Lucent Technologies
Bell Labs Innovations

WaveStar® ADM 16/1

Installation Guide – Release 8.0

Part II – Commissioning and Test

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Always observe the Safety Instructions given in Chapter 1 when operating the system.

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The order number of this document is 365-312-837 (Issue 1).

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2 System overview

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About this information product

Purpose

This part of the Installation Guide provides information on the configuration and test procedures of the system.

Reason for reissue

This is the first issue of this guide for Release 8.0.

Intended audience

This part of the Installation Guide is intended for users who wish to configure and test the *WaveStar*® ADM 16/1 system.

How to use this information product

This part of the Installation Guide is divided into a number of chapters. Through this the reader can quickly select the subject of his/her interest and need.

There are the following chapters:

- **About this information product**
  This section describes the purpose, intended audience, reason for reissue, and organisation of this document. This section references related documentation and explains how to order, make comments or recommend changes to this document.
- **Chapter 1, Safety**
  This chapter provides all relevant information and safety guidelines to safeguard against personal injury. Furthermore, this chapter may be useful to prevent material damage to the equipment.
- **Chapter 2, System overview**
  This chapter briefly describes the network element.

- **Chapter 3, Installing the Wavestar® ADM 16/1**
  This chapter provides information for getting the network element into operation.
- **Chapter 4, Testing the Wavestar® ADM 16/1**
  This chapter describes the testing of the network element locally by checking the transmission functionality.
- **Chapter 5, Fast downloading**
  This chapter describes the fast download application.
- **Glossary**
  The glossary provides definitions for telecommuication acronyms and terms.
- **Index**
  The index supplies users with specific subjects and corresponding page numbers to find necessary information.

Conventions used

The following conventions are used throughout the manual:

Numbering

The chapters of this document are numbered consecutively. The page numbering restarts at “1” in each chapter. To facilitate identifying pages in different chapters, the page numbers are prefixed with the chapter number. For example, page 2-3 is the third page in chapter 2.

Cross-references

Cross-reference conventions are identical with those used for numbering, i.e. the first number in a reference to a particular page refers to the corresponding chapter.

Keyword-blocks

This document contains so-called keyword blocks to facilitate the location of specific text passages. The keyword blocks are placed to the left of the main text and indicate the contents of a paragraph or group of paragraphs.

Abbreviations

Abbreviations used in this document can be found in the “Glossary” unless it can be assumed that the reader is familiar with the abbreviation.

Codes

The codes (CC, DC and SC) in this manual are used to define a hardware item owned by the Lucent Technologies Development Systems. The code consists of a letter combination followed by a combination of numbers (Example: CC123456789).

Related documentation

The following documents are network element (NE) related:

- **Application and Planning Guide**
  Provides detailed information on the NE, technical characteristics, features, cross-product interworking and system planning and engineering.
- **Installation Guide – Part I (Physical Installation)**
  Provides information on mounting and cabling of the NE.
- **Installation Guide – Part II (Commissioning and Test)**
  Provides information on commissioning and testing of the NE.
- **User Operations Guide**
  Provides information on provisioning and maintenance of the NE with the use of the Craft Interface Terminal (CIT).
- **Alarm Messages and Trouble Clearing Guide**
  Provides information on corrective procedures and action tables of the NE.
- **ITM-SC Provisioning Guide**
  Provides information on provisioning of the NEs with the use of the Integrated Transport Management-Subnetwork Controller (ITM-SC).

The following table lists the documents included in the *WaveStar* ® ADM 16/1 documentation set.

Document title	Document code
WaveStar ® ADM 16/1 Application and Planning Guide	109571158 (365-312-833)
WaveStar ® ADM 16/1 User Operations Guide	109571208 (365-312-834)
WaveStar ® ADM 16/1 Alarm Messages and Trouble Clearing Guide	109571141 (365-312-835)
WaveStar ® ADM 16/1 Installation Guide (Part I) – Physical Installation	109571174 (365-312-836)
WaveStar ® ADM 16/1 Installation Guide (Part II) – Commissioning and Test	109571182 (365-312-837)
WaveStar ® ADM 16/1 ITM-SC Provisioning Guide	109571190 (365-312-838)
CD-ROM Documentation *WaveStar* ® ADM 16/1 (all manuals on a CD-ROM)	109571166 (365-312-839)

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1 Safety

Overview

Purpose

This chapter comprises rules on mounting safety admonishments concerning EMC/ESD, Power supply and laser safety.

Contents

Safety guidelines and precautions

Overview

Purpose

The purpose of this chapter is to provide knowledge about the safety guidelines and precautions, when handling transmission equipment.

Contents

Rack mounting

Rules for mounting

This equipment is for installation in “restricted access locations” only.

The rack frames containing this equipment are suitable for mounting on concrete or other non-combustible surfaces only.

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EMC/ESD safety guidelines

Overview

The EMC/ESD boundary has been defined at Rack/Subrack level. The principle is based on the “Faraday Cage” theory. If there are doors or covers, then the doors must be closed and the covers must be mounted.

With every rack/subrack an ESD (electrostatic discharge) earth socket and an ESD sticker are supplied. On the Rack frame ETSI an ESD bonding point for an ESD wrist strap is present. It is mounted in a way that it’s always accessible for installation, normal operation and maintenance activity.

Wrist strap

The wrist strap must be worn when opening the Subrack doors.

Electrostatic sensitive devices

The equipment described in this guide contains static sensitive devices.

Electrostatic Discharge Precautions should be taken when operating or working on this equipment. The label read as follows:

Special handling precautions apply whenever installing or removing parts of the equipment include:

- Leaving components or equipment in original packaging until required for use.
- Removing plug-in units with previously discharged hands (e.g. using grounded wrist straps connected to the ESD Bonding Point on the Cabinet).
- Returning items for repair in suitable antistatic packaging.

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Power supply safety instructions

Overview

The installation must be compliant with IEC 60950–Ed3, 1999-04.

Electrical Safety

The equipment must be be grounded (connected to protective earth) (Class I equipment).

The equipment is connected to the Power Supply via a non-industrial plug (Type A Pluggable equipment). It uses an easily detachable power supply cord.

DC Power Supply

Each circuit pack is equipped with an on-board fuse due to safety aspects and system availabilty reasons. The value of the fuse is either 10A (core units) or 3A (core units and other circuit packs). The complete system, however, must be protected by an external 16A circuit breaker for each power feeding line. This circuitbreaker can be located on a Power Distribution Panel.

The equipment must be supplied with a Safety Extra-Low Voltage (SELV) of -48 V and the positive terminal of this source correctly connected to the protective earth.

The equipment can also be connected to a Telecommunication Network Voltage (TNV) of -48 V to -60 V. No specific requirements are necessary for this type of source.

The user interfaces are of the SELV type and must only be connected to circuits with the same type of interface.

AC Power Supply

An external AC power distribution system classified IT cannot be used. (For IT classification, see: IEC 60950–Ed3, 1999-04, Annex V: Power system isolated from earth or one point connected to earth through an impedance and direct electrical connection of the equipment to earth).

An external protection device is not necessary: the building installation is considered as providing short-circuit backup protection (IEC 60950–Ed3, 1999-04, paragraph 2.7.3).

The user interfaces are of the SELV type and must only be connected to circuits with the same type of interface.

Protection against short-circuits

Important! Always disconnect the Power supply of the equipment before carrying out any work on active or passive components.

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Laser safety guidelines

Overview

Optical fiber telecommunication systems, their associated test sets, and similar operating systems use semiconductor laser transmitters that emit infrared (IR) light at wavelengths between approximately 800 nanometers and 1600 nanometers. The emitted light is above the red end of the visible spectrum, which is normally not visible to the human eye. Although radiant energy at near-IR wavelengths is officially designated invisible, some people can see the shorter wavelength energy even at power levels several orders of magnitude below any that have been shown to cause injury to the eye.

Conventional lasers can produce an intense beam of monochromatic light. The term monochromaticity means a single wavelength output of pure color that may be visible or invisible to the eye. A conventional laser produces a small-size beam of light, and because the beam size is small the power density (also called irradiance) is very high. Consequently, lasers and laser products are subject to federal and applicable state regulations as well as international standards for their safe operation.

A conventional laser beam expands very little over distance, or is said to be very well collimated. Thus, conventional laser irradiance remains relatively constant over distance. However, lasers used in lightwave systems have a large beam divergence, typically 10 to 20 degrees. Here, irradiance obeys the inverse square law (doubling the distance reduces the irradiance by a factor of 4)and rapidly decreases over distance.

Lasers and eye damage

The optical energy emitted by laser and high-radiance LEDs in the 400-1400 nm range may cause eye damage if absorbed by the retina. When a beam of light enters the eye, the eye magnifies and focuses the energy on the retina magnifying the irradiance. The irradiance of the energy that reaches the retina is approximately 10^5 or 100,000 times more than at the cornea and, if sufficiently intense, may cause a retinal burn.

The damage mechanism at the wavelengths used in an optical fiber telecommunications is thermal in origin i.e., damage caused by heating. Therefore, a specific amount of energy is required for a definite time to heat an area of retinal tissue. Damage to the retina occurs only when one looks at the light sufficiently long that the product of the retinal irradiance and the viewing time exceeds the damage threshold. Optical energies above 1400 nm cause corneal and skin burns but do not affect the retina. The thresholds for injury at wavelengths greater than 1400 nm are significantly higher than for wavelengths in the retinal hazard region.

Classification of lasers

Manufacturers of lasers and laser products in the U.S. are regulated by the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) under 21 CFR 1040. These regulations require manufacturers to certify each laser or laser product as belonging to one of four major Classes I, II, lla, IIIa, lllb, or IV. The International Electro-technical Commission is an international standards body that writes laser safety standards under IEC-60825. Classification schemes are similar with Classes divided into Classes 1, 1M, 2, 2M, 3B, 3R and 4. Lasers are classified according to the accessible emission limits and their potential for causing injury. Optical fiber telecommunication systems are generally classified as Class I/1, because, under normal operating conditions, all energized laser transmitting circuit packs are terminated on optical fibers which enclose the laser energy with the fiber sheath forming a protective housing. Also, a protective housing / access panel is typically installed in front of the laser circuit pack shelves. The circuit packs themselves, however, may be FDA/CDRH Class I or IIIb or IEC Class 1, 1M, 3B, 3R or 4. State of the art Raman and EDFA optical amplifiers have now extended into the Class IV/4 designations.

Lightwave safety precautions for optical fiber telecommununication systems

In its normal operating mode, an optical fiber telecommunication system is totally enclosed and presents no risk of eye injury. It is a Class I/1 system under the FDA and IEC classifications.

The fiber optic cables that interconnect various components of an optical fiber telecommunication system can disconnect or break, and may expose people to laser emissions. Also, certain measures and maintenance procedures may expose the technician to emission from the semiconductor laser during installation and servicing. Unlike more familiar laser devices, such as solid-state and gas lasers, the emission pattern of a semiconductor laser results in a highly divergent beam. In a divergent beam, the irradiance (power density) decreases rapidly with distance. The greater the distance, the less energy will enter the eye, and the less potential risk for eye injury. Inadvertently viewing an unterminated fiber or damaged fiber with the unaided eye at distances greater than 5 to 6 inches normally will not cause eye injury provided the power in the fiber is less than a few milliwatts at the near IR wavelengths and a few tens of milliwatts at the far IR wavelengths. However, damage may occur if an optical instrument such as a microscope, magnifying glass or eye loupe is used to stare at the energized fiber end.

> **Important!** *Use of controls, adjustments and procedures other than those specified herein may result in hazardous laser radiation exposure.*

Laser safety precautions for enclosed systems

Under normal operating conditions, optical fiber telecommunication systems are completely enclosed; nonetheless, the following precautions shall be observed:

1. Because of the potential for eye damage, technicians should not stare into optical connectors or broken fibers.
2. Under no circumstance shall laser/fiber optic operations be performed by a technician before satisfactorily completing training in laser safety.
3. Since viewing laser emissions directly in excess of Class I/1 limits with an optical instrument such as an eye loupe greatly increases the risk of eye damage.

Laser safety precautions for unenclosed systems

During service, maintenance, or restoration, an optical fiber telecommunication system is considered unenclosed. Under these conditions, follow these practices:

1. Only authorized, trained personnel shall be permitted to do service, maintenance and restoration. Avoid exposing the eye to emissions from unterminated, energized optical connectors at close distances. Laser modules associated with the optical ports of laser circuit packs are typically recessed, which limits the exposure distance. Optical port shutters, Automatic Power Reduction (APR), and Automatic Power Shut Down (APSD) are engineering controls that are also used to limit the emissions. However, technicians removing or replacing laser circuit packs should not stare or look directly into the optical port with optical instruments or magnifying lenses. (Normal eyewear or indirect viewing instruments such as Find-R-Scopes are not considered magnifying lenses or optical instruments).
2. Only authorized, trained personnel shall use optical test equipment during installation or servicing since this equipment contains semiconductor lasers. (Some examples of optical test equipment are Optical Time Domain Reflectometers (OTDR's), Hand-Held Loss Test Sets).
3. Under no circumstances shall any personnel scan a fiber with an optical test set without verifying that all laser sources on the fiber are turned off.
4. All unauthorized personnel shall be excluded from the immediate area of the optical fiber telecommunication systems during installation and service.

Consult ANSI Z136.2 American National Standard for Safe Use of Lasers in the U.S. or outside the U.S., IEC-60825, Part 2 for guidance on the safe use of optical fiber optic communication systems in the workplace.

Optical specifications of the internal laser circuit packs:

Laser circuit pack code	Wavelength (nm)	Output power (mW)	Fiber type core/cladding diameter (µm)	Connector type	FDA class/IEC hazard level
S1.1	1310	0.16	SM(9/125)	SC, FC, ST	I/1
S4.1	1310	0.16	SM(9/125)	SC, FC, ST	I/1
L1.2	1550	1.6	SM(9/125)	SC, FC, ST	I/1
L4.2	1550	1.6	SM(9/125)	SC, FC, ST	I/1

Lucent Technologies Metropolis® AM 1 Plus complies with FDA/CDRH 21 CFR 1040.10 and 1040.11 as Class I and IEC 60825-1 as a Class 1 Laser Product.

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2 System overview

Overview

Purpose

This chapter introduces the Network Element (NE) WaveStar® ADM 16/1. For more information about applications of the WaveStar® ADM 16/1 see the Applications and Planning Guide.

Topics

The main topics covered in this chapter are:

- A short overview of the network element in general.
- The features and benefits of the network element.
- An overview is given of possible applications of the network element.
- A functional description is given for each unit that can be used in the network element. In case there is more than one type for a specific unit, this also is described.
- An overview of the technical data of the network element is given. This includes information on the interfaces of the system, physical design, power requirements, environmental conditions, requirements regarding the performance of the system and requirements regarding the local management system ITM-CIT.
- The aspects related to the management of the network element are described.

Contents

Section: Introduction to the WaveStar® ADM 16/1

Overview

Purpose

The WaveStar® ADM 16/1 system is designed to flexibly multiplex synchronous G.703 and plesiochronous G.702 tributary signals and/or LAN signals into 2.5 Gbit/s (STM-16) signals.

Contents

Design

Introduction

The WaveStar® ADM 16/1 can be used for the following:

- Terminal applications
- Broadcasting applications
- Payload concatenation
- Add/drop applications
- Hubbing application
- Tributary interface mixing
- Ring closure
- Dual Node Interworking (DNI)
- Small cross-connect
- Bandwith on demand.

The WaveStar® ADM 16/1 is a useful element for building efficient and flexible networks because of its wide signal capacity. Although the WaveStar® ADM 16/1 is designed for STM-16 applications, it can also be used in STM-4 and STM-1 networks. Together with WaveStar® OLS 80G or OLS 400G it can be used in Dense Wavelength Division Multiplex applications.

Subrack development

The WaveStar® ADM 16/1 is mounted in a self-supporting subrack which fits in a standard ETSI rack. The dimensions of this subrack, including cabling and bending radius, are HxWxD= 1000x500x545 mm.

Rack development

The WaveStar® ADM 16/1 can be mounted in the standard ETSI rack. Two WaveStar® ADM 16/1 subracks fit in one 2200 mm or 2600 mm height ETSI rack (H x W x D = 2200 or 2600 x 600 x 600 mm). An earthquake-proof rack with the same dimensions is also available.

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Section: Features

Overview

Purpose

This section provides information on the WaveStar® ADM 16/1 features. The feature lists are grouped into line and tributary, protection, synchronization and timing, bandwidth management, operations interfaces and miscellaneous features.

Contents

Line and tributary interfaces

Introduction

This chapter lists the interfaces which can be used on the line and the tributary side of the WaveStar® ADM 16/1.

Line interfaces

Optical interfaces on the line side, attenuation ranges measured at 1x10-10:

- SI-L 16.1/1C (1310 nm, according to table L 16.1 in ITU-T G.957)
- SI-L 16.2/1C (1550 nm, according to tables L 16.2 and L 16.3 in ITU-T G.957)
- SI-L 16.3/1B (1550 nm, 4 dB better than tables L 16.2 and L16.3 in ITU-T G.957)
- SI-L 16.3/1Y (1550 nm, 6 dB better than tables L 16.2 and L 16.3 in ITU-T G.957)
- SI-EML U 16.2/1 (1550 nm, for interworking with the Booster Pre-Amplifier, unit for U 16.2 and U 16.3 ITU-T G.691)
- LPBA-U 16.2/1 Booster Pre-Amplifier for bridging ultra long distances (up to 160 km)
- LBA V-16.2 Booster based on V-16.2 for bridging long distances (up to 120 km)
- SI-16EML80.x/1 (DWDM, ITU-T G.692, x=16)
- SI-16EML 9xxx/1 (DWDM, ranging from 191.90 Thz (1530 nm) to 195.85 THz (1565 nm).

Tributary interfaces

Interfaces on the tributary side are the following:

- 1.5 Mbit/s, 100 ohms conversion via Paddle Boards; maximum 63 x 1.5 Mbit/s channels per unit; maximum capacity per shelf 504 x 1.5 Mbit/s
- 2 Mbit/s, 75 or 120 ohms conversion via Paddle Boards; maximum 63 x 2 Mbit/s channels per unit; maximum capacity per shelf 504 x 2 Mbit/s
- (6 + 6) x 34 Mbit/s/45 Mbit/s 75 ohms; maximum 6 x 34 Mbit/s and/or 6 x 45 Mbit/s channels per unit; maximum capacity per shelf 48 x 34 Mbit/s and 48 x 45 Mbit/s
- 34 Mbit/s 75 ohms; maximum 6 x 34 Mbit/s channels per unit; maximum capacity per shelf 96 x 34 Mbit/s
- 45 Mbit/s 75 ohms; maximum 6 x 45 Mbit/s channels per unit; maximum capacity per shelf 96 x 45 Mbit/s
- 45 Mbit/s 75 ohms; maximum 12 x 45 Mbit/s channels per unit; maximum capacity per shelf 96 x 45 Mbit/s

- STM-0 (51.8 Mbit/s) optical/electrical conversion via Paddle Boards; maximum 12 x STM-0 per unit; maximum capacity per shelf 96 x STM-0
- Ethernet connection supporting 10/100 Base-T
- 2 x 1 Gigabit Ethernet interface per unit; maximum capacity is limitated by the shelf's backplane to 4 x VC4 (600 Mbit/s). If both interfaces are used this maximum must be shared between both interfaces.
- 140 Mbit/s 75 ohms; maximum 4 x 140 Mbit/s channels per unit; maximum capacity per shelf 32 x 140 Mbit/s
- STM-1 75 ohms; maximum 4 x STM-1 channels per unit; maximum capacity per shelf 2016 x VC-12.
- STM-1 the optical to electrical conversion is done via Paddle Boards; maximum 4 x STM-1 channels per unit; maximum capacity per shelf 2016 x VC-12
- STM-4 optical; one STM-4 channel per unit; maximum capacity per shelf 8 x STM-4 (possible to add/drop directly from STM-16 level).

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Protection

Introduction

This chapter lists the protection mechanisms of the WaveStar® ADM 16/1.

Traffic protection

Traffic protection can be set to the following:

- Point-to-point Multiplex Section Protection (MSP)
  - A 1 + 1 MSP protection relation can be set up between a pair of STM-16 interfaces. The applied protocol is according to ITU-T G.841/clause 7.1.
  - A 1 + 1 MSP protection relation can be set up between a pair of STM-1 or STM-4 optical tributary interfaces. The applied protocol can be selected per interface according to ITU-T G.841/clause 7.1 or to G.841/Annex B.
  - A 1 + 1 MSP protection relation can be set up between a pair of STM-0 optical tributary interfaces. The applied protocol is according to ITU-T G.841/Annex B.
- VC-n SNC/N protection switching Sub-network protection switching is selectable per VC using non-intrusive monitoring (SNC/N). This protection facility is non-reverting. The VC-N SNC protection in rings analog to 1 + 1 point-to-point schemes, the head-end is dual fed, while the tail-end is switched. SNC protection can be applied per individual VC pair, for lower order VCs the total number of VCs that can be SNC protected is limited only by the lower order cross-connect size. SNC/N protects against:
  - Server failures
  - Open matrix connections (unequipped signal)
  - An excessive number of bit errors (signal degrade)
  - Mis-connections (trail trace identifier mismatch)
- Multiplex Section Shared Protection Ring (MS-SPRING) In two fiber add/drop ring applications, the VC-4s on the ring can be protected by the MS-SPRING protection mechanism. Rings protected by MS-SPRING may have a maximum of 16 NEs. Within STM-16 MS-SPRING, channel 1 is protected by channel 9, channel 2 by 10 etc. up to channel 8 by 16. Each channel can be included or excluded from the MS-SPRING protection mechanism. The protection channel capacity can be used for low priority traffic.

- Dual Node Interworking (DNI) with drop and continue The DNI with drop and continue scheme protects the interconnection between two subnetworks within which the traffic is already protected by a network protection scheme. The advantage of using DNI protection in a network is that there are no single point of failures anymore. Sub-networks without DNI protected interconnections can be upgraded in-service to have DNI protected interconnections. DNI is supported in the following cases:
  - Between two MS-SPRING protected STM-16 rings
  - Between a MS-SPRING STM-16 ring and a lower order SNCP protected subnetwork.
- The WaveStar® ADM 16/1 supports the cascading of two protection schemes in one network element without the need for multiple passes through the cross-connects. The following schemes can be cascaded:
  - MS-SPRING or MSP on aggregates and MSP on tributaries
  - MS-SPRING or MSP on aggregates and LO-SNCP or HO-SNCP
  - MSP on tributaries and LO-SNCP or HO-SNCP
  - Two SNCP schemes on the same VC-n level.

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Synchronization and timing

Introduction

This chapter lists the features on synchronization and timing of the WaveStar® ADM 16/1.

Synchronization and timing

The WaveStar® ADM 16/1 can be provisioned for:

- Two external synchronization inputs at 2048 kHz or 2048 kbit/s
- Two external synchronization inputs 64 kHz composite clock
- Two external synchronization outputs at 2048 kHz or 2048 kbit/s
- Two external synchronization outputs 6312 kHz
- Internal clock with Stratum-3 hold-over performance
- Internal oscillator that can be set to the free running mode
- Internal oscillator that can be set to the locked mode
- Independent reference for external synchronization output. Suitable inputs are one of the 2 Mbit/s data inputs or one of the STM-N inputs (line or tributary)
- External synchronization output locked to internal clock
- Re-timing of 2 Mbit/s traffic signals
- Reference signal switching
- Timing link switching for internal clock
- Timing link switching for external synchronization output
- Support of ETSI SSM algorithm
- Assignment of SSM values to references
- Force outgoing SSMs to DUS
- Synchronization events log.

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Bandwidth management

Introduction

This chapter lists the features on bandwidth management (capabilities of the cross connect), of the WaveStar® ADM 16/1.

Bandwidth management

The WaveStar® ADM 16/1 is capable of:

- Dual staged cross connect architecture i.e. separate VC-4 higher order and VC-3, VC-2 and VC-12 lower order cross connect function
- Non-blocking VC-4 cross connect capability
- Time Slot Interchange on VC-4 through connection
- In service upgradable lower order VC-3, VC-2 and VC-12 cross connect capability
- Bi-directional cross connecting
- Mixing and grooming of various payloads
- Higher order cross connect size 64x64 VC-4s
- Lower order cross connect size 2016x2016 VC-12 equivalents
- 0:1 and 0:2 terminal application with fixed cross connect
- Externally modulated lasers for dense wavelength division multiplex (for the WaveStar® OLS 80G or WaveStar® OLS 400G system)
- Protection access on MS-SPRING
- Higher order and lower order broadcast functionality.

