

Lucent Technologies
Bell Labs Innovations



WaveStar™ AM 1

Add/Drop Multiplexer

Applications and Planning Guide

an InfoWare® Product WaveStar™ AM 1

365-372-200
Issue 1
July 1999

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Glossary

GL-1

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Introduction to the APG

Introduction

This Applications and Planning Guide (APG) provides the following information about the WaveStar™ AM 1 Add/Drop Multiplexer, Release 1.0:

- Features
 - Network Topologies
 - Product Description
 - Operations and Maintenance
 - System Engineering
 - Product Support
 - Technical Specifications
-

Intended Audience

The WaveStar™ AM 1 Applications and Planning Guide is written primarily for network planners and engineers. In addition, others needing specific information about the features, applications, operations, and engineering of the WaveStar™ AM 1 may find the information in this manual useful.

Reason for Issue

This Applications and Planning Guide, Issue 1, introduces the WaveStar™ AM 1 SDH Add/Drop Multiplexer. It has been issued for Release 1.0.

Using the APG

Introduction

This section describes the information provided in each chapter.

Chapter Descriptions

Table 1 describes the type of information in each chapter.

Table 1. Chapter Descriptions

Chapter	Title	Description
Preface	About This Document	Describes the Guide's purpose, intended audience, and organization References related documentation Feedback and comments on the APG
1	System Overview	Describes the product family Lists Release 1.0 features
2	Features	Describes features available in Release 1.0
3	Network Topologies	Describes applications possible with the WaveStar™ AM 1 Multiplexer
4	Product Description	Describes the hardware and configurations available for the product
5	System Planning and Engineering	Provides synchronization and planning information necessary for system deployment
6	Operations, Administration, Maintenance, & Provisioning	Describes OAM&P features such as: alarms, operation interfaces, performance monitoring, and security
7	Ordering	Reserved for ordering information
8	Product Support	Describes engineering and installation services Explains documentation and technical support Lists training courses

Chapter	Title	Description
9	Quality and Reliability	Provides the Lucent Technologies quality policy Lists reliability specifications
10	Technical Specifications	Lists the technical specifications for the WaveStar™ AM 1
Appendix	Glossary	Defines telecommunications terms

Commenting on the APG

Introduction

Because customer satisfaction is extremely important to Lucent Technologies, every attempt is made to encourage feedback from information product customers.

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Customer Training and Information Products
Room 20-3V6
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USA

Fax: 1-978-960-1214

System Overview

1

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Network Solutions

Introduction

The WaveStar™ AM 1 Add/Drop Multiplexer provides customers with a simple and inexpensive solution to accessing the SDH network.

System Description

The WaveStar™ AM 1 is an SDH STM-1 Add/Drop Multiplexer optimized to provide various 2 Mbit/s and 34 Mbit/s services to business and residential customers. It comes equipped with a single main board with the ability to add option cards, and is able to multiplex plesiochronous tributary signals into a 155 Mbit/s STM-1 optical aggregate signal.

In the Access Network, the WaveStar™ AM 1 can be installed at the customer premises for fiber-to-the-business applications, enabling a variety of configurations (see Chapter 3). Other applications include LAN-to-LAN traffic on campus networks or WANs.

Standard Unit and Options

The standard WaveStar™ AM 1 is capable of multiplexing up to sixteen 2 Mbit/s signals into an STM-1 signal. The WaveStar™ AM 1 is available with 1+1 MSP protection in terminal applications.

Two options include either an additional sixteen 2 Mbit/s signals (for a total of thirty-two) or the addition of two 34 Mbit/s signals (for a combination of sixteen E1s and two E3s) multiplexed into an STM-1 signal. The WaveStar™ AM 1 is available in a variety of configurations.

Operations

The WaveStar™ AM 1 can be remotely and locally controlled, monitored, and configured via a central Network Element Management System (ITM-SC). It can also be monitored and configured locally and remotely (remotely to other WaveStar™ AM 1s) via a craft interface terminal operating with ITM-CIT software.

Deployment

The WaveStar™ AM 1 can be deployed at the customer premises in a lockable wall-mounted enclosure or in a street cabinet.

The WaveStar™ SDH Product Family

Lucent Products

Lucent Technologies offers a wide range of SDH products designed to provide total network solutions. WaveStar™ products are designed to offer telecommunications service providers advanced services and revenue-generating capabilities.

Product Family

The WaveStar™ product family offers a series of products designed to bring customers' networks forward into the next century. The WaveStar™ product family and other related products include:

- **WaveStar™ TM 1 Terminal Multiplexer**
The WaveStar™ TM 1 is an SDH STM-1 Terminal Multiplexer optimized to provide various 2 Mbit/s services to business and residential customers.
 - **WaveStar™ AM 1 Add/Drop Multiplexer**
(Described in this APG)
 - **WaveStar™ ADM 16/1 Multiplexer**
The WaveStar™ ADM 16/1 is our next-generation SDH multiplexer and transport system and is able to multiplex PDH and SDH bit rates to higher levels up to 2.5 Gb/s (STM-16).
 - **WaveStar™ ADM 4/1 Multiplexer**
A compact and cost-effective SDH multiplexer. The WaveStar™ ADM 4/1 can be used in different configurations such as terminal multiplexer, add/drop multiplexer and repeater, and can be used in the dual-terminal mode.
 - **ISM-2000**
The Intelligent Synchronous Multiplexer (ISM) is a versatile multiplexer primarily designed to flexibly multiplex signals of 2, 34, 140, or 155 Mbit/s tributaries into STM-1 or STM-4 signals.
 - **PHASE**
PHASE is the flexible and modular SDH product family. The system can easily be configured as a terminal multiplexer, linear and ring add/drop multiplexer, as well as a local cross-connect with the same basic range of hardware units.
-

Product Family Interworking

The WaveStar™ AM 1 Add/Drop Multiplexer has been designed for interworking, via the DCC, with all the above Lucent products.

Features

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Features

Introduction

This chapter provides information on the WaveStar™ AM 1 Add/Drop Multiplexer features and their use in an STM-1 Access Network System.

Feature List

Key features of the WaveStar™ AM 1 include the following:

- Two STM-1 optical line interface pairs (transmit/receive)
 - Up to sixteen 2 Mbit/s interface ports
 - G.703 interface
 - G.704/G.706 interface
 - Optional additional sixteen 2 Mbit/s ports ...
or
 - Optional additional two 34 Mbit/s ports
 - Remote and local software downloading
 - General VC-12/VC-3 SNC/N protection
 - 1+1 MSP protection in terminal applications
 - Performance Monitoring
 - E1 loopbacks
 - 4 Miscellaneous Discrete Inputs (MDI)
 - 4 Miscellaneous Discrete Outputs (MDO)
 - Dual fiber pair working
 - Space-efficient for simple and rapid installation within street cabinets or on customer premises
 - Supported by the user-friendly Integrated Transmission Management (ITM) network management and element management systems
 - Optional AC/DC converter
 - Optional DC/DC converter
 - Optional battery backup
-

Feature Descriptions

Feature Descriptions

Transmission Interfaces

The WaveStar™ AM 1 can support up to thirty-two 2 Mbit/s tributary interfaces, or a combination of sixteen 2 Mbit/s and two 34 Mbit/s signals, while the aggregate side of the WaveStar™ AM 1 supports STM-1 optical interfaces according to G.957.

Remote/Local Software Downloading

The WaveStar™ AM 1 software can be downloaded remotely, via ITM-SC, or locally, via ITM-CIT.

Transmission Protection

- General VC-12/VC-3 SNC/N protection (non-revertive) is provided.

In an add/drop ring configuration, the system allows the set up of a non-intrusively monitored subnetwork connection protection scheme between any incoming TU-12 or TU-3 from the east line interface, and any TU-12 or TU-3 from the west line interface. A protection switch will occur based on "path signal fail," TIM, UNEQ, or DEG conditions. The threshold is user-settable for DEG. Only non-revertive operation is possible and manual and forced switching commands are supported.

- 1+1 MSP protection in terminal applications

In terminal applications between two WaveStar™ AM 1s, a 1+1 MSP protection relation can be set up by the user. Switching can either be revertive or non-revertive, uni-directional or bi-directional.

Performance Monitoring

Performance monitoring information can be derived from the overhead bytes (SOH, POH of each VC) and analyzed in accordance with ITU-T Recommendations G.784 and G.826. It is stored in the database of the WaveStar™ AM 1 in 15 minute and 24 hour registers. This information can be transmitted to the management center upon request.

(Continued on next page)

Feature Descriptions, *continued*

E1 Loopbacks

The WaveStar™ AM 1 provides for loopbacks on E1 signals, looping the incoming signals back to their corresponding outputs while maintaining the signal format. The downstream signal is replaced by an unequipped signal indication.

Miscellaneous Discretes

- The miscellaneous discrete inputs (MDI) are intended for customer use. They can be used to collect status information from other transmission equipment or non-transmission equipment such as power supply systems, open door detectors, or fire detectors.
- The miscellaneous discrete outputs (MDO) may be used to drive signaling devices or to influence the behavior of equipment external to the system.

Note that when receiving power, all four MDO contacts will normally be open. If power is lost, MDO#1's contacts will close (assigned to indicate power failure). MDO#2-4 are unassigned.

Dual Fiber Pair Working

The WaveStar™ AM 1 is equipped with two STM-1 optical line interface pairs (transmit and receive). The interface is a 1310 nm short-haul optical interface compliant with ITU-T Recommendation G.957 S.1.1.

Space Efficient Installation

Due to the compactness and space-efficient design of the WaveStar™ AM 1, it is ideally suited for customer premises wall-mounted applications, rack mounting in central offices, or in environmentally controlled street cabinets.

