Lucent Technologies
Bell Labs Innovations

CBX 500
Multiservice WAN Switch Hardware Installation Guide

Product Code: 80011
Revision 011
September 2005

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FEDERAL COMMUNICATIONS COMMISSION WARNING

This device complies with Part 15 of the FCC Rules and Regulations. Operation is subject to the following two conditions:

This device may not cause harmful interference, and

This device must withstand any interference received, including interference that may cause undesired operation.

The CBX 500 has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules and Regulations. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio and television communications. Operation of this equipment in a residential area is likely to cause interference in which case the user will be required to correct the interference at his or her own expense.

Shielded cables must be used with this unit to ensure compliance with the FCC Class A limits.

Do not attempt to repair or modify this equipment. Any repairs to the unit must be performed by Lucent Technologies or a Lucent-authorized representative.

Maintenance Agreements

Lucent offers a comprehensive program to provide hardware support, a 24-hour emergency hotline, overnight parts replacement, and an escalation procedure. Non-contract maintenance services are provided at current time-and-materials rates.

For more information, contact Lucent Technical Assistance Center (TAC) at 1-866-LUCENT8 (in the U.S.). For international telephone numbers see “Technical Support” in “About This Guide.”

Lucent has adopted a maintenance strategy based on customer-initiated requests to the Lucent TAC. The TAC coordinates all customer services, including hardware and software technical support, on-site service requirements, and module exchange and repair.

If the Product Is Damaged

If any portion of the switch is damaged, forward an immediate request to the delivering carrier to perform an inspection of the product and to prepare a damage report. Save the container and all packing materials until the contents are verified.

Concurrently, report the nature and extent of the damage to the Lucent TAC so that action can be initiated, either to repair or replace the damaged items.

Do not return any items to Lucent until you obtain instructions from a TAC representative. Report the problem or deficiency to the TAC representative, along with the model, type, and serial number. Upon receipt of this information, Lucent will provide you with service instructions, or a Return Authorization Number and shipping information. All items returned under warranty must be shipped to the manufacturer with the charges prepaid.

If Problems Arise

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC.

In the event that repairs are ever needed on this equipment, they should be performed by Lucent Technologies or an authorized Lucent representative. For information contact the Lucent TAC at 1-866-LUCENT8 (in the U.S.). For international telephone numbers see “Technical Support” in “About This Guide.”

Contents

Appendix A IOP and IOA Module Specifications

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About This Guide

The *CBX 500 Multiservice WAN Switch Hardware Installation Guide* describes how to install and set up the CBX 500® switch hardware, replace hardware modules, and interpret LED status indicators. This guide also provides basic troubleshooting solutions for potential hardware-related problems.

This guide is intended for network operations staff, systems integrators, and other qualified service personnel responsible for installing the CBX 500 switch.

What You Need to Know

The procedures in this guide require you to understand and follow the safety practices at your site, as well as those identified in this guide. The procedures also require you to understand the temperature, humidity, and electrical requirements for the installation site, which are described in Chapter 2, "Specifications and Safety Warnings."

You must also understand the switch's position in the overall network design before you can connect the switch to a network. You should work closely with the Network Management Station (NMS) operator and other systems integration personnel to ensure a functional installation.

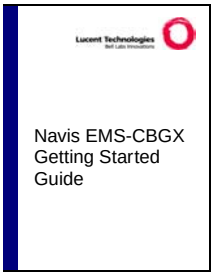
Be sure to read the software release notice (SRN) that accompanies this product. The SRN contains the most current product information and requirements.

Reading Path

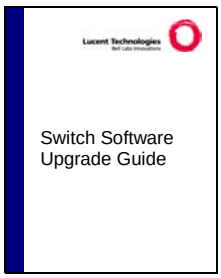
Use the following guides to install and manage the CBX 500 switch:

This guide describes how to install and set up the CBX 500 switch hardware, replace hardware modules, and interpret LED status indicators.

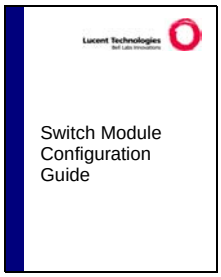
This guide describes prerequisite tasks, hardware and software requirements, and instructions for installing and upgrading Solaris and Navis EMS-CBGX on the NMS.



This guide describes how to start the Navis EMS-CBGX client on Windows and Solaris. It also provides a description of the Navis EMS-CBGX window components, how to access network and map configuration options, how to configure and manage Lucent switches and instructions for customizing Navis EMS-CBGX.



This guide describes procedures for upgrading a Lucent switch to the current release.



This guide describes the processor and input/output modules on each switch platform, and how to configure physical ports, timing, and other attributes through Navis EMS-CBGX.

How to Use This Guide

This guide contains the following information:

Read	To Learn About
Chapter 1	The CBX 500 switch, its features and hardware components.
Chapter 2	Product specifications for the CBX 500 hardware, including environmental and electrical considerations. This chapter also lists the Safety Warnings related to the use of the CBX 500 hardware.
Chapter 3	Installation prerequisites, such as unpacking the unit, taking inventory, and gathering installation items and equipment.
Chapter 4	How to set up and install the CBX 500 hardware.
Chapter 5	How to complete the installation of the CBX 500 hardware, power-up the switch, and determine its operating status.
Chapter 6	How to install new modules or replace existing modules in a CBX 500 switch, including the switch processor (SP), IOP modules, power supplies, cooling-fan modules, and PCMCIA cards.
Chapter 7	How to determine hardware operational status and perform general troubleshooting.
Appendix A	CBX 500 cell- and frame-based I/O modules.
Appendix B	CBX 500 cables and pinout assignments.
Appendix C	Country-specific regulatory information, including recommended and mandatory requirements by certification authorities; also environmental standards and compliance information.
Appendix D	Switch processor (SP) redundancy features.

What's New in This Guide?

The following table lists the latest enhancements and changes to this guide.

General Enhancement	See
Updated the information for Power Consumption by CBX 500 Components	Table 5-7, "Power Consumption by CBX 500 Components," on page 5-7
Added the1-port Channelized STM-1/E1 IMA IOM Module	Appendix A
Added the DS3/1 and STM-1/E1 Channelized ATM (IMA) Module	Appendix A
Added the 60-Port Channelized T1/E1 Circuit Emulation I/O Module	Appendix A
Added information for RJ48H Connector Pinout	Appendix B
Removed references to SP 10, SP 20, and SP 30 since they are no longer supported.	Chapter 1, "Overview," and Chapter 6, "Installing and Removing Modules."

Conventions

This guide uses the following conventions, when applicable:

Convention	Indicates	Example
`Courier Regular`	System output, filenames, and command names.	`Please wait...`
<Courier Bold Italics>	Variable text input; user supplies a value.	Enter ***<cdrompath>/docs/atmcfg.pdf*** to display...
<Courier Italics>	Variable text output.	*<cdrompath>*`/docs/atmcfg.pdf`
Courier Bold	User input.	> **show ospf names**
Menu ⇒ Option	A selection from a menu.	NavisCore ⇒ Logon
Italics	Book titles, new terms, and emphasized text.	*CBX 3500 Multiservice WAN Switch Hardware Installation Guide*
A box around text	A note, caution, or warning.	See examples below.

Note – provide additional information or helpful suggestions that may apply to the subject text.

Caution – notify the reader to proceed carefully to avoid possible equipment damage or data loss.

Warning – notify the reader to proceed carefully to avoid possible personal injury.

Related Documents

This section lists the related Lucent and third-party documentation that may be helpful to read.

- *CBX 3500 Multiservice Edge Switch Hardware Installation Guide* (Product Code: 80253)
- *B-STDX 8000/9000 Multiservice WAN Switch Hardware Installation Guide* (Product Code: 80005)
- *GX 550 Multiservice WAN Switch Hardware Installation Guide* (Product Code: 80077)
- *Navis EMS-CBGX Release 10.00.01.00 Getting Started Guide* (Product Code: 86019)
- *Switch Module Configuration Guide for CBX 3500, CBX 500, GX 550, and B-STDX 9000* (Product Code: 80263)
- *Frame Relay Services Configuration Guide for CBX 3500, CBX 500, and B-STDX 9000* (Product Code: 86020)
- *ATM Services Configuration Guide for CBX 3500, CBX 500, GX 550, and B-STDX 9000* (Product Code: 80260)
- *IP Services Configuration Guide for CBX 3500, CBX 500, and B-STDX 9000* (Product Code: 80264)
- *Switch Diagnostics User's Guide for CBX 3500, CBX 500, GX 550, and B-STDX 9000* (Product Code: 80262)
- *Console Command User's Reference for CBX 3500, CBX 500, GX 550, and B-STDX 9000* (Product Code: 86021)
- *Switch Software Upgrade Guide for CBX 3500, CBX 500, and GX 550* (Product code 80265)
- *Navis EMS-CBGX Release 10.00.01.00 Installation and Administration Guide* (Product Code: 86018)
- *NavisXtend Statistics Server Release 10.00.01.00 User's Guide* (Product Code: 86017)
- *NavisXtend Accounting Server Release 10.00.01.00 Administrator's Guide* (Product Code: 86024)
- *NavisXtend Provisioning Server Release 10.00.01.00 User's Guide* (Product Code: 86013)
- *NavisXtend Provisioning Server Release 10.00.01.00 Object Attribute Definitions User's Reference* (Product Code: 86014)
- *NavisXtend Provisioning Server Release 10.00.01.00 Command Line Interface User's Reference* (Product Code: 86015)
- *NavisXtend Provisioning Server Release 10.00.01.00 Error Codes User's Reference* (Product Code: 86016)

- *NavisXtend Provisioning Server Release 10.00.01.00 C++ API User's Reference* (Product Code: 860027)
- *NavisXtend Fault Server Release 10.00.01.00 User's Guide* (Product Code: 86025)
- *NavisXtend Database Standby Server Release 10.00.01.00 User's Guide* (Product Code: 86026)
- *NavisXtend Provisioning Server Legacy C API Reference* (Product Code: 80163)
- *Navis EMS-CBGX TMF 814 Adapter Implementation Reference* (Product Code: 86023)
- *Navis EMS-CBGX TMF 814 Adapter Installation and Administration Guide* (Product Code: 86022)

All Data Networking Group Release 10.00.01.00 manuals and the *Master Glossary* are available on the *CBX and GX Release 10.00.01.00 Customer Documentation CD-ROM* (Product Code: 80267).

Third Party

- *Solaris 9 Advanced Installation Guide*
- *Solaris 9 (SPARC Platform Edition) Release Notes*
- *Solaris 9 Sun Hardware Platform Guide*
- *Installation Guide Sybase Adaptive Server™ Enterprise on Sun Solaris*

Ordering Printed Manuals Online

You can order Data Networking Group manuals online. Use the following URL to access the Lucent Bookstore:

http://www.lucentdocs.com

Customer Comments

Customer comments are welcome. Please respond in one of the following ways:

- Fill out the Customer Comment Form located at the back of this guide and return it to us.
- E-mail your comments to cspubs@lucent.com

Technical Support

The Lucent Technical Assistance Center (TAC) is available to assist you with any problems encountered while using this Lucent product. Log on to our Customer Support web site and click on the ‘Contact Us’ link at the top right-hand side of the page to obtain telephone numbers for the Lucent TAC in your region:

http://www.lucent.com/support

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Overview

This chapter is an overview of the CBX 500 multiservice WAN switch, and includes the following topics:

CBX 500 Product Description

The CBX 500 is a multiservice, high-capacity ATM switch (5 Gbps) that supports ATM, Frame Relay, and IP switching at DS1/E1 through OC-12/STM-4 rates. In addition to the standard ATM user interfaces, the CBX 500 provides fast 100-Mbps Ethernet IP and high-density DS3 and channelized DS3 Frame Relay/IP interfaces.

The 16-slot, high-performance CBX 500 uses high port densities (up to 64,000 nodes per network — up to 16K virtual circuits on OC interfaces), dedicated signal processing, advanced distributed processing, and Virtual Network Navigator (VNN) topology management. These features provide integrated access to the full range of network-service offerings and support a virtually unlimited number of end users.

The CBX 500 multiservice switch extends Lucent's family of WAN switches with the capacity and throughput to support high-speed, multiservice network environments and future growth and scalability.

CBX 500 Features

The multiservice CBX 500 switch provides or supports the following features:

- Multiprocessor and custom silicon design for highest performance and throughput
- Quad-plane switch architecture with 128K cell buffers to ensure the highest level of data integrity
- VPC/PVC Point-to-Point, Point-to-Multipoint, and Multipoint-to-Point Tunnel (MPT)
- Frame Relay and Internet Protocol (IP) services based on the multi-protocol label switching (MPLS) standard
- Rapid Upgrade™, Resilient Frame Network-to-Network Interface (NNI), and PVC Redirect capability
- Up to 16K virtual circuits (VCs) per ATM I/O module
- Up to 1000 virtual private networks (VPNs) per switch
- Up to 96K additional cell buffers per I/O module for per-VC queuing
- Advanced traffic management and connection admission control (CAC) algorithm for increased network-resource use and efficiency
- ATM virtual channel connection (VCC) and internetworking services
- Cell rate monitoring for network accounting and design
- Guaranteed hardware multicast and Quality of Service (QoS)
- Logical multicasting on all cell-based modules (T1/E1 through OC-12c/STM-4)
- Early packet discard (EPD)/partial packet discard (PPD) on all cell-based modules (available for non-real time traffic traversing the VBR-NRT or ABR/UBR queues)
- Automatic protection switching (APS) intracard port redundancy on OC-3c/STM-1 and OC-12c/STM-4 modules
- Optional redundant switch processors (SPs) with Stratum 3 holdover timing system and modified reset latch feature, equipped with up to 128 Mbytes of RAM for high-speed switching
- Optional redundant power supplies for high-reliability networking
- Protocol translation features
- Usage-based billing capability
- Congestion management based on Lucent's VNN packet routing for large network support, which includes:
  - End-to-end delay
  - Cell delay variation and cell loss ratio
  - Administrative path control

  - Virtual private networks (VPNs)
  - Sophisticated support for point-to-multipoint connections
- Support for the four ATM service classes:
  - Constant bit rate (CBR)
  - Variable bit rate-real-time (VBR-RT)
  - Variable bit rate-non-real time (VBR-NRT)
  - Available bit rate/unspecified bit rate (ABR/UBR)
- ATM flow-control processing support enabling service providers to manage traffic proportionately on a per-circuit basis (for ABR, UBR, and VBR-NRT service classes) according to service level agreements
- Ten quality-of-service (QoS) classes implemented via hardware buffers (one CBR, four VBR-RT, four VBR-NRT, and one ABR/UBR)
- SVC support for UNI 3.0, UNI 3.1, and IISP interfaces
- Addressing support for E.164, network service access point (NSAP), data country code (DCC) ATM end-system addresses, and international code designator (ICD) ATM end-system addresses
- Explicit forward congestion indicator (EFCI) marking and checking
- Interim Link Management Interface (ILMI) and address registration on each port
- Three system-timing modes: recovered, external, or internal
- Four transmit timing and synchronization modes: loop, recovered, external, or internal
- Flexible ATM access services between E1 and STM-1 line speeds
- Connect to DSLAMs, wireless network access concentrators, CPE, and other Lucent or non-Lucent equipment
- High port density, with support for 63 User to Network Interface (UNI) or Network to Network Interface (NNI) E1 ports per module
- Up to 30 software-configurable IMA bundles containing one to eight E1 links

Hardware Component Descriptions

The CBX 500 has the following hardware components:

- Switch processors (SPs)
- Switch processor adapters (SPAs)
- Input/output processors (IOPs)
- Input/output adapters (IOAs)
- Power supplies
- Cooling fans
- Optional air filters

Figure 1-1 shows the CBX 500 switch.

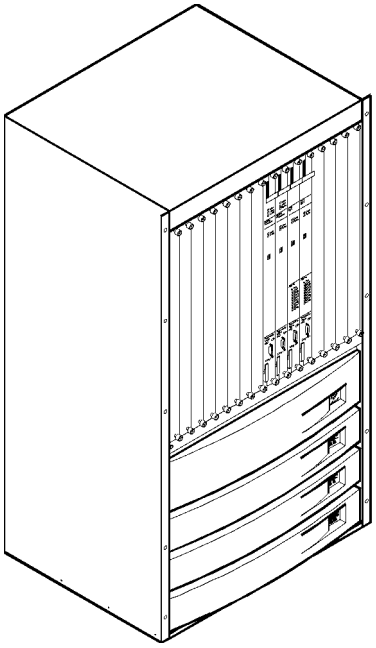


Figure 1-1. CBX 500 Switch

Modules in the switch are connected to each other via the backplane. The switch processor (SP) controls the switch and interacts with multiple I/O processor (IOP) modules. The IOPs can accommodate numerous interface specifications, speeds, and protocols as they process signal traffic.

The IOPs connect to the network via their I/O adapter (IOA) modules. The SPs connect to a similar network interface module called a switch processor adapter (SPA). The IOAs and SPA contain the connections for network cables and provide a hardware bridge between the physical network and the IOPs.

Figure 1-2 shows how these modules relate to each other via the backplane. The bottom connectors of the SP/SPA and IOP/IOA pair connect to the backplane, while the top connectors of the SP/SPA and IOP/IOA pair connect directly to each other.

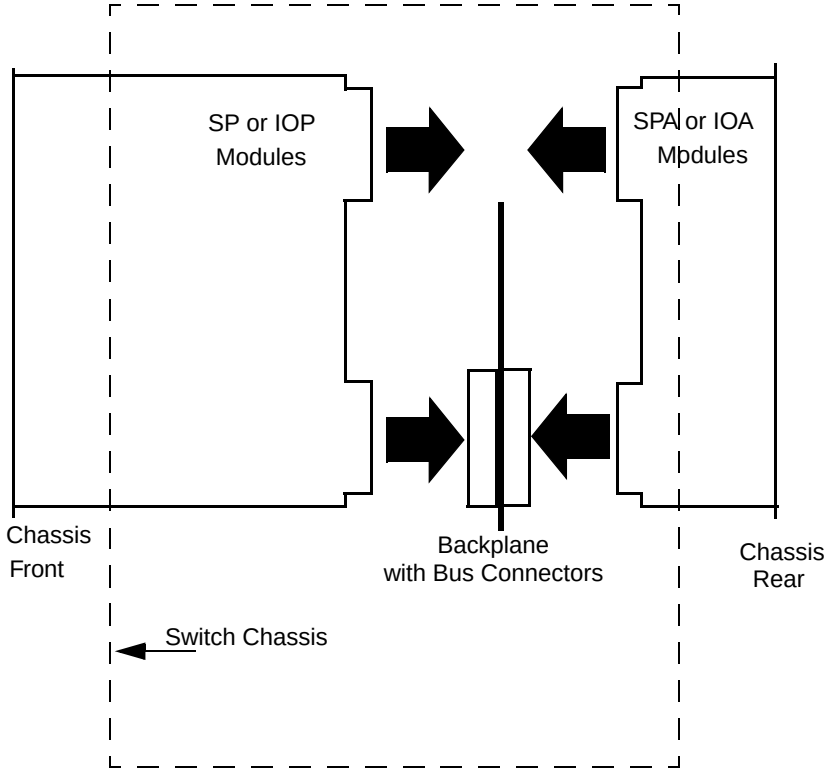


Figure 1-2. Relationship of SP and IOP Modules to Backplane

SP 40 Module

The switch processor Model 40 (SP 40) provides background management and static networking functions for the IOP modules.

SP Features

- Intel's i960 RISC processors for control and status
- State-of-the-art hardware switching for the high-performance packet switching needed for ATM, high-bandwidth transmission environments, and high port-density configurations
- Passive connector panels to allow an SP to be removed without powering down the switch or "hot swapping"
- Expanded RAM (up to 128 Mbytes) to support IP switching
- Stratum 3 holdover capability, which enables the switch to continue to provide system timing even after a selected timing source fails

SP Redundancy

Installations with high-reliability networking requirements may require a second SP to make the switch redundant. In the event of an SP failure, the redundant partner automatically becomes the active processor. This avoids serious service disruption on the network. See Appendix D for more information about redundancy on a CBX 500 switch.

Table 1-1 shows the SP 40 configurations supported on the CBX 500.

Table 1-1. Supported Redundant SP 40 Configurations

Slot 1 SP	Slot 2 SP
SP 40	Empty
Empty	SP 40
SP 40	SP 40

IOP Modules (IOPs)

IOPs manage the lowest level of a switch's trunk or user interface. IOPs perform physical data link and multiplexing operations on external trunks and user links.

In the switch, the IOP modules connect to the network via their backplane connection to the IOAs (Figure 1-2 on page 1-5). The IOPs can also communicate with each other, and the SPs, via a separate backplane connection. All IOP modules are supported on SP 40. When upgrading (or downgrading) your switch, you do not have to replace the IOP modules.

I/O and SP Adapters (IOAs and SPAs)

Adapters connect the IOP and SP modules to the network via a common backplane socket. The edge connectors on the SP and IOP modules plug into the backplane's sockets from one side. The IOAs and SPA plug into the backplane sockets from the other side (see Figure 1-2 on page 1-5).

The SPA has a covered bay that houses the Ethernet and IDE hard drive PCMCIA card pair for each SP. The SPA also has timing and alarm connections.

IOA configurations vary, depending on the specific module they support.

2

Specifications and Safety Warnings

This chapter describes the following specifications and safety warnings for the CBX 500 switch:

- Electronic/Electrical Requirements
- Physical Specifications
- Site Specifications
- DC Power Supply Warnings
- Safety Warnings
- Power Cord Requirements

Electronic/Electrical Requirements

The CBX 500 power supplies are auto-ranging. That is, they provide adequate power to the switch when the input voltage is between the minimum and maximum level for each type of power supply.

For either AC or DC input versions, the CBX 500 is powered by a minimum of two power supplies. For some applications, you can add a third power for redundancy, in the event of a circuit or power supply failure, as described in Table 2-1.