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Operations interfaces

Introduction

The WaveStar® ADM 16/1 offers a wide range of operations interfaces to meet the needs of an involving operations system (OS) network.

Operations interfaces

The operations interfaces include:

- Equipment indicators (faceplate LEDs) and User Panel
- Q- interface for interconnection with the Subnetwork Controller, allowing centralized operations, maintenance and provisioning
- F- interface for the local workstation, allowing local operations, maintenance and provisioning
- Loop-backs are possible at VC-n level or AU-4 level. Loop-backs at VC-n can be used to set far or near end loop-backs. Loop-backs at AU-4 can be used to set a loop-back within the higher order cross-connect.
- Station alarm interfaces.

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Miscellaneous features

Miscellaneous features

The miscellaneous features include:

- Performance Monitoring (G.821)
- Programmable NSAP address
- Support for STM-16 regenerator (SLM-16 or PHASE LR-16)
- Auto recovery after input power failure is restored
- Alarm categories for indication of alarm severity
- Miscellaneous Discrete inputs and outputs
- Zone-4 earthquake protection certification
- Front/rear Access for installation and service purposes
- Engineering Order Wire interface V10/V11 (E1 or E2 bytes access)
- User Channel interface (F1 and F2 bytes).

□

Section: System architecture and applications

Overview

Purpose

The Synchronous Digital Hierarchy (SDH) specifies a standard base rate and frame format together with a multiplexing scheme. This specification creates a modular family of rates and formats available for use with a standard line interface. The following section outlines characteristics of these networks and indicate which network topologies are commonly used in each network. It is then shown how these topologies are supported by the WaveStar® ADM 16/1 system.

Frame format

The SDH frame format makes it possible to identify and track the component bytes that form individual AUs or TUs in the aggregate signal. Identifying these bytes makes it easy to identify and extract individual VCs from time slots in one frame and insert them into time slots in another frame by time switching techniques between STM line streams.

The facility to identify and extract or insert individual VCs in a synchronous transport module lends itself to the implementation of SDH add/drop multiplexers. Combining add/drop multiplexers with digital cross connect systems, flexible network structures can be built that allow increased network availability and responsiveness to unexpected demand for existing or new services.

Contents

Basic architecture

Introduction

This chapter provides a more detailed view of the system composition and the subrack configuration of the WaveStar® ADM 16/1.

The WaveStar® ADM 16/1 is an add/drop multiplexer built around a cross connect facility. The WaveStar® ADM 16/1 provides flexible interface units, local and remote management, and control facilities via the Q- and F-interfaces and Embedded (or Data) Communication Channels (ECC or DCC).

Cross-connect

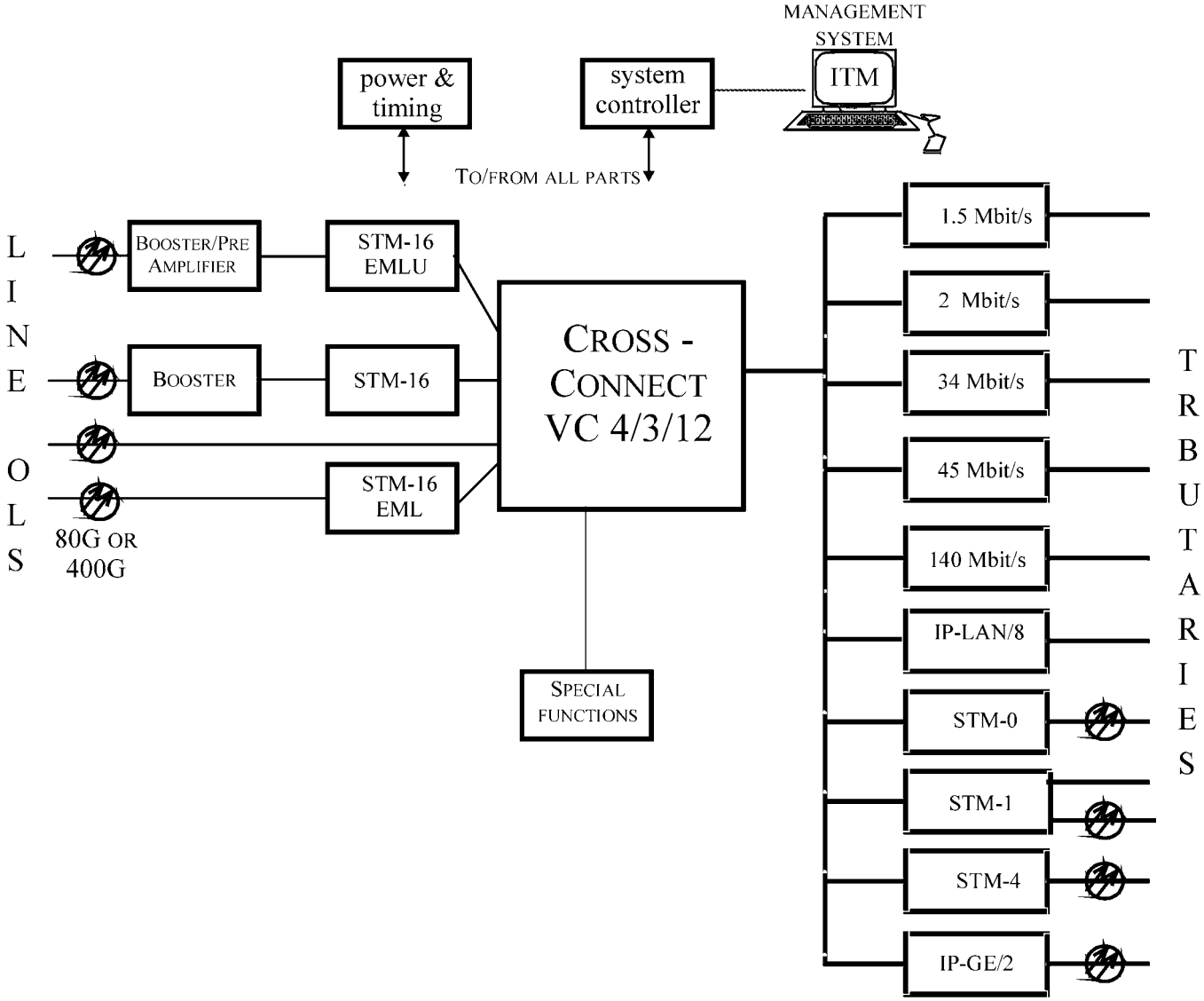
The cross-connect core of the Add/Drop Multiplexer (ADM) gives the WaveStar® ADM 16/1 the capacity to connect VC4 or VC12 signals between any tributary port or line port. This feature is known as Time Slot Assignment (TSA). In addition, it enables cross-connect of VCs between the two line signals (known as Time Slot Interchange: TSI). The WaveStar® ADM 16/1 can also be used as terminal multiplexer or as a small cross-connect. The next figure shows the basic WaveStar® ADM 16/1 architecture.

Core units

The system controller, the cross-connect unit and the power and timing unit are the core units and are always present in the WaveStar® ADM 16/1. The number and type of tributary interface units and the line interface units depend on the application. The 0:1 terminal application has one line interface unit connected to only one remote NE. The two fiber add/drop application has two line interface units, each connected to a different remote NE.

Schematic view

Figure 2-1 Basic WaveStar® ADM 16/1 architecture



Terminal applications

Introduction

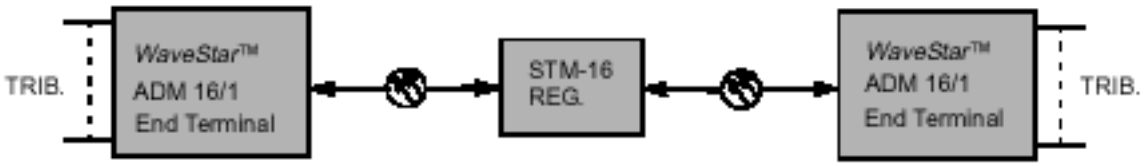
The WaveStar® ADM 16/1 can be configured to provide an STM-16, STM-4 or STM-1 point-to-point applications

Point-to-point

The next figure shows the terminal application of the WaveStar® ADM 16/1 in a network. The STM-16 point-to-point application is served by two 0x1 end terminals. The regenerator (SLM-16 or PHASE LR-16) increases the distance between the terminals. The regenerator is managed through the end terminals. The in-shelf optical booster pre-amplifier makes it possible to span longer distances without a regenerator.

Example

Figure 2-2 End terminal 0x1 STM-16

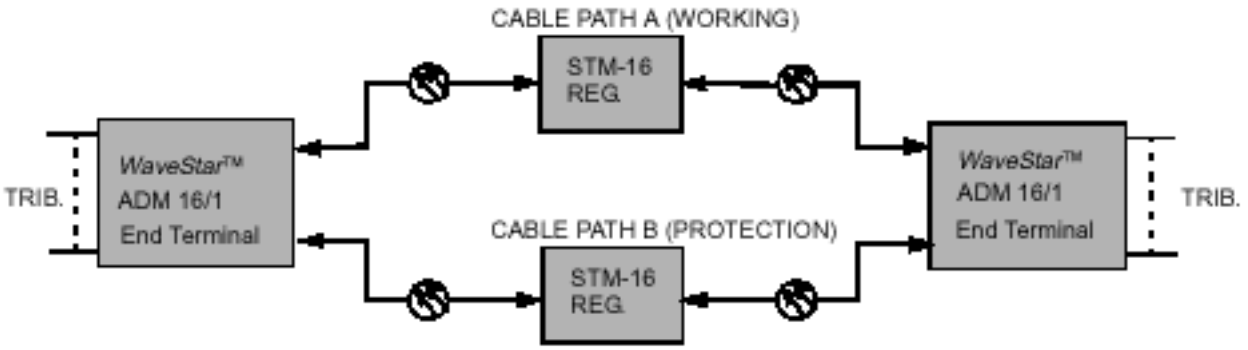


1+1 MSP protected point-to-point

The STM-16 1+1 MSP point-to-point application is served by two end terminals, each end terminal is equipped with two STM-16 lines, one for service and one for protection.

Example

Figure 2-3 1+1 MSP protected end terminal



□

Broadcasting applications

Introduction

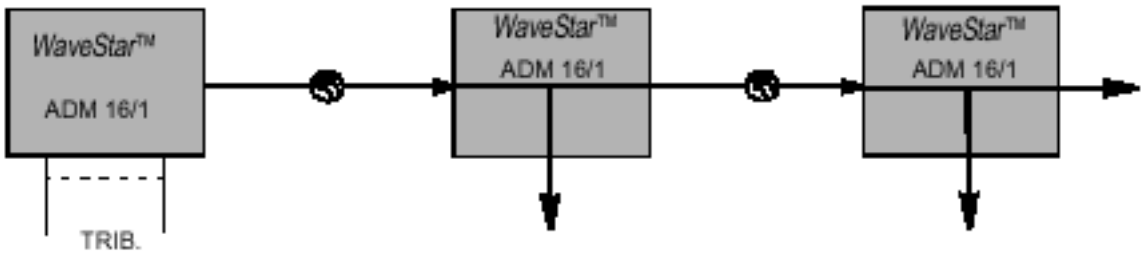
The WaveStar® ADM 16/1 has broadcast functionalities for VC-12, VC-3 and VC-4 containers. There are two broadcast modes possible, controlled by either the ITM-CIT or the ITM-SC.

Uni-directional broadcast

A particular incoming VC is retransmitted in multiple (n=2 or more) directions. The return channels remain unused.

Example

Figure 2-4 WaveStar® ADM 16/1, Uni-directional Broadcast

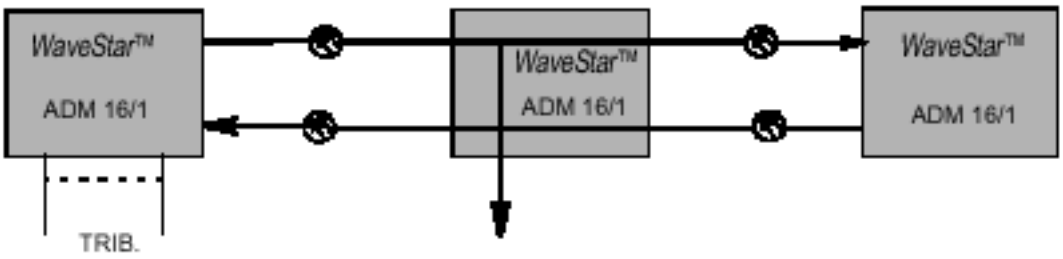


1 : 2 broadcast

This is meant for test purposes. One of the directions of a bi-directional signal is broadcasting to an unused system output.

Example

Figure 2-5 WaveStar® ADM 16/1, 1 : 2 Broadcast



Important! Setting up or breaking down a broadcast does not affect the traffic in the other branches.

□

Payload concatenation

Introduction

To create larger payload capacity than provided by a single VC-4 (149.760 Mbit/s) the SDH standard contiguous concatenation is used. In this method multiple VC's are taken together to create a bigger capacity transport pipe.

Contiguous concatenation

Contiguous concatenation is only applicable at the VC-4 level. In this case the payload is divided over multiple VC-4's which are carried over the network as a single block, where the VC-4's are mapped in adjacent AU-4 envelopes. This contiguous group of VC-4's has only one single column of path overhead and also has a single pointer, which controls the phase of the complete block. Contiguously concatenated VC-4's are denoted as VC-4-4c. The c indicates the fact that contiguous mapping is used.

Transport of concatenated VC-4's

To transport VC-4-4c payloads through the SDH network, it is necessary that all SDH network elements that are passed through support this mapping. The WaveStar® ADM 16/1 supports transport of VC-4-4c (599.040 Mbit/s) via the STM-16 aggregate interfaces and STM-4 tributary interfaces. The VC-4-4c payload can be added or dropped via the STM-4 tributary. In addition, protection of VC-4-4c is supported within the MS-SPRing protection scheme in an STM-16 ring. Also SNC/N protection is supported to protect the add/drop path via the tributaries, or in case MS-SPRing is not used. Lastly, passing VC-4-4c's can be non-intrusively monitored, both for faults and performance.

□

Add/drop applications

Introduction

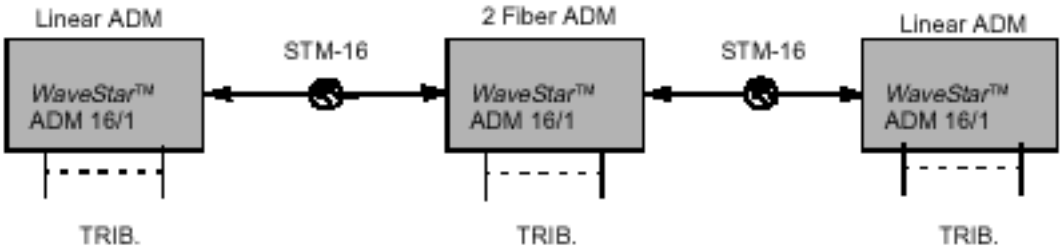
The WaveStar® ADM 16/1 two fiber add/drop is a flexible product that can be used for ring and non-ring applications, for example for point-to-point linear applications. Linear applications can be upgraded to conventional rings.

Linear add/drop

Both end NEs are WaveStar® ADM 16/1 systems functioning as a 0x1 terminal. The intermediate node(s) are two fiber ADM NEs. There is no route diversity.

Example

Figure 2-6 WaveStar® ADM 16/1 in linear add/drop application

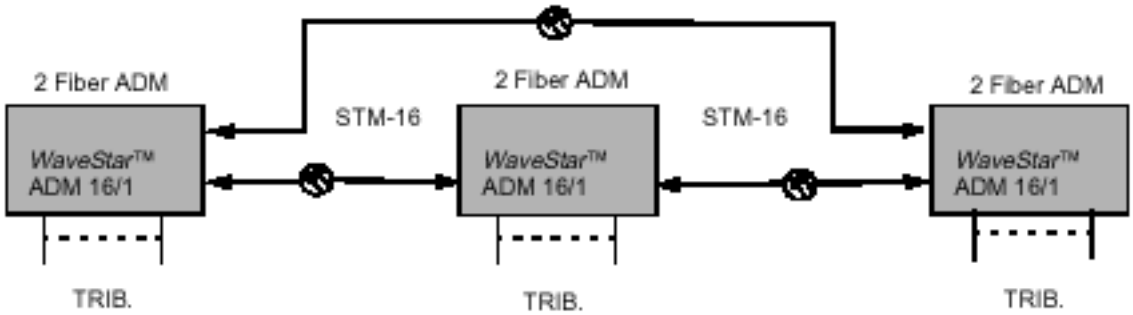


Folded ring

Folded rings have no geographical fiber diversity. WaveStar® two fiber ADM 16/1 NEs enable the user to create folded rings that can later easily evolve into full rings. In a folded ring, all fibers run in the same path, such as a cable sheath between the NEs. Because the network length may be long, regenerators may be needed in the path between the end NEs.

Example

Figure 2-7 WaveStar® ADM 16/1 in folded ring application



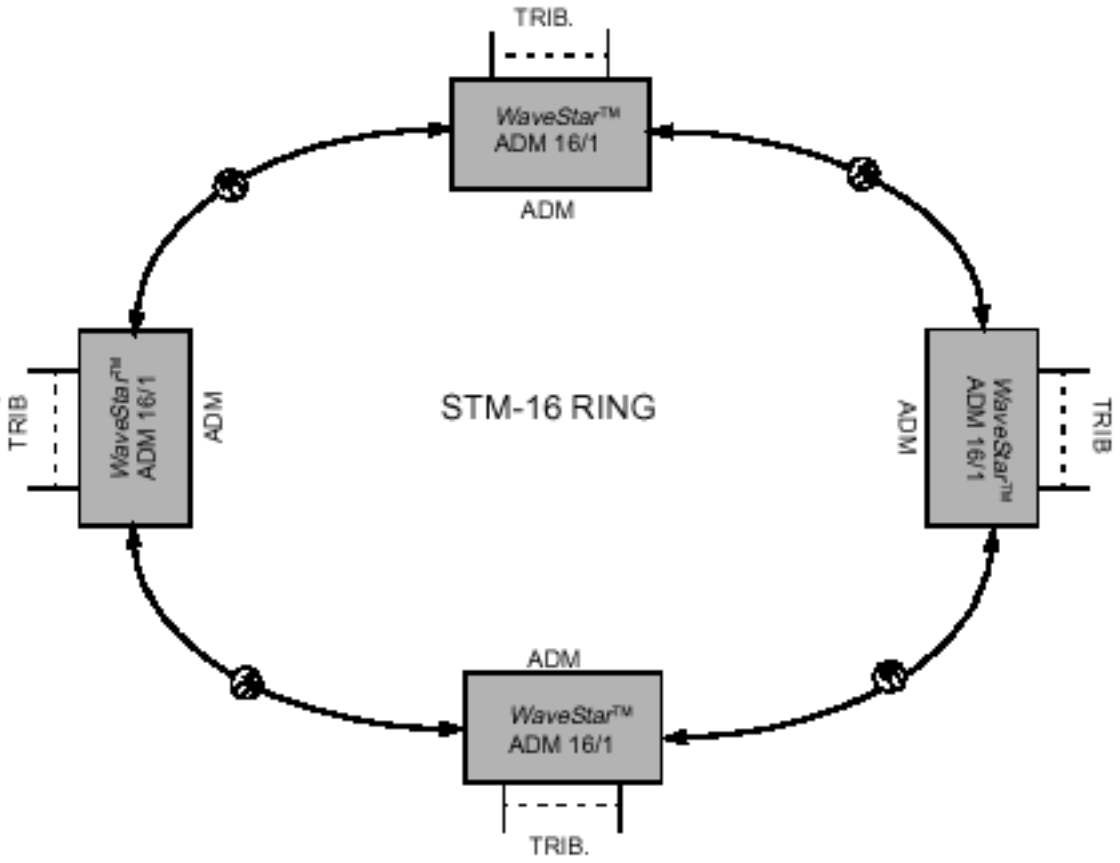
Ring application

Rings provide redundant bandwidth and/or equipment to ensure traffic availability in the event of any transmission or timing failure,

including a fiber cut or a node failure. The NEs in the ring are configured as a two fiber WaveStar® ADM 16/1. At STM-16 level, the MS-SPRING protection mechanism is used. MS-SPRING may have 2 to 16 NEs in the ring. In order to allow the customer to utilize all available bandwidth, the ring protection schemes can be provisioned independently at any required section or path level. At lower order path levels, the SNC protection mechanism may be used.

Example

Figure 2-8 WaveStar® ADM 16/1 in ring application



□

Hubbing application

Introduction

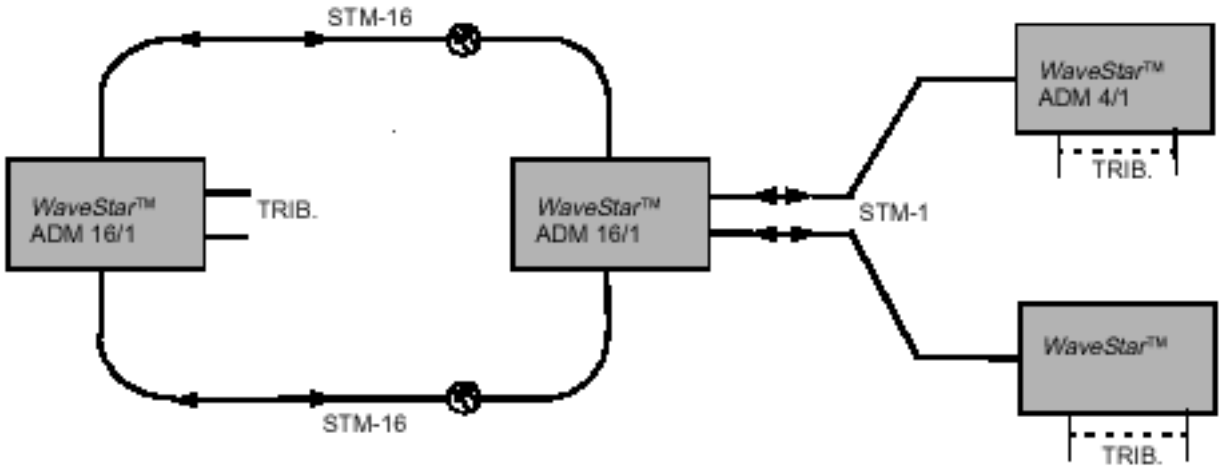
The WaveStar® ADM 16/1 can be configured to function as a hub-terminal at STM-16 level by deploying the WaveStar® ADM 16/1 as an end terminal or as an add/drop terminal.

Hubbing

The WaveStar® ADM 16/1 system can be configured to function as a hub terminal at STM-16 level. The WaveStar® ADM 16/1 can serve as cluster of, for example, WaveStar™ ADM 4/1 multiplexers located at remote sites. All traffic for the WaveStar® ADM 4/1 multiplexers passes through the hub using either electrical or optical interfaces.