Integrated Transmission Management (ITM) Support

The WaveStar™ AM 1 is supported by the ITM network management system. This includes the local ITM-CIT PC-based network management software for interfacing at the network element, and ITM-SC (LAN-10baseT) network management software for integrated management of an entire transport network.

(Continued on next page)

Feature Descriptions, *continued*

Optional AC/DC Converter

An optional AC/DC converter, 90-264V (47-63 Hz) to -48 VDC, is available in a separate enclosure.

Optional DC/DC Converter

An optional DC/DC converter, -24 to -48 VDC, is available in a separate enclosure.

Optional Battery Backup

An optional -48 VDC battery backup is available in a separate enclosure.

Synchronization and Timing

Synchronization

Synchronization of the WaveStar™ AM 1 Add/Drop Multiplexer can be either STM-1 line interface timing or via one of the 2 Mbit/s data inputs. Re-synchronization of 2 Mbit/s ports is also featured.*

Timing Modes

Timing for the WaveStar™ AM 1 can be referenced to either one of the two 155.52 Mbit/s optical STM-1 input lines, or any one of the sixteen 2.048 Mbit/s E1 input tributaries. The timing circuitry will not accept a reference input from an external office station clock input. The WaveStar™ AM 1 provides one external reference clock output (SYNC-OUT) at 2.048 Mhz.

The WaveStar™ AM 1 can operate in the Free Running, Hold-Over, or Locked modes.

* The user has the option of operating individual 2 Mbit/s outputs in the "re-synchronized" mode. In this mode the 2 Mbit/s output signal is timed by the system clock of the network element. However, when operating the WaveStar™ AM 1 with the additional sixteen 2 Mbit/s option card, jitter requirements for the 32nd port (TP2.16) operating in this mode may exceed ITU-T Recommendations G.783, G.813 (option 1), G.823 and G.825.

Operations, Administration, Maintenance, and Provisioning

OAM&P Features The WaveStar™ AM 1 supports supervision of in-station alarms via an LED on the wall-mountable unit or via a local Craft Interface Terminal with ITM-CIT. Remote access is via the Network Management System ITM-SC.

The WaveStar™ AM 1 also offers external alarm input and output interfaces providing for connection to external equipment. This offers the possibility to collect in-station alarms and/or to drive external devices.

See Chapter 6, *Operations, Administration, Maintenance, and Provisioning*, for more information.

Standards Compliance

Introduction

Lucent Technologies' WaveStar™ AM 1 complies with all the relevant SDH ETSI and ITU-T standards.

SDH Interface

The STM-1 aggregate optical interface is compliant with ITU-T Recommendation G.957 S.1.1.

Plesiochronous Interfaces

The 2 Mbit/s tributary interfaces are compliant with ITU-T Recommendations G.703.

The 34 Mbit/s tributary interfaces are compliant with ITU-T Recommendations G.703-8 for electrical clear channel tributaries.

Equipment Standards

Environmental conditions are in compliance with ETSI 300 019 Class 3.3.

EMC requirements are compliant with EN 300 386-2.

Performance Monitoring

Performance monitoring features are compliant with ITU-T G.826 and G.784.

Network Topologies

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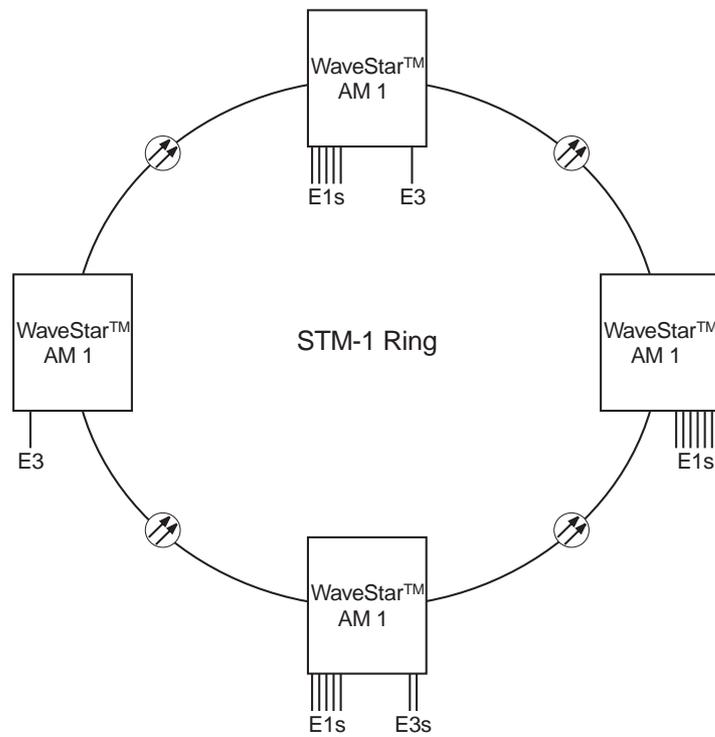
Applications

Introduction

This chapter illustrates six applications of the WaveStar™ AM 1: An STM-1 Ring, STM-1 Linear, STM-1 Folded Ring, STM-1 Single-Homed Ring, STM-1 Dual-Homed Ring, and an STM-1 Linear Extension Application.

Ring Application

The STM-1 Ring application illustrated in Figure 3-1 is an example of a simple and inexpensive way of transporting 2 Mbit/s and 34 Mbit/s signals on an STM-1 ring. The individual nodes can be equipped to add/drop combinations of E1s and E3s, and can be managed remotely or locally by either ITM-SC or ITM-CIT.



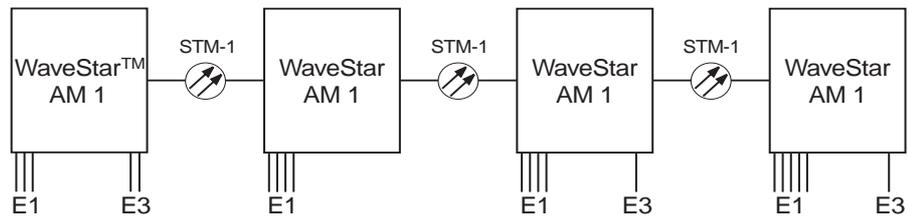
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Figure 3-1. STM-1 Ring Application

(Continued on next page)

Applications, *continued*

Linear Application Figure 3-2 is a linear unprotected application. When cost is a major factor, this application requires a minimum amount of equipment and fiber. It is well suited for LAN-to-LAN traffic on campus networks or between business locations requiring cost-effective and reliable communications. Management requirements of this application are minimal and once installed the system requires no periodic maintenance.



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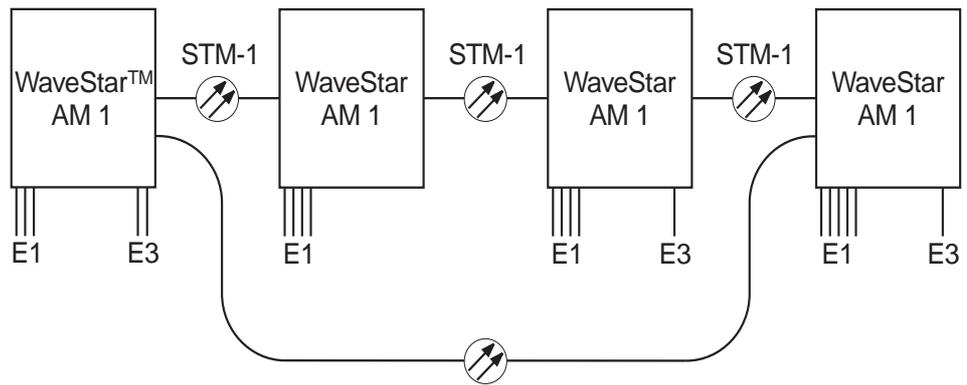
Figure 3-2. Linear ADM STM-1 Application — Unprotected

(Continued on next page)

Applications, *continued*

Folded Ring Application

An STM-1 Folded Ring applications is illustrated in Figure 3-3. Compared to the linear application in Figure 3-2, the folded-ring provides the extra measure of hardware protection as well as the potential to upgrade the ring with diverse fiber routing.



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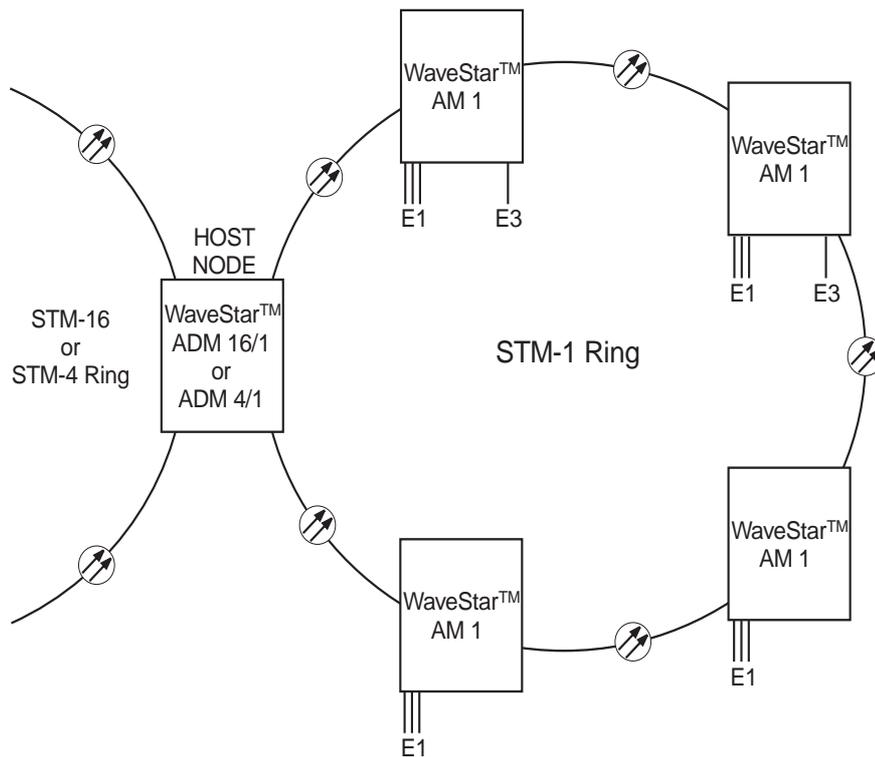
Figure 3-3. Folded Ring Application

(Continued on next page)

Applications, *continued*

Single-Homed Ring Application

Figure 3-4 illustrates a single-homed ring application. This configuration connects the STM-1 ring to the STM-N network through a host node. The WaveStar™ AM 1 STM-1 ring can then be managed from a remote location with the Integrated Transport Management Subnetwork Controller (ITM-SC) software.



tpa852515.cdr

Figure 3-4. Single-Homed Ring Application

(Continued on next page)

Applications, *continued*

Dual-Homed Ring Application

Figure 3-5 is an example of a dual-homed ring application. Similar to the single-homed example in Figure 3-4, access to the STM-N network is through two hosts. This may be preferable to the single-host application where completing the STM-1 ring may be difficult due to geographical features. It also provides an extra measure of hardware protection through the second host node.