Table 2-1. CBX 500 Electronic/Electrical Specifications

Application	Specification
120 VAC	90-132 VAC, 50-60 Hz, single phase, 2800 watts max (15 amps max, 1400 watts max per circuit); there will be either two or three circuits
220-240 VAC	180-264 VAC, 50-60 Hz, single phase, 2800 watts max (7.5 amps max, 1400 watts max per circuit); there will be either two or three circuits
-48 VDC or -60 VDC	-40 to -76 VDC, 70 amps max, 2800 watts max
Power Supply Thermal Dissipation	2880 watts max, 9120 BTU/hr AC 2880 watts max, 9120 BTU/hr DC

Physical Specifications

Table 2-2 describes the CBX 500 physical specifications.

Table 2-2. CBX 500 Physical Specifications

Specification	Description
ATM Standards	ATM Forum UNI (Version 3.0 and Version 3.1), ATM Forum Interim Inter-Switch Signalling Protocol (IISP)
WAN Interfaces	T1, E1, DS3(cell- and frame-based), E3 (cell-based), OC-3c/STM-1 (optical and electrical), OC-12c/STM-4, Ethernet
Management Interfaces	Ethernet, RS-232
Physical Characteristics	Basic switch includes three power supply modules, one cooling fan module, one SP module, and one SPA module mounted inside a chassis
Overall Switch Chassis Size[a]	19.0 in. (48.26 cm) wide x 33.25 in. (84.455 cm) high x 15 in. (38.1 cm) deep
Switch Weight	200 lb max (fully configured)

[a] Depth size does not include calculations for cable spacing.

Site Specifications

The following sections describe the CBX 500 switch site specifications.

Operating Environment

Table 2-3 describes the environmental requirements for selecting a CBX 500 hardware installation site. The site requirements are based on Network Equipment Building System (NEBS) GR-63-CORE and GR-1089-CORE.

Table 2-3. CBX 500 Site Specifications

Parameter	Requirement
Ambient Operating Temperature	5°C to +40°C
Relative Humidity	10% to 95% (noncondensing)
Operating Altitude	to 10,000 ft (3050 m)
Ambient Storage Temperature	-40°C to +65°C, 95% relative humidity
Storage Altitude	-1,000 to +30,000 ft (-305 to 9150 m)

Space Requirements

The CBX 500 hardware requires the following minimum clearances for the chassis:

- 6 in. (15 cm) at the back panel (for cable routing)
- 20 in. (54 cm) at the front panel
- 3 in. (8 cm) of air flow space on both sides of the chassis
- 3.5 in. (8.9 cm) at the top of the chassis

DC Power Supply Warnings

Warning –

- The DC power supply must be installed only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70. Connect to a 48V DC source which is electrically isolated from the AC source and which is reliably connected to earth.
- This equipment is designed to permit the connection of the grounded conductor of the DC supply circuit to the grounding conductor at the equipment. If this connection is made, all of the following conditions must be met:
  - This equipment shall be connected directly to the DC supply system grounding electrode conductor or to a bonding jumper from a grounding terminal bar or bus to which the DC supply system grounding electrode conductor is connected.
  - This equipment shall be located in the same immediate area (such as, adjacent cabinets) as any other equipment that has a connection between the grounded conductor of the same DC supply circuit and the grounding conductor, and also the point of grounding of the DC system. The DC system shall not be grounded elsewhere.
  - The DC supply source is to be located within the same premises as the equipment.
  - There shall be no switching or disconnecting devices in the grounded circuit conductor between the DC source and the point of connection of the grounding electrode conductor.
- A readily accessible disconnect device must be provided in the fixed wiring for a DC power supply. It must be suitable for the rated voltage and current specified.
- Safe operation of this unit requires connection to a grounded outlet. To prevent possible injury from voltages on the telecommunications network, disconnect all telecommunications network lines before disconnecting the unit from the grounded outlet.

Safety Warnings

1. There are mechanical and electrical shock hazards present throughout the system if one or more of the modules is removed. There are no operator serviceable components. Only qualified personnel are allowed to service the unit.
2. This equipment must be connected to a protective ground in accordance with the instructions provided in this guide. Improper grounding may result in an electrical shock.
3. This equipment does not provide safety isolation between any port that is connected to a digital network termination point and any other port to which terminal equipment may be connected.
4. The icons "|" and "⏻" next to the switch on the power supply represent "On" and "Standby" respectively. In the "|" (On) mode, the power supply is fully operational, delivering power to the system. In "⏻" (Standby) mode, the power supply is operational, but is not delivering power to the system. The only way to completely disconnect the supply is to remove the appropriate power cord from the back of the unit.

Warning – This unit has more than one power supply cord. To avoid electrical shock, disconnect the appropriate power supply cord prior to servicing.

Signes Précurseurs de Sécurité

1. Il y a danger de hasards mécaniques et de shocks électriques parmi le système si un ou plusieurs modules sont enlevés. Il n'y a pas de parties constituantes qui peuvent être entretenu. Seulement les techniciens qualifiés peuvent faire l'entretien de ce système.
2. Il faut connecter cet équipement à une prise de terre protegée conformément aux instructions fournis dans ce guide. Une prise de terre incorrecte résultera en commotion électrique.
3. Cet équipement ne fournit pas sureté d'isolement entre un port qui est connecté a un point reseau digital et tout autre port auquel l'équipement terminal peut être connecté.
4. Les icones "|" et "⏻" à côté du commutateur sur la prise de courant représentent "en march" (On) et "se tenir prêt" (Standby) respectivement. Dans le mode "|" (On) la prise de courant est complètement opérationnel, délivrant le courant au système. Dans le mode "⏻" (Standby) la prise de courant est opérationnel, mais ne délivre aucun courant au système. La seule façon de couper complètement le courant est d'enlever le cordon d'alimentation approprié à l'arrière de l'appareil.

Warning – Cet appareil comporte plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques débrancher le cordon d'alimentation approprié avant le dépannage.

Achtung: Zusätzliche Sicherheitshinweise

- Wenn ein oder mehrere Module entfernt werden, besteht die Gefahr eines elektrischen Stromschlages oder Verletzung durch mechanische Elemente. Es gibt keine vom Bediener zu wartenden Komponenten. Die Wartung darf nur vom qualifizierten Fachpersonal vorgenommen werden.
- Die Symbole "|" and "⏻" in der Nähe des Schalters am Netzteil bezeichnen "EIN" und "Bereitschaft" (Standby). In der Stellung "|" (EIN) ist das Netzteil in Funktion und liefert Strom in das System. In der Stellung "⏻" (Bereitschaft, Standby) ist das Netzteil in Funktion, liefert aber keinen Strom in das System. Die einzige Möglichkeit das Netzteil ganz abzuschalten ist die entsprechende Zuleitung an der Rückseite des Gehäuses herauszuziehen.

Warning – Achtung: Dieses Gerät hat mehr als eine Zuleitung. Um einen elektrischen Strom-schlag zu vermeiden muß die entsprechende Strom-Zuleitung vor der Wartung vomNetz getrenntwerden.

Power Cord Requirements

The CBX 500 power cord is connected via a three-prong plug that grounds the switch and polarizes the connection. The ground connector must be grounded properly. Table 2-4 lists the country requirements for the plug types and their ratings.

Note – The AC power cord must be terminated with an IEC 320 receptacle.

Table 2-4. AC Power Cord Requirements

Country	AC Power Cord Type and Rating
USA and Canada	NEMA 5-15 15A/125 VAC
U.K.	BS 1363 10A/240 VAC
Australia	AS 3112 10A/240 VAC
Japan	JIS 8303 15A/125 VAC
Switzerland	SEV 1011 10A/220-240 VAC
Germany	CEE7 VII 16A/250 VAC

3

Preparing for the Installation

This chapter describes the tasks that must be completed before installing the CBX 500 switch. These tasks include:

- Selecting the Installation Site
- Checking the Switch for Damage
- Moving the Switch to the Installation Site
- Unpacking the Switch
- Unpacking the Accessory Kit
- Verifying the Hardware Configuration

Selecting the Installation Site

Before you choose a setup location for the CBX 500 switch, read and follow the site and electrical requirements defined in Chapter 2.

When selecting the setup location, you must ensure that the switch has adequate ventilation and space for current and future cabling requirements. You can rack-mount the CBX 500 switch in a standard 19- or 23-inch (48.26 or 58.42 cm) wide equipment cabinet, or place it on a flat surface as a free-standing unit, as described in the section, "Setting Up the Switch" in Chapter 4.

Checking the Switch for Damage

The CBX 500 is delivered in a protective shipping carton. The switch is shipped with all the ordered modules installed. The switch chassis is attached to a wooden pallet with screws and L-brackets (see Figure 3-1).

Before you remove the CBX 500 switch from the shipping carton and delivery pallet, check for damage. If there is any damage, follow the instructions described in the "If the Product Is Damaged" section in the hardware warranty.

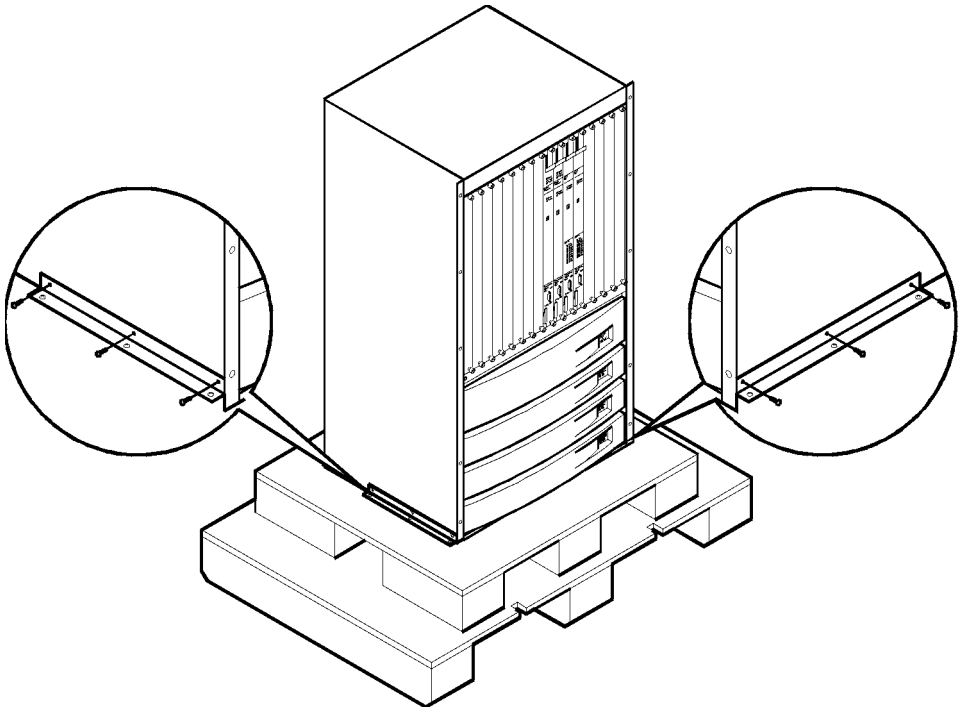


Figure 3-1. CBX 500 Switch, Typical Shipping Configuration

Moving the Switch to the Installation Site

Due to the large size and weight of a fully configured switch, Lucent recommends moving the switch to the installation site *before* unpacking it from the shipping carton.

Caution – A fully configured switch weighs up to 200 pounds. To avoid potential injury, use a hand lift for moving or rack-mounting the switch.

Unpacking the Switch

To unpack the switch:

1. Open the carton and remove all enclosed packing materials. Save the packing materials in case you need to repack the switch later.
2. Check the contents of the carton against the items listed on the packing slip.
3. Using a #2 Phillips-head screwdriver, remove the screws from the L-brackets on the delivery pallet (see Figure 3-1 on page 3-2).
4. Carefully remove the switch from the pallet.

Unpacking the Accessory Kit

The items in the accessory kit vary with each order. Unpack the accessory kit and check the contents against the items listed on the packing slip.

The following *required* items are shipped with each CBX 500 order:

- RS-232 shielded straight-through modem cable, M-F, 15 ft. (4.575 m)
- RS-232 null modem cable, M-F, 15 ft. (4.575 m)
- Shielded straight-through 9-pin D-sub diagnostic cable
- Two power cords (AC only)
- Antistatic wrist strap
- Packet of installation hardware
- *CBX 500 Multiservice WAN Switch Hardware Installation Guide*
- *CBX and GX Release 10.00.01.00 Customer Documentation CD-ROM*, Product Code: 80267
- *Reading Roadmap*, Product Code: 80113

The following *optional* accessory items are shipped as required by the order:

- NavisCore (network management software) and associated documentation
- Additional AC power cord for optional redundant power supply
- IOA module-specific cables (fiber-optic, coaxial, or shielded twisted-pair)

Verifying the Hardware Configuration

The modules ordered with the switch are installed prior to shipment. Check the switch to verify that it is configured as ordered.

Before Handling Equipment

Warning – Static electricity can damage the equipment. Wear an antistatic strap when handling any of the switch components.

Before handling any of the switch components, put on the antistatic wrist strap that is provided in the accessory kit, and connect it to the grounding jack located on the front of the switch as shown in Figure 3-2 on page 3-5.

Checking the SP and IOP Modules

The CBX 500 switch has a backplane design that enables the SP and IOP modules in the front of the switch to connect to the SPAs and IOAs in the back of the switch. Figure 3-2 shows the front slots of the CBX 500 and an example configuration that includes a redundant SP module.

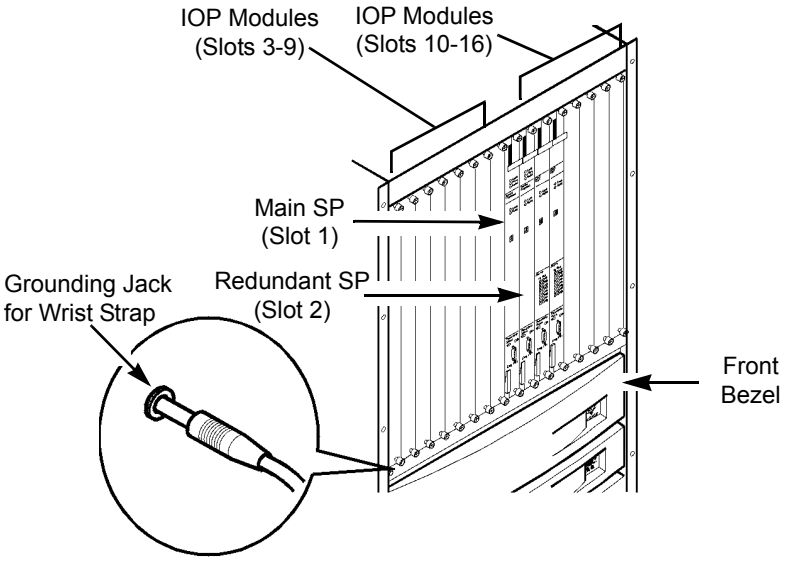


Figure 3-2. Front View of the CBX 500

Slots 1 and 2 are reserved for the SP modules; they cannot be used for IOP modules. Slot 1 contains the main SP module and Slot 2 may contain the optional redundant SP module. If you have a redundant SP configuration, verify that both are SP 40s.

Slots that do not contain IOP modules are masked with blank covers to ensure proper air flow through the switch.

Checking the SPA and IOA Modules

Figure 3-3 shows the back of the CBX 500 chassis.

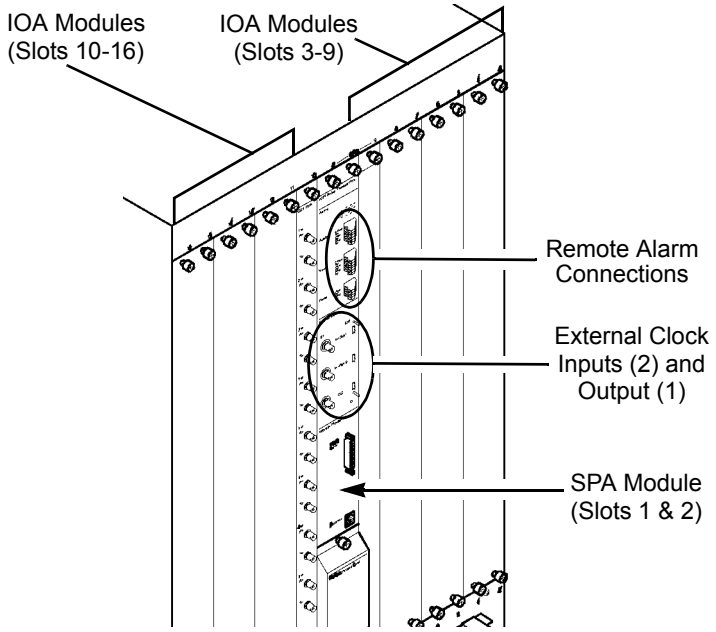


Figure 3-3. CBX 500 Showing SPA and IOA Module Locations

The SP adapter (SPA) and I/O adapter (IOA) modules are installed in the back of the switch. The SPA always occupies two slots (Slots 1 and 2), even if only one SP module is installed. For each IOP module installed in the switch, there must be a supporting IOA module installed in the same slot at the back of the switch.

Be sure to verify the IOA module type and the slot locations. For example, a DS3 IOP installed in Slot 3 should have a corresponding DS3 IOA installed in Slot 3.

Checking the PCMCIA Configuration

Figure 3-4 shows the PCMCIA bay (containing four PCMCIA slots) on the SPA.

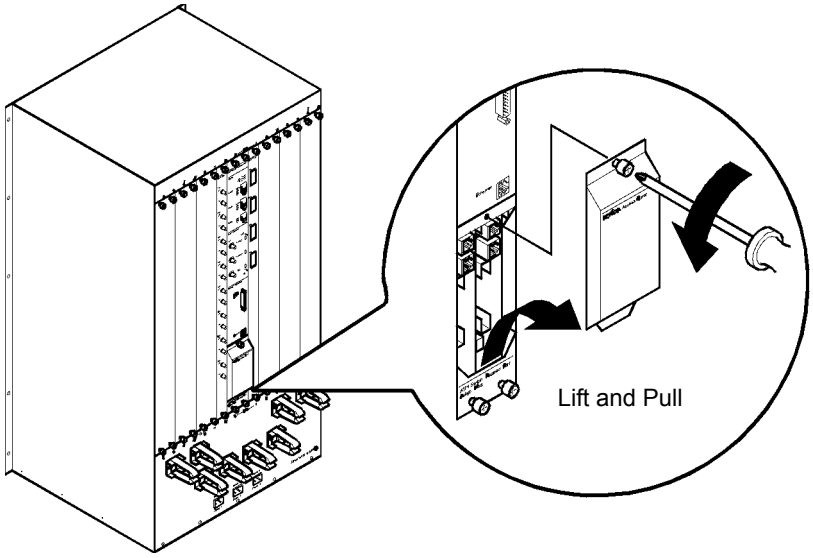


Figure 3-4. PCMCIA Card Bay

There are two slots for each SP. If the switch is the gateway (or connected directly to the console or NMS via an Ethernet connection), the thinner PCMCIA card on the right is the Ethernet card. The thicker IDE hard drive is in the left slot. If you have a redundant switch (two SPs), there are two pairs of Ethernet and IDE hard drive cards.

An internal cable connects the Ethernet cards to the RJ-48 jack(s) located just above the cards. This enables you to use the standard Ethernet connector on the SPA when you connect the switch to the console terminal or NMS. The SPA is shipped with the appropriate Ethernet and hard disk drive cards installed.

What's Next?

When you finish unpacking and taking inventory of the CBX 500 hardware and accessory kit and have checked the installed modules, you can install the switch. Proceed to Chapter 4, "Installing the CBX 500 Switch."

4

Installing the CBX 500 Switch

This chapter describes, in the following topics, how to set up and install the CBX 500 switch:

Before You Begin

Verify that the following tasks (mostly from Chapter 3) are complete:

1. Selecting the installation site (see page 3-1).
2. Unpacking the switch (see page 3-3).
3. Unpacking the accessory kit (see page 3-4).
4. Verifying the module configuration in the switch (see page 3-5).
5. Gathering the tools and equipment needed for installation (see page 4-2).

Required Installation Tools and Equipment

To install the CBX 500 hardware, you need the following tools and equipment:

- An NMS or console terminal connection to the SP's network management port to download installation scripts to the switch.
- An ASCII/VT100 console terminal or equivalent that runs at 19,200 bps and can download software using terminal emulation software.
- RS-232 null modem cable (included in the accessory kit) for connecting a SPARCstation to the switch.
- RS-232 straight-through modem cable (included in the accessory kit) for connecting a modem dial-up link to the switch.
- Antistatic wrist strap (included in the accessory kit).
- A #2 Phillips-head screwdriver.
- A 1/8-in. and a 3/16-in. flathead screwdriver.
- A wire-wrap gun (required only for T1 clock input or output connections).
- A 7/16-in. wrench or socket (required only if you have a DC power supply).
- Hand lift (recommended).
- (*Optional*) Ethernet transceiver or LAN connection for connecting the switch to the NMS. This is only required if the switch is connected directly to the NMS (i.e., the gateway switch).

Note – Although a torque driver is not supplied in the accessory kit, it is recommended that, when tightening screws with a #2 Phillips-head screwdriver, a maximum of *6 to 8* ***inch-pounds*** *of torque* should be used.

Setting Up the Switch

Place the switch in a way that facilitates cable connections to the back of the switch. The switch can be placed on a flat surface as a free-standing switch, or rack-mounted in a standard 19- or 23-inch (48.26 or 58.42 cm.) wide equipment cabinet. The following sections describe the steps for each method of installation.

As a Free-Standing Switch

Place the switch on the selected flat surface. Remember that all cables connect to the back of the switch and the switch requires proper ventilation. (See Chapter 2, "Specifications and Safety Warnings," for ventilation and cable space requirements.)