Example

Figure 2-9 WaveStar® ADM 16/1 in hubbing application



□

Tributary interface mixing

Introduction

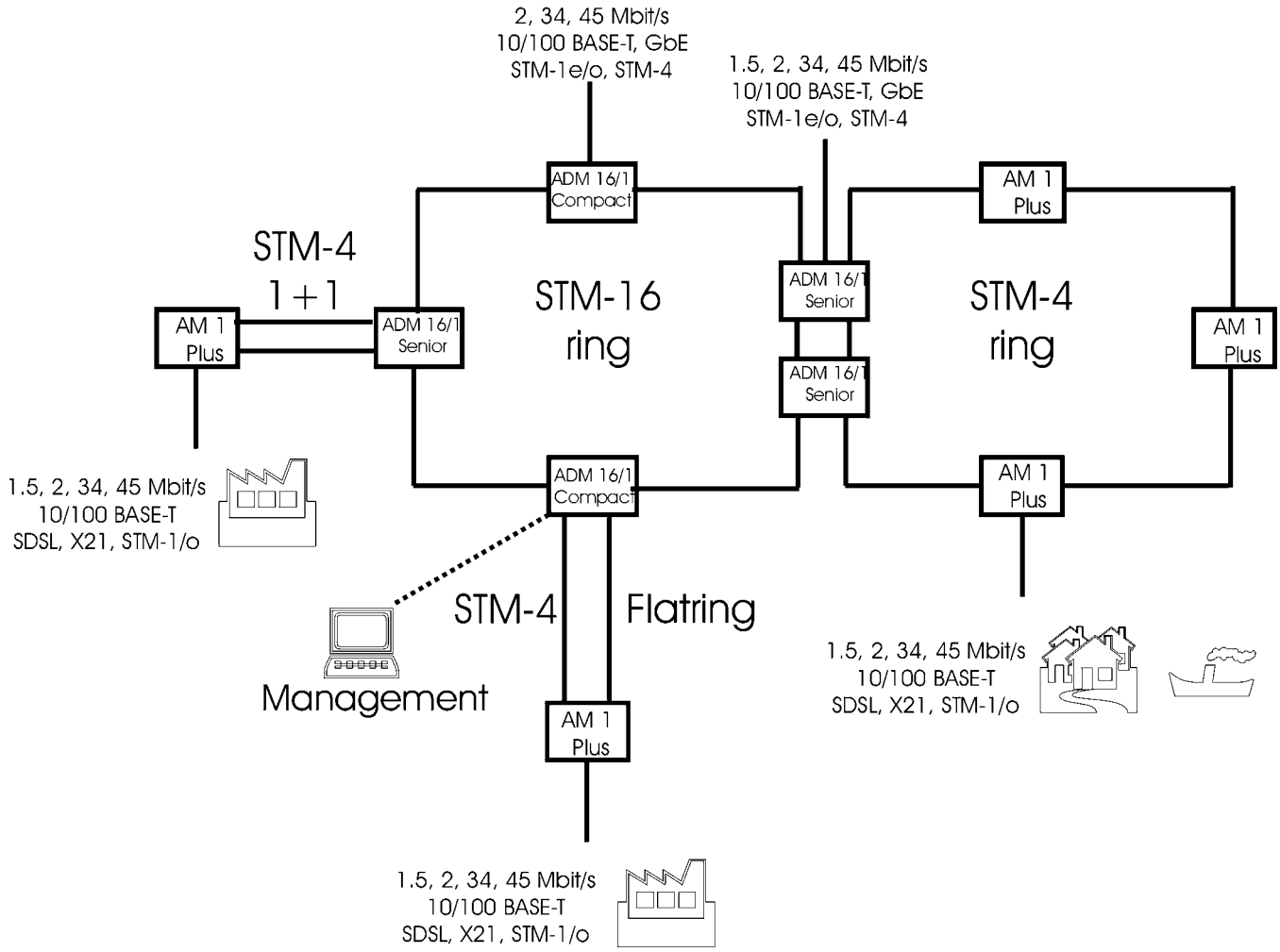
The WaveStar® ADM 16/1 supports a mix of 1.5, 2, 34, 45, 10/100 Base-T, STM-0, 140, STM-1, STM-4, 1000 Base-X tributary interface input and output signals. It is possible to mix these interfaces in the same subrack. Mixing can be done for all platforms e.g. terminal or add/drop. Also, a signal can enter a WaveStar® ADM 16/1 network element through one type and exit through another type (if the payload that is being carried is compatible with both interface types). Mixing is supported not only within a terminal, but also between terminals.

Capabilities

Tributary interface mixing allow planners to improve their equipment deployment based on the needs of the particular application. For example network needs may require SDH deployment in one area before others. The PDH interfaces (140 Mbit/s) at one end of a circuit

within a WaveStar® ADM 16/1 can be upgraded to SDH interfaces (STM-1) without any changes at the other end.

Figure 2-10 WaveStar® ADM 16/1 tributary interface mixing



Ring closure

Introduction

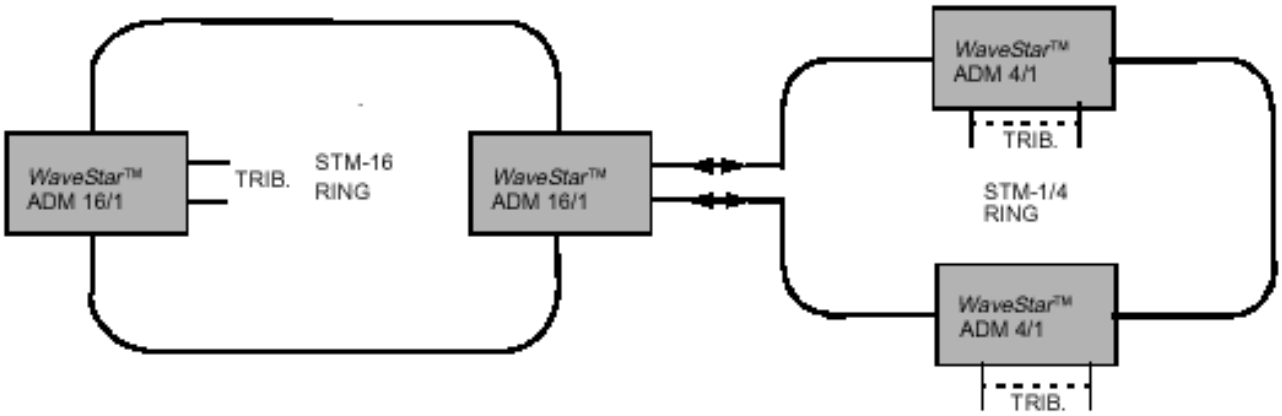
Two rings working at different or the same line speed can be interconnected by a single network element.

Ring closure

The WaveStar® ADM 16/1 system has the possibility to work as a ring closure network element because the architecture of the system makes it possible to have for instance 2 x STM-16 and 2 x STM-1 interfaces in one subrack.

Example

Figure 2-11 WaveStar® ADM 16/1 used as a ring closure network element



□

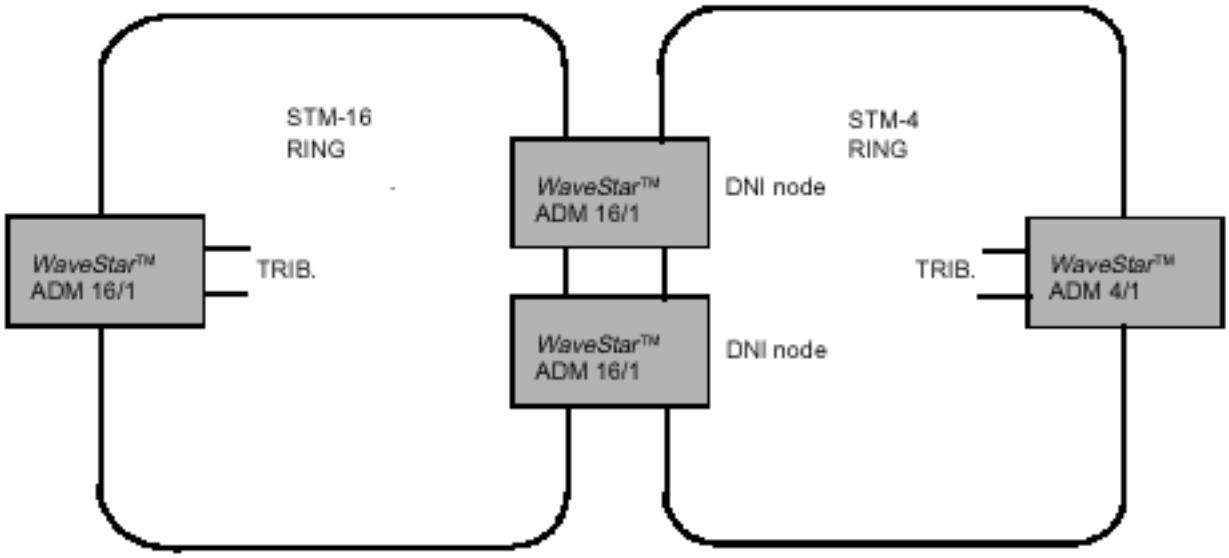
Dual Node Interworking (DNI)

Introduction Two rings working at different or the same line speed can be interconnected by two network elements, working in add/drop mode and protected by the Dual Node Interworking protection mechanism.

DNI The DNI protection scheme protects the interconnection between two subnetworks within which the traffic is alreasy protected by another network protection. This means that traffic going from one node to another may be MS-SPRING or path (SNCP) protected and will, in this case, be extra protected in the nodes interconnecting both rings by activating the DNI protection mechanism in these two nodes.

Example

Figure 2-12 WaveStar® ADM 16/1 used as DNI network



□

Dense Wavelength Division Multiplexing (DWDM)

Introduction

Because the demand from customers for extra capacity is growing every day, there is a limiting factor for most network operators: the number of available fibers.

WaveStar® OLS 80G DWDM system

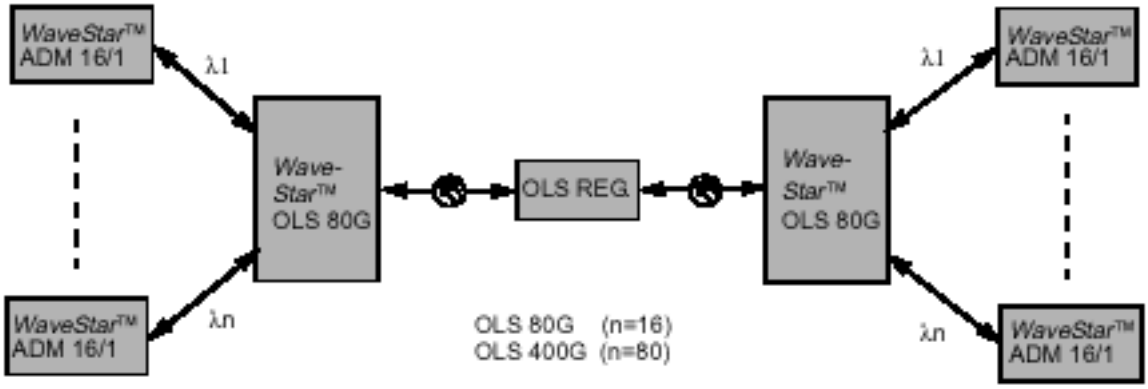
By using the WaveStar® OLS 80G system together with the WaveStar® ADM 16/1 system, it is possible to enhance the capacity by a factor 16. The WaveStar™ OLS 80G system along with the WaveStar® ADM 16/1 system enhances the span capacity by a factor of 16. The line interface units with externally modulated lasers, which all have individual wavelengths, are directly connect the system to the WaveStar® OLS 80G system. Distances of up to 640 km can be bridged using the WaveStar™ OLS 80G together with the WaveStar® ADM 16/1.

WaveStar® OLS 400G DWDM system

The WaveStar® OLS 400G enables carriers to simultaneously mix and match combinations of 2.5 Gbit/s (STM-16) and 10 Gbit/s (STM-64) SDH channels over one fiber. The WaveStar® 400G system gives any service provider the flexibility to upgrade to 80 STM-16 channels.With operational optical features such as optical add/drop and gain control build into the WaveStar® 400G system, service provides can automatically tailor channel configurations to mach bandwidth needs. The WaveStar® 400G is available with a network management system for integrated administration of the optical an SDH layers.

Example

Figure 2-13 Dense Wavelength Division Multiplex application



□

Small cross-connect

Introduction

The cross-connect unit is the core unit of the WaveStar® ADM 16/1 system. The cross-connect unit functionally consists of two parts: a higher- and a lower order cross-connect, although physically the cross-connect unit is a single circuit pact. The WaveStar® ADM 16/1 network element can be used to function as a small cross-connect system. At VC-4 level, a maximum cross-connect capability of 64 x 64 is available. For lower order VCs (VC-3 and VC-12) a maximum of 32 x 32 VC-4s may be opened at any time for grooming purposes.

Small cross-connect

Within a single shelf a VC-4, VC-3, VC-12 cross-connect can be realized to cross-connect a maximum of 64 x STM-1 equivalents. A maximum of 32 x VC-4s can be groomed in the lower order cross-connect. Cross-connections can be set bi-directional.

Higher order cross-connect

64 x STM-1 equivalents can be connected to the higher cross-connect as follows:

- 16 x STM-1 derived from the east
- 16 x STM-1 derived from the west
- 32 x STM-1 derived from the tributary side (8 slots with four STM-1 circuits per circuit pack)

Hence, in total 64 STM-1 equivalent signals can be connected to the higher order cross-connect and can be cross-connected at VC-4 level.

Lower order cross-connect

When the contents of some of these VC-4s needs to be groomed or Time Slot Interchanged (TSI), a maximum of 32 x bi-directional VC-4s can be connected to the lower order cross-connect for this purpose.

□

Section: Subrack and unit description

Overview

Purpose

This section provides more detailed information of the shelf complements and of the units in the WaveStar® ADM 16/1. The physical design of the subrack and units are described including the different paddle boards the user panel and the inter connecting panel (I/O Box).

Contents

Subrack layout

Introduction

The WaveStar® ADM 16/1 contains the high-density 9 Tributary add/drop (9TAD) subrack with D700 construction. The construction provides the facilities to house the WaveStar® ADM 16/1 units (circuit packs).

Subrack

Each subrack consists of mechanics, a backplane, indicators, and an inter connecting panel (I/O box). Via the inter connecting panel access to overhead channels, station alarms, MDO/MDI and the Q-LAN is possible. Cabling is pre-fabricated and is connected to the rear of the subrack. If protection or impedance conversion is needed, paddle boards are inserted between the customer cabling and the backplane. The following figure shows the 9TAD subrack, including:

- inter connecting panel
- one slot for the system controller (SC) unit
- two slots for the cross-connect unit (CC), one working and one for equipment protection
- two slots for the line interface unit (LS)
- nine slots (including protection) for the tributary interface units (TRIB)
- two slots for the power and timing unit (PT), one working and one for equipment protection
- three fans.

Inter connection panel (I/O box)

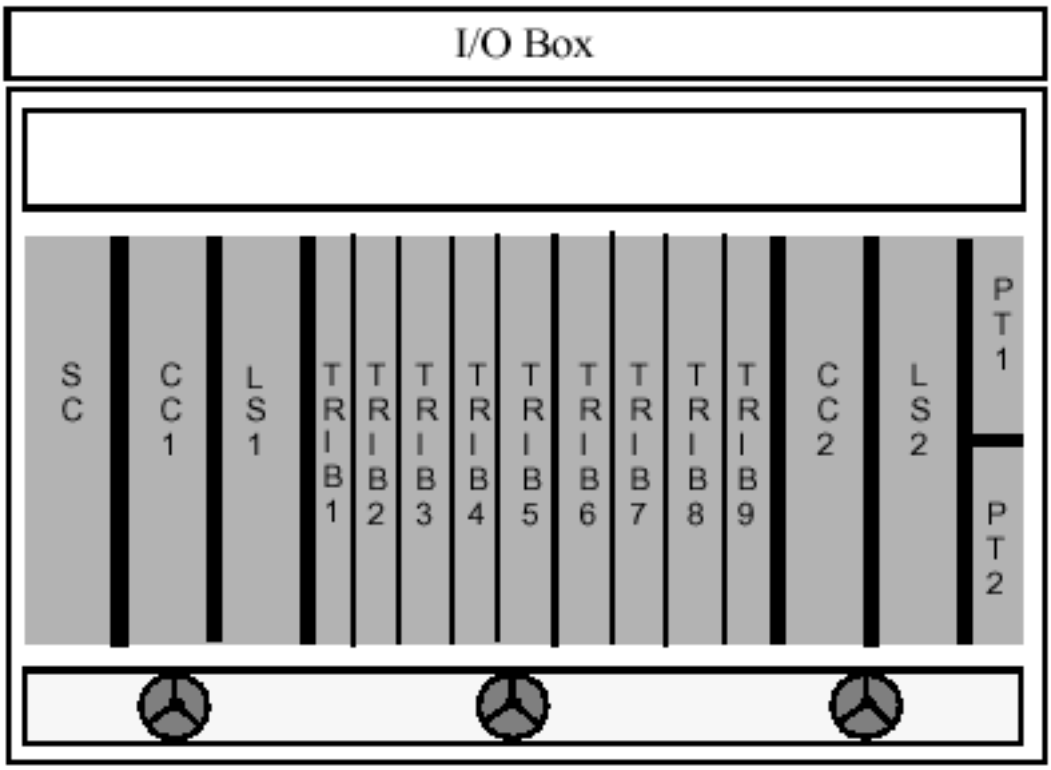
The inter connection panel forms the interface for the permanent and semi-permanent supervision interfaces of the WaveStar® ADM 16/1. The layout of the inter connection panel is different for the two types of subracks.

The interconnection panel provides connections for:

- the station clock in- and outputs
- the station alarms
- the user overhead bytes V.11 provisionable
- the user overhead bytes G.703 provisionable
- the miscellaneous in- and outputs
- the ITM-CIT
- the ITM-SC
- the Q-LAN
- the powerblock only for subrack EFA4 (the powerblock for the EFA2 is on the rear of the subrack itself).

Subrack view

Figure 2-14 WaveStar® ADM 16/1 high density 9 trib. subrack layout



□

System Controller (SC)

Introduction

The system controller provisions and controls all units via a duplicated LAN-bus. It also controls the user panel (located at the front of the SC) and provides operational interfaces.

System Controller

The SC facilitates first line maintenance by several LEDs and buttons on the user panel. General status and alarm information is displayed. Various controls and an F-interface connector, for the ITM-SC, are located on this user panel. The SC facilitates second line maintenance by communication with the centralized management system ITM-SC and/or ITM-NM. Necessary for the routing of management information between network elements and their management system is the Data Packet Switch (DPS). The SC is not duplicated, since a malfunction does not affect service. When this unit fails transmission is maintained. The SC provides the following external interfaces:

- miscellaneous discretes (8 x input, 4 x output)
- station alarm interfaces
- Q-LAN 10 Base 2 or 10 Base T interface (for network and network element level management)
- low cost EMS F interface (for local network management)
- two F interfaces for rear and front access (for local network element management and maintenance)
- four G.703 and 2 x V.11 interfaces.

□

Cross-connect unit (CC)

Introduction

The cross-connect unit is the core of the WaveStar® ADM 16/1 system. There are three types of cross-connect units can be used in the network element:

- cross-connect unit CC-64/16
- cross-connect unit CC-64/32
- fixed cross-connect unit

The cross-connect units CC-64/16 or CC-64/32 functionally consists of two parts: a high order (HO) and a low order (LO) cross-connect, although physically the cross-connect is a single unit.

Cross-connect unit

HO and LO cross-connect are point-to-point interconnected via 32 STM-1 equivalent signals. The LO cross-connect function is a uni-directional connection facility that allows traffic to be switched/protected bi-directional.

HO VC-4s are arriving from the line or tributary units need only to be routed through the LO cross-connect if the low order VC content needs to be groomed. Otherwise the VC-4 is routed via the HO cross-connect only. Flexible routing is possible between line interface units, between a line interface unit and a tributary interface unit, and finally between tributary interface units. The architecture of the WaveStar® ADM 16/1 makes it possible to use an interface unit in almost any slot position.

To enhance system reliability, the cross-connect unit may be 1 + 1 protected by an accompanying unit in the subrack.

By exchanging the cross-connect unit and re-creating the node it is possible to enhance the system's lower-order cross-connect and thus the total cross-connect capacity.

High order cross-connect

The high order cross- (HO) connect switches VC-4s and has a capacity of 64 x 64. Tributary and line interface units are point-to-point connected to the HO cross-connect via STM-1 equivalent signals. Other functions of the HO cross-connect are: high order SNC protection switching, MS Spring protection switching, 1:1 or 1+1 protection switching, AIS insertion and non-intrusive monitoring of VC-4s including monitoring for VC-unequipped.

Low order cross-connect

The low order (LO) cross-connect CC-64/32 switches or grooms VC-3s and/or VC-12s and has a capacity of up to 2016 x 2016 VC-12 equivalents or 32 x 32 VC-4s. The low order (LO) cross-connect CC-64/16 switches or grooms VC-3s and/or VC-12s and has a

capacity of up to 1008 x 1008 VC-12 equivalents or 16 x 16 VC-4s. Other functions of the LO cross-connect are: low order SNC protection, AIS insertion and non-intrusive monitoring of low order VCs including monitoring for VC-unequipped.

Fixed cross-connect unit

The fixed cross-connect unit replaces the working cross-connect unit to provide for a 0:1 or 0:2 terminal configuration with fixed cross-connections. The 16 VC-4s of four tributary interface units are routed toward one line interface unit and the 16 VC-4s of four other tributary interface units are routed towards the other line interface unit. The protection cross-connect slot and one of the tributary slots remain unassigned. All types of tributary interface units can be used. No transmission protection is possible and only the power and timing unit can be equipment protected.

□

Line interface unit (LS) and booster pre-amplifier (LPBA)

Introduction

The WaveStar® ADM 16/1 can be equipped with STM-16 line interface units which are available in several types. To bridge very long or ultra long distances a booster or booster pre-amplifier can be used.

Line interface unit

Options for STM-16 are 1310 nm (long haul), 1550 nm (long haul and ultra long haul) and Dense Wavelength Division Multiplex. Automatic laser shutdown (ALS) is supported on all line interface units. All these units have a universal build-out connector type to support full contact (FC) or square couple (SC) connector types.

Unit types

The following line interface units are available:

Unit	Description and remarks
SI-L 16.1/1C	Long haul 2.5 Gbit/s 1310 nm, according to table L16.1 in ITU-T G.957, support of optical analog parameters
SI-L 16.2/1C	Long haul 2.5 Gbit/s 1550 nm, according to tables L16.2 and L16.3 in ITU-T G.957, support of optical analog parameters
SI-EML-U 16.2/1	Ultra long haul 2.5 Gbit/s, required for the booster pre-amplifier
SI-16EML 9xxx/1	DWDM, 2.5 Gbit/s, required for the WavStar™ 400G system, x ranges from 9190 to 9585 representing the frequencies 191.90 THz (1565 nm) to 195.85 THz (1530 nm) in steps of 50 GHz
SI-16EML 80.x/1 x=1 to 16	DWDM, 2.5 Gbit/s, required for the WaveStar® OLS 80G system for the wavelengths see the next table

Wavelengths for DWDM

Wavelengths for the SI-EML 80.x/1 line interface unit:

Channel number	Wavelength (nm)
1	1549.32
2	1550.92
3	1552.52
4	1554.13

Channel number	Wavelength (nm)
5	1555.75
6	1557.36
7	1558.98
8	1560.61
9	1548.51
10	1550.12
11	1551.72
12	1553.33
13	1554.94
14	1556.55
15	1558.17
16	1559.79

Booster and booster pre-amplifier

A booster is used to bridge very long distances (up to 120 km). This unit (LBA-V 16.2/1) amplifies the transmitted optical STM-16 signals. The booster can be placed in any of the triburary slot positions. Any long haul STM-16 line interface unit can be used.

For ultra long distances (up to 160 km) a booster pre-amplifier is used. This unit (LBPA-U 16.2/1) amplifies the transmitted optical STM-16 signals. The booster pre-amplifier can be placed in any of the tributary slot positions and requires a special line interface unit (SI-16EML U 16.2/1).

□

Electrical and optical tributary interface units (TRIB)

Electrical and optical tributary interface units

The electrical tributary interface unit contains the low-speed electrical interfaces. The optical tributary interface unit contains the low-speed (STM-0, STM-1, STM-4 and IP-GE/2) interfaces. The interface unit provides the plesiochronous or synchronous interface circuits and takes care of the aligning into TUs.