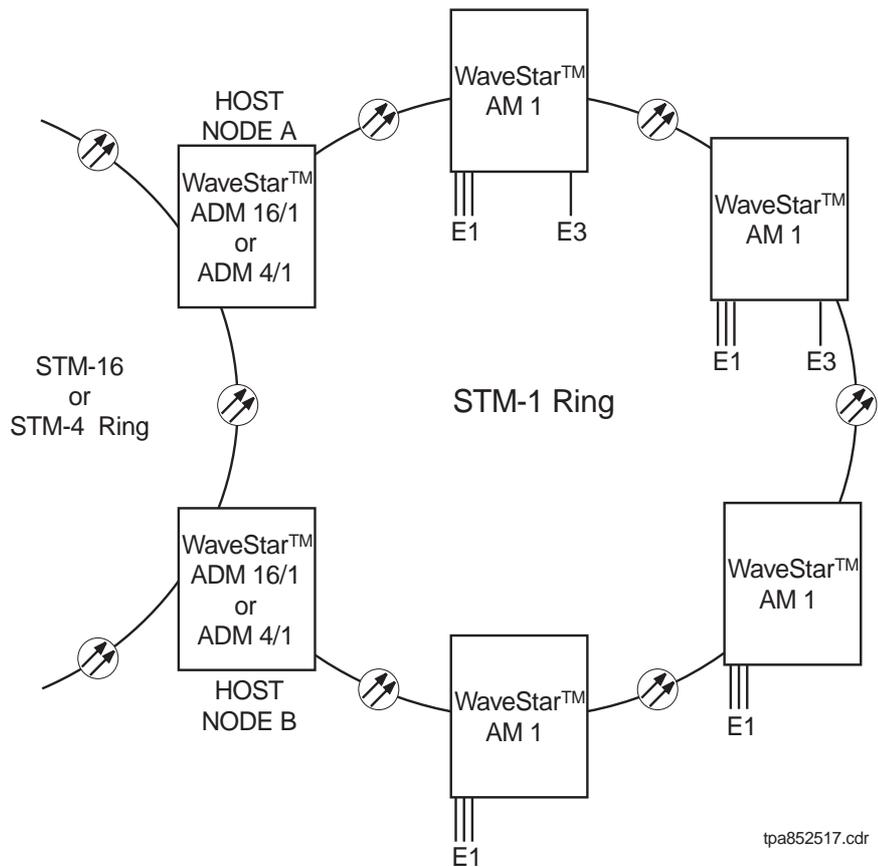


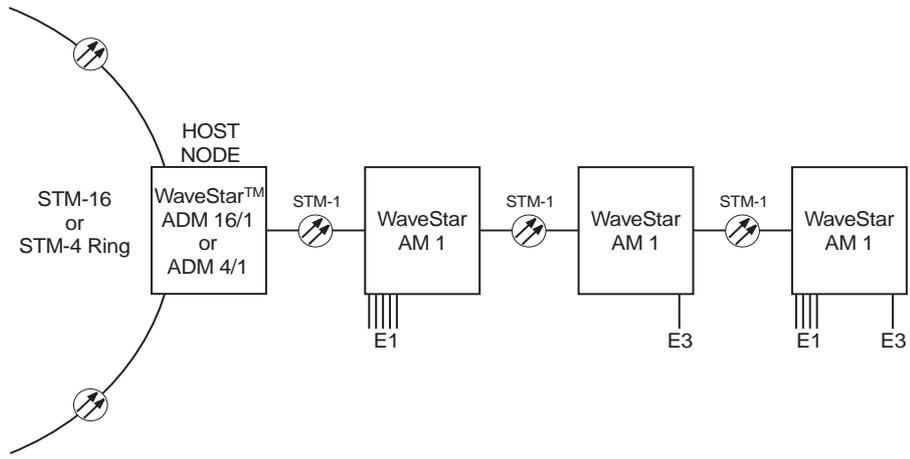
Figure 3-5. Dual-Homed Ring Application

(Continued on next page)

Applications, *continued*

**Linear Extension
Application**

Figure 3-6 is an unprotected linear extension hosted by an ADM 16/1 or ADM 4/1 network element. It is a low cost solution for extending E1 and E3 services from the STM-N ring.



tpa852516.cdr

Figure 3-6. Linear ADM Extension Application — Unprotected

Product Description

4

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Hardware Overview

Introduction

This chapter provides a hardware description of the WaveStar™ AM 1 Add/Drop Multiplexer.

Hardware Description

The WaveStar™ AM 1 is a compact and cost-effective STM-1 Add/Drop multiplexer designed to be installed at the customer's premises for fiber-to-the-business applications. Its space-efficient design allows for wall-mounting within controlled environment locations (e.g. interior closet) or in street cabinets. The lockable wall-mounted unit contains the following:

- 250 x 375 x 33 mm (H x W x D) unit size (without mounting brackets); 55 mm unit depth with options
 - WaveStar™ AM 1 main board
 - Two STM-1 optical line interface pairs (transmit/receive) with type SC connectors
 - Sixteen 2 Mbit/s electrical tributary interfaces with RJ45 connectors suitable for symmetrical twisted pair cables with an impedance of 120Ω
 - Option cards for an additional sixteen 2 Mbit/s tributaries *OR* an additional two 34 Mbit/s electrical tributaries with DIN 1.6/5.6 coaxial connectors
 - F-interface (RJ45) for the Craft Interface Terminal (ITM-CIT)
 - LAN Q-interface to connect to the EMS or to other NEs (LAN-10baseT)
 - External Synchronization Output at 2048 kHz (SYNC-OUT)
 - Dual Power Feed via a protected terminal block
 - Two LEDs (Red, Green) to indicate the status of the unit
 - Four Miscellaneous Discrete Inputs (MDIs) to read the status of external alarm points
 - Four Miscellaneous Discrete Outputs (MDOs) to drive external devices to be assigned by the customer (MDO1 configured for power failure)
-

Optional Hardware

Optional hardware (not shown) for the WaveStar™ AM 1 is as follows:

- Optional external 90-264V AC/DC power converter
 - Optional external -24 to -48 DC/DC power converter
 - Optional -48 VDC battery backup
 - Optional 120Ω to 75Ω adapters
-

(Continued on next page)

Hardware Overview, *continued*

Figure 4-1

Figure 4-1 is an illustration of the WaveStar™ AM 1 Add/Drop Multiplexer lockable wall-mounted unit. Pictured below is the basic unit with two STM-1 optical interface ports and sixteen 2 Mbit/s electrical tributaries.

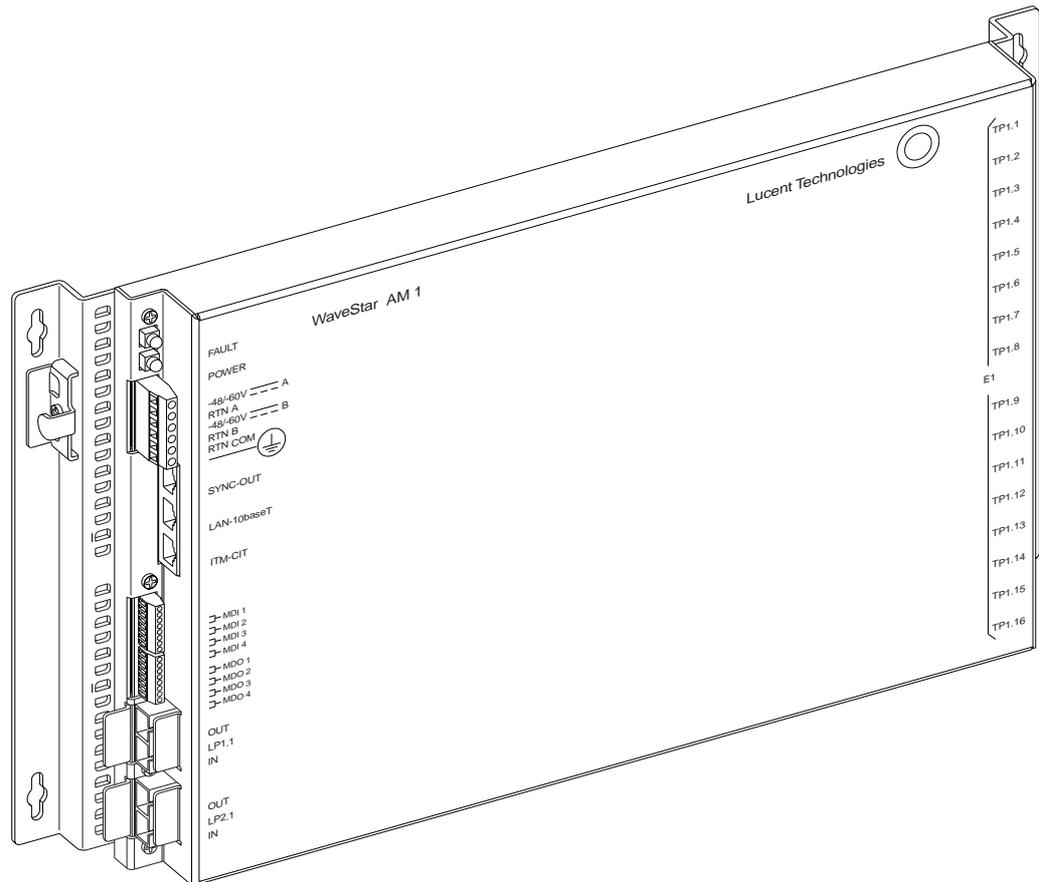


Figure 4-1. WaveStar™ AM 1 Add/Drop Multiplexer

Hardware Overview, *continued*

Figure 4-2 Figure 4-2 is an exploded view of the WaveStar™ AM 1 Add/Drop Multiplexer. It is shown with the additional sixteen 2 Mbit/s port option. A second option card (not shown) would instead provide two 34 Mbit/s (E3) ports.