As a Rack-Mounted Switch

Note – The rack-mount spacing meets IEC 297-2 and ANSI/EIA-RS-310-C standards.

Note – The 23-in. (58.42 cm.) cabinet installation requires the use of adapter brackets (Product Code 90010).

The 19-in. (48.26 cm.) cabinet installation requires the use of adapter brackets (Product Code 11093).

Determine whether you want the switch to be flush-mounted or mid-mounted into the cabinet. The switch is delivered with 19-inch flush-mount brackets already installed on the front of the switch. To mid-mount the switch into the cabinet, you must first install mid-mount brackets onto the switch. You can order these brackets from Lucent. For a current product code/price list, contact your Lucent account manager.

Caution – The weight and position of the CBX 500 switch within the cabinet may make the cabinet top-heavy or unstable. You must anchor the cabinet securely before installing the switch. This is particularly important with mid-mount installations.

Installing 19-inch Mid-Mount Brackets

Figure 4-1 shows how to install the 19-inch mid-mount brackets onto the switch.

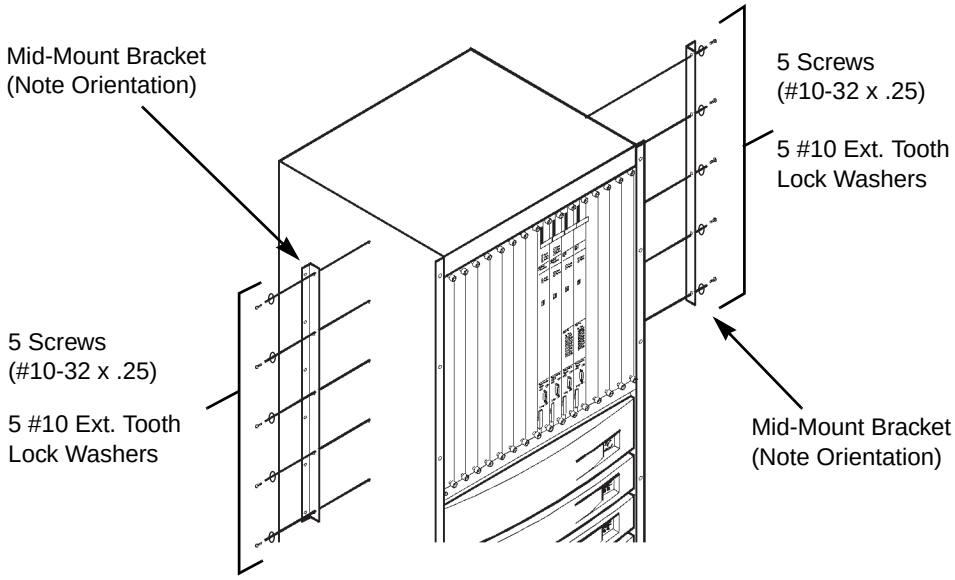


Figure 4-1. Installing 19-inch Mid-Mount Brackets

To install 19-inch mid-mount brackets onto the switch:

1. Position a mid-mount bracket onto one side of the switch, lining up the five screw holes on the bracket with the five screw holes on the side of the switch. Figure 4-1 shows the correct orientation of the brackets.
2. Using a #2 Phillips-head screwdriver, install the five #10-32 x .25 truss-head screws and #10 external tooth lock washers that came with the brackets through the mid-mount bracket holes into the switch. *Use a maximum of **6 to 8 inch-pounds** of torque*.
3. Repeat Steps 1 and 2 to install the second mid-mount bracket onto the other side of the switch.

Caution – Failure to use the proper screws may damage the switch.

Installing 23-inch Mid-Mount Brackets

Figure 4-2 shows how to install the 23-inch mid-mount brackets onto the switch.

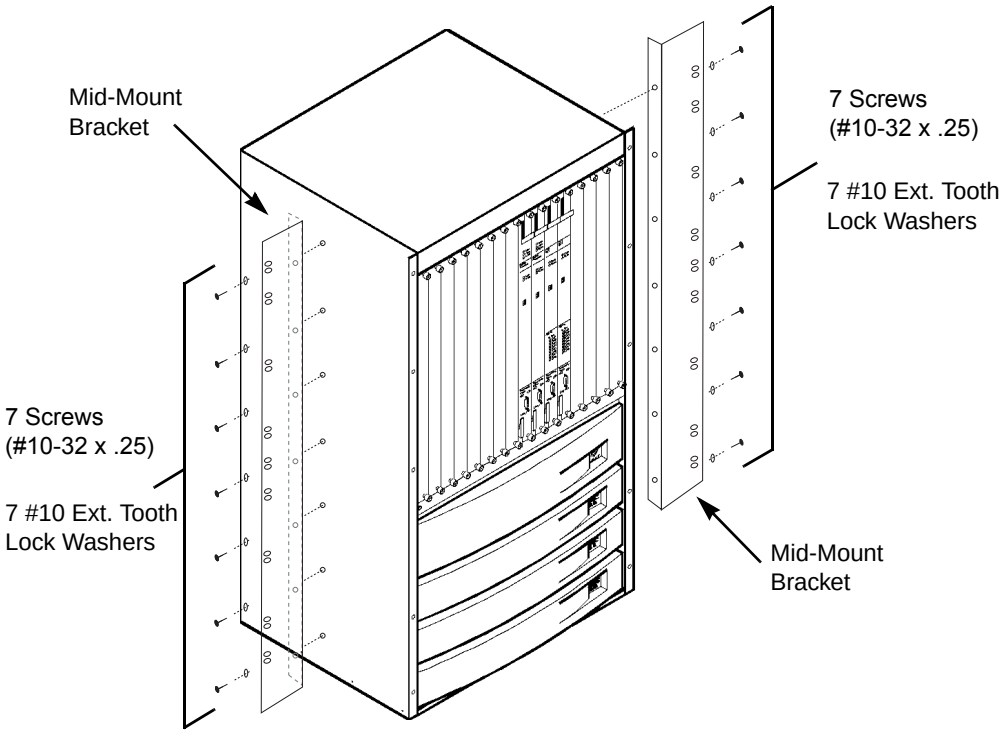


Figure 4-2. Installing 23-inch Mid-Mount Brackets

To install 23-inch mid-mount brackets onto the switch:

1. Position a mid-mount bracket onto one side of the switch, lining up the seven screw holes on the bracket with the seven screw holes on the side of the switch. Figure 4-2 shows the correct orientation of the brackets.
2. Using a #2 Phillips-head screwdriver, install the seven #10-32 x .25 truss-head screws and #10 external tooth lock washers that came with the brackets through the mid-mount bracket holes into the switch. Use a maximum of **6 to 8 inch-pounds** of torque.
3. Repeat Steps 1 and 2 to install the second mid-mount bracket onto the other side of the switch.

Caution – Failure to use the proper screws may damage the switch.

Installing 23-inch Front-Mount Brackets

Figure 4-3 shows how to install the 23-inch front-mount brackets onto the switch.

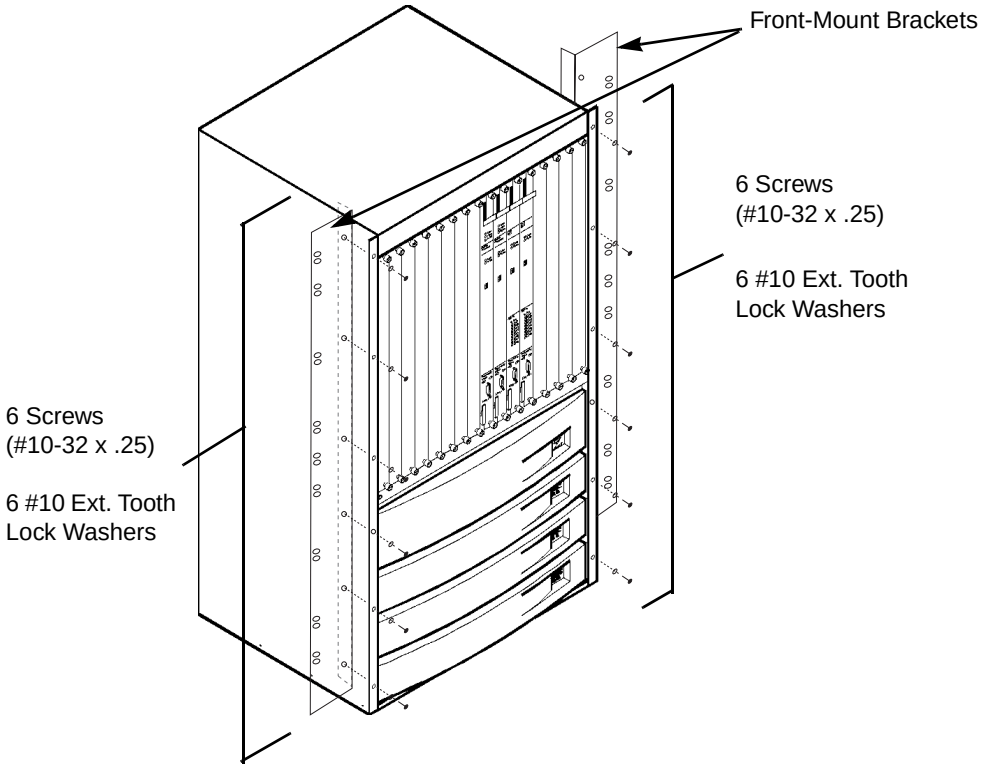


Figure 4-3. Installing 23-inch Front-Mount Brackets

To install 23-inch front-mount brackets onto the switch:

1. Position a front-mount bracket onto one side of the switch, lining up the six screw holes on the bracket with the six screw holes on the side of the switch. Figure 4-2 shows the correct orientation of the brackets.
2. Using a #2 Phillips-head screwdriver, install the six #10-32 x .25 truss-head screws and #10 external tooth lock washers that came with the brackets through the switch into the front-mount bracket holes. Use a maximum of **6 to 8 inch-pounds** of torque.

Note – Upon completion of the bracket assembly one extra screw and washer per side will remain. These can be discarded.

3. Repeat Steps 1 and 2 to install the second front-mount bracket onto the other side of the switch.

Caution – Failure to use the proper screws may damage the switch.

Installing the Switch into the Cabinet

Caution – The procedure for rack-mounting the switch requires more than one installer. A fully-configured switch weighs up to 200 pounds, so Lucent recommends that you use a hand lift for raising the switch into the cabinet.

To rack-mount the switch into the equipment cabinet:

1. Raise the switch to the appropriate installation height, using a hand lift (or a minimum of three installers).
2. Align the holes in the chassis with the appropriate mating hole pattern in the equipment rack and install screws as noted below:
   - For 19-inch mid-mount applications - 6 holes per side
   - For 23-inch mid-mount applications - 11 holes per side
   - For 23-inch front-mount applications - 11 holes per side.
3. Install truss-head screws of the appropriate size (10-32 or 12-24) through the mount bracket on the switch (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*) into the mount bracket on the equipment cabinet, using a #2 Phillips-head screwdriver.

Note – Upon completion of the assembly of the chassis to the equipment rack, you may have some remaining screws, depending on the mounting configuration selected. This extra hardware can be discarded, if desired.

Connecting Cables to the Switch

After you set up the switch in the desired location, connect the switch to the network by attaching the appropriate cables to the IOA modules in the back of the switch. The IOA cables are either coaxial (for OC-3c/STM-1 electrical, DS3, E3, and 75-ohm E1 connections), DB-15 (for T1 and 120-ohm E1 connections), or fiber optic (for OC-3/STM-1 optical and OC-12c/STM-4 connections).

The SPA module provides the ports for connecting the switch to the NMS or console. See Appendix B, "Cables and Pinout Assignments," for NMS and console cable pinouts.

Network Management Connections

The SPA modules support the "network management" connection, which uses a standard DB-25 port for attaching a console terminal to the switch.

The IOA modules support the "management VC/PVC" connection, which is a physical port connection on an IOA, not the SPA. This physical connection is viewed as a "virtual port" that enables the NMS to manage the switch through a single router or through an ATM network interface card (NIC) UNI-DCE connection.

Figure 4-4 shows the CBX 500 switch connected to an NMS and console terminal.

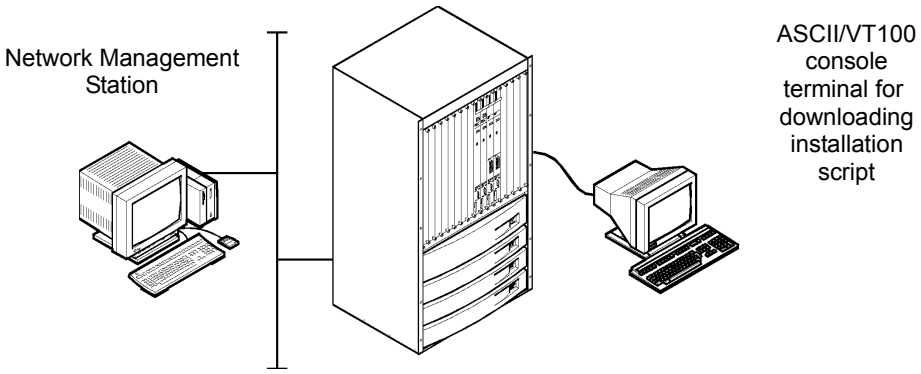


Figure 4-4. CBX 500 Switch Connected to NMS and Console Terminal

Connecting the Console

Figure 4-5 shows a cable connection from the switch to the console terminal.

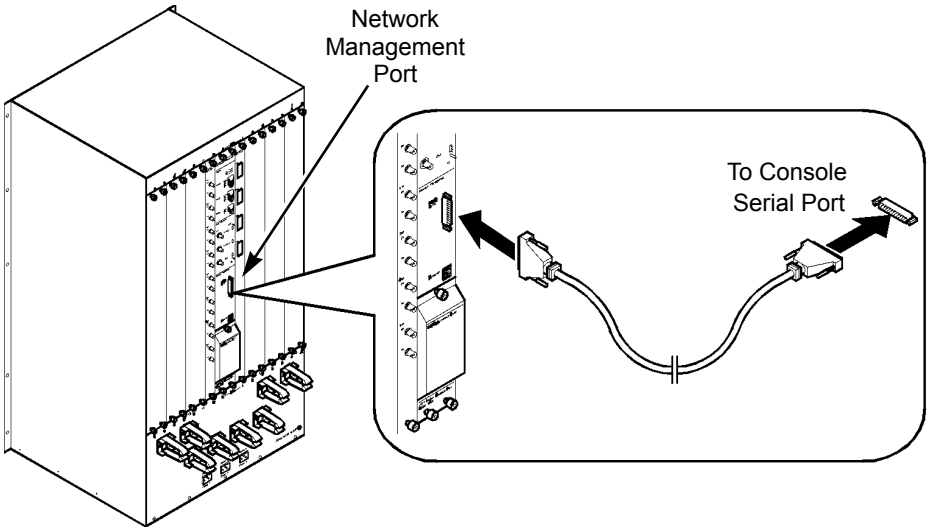


Figure 4-5. Console Connection to CBX 500 Switch

To connect the console terminal to the switch:

- *If the console is a PC*, connect the DB-25 end of the RS-232 DB-9 to DB-25 Shielded Crossover cable to the network management port on the SPA. Then connect the DB-9 end of the RS-232 DB-9 to DB-25 Shielded Crossover cable to the serial port on the PC.
- *If the console is a SPARCstation*, connect the female connector of the RS-232 shielded null-modem cable to the SPA network management port. Connect the female connector on the RS-232 shielded null-modem cable to the serial port on the SPARCstation.

Note – For a remote dial-up connection from the console to the switch, use the RS-232 shielded straight-through cable described in Appendix B, "Cables and Pinout Assignments."

See Appendix B, "Cables and Pinout Assignments," for detailed information about the cables that connect the console to the NMS.

Setting Up the NMS

If the switch being installed is the first switch in your network (i.e., gateway switch), read and follow the instructions in this section and in the *B-STDX, CBX, and GX Getting Started User's Guide*.

See the *B-STDX, CBX, and GX Network Management Station Installation Guide* for NMS hardware requirements and software installation information. After installing the software, you can connect the NMS to the switch, as described in the next section.

Connecting the NMS

You can connect the CBX 500 switch to the NMS, using the following methods:

Direct Ethernet — Connects the switch and NMS when they are on the same LAN. This method provides the greatest speed and ease-of-use (see page 4-11).

Indirect Ethernet — Connects the switch and the NMS when they are on separate LANs. This option requires a router (see page 4-12).

Management VC (VPI/VCI) — Connects the NMS and the switch through a single router or via an ATM network interface card (NIC). This connection is recommended when you use an attached NMS or IP host to transfer information between the host and a local switch. See the *B-STDX, CBX, and GX Getting Started User's Guide* for information about configuring a management VPI/VCI connection (see page 4-13).

Management PVC — Connects the NMS or IP host to the switch via an ATM router or NIC. You can use this type of connection for all applications that use a switch (particularly a remote switch) and an attached NMS or IP host. The management PVC connection is an actual PVC between the UNI port (connected to the NMS or IP host) and the remote-switch SP module. Management PVC connections prevent overhead management traffic from burdening the switch. See the *B-STDX, CBX, and GX Getting Started User's Guide* for information about setting up a management PVC connection
(see page 4-13).

Lucent recommends direct or indirect Ethernet as the primary connection method from the NMS to the switch.

Note – Lucent recommends that you provision dial-up or some other access to each switch in the Lucent network as a backup.

Figure 4-6 through Figure 4-8 show the types of NMS-connection methods.

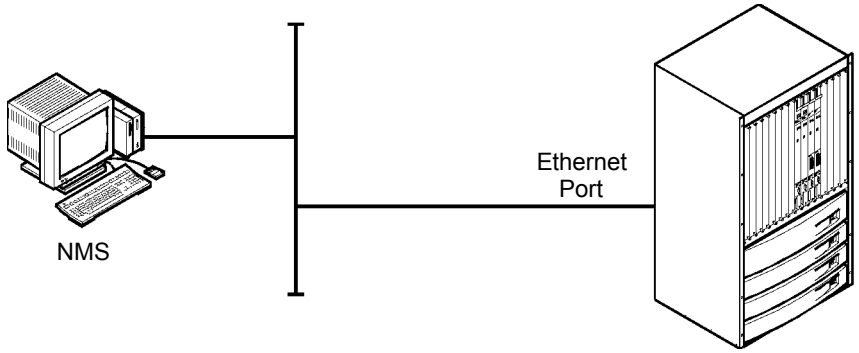


Figure 4-6. Direct Ethernet Method

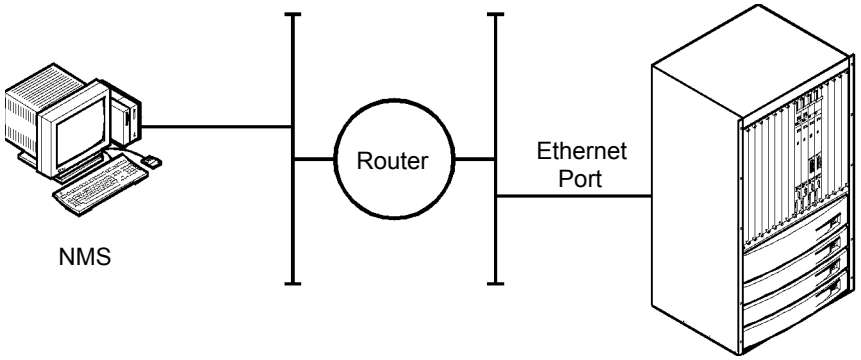


Figure 4-7. Indirect Ethernet Method

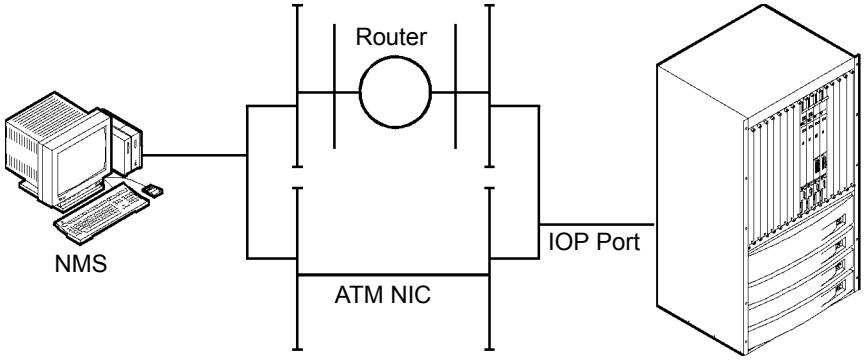


Figure 4-8. Management VC/PVC Method

Using Direct Ethernet

Figure 4-9 shows how to make a direct Ethernet connection from the switch to the NMS.

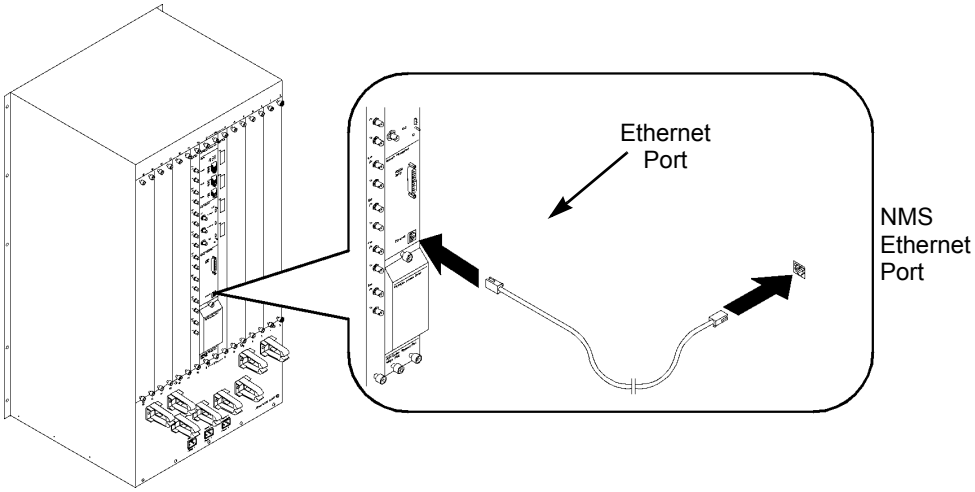


Figure 4-9. Direct Ethernet Connection

To connect the NMS to the switch using a direct Ethernet connection:

1. Connect one end of the NMS Ethernet wire to the RJ-48 Ethernet port located on the SPA module.
2. Connect the other end of the NMS Ethernet wire to the LAN on which the switch resides.
3. Ensure that the Ethernet transceivers are properly connected to the network.