Electrical tributary interface units

The following electrical tributary interface units are available:

Unit	Description and remarks
PI-E1/63	63 interfaces of 2 Mbit/s, 75 ohms
PI-DS1/63	63 interfaces of 1.5 Mbit/s, 75 ohms
PI-DS3/12	12 interfaces 45 Mbit/s, 75 ohms
PI-E3/6	6 interfaces 34 Mbit/s, 75 ohms
PI-DS3/6	6 interfaces 45 Mbit/s, 75 ohms
SPIA-1E4/4	4 interfaces 140 Mbit/s / STM-1e, 75 ohms, see also chapter tributary converter units
SIA-1/4	4 interfaces, 75 ohms, see also chapter tributary converter units
PI-E4/4	4 interfaces 140 Mbit/s, 75 ohms
SI-1/4	4 interfaces STM-1, 75 ohms
IP-LAN/8	8 Ethernet interfaces 10/100 Base-T

Optical tributary interface units

The following optical tributary interface units are available:

Unit	Description and remarks
SA-0/12	4 interfaces STM-0, supports MSP and loop-backs, see also chapter tributary converter units
SA-1/4B	4 interfaces STM-1, supports MSP and loop-backs, see also chapter tributary converter units
SPIA-1E4/4	adapter for 4 optical STM-1 signals, supports MSP tributary DCC and loop-backs, see also chapter tributary converter units
SIA-1/4	adapter for 4 optical STM-1 signals, supports MSP DCC and loop-backs, see also chapter tributary converter units

Unit	Description and remarks
SI-S4.1/1	optical short haul STM-4, 1310 nm, supports, AU-4-4c, AU-4 and AU-3/TU-3 conversion, MSP DCC and loop-backs, no optical adapter units are needed
SI-L4.2/1+6dB	optical long haul STM-4, 1550 nm, supports, AU-4–4c, AU-4 and AU-3/TU-3 conversion, MSP DCC and loop-backs, no optical adapter units are needed
IP-GE/2	2 Eternet interfaces for optical 1000 Base-T. The unit is provided with pluggable optical modules which provide for short or long haul transmission.

□

Tributary converter units (SPIA) and (SA)

Introduction

Two types of converter units support the conversion from AU-3 to AU-4 structured signals. These units form the gateway between ETSI SDH and non-EDSI SDH applications

Converters SPIA-1E4/4 or SA-1/4B

Converter unit SPIA-1E4/4 supports the connection of STM-1 optical AU-3 structured signals to the WaveStar® ADM 16/1 system. Because the cross connect unit supports AU-4 ETSI structured signals only, a translation from AU-3 to TU-3s needs to take place. The SPIA-1E4/4 performs the conversion. The unit can also operate in the AU-4 mode. The converter unit supports the following modes:

- AU-3 to TU-3 and TU-3 to AU-3 conversion
- AU-4

The unit can accept 4 STM-1 signals and can be housed in any of the tributary slots. The customers optical interface is connected to the optical paddle board OI-S1.1/2 behind the converter unit.

Converter SA-0/12

Converter unit SA-0/12 supports the connection of STM-0 optical AU-3 structured signals to AU-4 structured signals needed by the cross connect unit. The converter unit supports the following modes:

STM-0 <-> AU-3 <-> VC-3 <-> TU-3 <-> AU-4 conversion

The unit can accept 12 STM-0 signals and can be housed in any of the tributary slots. The customer optical interface is connected to the Optical Paddle Board OI-0/6 behind the Converter unit.

□

Transmission paddle boards and optical interface circuits

Description

The paddle boards (PB) or optical interface (OI) circuits provide impedance conversion, protection switch facilities, or electrical-to-optical conversion. The paddle boards are mounted behind the tributary or optical tributary converter units on the subrack backplane, paddle board PB-1E4/PP/2 however is mounted behind line interface unit 1.

Paddle board types

The following table shows per unit which paddle boards may be used, and it provides a description of each of these paddle boards:

Units	Paddle Board	Description
PI-DS1/63	PB-DS1/100/32	1.5 Mbit/s (DS1) 100 to 75 ohms, 32 channels
	PB-DS1/P100/32	1.5 Mbit/s (DS1) 100 to 75 ohms, conversion + protection, 32 channels
PI-E1/63	PB-E1/75/32	2 Mbit/s (E1) direct through connect PB 75 ohms, 32 channels
	PB-E1/P75/32	2 Mbit/s (E1) protection PB 75 ohms, 32 channels
	PB-E1/120/32	2 Mbit/s (E1) 120 to 75 ohms conversion
	PB-E1/P120/32	2 Mbit/s (E1) 120 to 75 ohms conversion + protection
PI-E3/6 PI-DS3/6 PI-DS3/12	PB-E3DS3/6	34/45 Mbit/s (E3/DS3) protection PB, the PB is mounted horizontally across the working and protecting unit, 6 channels
SPIA-1E4/4 SIA-1/4 SI-1/4 PI-E4/4	PB-1E4/PW/2	STM-1e or 140 Mbit/s (E4) protection PB for the working (W) unit, 2 channels
	PB-1E4/PP/2	STM-1e or 140 Mbit/s (E4) protection PB for the protection (P) unit, 2 channels
IP-LAN/8	PB-LAN/4	Ethernet 10/100 Base-T PB with RJ45 connectors for 4 Ethernet interfaces.
SPIA-1E4/4 SIA-1/4 SA-1/4B	OI-S1.1/2 OI-L1.2/2	STM-1 optical interface circuit, 2 channels

Units	Paddle Board	Description
SA-0/12	OI-0/6	STM-0 optical interface circuit, 6 channels

Power and timing unit (PT) and timing interface circuit

Introduction

The WaveStar® ADM 16/1 can be equipped with two power and timing units that backup one another. The timing and synchronization interface paddle board (TI) provides extra inputs and outputs with a specific format.

Power part

The power and timing units perform the necessary filtering functions to meet the ETSI requirements. To maintain high availability and to ensure operation while a PT is repaired, these filters are duplicated. The actual DC/DC conversion is located on the individual units. The power feed remains duplicated between PT and the units.

Timing part

The PT is also responsible for system timing. The local oscillators can be synchronized to one of the timing references.

There are two types of power and timing units; one standard with an internal oscillator that meets ITU G.813 option 1 and one that meets ITU G.813 option 1 with Stratum-3 hold-over.

The WaveStar® ADM 16/1 can be provisioned for the following synchronization modes:

- Free running
- Hold-over
- Locked with reference to:
  - one of the external synchonization inputs
  - one of the STM-Ninputs
  - one of the 2 Mbit/s tributary inputs.

Timing interface circuit

The timing and synchronization interface circuit (TI) provides extra inputs and outputs with a specific format.

Available for DS0 or DS2 multiplex hierarchies is:

Timing Interface (TI)	Description
TI-DS2DS0/1	64 kHz and 8 kHz Input / 6312 kHz Output

The timing interface circuit contains hardware to transform the external 64+8 kHz composite clock signal into the internal 2 MHz station clock signal. The TIs also transforms the internal 2 MHz station clock signal into an external 6312 kHz sine-wave clock signal. Each TI has one input and one output. These interface circuits must be installed behind the PTs on the backplane.

□

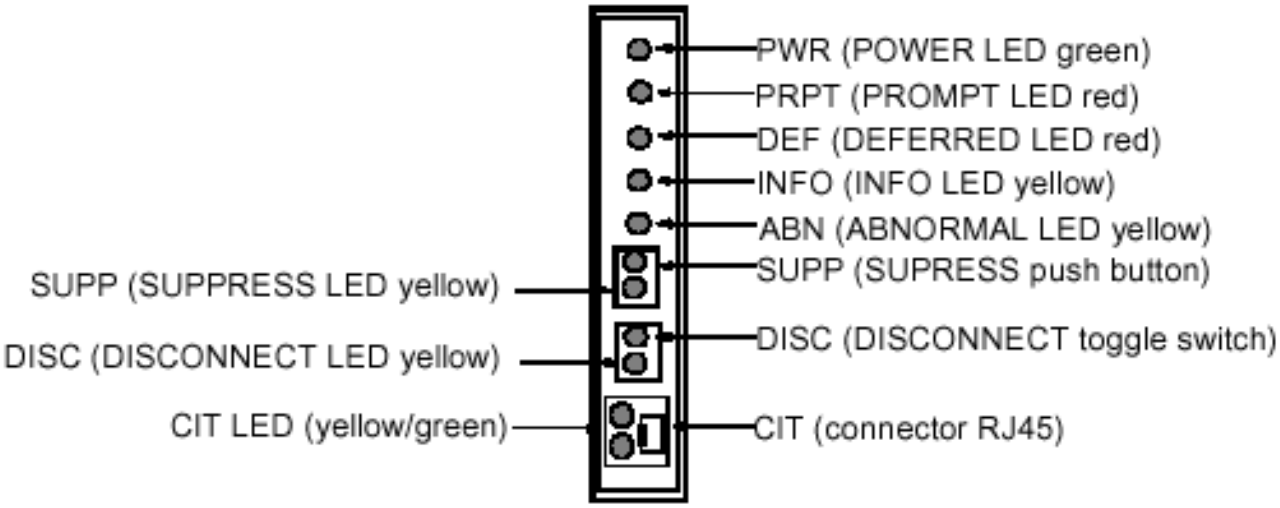
User panel

Introduction The user panel provides an overview of the system status.

User panel To provide system status information the user panel is equipped with LEDs, buttons and a connector. The user panel is integrated in the faceplate of the system controller. Lightguides are used to make the alarm and status indicators on the SC visible with the front door of the subrack closed. The door must be opened to operate the buttons or make a connection to the ITM-CIT. The Integrated Transport Management-Craft Interface Terminal (ITM-CIT) (also referred to as local workstation) can be connected to the WaveStar® ADM 16/1 through the RJ45 connector located on the user panel. The following figure shows lay-out of the user panel

View

Figure 2-15 User panel layout



□

Section: Technical data of the WaveStar® ADM 16/1 and of the ITM-CIT

Overview

Purpose

This section provides technical data of:

- the WaveStar® ADM 16/1
- the local management system ITM-CIT.

Contents

Technical data

Introduction

The following tables supply technical data of the WaveStar® ADM 16/1.

Interfaces

Interfaces and general ITU recommendations:

General ITU-T Interface and IEEE Recommendations	G.707, G.708, G.709 IEEE 802
Equipment Recommendations	G.781, G.782, G.783, G.784, G813
Physical Interface Recommendations	G.957, draft G.691 for optics and G.703 for electrical interfaces
Optical safety	IEC 60825-1, IEC 60825-2 and G.664, draft

Performance requirements

Performance monitoring and performance on jitter are according to:

Jitter on STM-N Interfaces	G.813, G.825
Jitter on PDH Interfaces	G.823, G.783
Error Performance	G.826
Performance monitoring	G.784, G.826

Physical design

The outside subrack dimensions, including the Inter connection panel (I/O Box), are 1000x500x545 mm (hxwxd). The weight, including internal cables, is less then 70 kg.

Environmental conditions

Environmental conditions according to:

Environment	ETSI Class 3.1
Storage	ETSI Class 1.2
Transportation	ETSI Class 2.3

EMC/ESD

The WaveStar® ADM 16/1 fulfills the requirements as specified in EDSI 300 386-1; public telecommunication network equipment. EMC/ESD requirements are also indicated in the table below:

Radiated emission	EN 55 022 Class B

Conducted emission:	
AC power	EN 55 022 Class B
DC power	EN 55 022/ETS 300 386-1
Telecom ports	CISPR 22 Class B
Electrostatic discharge	IEC 1000-4-2 level 4
	EN 61000-4-2 level 4
Radiated immunity	IEC 1000-4-3 level 3
Electrical fast transient:	
AC power	IEC 1000-4-4 level 3
DC power	IEC 1000-4-4 level 3
Telecom ports	IEC 1000-4-4 level 3
Surges:	
AC power	IEC 1000-4-5 level 4
Indoor telecom port	ETS 300 386-1
Continuous wave:	
AC power	IEC 1000-4-6 level 2
DC power	IEC 1000-4-6 level 2
Telecom ports	IEC 1000-4-6 level 2

Station power

The following table gives information about the station input power. The power dissipation depends on the number and sort units in the subrack.

Battery	-48/-60V DC (-41V...-72V)
Power dissipation	450W...600W

Power consumption

The power consumption of the units is given in worst case situation:

Unit	Consumed power (max.)
Power and Timing Unit 4.6 ppm	15 W
Power and Timing Unit 0.37 ppm	16 W
Cross-Connect Unit 64/16	45 W
Cross-Connect Unit 64/32	56 W
Fixed Cross-Connect Unit	3 W
Tributary Interface Unit:	

Unit	Consumed power (max.)
electrical	24 W
optical	
IP-LAN/8	41.1 W
IP-GE/2	44.4 W
Booster pre-amplifier	19.2 W
Line Interface Unit	38 W
System Controller	31 W
Fans	15 W

Section: Integrated transport management (ITM) product family

Overview

Purpose

Today's transport networks consist of flexible network elements, such as cross connects and add-drop multiplexers. Lucent Technologies' Integrated Transport Management (ITM) product family provides the means for managing these networks. The ITM product range consists of the Navis™ Optical Network Management System (NM), the Navis™ Optical Element Management (SNMS), the Cross connect Module (XM), the WaveStar® ITM Subnetwork Controller (SC) and the WaveStar® ITM Craft Interface Terminal (CIT).

Contents

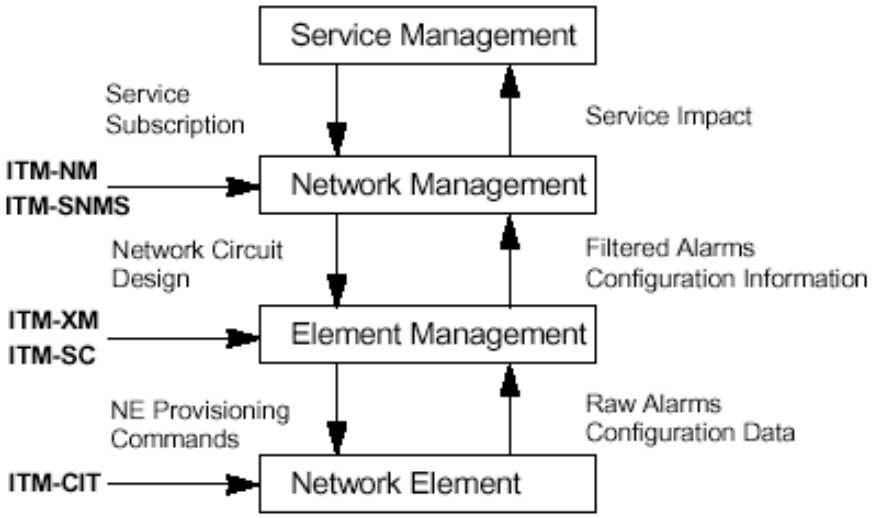
TMN framework implementation

Introduction

The Lucent ITM product range complies with the TMN building blocks (ITU-T M.3010). Each ITM module can be assigned to one of the TMN building blocks (e.g. Operations System, Mediation Device) due to the mandatory functions performed by that module. In addition, the products of the ITM family can also be situated in the layering concept of the TMN framework.

Schematic overview

Figure 2-16 An overview of the different management layers:



Navis™ ONMS

The Navis™ Optical Network Management System (formerly named ITM-NM) module is the Network Management Layer (NML) that provides integrated network layer management for multi-technology flexible transport networks. The Navis™ Optical Network Management System ensures network reliability and integrity by providing network restoration capabilities and real-time alarm surveillance.

Navis™ OEMS

The Navis™ Optical Element Management System (formerly named ITM-SNMS) is also a Network Management Layer (NML). The Navis™ Optical Element Management System is tailored for medium and smaller sized networks, or medium and smaller administration domains within lager networks. It offers an integrated view of (part of) the network, and - via the EMS - a direct view on the Network Elements. It supports a basic, yet complete, set of SDH management operations.

ITM-XM The ITM-XM, as an Element Management Layer (EML) system, provides support for configuration and monitoring Digital Cross connect Systems (DXCs) allowing complete network connectivity of the telecommunications infrastructure.

WaveStar® ITM-SC The WaveStar® ITM-SC provides the user with the capability to provision, configure and on-line monitor SDH sub-networks consisting of Network Elements (NEs) as single entities. So the ITM-SC is also an EML. It provides for node back-up capabilities, and it maintains data base structures for current and historic alarm and configuration data of all the SDH NEs within its domain. The ITM-SC communicates with the NEs through the Gateway NEs (GNEs) that are connected directly to the ITM-SC via Q-LAN. Communication between NEs in the SDH network itself generally proceeds via the DCC bytes in the overhead of the STM-N signal. Where there is no DCC connectivity between NEs, a Local Communication Network (LCN) in the form of a Q-LAN may be used.

WaveStar® ITM-CIT The window-based WaveStar® ITM-CIT, as a local management system, supports configuration, monitoring and performing system tests on a number of SDH NE types. The ITM-CIT can manage different types of NEs with one software package.The CIT is a tool for local activities associated with installing, testing and local provisioning. Workstation, mediation and operations functions are integrated in one physical system. The CIT is a menu-driven program that manages one NE at a time. Remote login of NEs is possible.

□

3 Installing the WaveStar® ADM 16/1

Overview

Purpose

The document describes the installing of the network element by checking the physical installation and equipping the network element's subrack with units. And after having equipped the NE with units it describes the provisioning actions which have to be performed with the ITM-CIT.

Objective

Verifying that all cables are connected correctly, the units are in the right subrack slots and the ITM-CIT is connected correctly.

Outcome

The WaveStar® ADM 16/1 is installed properly and provisioning can start.

Intended use

This chapter provides the installation personnel with information necessary to install the units in the network element.

Contents

Section: Checking the physical installation

Overview

Purpose

Before installing the WaveStar® ADM 16/1 NE, all physical installation work must have been done. All equipment necessary to install the NE must be present. Check this very carefully. Checking the physical installation includes verifying that the WaveStar® ADM 16/1 subrack is correctly mounted in a rack.

The physical installation work for the WaveStar® ADM 16/1 subrack must have been completed and checked. Otherwise the network element will not be provisioned correctly.

Prerequisites

The “WaveStar® ADM 16/1 Installation Guide – Part I” must be present.

Contents

Checking the subrack installation

Checking the installation of the subrack

Verifying that the WaveStar® ADM 16/1 subrack is correctly mounted in a rack frame means:

- The rack is installed and all rack wiring is fitted.
- The power and station alarm voltages are connected to the rack and checked. The battery voltage should be in the range: -41 V... -72 V.
- The WaveStar® ADM 16/1 subrack is installed in the rack.
- The cabling (Station Alarm, MD I/O, CITQ/CITF, Q-LAN-10BT and Q-LAN cables) from the I/O box to the subrack backplane is connected.
- The fan unit is installed and its cabling is connected to the subrack backplane.
- The dust-filter is clean. Change the dust-filter once every four months.
- The Q-LAN is correctly connected or terminated on the Q-LAN connection of the I/O area.
- The Station Clock Input or Output (STAT CLOCK IN/OUT) is connected to the I/O area (optional). For more information on checking the correct connection of the Station Clock interfaces, see “Checking the Station Clock cabling”.
- The Miscellaneous Discretes Input or Output (MD I/O) connector on the I/O area is connected correctly (optional).
- The Station Alarm connector interfaces are connected correctly (optional).

□

Checking the Q-LAN connections

Introduction

The Q-LAN connection on the I/O area provides two interfaces for managing the WaveStar® ADM 16/1 network element communication with an element management system (EMS). The integrated transport management - subnetwork controller (ITM-SC) is an example of an EMS.

Checks on Q-LAN connections

The following checks must be done for a Q-LAN connection:

- In case the system is not connected to a Q-LAN (then the system is remotely managed by an EMS via the data communication channel). In this case 50 ohms terminators must be placed on both Q-LAN connectors on the I/O area.
- In case the system is directly connected to an element management system (EMS) by Q-LAN:
  1. An Ethernet® adapter (transceiver box) with BNC (Bajonet Naval Connector) splitter must be connected to the ITM-SC.
  2. A 50 ohms cable termination must be placed on the BNC-splitter at the adapter.
  3. The EMS must be connected to the system by a 50 ohms cable between the adapter and one of the Q-LAN connectors on the subrack's I/O area. The other connector must be terminated or used to extend the Q-LAN to another NE.
- In case the NE is connected to another NE by the Q-LAN:
  1. The NEs must have been interconnected via a 50 ohms cable by their Q-LAN connectors
  2. If one or more Q-LAN connectors are not used: a 50 ohms cable termination must have been placed on the unused Q-LAN connector(s).
  3. It is important that the Q-LAN is terminated with 50 ohms at both ends when not used. A wrongly terminated Q-LAN will result in loss of management of the EMS and a flashing LED on the SC unit.
  4. It is not possible to use the 10 BASE T (Q-LAN 10BT and CITQ on the inter connection panel) and the 10 BASE 2 (Q-LAN) connections simultaneously!

□

Connections to the station clock, power and timing units

Station clock inputs and outputs

The WaveStar® ADM 16/1 has two station clock inputs (IN1 and IN2) and two station clock outputs (OUT1 and OUT2) on the inter connection panel. The EMS user selects the station clock inputs and outputs. The inputs to connect external timing reference signals to synchronize the NE. The outputs to synchronize external equipment, such as a synchronization supply unit (SSU).

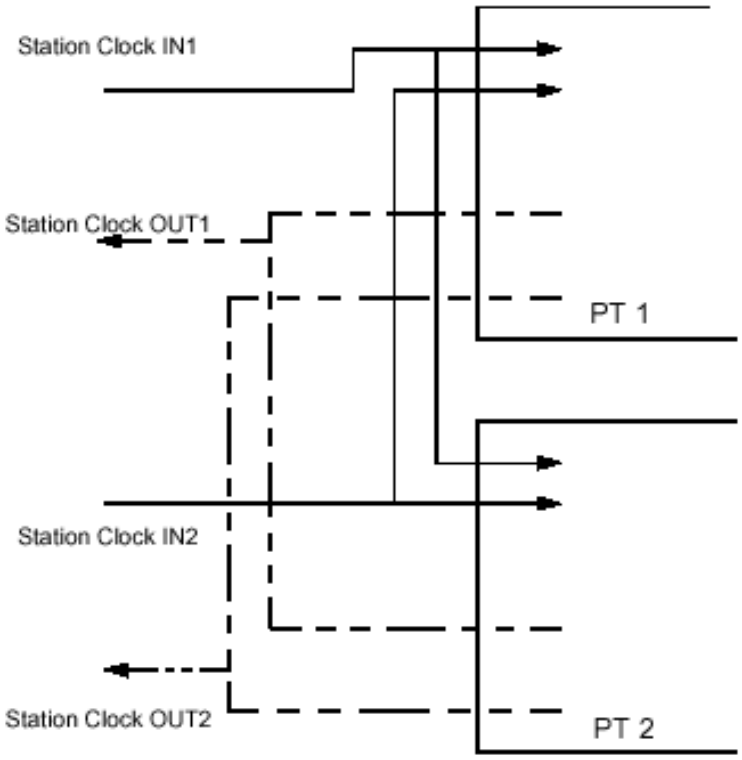
station clock input IN1 and station clock output OUT1 form the IN1/OUT1 connector pair. station clock input IN2 and station clock output OUT2 form the IN2/OUT2 connector pair.

Power and timing units

The power and timing (PT) units take care of the (internal/external) timing reference signals and provide the power supply filter functions. The timing part of the PT unit provides the timing synchronization functions. The power and timing units are normally duplicated for protection. If they are duplicated, the power supply filter parts of both PT units are active. Between the timing parts of the PT units an automatic protection switching relation is set up (1+1 unit non-revertive protection). Of the timing parts of the PTs only one is active at a time. This is called the active PT unit, the other one is called the standby PT unit. The active PT unit provides the timing functions to the WaveStar® ADM 16/1. The PT units provide two external reference inputs and outputs, both 2.048 MHz or 2.048 Mbit/s, 75 or 120 ohms. (The selection of 75 or 120 ohms impedance is done by using respectively twisted pair wires or coax cable on the station clock input connectors. For more information concerning this point, see the *"WaveStar® ADM 16/1 Installation Guide – Part I"*.) All external timing reference signals are serviced by the active PT unit. In case of a failure, the external timing reference signals are switched to the standby PT unit.

Schematic view

Figure 3-1 Power and timing units external timing interfaces



Connections to the timing interface paddle boards and synchronization supply unit

Timing interface paddle boards

The timing interface (TI) paddle boards provide conversion functions for connecting timing reference signals, other than the 2.048 MHz/Mbit/s signals, to the WaveStar® ADM 16/1.

