-51
 - ORing, 4-80
 - OS
 - interfaces, 2-6
 - types, 5-4
 - command response only, 5-4
 - defined, 5-4
 - maintenance, 5-4
 - memory administration, 5-4
 - other, 5-4
 - peer, 5-4
 - predefined sets of, 5-4
 - OSI
 - routing information, B-3
 - OT
 - bay, 3-20
 - cabinet, 3-20
 - miscellaneous-mounted shelves, 3-20
 - power distribution, 4-80
 - OT Cabinet, 7-10
 - fuse panel, 4-75
 - shelves, 4-3
 - OT Complementary Shelf, 4-15
 - OT Controller, 4-45
 - OT System Controller shelf, 4-15
 - OTCTL, 4-45, 4-60, 7-13
 - OTPM, 4-58
 - OTU, 3-4, 3-17
 - used for regeneration, 3-20
 - OTUs
 - Complementary Shelves, 4-14
 - functionality, 4-55
 - outside plant loss, 9-20
-
- P**
- package descriptions, 7-3, 7-9
 - packages
 - bay
 - Dual End Terminal, 4-35
 - Dual Repeater, 4-35
 - cabinet
 - 4-line End Terminal, 4-35
 - 4-line Repeater, 4-35
 - Dual End Terminal, 4-35
 - Dual Repeater, 4-35
 - End Terminal and Repeater, 4-35
 - for Optical Line System, 4-2
 - OLS descriptions, 7-3
 - OT bay, 4-35
 - OT cabinet, 4-35
 - shelf, miscellaneous-mounted, 4-35
 - packages, OLS, 4-35
 - panel, 4-70
 - fuse/power indicating, 4-73
 - OT Complementary Shelf, 4-72
 - OLS
 - fuse, 4-71
 - panels
 - fuse, 4-75
 - parallel telemetry
 - interface, 2-6
 - parameters
 - line, 5-44
 - optical, 5-44
 - provisionable, 5-52
 - password-protection, OPS, 5-18
 - Pentium, 5-2
 - performance
 - monitoring
 - continuous, 2-10
 - thresholds, 2-10
 - performance monitoring, 5-43
 - data storage, 5-45
 - during failed conditions, 5-45
 - optical channel/line, 5-44
 - parameter thresholds, 5-45
 - reports, 5-47
 - supervisory channel, 5-43
 - physical design, 4-9
 - physical dimensions, 6-27
 - planning
 - considerations, 6-1
 - network, 6-1
 - plant loss, 9-20
 - port states
 - auto (AUTO), 5-48
 - in service (IS), 5-48
 - not monitored (NMON), 5-48
 - Power
 - shut-down, 2-4
 - power, 4-76
 - bus, 4-79
 - cables, 4-76, 4-78, 7-21
 - distribution
 - end terminal and repeater bay/cabinet, 4-77
 - OLS Integrated Bay (Single), 4-78
 - OT bay/cabinet, 4-78

- philosophy, 4-76
- shelf level, 4-79
- for circuit packs, 4-80
- planning, 6-27
 - super kits, 6-28
- restart, 5-37
- shutdown, 5-37
- specifications, 6-27, 9-5
- power distribution, 4-80
- power planning, 6-27
- power, OPS, 4-76
- proactive maintenance, 5-22
- procedures
 - maintenance, 2-6
- protection switching, 5-28
- protocol. See X.25
- provisionable parameters, 5-52
- provisioning, 5-51
 - circuit pack replacement, 5-52
 - CIT parameters
 - local and remote, 5-51
 - consistency audits, 5-46
 - local or remote, 5-51
 - map, 5-52
 - parameters, 5-52
 - parameters and original value, 5-51
 - performing on a centralized basis, 2-8, GL-15
 - slot preprovisioning, 5-52
- pump laser
 - OA, 4-53

Q

- Q-LAN
 - functionality, B-1
 - Interface feature, B-1
- QOTU, 4-56
 - port designations, 4-56
- Quad Optical Translator Unit, 4-56

R

- reactive maintenance, 5-22
- Regional Technical Assistance Center, 8-2
- registers
 - description, 5-45

- Release 2.1 features
 - Dual Facing End Terminal Configuration, 4-20
 - single OA end terminal shelf configurations, 4-16, 4-17, 4-21
- reliability, 4-76, 9-1
 - APSD triggers, 5-41
 - specifications, 9-11
- remote
 - alarms, 2-8
 - in same subnetwork, 5-24
 - login, 2-8, 2-9
 - NE status, 5-24
 - software copy, 5-23
- remote access
 - alarm report, 5-23
 - CIT, 5-23
 - indicator strip, 5-23
 - operations system, 5-23
- repeater shelf
 - description, 4-12
- report
 - addressed slot
 - state of, 5-48
 - alarm and status, 5-47
 - history, 5-47
 - performance monitoring register values, 5-47
 - version/equipment list, 5-48
- reports, 5-47
 - active alarms, 5-47
 - history, 5-47
 - state
 - types of, 5-48
 - status, 5-47
 - version/equipment list, 5-48
- requirements, 4-8
 - APSD timing, 5-37
 - Bellcore, 4-8
- retrieval data, OPS, 5-17
- RPP FIT rates, 9-11
- RTAC, 8-2