Using Indirect Ethernet

Figure 4-10 shows an indirect Ethernet connection from the switch to the NMS.

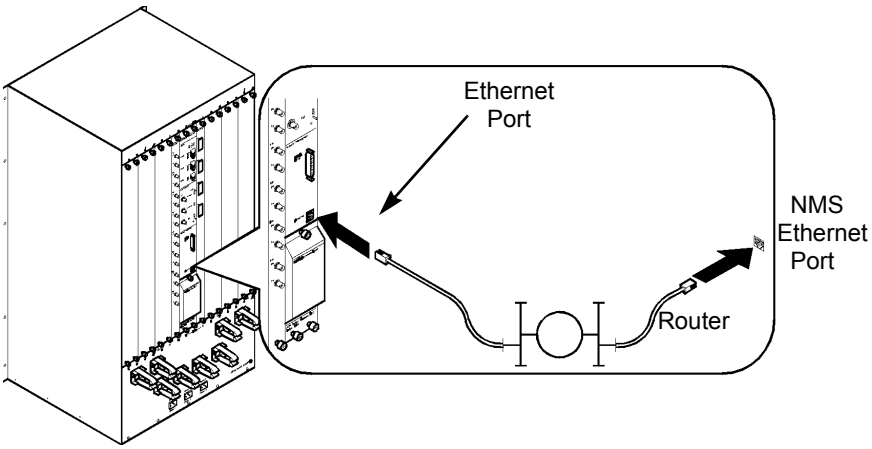


Figure 4-10. Indirect Ethernet Connection

To connect the NMS to the switch using an indirect Ethernet connection:

1. Connect one end of the NMS Ethernet wire to the RJ-48 port on the SPA module.
2. Connect the other end of the NMS Ethernet wire to the local LAN.

3. Connect the switch's Ethernet port to a remote LAN that has router connectivity to the LAN on which the NMS resides.
4. Ensure that the Ethernet transceivers are connected properly to the network.

Using Management VC/PVC

The management VC and PVC methods connect the NMS to the switch through a single router over an ATM UNI connection. Figure 4-11 shows a management VC/PVC connection.

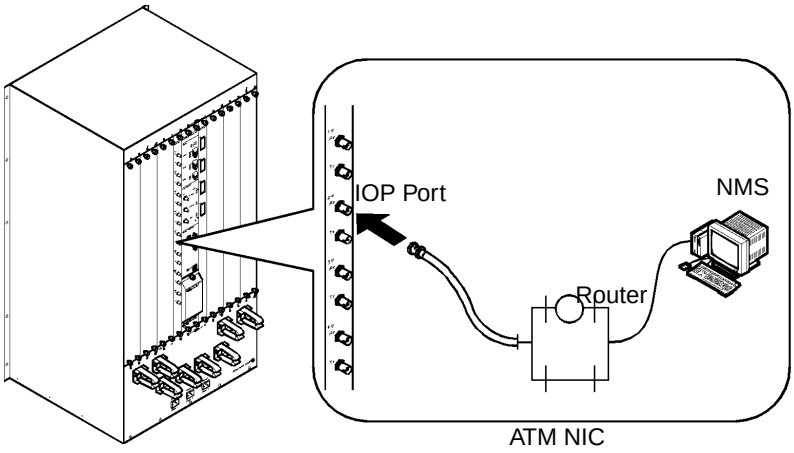


Figure 4-11. Management VC/PVC Connection

To connect the NMS to the switch:

1. Connect the NMS to the LAN that has a router connection to the switch via an ATM UNI connection.
2. Configure the NMS to use either a management VPI/VCI connection (local switch) or a management PVC connection (remote switch).
3. Configure the switch to route management traffic through the designated management VC/PVC connection.
4. Configure the router or ATM NIC with a static route to the Lucent network.

Connecting External Clock Inputs and Outputs

This section describes how to connect an external clock source for either T1 or E1. Follow the instructions in this section only if you want to use an external clock source for your switch network.

There are five possible timing sources for the active SP:

Two external clocks — The external clock inputs can accept timing from an external high-accuracy source.

Two IOP-module derived sources — The SP has a timing subsystem that manages all aspects of locking and distribution of the clock to each of the IOP modules.

Internal clock source with Stratum accuracy — If the selected clock sources fail, the system is automatically reconfigured so that it is synchronized with the SP's internal clock (which has Stratum 3 accuracy).

T1 Clock Connection

The T1 timing inputs work with DS1 timing references that comply with the ANSI T1.102 standard. The T1 timing output takes its timing source from a selected clock source configured via the NMS.

The SPA panel on the back of the switch contains three sets of wire-wrap pins for connecting the following:

- An external T1 clock input
- A redundant external T1 clock input
- A T1 clock output

E1 Clock Connection

The E1 timing inputs work with E1 timing references that comply with the ITU-T G.703, Section 6 standard. The E1 timing output takes its timing source from a selected active SP clock source configured via the NMS.

The SPA panel also contains three 75-ohm BNC connectors for connection to:

- An external E1 clock input
- A redundant E1 clock input
- An E1 clock output

You can configure the operation mode (T1 or E1) through the NMS. For instructions, see the *B-STDX, CBX, and GX Switch Module Configuration Guide*.

Note – Through the NMS software, you can configure the clock sources and clock-source priorities. For example, you can adjust the line build-outs over a range of 0 to 655 feet for T1 timing outputs. You cannot adjust the line build-outs for E1 timing outputs.

Figure 4-12 shows the location of the clock inputs/outputs on the SPA module.

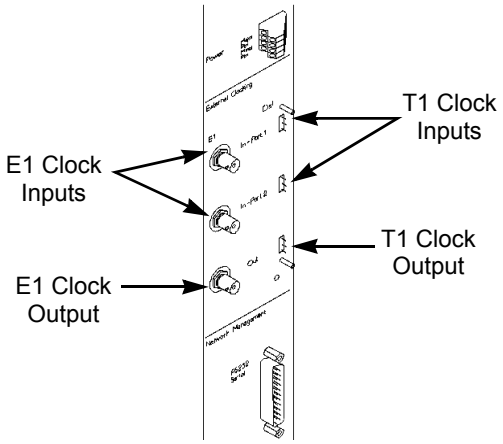


Figure 4-12. External Clock Inputs and Clock Outputs

Connecting External T1 Clock Source Inputs/Outputs

To connect an external T1 clock source input or output:

1. Remove the protective cover from the wire-wrap pins.
2. Using a solid 26 AWG wire, strip the end of the wire approximately 1 to 1-1/2 inches.
3. Insert the stripped end of the wire into a wire-wrap gun for a .045 square post.
4. Use the wire-wrap gun to install the wire onto the wire-wrap pins.
5. Reinstall the protective cover onto the wire-wrap pins.

To connect an external E1 clock-source input or clock output, connect a 75-ohm cable with a BNC connector to the appropriate BNC port on the SPA module.

Connecting Alarm Relays

The SPA module contains an eight-position terminal strip with #4 screw terminals for connecting remote audio and visual alarms (normally open, contact closed), as shown in Figure 4-13 on page 4-16. These alarm relays alert you to critical, major, and minor alarm conditions in the switch. The alarm conditions are (from top to bottom):

- Audible (connects to audible alarm)
  - critical switch error condition
  - major switch error condition
  - minor switch error condition
- Visual (connects to visual alarm)
  - critical switch error condition
  - major switch error condition
  - minor switch error condition
- Power (connects to power relay)
  - major switch error condition
  - minor switch error condition

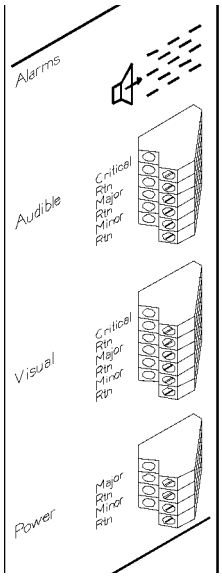


Figure 4-13. Remote Alarm Terminals

Connecting a Remote Alarm

To connect a remote alarm:

1. Locate the appropriate terminal for the alarm connection that you want to make.
2. Using a 1/8-in. flathead screwdriver, loosen the screws on the positive (Critical, Major, Minor) and return (RTN) terminals.
3. Using 12-24 AWG solid or stranded wire, strip the ends of the wire approximately 1/4 in. (6.35 mm).
4. Insert the wire leads into the appropriate positive terminal connector and its return.
5. Using a 1/8-in. flathead screwdriver, tighten the screws on the positive and return terminals to secure the leads.

G.703 Product Attachment Information

1. According to the requirements of TIS 6328/8.2, the default configuration of the 75Ω G.703 (E1) interface with regard to the grounding of the outer conductor of the BNC connectors is as follows:

   - Transmit port (XMTR) — connected to earth ground
   - Receive port (RCVR) — insulated from earth ground

   To connect the receive port to earth ground:

   a. Remove the BNC retaining nut and metal washers on the RCVR port BNC connector.

   b. Remove and discard the insulating washer from the BNC connector.

   c. Reinstall the retaining nut and metal washers on the BNC connector. The outer shell of the RCVR port is then positively connected to earth ground.

Warning – The default earthing of the G.703 port may result in a violation to the EN55022 Class B EMI specification. Compliance with the EN55022 Class B specification requires that the outer conductor of both the transmit and receive ports of the 75Ω G.703 interface must be securely attached to earth ground.

2. The 75Ω G.703 interface has not been tested in a BS6701 configuration and should not be connected to BS6701 approved cabling.

Table 4-1 summarizes the recommended cable specifications for connecting to CBX 500 equipment.

Table 4-1. Cable Specifications

Interface Type	Number Twisted Pairs	DC Res. Ω/km	Nom. Imp Ω	Nom. Capacitance pf/m	% Shield	Max. Length
G.703 - 75 Ω	N/A	49.2	75	66.7	95%	120 m

5

Determining the Operating Status

This chapter includes the following topics for determining the operating status:

Before You Begin

Before you begin, verify that the following tasks (from Chapter 4) are complete:

1. Set up the switch hardware as a free-standing or rack-mounted unit (see page 4-3).
2. Connect cables and console terminal to the switch (see page 4-8 and page 4-9).
3. Set up the Network Management Station (NMS); see page 4-10.
4. Connect the NMS to the switch (see page 4-10).
5. (*Optional*) Connect the external clock source inputs and outputs (see page 4-14).
6. (*Optional*) Connect the remote alarms (see page 4-17).

Status LEDs

The status LEDs on the CBX 500's modules indicate the operating status of the switch and of each module. You can monitor these LEDs locally on the switch, or remotely through the NMS.

Switch Status LEDs

The overall status of the switch is indicated by the Good, Marginal, and Failed status LEDs at the top of the SP module. These LEDs indicate the status of the switch, but not of the SP module itself.

Table 5-1. Switch Status LEDs on SP Module

LED Condition	Indicates
Good (Green) ON	The switch is fully operational; no errors have been detected.
Marginal (Yellow) ON	The switch hardware is operational but the software configuration has not been downloaded; or a non-fatal error condition exists on the switch.
Failed (Red) ON	The switch detected an operational error condition.

Module Status LEDs

Each IOP module and the SP module have Good and Failed status LEDs that show the operating condition of the module.

Table 5-2. Module Status LEDs

LED Condition	Indicates
Good (Green) ON	The module is fully operational; no errors have been detected.
Failed (Red) ON	The module detected an operational error condition. Contact the TAC for assistance.
Good and Failed BLINKING	The OS software image is currently being downloaded to the module from the active SP. *This is not an error condition.*

Port Alarm LEDs

The IOPs also have port-specific LEDs that indicate three possible alarm conditions.

Table 5-3. Port Alarm LEDs

LED Condition	Indicates
Yellow Alarm ON	The Yellow LED can glow (can be ON) in case of port specific yellow alarms, for example, FERF (Far End Receiver Failure), PLCP (Physical Layer Convergence Protocol) yellow, FEAC (Far-End Alarm and Control) SA Equipment Failure.
Red Alarm BLINKING (also called a Blue Alarm)	The Red LED can blink in case of any port specific blue alarm, for example, AIS (Alarm Indication Signal), Idle, FEAC AIS, FEAC-idle.
Red Alarm ON	The Red LED can glow (can be ON) in case of port specific red alarms, for example, OOF (Out of Frame), LOS (Loss of Signal), LOF (Loss of Frame), C-bit mismatch, FEAC OOF/LOS, PLCP LOF.

During the boot process, which follows a cold boot or a power cycle, the Good/Failed LEDs on the IOPs change states as described in Table 5-4:

Table 5-4. IOP LED "Boot" States

IOP State	IOP Good (Green) LED	IOP Failed (Red) LED
Extended POST failure	OFF	Blinking slowly, one second ON, then one second OFF
Boot flash image update from the hard disk	Continuously ON	Blinking rapidly
Application image being read from hard disk	ON/OFF at the same time as Failed LED	ON/OFF at the same time as the Good LED
Application image being uncompressed	Blinking	OFF
PRAM image being read from hard disk	ON/OFF in sequence that alternates with Failed LED	ON/OFF in sequence alternating with Good LED
PRAM image being uncompressed	Blinking	OFF
PRAM is uninitialized for this module	Blinking	OFF

Redundancy Status LEDs

All modules have Redundancy LEDs on the bottom of the module to indicate the redundancy status of the module. The LEDs are on, or blinking, only if the module is part of a redundant pair.

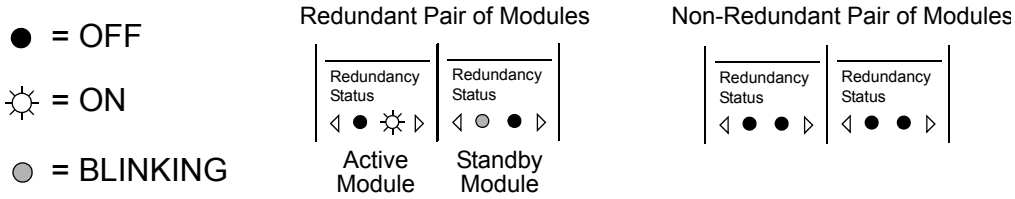


Figure 5-1. Redundancy Status LEDs

PCMCIA Status LEDs

The LEDs under the PCMCIA slots are normally off. If the SP senses an error condition in a PCMCIA card, the failed card's LED is turned on. In a redundant SP configuration, the PCMCIA LEDs for the active SP are off, while the PCMCIA LEDs for the standby SP blink.

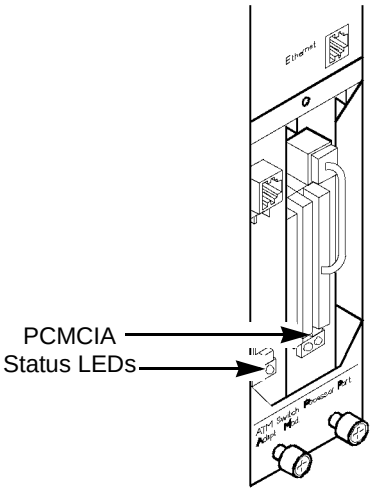


Figure 5-2. PCMCIA Status LEDs

Caution – If a PCMCIA card's LED is on (indicating an error condition), you must power down the switch before removing the PCMCIA card.

Power Supply Status LEDs

Each power supply has Good and Failed status LEDs to indicate the operational status of the power supply.

Table 5-5. AC/DC Power-Supply LEDs

LED Condition	Indicates
Good (Green) ON	The power supply is fully operational.
Red (Failed) BLINKING	The power supply has a partial failure but is still operational. Replacement is recommended.
Red (Failed) ON	The power supply is not working.

DC Power Failures - LED Status

In addition to the standard LED conditions described in Table 5-5, DC power supply green LEDs have additional blinking patterns that indicate possible loss of power on either of the 48V power-source inputs (A and B) to the DC power supplies. Failure on either DC power source results in a slow blinking of the green LEDs on *all three power supplies*.

Table 5-6 describes the LED blinking pattern for failures on DC power sources, A and B.

Table 5-6. DC Power Failures - LED Status

Green LED Blinking Pattern	Indicates Power Failure on
Three seconds ON, one second OFF	DC Input A
Three seconds ON, one second OFF; then one second ON and one second OFF	DC Input B

Note – If a power failure occurs on either DC power source A or B, the green LEDs will blink on all three power supplies. However, the LEDs are not synchronized so you may need to monitor one power supply at a time to determine the blinking-pattern status.

Evaluating Power Loads for a Two-Power Supply Switch

If your switch is configured with a single-chassis power supply (two power supplies instead of three), you must evaluate overall power consumption for the switch and I/O modules before you connect power to the switch.

The CBX 500's 120-VAC chassis power supplies deliver 1050 watts of +5V power. Depending on the switch configuration and the power supplies, the total I/O module capacity may be limited if a single-chassis power supply is used.

Calculating Power Consumption

To calculate power consumption and stay within the limits of a single power supply, use the following formula:

(SP power) + [(number of modules) x (power per module)] <= 1050

When calculating power consumption, be aware of the following power usage factors:

- In redundant SP configurations, a pair of SPs draws 260 watts (worst case) with one SP active and the other a standby.
- In non-redundant SP configurations, the single active SP draws 170 watts.
- CBX 500 IOPs have a maximum power consumption limit of 100 watts per slot. Using this number, you can calculate the worst-case power consumption on the switch backplane, as follows: 14 x 100 (IOMs) + 260 (SPs) + 75 (fans) = 1735 watts.To obtain the input power, divide this number by the power supply efficiency, 0.70.

Problems should not occur if the configuration does not exceed the 1050 watt limit.

Table 5-7 describes the breakout of the total power used by CBX 500 SPs, IOMs, and fan assemblies.

Table 5-7. Power Consumption by CBX 500 Components

Components	Power Consumption (Watts)
Switch Processor (SP) Modules	
Switch Processor (SP) Pair (single-chassis power supply)	260 (active SP- 170) (standby SP - 90)
I/O Processor (IOP) Modules	
1-port OC-12c/STM-4 (with NRTS)	65 (82)
4-port OC-3c/STM-1 ATM (electrical and optical) (with NRTS)	65 (80)
4-port Ethernet	91
4-port channelized DS3/1/0 Frame	75
6-port DS3 Frame/IP	90
8-port T1 and E1 ATM (with NRTS)	65 (83)
8-port DS3 and E3 ATM (with NRTS)	75 (91)
8-port Subrate Module	105
1-port Channelized Inverse Multiplexing over ATM (IMA) Module	13
3-port Channelized Inverse Multiplexing over ATM (IMA) Module	105
32-port Channelized T1/E1 FR/IP IOM	90
60-port Channelized T1/E1 CE I/O Module	105
DS3/1 and STM-1/E1 ATM IMA Module	92
Fan Assemblies	
Fans	75

Connecting Power to the Switch

The CBX 500 is powered by either two AC or two DC power supplies. You can also install a third power supply for redundancy, to ensure continuous power in the event of a circuit or power-supply failure.

Switches with AC Power Supplies

To connect the switch's AC power supplies to a power source:

1. Verify that the correct power source is available for the CBX 500 power supplies. (See Chapter 2, "Specifications and Safety Warnings" for power specifications.)

Warning – Before connecting the AC power cords, see the section, "Electronic/Electrical Requirements," in Chapter 2. See also Appendix C for circuit regulatory information.

2. Attach the main power cords to the switch by plugging the AC power cords into the Power 1 - IEC 320 and Power 2 - IEC 320 inlets at the rear of the switch. For a redundant power supply, plug the cord into the Power 3 - IEC 320 inlet.
3. Insert the main power cords into one or more of the cable strain-relief clamps, and ensure that there is some slack in the power cords between the clamp and the IEC 320 inlet.
4. Verify that the power switch on each power supply is in the OFF position.
5. Plug the main power cords into a 3-wire grounding receptacle. To ensure continuous power in the event of an electrical circuit outage, you should plug each power cord into receptacles on different circuits.

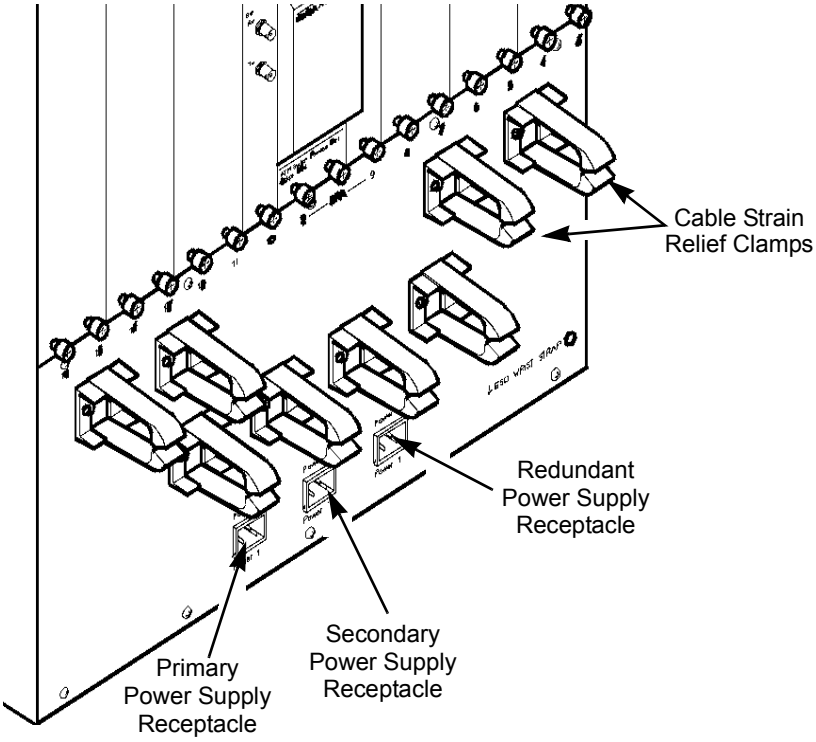


Figure 5-3. Connecting an AC Power Supply

Switches with DC Power Supplies

To connect the switch's DC power supplies to a power source:

1. Verify that the correct power source is available for the CBX 500 power supplies. (See Chapter 2, "Specifications and Safety Warnings," for power specifications.)