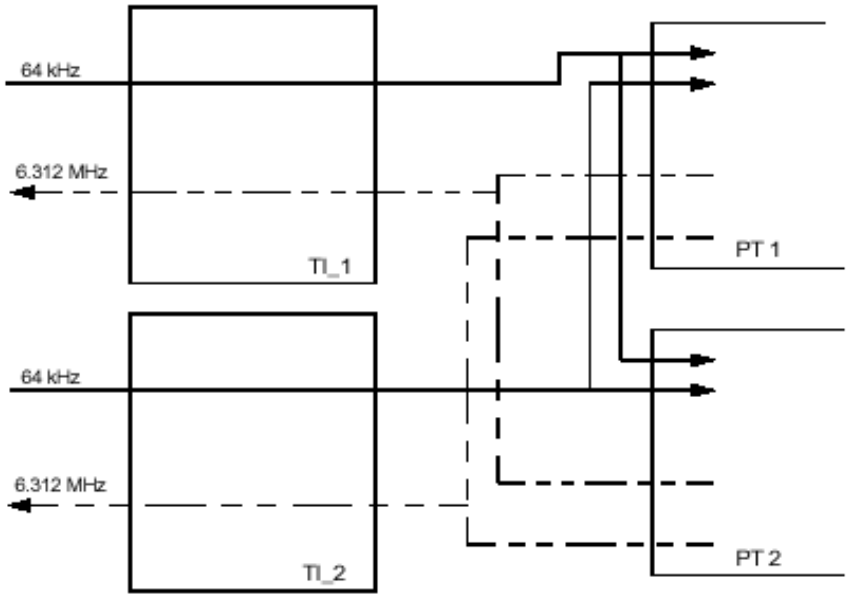
The TI paddle board of type TI-DS2DS0/1 provides the interfaces for:

- 64 kHz (120 ohms) timing reference signals from the station clock inputs.
- 6.312 MHz (75 ohms) signals to the station clock outputs.

The TI paddle boards are behind slot PT 1 or PT 2 on the backplane, see the "WaveStar® ADM 16/1 Installation Guide – Part I". Each TI paddle board provides the connections from the IN1/OUT1 or IN2/OUT2 connector pairs of the Inter connection panel. The TI paddle board distributes the external timing reference input signal to both power and timing units and collects the output timing reference signal from both PT units.The TI paddle boards are not individually associated with the PT units. It is possible to use only one TI paddle board, but software will generate an alarm because two TI paddle boards are expected. If only one TI paddle board is used, only one connector pair is available for external timing reference signals. If both IN1/OUT1 and IN2/OUT2 connector pairs are used, a TI paddle board must be placed behind each PT unit.

Schematic view

Figure 3-2 PT units and TI paddle boards for external timing reference connection



Frequency check

Check the frequency and type (MHz or Mbit/s) of the connected timing signals. Two situations can arise:

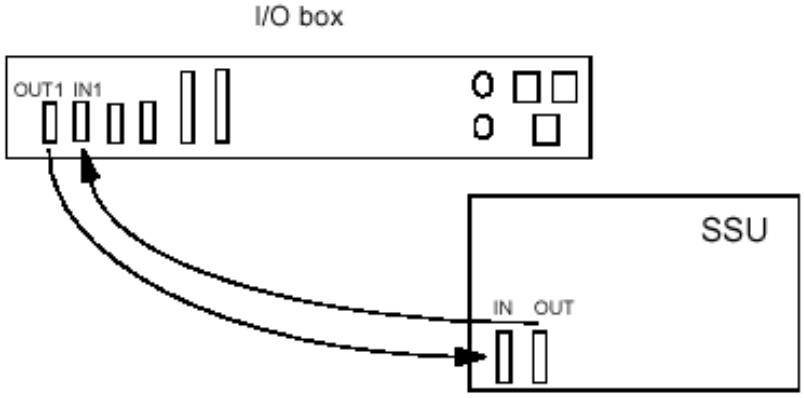
- Paddle boards TI-DS2DS0/1 are used, then:
  1. The station clock input is a 64 kHz signal AMI coded return to zero of 120 ohms.
  2. The station clock output is a 6.312 MHz signal of 75 ohms.
  3. The connections of the paddle board to the inter connection panel must be made, each paddle board corresponds with one IN/OUT connector pair.
- No TI paddle boards are used, then:
  1. The station clock input is a 2.048 MHz or 2.048 Mbit/s signal (75/120 ohms).
  2. The station clock output is a 2.048 MHz or 2.048 Mbit/s signal (75/120 ohms).
  3. The connections from the backplane of the PT units to the inter connection panel must have been made.

Connections to a synchronization supply unit

If a synchronization supply unit (SSU) is connected to the WaveStar® ADM 16/1; one of the station clock inputs (IN1 or IN2) and one of the station clock outputs (OUT1 or OUT2) must be connected to the SSU.

Schematic view

Figure 3-3 WaveStar® ADM 16/1 connections to the SSU



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Section: Equipping the NE

Overview

Purpose

This section describes the equipment that can be placed in the WaveStar® ADM 16/1 9TAD subrack. It also shows the layout of the subrack and the procedures for installing the units in the WaveStar® ADM 16/1 NE.

In particular, information is supplied as to which unit can be placed in which slot of the WaveStar® ADM 16/1 9TAD subrack an how to install the units in the subrack.

Prerequisites

All units must be available at the WaveStar® ADM 16/1 site.

Contents

Core units and system controller

Power supply and timing unit

Power supply filter and timing unit (PT): (PT-stnd or PT-str3) The PT unit is duplicated for protection. The core unit being PT1 and the protection unit being PT2. The power supply filter parts of both PT units are active. Between the timing parts of the PT units an automatic protection switching relation is set up (1+1 unit non-revertive protection). Of the timing parts of the PTs only one is active at a time. The core unit PT1 is placed in slot position 15. The protection PT2 is placed in slot position 16.

System controller

System controller unit (SC): (SC with system software release R 6.0.) The SC is placed in slot position 1. The system controller provisions and controls all units via a local LAN-bus. The SC also provides the external operations interfaces for office alarms, miscellaneous discretes and connections to the overhead channels. The SC also facilitates first line maintenance by LEDs and buttons on the front panel. On this front panel general status and alarm information is displayed. Various controls and an F-interface connector, for local maintenance via the ITM-CIT is located on the front panel. The SC communicates with the management system WaveStar® ITM-SC and/or with the Navis™ Optical Network Management System.

Cross-connect

Cross-connect unit (CC): (CC-64/16, CC-64/32 or Fixed CC) The CC unit can be duplicated for protection. The core unit being CC1 and the protection unit being CC2. The protection cross-connect unit CC-64/16 or CC-64/32 provides 1+1 unit (non-revertive) protection. Only one CC unit is active at a time. The core unit CC1 is placed in slot position 2. The protection unit CC2 is placed in slot position 13. The fixed cross-connect unit is placed in slot position 2 and has no 1+1 protection.

□

Line units and tributary interface units

Line interface units

STM16 line interface unit (LINE). The LINE units can be placed in slot positions 3 and/or 14.

Line interface unit types

The following types are available:

Type	Description
SI-L 16.1/1C	Long haul 2.5 Gbit/s 1310 nm, according to table L16.1 in ITU-T G.957, support of optical analog parameters
SI-L 16.2/1C	Long haul 2.5 Gbit/s 1550 nm, according to tables L16.2 and L16.3 in ITU-T G.957, support of optical analog parameters
SI-EML-U 16.2/1	Ultra long haul 2.5 Gbit/s, required for the Booster Pre-Amplifier
SI-16EML 9xxx/1	DWDM, 2.5 Gbit/s, required for the WavStar™ 400G system, x ranges from 9190 to 9585 representing the frequencies 191.90 THz (1565 nm) to 195.85 THz (1530 nm) in steps of 50 GHz
SI-16EML 80.x/1 x=1 to 16	DWDM, 2.5 Gbit/s, required for the WaveStar® OLS 80G system for the wavelengths see the next table

Booster and booster pre-amplifier

Booster: (LBA-V 16.2/1) booster according to ITU-T G.691 V-16.2/3). A booster is used to bridge very long distances (up to 120 km). This unit amplifies the transmitted optical signals and can be used in combination with any STM-16 long haul Line Interface Unit. The booster can be placed in any of the tributary slot positions.

Booster pre-amplifier: (LBPA-U 16 2/1 booster pre-amplifier according to ITU-T U 16 2/3). A booster pre-amplifier is used to bridge ultra long distances (up to 160 km). The unit amplifies the transmitted signals and must be used with line interface unit SI-EML U 16.2/1. The booster pre-amplifier can be placed in slot position 4 to 12. The booster pre-amplifier is limited available, please contact your sales organization.

Electrical and optical tributary interface units

Tributary interface units (TRIB). The tributary interface units provide the plesiochronous or synchronous electrical interfaces of the WaveStar® ADM 16/1.

Electrical tributary interface unit types

The following types are available:

Type	Description	Slot Position
PI-E1/63	2 Mbit/s, 63 interfaces per unit	4 to 12
PI-DS1/63	1.5 Mbit/s, 63 interfaces per unit	4 to 12
PI-E3/6	34 Mbit/s, 6 interfaces per unit	4 to 11
PI-DS3/6	45 Mbit/s, 6 interfaces per unit	4 to 11
PI-DS3/12	45 Mbit/s, 12 interfaces per unit	4 to 11
PI-E4/4	140 Mbit/s, 4 interfaces per unit	4 to 12
SI-1/4	STM-1e, 4 interfaces per unit	4 to 12
SPIA-1E4/4	140 Mbit/s/STM-1e, 4 interfaces per unit	4 to 12
SIA-1/4	STM-1e, 4 interfaces per unit	4 to 12
IP-LAN/8	8 Ethernet 10/100 Base-T interfaces per unit, see also chapter “Rules for Inserting and Connecting Tributary Interface Units”.	4 to 11

Optical tributary interface unit types

The following types are available:

Type	Description	Slot Position
SA-0/12	STM-0, 12 interfaces per unit, see also chapter ″Optical paddle boards″	4 to 11
SI-L4.2/1+6 dB	STM-4, 1 interface per unit, optical long haul 1550 nm	4 to 12
SI-S4.1/1	STM-4, 1 interface per unit, optical short haul 1310 nm	4 to 12
SPIA-1E4/4	STM-1, 4 interfaces per unit, see also chapter ″Optical paddle boards″	4 to 11
SIA-1/4	STM-1, 4 interfaces per unit, see also chapter “Optical paddle boards”	4 to 11
SA-1/4B	STM-1, 4 interfaces per unit, see also chapter ″Optical paddle boards″	4 to 11

Type	Description	Slot Position
IP-GE/2	2 Ethernet 1000 Base-X interfaces per unit, see also chapter “Rules for Inserting and Connecting Tributary Interface Units”.	4 to 12

Synchronous adapter units

Three types of units are available for converting AU-3 structured signals into TU-3 structured signals that can be handled by the cross-connect. The optical interfaces are located on optical paddle boards mounted directly behind the synchronous adapter unit. The synchronous adapter units can be placed in slot positions 4 to 11.

Synchronous adapter unit types

The following types are available:

Type	Description
SA-0/12	52 Mbit/s (STM-0), 12 interfaces per unit. Conversion unit for AU-3 to TU-3
SPIA-1E4/4	155 Mbit/s (STM-1), 4 interfaces per unit. Conversion unit for AU-3 to TU-3, AU-4
SIA-1/4	155 Mbit/s (STM-1), 4 interfaces per unit. Conversion unit for AU-3 to TU-3, AU-4
SA-1/4B	155 Mbit/s (STM-1), 4 interfaces per unit. Conversion unit for AU-3 to TU-3, AU-4

□

Paddle boards

Optical paddle boards

In case optical tributary signals are used, which can be the case if the synchronous adapter units are used, optical paddle boards must be used. Two optical paddle boards can be placed on the backplane directly behind the synchronous adapter unit (SPIA-1E4/4, SIA-1/4, SA-1/4B or SA-0/12).

Optical paddle board types

The following types are available:

Type	Description
OI-0/6	STM-0, wavelength 1310 nm, 6 interfaces per board
OI-S1.1/2	Optical Short Haul, STM-1, wavelength 1310 nm, 2 interfaces per board
OI-L1.2/2	Optical Long Haul, STM-1, wavelength 1550 nm, 2 interfaces per board

Electrical paddle boards

It is advised to always use paddle boards for 1.5 Mbit/s and 2 Mbit/s interfaces. This is to be able to change the configuration of the NE without having to adjust the cable lengths. The other electrical interface types can be used without paddle boards this depending on the application.

Electrical paddle board types

The following types are available:

Type	Description
PB-DS1/ 100/32	100 to 75 ohms impedance conversion for 32 channels. This paddle board is used in not equipment protected applications. The paddle board must be installed behind each PI-DS1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths.
PB-DS1/ P100/32	100 to 75 ohms impedance conversion + protection for 32 channels. This paddle board is used in equipment protected applications. The paddle board must be installed behind each working PI-DS1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths

Type	Description
PB-E1/75/32	Direct through connections paddle board for 32 channels. This paddle board is used in not equipment protected applications. It is advised to install the paddle board behind each PI-E1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths.
PB-E1/P75/32	Protection paddle board for 32 channels. This paddle board is used in equipment protected applications. The paddle board must be installed behind each working PI-E1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths.
PB-E1/120/32	120 to 75 ohms impedance conversion for 32 channels. This paddle board is used in not equipment protected applications. The paddle board must be installed behind each PI-E1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths.
PB-E1/ P120/32	120 to 75 ohms impedance conversion + protection for 32 channels. This paddle board is used in equipment protected applications. The paddle board must be installed behind each working PI-E1/63 unit. Different types of paddle boards can be replaced without adjusting the cable lengths.
PB-1E4/PW/2	Protection paddle board for 2 channels 140 Mbit/s or STM-1e. This paddle board is used in equipment protected applications. Two of these paddle boards must be installed behind each working unit (PI-E1/4, SI-1/4, SPIA-1E4/4 or SIA-1/4). However, it can already be installed if equipment protection is needed in the future. A hit-free upgrade to 1:N (N=1 to 4) equipment protection can then be achieved.

Type	Description
PB-1E4/PP/2	Protection paddle board for 2 channels 140 Mbit/s or STM-1e. This paddle board is used in equipment protected applications. Two of these paddle boards must be installed behind the protection unit (PI-E1/4, SI-1/4, SPIA-1E4/4 or SIA-1/4). However, it can already be installed if equipment protection is needed in the future. A hit-free upgrade to 1:N (N=1 to 4) equipment protection can then be achieved. Slot 4 is used for the protection unit while slots 5 to 8 are used for the working units. Paddle boards PB-1E4/PP/2 are installed on the backplane in position XP01 and XP02.
PB-E3DS3/6	Protection paddle board for 6 channels (34 Mbit/s or 45 Mbit/s). This paddle board is used in equipment protected applications. This paddle board must be mounted horizontally across both working and protection unit (PI-E3DS3/6+6 or PI-DS3/12). Working/protection slot pairs are 4/5, 6/7, 8/9 and 10/11. However, it can already be installed if equipment protection is needed in the future. A hit-free upgrade to 1+1 equipment protection can then be achieved.
PB-LAN/4	paddle board provides connectors for 4 Ethernet 10/100 Base-T interfaces. Two paddle boards must be used for one IP-LAN/8 tributary unit.

Timing paddle board

Timing paddle board (TI-DS2DS0/1). This board has an 64 kHz synchronous 120 ohms input and an 6312 kHz synchronous 75 ohms output. For the connection of timing paddle boards, see chapter ″Connections for the timing interface paddle boards and synchronization supply unit”.

□

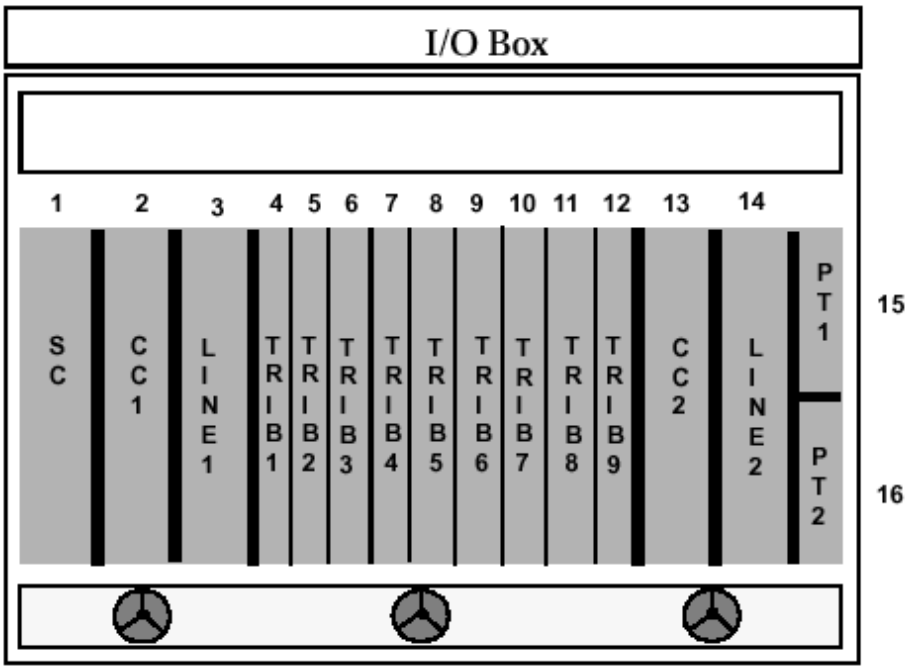
Equipping the subrack

Slots in the subrack

Equipping the WaveStar® ADM 16/1 consists of installing units into the appropriate slots of the empty subrack. The following diagram shows the slots of the subrack.

Subrack view

Figure 3-4 WaveStar® ADM 16/1 9TAD subrack slot layout



Guidelines for installing the units

Do the following before installing the units:

- Read the special handling precautions on EMC/ESD Safety Guidelines before installing or removing parts of the equipment, (see ″EMC/ESD Safety Guidelines” in “Chapter Safety).
- Read the Laser Safety Guidelines section before handling optical units or connecting or disconnecting optical fibres, (see “Laser Safety Guidelines” in ″Chapter Safety″).
- Verify that the card type corresponds with the equipment specification for this configuration.
- Insert the units in the correct order and the correct slots, (see ″Units Installation Procedure”).

- After the unit is installed the unit LED remains on (except for the PTs) until:
  1. the SC is installed
  2. the NE is created (by the ITM-CIT).
  3. the user assigns the unit to the slot by provisioning it with the the ITM-CIT.

During insertion of units, the LEDs on the system controller's User Panel and the local alarm loops (station alarms) may show activity. This can be ignored until the system has been fully configured and provisioned.

□

Rules for inserting and connecting tributary interface units

PI-DS1/63 For inserting this tributary interface unit the following rules apply:

- Paddle boards are always needed.
- If 1:N equipment protection plus impedance conversion 100/75 ohms is required for the units, slots 4 to 11 are available for the working units. Slot 12 is then used for the protection unit. Paddle board PB-DS1/P100/32 must be installed behind the working units.
- If only impedance conversion 100/75 ohms is required for the units, slots 4 to 12 are all available for the units. Paddle boards PB-DS1/100/32 must be installed behind all units.

PI-E1/63 For inserting this tributary interface unit the following rules apply:

- Paddle boards are always needed.
- If 1:N equipment protection is required for the units, slots 4 to 11 are available for the working units. Slot 12 is then used for the protection unit. Paddle boards PI-E1/P75/32 must be installed behind the working units. Paddle board PB-E1/75/32 must be installed behind the protection unit.
- If 1:N equipment protection plus impedance conversion 120/75 ohms is required for the units, slots 4 to 11 are available for the working units. Slot 12 is then used for the protection unit. Paddle boards PB-E1/P120/32 must be installed behind the working units.
- If only impedance conversion 120/75 ohms is needed, slots 4 to 12 are all available for the units. Paddle board PB-E1/120/32 must be installed behind all units.
- If no impedance conversion is needed, slots 4 to 12 are all available for the units. Paddle board PB-E1/75/32 must be installed behind all units.

Simultaneous use of PI-DS1/63 and PI-E1/63 A maximum of eight working tributary interface units PI-DS1/63 or PI-E1/63 can be installed. Units for 1.5 or 2 Mbit/s can not be protected at the same time. The unit type in slot 12 determines whether 1.5 or 2 Mbits units are protected.

PI-E4/4, SI-1/4, SPIA-1E4/4 or SIA-1/4

For inserting these Tributary Interface Unit the following rules apply:

- If 1:N equipment protection is required for the units, slots 5 to 8 are available for the working units. Slot 4 is then used for the protection unit. paddle board PB-1E4/PW/2 must be installed behind the working unit. Paddle board PB-1E4/PP/2 must be installed behind the protection unit. However, the protection paddle board (PB-1E4/PP/2) is physically installed on the backplane in positions XP01 and XP02.
- If no equipment protection is needed, slots 4 to 12 are available for the units. No paddle boards are needed, and the tributary signals can be connected directly to the backplane.
- With four tributary interface units SPIA-1E4/4, SIA-1/4, PI-E4/4 or SI-1/4 the full capacity of the STM-16 line can be used. The SPIA-1E4/4 unit in slot 4 can protect any combination of SI-1/4, PI-E4/4, SPIA-1E4/4 and SIA-1/4 units in slots 5 to 8 (all port interfaces are either STM-1e or 140 Mbit/s). SPIA-1E4/4 in slot 4 can also protect SPIA-1E4/4 units that have a mix of port types (e.g. SPIA-1E4/4 in slot 5 has ports 1 and 2 in 140 Mbit/s mode and ports 3 and 4 in STM-1e mode while SPIA-1E4/4 in slot 6 has ports 1 and 3 in STM-1e mode and ports 2 and 4 in 140 Mbit/s mode.

PI-E3/6 or PI-DS3/6

For inserting this tributary interface unit the following rules apply:

- If 1+1 equipment protection is required for the units, paddle boards PB-E3DS3/6 must be mounted horizontally across both the working and protection tributary interface unit. Slot combinations for working/protection units are 4/5, 6/7, 8/9 and 10/11.
- If no equipment protection is needed, slots 4 to 11 are available for the units. No paddle boards are needed and the tributary signals can be connected directly to the backplane.

SI-S4.1/1 or SI-L4.2/1+6 dB

For inserting these units the following rules apply:

- No paddle boards are necessary
- Slot 4 to 12 are available for the units
- Combinations for working and protection MSP groups are 4/5, 6/7, 8/9 and 10/11.

SA-0/12, SA-1/4B, SPIA-1E4/4 or SIA-1/4 (optical mode)

For inserting these units the following rules apply:

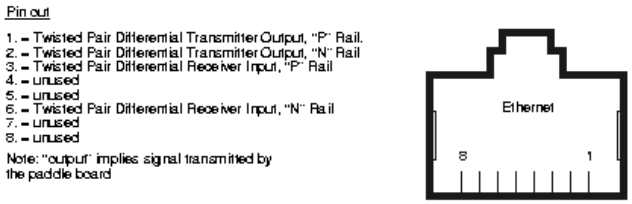
- The SA-0/12, SPIA-1E4/4 or SIA-1/4 units can be placed in slots 4 to 11.
- If optical tributary signals must be connected to the subrack, the optical paddle board OI-S1.1/2 or OI-L1.2/2 must be installed behind the SA-1/4B, SPIA-1E4/4 or SIA-1/4 Unit. Optical paddle board OI-0/6 must be placed behind the SA-0/12.
- If no optical signals must be connected to the Synchronous Adapter unit, the optical paddle board can be omitted. The electric tributary signals are connected directly to the backplane.

IP-LAN/8

For inserting the Ethernet LAN unit the followin rules apply:

- Paddle boards are needed to connect the IP-LAN/8 unit. Two for each IP-LAN/8 unit.
- The following figure shows the connector pin designation of the paddle board. The figure is a view looking into the connector.

Figure 3-5 RJ45 connector for 10/100 Base-T interface



Important! The Ethernet TransLAN+ unit (LJB459) can only be used in combination with system controller hardware (LJB457B) or with later versions of this system controller.