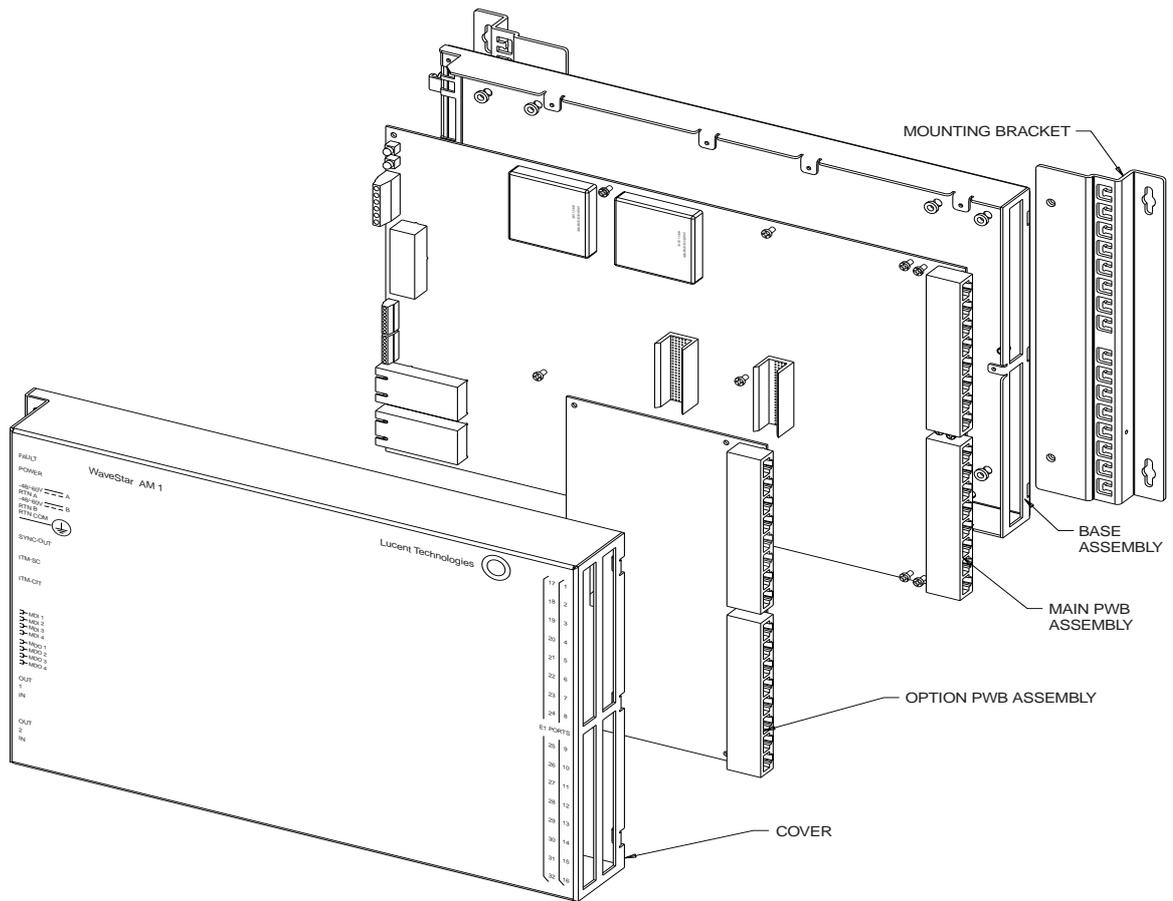


Figure 4-2. WaveStar™ AM 1 Add/Drop Multiplexer — Exploded View with Options

Hardware Overview, *continued*

Figure 4-3 Figure 4-3 is an illustration of the WaveStar™ AM 1 Add/Drop Multiplexer in a rack mounted installation.

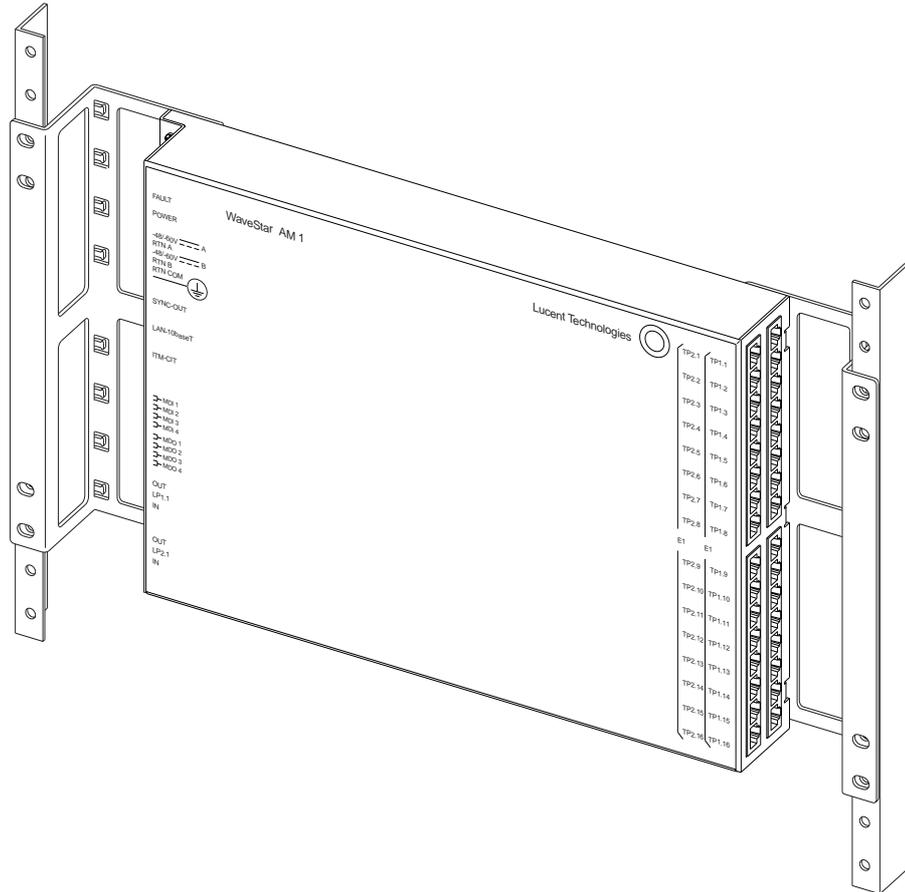


Figure 4-3. WaveStar™ AM 1 Add/Drop Multiplexer — Rack Mounted View

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General Planning Information

Introduction

The following is a high level overview of planning considerations for the WaveStar™ AM 1 Add/Drop Multiplexer.

Planning Considerations

When planning your system with the WaveStar™ AM 1, the following items should be considered:

- Synchronous Capacity — two STM-1 optical interface pairs
 - Plesiochronous Capacity — sixteen 2 Mbit/s E1 interfaces (basic unit)
 - Optional sixteen additional E1s (total of thirty-two)
or
 - Optional two 34 Mbit/s E3s (total of sixteen E1s and two E3s)
 - Synchronization — STM-1 line interface timing or via a 2 Mbit/s data input
 - Protection — VC-12/VC-3 SNC/N, 1+1 MSP in terminal applications
 - Operations Systems — remote and local management with ITM-SC and local and remote (remote to other WaveStar™ AM 1s) with ITM-CIT
 - Power — dual -48/-60 VDC power feed, power consumption below 25 watts with the basic unit, below 50 watts with either option card
 - Optional external 90-264V AC/DC power converter
 - Optional external -24 to -48 DC/DC power converter
 - Optional external -48 VDC battery backup
 - Four Miscellaneous Discrete Inputs (MDI)
 - Four Miscellaneous Discrete Outputs (MDO) — MDO#1 assigned
 - Ring size — Maximum of 12 nodes (depending on traffic)
 - Growth — Limited to additional WaveStar™ AM 1s or interfacing to a host at the STM-1 signal rate.
-

Operations, Administration, Maintenance, and Provisioning

6

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Operations Overview

Introduction

This chapter describes the OAM&P of the WaveStar™ AM 1. It includes the following:

- Operations Interfaces
 - Maintenance supervision
 - Software maintenance
 - Maintenance testing
 - Performance monitoring (G.826 and G.784.)
 - Self-diagnostics
 - System alarm indicators
 - 4 Miscellaneous Discrete Input (MDI) contacts
 - 4 Miscellaneous Discrete Output (MDO) contacts
-

Operations Interfaces and Administration

The WaveStar™ AM 1 has been configured for remote and local operations management via the Lucent Technologies' Integrated Management Network (ITM) management system. Remote management can be via the STM-1 DCC and the ITM-SC* or ITM-CIT software, or locally via ITM-CIT. Local connections are via an RJ45 connector mounted on the WaveStar™ AM 1 unit and PC-based ITM-CIT software.