Warning – Before connecting the power cords, see the section, "Electronic/Electrical Requirements," in Chapter 2. See also Appendix C for circuit regulatory information.

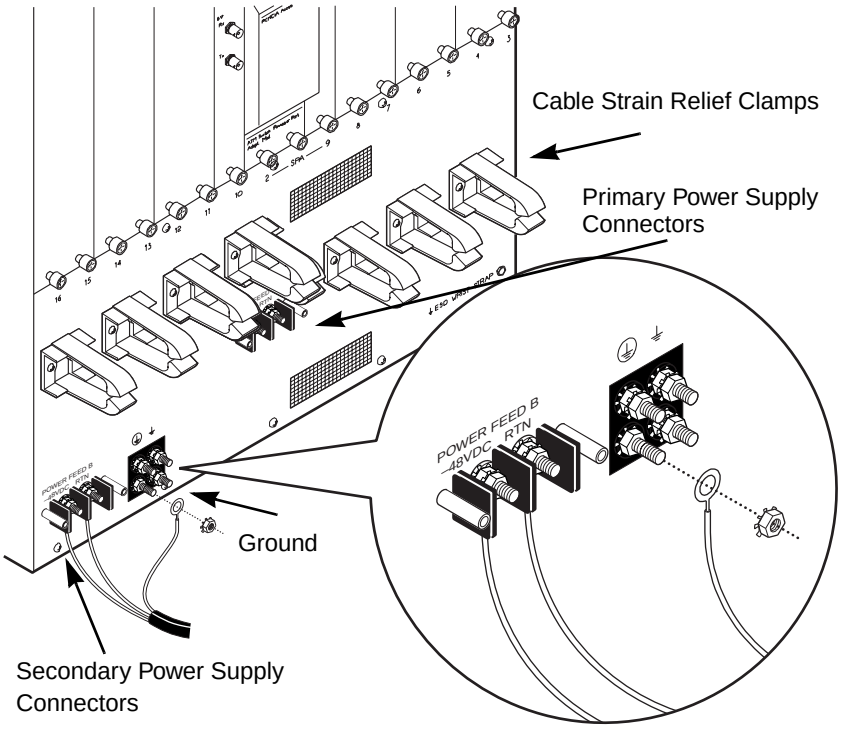


Figure 5-4. Connecting the -48 VDC Power Supplies

2. Attach a power cord to each set of power connectors as follows. Both power cords must be connected at all times when operating the switch.

Note – The DC power cord wires should terminate in *1/4-in. diameter* listed ring lugs, using the tools specified by the manufacturer. Also, the wire gauge you use depends on the distance from the connection point.

Warning – Verify that the power is *off* or disconnected at the source before beginning this procedure.

   a. Verify that the power switch on the power supply is set to the OFF position.
   b. Locate the #10 studs on the back of the unit.
   c. Using a #2 Phillips-head screwdriver, remove the two screws that secure the protective cover over the studs. Then remove the protective cover.
   d. Using a 7/16-in. wrench or socket, remove the top locking nut from each of the three studs (labelled -48V, RTN, and ⏚). Do not remove the bottom locking nut.

e. Install the three ring lugs onto the appropriate posts.

Note – You can optionally ground the chassis to the enclosure by attaching a dual mount ground lug to the dual mount ground on the back of the unit (see Figure 5-4 on page 5-10).

Note – It is recommended that, to provide a single-point ground connection, only one of the chassis grounds should be connected to earth ground (⏚).

f. Reinstall the locking nut onto each post, then use a 7/16-in. wrench or socket to tighten the nut.

g. Reinstall the protective cover with the two screws, ensuring that its opening is at the *bottom*, to prevent any small, falling objects from making contact with the studs.

3. Place the power cords across the bottom of the chassis to make it easier for them to feed *up* through the opening in the protective cover (see the zoom-in illustration within Figure 5-4 on page 5-10), ensuring that there is some slack in the power cords between the clamp and the terminal posts.

4. Plug the other end of the main power cords into the DC power source for the switch. To ensure continuous power in the event of a power source failure, you should plug each power cord into different DC power sources, if possible.

Powering Up the Switch

Caution – Do not power up the switch without an SP installed in the chassis. Powering up a switch without an installed SP can damage hardware components. Also, check that the SP modules are both SP 40s. If they are not the same model type, do not power up the switch; instead, remove one of the SP modules or contact the Technical Assistance Center (TAC) for guidance.

To power up the switch, toggle the power switches for the primary and secondary power supplies to their ON positions. If a redundant power supply is installed, you must also toggle its power switch to the ON position.

The switch initializes itself by performing self-checks and diagnostics (if enabled). The SP module's Good LED (not the switch LED at the top of the SP card) begins to blink. The blinking speed changes and the LED actually goes off during the initialization of the SP module. After *several minutes*, the SP module's Good LED comes on and remains on. The SP card is now operational.

The state of the other LEDs depends on whether the PRAM has been downloaded to the switch:

If PRAM has not been downloaded to the switch — The switch's Marginal LED located at the top of the SP module comes on solid yellow, indicating that the switch is not configured; also, the Good LED on each IOP module blinks. For information about downloading configurations to the switch, see the *B-STDX, CBX, and GX Getting Started User's Guide*.

If PRAM has already been downloaded to the switch — The SP module's Good LED remains solid green, as does the switch's Good LED located at the top of the module. Also, the Good LED on each *configured* IOP module comes on solid green. (The Good LED on any *unconfigured* IOP module blinks slowly.)

What's Next?

After installing the hardware and powering up the switch, you must perform the following tasks:

- Download the software configuration to the switch, see the *Switch Software Upgrade Guide for CBX 3500, CBX 500, and GX 550* for instructions.
- Install and configure the NMS software, see the *Navis EMS-CBGX Release 10.00.01.00 Installation and Administration Guide* for instructions.

6

Installing and Removing Modules

The chapter provides information about installing and removing CBX 500 modules, in the following topics:

Installation and Removal Precautions

The CBX 500 switch design enables you to install, remove, and replace most modules by "hot-swapping" (that is, without powering down the switch). However, you may choose to power down the switch as a precaution if the switch is not currently operational.

Read the following precautions to avoid personal injury and damage to the equipment.

Parts Repair

Caution – Do *not* attempt to repair parts or modules yourself. Return all defective modules to Lucent for repair. Only Lucent-trained service representatives are authorized to service parts.

Static Protection

Warning – Do *not* attempt to remove or install modules without using appropriate static-guard measures. Lucent includes a grounded antistatic wrist strap in the accessory kit.

Electrical Energy Hazard

Warning – When the switch is powered up, an electrical energy hazard is present within the card cage. Remove all metallic objects from hands and wrist to prevent bridging of live contact points.

Switch Processor Module

Caution –

- You cannot hot-swap the main SP or SPA module on an operational switch unless a redundant SP module is installed and active at the time. You cannot hot-swap to replace the *active* SP module or the associated PCMCIA card.
- If the switch has a redundant SP configuration, you must first change the status of the component to be replaced from active to redundant before removing/replacing it. See the *B-STDX, CBX, and GX Switch Module Configuration Guide* for information about switching to a redundant card, using NavisCore.

Removing an SP Module

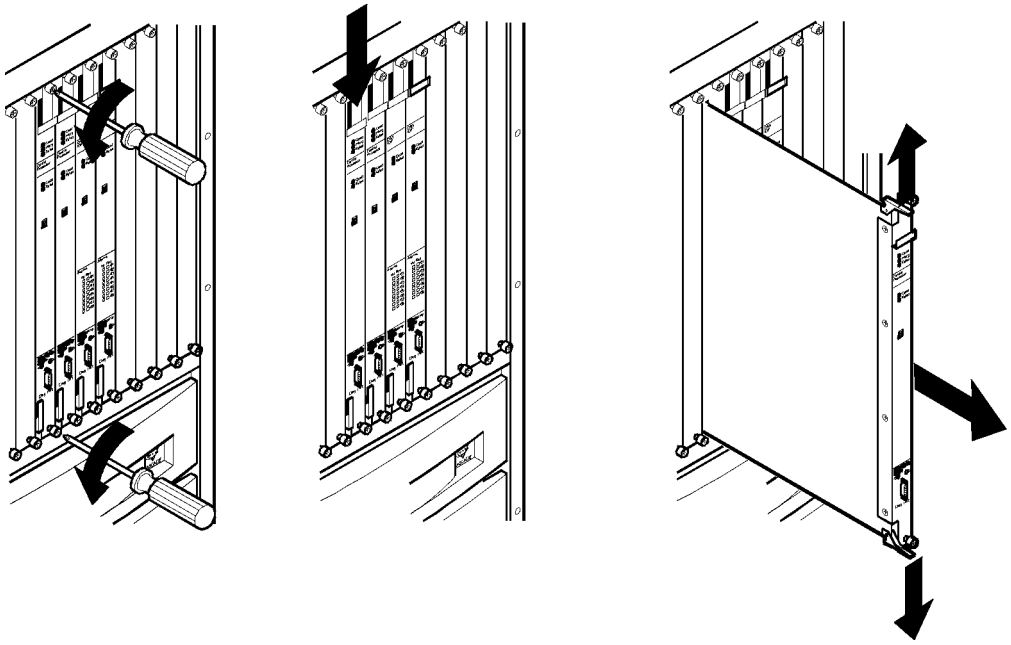


Figure 6-1. Removing a Switch Processor (SP) Module

Warning – The following procedure may make the device susceptible to electrostatic charge.

To remove an SP module:

1. Put on the antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.
2. If the switch does not contain a redundant SP, or if both the main SP and the redundant SP module are being replaced simultaneously, notify all users that the switch is being shut down. Then power down the switch.

3. Using a #2 Phillips-head screwdriver, loosen the thumbscrews located on the top and bottom of the SP module. Other screwdrivers may damage the screw heads.
4. Slide the ejector lock at the top of the SP module down.
5. Lift the top and bottom card ejectors simultaneously to remove the module from the switch.
6. Carefully slide the SP module out of the chassis and place it into an antistatic container.

Installing an SP Module

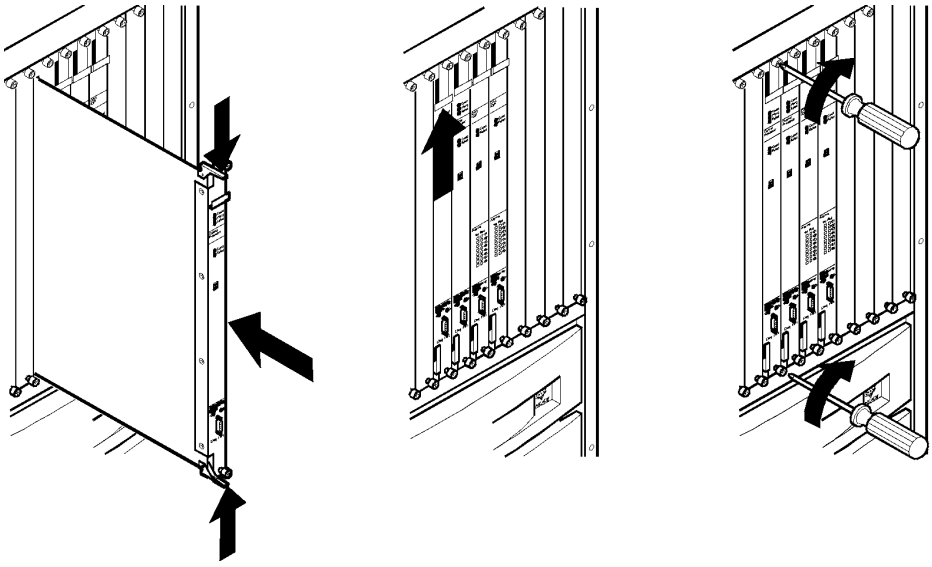


Figure 6-2. Installing an SP Module

Warning – The following procedure may make the device susceptible to electrostatic charge.

To install an SP module:

1. Align the replacement SP module with the card guide and carefully slide the module into the switch.
2. Depress the card ejectors simultaneously to seat the module into the backplane.
3. Slide the card ejector lock up.
4. Using a #2 Phillips-head screwdriver, tighten the two thumbscrews (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).
5. If necessary, restore power to the switch.

After the normal bootup and initialization (which may take several minutes), the SP's Good LED (green) should be on.

Note – The Good and Failed LEDs on the newly installed SP blink simultaneously while the OS software image is downloading. This is not an error condition.

Note – If the original operating system (loaded at the factory before shipping the SP) becomes lost or corrupted, follow the instructions in the appropriate switch-code release note to download a new OS and configuration.

Installing a Redundant SP

Warning – The following procedure may make the device susceptible to electrostatic charge.

The main SP is always installed in Slot 1. To install a redundant SP module in Slot 2:

1. Put on the antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.
2. Use a #2 Phillips-head screwdriver to loosen the thumbscrews, then remove the filler module from Slot 2 in the front of the switch.
3. Ensure that the ejector lock located at the top of the redundant SP module is in the *down* position.
4. From the front of the switch, align the redundant SP module with the card guide in Slot 2, and carefully slide the card into the switch.
5. Depress the card ejectors simultaneously to engage the module with the backplane and SPA.
6. Slide the card ejector lock up.
7. Using a #2 Phillips-head screwdriver, secure the module into the chassis by tightening the two thumbscrews (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).
8. Check the LEDs on the redundant SP to verify the operational status of the card. After several minutes, the green Good LED should remain on. Also, the Redundancy Status LED on the bottom left of the card should be blinking green, indicating that the card is in standby mode. The active SP's Redundancy Status LED should be solid green, indicating that the card is in active mode.
9. Configure the switch for a redundant SP configuration via the NMS software. For instructions, see the *B-STDX, CBX, and GX Switch Module Configuration Guide.*

The Good and Failed LEDs on the newly installed SP blink simultaneously while the OS software image is being downloaded. This is *not* an error condition.

Note – If the original operating system (loaded at the factory before shipping the SP) becomes lost or corrupted, follow the instructions in the appropriate switch-code release note to download a new OS and configuration.

Replacing the SPA Module

The SPA always occupies Slots 1 and 2 in the back of the switch.

Note – Disengage the SP modules from the SPA before removing the SPA module from the switch.

Warning – The following procedure may make the device susceptible to electrostatic charge.

To replace the SPA module:

1. Put on the antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.
2. Notify all users that the switch is about to be powered down, and then power down the switch.
3. From the front of the switch, disengage the SP module (and redundant SP module, if one is installed) as follows:
   a. Using a #2 Phillips-head screwdriver, loosen the thumbscrews located on the top and bottom of the SP module. Failure to use a #2 Phillips-head screwdriver may damage the screw heads.
   b. Locate the ejector lock at the top of the SP module. Then, slide the ejector lock down to disengage the card. The SP is now disconnected from the network.
   c. Lift the top and bottom card ejectors simultaneously to disengage the module from the backplane. Lift both ejectors simultaneously to avoid damage to the module.
   d. Slide the SP module out of the chassis about one inch (2.54 cm).
4. From the back of the switch, disconnect any external cables and wires from the existing SPA module. Tag the cables and wires for identification and reconnection.
5. Using a #2 Phillips-head screwdriver, loosen the two thumbscrews on the top of the SPA and the two thumbscrews at the bottom of the SPA. Figure 6-3 shows the procedure for removing the SPA module from the back of the switch.

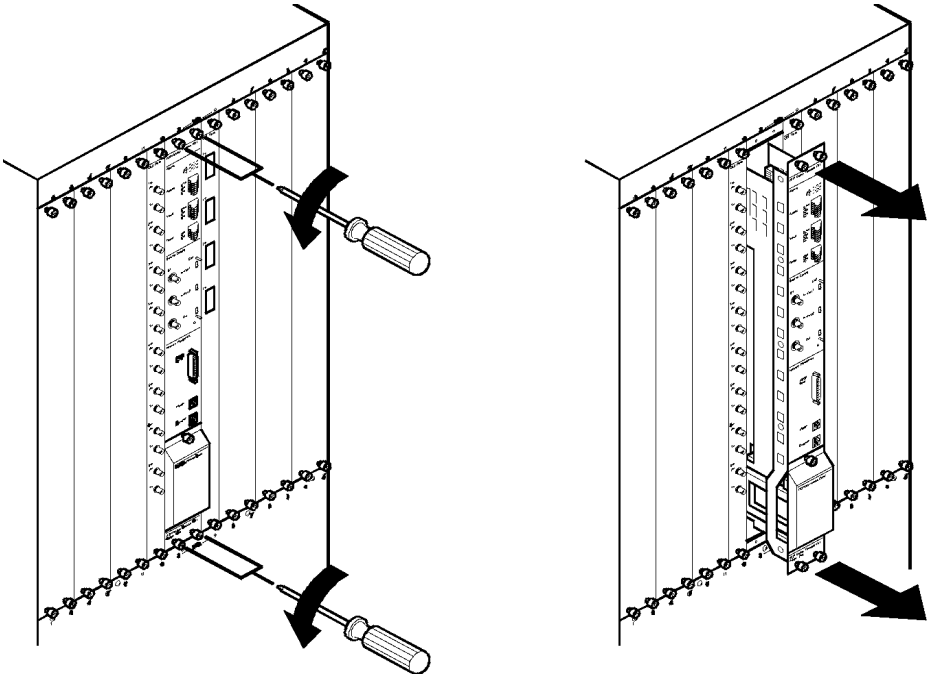


Figure 6-3. Removing the SPA Module

6. Holding on to the thumbscrews for leverage, carefully slide the SPA module out of the switch and place it in an antistatic container.
7. Align the replacement SPA module with the card guides and slide it into the switch.
8. *Hand-tighten* the thumbscrews on the SPA.
9. Reconnect the external cables and wires, and remove the tags that you placed on them.
10. In the front of the switch, install the SP. Ensure that you push the ejector lock up and tighten the thumbscrews.
11. On the back of the switch, finish tightening the thumbscrews at the top and bottom of the SPA module.
12. Remove the PCMCIA cards from the old SPA module by following these steps:
    a. Using a #2 Phillips-head screwdriver, loosen the screw at the top of the PCMCIA cover.
    b. Remove the cover by lifting it up and away from the switch.
    c. Disconnect the cable on the Ethernet card from the socket on the SPA.
    d. Push the square, flat black buttons at the bottom of each PCMCIA card to eject the cards. Guard the removed cards against static discharge.

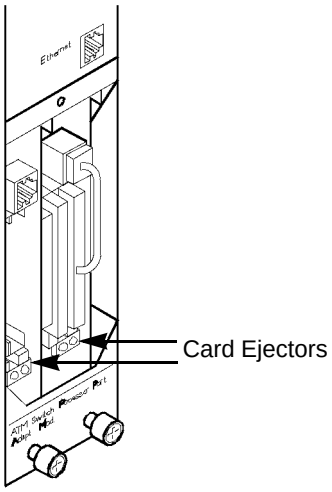


Figure 6-4. PCMCIA Card Bay

Each SP has a pair of PCMCIA cards; the thinner one on the right is the Ethernet card. The hard drive is thicker than the Ethernet card and occupies the left slot. (There can be an Ethernet/hard drive pair for both SPs in the switch.)

13. Install the PCMCIA cards in the replacement SPA module by following these steps:

a. To install each PCMCIA card, determine its correct slot position (hard drive on the left and Ethernet card on the right), align the card edge with the guides, and push the card in until the black ejector button pops back up.

b. When all the PCMCIA cards are installed, reconnect the cable between the PCMCIA Ethernet card and SPA socket.

c. Do not replace the PCMCIA card bay cover yet.

14. Restore power to the switch.

15. Check the LEDs to verify the operational status of the SP modules (if necessary, see Chapter 5). After several minutes, the green Good LED on the SPs should remain on.

16. Verify that the LEDs on the PCMCIA cards are off. The LEDs only come on to identify a failed PCMCIA card.

17. Slide the PCMCIA cover back into position, and using a #2 Phillips-head screwdriver, tighten the screw at the top of the PCMCIA cover (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).

Removing and Replacing PCMCIA Cards

You can remove and replace the PCMCIA cards from the SPA module with the switch powered on. However, the SP from which you are removing the PCMCIA card must *not be the active SP* at the time of removal/replacement. You must temporarily perform a switchover-to-redundant card operation, then remove/replace the PCMCIA card.

Note – If you are replacing the PCMCIA cards on both SPs (active and redundant), replace the PCMCIA card on the **redundant** SP first, then wait 15 to 20 minutes before switching over to the active SP. This delay provides adequate time for the switch to synchronize its internal files.

Warning – The following procedure may make the device susceptible to electrostatic charge.

To remove and replace the PCMCIA cards:

1. **If the SPA is active:** First change the status from active to redundant by performing a switchover-to-redundant card operation via NavisCore. See the *B-STDX, CBX, and GX Switch Module Configuration Guide* for details.
2. On the redundant SP, unscrew the latch retainer and set the reset latch to the *down* position.
3. Using a #2 Phillips-head screwdriver, loosen the screw at the top of the PCMCIA cover.
4. Remove the cover by lifting it up and away from the switch.
5. Disconnect the cable on the Ethernet card from the socket on the SPA.
6. Push the square, flat black buttons at the bottom of each PCMCIA card to eject the cards. After the cards are removed, ensure that they are protected from static discharge.