IP-GE/2

For inserting the Gigabit Ethernet unit the following rules apply:

- The correct optical module must be mounted on the Gigabit Ethernet unit. This optical module is used to support various optical 1000 BASE-X interface standards.
- The optical modules must be ordered separately.
- The Gigabit Ethernet unit can only be inserted or removed from the subbay when the fibers are removed from the optical modules.
- The transport capacity of the IP-GE/2 is limited by the backplane to 4xVC4 (600 Mbit/s).
- No paddle boards are necessary.

Tributary interface units cabling

For cabling the tributary interface units the following rules apply:

- The tributary signals (1.5 Mbit/s or 2 Mbit/s) must be connected to the paddle boards behind the tributary units
- If there is no equipment protection, the tributary signals (34 Mbit/s, 45 Mbit/s, 140 Mbit/s or STM-1e) can be connected directly to the backplane behind the tributary units.
- If optical tributary signals STM-0 or STM-1 must be connected, optical paddle boards must be placed on the backplane behind the tributary interface units. The optical signals are connected to the optical paddle boards.

□

Units installation procedure

Procedure Follow these steps to install the units in the subrack.

1. Insert PT-stnd or PT-str3 unit in slot 15. Place protection PT-stnd or PT-str3 unit in slot 16.

2. If a 64 kHz input or 6.312 MHz output signal must be connected to the station clock input or output, place the TI-DS2DS0/1 paddle boards behind the PT units. Make the connections from the I/O area to the backplane or the TI paddle boards. See chapter ″Connections for the TI paddle boards and SSU″.

3. Insert the cross-connect unit (CC-64/16, CC-64/32 or a Fixed CC) in slot 2. Place protection CC-64/16 or CC-64/32 in slot 13.

   Important! Protection and working CC unit must be of the same type.

4. Insert the line interface unit in slot 3. Place the second line interface unit, required for a protection ADM STM-16 configuration in slot 14. Slot 14 is not used in the 0:1 terminal application.

5. Insert a tributary interface unit in one of the slots 4 to 12. See chapter ″Rules for inserting and connecting tributary interface units″.

6. Insert the system controller in slot 1. It may take awhile before it is possible to connect an EMS to the SC.

   Result: The LED on the SC switches off. After approximately 15 minutes, the LEDs on the line interface unit and the power and timing units switch off.

7. Connect the tributary interface (electrical/optical) cabling. See chapter ″Rules for inserting and connecting tributary interface units″.

8. Make the optical connections between the booster or the booster pre-amplifier and the line interface unit. The optical connections are made on the front of these units.

9 Connect the line interface cabling to the front of the line interface units.

10 Provision the NE with help of an EMS, according to the installed units and connected cables (see chapter “Guidelines for network element provisioning”).

END OF STEPS

□

Section: Guidelines for NE provisioning

Overview

Purpose

This section explains how to connect the ITM-CIT to the WaveStar® ADM 16/1 and provision the network element using the ITM-CIT after installation. Information is provided concerning how the ITM-CIT should be connected to the network element and the correct parameters to use when provisioning the NE with the ITM-CIT.

Prerequisites

It is assumed that the *WaveStar® ADM 16/1 User Operations Guide* is present.

Contents

Connecting the ITM-CIT

Connecting the ITM-CIT

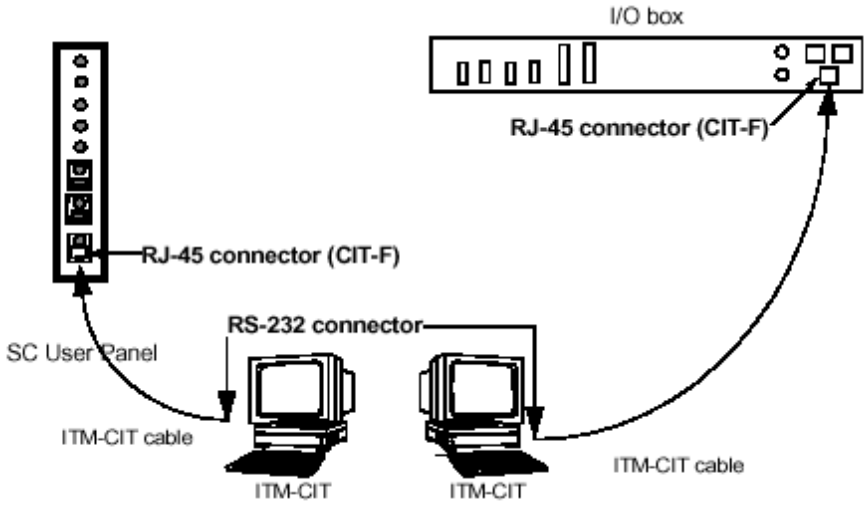
To perform software tests and provision the system with local configuration parameters, an Integrated Transport Management - Craft Interface Terminal (ITM-CIT) must be connected to the WaveStar® ADM 16/1 locally. A cable is needed with an RS-232 connector on one end and an RJ-45 (Modular Jack) connector on the other end (for details, refer to the "WaveStar® ADM 16/1 Installation Guide – Part I").

Connect the ITM-CIT to the WaveStar® ADM 16/1 via the Modular Jack (CIT-F) on the inter connection panel (I/O box) or on the SC user panel. The CIT-F connections all interface to the same logical SC CIT-F port. However, only one CIT-F connector may be used at a time. The CIT-Q and CIT-F connections can be used simultaneously by different systems.

Important! Only one CIT-F connection may be used at a time.

ITM-CIT connections

Figure 3-6 ITM-CIT connections to the WaveStar® ADM 16/1



□

Provisioning with the ITM-CIT

Procedure Follow these steps to provision the network element with the ITM-CIT

1 Connect the ITM-CIT to the NE.

2 Create the NE using the ITM-CIT. Identify the NE to the ITM-CIT to make provisioning of this NE possible.

3 Assign the inserted cards to the slots. Check whether the SC correctly initializes the units.

> **Result:** The LEDs on the inserted units switch off shortly after correctly assigning the units in the slots.

4 Confirm the MIB of the NE.

5 Provision the service protection state of the units (do this for the PT, CC-64/16 or CC-64/32) in case these units are protected by redundancy.

> **Important!** Be careful when changing the protection state of a unit. A protection switch is not hit-free!

6 Put the line ports in the monitored state.

> **Result:** The flashing of LEDs on the line interface units should stop when a line signal is connected to the line port and the port state is set to “monitored”.

7 Put the tributary ports to which actual tributary signals are connected in the monitored or auto state.

Result: The flashing of LEDs on the tributary interface units should stop when a tributary signal is connected to the tributary port and the port state is set to monitored or auto.

8 If one of the station clock inputs on the inter connection panel is going to be used:

- Provision the signal type of the timing reference signal.
- Put the port of the timing reference signal corresponding to the used input connector in the monitored state. Connectors IN1 and IN2 on the inter connection panel correspond respectively with MTP1.1 and MTP1.2 on the ITM-CIT.
- Assign the connected timing reference signal on the station clock input to a logical timing source.
- Follow the timing provisioning procedures in chapter ″Provisioning timing″ in the “WaveStar® ADM 16/1 User Operations Guide”.

9 If one of the station clock outputs is used:

- Provision the signal type of the timing reference signal.
- Enable the station clock output corresponding to the used output connector. Connectors OUT1 and OUT2 on the inter connection panel correspond respectively with MTP1.1 and MTP1.2 on the ITM-CIT.

10 Provision the names of the MD I/Os (optional). The ITM-CIT can provision the names of the devices that are actually connected to the MD I/O connector on the inter connection panel.

11 Execute a local system test (LST).

12 Execute a LED test.

END OF STEPS

□

4 Testing the WaveStar® ADM 16/1

Overview

Purpose

This document describes the testing of the network element locally by checking the transmission functionality. This testing is done with the use of external test equipment.

Objective

Verifying that after insertion and initialization of all units the network element is working correctly by looping the transmission inputs to the outputs, and checking if the transmission path is error-free.

Outcome

Secure the well-functioning of the network element after local provisioning.

Intended use

This chapter provides the testing personnel with tests which must be carried out after the WaveStar® ADM 16/1 is installed for the first time.

Contents

Section: Measuring the optical output power

Overview

Purpose

To check whether the optical output power of the line- or tributary interface units is in the proper range.

Contents

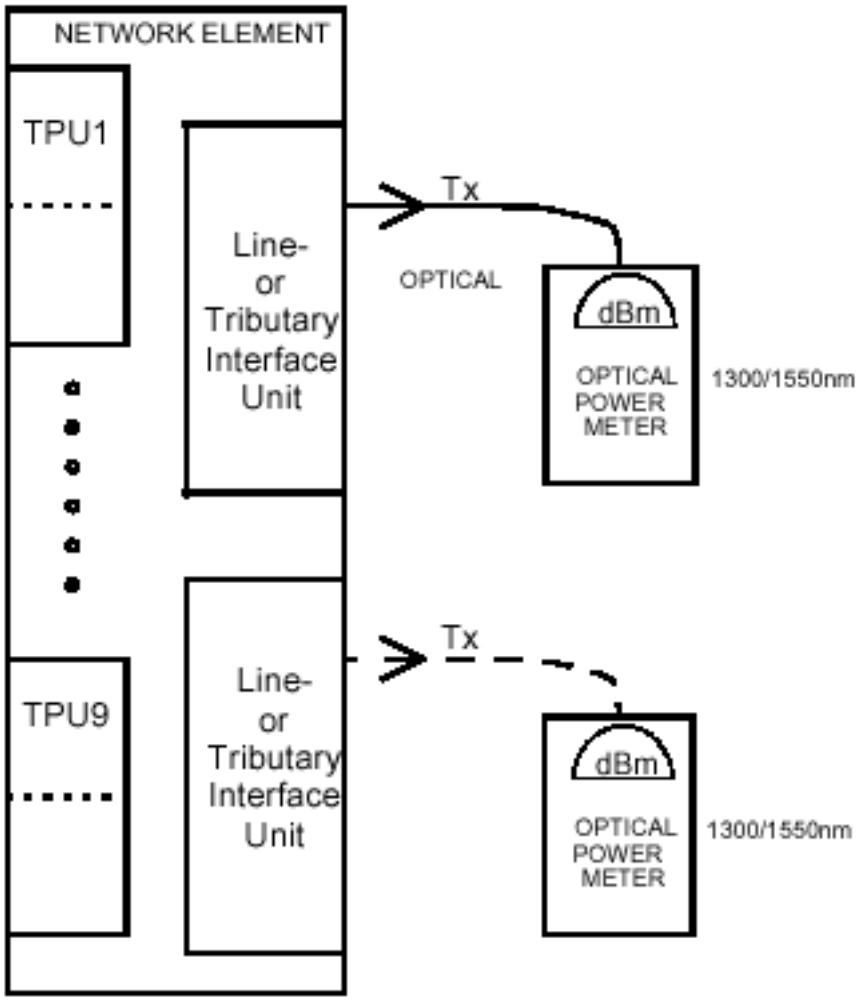
Test configuration for measuring the optical output power

Optical output power measurement

Testing the optical line interfaces takes place per optical line- or tributary interface unit by measuring the optical output level on the Tx connector on the front of these units, see the following figure. For the optical signals STM-1 and STM-0 however, the output level must be measured on the optical distribution frame.

Schematic view

Figure 4-1 Optical output power measurement



□

Values of the optical output power

Optical output power

The following table gives the values of the optical transmitters in WaveStar® ADM 16/1.

Unit	Description and remarks	Wavelength range	Optical output power
SI-L 16.1/1C	Long Haul STM-16	1280 - 1335 nm	+2...-2 dBm
SI-L 16.2/1C	Long Haul STM-16	1535 - 1565 nm	+2...-2 dBm
SI-EML U 16.2/1 + LBPA	must be measured at the output of the Booster	1552.52 nm	+12...+15 dBm
LBA=V 16.2/1	must be measured at the output of the Booster	1535 – 1560 nm	+12...+15 dBm
SI-16EML80.x/1 x channel numbers (x=1 to 16)	required for WaveStar® OLS 80G system	1549.32 - 1559.79 nm	-1...-11 dBm
SI-16EML 9xxx/1	required for WaveStar® OLS 400G system	1530.72 - 1562.23 nm	-3.8...-6.2 dBm
SI-S4.1/1	Short Haul STM-4	1280 - 1345 nm	-8...-15 dBm
SI-L4.2/1+6 dB	Long Haul STM-4	1535 – 1565 nm	+2...-3 dBm
OI-L1.2/2	Long Haul STM-4	1535 – 1565 nm	0...-5 dBm
OI-S1.1/2	Short Haul STM-1	1270 - 1360 nm	-8...-15 dBm
OI-0/6	Short Haul STM-0	1270 - 1360 nm	-11...-17 dBm
IP-GE/2	Gigabit Ethernet	1000 BASE-SX, 1000 BASE-LX or 1000 BASE-ZX	

□

Measure the optical output power

When to use Use the following procedure to measure the optical output power.

Before you begin No prerequisites or precautions are needed when performing this procedure.

Related information Connections to units are described in the "WaveStar® ADM 16/1 Installation Guide – Part I".

Procedure Proceed as follows to measure the optical output power.

1 Connect, by means of a single mode fiber cable, an optical power meter to the transmission optical output connector on the front of line- or tributary interface unit (Tx)

2 Adjust the optical power meter for measurements on 1300 nm or 1550 nm, depending on the type of line- or tributary interface unit used and check if the output power is in the range given in table ″Values of the Optical Output Power″. If the optical power is not in the range given in table ″Values of the Optical Output Power″, proceed with step [3]. If the optical power is within the range given in the table, proceed with step [4].

3 Disconnect the optical power meter and:

- clean the connectors on the optical power meter and on the line- or tributary interface unit
- check if the correct fiber cable between the optical power meter and the line- or tributary interface unit is used
- check if the optical power meter's measuring range is in accordance with the line- or tributary interface unit type used. Check the optical power again (start from step [2]). However, if the optical power is still not within the range, change the line- or tributary interface unit by a new one of the same type Wait until the system controller (SC) has initialized the unit (LED on the line- or tributary interface unit goes off or starts blinking) and check the optical power again (start from step [1]).

4 Disconnect the optical power meter.

5 Start from step [1] to test another line- or tributary interface unit.

END OF STEPS

□

Section: Checking the high speed parts of the line- or tributary interface unit

Overview

Purpose

To check whether the high speed circuits on the line- or tributary interface units are working correctly.

Contents

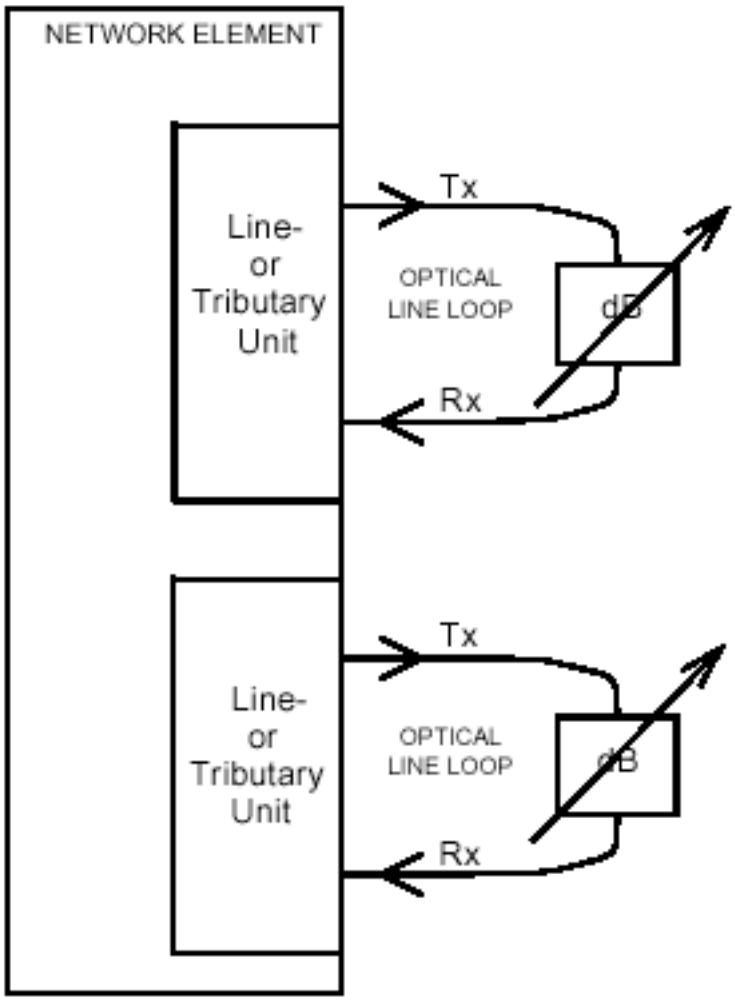
Test configuration for looping the line- or tributary interface unit

Line- or tributary interface unit test

The line- or tributary interface unit signals are tested by looping the output signal of the unit back to the input of the unit which form part of the same high speed interface, see the following figure. For the optical signals STM-1 and STM-0 however, the output level must be measured on the optical distribution frame.

Schematic view

Figure 4-2 Looping the line- or tributary interface unit



□

Checking the line- or tributary interface unit

When to use

Use the following procedure to check the optical circuits of the line- or tributary unit.

Before you begin

Before the NE is made part of the transmission network it is advised to check the optical high speed transmission units on their functioning.

Related information

Connections to units are described in the "WaveStar® ADM 16/1 Installation Guide – Part I".

Procedure

Proceed as follows to check the units:

1 Connect an adjustable optical attenuator between the connectors on the front of line- or tributary interface unit 1 and set the attenuation to a value until the LED on the line interface unit goes off.

2 Increase the optical attenuation carefully until the LED on the unit flashes

Result: The LED on the line- or tributary interface unit flashes again.

3 Decrease the optical attenuation

Result: The LED on the line- or tributary interface unit goes off again.

4 Start from step [1] and perform this test on all line- and tributary interface units.

END OF STEPS

□

Section: Transmission test on the tributary interface unit

Overview

Purpose

To check whether the low speed circuits on the tributary interface units are working correctly.

Contents

Transmission test configuration

Tributary interface unit test

For the tributary interface unit test, a data analyzer is needed. The type of data analyzer depends on the type of tributary interface unit to be tested. In case more than one type of tributary interface unit is used in the system, for each type the specified data analyzer is needed and must be set up.

The tributary interface units are tested, one by one, by supplying an external tributary data signal to each channel of the tributary interface unit to be tested and by feeding back this signal back via the same channel.

This test requires that the appropriate cross connections are defined, otherwise there will be an AIS or unequipped signal at the outputs of the tributary interface unit. On how to set the cross connections you are referred to the "WaveStar® ADM16/1 User Operations Guide".

Data Analyzer settings

The following tables present the the settings for the data analyzer.

Unit	**# Ch**	**Code**	**Bit rate[1)]**
PI-DS1/63	63	AMI or B8ZS	1544 kBit/s
PI-E1/63	63	HDB-3	2048 kbit/s
PI-E3/6	6	HDB-3	34.368 Mbit/s
PI-DS3/6	6	HDB-3	44.736 Mbit/s
PI-DS3/12	12	HDB-3	44.736 Mbit/s
PI-E4/4	4	CMI	139.264 Mbit/s
SI-1/4	4	CMI	155.52 Mbit/s
IP-LAN	8	Manchester	10/100 Base-T

Unit	# Ch	Code	Bit rate[1)]
SPIA-1E4/4 [2)]	4	NRZ	139.264 Mbit/s or 155.52 Mbit/s (STM-1)
SIA-1/4 [2)]	4	NRZ	155.52 Mbit/s (STM-1)
SA-1/4B [2)]	4	NRZ	155.52 Mbit/s (STM-1)

SA-0/12 [2)]	12	NRZ	51.84 Mbit/s (STM-0)
SI-S4.1/1 [3)]	1	NRZ [4)]	622.08 Mbit/s (STM-4)
SI-L4.2/1+6 dB	1	NRZ [4)]	622.08 Mbit/s (STM-4)
IP-GE/2 [3)]	2	8B/10B	1000 Base-X[5)]

1) Pseudorandom signal; 2^{23-1}.

2) Optical interface via paddle board.

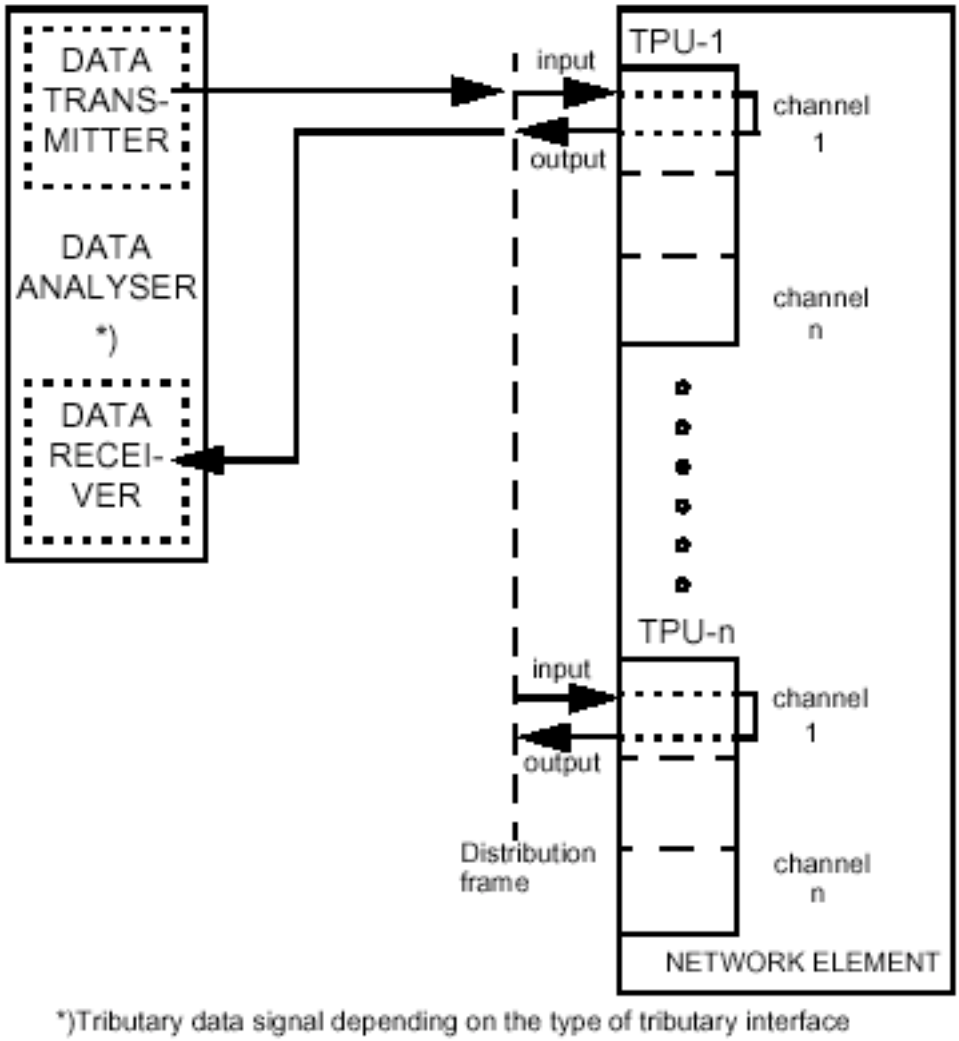
3) Front access on the unit via an optical module.

4) Optical line code.

5) Due to the capacity of the STM-4 backplane, the capacity of the IP-GE/2 LAN unit is limited to 600 Mbit/s.

Schematic view

Figure 4-3 Error measurement on the tributary interface unit



*)Tributary data signal depending on the type of tributary interface

A faster way of testing a tributary interface unit is by looping each channel output to the input of the next channel (within one unit). The first input and the last output must be connected to the data analyzer. In this way all channels of a tributary interface unit can be tested in one time. A fast way to test the IP-LAN units is to use two of them in the same subbay and set the one loopback on VC-4 level via the cross-connect unit. This in stead of using one IP-LAN unit and having to set more LO cross connections. For some types of tributary unit it is possible to provision internal loops, on the incoming as well as the outgoing signal. These loops can also be used for testing. Procedures to do so are described in the “WaveStar® ADM 16/1 User Operations Guide”.

□

Transmission test

When to use

Use the following procedure to check the low speed circuits of the tributary unit.