Management access features include:

- Simultaneous access by the EMS and local workstations
 - Remote access to other WaveStar™ AM 1s in the same network by ITM-CIT
 - Network element level security via three password controlled authorization levels: ADMIN, CONFIGURE, and VIEW.
-

(Continued on next page)

* Note that ITM-SC software for the WaveStar™ TM 1 and WaveStar™ AM 1 will be available two months prior to the existing ITM-SC software being updated to include these products. Therefore, management of an SDH network containing the WaveStar™ TM 1 or WaveStar™ AM 1 may require two separate platforms of ITM-SC during this two-month period (October 31, 1999 to December 31, 1999).

Operations Overview, *continued*

Maintenance Supervision

Transmission and equipment fault supervision is monitored remotely via the ITM-SC and locally via LEDs on the unit and via the ITM-CIT. The local ITM-CIT may also be used to remotely access other WaveStar™ AM 1 nodes in the network.

Alarm and port termination monitoring features include:

- Physical port provisioning of STM-1, E1, and E3 in three different modes: automatic (AUTO), monitored (MON), or non-monitored (NMON).
- VC path termination point provisioning in either the MON or NMON mode
- Alarm severity levels of PROMPT, DEFERRED, and INFORMATION provisionable for each alarm type
- User can assign an alarm message and severity to each MDI (miscellaneous discrete input).

Failure reporting features:

- Failure reports are generated for equipment, configuration, and software faults with sufficient information to identify the next step in the fault correction process.
 - Alarm forwarding to the remote EMS (Element Management System) is supported via ITM-SC (LAN-10baseT) and to the local workstation via the F-interface (ITM-CIT).
 - The NE can store the 500 most recent alarm events and can be accessed by either the local or remote monitoring stations.
 - Failures are reported as defined in G.783 and ETS 300417.
-

Software Maintenance

Software maintenance includes the following:

- Local and remote non-service affecting software download via ITM-SC
 - Database upload/download from the ITM-SC
 - In-service database reprovisioning available via the local workstation running ITM-CIT software
-

(Continued on next page)

Operations Overview, *continued*

Maintenance Testing

E1 loopbacks are available for circuit testing during maintenance operations

Performance Monitoring

Provisioning and retrieval of performance monitoring parameters are derived from the overhead bytes (SOH, POH of each VC) and are in accordance with ITU-T Recommendations G.874 and G.826. This is accomplished via ITM-SC and ITM-CIT. Performance threshold counts are user settable.

The following parameters are monitored:

- Severely Errored Seconds (SES)
 - Errored Seconds (ES)
 - Background Block Errors (BBE)
 - UnAvailable Seconds (UAS)
-

Self-Diagnostics and Recovery

The WaveStar™ AM 1 supports the following diagnostic and recovery features:

- The WaveStar™ AM 1 continuously runs self-diagnostic tests to monitor the health of the transmission system
 - The WaveStar™ AM 1 auto-recovers after a power failure
 - The WaveStar™ AM 1 will auto-recover from a database failure by requesting the backup database be downloaded from the EMS.
-

System Alarm Indicators

The WaveStar™ AM 1 supports two LEDs which provide the following maintenance information:

- 1 Green LED to indicate power
 - 1 Red LED to indicate unit fault or signal failure
-

(Continued on next page)

Operations Overview, continued

Miscellaneous Discrete Inputs/Outputs

The WaveStar™ AM 1 provides four miscellaneous discrete inputs (MDIs) that can be used to read external devices assigned by the customer. Examples are monitoring temperature, humidity, open doors, etc.

The WaveStar™ AM 1 provides four miscellaneous discrete outputs (MDOs) that can be used to drive external devices assigned by the customer. Examples are signaling devices, temperature conditioning, etc.

Note that MDO#1 has been assigned to indicate a power failure (normally open contacts will close), MDO#2-4 are unassigned.

Ordering

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NOTE:

Chapter 7 has been reserved for ordering. There will be no ordering information in this manual. Contact your Lucent Technologies Account Representative for further information.

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Technical Assistance

Introduction

Many of our customers have established their own support procedures. These procedures usually involve escalation within their own companies. However, some issues may require additional assistance from Lucent Technologies.

Lucent Technologies has been and continues to be committed to providing excellence in technical customer support for its products and services. Therefore, we provide a hierarchical support structure ready and available to solve any WaveStar™ AM 1 technical issue.

When additional technical assistance is needed, use the appropriate contact information in Table 8-1. (Note that accessing a Lucent Technologies' web site may require the assistance of Lucent personnel.)

Table 8-1. WaveStar™ AM 1 Technical Support Contacts

Customer Location	Initial Lucent Technologies Contact Location
International	URL address of Lucent homepage: http://www.lucent.com
	URL address of CTS homepage: http://hzswww.nl.lucent.com/cts/ (May require assistance of Lucent personnel.)
Peoples Republic of China	Lucent Technologies China, Beijing (86) 10 6522 5566 ext. 4046 Lucent Technologies China, Guangzhou (86) 20 8331 1600 ext. 328 Lucent Technologies China, Shanghai (86) 21 6470 5858

Training

Relevant Courses

Contact Customer Training and Information Products (CTIP) on 1-888-LUCENT8 (1-888-582-3688), prompt #2, for course information or to enroll in training courses. The following WaveStar™ AM 1 related courses are available:

- TR5967 — WaveStar™ ADM 16/1 Overview
- TR5966 — WaveStar™ ADM 16/1 Operations & Maintenance
- TR5881 — WaveStar™ ADM 4/1 Operations & Maintenance

The following related courses are available:

- TR5951 — SDH Introduction
 - OC3100 — Synchronous Digital Hierarchy (SDH).
-

Documentation Set

Introduction

The Lucent Technologies documents listed in this section provide additional information about the WaveStar™ AM 1 Add/Drop Multiplexer.

Document List

Table 8-2 lists the documents included in the WaveStar™ AM 1 documentation set:

Table 8-2. WaveStar™ AM 1 Documentation Set

Document Number	Title	Date Available
365-372-200	<i>WaveStar™ AM 1 Applications and Planning Guide</i>	7/99
365-372-201	<i>WaveStar™ AM 1 User Guide</i>	11/99

Documentation Ordering Information

How to Order Documentation

The following provides the information necessary to order documents or product drawings.

Mail your order to ...	OR call ...
Lucent Technologies Inc. Customer Information Center Attn: Order Entry Section 2855 N. Franklin Road P.O. Box 19901 Indianapolis, Indiana, USA 46219	Within USA or Canada: 1-888 LUCENT-8 (1-888-582-3688)
	24-hour/day toll free FAX: 1-800-566-9568
	From Asia/Pacific Region and China: +1-317-322-6411
	From Caribbean/Latin America Region and Canada: +1-317-322-6646
	From Europe, Middle East, and Africa: +1-317-322-6416
	FAX: +1-317-322-6699
A check, money order, purchase order number, or charge number <i>VISA</i> ^a bank card, <i>American Express</i> ^b card services, or <i>MasterCard</i> ^c bank card is required with all orders. Make checks payable to Lucent Technologies.	

a. *VISA* is a registered trademark of VISA International Service Association.

b. *American Express* is a registered trademark of American Express Company.

c. *MasterCard* is a registered trademark of MasterCard International Incorporated.

Standard Warranty

Introduction

The warranty period for a defective product repaired under warranty is three months, or the unexpired term of the new product warranty period, whichever is longer.

If Lucent Technologies Optical Networking Group (ONG) does *not* install the product, the warranty term begins on the date the product is shipped. If Lucent Technologies' ONG installs the product, the warranty term begins when the installation is complete. All support services provided by Lucent Technologies ONG will be provided by way of a separate Technical Support Contract (TSC) which *will be* a component of the *initial* SDH product sale. Beyond this warranty time frame, a separate extended-warranty contract must be agreed to by both the Lucent Technologies' ONG and the customer at an *additional* and *specified* price.

The customer may make a warranty claim only if the customer has paid the full contracted price and has complied with all other obligations under this warranty agreement.

Hardware

WaveStar™ AM 1 hardware has a standard warranty of five years. The product is warranted to be free from defects directly resulting from material and/or construction faults and conforms to the product's specifications referenced in Lucent Technologies' ONG documentation and as agreed to in the "Customer Purchase Agreement."

This warranty does not extend to damage resulting from natural wear and tear, incorrect, careless or incompetent treatment, exceeding environmental conditions (for example, air conditioning, humidity, etc.) by the customer, incorrect storage, or external causes such as fire or flooding.

Software

WaveStar™ AM 1 software has a standard warranty period of one year. Lucent Technologies' ONG shall remedy to the best of its ability any malfunction free of charge, if the product software does not meet the functional specification. A warranty claim is possible only and so far as the customer demonstrates that the operational use of the product software essentially deviates from the functional specification.

(Continued on next page)

Standard Warranty, *continued*

Software

The warranty does not imply that the product software will run uninterrupted or error-free. This warranty does not extend to damage resulting from incorrect, careless or incompetent treatment by the customer, incorrect storage or external causes such as fire or flooding. Lucent Technologies' ONG also has the right to grant Right To Use (RTU) licenses for its software.

Discontinued Availability

Lucent Technologies' ONG reserves the right to notify the customer in advance of the intention to Discontinue the Availability (DA) of a product. Lucent Technologies' ONG also reserves the right to offer a Technical Support Contract (TSC) to make repair and technical support services available for an additional period of time after a product has been discontinued. All TSC services will be at a specified price dependent on the terms and conditions of the contract.

The rights and obligations of Lucent Technologies' ONG and the customer shall neither be assigned nor delegated without prior written consent of the other party, except that Lucent Technologies' ONG may assign its obligations to any of its affiliates or non-Lucent Technologies contractors without further consent by the customer.