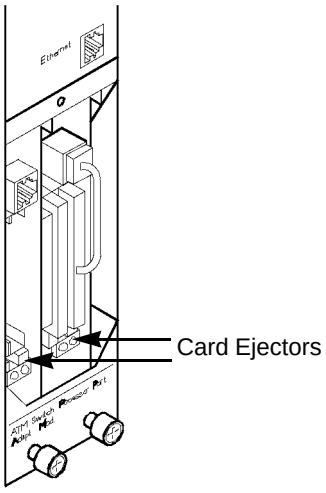


Figure 6-5. PCMCIA Card Slot Configuration

Each SP has a pair of PCMCIA cards — the one on the right is the Ethernet card, and the hard drive occupies the left slot. (There is an Ethernet/hard drive pair for both SPs in the switch.)

7. Install the PCMCIA cards in the SPA module as follows:

a. To install each PCMCIA card, determine its correct slot position (hard drive on the left and Ethernet card on the right), align the card edge with the guides, and push the card in until the black ejector button pops up.

b. When all the PCMCIA cards are installed, reconnect the cable between the PCMCIA Ethernet card and the SPA socket.

c. Do not replace the PCMCIA card bay cover yet.

8. Set the reset latch to the *up* position and screw in the latch retainer.

Note – At this time, if you want to replace the PCMCIA card on the other SP, wait 15-20 minutes after the SP is back online before performing another card switchover. This delay provides adequate time for the switch to synchronize its internal files.

---

9. Check the LEDs to verify the operational status of the SP modules (if necessary, see Chapter 5). After several minutes, the green Good LED on the SPs should remain on.

10. Verify that the LEDs on the PCMCIA cards are off. (The LEDs only come on when there is a PCMCIA card failure.)

11. Slide the PCMCIA cover back into position and, using a #2 Phillips-head screwdriver, tighten the screw at the top of the PCMCIA cover (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).

Installing or Replacing IOA Modules

IOA modules are installed into the back of the switch. Openings for unused IOA slots are protected by blank covers. The IOA module has to be installed in the back of the switch before you can install the IOP module that it supports.

Caution – Unlike previous CBX 500 modules, the 32-Port Channelized T1/E1 FR/IP IOM uses a new type of connector with closely-spaced pin alignments. You should carefully plug in and secure the IOA before connecting the input/output processor (IOP) module to it.

Figure 6-6 on page 6-12 illustrates how to remove IOA modules from the back of the switch.

Warning – The following procedure may make the device susceptible to electrostatic charge.

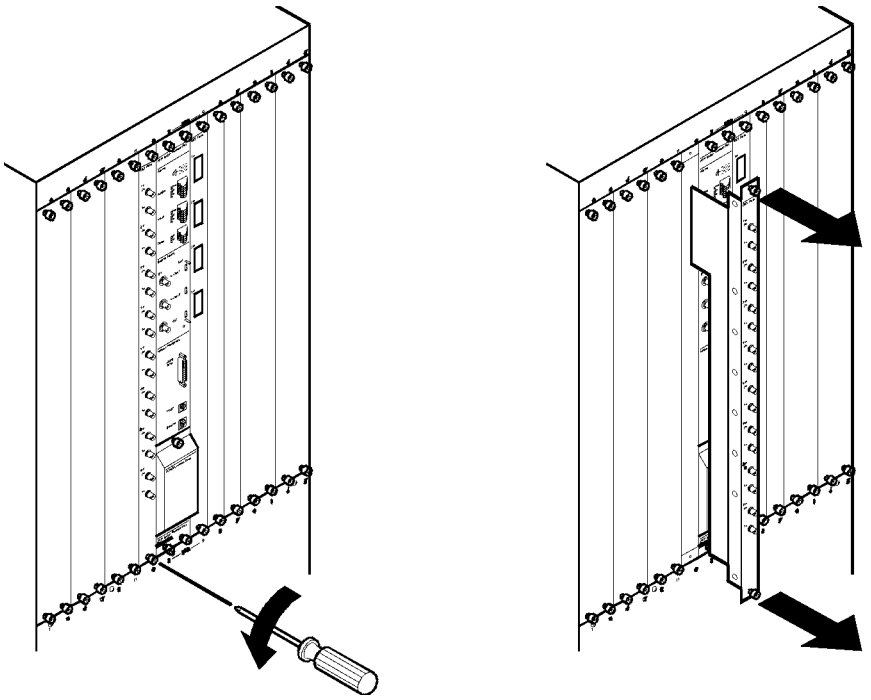


Figure 6-6. Removing IOA Modules

Installing IOA Modules

Caution – Unlike previous CBX 500 modules, the 32-Port Channelized T1/E1 FR/IP IOM uses a new type of connector with closely-spaced pin alignments. You should carefully plug in and secure the IOA before connecting the input/output processor (IOP) module to it.

To install an IOA module:

Warning – The following procedure may make the device susceptible to electrostatic charge.

1. Put on the antistatic wrist strap (provided in the accessory kit), and plug it into the ESD grounding jack on the switch.
2. Complete this step only if there is an IOP module installed for the IOA. You must disengage the IOP from the backplane before you install the IOA.
   a. Using a #2 Phillips-head screwdriver, loosen the thumbscrews located on the top and bottom of the IOP module.
   b. Locate the ejector lock at the top of the IOP module, then slide the ejector lock down to disconnect the IOP from the network.
   c. Lift the top and bottom card ejectors simultaneously to disengage the module from the switch.
   d. Carefully slide the IOP module out of the switch about one inch (2.54 cm).
3. Remove the blank filler module covering the IOA's slot.
4. Align the IOA module with the card guides.
5. Gently slide the IOA module into the switch and *hand-tighten* the thumbscrews. The screws should be fully tightened only *after* the IOP is installed.

To install the IOP, see "Installing and Replacing IOP Modules" on page 6-15.

Replacing IOA Modules

Caution – Any circuits running through the IOP module are terminated when the module is removed, possibly resulting in a loss of data. Lucent recommends setting the IOP module's administrative status to *Down* via the NMS before removing the module from the switch. If necessary, see the *B-STDX, CBX, and GX Switch Module Configuration Guide* for instructions.

Warning – The following procedure may make the device susceptible to electrostatic charge.

To replace an IOA module when an IOP is already installed:

1. Put on the antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.
2. Using a #2 Phillips-head screwdriver, loosen the thumbscrews located on the top and bottom of the IOP module.
3. Locate the ejector lock at the top of the IOP module, then slide the ejector lock down to disconnect the IOP from the network.
4. Lift the top and bottom card ejectors simultaneously to disengage the module from the switch. Then carefully slide the IOP module out of the switch about one inch (2.54 cm).
5. From the back of the switch, disconnect any external cables from the existing IOA module. Tag the cables for identification and reconnection.
6. Using a #2 Phillips-head screwdriver, loosen the thumbscrews at the top and bottom of the IOA.
7. Grasp the thumbscrews for leverage, then carefully slide the IOA module out from the back of the switch and place the module into an antistatic container.
8. Insert the new or replacement IOA module into the back of the switch, aligning it with the card guides.
9. Gently slide the module into the card guide, and *hand-tighten* the thumbscrews on the IOA. Then reconnect the external cables to the IOA module, and remove the cable's identification tags.
10. Install the IOP into the front of the switch. (If necessary, see "Installing and Replacing IOP Modules" for instructions.)
11. Return to the back of the switch and secure the IOA module by tightening the thumbscrews at the top and bottom of the module.

12. If necessary, reconnect the power cords and power up the switch.

Note – Before continuing, wait until the Good LED on the active IOP module is either solid green or blinking slowly. This may take several minutes.

13. If necessary, synchronize the IOP card from the NMS. For information about PRAM sync functions, see the *B-STDX, CBX, and GX Getting Started User's Guide*.

14. Check the LEDs to verify the operational status of the cards.

Installing and Replacing IOP Modules

You can install IOP modules in slots 3-9 and 10-16 as shown in Figure 6-7. Slots 1 and 2 are reserved for switch processor (SP 40) modules.

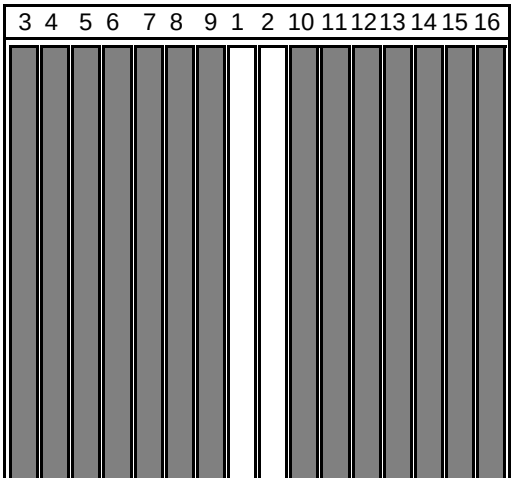


Figure 6-7. IOP Slots with SP 40

Redundant IOP Modules

You must install redundant IOP pairs in specific adjacent slots (see Figure 6-8).

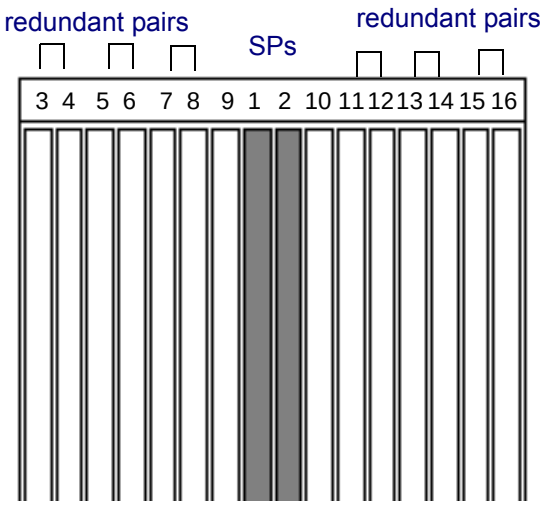


Figure 6-8. Redundant-Pair Slots

See Appendix D, "Redundancy" for more information about CBX 500 redundancy.

Installing a New IOP Module

When adding a new IOP module to the switch, you must first install its IOA module, as described in the following sections.

Installing a New IOA Module

Note – Unused IOA slots contain blank filler covers.

Warning – The following procedure may make the device susceptible to electrostatic charge.

Caution – Unlike previous CBX 500 modules, the 32-Port Channelized T1/E1 FR/IP IOM uses a new type of connector with closely-spaced pin alignments. You should carefully plug in and secure the IOA before connecting the input/output processor (IOP) module to it.

1. Put on an antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.

2. Remove the blank cover from the selected slot by loosening its screws.
3. Align the IOA with the card guides and insert it into the back of the switch.
4. Slide the IOA all the way into the switch and hand-tighten the thumbscrews.

Installing a New IOP Module

Warning – The following procedure may make the device susceptible to electrostatic charge.

Caution – Unlike previous CBX 500 modules, the 32-Port Channelized T1/E1 FR/IP IOM uses a new type of connector with closely-spaced pin alignments. You should carefully plug in and secure the IOA before connecting the input/output processor (IOP) module to it.

To install a new IOP module:

1. Remove the blank slot cover on the front of the switch that corresponds to the installed IOA on the back of the switch.
2. Align the IOP module with the card guides and carefully slide the module into the switch. Press firmly to be sure that it has engaged the backplane connectors.
3. Depress the ejectors simultaneously.
4. Slide the card ejector lock up.
5. Using a #2 Phillips-head screwdriver, secure the IOP module by tightening its thumbscrews (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).
6. Using a #2 Phillips-head screwdriver, secure the IOA module by tightening the thumbscrews (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).
7. If necessary, reconnect the power cord(s) and power up the switch.
8. Check the LEDs on the IOP to verify the operational status of the module.

Note – Before continuing, wait until the Good LED on the IOP module is either solid green or blinking slowly. This may take several minutes.

Note – If the SP detects a mismatch of boot code between the SP and the new IOP card, the SP automatically downloads its current version of the boot code to the IOP card before downloading the application code. The IOP card may reboot several times before the download process completes.

When the Good LED on the IOP is blinking slowly, the NMS operator can synchronize the IOP card. For instructions, see the *B-STDX, CBX, and GX Getting Started User's Guide.*

Replacing an IOP Module

Lucent recommends setting the administrative status of the IOP module to *Down* (via the NMS) before replacing the module. When an IOP is removed, all of its ports and circuits are terminated. Data loss may also occur on those circuits.

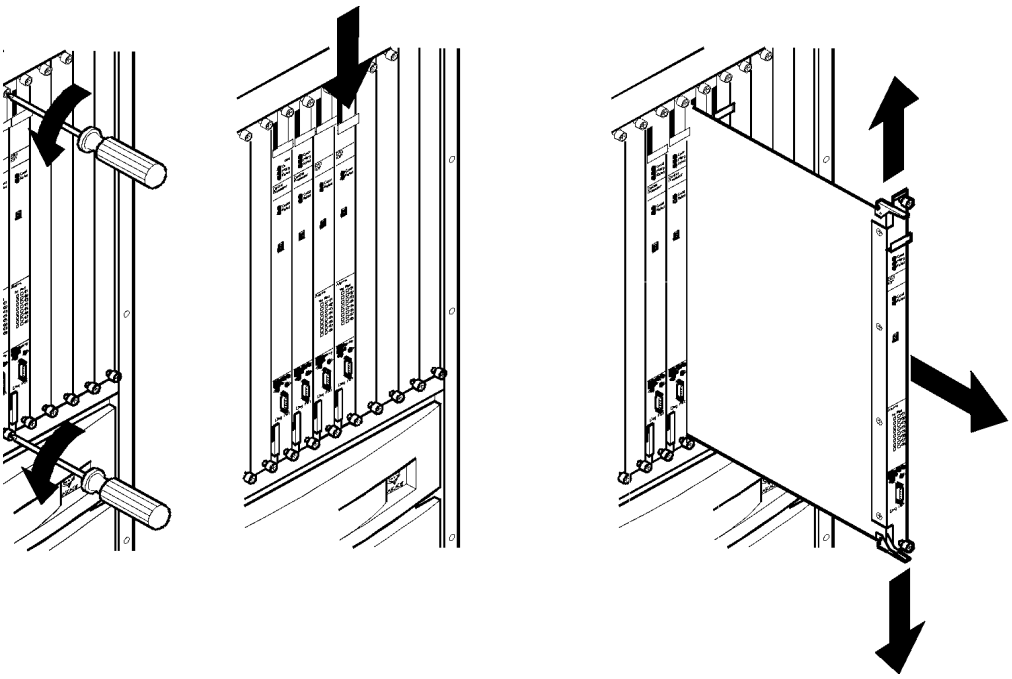


Figure 6-9. Removing IOP Modules

Warning – The following procedure may make the device susceptible to electrostatic charge.

To install or replace an IOP module:

1. Put on the antistatic wrist strap (provided in the accessory kit) and plug it into the ESD grounding jack on the switch.
2. From the back of the switch, use a #2 Phillips-head screwdriver to loosen, but not remove, the corresponding IOA module. Failure to use a #2 Phillips-head screwdriver may damage the screw heads.
3. From the front of the switch, slide the ejector lock located at the top of the IOP module down to disconnect the module from the network.

4. Lift the top and bottom card ejectors simultaneously to remove the module from the switch. Lift both ejectors simultaneously to avoid damage to the module.
5. Slide the IOP module out of the switch and place it into an antistatic container.
6. Align the new or replacement IOP module with the card guides and carefully slide the module into the switch. Press firmly to be sure that it has engaged the backplane connectors.
7. Depress the ejectors simultaneously.
8. Slide the card ejector lock up.
9. Using a #2 Phillips-head screwdriver, secure the module into the switch by tightening the thumbscrews on the IOP and IOA modules (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).

Note – If the SP detects a mismatch of boot code between the SP and the new IOP card, the SP automatically downloads its current version of the boot code to the IOP card before downloading the application code. The IOP card may reboot several times before the download process completes.

When the IOP's Good LED is blinking slowly, the NMS operator can synchronize the IOP card. For instructions, see the *B-STDX, CBX, and GX Getting Started User's Guide.*

Installing or Replacing Power Supplies

Normally, you can install a power supply without powering down the switch. The exception is the replacement of either power supply in a non-redundant configuration (that is, there is no redundant power supply installed). In that case, you must shut the switch down before installing the new power supply.

Caution – Toggle the faulty power supply's ON/STANDBY switch to STANDBY before you remove the power supply from the switch.

Note – Before replacing the power supply, see the section,"DC Power Supply Warnings," in Chapter 2.

CBX 500 switches support both AC and DC power supplies.

Figure 6-10 on page 6-20 shows the Power Distribution Unit for the AC power supply module.

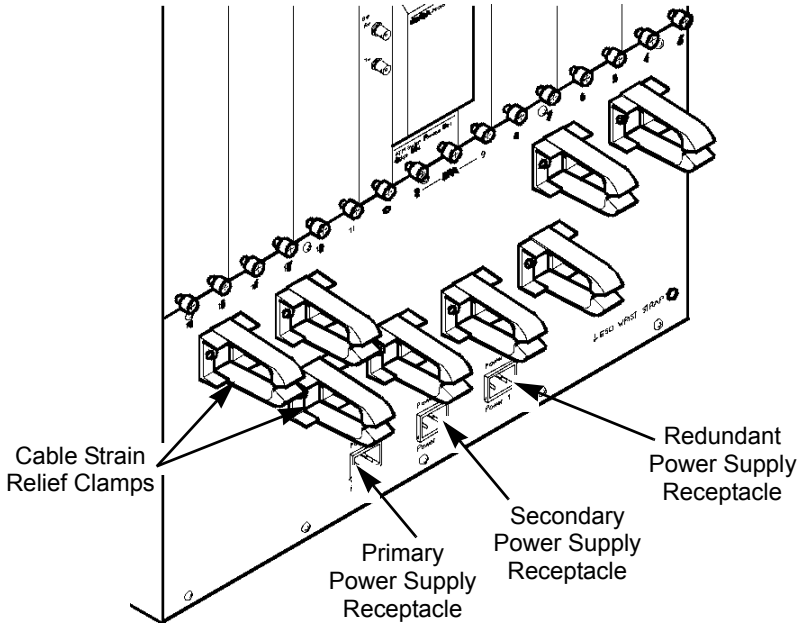


Figure 6-10. Power Distribution Unit for the AC Power Supply

Figure 6-11 shows the Power Distribution Unit for a -48 VDC power supply module.

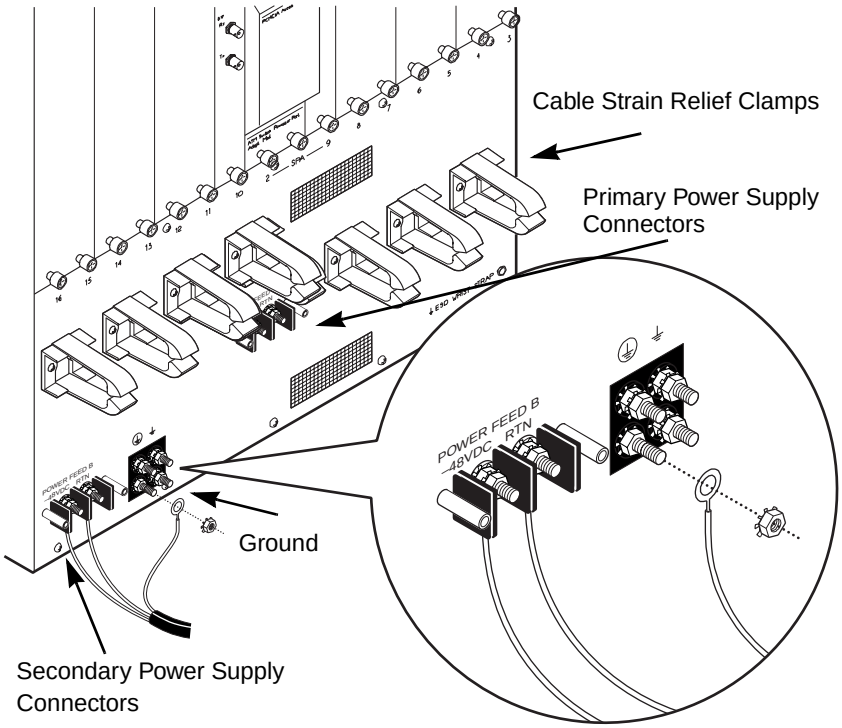


Figure 6-11. Power Distribution Unit for a -48 VDC Power Supply

Although the AC and DC power supply modules look different, the removal and replacement procedures are identical except for the power cord connection. Both AC and DC power supplies are removed from the front of the switch.

Removing a Power Supply

Note – In switches with nonredundant power supplies, all circuits running through the switch are terminated when the nonredundant power supply module is removed. Notify all relevant operations personnel before shutting down the switch.

Warning – The following procedure may make the device susceptible to electrostatic charge.

1. Toggle the faulty power supply's power switch to the STANDBY position. Then unplug the faulty power supply's power cord from the power source feeding the Power Distribution Unit.
2. Grasp the edges of the front bezel, then pull the bezel off.

3. Using a #2 Phillips-head screwdriver, remove the two screws located on either side of the power supply module, as shown in Figure 6-12.