Before you begin

Before the NE is made part of the transmission network it is advised to check the electrical interface of the tributary interface unit.

Related information

Connections to units are described in the "WaveStar® ADM 16/1 Installation Guide – Part I".

Procedure

Proceed as follows to perform the transmission test:

1 Switch on the data analyzer and adjust both the transmitter and receiver side according to the settings in the tables ″data analyzer settings″.

2 Disconnect the distribution frame or subrack cabling of the tributary interface unit to be tested. Make sure the old situation can be restored again when necessary!

3 Connect the transmitter output of the data analyzer to the input of channel 1 of the tributary interface unit to be tested. See figure ″Error measurement on the tributary interface unit″.

4 Connect the output of the same channel of the tributary interface unit to the receiver input of the data analyzer.

5 Provision a loopback via the tributary interface unit or via the cross-connect unit. See figure ″Error measurement on the tributary interface unit″.

6 Check if the signal received by the data analyzer contains errors

- If the received signal does not contain errors then the tributary interface unit channel under test is functioning fault-free
- In case any errors occur in the received signal check on any active alarms. To solve the problem you are referred to the "WaveStar® ADM 16/1 Alarm Messages and Trouble Clearing guide".

7 Disconnect the Data Analyzer from the system and switch it off. restore the cabling of the tributary interface unit just tested properly.

8 Start from step [1] to test another tributary interface unit channel.

END OF STEPS

□

5 Fast downloading

Overview

Purpose

The “Fast download” application permits to download the current software in the equipment in about five minutes. The “Fast download” is realized from a PC connected to the Q-LAN interface of the NE.

The “Fast download” application is installed in the Windows environment using the program supplied. It is a simple process during which on-screen guidance is provided.

NOTE: Use always the *Fast Download Tool* that has been delivered with the system.

The purpose of this chapter is to explain:

- How to install the “Fast download” application
- How to use this application.

Contents

PC requirements

Minimum PC configuration

For the ITM-CIT a personal computer is necessary which fulfils the following minimum requirements:

- *Pentium* ® processor with 450 MHz or higher
- 128 MB RAM or higher
- Keyboard
- Mouse
- 300 MB of free hard-disk drive space
- CD-ROM drive
- Display with 1024x768, 16 million colors recommended
- RS-232 communication port (serial asynchronous port)
- *Microsoft* ® *Windows* ® 2000 or *Windows XP* ® operating system
- ITM-CIT connector (F-interface) cable (one end RS-232 and the other end RJ-45 modular jack).

The performance can be enhanced by using a higher performance personal computer. Independent of the requirements listed above the minimum requirements of the operating system must be fulfilled. A CD-ROM containing the ITM-CIT software must be available.

□

Installation of the fast download application

Procedure Proceed as follows to install the “Fast download” application:

1 Insert the CD-ROM which includes the “Fastdownload.exe” file in the CD-ROM drive of the PC.

2 Select the `Run...` command from the Windows *Start menu*, type *d:\fastdownload.exe* (where *d:* is the CD-ROM drive indicator) and click `OK`.

Result: The screen of the *WinZip Self-Extractor – FastDownload.exe* is displayed.

3 Select the directory to which the files shall be extracted and press the `Unzip` button.

Result: The files will be extracted.

4 Select the `Run...` command from the Windows *Start menu*, type *C:\TEMP\setup.exe* (where *C:\TEMP* is the used directory) and click `OK`.

Result: The *Fastdownload Installer dialog box* appears. Follow the instructions and accept the license agreement.

5 Install successively as requested the “Fast Download Tool” and “WinPcap”. When the installation is complete, a message appears indicating that the installation has been successfully.

6 Reboot the PC to allow for the tool to connect to the present Ethernet Adapters.

END OF STEPS

□

Use of the fast download application

Before you begin

Be sure all listed assumptions described below are fulfilled before carrying out the fast software download:

- The NE is powered on.
- The "Fast download" application is installed on the PC.
- An Ethernet cable is installed between the Ethernet access of the PC and the Q-LAN interface (RJ45 connector) of the NE. A **crossed** cable must be used.
  NOTE: This connection can also be realized through a HUB. In that case **straight** cables must be used between the PC and the HUB and between the HUB and the NE.

Procedure

Proceed as follows to install the NE software via the "Fast download" application:

1 Select `Start` → `Programs` → `Fast download tool`.

Result: The screen *Fast Download Tool* is displayed.

2 Select the correct Ethernet Adapter.

3 Select the load with the extension `.ISD` or `.S3` to be downloaded.

If an ".S3" file is selected for download then the tool will do a conversion to ".ISD". Press `OK` to the displayed "Attention" message.

4 Select the `NE` for downloading the `MAC address`.

5 Click on the `Download` button to start the software download to the NE.

Result: The download starts and the following steps are observed: "Connecting", "Erasing" and "Downloading" (the progress of the downloading is indicated).

6 When the download is completed successfully then the NE will automatically perform a "Switch, MIB clear", it will reboot and come up with the newly loaded software and an empty MIB.

7 Click on `Exit`.

END OF STEPS

Fast downloading problems

User actions for fast downloading:

Problem	User action
The fast download program is aborted	If you quit during the fast download process is running, you must restart the procedure from the beginning or you must switch off, switch on the NE.
The fast download program displays an error message	Taking into account the error message, introduce a correction and restart the procedure.

NE software upgrade

The software activation of the NE is done automatically after the download. The connection with the ITM-CIT or the ITM-SC is available about 90 seconds later. The user has to configure the equipment again.

□

Glossary

NUMERICS

5ESS
Number 5 Electronic Switching System

5TAD
Five Tributary Add-Drop subrack

9TAD
Nine Tributary Add-Drop subrack

12 digit Numerical Code (12NC)
Used to as the unique identifier of an item or product. The first ten digits identify an item. The eleventh digit specifies the particular variant of the item. The twelfth digit indicates the revision issue. Items for which the first eleven digitsare the same are functionally equal and may be exchanged.

A

AAU
Alarm Adapter Unit. Radio Relay circuit pack that is used for the collection of external alarms and remote control of external equipment.

AC
Alternating Current

ACU
Alarm Collection Unit. Radio Relay circuit pack that collects of equipment alarms, analogue measurements from internal monitoring points and calculation data.

ADM
Add-Drop Multiplexer

Administrative Unit (AU)
Carrier for TUs

Administrative-Unit Pointer (AU PTR)
Indicates the phase alignment of the VC-n with respect to the STM-N frame. The pointer position is fixed with respect to the STM-N frame.

Administrator
See ITM-SC System Administrator.

Agent
Performs operations on managed objects and issues events on behalf of these managed objects. All SDH managed objects will support at least one agent. Control of distant agents is possible via local ″Managers″.

Alarm
The notification (audible or visual) of a significant event. See also Event.

Alarm Indication Signal (AIS)
Code transmitted downstream in a digital Network that shows that an upstream failure has been detected and also alarmed if the upstream alarm has not been suppressed. Also called to as All OneS.

Alarm Severity
An attribute that defines the priority of the alarm message. The way in which alarms are processed depends on the severity.

Aligning
Using a pointer to indicate the head of a virtual container, e.g. to create an Administrative Unit (AU) or a Tributary Unit (TU).

ALS
Automatic Laser Shutdown

Alternate Mark Inversion (AMI)
A line code that employs a ternary signal to convert binary digits. In this line code successive binary ones are represented by signal elements that are normally of alternately positive and negative polarity but are equal in amplitude, binary zeros are represented by signal elements that have zero amplitude.

American Standard Code for Information Interchange (ASCII)
A standard 8-bit code that is used to exchange information among data processing systems and associated equipment.

Anomaly
A difference between the actual and the desired operation of a function.

ANSI
American National Standards Institute

APS
Automatic Protection Switching

AS
Alarm Suppression assembly

Assembly
Gathering together of payload data with overhead and pointer information (an indication of the direction of the signal).

Association
A logical connection between manager and agent through which management information can be exchanged.

Asynchronous
See Non-synchronous.

ATC
Auxiliary Transmission Channel

ATM
Asynchronous Transfer Mode

ATPC
Automatic Transmit-Power Control

AU
Administrative Unit

AU4AD
Administrative Unit 4 Assembler/Disassembler

AUG
Administrative Unit Group

AUTO
Automatic

Automatic Transmit Power Control (ATPC)
Reduces the power output from the transmitter during normal propagation conditions and increases the power output to maximum during fading periods to try to maintain the nominal level of receiver input.

Autonomous Message
A message transmitted from the controlled network element to the ITM-SC that was not a response to a command that orginated in the ITM-SC.

B

B3ZS
Bipolar 3-Zero Substitution

B8ZS
Bipolar 8-Zero Substitution

BBTR
Backplane Bus TRansceiver

BC
Board Controller

BCC
Board Controller Complex

BIN
BINary

BIP
Bit-Interleaved Parity

BISDN
Broadband Integrated Services Digital Network

Bit Error Ratio (BER)
The ratio of bits received in error to bits sent.

Bit Interleaved Parity (BIP)
A method of error monitoring that uses a specified number of bits (BIP-8)

BLD OUT LG
Build-Out Lightguide

Board Controller Local Area Network (BC-LAN)
The internal local area network that provides communications between the Line Controller circuit pack and board controllers on the circuit packs that are associated with a high-speed line.

Branching
Interconnection of independent line systems.

Broadband Communication
Voice, data, and/or video communication at greater than 2 Mbit/s rates.

Broadband Service Transport
STM-1 concatenation transport over the SLM for ATM applications.

BUSTR
BUS Transmitter and Receiver

C

CAS
Channel Associated Signaling

CAT
CATastrophic

CC
Cross-Connection, Cross-Connect

CCIR
See ITU-R.

CCITT
See ITU-T.

CCS
Common Channel Signaling

CEPT
Conférence Européenne des Administrations des Postes et des Télécommunications

Channel
A sub-unit of transmission capacity within a defined higher level of transmission capacity, e.g. a CEPT-4 (140 Mbit/s) within a 565 Mbit fiber system.

CIR
Committed Information Rate

Circuit
A combination of two transmission channels that permits bidirectional transmission of signals between two points to support a single communication.

CIT
Craft Interface Terminal

Clear Channel (Cl. Ch.)
A provisionable mode for the 34 and 140 Mbit/s tributary outputs that causes parity violations not to be monitored or corrected before the 34 and 140 Mbit/s outputs are encoded.

Client
Computer in a computer network that generally offers a user interface to a server. See also Server.

CMI
Coded Mark Inversion

CO
Central Office

Co-resident
A hardware configuration where the ITM-SC and ITM-NM applications can be independently active at the same time on the same hardware and software platform without interfering with

each other's functioning.

Common Object Request Broker Architecture (CORBA)
CORBA allows applications to communicate with one another no matter where they are located or who has designed them.

Concatenation
A procedure whereby a multiplicity of Virtual Containers are associated with each other with the result that their combined capacity can be used as a single container across which bit-sequence integrity is maintained.

Configuration Management (CM)
Subsystem of the ITM-SC that, among other things, configures the network and processes messages from the network.

CONN PCB
Connector Printed Circuit Board

Container (C)
Carries plesiochronous signal, the ″payload″.

CP
Circuit Pack

Craft Interface Terminal (CIT)
Local manager for SDH network elements.

CRC
Cyclic Redundancy Check

Cross-Connect Map
Connection map for an SDH network element; contains information about how signals are connected between high speed time slots and low speed tributaries. See also Squelch Map.

Cross-Polarization Interference Cancellation
This feature permits both orthogonal polarizations of one Radio Frequency carrier to be used simultaneously, which provides greater spectral efficiency.

CTP
Connection Termination Point

CV
Code Violation

D

DACS
Digital Access & Cross-connect System

DACScan-T
See Integrated Transport Management Network Manager.

Data Communication Channel (DCC)
The embedded overhead communication channel in the SDH line. The DCC is used for end-to-end communication and maintenance. It carries alarm, control, and status information between network elements in an SDH network.

Data Communication Equipment (DCE)
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.

Data Terminating Equipment (DTE)
Originates data for transmission and accepts transmitted data.

Database Administrator
A user who administers the database of the ITM-SC application. See also User Privilege.

DC
Direct Current

DCF
Data Communications Function

DCN
Data Communications Network

DCS
Digital Cross-connect System

DDF
Digital Distribution Frame

Dedicated Protection Ring (DP-Ring)
A protection method used in some network elements.

Default Value Provisioning
The original values are preprogrammed at the factory. These values can be overridden using local or remote provisioning.

Defect
A limited interruption of the ability of an item to perform a required function. The defect may or may not lead to maintenance action this depends on the results of additional analysis.

Demultiplexing
A process applied to a multiplexed signal to recover signals combined within it and restore the distinct individual channels of these signals.

Digital Link
A transmission span such as a point-to-point 2 Mbit/s, 34 Mbit/s, 140 Mbit/s, VC12, VC3 or VC4 link between controlled network elements. The channels within a digital link are insignificant.

Digital Section
A transmission span such as an STM-N or 565 Mbit/s signal. A digital section may contain multiple digital channels.

DIL
Dual In Line

Directory-Service Network Element (DSNE)
A designated network element that is responsible for administering a database that maps network element names (node names) to addresses (node Id). There can be one DSNE per (sub)network.

Disassembly
Splitting up of a signal into its constituents as payload data and overhead (an indication of the direction of a signal).

Domain
The domain of an ITM-SC is the set of all SDH network elements that are controlled by that particular ITM-SC.

Downstream
At or towards the destination of the considered transmission stream, i.e. in the direction of transmission.

DPLL
Digital Phase-Locked Loop

DPS
Data communication Packet Switch

DR
Digital Radio

DRI
Dual-Ring Interworking

DS-n
Digital Signal, Level n

DTMF
Dual-Tone Multi-Frequency

Dual Homing
An STM-1/STM-4 ring with AM-1 Plus equipment can be dual homed on a ring consisting of Metropolis® ADM (universal) Metropolis® ADM (Compact shelf) or WaveStar® ADM 16/1. Also STM-16 rings can be dual homed with the ADM Metropolis® (Universal shelf)).

Dual-Node Interworking
Dual Node Interworking (DNI) is a configuration of two ring networks that share two common nodes. DNI allows 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.

DUS
Do not Use for Synchronization

DWDM
Dense-Wavelength Division Multiplexing

E

EC-n
Electrical Carrier, Level n

ECC
Embedded Control Channel

EDFE
Ethernet Dropped Frames Errors

EH&S
Environmental Health and Safety

EINB
Ethernet Incoming Number of Mbytes

Electronic Industries Association (EIA)
A trade association of the electronic industry that establishes electrical and functional standards.

Element Management System (EMS)
See Integrated Transport Management Subnetwork Controller.

EMC
ElectroMagnetic Compatibility

EMI
ElectroMagnetic Interference

EONB
Ethernet Outgoing Number of Mbytes

EOW
Engineering Order Wire

Equivalent Bit Error Ratio (EBER)
The calculated average bit error rate over a data stream.

Errored Second (ES)
A performance monitoring parameter.

ES
End System

ESD
ElectroStatic Discharge

ESPG
Elastic Store & Pointer Generator

ETSI
European Telecommunication Standardisation Institute

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 ITM-SC.

Event Management (EM)
Subsystem of the ITM-SC that processes and logs event reports of the network.

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

Extra Traffic
Unprotected traffic that is carried over the protection channels when that capacity is not used for the protection of service traffic.

F

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.

FAS
Frame Alignment Signal

FAW
Frame Alignment Word

FC
Full contact Connector

FCC
Federal Communications Commission

FDDI
Fiber Distributed Data Interface

FEP
Front End Processor

Free Running
An operating condition of a network element in which its local oscillator is not locked to any synchronization reference and uses no storage techniques to sustain its accuracy.

G

GARP
Generic VLAN Registration Protocol

Gateway Network Element (GNE)
Passes information between other network elements and management systems via a Data Communications Network.

Gbit/s
Gigabits per second

Geographic Location
Location of the ITM-SC server. the geographic locationis entered as part of the installation procedure of an ITM-SC.

Geographic Redundancy (GR)
Allows protection of management for a network element by assigning the network element to two ITM-SCs. The first primary ITM-SC usually manages the Network Element and is now in the protected domain. If the primary ITM-SC or the link between the network element and the primary ITM-SC fails, the secondary ITM-SC will automatically take over management of the network element and is now in the protecting domain. The two ITM-SCs are connected by a peer to peer link, which they use to pass Geographic Redundancy management information to each other. This link must be established before any network element can be protected by Geographic Redundancy.

GFP
Generic Framing Procedure

Global Wait to Restore Time
The time to wait before switching back to the timing reference occurs after a timing link failure has cleared. This time applies for all timing sources in a system hence the name global. This can be between 0 and 60 minutes, in increments of one minute.

GNE
Gateway network element - A network element that passes information between other network elements and operations systems via a data communications network.

GUI
Graphical User Interface

GVRP
Generic VLAN Registration Protocol

H

HE
Host Exchange

High Density Bipolar 3 code (HDB3)
Line code for e.g. 2 Mbit/s transmission systems.

High level Data Link Control (HDLC)
Protocol in the data-link layer of the OSI reference model.

Higher order Path Adaptation (HPA)
Function that adapts a lower order Virtual Container to a higher order Virtual Container by processing the Tributary Unit pointer which indicates the phase of the lower order Virtual Container Path Overhead relative to the higher order Virtual-Container Path Overhead, and assembling/disassembling the complete higher order Virtual Container.

Higher order Path Connection (HPC)
Function that provides for flexible assignment of higher order Virtual Containers within an STM-N signal.

Higher order Path Termination (HPT)
Function that terminates a higher order path by generating and adding the appropriate Virtual-Container Path Overhead to the relevant container at the path source and removing the Virtual-Container Path Overhead and reading it at the path sink.

HMI
Human Machine Interface

HO
High Order

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

frequency comparison with a synchronized reference.

Host Name
Name of the server on which the ITM-SC is running.

HP-UX
Unix Operating System for a Hewlett Packard platform.

HS
High Speed

I

I/O
Input/Output

ICB
Interconnection Box

ICP
InterConnection Panel

IEC
International Electrotechnical Committee

IEEE
Institute of Electrical and Electronic Engineers

IF
Intermediate Frequency

IFT
InterFace Terminal

Integrated Transport Management Craft Interface Terminal (ITM-CIT)
Local manager for SDH network elements in a subnetwork. Also called the to as Craft Interface Terminal.

Intelligent Synchronous Multiplexer (ISM)
A network multiplexer that is designed to flexibly multiplex plesiochronous and STM-1 tributary port signals into STM-1 or STM-4 line port signals.

Intermediate System (IS)
A system that routes/relays management information. An SDH network element may be a combined Intermediate and end system.

IPS
Inter Processor Status

IS
In-Service

IS-IS Routing
The network elements in a management network, route packets (data) between each other using an IS-IS level protocol. The size of a network that is running IS-IS Level 1 is limited, and therefore certain mechanisms are employed to facilitate the management of larger networks. For STATIC ROUTING, it is possible to disable the protocol over the LAN connections and thereby effectively cause the management network to be partitioned into separate IS-IS Level 1 areas. In order for the ITM-SC to communicate with a specific network element in one of these areas, the ITM-SC must identify the Gateway network elementthrough which this specific network element is connected to the LAN. All packets to this specific network element are routed directly to the Gateway network element by the ITM-SC, before being re-routed (if necessary) within the Level 1 area. For DYNAMIC ROUTING an IS-IS Level 2 routing protocol is used that allows a number of Level 1 areas to interwork. The network elements that connect an IS-IS area to another area are set to run the IS-IS Level 2 protocol within the network element and on the connection to other network elements. Packets can now be routed between IS-IS areas and the ITM-SC does not have to identify the Gateway network elements.

ISDN
Integrated Services Digital Network

ISO
International Standards Organisation

ITM-SC Administrator
See ITM-SC System Administrator.

ITM-SC System Administrator
A user of the ITM-SC application with System Administrator privileges. See also User Privilege.

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.

J Jitter

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

L

LAN
Local Area Network

LBA
Lightwave Booster Amplifier.

LBO
Lightguide Build-Out - An optical attenuator that guarantees the proper signal level and shape at the receiver input.

LCAS
Link Capacity Adjustment Scheme

LCN
Local Communications Network

LDI
Linear Drop/Insert (Add-Drop)

LED
Light Emitting Diode

LEN
Local Exchange Node

LF
Low Frequency

LH
Long Haul

License key
An encrypted code that is required to enable the use of specific modules in the ITM-SC. Valid license keys can be obtained from your provider.

Line
Transmission line; refers to a transmission medium, together with the associated high speed equipment, that are required transport information between two consecutive network elements, one of which originates the line signal and the other terminates the line signal.

Line Build Out (LBO)
An optical attenuator that guarantees the proper signal level and shape at the receiver input.

Line Overhead Controller (LOC)
SLM circuit pack that accesses the overhead bytes from the high speed line.

LNC
LiNe Controller (SLM)

LO
Low Order

LOF
Loss Of Frame

LOM
Loss Of Multiframe

Loop Timing
A timing mode in which the terminal derives its transmit timing from the received line signal.

LOP
Loss Of Pointer

LOS
Loss Of Signal

Lower order Path Adaptation (LPA)
Function that adapts a PDH signal to a synchronous network by mapping the signal into or de-mapping the signal out of a synchronous container.

Lower order Path Connection (LPC)
Function that provides for flexible assignment of lower order VCs in a higher order VC.

Lower order Path Termination (LPT)
Function that terminates a lower order path by generating and adding the appropriate VC POH to the relevant container at the path source and removing the VC POH and reading it at the path sink.

LPU
Line Port Unit

LPU155
Line Port Unit 155 Mbit/s

LRX
Line Receiver

LS
Low Speed

LTA
Line Terminal Application

LTX
Line Transmitter

LTX/EML
Line Transmitter with Electro-absorption Modulated Laser

M

MAF
Management Application Function

Management Connection
Identifies the type of routing used (STATIC or DYNAMIC). If STATIC is selected, Management Connection allows the gateway network element to be identified. See also IS-IS Routing.

Management Information Base (MIB)
The database in the network element. Contains the configuration data of the network element. A copy of each MIB is available in the ITM-SC and is called the the MIB image. Under normal circumstances the MIB and MIB image of one Network Element are synchronized.

Manager
Is capable of issuing network management operations and receiving events

Manager
Capable of issuing network management operations and receiving events. The Manager communicates with the Agent in the controlled network element.

Manufacturer Executable Code (MEC)
Network element system software in binary format that is downloaded to one of the stores can be executed by the system controller of the network element.

Mapping
Gathering together of payload data with overhead, i.e. packing the PDH signal into a Virtual Container.

MDI
Miscellaneous Discrete Input

MDO
Miscellaneous Discrete Output

Mediation Device (MD)
Allows for exchange of management information between Operations System and network elements.

MEF
Maintenance Entity Function (in NE)

MEM
System MEMory unit

Message Communications Function (MCF)
Function that provides facilities for the transport and routing of Telecommunications Management Network messages to and from the Network Manager.

Metropolis® ADM MultiService Mux
A network multiplexer that is designed to flexibly multiplex plesiochronous and/or STM-1 tributary port signals into STM-4 or STM-16 line port signals.

MF
Mediation Function

MFS
Multi Frame Synchronization signal

MIB
The Management Information Base is the database in the node. The MIB contains the configuration data of the node. A copy of each MIB is available in the EMS and is called the MIB image. Under normal circumstances, the MIB and MIB image of one node are synchronized.

MIB image
See Management Information Base.

Midspan Meet
The capability to interface between two lightwave network elements of different vendors. This applies to high speed optical interfaces.

MLAN
MultiLAN

MMI
Man-Machine Interface Also called Human Machine Interface (HMI)

MO
Managed Object

Motif
X-Windows System supplied by Open Software Foundation.

MS
Multiplexer Section

MSOH
Multiplex Section Overhead. Part of the SOH (Section Overhead). Is accessible only at line terminals and multiplexers.

MSP
Multiplex Section Protection. Provides capability of switching a signal from a working to a protection section.

MTBF
Mean Time Between Failures

MTBMA
Mean Time Between Maintenance Activities

MTIE
Maximum Time Interval Error

MTPI
Multiplexer Timing Physical Interface

MTTR
Mean Time To Repair

Multiplexer Section OverHead (MSOH)
Part of the Section Overhead. Is accessible only at line terminals and multiplexers.