Warranty Transfer

The entitlements of this warranty are *not* transferable.

Standard Repair

Introduction

If Lucent Technologies' ONG determines that a product is not defective or is in conformance, the customer shall pay Lucent Technologies' ONG the costs of handling, inspecting, testing, and transporting the product and, if applicable, travel and related expenses.

Repair Interval

Lucent Technologies' ONG repair locations set their own standards for return intervals. On average, the minimum time to return repairs to the customer is 14 days from the receipt of the product by the repair location. The maximum time to return repairs to the customer can range from 50 to 180 days.

Out-of-Warranty Provisions

For any activity associated with repair or replacement of hardware and/or software systems that is determined by Lucent Technologies' ONG to be out of warranty, materials and labor will be billed at Lucent Technologies' ONG list price (time-and-materials plus additional incurred expenses), or in accordance with a separate Technical Support Contract.

International Repair and Service

The customer or the customer's in-country representative should send a description of the material to be returned for repair or service including the quantity, comcodes, and serial numbers (if available) to the Lucent Technologies' Charlotte Service Center.

After the Charlotte Service Center receives the repair information, they will assign an order number and fax an Authorization To Repair Form to the customer or the customer's in-country representative. The material can then be consigned and shipped to:

Lucent Technologies
Charlotte Service Center
6701-A Northpark Blvd.
Charlotte, NC 28216 USA
Attn: International Repair
Notify: Hipage Co. (704) 357-3050

(Continued on next page)

Standard Repair, *continued*

International Repair and Service

After the material has been shipped, the following information should be faxed to the Charlotte Service Center:

- Customer's return address
- Customer contact name, telephone number, and fax number
- Value of material
- Identification of any hazardous equipment or material
- Shipping information including the date of shipment, air waybill, carrier name, flight number, number of cartons, and weight of material.

When the material arrives at the Charlotte Service Center, it is entered into the Repair, Service, and Return database for tracking purposes, to verify shipment and quantities, and to determine the appropriate repair location. The material is then shipped to the appropriate repair location.

The repair location will repair the material and then ship it back to the Charlotte Service Center. If it is determined that an item is not repairable and the item is under factory warranty, a replacement will be sent. If the item is out of factory warranty, the customer will advise their Country Desk Representative if they would like to order a replacement.

The Charlotte Service Center will prepare the paperwork for exporting the material, and ship the material to the customer. When available, the Charlotte Service Center will fax the shipping information to the customer or the customer's in-country representative.

Upon receipt of the material, the customer or the customer's in-country representative should send the Charlotte Service Center the order numbers of the material received and the date the material was received. The Charlotte Service Center will then close the order on the Repair, Service, and Return database.

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Lucent's Commitment to Quality and Reliability

Overview

This section provides the Lucent Technologies' quality policy, describes the reliability program, and describes the International Organization for Standardization certification awarded to Lucent Technologies' Optical Networking Group.

Quality Policy

Lucent Technologies is committed to achieving sustained business excellence by integrating quality principles and methods into all we do at every level of our company to:

- **Anticipate and meet** customer needs and exceed their expectations, every time
- **Relentlessly improve how we work**—to deliver the world's best and most innovative communications solutions—faster and more cost-effectively than our competitors

Quality Principles

- **Customer value**—Drive actions from a desire to serve customers. Know current and emerging needs. Understand why customers buy from us and why they don't, and act on that knowledge to deliver superior value.
- **Partnership**—Build long-term relationships with customers and strategic suppliers based on shared objectives.
- **Leadership**—Develop leaders who set high expectations, live by Lucent Values, and create an environment for serving customers and achieving business excellence.
- **Ownership**—Become personally involved in the success of the business. Turn good ideas into better ways of doing business—working together, taking prudent risks, learning from mistakes and implementing improvements based on what we learn.
- **Process**—Manage work with a focus on results—improving efficiency and productivity, delivering value to customers, and creating financial rewards for shareowners.
- **Improvement**—Make the plan-do-check-act cycle the way we operate—to achieve both continuous and breakthrough improvements in cost, cycle time, and quality.

(Continued on next page)

Lucent's Commitment to Quality and Reliability, *continued*

Quality Policy

- **Management by Fact**—Know what you want. Measure what you get. Act on the difference.
- **Results Orientation**—Establish and meet both short- and long-term commitments to all key stakeholders—customers, employees, shareholders, suppliers, partners, and society.

Shared Methods

- **Policy Deployment**—To set, deploy, and reach goals and align efforts company wide.
- **Process Management**—To manage, improve, and streamline how we work to deliver greater value to customers.
- **Problem Solving**—To close the gaps that separate us from our goal to be the industry leader.
- **Benchmarking**—To set meaningful standards and learn from the successful practices of best-in-class companies.
- **Management System Assessment**—To improve the way we manage the business through systematic evaluation, feedback, and action.

—Richard A. McGinn, Chairman and CEO

This Lucent Technologies Quality Policy guided the development of the WaveStar™ AM 1 Add/Drop Multiplexer and will continue affecting this product throughout its lifetime. The primary tool ensuring product quality is the Quality Plan, used with Lucent Technologies Optical Networking Group Reliability Program.

Reliability Program

**Program
Description**

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

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

During manufacturing and field deployment, techniques such as premanufacturing, qualification, production quality tracking, failure mode analysis, feedback, and correction further enhances the ongoing reliability of the WaveStar™ AM 1.

International Standards Organization (ISO) Certification

ISO 9001

Lucent Technologies' Optical Networking Group has received ISO 9001 certification for its Merrimack Valley manufacturing facility and associated development organizations. Merrimack Valley manufactures systems for transporting data, voice, and images over public and private telecommunications networks. Major product lines consist of digital access and cross-connect systems (DACS-II, III, IV, VI), network multiplex systems (DDM-2000), lightwave systems (FT-2000), as well as a growing family of WaveStar™ products.

ISO 9001 is an internationally recognized quality standard which is the key fundamental of a well designed quality system. ISO 9001 is the most comprehensive standard in the ISO 9000 series, requiring well documented and implemented controls for design development, production, delivery, installation, and service. Its purpose is to ensure manufacturers produce products with consistently high levels of quality and service.

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Overview

Introduction

This chapter contains the technical specifications for the WaveStar™ AM 1 Add/Drop Multiplexer.

System Specifications

Optical Interface

- A 155 Mbit/s G.957/S-1.1 short-haul optical interface with an attenuation range from 0 to 12 dB (1×10^{-10} sensitivity) at an operating wavelength of 1310 nm.
 - The STM-1 optical access is via an SC-type connector.
-

Tributary Interfaces

- Interface at 2048 Kbit/s \pm 50 ppm, HDB3 coded and conforming to G.703-6, asynchronously mapped via VC-12 in TU-12.
 - The 2 Mbit/s electrical interface access is via a RJ45 connector suitable for symmetrical twisted pair cables with an impedance of 120 Ω .
 - Interface at 34368 Kbit/s \pm 20 ppm and conforming to G.703-8, asynchronously mapped into LO-VC3.
 - The 34 Mbit/s electrical clear channel interface access is via a coaxial DIN 1.6/5.6 type connector.
-

Mapping

- The WaveStar™ AM 1 supports an AU4 <-> VC4 <-> TUG3 <-> TUG2 <-> TU12 <-> VC12 mapping scheme for each VC-12 created and terminated in the system.
 - The WaveStar™ AM 1 supports an AU4 <-> VC4 <-> TUG3 <-> TU3 <-> VC3 mapping scheme for each VC-3 created and terminated in the system.
-

Connectivity

- The WaveStar™ AM supports bi-directional, non-blocking cross-connection switching at the VC-12 level.
 - The WaveStar™ AM supports bi-directional, non-blocking cross-connection switching at the VC-3 level.
-

(Continued on next page)

System Specifications, *continued*

Power Specifications

- Input Voltage, -48/-60 VDC
 - Power Consumption, less than 25 watts for the basic unit; less than 50 watts with either option card
 - External 90-264V (47-63 Hz) AC/DC converter (optional)
 - External -24 to -48 DC/DC converter (optional)
 - -48 VDC battery backup (optional)
 - The system optionally supports the grounding philosophy according to ETSI Requirements 300 253 (battery return connected to ground).
-

Equipment Dimensions

- Dimensions (H x W x D) 250 x 375 x 33 mm without optional PWBs (excluding mounting brackets)
 - Dimensions (H x W x D) 250 x 375 x 55 mm with optional PWBs (excluding mounting brackets)
 - Weight less than 5 Kg with optional PWBs and mounting brackets
-

Supervision Interface

- F-interface for Craft Interface Terminal via RJ45 connector with metal shell for grounding (ITM-CIT)

The interface conforms to V.10/RS-232C standards

- LAN Q-Interface via RJ45 connector with metal shell for grounding (LAN-10baseT)

The interface conforms to industry Ethernet standards

Synchronization and Timing

- Synchronization can be derived from the incoming STM-1 signals
 - Synchronization can be derived from an incoming 2 Mbit/s data input
 - Re-synchronization of the 2 Mbit/s ports is supported
 - Support of SSM byte according to ETSI ETS 300 417-6
 - External synchronization output at 2048 kHz is according to G.703-10 (SYNC-OUT), impedance of 120Ω symmetrical or 75Ω coax.
-

(Continued on next page)

System Specifications, *continued*

Performance Monitoring

- Performance monitoring is in accordance with ITU-T G.826 and G.784.
 - The following four parameters are available to estimate the error performance of a path:
 - SES: number of Severely Errored Seconds in the received signal
 - ES: number of Errored Seconds in the received signal
 - BBE: number of Background Block Errors in the received signal
 - UAS: number of UnAvailable Seconds in the received signal.
 - Monitoring can be done on the incoming STM-1 optical interfaces of the WaveStar™ AM 1 unit
 - Monitoring can be done on any incoming VC-12 terminating in the unit
 - Monitoring can be done on any incoming VC-3 terminating in the unit
 - Performance monitoring data is stored in one current and sixteen recent 15 minute registers, and one current and one recent 24 hour registers
 - Threshold reports are generated when user-settable performance parameters are exceeded during 15 minute and 24 hour periods
-