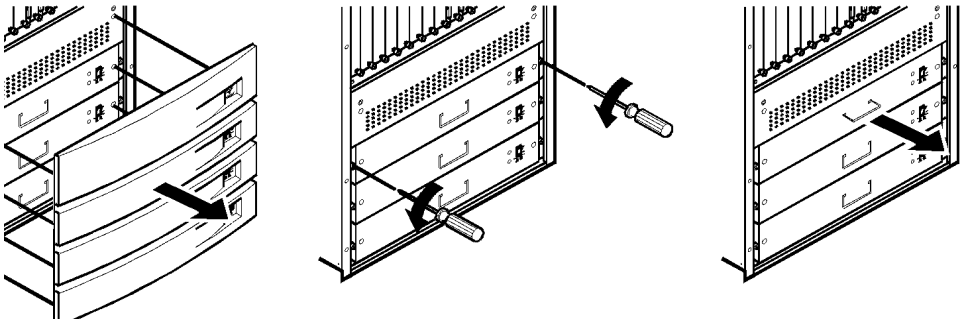


Figure 6-12. Removing the Power Supply Module

4. Grasp and lift the handle on the front of the power supply, then carefully pull the power supply out of the power supply bay.

Installing a Power Supply

Warning – The following procedure may make the device susceptible to electrostatic charge.

1. If the front bezel is in place, remove it by grasping the edges of the bezel and pulling.
2. Insert the new or replacement power supply by aligning it with the power supply rails inside the chassis.

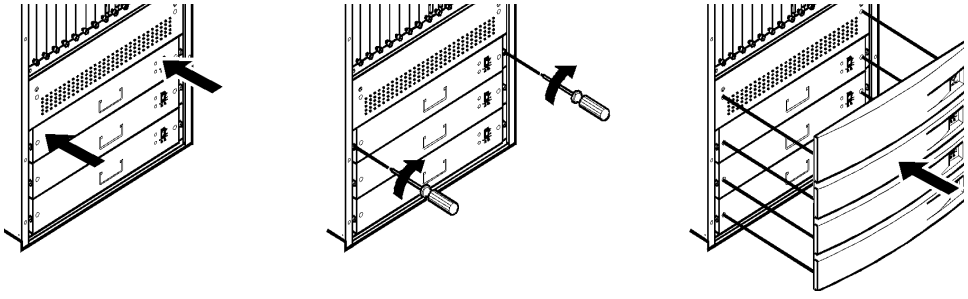


Figure 6-13. Installing a Power Supply Module

3. Gently push the power supply module into the backplane and align the two screw holes, as shown in Figure 6-13.
4. Tighten the two screws with a #2 Phillips-head screwdriver (*using a maximum of 6 to 8* ***inch-pounds*** *of torque*).
5. Reconnect or reinstall the power cords, as described on the next page, for both AC and DC power cords.

Note – Before connecting the power cords, see the section, "Electronic/Electrical Requirements," in Chapter 2. See also Appendix C for circuit regulatory information.

To attach an AC power cord, perform the following steps:

a. Connect the power cord to the primary power supply by plugging the AC power cord into the Power 1 - IEC 320 inlet on the back of the switch. Connect the power cord to the secondary power supply by plugging the AC power cord into the Power 2 - IEC 320 inlet on the back of the switch. For a redundant power supply, plug the cord into the Power 3 - IEC 320 inlet.

b. Insert the power cord into one or more of the cable strain-relief clamps, and ensure that there is some slack in the power cord between the clamp and the IEC 320 inlet.

c. Verify that the power switch on the power supply is in the STANDBY position.

d. Plug the power cord into a three-wire grounding receptacle. To ensure continuous power in the event of an electrical circuit outage, plug the power cord into a receptacle on a different circuit than the one used by the other power supplies.

To attach a DC power cord, perform the following steps. Both DC power cords must be connected at all times when operating the switch.

Warning – Disconnect the power to the wire leads before you begin this procedure.

a. Verify that the power switch on the power supply is set to the STANDBY position.

b. Locate the three #10 studs on the back of the power supply.

c. Using a #2 Phillips-head screwdriver, remove the two screws that secure the protective cover over the studs. Then remove the protective cover.

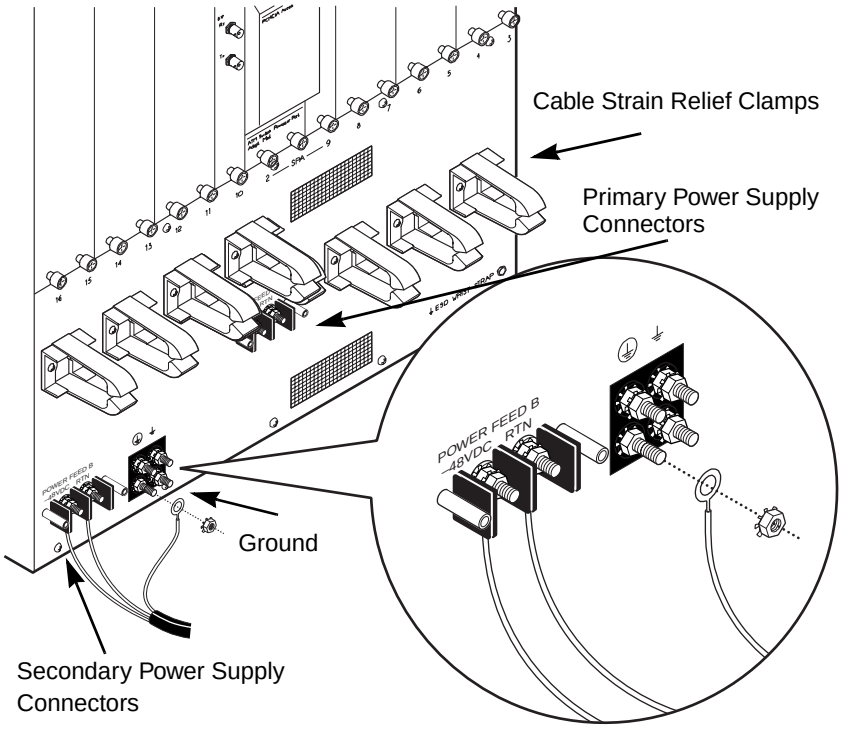


Figure 6-14. Connecting the -48 VDC Power Supply

d. Using a 7/16-in. wrench or socket, remove the top locking nut from each of the three studs (labelled -48V, RTN, and ⏚). Do not remove the bottom locking nut.

e. Install the three ring lugs onto the appropriate posts.

Note – You can optionally ground the chassis to the enclosure by attaching a dual mount ground lug to the dual mount ground on the back of the unit (see Figure 5-4 in Chapter 5).

Note – It is recommended that, to provide a single-point ground connection, only one of the chassis grounds should be connected to earth ground (⏚).

f. Reinstall the locking nut onto each post, then use a 7/16-in. wrench or socket to tighten the nut.

g. Reinstall the protective cover by tightening its two screws.

h. Plug the power cord into a DC power source. To ensure continuous power in the event of a power source failure, you should plug each power cord into a different DC power source, if possible.

6. Toggle the power switch for the power supply module to the ON position.

7. Reinstall the front bezel by aligning the four posts on each side of the cover with the holes on the fan assembly cover and power supplies. Then push on both sides of the cover with the palms of your hands to snap the cover back into place.

Replacing the Cooling Fan Module

You are not required to power down the switch to replace the cooling fan module. The switch can run without fans for a short period of time and can tolerate the temperatures outlined in the section, "Site Specifications," in Chapter 2.

Caution – Do not place your fingers near the fans when removing the fan module from the switch. The fan blades may still be turning.

Before removing the cooling fan module from the switch, you must remove the fan module cover and fan access cover, as shown in Figure 6-15.

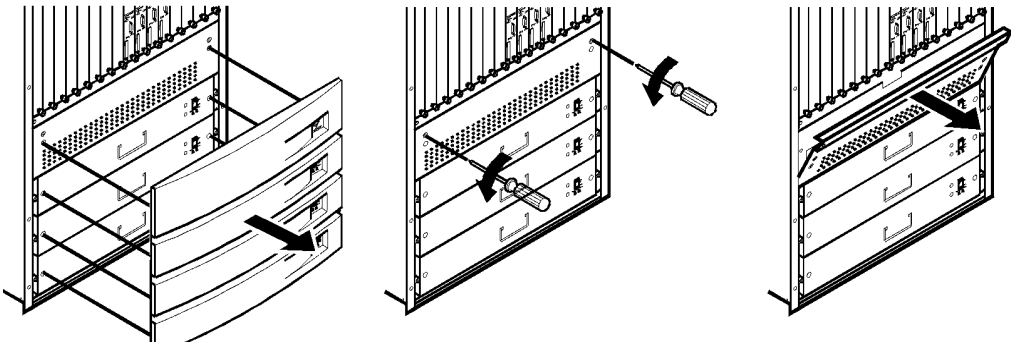


Figure 6-15. Accessing the Cooling Fan Module

Removing the Cooling Fan Module

Warning – The following procedure may make the device susceptible to electrostatic charge.

To remove the cooling fan module:

1. Grasp the edges of the front bezel (the cover on the bottom front of the switch), then pull on the bezel to remove it.
2. Using a 1/4-in. flathead screwdriver, loosen the two captive screws located on the right and left edges of the fan access cover.
3. Tilt the fan access cover forward and down.
4. Using a 1/4-in. flathead screwdriver, loosen the two captive screws located on the right and left edges of the fan tray.

5. Carefully slide the fan tray out of the switch along the card guides, as shown in Figure 6-16.

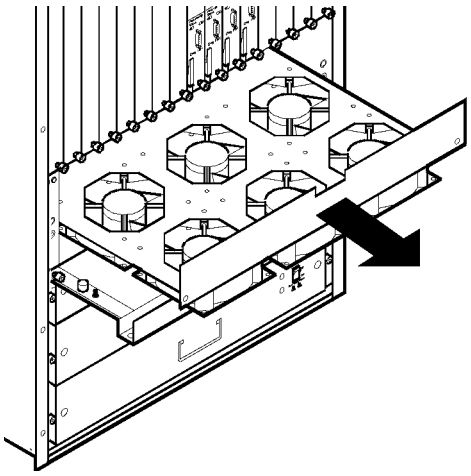


Figure 6-16. Removing the Cooling Fan Module

Installing the Cooling Fan Module

Warning – The following procedure may make the device susceptible to electrostatic charge.

To install the cooling fan module:

1. Align the replacement fan module with the guides and slide it into the switch.
2. Using a 1/4-in. flathead screwdriver, tighten the two captive screws to secure the fan tray.
3. Tilt the fan access cover up into place.
4. Using a 1/4-in. flathead screwdriver, tighten the two captive screws to secure the access cover.
5. Reinstall the front bezel by aligning the four posts on each side of the bezel with the holes on the fan assembly cover and power supplies. Then push on both sides of the bezel with the palms of your hands to snap the cover into place, as shown in Figure 6-17.

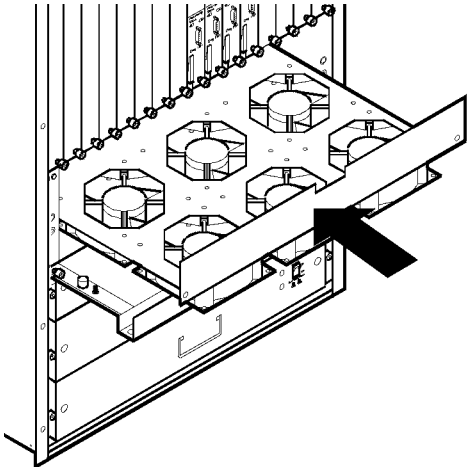


Figure 6-17. Installing the Cooling Fan Module

Installing or Replacing Air Filters

There are two air filters that you can optionally order and install in the CBX 500 switch:

- The top filter slides into the air intake area above the fan tray on the front of the chassis
- The side filter slides into the chassis vertically to the left of the power supplies

You are not required to power down the switch to install or replace the air filters.

Caution – Air filters **must** be vacuumed or replaced once a month to prevent heat from building up inside the chassis. To order a replacement air filter, contact your sales representative.

Warning – The following procedure may make the device susceptible to electrostatic charge.

To install or replace the top and side air filters:

1. Grasp the edges of the front bezel (the cover on the bottom front of the switch), then pull on the bezel to remove it.
2. Using a 1/4-in. flathead screwdriver, loosen the two captive screws located on the right and left edges of the fan access cover.
3. Tilt the fan access cover forward and down.
4. Slide the top air filter (larger of the two) horizontally into the air intake area above the fan tray (see Figure 6-18 on page 6-28).

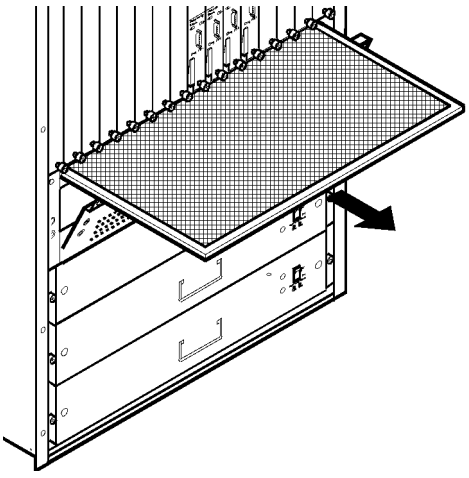


Figure 6-18. Installing or Replacing the Top Air Filter

5. Secure the fan-access cover.

6. To the left of the power-supply bank (power supplies 1, 2, and 3), locate the air filter's cover plate, which is approximately 1/4-in. wide.
7. Remove the cover plate's top screw with a 1/4-in. Phillips-head screwdriver.
8. Carefully pull out the cover plate from the chassis (Figure 6-19).

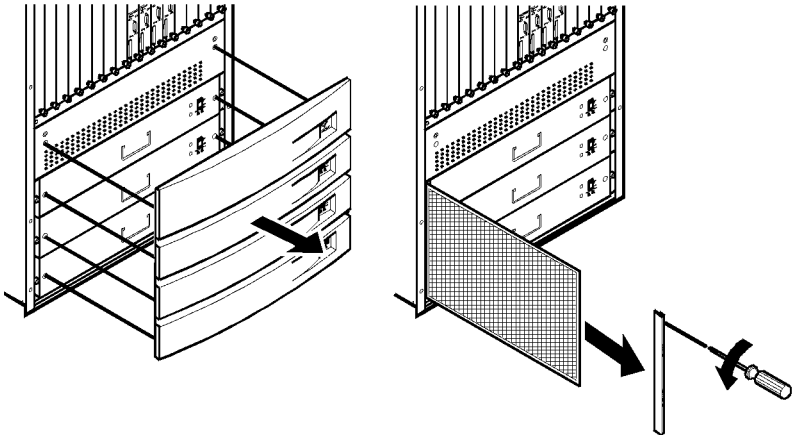


Figure 6-19. Installing or Replacing the Side Air Filter

9. Insert the side filter (smaller of the two) into place vertically.
10. Reinstall the cover plate over the end of the filter and replace the top screw.
11. Reinstall the front bezel by aligning the four posts on each side of the bezel with the holes on the fan assembly cover and power supplies. Then push on both sides of the bezel with the palms of your hands to snap the cover into place.
12. To replace the air filters, follow the steps to remove the old filters and reinstall new ones.

7

Troubleshooting

This chapter provides general troubleshooting information for the CBX 500. Unless otherwise noted, this chapter addresses only hardware problems and their most probable solutions. If you suspect software problems, see the *B-STDX, CBX, and GX Switch Diagnostics Guide.*

The status of the CBX 500 switch and its modules is indicated by status LEDs. For more information about the location and meaning of the LEDs, see Chapter 5, "Determining the Operating Status."

This chapter includes the following topics:

Power-up Diagnostics for SP and IOP Modules

To display the status of any SP or IOP module's power-up diagnostics, you must connect a console terminal to the diagnostic port located on the module's front panel.

Running and displaying diagnostics depends on the position of the two-position DIP switches located on the front of each module. To run diagnostics and display the results on the terminal, the DIP switches must be in opposite positions — one ON, the other OFF. Table 7-1 shows the results of all four possible settings:

Table 7-1. DIP Switch Settings

DIP Switch 1	DIP Switch 2	Results
ON	ON	Power-up diagnostics run but the results *do not* display on the console terminal.
OFF[a]	ON	Power-up diagnostics run and the results display on the console terminal.
ON	OFF[a]	Power-up diagnostics run and the results display on the console terminal.
OFF[a]	OFF[a]	Power-up diagnostics are *bypassed*, and the system debugger is accessible on the console terminal.

[a] OFF settings on the SP prevent it from rebooting failed IOP modules.

For all three settings that run the power-up diagnostics, the module halts and the Failed module status LED comes on if an error is detected. If no errors are detected, the system software executes and brings the module up.

Note – The SP polls the slots on the switch to verify the operation of all modules. If the SP polling mechanism suspects a failure in an IOP module slot, it reboots the card. If either position on the SP module DIP switch is in the OFF (left) position, the SP cannot reboot the cards.

Switch Troubleshooting

Table 7-2 describes switch problems, possible causes, and recommended solutions.

Table 7-2. Switch Troubleshooting

Problem	Cause	Solution
Marginal LED (yellow) remains solid at the top of the SP module.	There is a marginal error condition on the switch, possibly indicating the failure of a redundant power supply, fan module, or IOP. Possibly, it indicates that the SP is not configured.	Check the status LEDs on the power supply, fan module, and IOP modules. If a failure is detected, replace the failed module. If the SP is not configured, download the configuration (described in the *B-STDX, CBX, and GX Getting Started User's Guide).*
Failed LED (red) remains solid at the top of the SP module.	The OS is corrupt.	The NMS operator must check the switch and download the OS. For instructions, see the appropriate switch software release notes.
Switch continually reboots.	One or more IOP ejector locks are in reset mode. Bad or corrupt OS. The PCMCIA hard drive is not working or is inserted improperly.	Ensure that all IOP ejector locks are fully up and locked. See the section, "Installing and Replacing IOP Modules," in Chapter 6. The NMS operator must check the switch and download the OS. For instructions, see the appropriate switch-code release notes. Check the LEDs on the PCMCIA cards. Reseat or replace the cards as needed.

IOP Module Troubleshooting

Table 7-3 describes IOP problems indicated by their status LEDs.

Table 7-3. IOP Module Status

Problem	Cause	Solution
No LEDs are lit on the module.	The DIP switch on the IOP module may be in debug mode (i.e., both positions are set to the OFF position).	Check the position of the DIP switch on the module. If both positions are OFF (left), change them to the ON (right) position. See the section, "Powering Up the Switch," in Chapter 5.
All LEDs on the module remain solid.	One of the following conditions exists: • The module is in reset mode. • The module failed its internal CPU diagnostics. • The i960 boot PROM, 8031 boot PROM, or processor failed, is loose, or is missing.	Check the ejector lock slide located at the top of the module and ensure that it is fully up and locked. Contact the TAC for assistance. Replace the affected module.
Failed LED (red) remains solid.	Power-up diagnostics detected a fatal error on the IOP module.	Replace the affected module and contact the TAC.
Redundancy LED (green) was on and is now blinking.	There may be an error condition on the IOP module.	The IOP module changed from active to standby. See the *B-STDX, CBX, and GX Switch Diagnostics Guide* for information about checking the Traps Alarm log.

Power Supply Troubleshooting

Table 7-4 describes power supply problems indicated by their status LEDs.

Table 7-4. Power Supply Status

Problem	Cause	Solution
No LEDs are lit on the switch's power supplies.	The switch is not receiving power. The power cords may not be attached properly to the primary or secondary power supplies, or to the wall outlet receptacle.	Check the power cords for each installed power supply to ensure proper seating at both the wall outlet and in the receptacles on the back of the switch.
Solid red LED appears on a power supply.	One of the following conditions exists: • A local power supply failure has been detected, including a power supply fan failure, voltage out of range, and temperature out of range • The power supply microprocessor failed to load	Replace the power supply module. See the section, "Installing or Replacing Power Supplies," in Chapter 6 for instructions.
Blinking red LED on a power supply.	The power supply has experienced a partial failure, but is still operational.	Replace the power supply module. See the section, "Installing or Replacing Power Supplies," in Chapter 6 for instructions.

A

IOP and IOA Module Specifications

This appendix provides technical information and specifications about the following CBX 500 IOP and IOA modules:

- 8-port T1 and E1 IOP Modules
- 32-port Channelized T1/E1 FR/IP IOM
- 8-port DS3 and E3 ATM UNI IOP Modules
- 6-port DS3 Frame/IP IOP Module
- 4-port Channelized DS3 Frame/IP IOP Module
- 4-port ATM UNI OC-3c/STM-1 IOP Module
- 1-port OC-12c/STM-4 IOP Module
- 4-port Ethernet IOP Module
- 8-port Subrate Module
- 1-port Channelized Inverse Multiplexing over ATM (IMA) Module
- 3-port Channelized Inverse Multiplexing over ATM (IMA) Module
- 3-Port DS3/1 and 1-Port STM-1/E1 Channelized ATM IMA Enhanced Module
- 60-Port Channelized T1/E1 CE I/O Module

LED Status Indicators

The CBX 3500 IOPs have the following LED status indicators:

Table A-1. IOP Status LEDs

LED State	Status Description
Good and Failed LEDs: Indicate module status	
Good ON (Green LED)	Normal operation
Failed ON (Red LED)	Module failure
Good and Failed LEDs BLINKING simultaneously	OS software image currently being downloaded from the active SP.
Alarms LEDs: Indicate port status	
Yellow Alarm ON	The Yellow LED can glow (can be ON) in case of port specific yellow alarms, for example, FERF (Far End Receiver Failure), PLCP (Physical Layer Convergence Protocol) yellow, FEAC (Far-End Alarm and Control) SA Equipment Failure.
Red Alarm BLINKING (also called a Blue Alarm)	The Red LED can blink in case of any port specific blue alarm, for example, Alarm Indication Signal (AIS), Idle, FEAC AIS, FEAC-idle.
Red Alarm ON	The Red LED can glow (can be ON) in case of port specific red alarms, for example, OOF (Out of Frame), LOS (Loss of Signal), LOF (Loss of Frame), C-bit mismatch, FEAC OOF/LOS, PLCP LOF.
Redundancy Status LEDs: Indicate IOM redundancy status.	
Redundant ON (Green LED)	Redundant module online ***Note:*** *See Status LEDs section under specific IOP for more information.*

8-port T1 and E1 IOP Modules

In the CBX 500 switch, the 8-port T1 and E1 IOP modules provide user connections at data rates of 1.544 Mbps (T1) or 2.048 Mbps (E1) on each of the eight ports. You can configure each port individually as a User-to-Network Interface (UNI). With a 16-slot modular architecture, the CBX 500 can support 112 T1/ E1 ports per switch.