S

- sample, 7-36, 7-37
- sample procedure, 7-34
- SC connector, 6-16
- security
 - guest login, 5-21

- login aging, 5-21
- login ID, 5-20
- network element login, 5-19
- password, 5-20
- password aging, 5-21
- port, 5-19
- tiers of, 5-19
- types of, 5-19
- user authorization levels, 5-20
- user login, 5-20
- See also authorization
- serial port, 5-2
- shelf
 - OT Complementary, 4-14
 - OT System Controller, 4-13
- Shelf descriptions
 - End Terminal Shelf 2, 4-26
- shelves
 - cable dressing, 4-60
 - description, 4-10
 - filtering, 4-79
 - power distribution, 4-79
- shelves, bay-mounted, 4-5, 4-6
- shelves, miscellaneous-mounted, 4-5
- Short Reach, 9-20
 - LEA105, 3-2
- signal to noise ratio, 9-22
- single-mode
 - lightguide jumpers, 9-3
- single-OA, 6-6
- single-OA/single-OA, 3-12
- single-OA/two-OA, 3-14
- slot states
 - auto (AUTO), 5-48
 - equipped (EQ), 5-48
- SNR, 9-22
- software
 - download
 - remote, 2-8, 5-23
 - list numbers, 7-139, 7-140
- software compatibility, 7-32
- software copy
 - local, 5-25
 - remote, 2-10
- remote, 5-25
- software upgrades
 - local, 5-25
 - remote, 2-10
- remote, 5-25
- SONET, 1-2
- span
 - capacity growth, 1-3
- spare, A-7
- spare circuit packs, spare fuses, A-7
- sparing
 - circuit packs, A-2
- specifications
 - customer maintenance signal, 9-22
 - environmental, 9-10
 - floor loading, 9-9
 - IS-3, 9-24
 - maintainability, 9-2
 - optical signal power
 - 1.3 microns, 9-18
 - 1.5 microns, 9-17
 - power, 9-5
 - reliability, 9-11
 - FIT rates, 9-11
 - technical, 9-3
- splitter module, 3-3
- SPODU, 3-3, 5-31
- SPOMU, 5-31
- sqelch map
 - ring, 5-46
- ST connector, 6-16
- standards, 4-8
- Subdomain
 - level 2, B-11
- super kits
 - OLS Integrated Bay (Double), 7-136
 - OLS Integrated Bay (Triple 1), 7-137
 - OLS Integrated Bay (Triple 2), 7-138
 - OLS Integrated Cabinet (Double), 7-136
 - OLS Integrated Cabinet (Triple 1), 7-137
 - OLS Integrated Cabinet (Triple 2), 7-138
- supervisory channel, 3-3
- supervisory signal, 5-25
 - description, 5-23
- support
 - account executive, 8-6
 - technical, 8-2
 - training, 8-6
 - warranty, 8-6
- synchronization, 6-2
- SYCTL, 4-59
- SYCTL circuit pack
 - description, 4-59
 - serial telemetry, 4-59
 - X.25 interfaces, 4-59
- SYCTL, supporting OT, 4-59

SYSTEMEM, 4-59
SYSTEMEM circuit pack, 4-59
 EPROM, 4-59
system
 control
 architecture, 5-60
 reliability, 4-76
 startup, 5-21
System Controller Shelf, 4-13

T

TCA, 5-45
technical support, 8-2
Telemetry, 4-58
telemetry, 5-53
telemetry (TLM) circuit pack
 See TLM circuit pack, 4-58
Telemetry feed-through, 2-5
testing, 5-45
threshold-crossing alert, 5-45
timing, 6-2
TL1, 2-6, 5-3
TLM, 4-58, 5-53
TLM circuit pack
 description, 4-58
TOHCTL, 4-59
 circuit pack, 5-62
 description, 4-59
tolerance
 optical refraction, 9-4
tone, 5-25
 frequencies, 9-21
training, xxx
Transaction Language 1. See TL1
transmission
 characteristics, 9-4
 circuit packs
 functions, 4-53
 medium, 9-3
 repeater, 4-37
 supervisory signal, 5-23
Tributary Overhead Controller. See TOHCTL
two-OA, 6-3
two-OA/single-OA, 3-15
two-OA/two-OA, 3-13

U

Unavailability
 silent failure, 9-14
unavailability
 hardware, 9-13
 OC-48 channel, 9-13
 telemetry channel, 9-14
upgrading
 software, 6-11
upgrading, OPS, 6-10

V

version recognition
 automatic, 2-9, 5-19

W

WAD, 1-3
warranty, 9-2
Warranty Support, 8-6
wavelength add/drop, 1-3
wavelengths
 and span capacity growth, 1-3
 operating, 9-3
WaveStar, 4-35
Windows 95, 1-2, 2-6
Worksheets, 7-37
worksheets, 7-45, 7-58, 7-96

X

X.25
 interface, 2-6