Miscellaneous Discrete Inputs/Outputs

- The user can assign, through the EMS or local workstation, an alarm message and alarm severity to each of the four miscellaneous discrete inputs (MDIs). They will be equivalent with other system alarms.
 - When receiving power, all four miscellaneous discrete outputs (MDOs) will normally be open. If power is lost, MDO#1's contacts will close (assigned to indicate power failure). MDO#2-4 are unassigned.
-

Environmental Conditions

- Compliant with ETSI 300 019 Class 3.3
 - ETSI EMC - The system meets the requirements of EN 300 386-2 for equipment installed in locations other than telecom centers
 - The system operates with convection cooling.
-

(Continued on next page)

System Specifications, *continued*

System Reliability The WaveStar™ AM 1 reliability predictions follow:

AM 1	
FITS	MTBF
4500	25

1. Calculations are based on the Reliability Information Notebook, 7th Edition (RIN-7), Lucent Technologies, August 1995. All components evaluated at 40° C ambient and 50 percent electrical stress.
2. FITS is the number of failures per billion hours of operation (10^9).
3. Mean Time Between Failures (MTBF) in years.

Glossary

A

Add/Drop Multiplexer (ADM)

The term for a synchronous network element capable of combining signals of different rates and having those signals added to or dropped from the stream.

Alarm

Visible or audible signal indicating that an equipment failure or significant event/condition has occurred.

Alarm Cut-Off and Test (ACO/TST)

The name of a pushbutton on the user panel used to silence audible alarms.

Alarm Indication Signal (AIS)

A code transmitted downstream in a digital network that indicates that an upstream failure has been detected and alarmed if the upstream alarm has not been suppressed.

Alarm Severity

An attribute defining the priority of the alarm message. The way alarms are processed depends on the severity.

Alarm Suppression

Selective removal of alarm messages from being forwarded to the GUI or to network management layer OSs.

Alarm Throttling

A feature that automatically or manually suppresses autonomous messages that are not priority alarms.

Alternate Mark Inversion (AMI)

A line code that employs a ternary signal to convert binary digits, in which successive binary ones are represented by signal elements that are normally of alternative positive and negative polarity but equal in amplitude and in which binary zeros are represented by signal elements that have zero amplitude.

American Standard Code for Information Interchange (ASCII)

A standard 7-bit code that represents letters, numbers, punctuation marks, and special characters in the interchange of data among computing and communications equipment.

Asynchronous

The essential characteristic of time-scales or signals such that their corresponding significant instants do not necessarily occur at the same average rate.

Asynchronous Transfer Mode (ATM)

A high-speed transmission technology characterized by high bandwidth and low delay. It utilizes a packet switching and multiplexing technique which allocates bandwidth on demand.

Attribute

Alarm indication level: critical, major, minor, or no alarm.

Automatic Protection Switch

A protection switch that occurs automatically in response to an automatically detected fault condition.

Autonomous Message

A message transmitted from the controlled Network Element to the ITM-SC which was not a response to an ITM-SC originated command.

B**Bandwidth**

The difference in Hz between the highest and lowest frequencies in a transmission channel. The data rate that can be carried by a given communications circuit.

Baud Rate

Transmission rate of data (bits per second) on a network link.

Bidirectional Line

A transmission path consisting of two fibers that handle traffic in both the transmit and receive directions.

Bidirectional Line-Switched Ring (BLSR)

A bidirectional ring in which protection switching is accomplished by switching working traffic into protection time slots in the line going in the opposite direction around the ring.

Bidirectional Ring

A ring in which both directions of traffic between any two nodes travel through the same network elements (although in opposite directions).

Bidirectional Switch

Protection switching performed in both the transmit and receive directions.

Bit

The smallest unit of information in a computer, with a value of either 0 or 1.

Bit Error Rate (BER)

The ratio of error bits received to the total number of bits transmitted.

Bit Error Rate Threshold

The point at which an alarm is issued for bit errors.

Bit Interleaved Parity-n (BIP-n)

A method of error monitoring over a specified number of bits (BIP-3 or BIP-8).

Broadband Communications

Voice, data, and/or video communications at greater than 2 Mb/s rates.

Byte

Refers to a group of eight consecutive binary digits.

C**Cell Relay**

Fixed length cells. For example, ATM with 53 octets.

Central Office (CO)

A building where common carriers terminate customer circuits.

Channel

A sub-unit of transmission capacity within a defined higher level of transmission capacity.

Circuit

A set of transmission channels through one or more network elements that provides transmission of signals between two points, to support a single communications path.

Clear Channel (CC)

A digital circuit where no framing or control bits are required, thus making the full bandwidth available for communications.

Closed Ring Network

A network formed of a ring-shaped configuration of network elements. Each network element connects to two others, one on each side.

Coding Violation (CV)

A performance monitoring parameter indicating bipolar violations of the signal have occurred.

Collocated

System elements that are located in the same location.

Concatenation

A procedure whereby multiple virtual containers are associated one with each other resulting in a combined capacity that can be used as a single container across which bit sequence integrity is maintained.

Consultative Committee for the International Telephone and Telegraph (CCITT)

International Telephone and Telegraph Consultative Committee — An international advisory committee under United Nations' sponsorship that has composed and recommended for adoption worldwide standards for international communications. Recently changed to the International Telecommunications Union Telecommunications Standards Sector (ITU-TSS).

Craft Interface Terminal (CIT)

The user interface terminal used by craft personnel to communicate with the network element.

Critical (CR)

Alarm that indicates a severe, service-affecting condition.

Cross-Connection

Path-level connections between input and output tributaries or specific ports within a single NE. Cross-connections are made in a consistent way even though there are various types of ports and various types of port protection. Cross-Connections are reconfigurable interconnections between tributaries of transmission interfaces.

D**Data Communications Channel (DCC)**

The embedded overhead communications channel in the synchronous line, used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between network elements in a synchronous network.

Default

An operation or value that the system or application assumes, unless a user makes an explicit choice.

Demultiplexing

A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

Digital Multiplexer

Equipment that combines by time-division multiplexing several digital signals into a single composite digital signal.

Downstream

At or towards the destination of the considered transmission stream, for example, looking in the same direction of transmission.

Drop and Continue

A circuit configuration that provides redundant signal appearances at the outputs of two network elements in a ring. Can be used for Dual Ring Interworking (DRI) and for video distribution applications."

Drop-Down Menu

A menu that is displayed from a menu bar.

DS1 Signal

Signal with a data rate of 1.544 Mb/s.

DS3 Signal

A logical or electrical B3ZS signal with a data rate of 44.736 Mb/s.

Dual Ring Interworking (DRI)

Provides path-level protection for selected circuits that are dual interconnected between two rings. The self-healing mechanisms of the two rings remain independent and together protect against simultaneous single failures on both rings (not affecting the interconnections). The DRI protection additionally protects against failures in either of the interconnections between the rings, whether the failure is a facility or interconnection node.

E**Electrical Carrier, Level 1 (EC-1)**

An electrical interface signal at the SONET rate of STS-1.

Electromagnetic Compatibility (EMC)

A measure of equipment tolerance to external electromagnetic fields.

Electromagnetic Interference (EMI)

High-energy, electrically induced magnetic fields that cause data corruption in cables passing through the fields.

Electrostatic Discharge (ESD)

Static electrical energy potentially harmful to circuit packs and humans.

Errored Seconds (ES)

A performance monitoring parameter. ES "type A" is a second with exactly one error; ES "type B" is a second with more than one and less than the number of errors in a severely errored second for the given signal. ES by itself means the sum of the type A and type B ESs.

Event

A significant change. Events in controlled Network Elements include signal failures, equipment failures, signals exceeding thresholds, and protection switch activity. When an event occurs in a controlled Network Element, the controlled Network Element will generate an alarm or status message and send it to the management system.

Externally Timed

An operating condition of a clock in which it is locked to an external reference and is using time constants that are altered to quickly bring the local oscillator's frequency into approximate agreement with the synchronization reference frequency.

F**Far End (FE)**

Any other network element in a maintenance subnetwork other than the one the user is at or working on. Also called remote.

Far-End Block Error (FEBE)

An indication returned to the transmitting node that an errored block has been detected at the receiving node. A block is a specified grouping of bits.

Far-End Receive Failure (FERF)

An indication returned to a transmitting Network Element that the receiving Network Element has detected an incoming section failure. Also known as RDI.

Folded Rings

Folded (collapsed) rings are rings without fiber diversity. The terminology derives from the image of folding a ring into a linear segment.

Frame

The smallest block of digital data being transmitted.

Free Running

An operating condition of a clock in which its local oscillator is not locked to an internal synchronization reference and is using no storage techniques to sustain its accuracy.

G**Gateway Network Element (GNE)**

A network element that passes information between other network elements and management systems through a data communication network.

H**High Level Data Link Control (HDLC)**

OSI reference model datalink layer protocol.

Holdover

An operating condition of a clock in which its local oscillator is not locked to an external reference but is using storage techniques to maintain its accuracy with respect to the last known frequency comparison with a synchronization reference.

Human Machine Language (MML)

A standard language developed by the ITU for describing the interaction between humans and dumb terminals.

I**In-Service (IS)**

A memory administrative state for ports. IS refers to a port that is fully monitored and alarmed.

Integrated Transport Management Network Module (ITM NM)

Lucent Technologies' integrated network management system that provides a broad end-to-end view of the SONET network.