Multiplexer Section Protection (MSP)
Provides capability of switching a signal from a working to a protection section.

Multiplexer Section Shared Protection Ring (MS-SPRING)
A protection method used in multiplex line systems.

Multiplexer Section Termination (MST)
Function that generates the Multiplexer Section Overhead in the transmit direction and terminates the Multiplexer Section Overhead in the receive direction.

Multiplexer Timing Source (MTS)
Function that provides the timing reference to the relevant component parts of the multiplex equipment and represents the SDH network element clock.

Multiplexing
A procedure by which multiple lower order path layer signals are adapted into a higher order path, or by which the multiple higher order path layer signals are adapted into a multiplex section.

N

NE
Network element. The NE is comprised of telecommunication equipment (or groups/parts of telecommunication equipment) and support equipment that performs network element functions. A Network Element has one or more standard Q-type interfaces.

NEF
Network element function

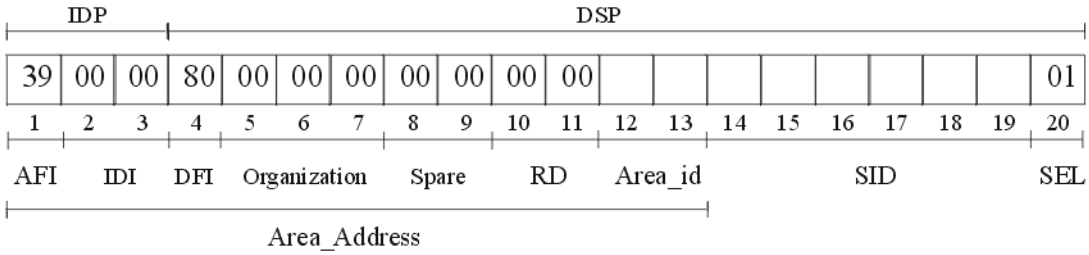
NEM
Network element manager

Network Element (NE)
A network element is comprised of telecommunication equipment (or groups/parts of telecommunication equipment) and support equipment that performs network element functions. A Network Element has one or more standard Q-type interfaces. A network element ican be directly managed by a management system. See also Node.

Network Element Equivalent (NEE)
The functionality, database size and processing power that are required from the ITM-SC are different for each type of network element that is supported. Therefore each type represents a certain amount of Network Element Equivalent.

Network Mediation Unit (NMU)
Collects fault and alarm events from transmission equipment. The ITM-SC can forward alarms to the NMU. The NMU can forward alarms to an Operations System.

Network Service Access Point (NSAP)
An end system address of the System Controller according to ISO 8348 AD2. The format is ISO_DCC_LUCENT, which has the following structure:



Where

Field	Description	Length	Fixed Values
IDP	Initial Domain Part	3 octets	-
DSP	Domain Specific Part	17 octets	-
AFI	Authority and Format Identifier	1 octet	39
IDI	Initial Domain Identifier	2 octets	00 00
DFI	DSP Format Identifier	1 octet	80
Organization		3 octets	00 00 00
Spare		2 octets	00 00
RD	Routing Domain	2 octets	00 00
Area_id		2 octets	Provisionable
SID	System Identification	6 octets	-
SEL	NSAP Selector	1 octet	01
Area_Address	All Octects from AFI to Area_id	13 or 3 octets	-

NMC
Network Maintenance Center

NMS
Network Management System

NNE
Non-SDH network element

NNI
Network Node Interface

Node
A node or network element is defined as all equipment that is controlled by one system controller.

Node
Defined as all equipment that is controlled by one system controller. A node can not always be directly managed by a management system. See also network element.

NOMC
Network Operation Maintenance Channel

Non-revertive switching
In non-revertive switching, there is an active and standby high-speed line, circuit pack, etc. When a protection switch occurs, the standby line, circuit pack, etc., is selected causing the old standby line, circuit pack, etc., to be used for the new active line, circuit pack, etc. The original active line, circuit pack, etc., becomes the standby line, circuit pack, etc. This status remains in effect when the fault clears. Therefore, this protection scheme is “non-revertive” in that there is no switch back to the original status in effect before the fault occurred.

Non-revertive switching
In non-revertive switching there is an active and a standby high speed line, circuit pack, etc. When a protection switch occurs, the standby line, circuit pack, etc. is selected which causes the old standby line, circuit pack, etc, to be used for the new active line, circuit pack, etc. The original active line, circuit pack, etc. becomes the standby line, circuit pack, etc. This status remains in effect when the faults clears. Therefore, this protection scheme is non-revertive in that there is no switch back to the original status that was in effect before the fault occurred.

Non-synchronous
The essential characteristic of timescales or signals such that their significant instants do not necessarily occur at the same average rate.

Not Protected Domain
The Not Protected Domain for the ITM-SC contains all the network elements that are managed by that ITM-SC and are not currently protected by another ITM-SC. If the ITM-SC fails, the network elements in this domain are not managed by any ITM-SC. See also Geographic Redundancy.

NPI
Null Pointer Indication

NRZ
Non-Return to Zero

NSA
Non-Service Affecting

NUT
Non pre-emptible Unprotected Traffic

NVM
Non-Volatile Memory

O

OA
Optical Amplifier

OAA case tools
A software package/tool to aid the process of requirements, analysis, design and implementation of object orientated systems.

OAM&P
Operations, Administration, Maintenance and Provisioning

OC-n
Optical Carrier, Level n

ODF
Optical Distribution Frame

ODU
Optical Demultiplexer Unit

OFS
Out of Frame Second

OI
Optical Interface

OMU
Optical Multiplexer Unit

OOF
Out Of Frame

OOS
Out Of Service

Operations System (OS)
The Operations System is the system that provides operations, administration and maintenance functions.

Operator
A user of the ITM-SC application with Operator privileges. See also User Privilege.

Optical Line System (OLS)
A high-capacity lightwave system that is designed to multiplex eight optical signals with different wavelengths into one combined signal through an optical fiber. There is a difference of 1.5 micrometer in wavelength between two multiplexed signals.

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

OSB
Optical Splice Box

OSF
Open Software Foundation Operations System Function

OSF/Motif
The WaveStar® ITM-SC application has an X-windows graphical representation and the components used in the "Graphical User Interface" are OSF/Motif compliant, these components that are comprise of items such as: scrollbars, menus, radio buttons, etc.

OSI
Open Systems Interconnection

OW
(Engineering) Order Wire

P

PABX
Private Automatic Branch eXchange

Paddle Board - Peripheral Control and Timing link (PB-PCT)
A small circuit board used in a 5ESS exchange for protection switching and optical to electrical conversion of the PCT-link.

Path
A logical connection between one termination point at which a standard format for a signal at the given rate is assembled and from which the signal is transmitted, and another termination point at which the received standard frame format for the signal is disassembled.

Path AIS
Path Alarm Indication Signal - A path-level code that is sent downstream in a digital network as an indication that an upstream failure has been detected and alarmed.

Path Overhead (POH)
The Virtual-Container Path Overhead provides 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.

PC
Personal Computer

PCB
Printed Circuit Board

PCM
Pulse Code Modulation

PCT-link
Peripheral Control and Timing-link

PDH
Plesiochronous Digital Hierarchy

Peer ITM-SC
ITM-SC at the other end of the peer-to-peer link.

Peer to Peer link
Connection between two ITM-SCs with Geographic Redundancy. The link is used to co-ordinate the management of a network element. See also Geographic Redundancy.

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

Peripheral Control and Timing Facility Interface (PCTFI)
A proprietary physical link interface that supports the transport of 21 * 2 Mbit/s signals.

PI
Physical Interface, Plesiochronous Interface

PIR
Peak Information Rate

PJE
Pointer Justification Event

Platform
Family of equipment and software configurations that are designed to support a particular Application.

Plesiochronous Network
A network that contains multiple subnetworks, each of which is internally synchronous and operates at the same nominal frequency, but the timing of any of the subnetworks may be slightly different at any particular instant.

PLL
Phase Lock Loop

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

PMA
Performance Monitoring Application

Pointer
An indicator whose value defines the frame offset of a virtual container with respect to the frame reference of the transport entity on which the Virtual Container is supported.

POTS
Plain Old Telephone Service

PP
Pointer Processing

PPC
Pointer Processor and Cross-connect

Primary ITM-SC
ITM-SC that is usually managing a network element. If the primary ITM-SC fails, management of the network element is passed over to the secondary ITM-SC. A network element should be provisioned normally on the primary ITM-SC and then be configured for use on the secondary ITM-SC. See also Geographic Redundancy.

Primary Reference Clock (PRC)
The main timing clock reference in SDH equipment.

Protected Domain
The protected domain for an ITM-SC contains all the network elements for which this manager is the primary ITM-SC and which are protected by another secondary ITM-SC. See also Geographic Redundancy.

Protecting Domain
The protecting domain for an ITM-SC contains all the network elements for which this manager is the secondary ITM-SC. See also Geographic Redundancy.

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.

Provisioning
Assigning a value to a system parameter.

PSA
Partially Service Affecting

PSDN
Public Switched Data Network

PSF
Power Supply Filter

PSF-SIP
Power Supply Filter; originally designed for an Italian customer.

PSN
Packet-Switched Network

PSTN
Public Switched Telephone Network

PT
Protected Terminal Power-supply filter and Timing circuit pack

PVID
Port VLAN ID

Q

Q-LAN
Thin Ethernet LAN (10BaseT) that connects the manager to gateway network elements so that management information can be exchanged between network elements and management systems.

QAF
Q-Adapter Function (in NE)

QOS
Quality Of Service

Quality Level (QL)
The quality of the timing signal(s) that are provided to clock a network element. The level is provided by the Synchronization Status Marker which can accompany the timing signal. If the System and Output Timing Quality Level mode is “Enabled”, and if the signal selected for the Station-Clock Output has a quality level below the Acceptance Quality Level, the network element “squelches” the Station-Clock Output Signal, which means that no signal is forwarded at all. Possible levels are: - PRC (Primary Reference Clock) - SSU_T (Synchronization Supply Unit - Transit) - SSU_L (Synchronization Supply Unit - Local) - SEC (SDH Equipment Clock) - DUS (Do not Use for Synchronization).

R

RA
Regenerator Application

Radio Protection Switching system (RPS)
The main function of the RPS is to handle the automatic and manual switching from a main channel to a common protection channel in an N+1 system.

Radio Relay (RR)
A point-to-point Digital Radio system to transport STM-1 signals via microwaves.

RCU
Rigid Connect Unit

RCVR Data Distribution Unit (RCVR)
Radio Relay circuit pack that distributes of the protection channel and the low-priority traffic in the receiver side.

RDDU
RCVR Data Distribution Unit

RDI
Remote Defect Indicator. Previously known as Far End Receive Failure (FERF).

RDI
Ring Drop/Insert (Add-Drop)

RDSV
Running Digital Sum Violations

Receive-direction
The direction towards the cross-connect.

REGEN
Regenerator

Regenerator Loop
Loop in a network element between the Station Clock Output(s) and one or both Station Clock Inputs, which can be used to dejitterize the selected timing reference in network applications.

Regenerator Overhead Controller (ROC)
SLM circuit pack that provides user access to the SDH overhead channels at repeater sites.

Regenerator Section Termination (RST)
Function that generates the Regenerator Section Overhead (RSOH) in the transmit direction and terminates the RSOH in the receive direction.

REI
Remote Error Indication. Previously known as Far End Block Error (FEBE).

Relay Unit (RU)
Radio Relay circuit pack whose main function is to perform protection switching when the Alignment Switch in the demodulator unit is unable to perform protection switching.

Restore Timer
Counts down the time (in minutes) during which the switch waits to let the worker line recover before switching back to it. This option can be set to prevent the protection switch continually

switching if a line has a continual transient fault. This field is greyed out if the mode is non-revertive.

Revertive Switching
In revertive switching, there is a working and protection high speed line, circuit pack, etc. When a protection switch occurs, the protection line, circuit pack, etc. is selected. When the fault clears, service reverts back to the original working line.

RF
Radio Frequency

RFI
Remote-Failure Indicator

RGU
ReGenerator Unit

Route
A series of contiguous digital sections.

RPS
Ring Protection Switching

RSM
Remote Switching Module

RSOH
Regenerator-Section OverHead; part of the SOH.

RZ
Return to Zero

S

SA
Service Affecting Synchronous Adapter

SAI
Station Alarm Interface

SC
Square coupled Connector

SD
Signal Degrade

SDH
Synchronous Digital Hierarchy. Definition of the degree of control of the various clocks in a digital network over other clocks.

SDH-TE
SDH - Terminal Equipment

SEC
SDH Equipment Clock

Secondary ITM-SC
Backup ITM-SC for a network element should the primary ITM-SC fail. A network element should be provisioned normally on the primary ITM-SC and then be configured for use on the secondary ITM-SC. See also Geographic Redundancy.

Section
A transport entity in the transmission media layer that provides integrity of information transfer across a section layer network connection by means of a termination function at the section layer.

Section Adaptation (SA)
Function that processes the AU-pointer to indicate the phase of the VC-3/4 POH relative to the STM-N SOH and assembles/disassembles the complete STM-N frame.

Section Overhead (SOH)
Capacity added to either an AU-4 or to an assembly of AU-3s to create an STM-1. Always contains STM-1 framing and can contain maintenance and operational functions. SOH can be subdivided into MSOH (multiplex section overhead) and RSOH (regenerator section overhead).

SEF
Support Entity Function (in NE)

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

Server
Computer in a computer network that performs dedicated main tasks that require generally sufficient performance. See also Client.

Service
The operational mode of a physical entity that indicates that the entity is providing service. This designation will change with each switch action.

Severely Errored Frame Seconds (SEFS)
A performance monitoring parameter.

Severely Errored Second (SES)
A second that has a binary error ratio. SES is used as a performance monitoring parameter.

Severity
See Alarm Severity

SH
Short Haul

SI
Synchronous Interface

SIB
Subrack Interface Box

SLC
Subscriber Loop Carrier

SLM
Signal Label Mismatch

Smart Communication Channel (SCC)
An HDLC messaging channel between the SDH-TE and the 5ESS host node. Similar to the DCC messaging channels that are located in the STM-N section overhead.

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

Soft Windows
PC emulator package for HP platforms.

SOH
Section Overhead. Capacity added to either an AU-4 or to an assembly of AU-3s to create an STM-1. Always contains STM-1 framing and can contain maintenance and operational functions. SOH can be subdivided in MSOH (Multiplex Section OverHead) and RSOH (Regenerator Section OverHead).

SONET
Synchronous Optical Network

Space Diversity (SD)
Reception of the Radio signal via mirror effects on Earth.

SPB2M
Subrack Protection for 2 Mbit/s Board

Specification and Design Language (SDL)
This is a standard formal language for specifying (essentially) finite state machines.

SPI
SDH Physical Interface Synchronous-Plesiochronous Interface

Squelch Map
Traffic map for SLM Add-Drop Multiplexer network elements that contains information for each cross-connection in the ring and indicates the source and destination network elements for the low-speed circuit to which the cross-connection belongs. This information is used to prevent traffic misconnection in rings that have isolated network elements or segments. See also Cross-Connect Map.

SSM
Synchronization Status Marker

Standby
The operational mode of a physical entity that indicates that the entity is not providing service, but standby. This designation changes with each switch action.

Standby
The operational mode of a physical entity that indicates that the entity is not providing service but is on standby. This designation will change with each switch action.

Station Clock Input (SCI)
An external clock may be connected to a Station Clock Input.

Station Clock Output (SCO)
A clock signal that can be used for other systems.

STM
Synchronous Transport Module Building block of SDH.

STM
Synchronous Transport Module building block of SDH

STP
Spanning Tree Protocol

Stretched Ring (STRING)
An open ring in which each node is an Add-Drop Multiplexer. The end nodes operate with one equipped high-speed line.

STS
Synchronous Transport Signal; used in SONET.

STVRP
Spanning Tree with VPN Registration Protocol

Subnetwork
A group of interconnected/interrelated network elements. The most common connotation is an SDH network in which the network elements have Data Communications Channels (DCC) connectivity.

Supervisor
A user of the ITM-SC application with Supervisor privileges. See also User Privilege.

Supervisory Unit (SU)
Radio Relay circuit pack that gives comprehensive supervision and control facilities to the user by collecting information from the Alarm Collection Units and Alarm Adapter Units.

SVCE
Service

Switch Receive Unit (SWR)
SLM circuit pack that provides the cross-connect in the receive direction between high speed line timeslots and low speed tributaries.

Switch Transmit Unit (SWT)
SLM circuit pack that provides the cross-connect in the transmit direction between high speed line timeslots and low speed tributaries.

Switching Module (SM)
An access module from the 5ESS switch.

Synchronization Supply Unit (SSU)
A circuit pack that recovers and reshapes the clock signal in order to filter out jitter. Local (SSU_L) and Transit (SSU_T) types are available.

Synchronous
The essential characteristic of time-scales or signals such that their corresponding significant instants occur at precisely the same average rate.

Synchronous Digital Hierarchy (SDH)
A hierarchical set of digital transport structures that is standardized for the transport of suitably adapted payloads over transmission networks.

Synchronous Equipment Management Function (SEMF)
Function that converts performance data and implementation-specific hardware alarms into object-oriented messages for transmission over the DCC and/or the Q-interface. The SEMF also converts object-oriented messages that are related to other management functions so that they can pass across the S reference points.

Synchronous Line Multiplexer (SLM)
A line multiplexer that is designed to multiplex VC-4 and STM-1 tributary port signals into STM-16 line port signals.

Synchronous Network
The synchronization of synchronous transmission systems with synchronous payloads to a master Network clock that can be traced to a single reference clock.

Synchronous Transport Module (STM)
The information structure that is used to support (section layer) connections in SDH.

System Administrator
A user of the computer system on which the ITM-SC application can be installed. See also User Privilege.

System Controller (CTL)
ISM circuit pack that controls the configuration of an Intelligent Synchronous Multiplexer system.

System Controller (SC)
A circuit pack that controls and provisions all units. It also contains the data communication packet switch functionality that is necessary for routing of management information between network elements and their management system.

System Controller (SCT)
SLM Line Terminal and Regenerator network element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The SCT circuit pack provides overall administrative control of the system. The SCT memory is included in the same one circuit pack.

System Controller (STC)
SLM Add-Drop Multiplexer network element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The STC circuit pack provides overall administrative control of the system. The STC memory is provided by the MEM circuit pack.

System Controller (SYSCTL)
OLS circuit pack that provides the highest level of system control for the Optical Line System. The SYSCTL circuit pack provides overall administrative control of the system. The SYSCTL memory is provided by the SYSMEM circuit pack.

System Memory Unit (MEM)
SLM Add-Drop Multiplexer network element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The MEM circuit pack provides memory support for the System Controller (STC) circuit pack.

System Memory Unit (SYSMEM)
OLS circuit pack that provides the highest level of system control for the Optical Line System. The SYSMEM circuit pack provides memory support for the SYSCTL circuit pack.

T

TCA
Threshold Crossing Alarm

TCP/IP
Transmission Control Protocol/Internet Protocol

TDEV
Timing DEViation

TDM
Timing Division Multiplexing

Template
A collection of parameters that define a specific network element configuration. A template gives the user the opportunity to configure parameters in a network element with a single operation. The template is re-usable and allow the user to configure the parameters in many Network Elements in the same way. A set of default templates is provided, and the user can create new templates and edit or delete user-created ones. Note that a template is always associated with one specific network element type and can not be used for other network element types.

TERM
Terminal Multiplexer

TGU
Timing Generator Unit

TI
Timing Interface

TLM
TeLeMetry Unit

TLP
Terminal with Line Protection

TMN
Telecommunications Management Network

TPU
Tributary Port Unit

TPU-PCT
Tributary Port Unit - Peripheral Control and Timing link

TPU155
Tributary port Unit 155 Mbit/s

TPU2
Tributary port Unit 2 Mbit/s

TPU34/45
Tributary port Unit 34/45 Mbit/s

Transmit-direction
The direction outwards from the cross-connect.

Trellis Code Modulation
A combined coding and modulation scheme for improving the reliability of a digital transmission system without increasing the transmitted power or the required bandwidth.

TRF
TRansFer unit

Tributary
A signal of a specific rate (2 Mbit/s, 34 Mbit/s, 140 Mbit/s, VC12, VC3, VC4, STM-1 or STM-4) that may be added to or dropped from a line signal.

Tributary Overhead Controller (TOC)
SLM circuit pack that allows access to the overhead bytes of the incoming tributary signal.

Tributary Overhead Controller (TOHCTL)
OLS circuit pack that allows access to the overhead bytes of the Supervisory channel.

Tributary Unit (TU)
An information structure that provides adaptation between the lower order path layer and the higher path layer. Consists of a VC-n plus a tributary unit pointer TU PTR.

Tributary Unit Pointer (TU PTR)
Indicates the phase alignment of the VC with respect to the TU in which it resides. The pointer position is fixed with respect to the TU frame.

TSA
Time Slot Assignment

TSI
Time Slot Interchange

TTP
Trail Termination Point

TUG
Tributary Unit Group

U

UAS
UnAvailable Seconds

UIM/X
A package that is used for developing the WaveStar® ITM-SC GUI for X-windows.

ULDT
Ultra Long Distance Transmission

Unavailable Seconds
A performance monitoring parameter.

Uninterruptable Power Supply (UPS)
Allows connected computer equipment to gracefully shutdown and therefore prevents damage in the case of a power failure. Also absorbs dips in the power supply.

Universal Co-ordinated Time (UTC)
An indication of the time of an event that is independent of the time-zone in which the event occurred. The local time can be calculated from the Universal Co-ordinated Time.

Upgrade
An upgrade is the addition of new capabilities (feature). An upgrade requires new software and may require new hardware.

UPL
User PaneL

Upstream
At or towards the source of the considered transmission stream, i.e. in the direction that is opposite to the direction of transmission.

User Privilege
A permission of a user that allows to perform actions on the computer system on which the ITM-SC application runs. There are the following different types of users:

User Type	User name	Permissions
System Administrator this is NOT an ITM-SC user	root (fixed)	maintain platform .
Database Administrator this is NOT an ITM-SC user	informix (fixed)	maintain database .
ITM-SC System Administrator	i2kadmin (fixed)	maintain ITM-SC application , maintain Network Element templates , maintain MEC files on the ITM-SC, set default ITM-SC parameters .
Supervisor	free choice	perform all data retrieval functions , perform all alarm suppression functions , perform configuration changes .
Operator	free choice	perform all data retrieval functions , perform all alarm suppression functions.

V Value
A number, text string, or other menu selection that is associated with a parameter.

VF
Voice Frequency

Virtual Container (VC)
Container with a path overhead.

VLAN
Virtual LAN

VPN
Virtual Privat Network

W

Wait to Restore Time (WRT)
The time to wait before switching back after a failure has cleared in a revertive protection scheme. This time can be between 0 and 15 minutes, in increments of one minute.

WAN
Wide Area Network

Wander
Long term variations of amplitude frequency components (below 10 Hz) of a digital signal from their ideal position in time. Wander can result in buffer problems at a receiver.

WaveStar® Integrated Transport Management Subnetwork Controller (ITM-SC)
Manager for SDH network elements in a subnetwork. Also called an Element Management System.

WaveStar® Network Management System (NMS)
Manager for SDH network elements in a network. Formerly known as DACScan-T.

WDM
Wavelength Division Multiplexing

What You See Is What You Get (WYSIWYG)
Information as displayed on the screen will appear in the same way on printed output.

Wideband Communications
Voice, data, and/or video communication at digital rates from 64 kbit/s to 2 Mbit/s.

Windows
Graphical User Interface on PC systems.

Working
Label attached to a physical entity. Inthe case of revertive switching the working line or unit is the entity that carry service under normal operation. In the case of non-revertive switching this label has no particular meaning.

WS
WorkStation

WSF
Work Station Facility

X **X-Terminal**
Workstation that can support an X-Windows interface

X-Windows
Graphical User Interface on Unix Systems.

XMTR
Transmitter

XMTR Switch Unit
Radio Relay circuit pack that performs connections for protection switching and transmission of low priority traffic on the protection channel.

XPIC
Cross Polarization Interference Cancellation

XSU
XMTR Switch Unit

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