J**Jitter**

Short term variations of amplitude and frequency components of a digital signal from their ideal position in time.

L**Lightguide Build-Out (LBO)**

An attenuating (signal-reducing) element used to keep an optical output signal strength within desired limits.

Line

A transmission medium, together with the associated equipment, required to provide the means of transporting information between two consecutive network elements. One network element originates the line signal; the other terminates it.

Line Build Out (LBO)

An equalizer network that guarantees the proper signal level and shape at the DSX panel.

Line Protection

The optical interfaces can be protected by line protection. Line protection switching protects against failures of line facilities, including the interfaces at both ends of a line, the optical fibers, and any equipment between the two ends. Line protection includes protection of equipment failures.

Line Timing

Refers to a network element that derives its timing from an incoming OC-N/STM-N signal.

Link

The mapping between in-ports and out-ports. It specifies how components are connected to one another.

Local Area Network (LAN)

A communications network that covers a limited geographic area, is privately owned and user administered, is mostly used for internal transfer of information within a business, is normally contained within a single building or adjacent group of buildings, and transmits data at a very rapid speed.

Loopback

Type of diagnostic test used to compare an original transmitted signal with the resulting received signal. A loopback is established when the received optical or electrical external transmission signal is sent from a port or tributary input directly back toward the output.

Loop Timing

A special case of line timing. It applies to network elements that have only one OC-N/STM-N interface. For example, terminating nodes in a linear network are loop timed.

Loss of Frame (LOF)

A failure to synchronize to an incoming signal.

Loss of Pointer (LOP)

A failure to extract good data from a signal payload.

Loss of Signal (LOS)

The complete absence of an incoming signal.

M**Major**

Indicates a service-affecting failure, main or unit controller failure, or power supply failure.

Mapping

The logical association of one set of values, such as addresses on one network, with quantities or values of another set, such as devices or addresses on another network.

Minor

Indicates a non-service-affecting failure of equipment or facility.

Miscellaneous Discrete Interface

Allows an operations system to control and monitor equipment collocated within a set of input and output contact closures.

N**Network Element (NE)**

A node in a telecommunication network that supports network transport services and is directly manageable by a management system.

Network Service Access Point (NSAP) Address

Network Service Access Point Address (used in the OSI network layer 3). An automatically assigned number that uniquely identifies a Network Element for the purposes of routing DCC messages.

Node

Defined as all equipment that is controlled by one system controller. A node is not always directly manageable by a management system. A node may also be defined as any network element in a network.

O**Open Systems Interconnection (OSI)**

Referring to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

Operations Interface

Any interface providing you with information on the system behavior or control. These include the equipment LEDs, user panel, CIT, office alarms, and all telemetry interfaces.

Operations Interworking (OI)

The capability to access, operate, provision, and administer remote systems through craft interface access from any site in a SONET/SDH network or from a centralized operations system.

Operations System (OS)

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

Optical Carrier n (OC-n)

An optical carrier signal at the SONET rate of n, where n equals 1, 3, 12, 48, or 192. The basic rate of an OC-1 signal is 51.84 Mb/s, equivalent to an STS-1, with other values of N direct multiples of this basic rate.

Optical Carrier nc (Concatenated)

An optical carrier signal at the SONET rate of n, where n equals 3, 12, or 48. The OC-3c signal is constructed by concatenating three STS-1 signals into an OC-3c. These three STS-1s are linked together with a single path overhead (rather than three) which increases the total available payload bandwidth over that of the three individual STS-1s.

Orderwire (OW)

A dedicated voice-grade line for communications between maintenance and repair personnel.

Outage

A disruption of service that lasts for more than 1 second.

P**Parameter**

A variable that is given a value for a specified application. A constant, variable, or expression that is used to pass values between components.

Parity Check

Tests whether the number of ones (or zeros) in an array of binary bits is odd or even; used to determine that the received signal is the same as the transmitted signal.

Pass-Through

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

Path

A logical connection between the point at which a standard frame format for the signal at the given rate is assembled, and the point at which the standard frame format for the signal is disassembled.

Path Overhead (POH)

Informational bytes assigned to, and transported with the payload until the payload is demultiplexed. It provides for integrity of communication between the point of assembly of a virtual container and its point of disassembly.

Path Terminating Equipment

Network elements in which the path overhead is terminated.

Performance Monitoring (PM)

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

Plesiochronous Network

A network that contains multiple subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant.

Port (also called Line)

The physical interface, consisting of both an input and output, where an electrical or optical transmission interface is connected to the system and may be used to carry traffic between network elements. The words "port" and "line" may often be used synonymously. "Port" emphasizes the physical interface, and "line" emphasizes the interconnection. Either may be used to identify the signal being carried.

Port State Provisioning

A feature that allows a user to suppress alarm reporting and performance monitoring during provisioning by supporting multiple states (automatic, in-service, and not monitored) for low-speed ports.

Protection

Extra capacity (channels, circuit packs) in transmission equipment that is not intended to be used for service, but rather to serve as backup against equipment failures.

Q

R**Receive-Direction**

The direction towards the Network Element.

Remote Network Element

Any Network Element that is connected to the referenced Network Element through either an electrical or optical link. It may be the adjacent node on a ring, or N nodes away from the reference. It also may be at the same physical location but is usually at another (remote) site.

Return to Zero

A code form having two information states (termed zero and one) and having a third state or an at-rest condition to which the signal returns during each period.

Ring

A configuration of nodes comprised of network elements connected in a circular fashion. Under normal conditions, each node is interconnected with its neighbor and includes capacity for transmission in either direction between adjacent nodes. Path switched rings use a head-end bridge and tail-end switch. Line switched rings actively reroute traffic over the protection capacity.

S**Section**

The portion of a transmission facility, including terminating points, between a terminal network element and a line-terminating network element, or two line-terminating network elements.

Self-Healing

A network's ability to automatically recover from the failure of one or more of its components.

Severely Errored Seconds (SES)

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

Single-Mode Fiber (SM)

An 8- μ m diameter low-loss, long-span optical fiber typically operating at either 1310 nm, 1550 nm, or both.

Site Address

The unique address for a Network Element.

Software Backup

The process of saving an image of the current network element's databases, which are contained in its NVM, to a remote location. The remote location could be the WaveStar CIT or an OS.

Software Download

The process of transferring a generic (full or partial) or provisioned database from a remote entity to the target network element's memory. The remote entity may be the WaveStar CIT or an OS. The download procedure uses bulk transfer to move an uninterpreted binary file into the network element.

Software ID

Number that provides the software version information for the system.

Span

An uninterrupted bidirectional fiber section between two network elements.

STS-1

The basic building block logical signal in the SONET standard with a data rate of 51.84 Mb/s.

Subnetwork

A group of interconnected/interrelated Network Elements. The most common connotation is a synchronous network in which the Network Elements have data communications channel (DCC) connectivity.

Supervisor

A user of the application with supervisor user privileges.

Synchronization Messaging

Synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork.

Synchronous

The essential characteristic of time scales or signals such that their corresponding significant instances occur at precisely the same average rate, generally traceable to a single Stratum-1 source.

Synchronous Digital Hierarchy (SDH)

A hierarchical set of digital transport structures, standardized for the transport of suitable adapted payloads over transmission networks.

Synchronous Network

The synchronization of transmission systems with synchronous payloads to a master (network) clock that can be traced to a reference clock.

Synchronous Optical Network (SONET)

The North American standard for the rates and formats that defines optical signals and their constituents.

Synchronous Transport Module, Level n (STM-n)

A building block information structure that supports SDH section layer connections, where n represents a multiple of 155.52 Mb/s. Normally n=1, 4, 16, or 64.

Synchronous Transport Signal (STS, STS-n)

The basic logical building block signal for SONET with a rate of 51.84 Mb/s for an STS-1 signal and a rate of n times 51.84 Mb/s for an STS-n signal.

T**T1**

A carrier system that transmits at the rate of 1.544 Mb/s (a DS1 signal).

T3

A carrier system that transmits at the rate of 44.736 Mbps (a DS3 signal).

Threshold-Crossing Alert (TCA)

A message type sent from a Network Element that indicates that a certain performance monitoring parameter has exceeded a specified threshold.

Through Timing

Refers to a network element that derives its transmit timing in the east direction from a received line signal in the east direction and its transmit timing in the west direction from a received line signal in the west direction.

Time Division Multiplexing (TDM)

A technique for transmitting a number of separate data, voice, and/or video signals simultaneously over one communications medium by interleaving a portion of each signal one after another.

Transaction Language One (TL1)

A machine-to-machine communications language that is a subset of ITU's human-machine language.

Transmit-Direction

The direction outwards from the Network Element.

True Wave™ Optical Fiber

Lucent Technologies' fiber generally called non-zero dispersion-shift fiber, with a controlled amount of chromatic dispersion designed for amplified systems in the 1550/1310 nm range.

U**Unavailable Seconds (UAS)**

In performance monitoring, the count of seconds in which a signal is declared failed or in which 10 consecutively severely errored seconds (SES) occurred, until the time when 10 consecutive non-SES occur.

Upstream

At or towards the source of the considered transmission stream, for example, looking in the opposite direction of transmission.

V**Virtual Circuit**

A logical connection through a data communication (for example, X.25) network.

Voice Frequency (VF) Circuit

A 64 kilobit per second digitized signal.

Volatile Memory

Type of memory that is lost if electrical power is interrupted.

W**Wide Area Network (WAN)**

A communication network that uses common-carrier provided lines and covers an extended geographical area.

Wideband Communications

Voice, data, and/or video communication at digital rates from 64 kb/s to 2 Mb/s.

X**X.25 Interface/Protocol**

The ITU packet-switched interface standard for terminal access that specifies three protocol layers: physical, link, and packet for connection to a packet-switched data network.

X-Terminal

Workstation that can support an X-Windows interface.