Each module has 8K cell buffers per port. The port buffers, in addition to the 128K cell buffers supported by the CBX 500's quad-plane architecture, provide the T1 and E1 modules with flexibility, performance, and data integrity.

Specifications

Physical Dimensions

Table A-2. 8-port T1 and E1 IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weight	3 lb (1.36 kg)	1.6 lb (.73 kg)

Power Requirements

65 Watts

Agency Approvals

Electromagnetic Emissions Certifications: FCC Part 15 Class A, EN55022 Class A (CISPR), and EN50082

Temperature Range

0° to 50°C (32° to 122°F)

Physical Interfaces

8 ATM UNI 3.0/3.1 cell bearing T1 (1.544 Mbps) or E1 (2.048 Mbps) ports

Physical Connectors (T1)

DB15, 100 ohm

Physical Connectors (E1)

BNC (75 ohm) or DB15 (120 ohm)

Signal Distance/Levels

- Rx Sensitivity: 0dBm, -10dBm
- Pulse Equalizer: 0-655 ft. (DSX-1)
- Line Code: AMI, B8ZS
- Framing: D4, ESF
- Jitter: meets or exceeds template defined in AT&T Publication 62411

T1 Interface Standards

- ATM Forum UNI 3.0/3.1
- ANSI T1.102
- ANSI T1.107
- ANSI T1.231
- ANSI T1 403
- ITU G.804
- AT&T 62411
- AT&T 54016

E1 Interface Standards

- ATM Forum UNI 3.0/3.1
- ITU G.703
- ITU G.704
- ITU G.804
- ITU G.823

Diagnostic and Loopback Tests

The module supports the following diagnostic and loopback tests:

- Near-end line loopback
- Payload loopback
- Framed/Unframed inband line loopback
- Extended Superframe (ESF) FDL line/payload loopback

The module also supports:

- Performance Monitoring
- Standard Alarms, such as, Loss of Signal (LOS), Loss of Frame (LOF), and Alarm Indication Signal (AIS)

Framing

- M13 mode
- C-Bit parity mode

Status Indicators

LEDs: Good (green), Failed (red)

LED State	Status
Good ON	Normal operation
Failed ON	Indicates module failure

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow ON	Downstream equipment sees loss of signal
Red ON	Loss of signal
Red BLINKING	Downstream equipment failure

Figure A-1 on page A-6 shows the T1 IOP and IOA, the E1 IOP, and 75-ohm and 120-ohm E1 IOA modules.

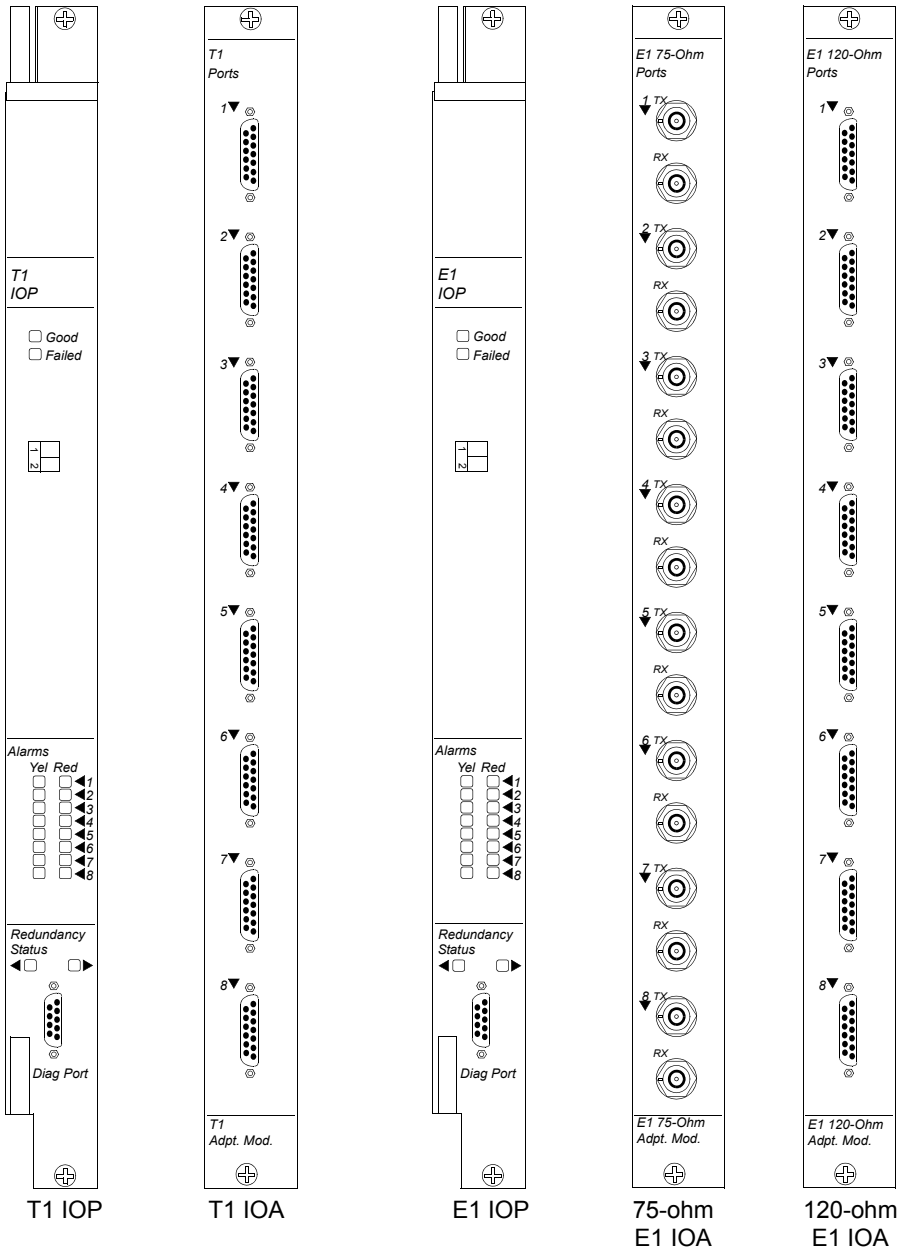


Figure A-1. T1/E1 IOP and IOA Modules

32-port Channelized T1/E1 FR/IP IOM

The 32-Port Channelized T1/E1 Frame Relay/Internet Protocol (FR/IP) input/output module (IOM) for the CBX 500 switch provides 32 T1/E1 channelized physical ports on the input/output adapter (IOA). The CBX 500 switch supports a maximum of ten 32-Port Channelized T1/E1 FR/IP IOMs per chassis.

Specifications

Physical Dimensions

Height: 16 in. (40.6 cm)

Width: 1 in. (2.5 cm)

Depth: 11 in. (27.9 cm)

Weight: 4.5 lbs. (3.5 lbs. for the IOP and 1.0 lb. for the IOA)

Power Requirements:

90 watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals

- ITU and European Telecommunications Standards Institute (ETSI) standards
- Electromagnetic Emissions Certifications
  - Federal Communications Commission (FCC) Part 15 Class A
  - EN55022 (CISPR Class A)
  - Network Equipment-Building Standards (NEBS) GR-63-CORE, GR-1089-CORE
  - Underwriters Laboratories (UL) 1950, EN 60950

Interface Standards

- American National Standards Institute (ANSI) T1.231 (performance monitoring)

Other Standards

- Frame Relay Forum FRF.5, FRF.8, and FRF.16
- ITU-T G.703

- ITU-T G.704 — basic frame structure and cyclic redundancy check (CRC) implementations
- ITU-T G.826 (performance parameters)
- E1 Management Information Base (MIB) — Request For Comment (RFC) 1406 (for near-end statistics)
- RFC 1490 translation FRAD
- HDLC/SDLC encapsulation FRAD (for X.25 traffic)
- CE Mark

Physical Interfaces

32 physical ports per IOA module:

- T1 mode: 24 DS0 channels per physical port (768 logical ports per IOM, each at 64 Kbps)
- E1 mode: 30 TS0 channels per physical port (960 logical ports per IOM, each at 64 Kbps)

Physical Connectors

- 32-Port Channelized T1 FR/IP I/O connector panel: RJ48, 100-ohm
- 32-Port Channelized E1 FR/IP I/O connector panel: RJ48, 120-ohm

Cable Requirements

Caution – To ensure standards compliance, the use of shielded cable is *mandatory* for the 32-Port Channelized T1 FR/IP I/O connector panel (Product Code: 11152) and the 32-Port Channelized E1 FR/IP I/O connector panel (Product Code: 11151).

You *must* use shielded cables with either the 32-Port Channelized T1 FR/IP I/O connector panel (Product Code: 11152) or the 32-Port Channelized E1 FR/IP I/O connector panel (Product Code: 11151). The product code for your physical connector is printed on the faceplate label of the 32-Port Channelized T1/E1 FR/IP I/O module.

The shielded cable and cable connector (plug) requirements are as follows:

Shielded cable — You must use a shielded cable that is comparable to Manhattan/CDT Part Number M19094. For details, see the Manhattan/CDT Web site (http://www.manhattancdt.com).

Shielded cable connector — The proper plug for the Manhattan/CDT or comparable shielded cable is Stewart Connector Part Number 943-SP-370808SM2. For details, see the Stewart Connector Web site (http://www.stewartconnector.com).

Framing

- Channelized T1– D4 (Super Frame) and ESF (Extended Super Frame) formats
- Channelized E1 – G.704 basic frame and the following CRC-4 multiframe structure framing formats:
  - TS16 enabled and CRC-4 enabled/disabled
  - TS16 disabled and CRC-4 enabled/disabled
  - Unstructured

Diagnostic and Loopback Tests

- DS1/E1diagnostics
- BERT testing for both T1 and E1

The following NMS-initiated loopbacks are supported for both T1 and E1 modes:

- Near End Line Loopback
- Near End Diag Loopback
- Far End Loopback (outbound data looped back towards the switch, only for T1 mode)
- Payload Loopback

The module also supports standard alarms, such as, Loss of Signal (LOS), Out of Frame (OOF), and Alarm Indication Signal (AIS)

Clocking Options

- Loop timing
- Internal timing (better than Stratum 4 - +/- 20 PPM [parts per million])
- Any of the 32 physical ports can be selected as the timing source of port timing reference A or port timing reference B

Module LED Status

Table A-3. Module LED Status Indicators

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Redundant module online ***Note:*** *Not supported in this release.*
Good and Failed LEDs blinking simultaneously	Operating system software image currently being downloaded from active switch processor (SP)

Port Alarm Status

Table A-4. Port Alarm Status Indicators

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal resulting in a remote alarm identification (RAI)
Red LED lit	Loss of frame or signal
Red LED blinking	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)

Figure A-9 shows the 32-Port Channelized T1/E1 FR/IP IOP and IOA modules.

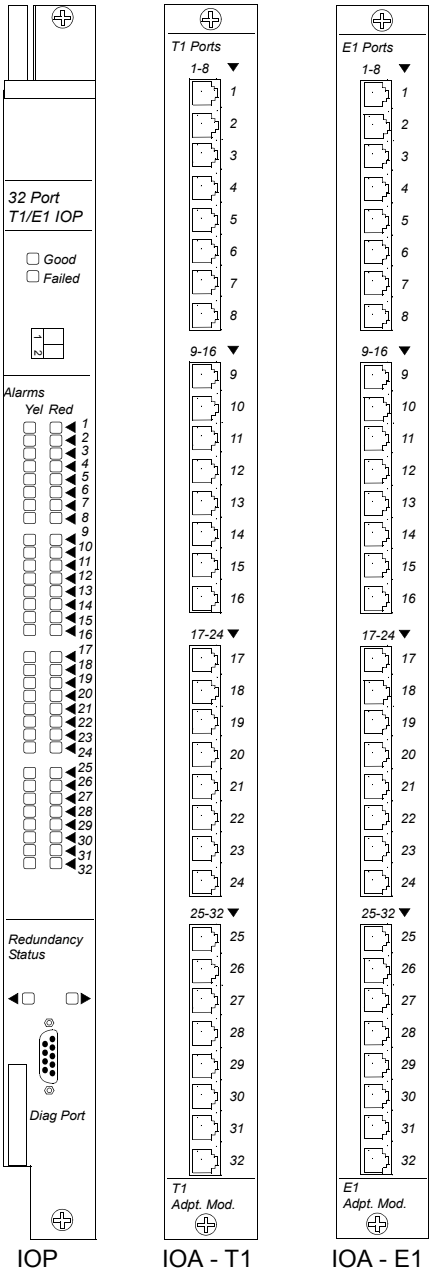


Figure A-2. 32-Port Channelized T1/E1 FR/IP IOP and IOA Modules

8-port DS3 and E3 ATM UNI IOP Modules

The 8-port DS3 and E3 ATM UNI IOP modules provide trunk or user connections at data rates of 44.738 Mbps (DS3) and 34.368 Mbps (E3) at each of the eight ports. You can configure each port as one of the following:

- User-to-Network Interface (UNI)
- Interim Inter-Switch Signalling Protocol (IISP) connection
- Direct trunk
- OPTimum cell trunk

The 16-slot CBX 500 switch provides a maximum of 112 DS3 or E3 ports per switch. The port buffers (8K each), combined with the 128K programmable cell buffers in the switch processor (SP) quad-plane architecture, provide the flexibility, performance, and data integrity required for high-speed networking.

Specifications

Physical Dimensions

Table A-5. 8-port DS3 and E3 ATM UNI IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weight	5 lb (2.3 kg)	1.6 lb (.73 kg)

Power Requirements

75 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals

Electromagnetic Emissions Certifications: FCC Part 15 Class A, CISPR Class A

Interface Standards

- ITU G.703
- ANSI T1.102 (DS3 module only)
- ITU G.705 (E3 module only)

Other Standards Supported - DS3

- ANSI T1E1.1/94-002R1
- ANSI T1.107
- ANSI T1.107a
- ANSI T1.403
- ATM Forum UNI 3.0/3.1
- Bellcore TR-NWT 001112
- Bellcore TR-TSY-000499
- Bellcore TR-NWT-000820
- ITU G.804
- RFC 1407
- TR54014 (AT&T ACCUNET T45 and T45R)

Other Standards Supported - E3

- ITU G.751
- ITU G.832
- ITU G.804
- ATM FORUM 94-0406R4
- RFG 1407

Physical Interfaces - DS3

- 8 ATM UNI 3.0/3.1 cell-bearing DS3 ports supporting C-bit/M-framing, PLCP per TR-TSY-000773, and direct cell mapping per G.804
- BNC connector per ANSI T1.404

Physical Interfaces - E3

- 8 ATM UNI 3.0/3.1 cell-bearing E3 (34.368 Mbps) ports supporting G.751 framing and direct-cell mapping per G.804
- BNC connector per ANSI T1.404

Loopback Tests

The 8-port ATM DS3 module supports:

- Near end line
- Payload
- FEAC Loopback

The module also supports:

- Performance monitoring
- Standard alarms, such as, Loss of Signal (LOS), Alarm Indication Signal (AIS), Out of Frame (OOF), CBIT, Equipment Failure, Far End Receiver Failure (FERF), and Physical Layer Convergence Protocol (PLCP)

Framing

- M13 mode
- C-Bit parity mode

Module Status Indicators

LEDs: Good (green), Failed (red), Redundant (green)

LED State	Status
Good ON	Normal operation
Failed ON	Module failure
Redundant ON	Active module (that is, this module is online)
Good and Failed LEDs BLINKING simultaneously	OS software image currently being downloaded from the active SP

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow ON	Downstream equipment sees loss of signal
Red BLINKING	Downstream equipment failure
Red ON	Loss of signal

Figure A-3 shows the DS3 and E3 IOP and IOA modules.

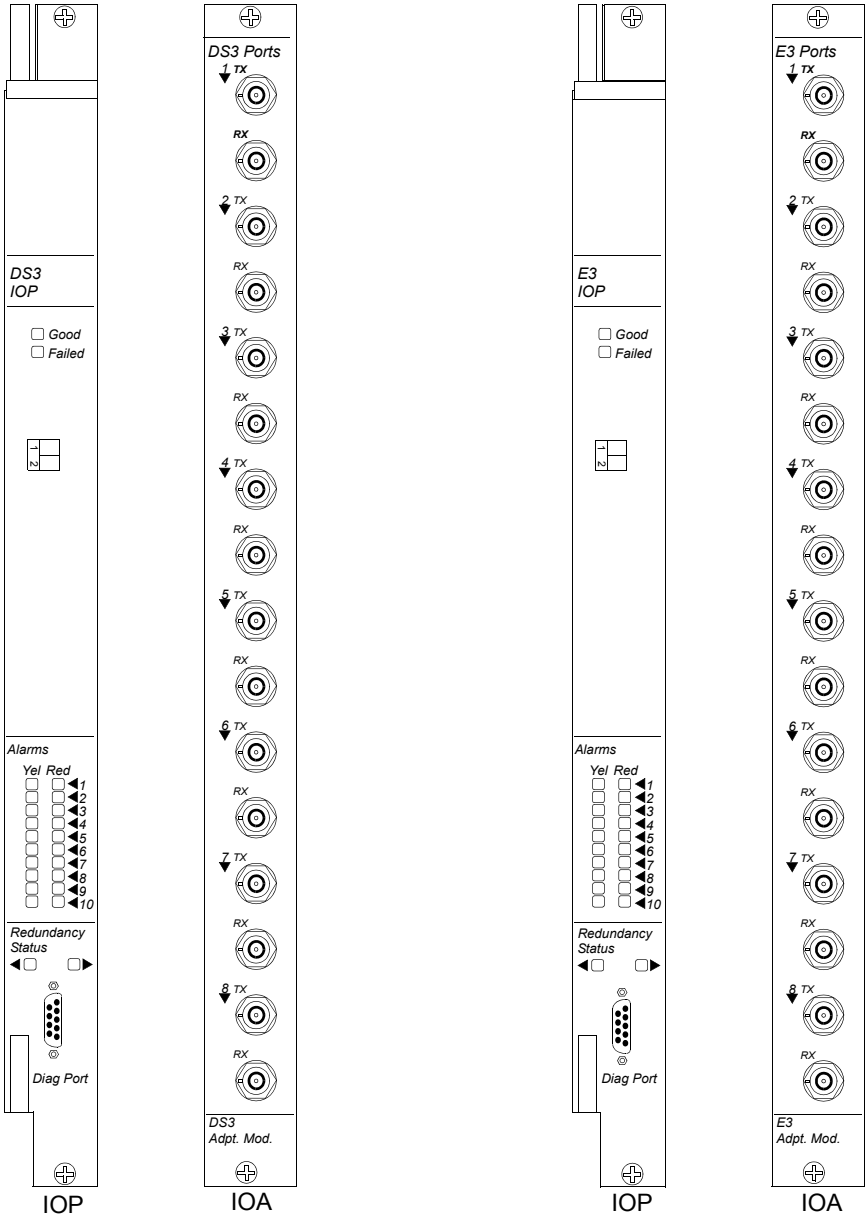


Figure A-3. DS3/E3 IOP and IOA Modules

6-port DS3 Frame/IP IOP Module

The 6-port DS3 Frame/IP module enables the CBX 500 to operate as a multiservice switch by providing IP routing for cell-based IP traffic, Frame Relay switching, and Frame Relay-to-ATM interworking. In addition, the module works with IP Services to provide routing for the entire CBX 500 switch through a local IP forwarding engine on the module.

The DS3 Frame/IP module enables the CBX 500 to accept Frame Relay traffic at 44.736 Mbps at each port and provides line-speed packets at 128-byte frames. The CBX 500 16-slot modular architecture can support up to 84 DS3 Frame Relay ports per switch.

You can configure the following trunk interfaces on the 6-port DS3 Frame/IP module:

- Frame Relay UNI
- Frame Relay NNI
- IP
- ATM FUNI
- Direct or OPTimum trunk

Specifications

Physical Dimensions

Table A-6. 6-port DS3 Frame/IP IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weight	5 lb (2.3 kg)	1.6 lb (.73 kg)

Power Requirements

105 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals

Electromagnetic Emissions Certifications: FCC Part 15 Class A, EN55022 (CISPR Class A), NEBS GR-63-CORE, GR-1089-CORE, UL 1950, EN60950

Interface Standards

- ANSI T1.102

Other Standards

- Frame Relay Forum
- RFC 1483
- RFC 1407
- Bellcore TR-NWT-000820

Physical Interfaces

- 6 DS3 (44.736 Mbps) ports

Physical Connectors

- Dual 75-ohm BNC connector

Diagnostic and Loopback Tests

The module supports the following diagnostic and loopback tests:

- Near-end line tests
- Far-end loopback tests
- Near End diagnostics tests

The module also supports:

- Performance Monitoring
- Standard alarms, such as, Loss of Signal (LOS), Loss of Frame (LOF), and Alarm Indication Signal (AIS)

Framing

- M13 mode
- C-Bit parity mode

Module Status Indicators

LEDs: Good (green), Failed (red), Redundant (green)

LED State	Status
Good ON	Normal operation
Failed ON	Module failure
Redundant ON	Active module (that is, this module is online)
Good and Failed LEDs BLINKING simultaneously	OS software image currently being downloaded from the active SP

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow ON	Downstream equipment sees loss of signal
Red BLINKING	Downstream equipment failure
Red ON	Loss of signal

Figure A-4 on page A-19 shows the DS3 Frame/IP IOP and IOA modules.

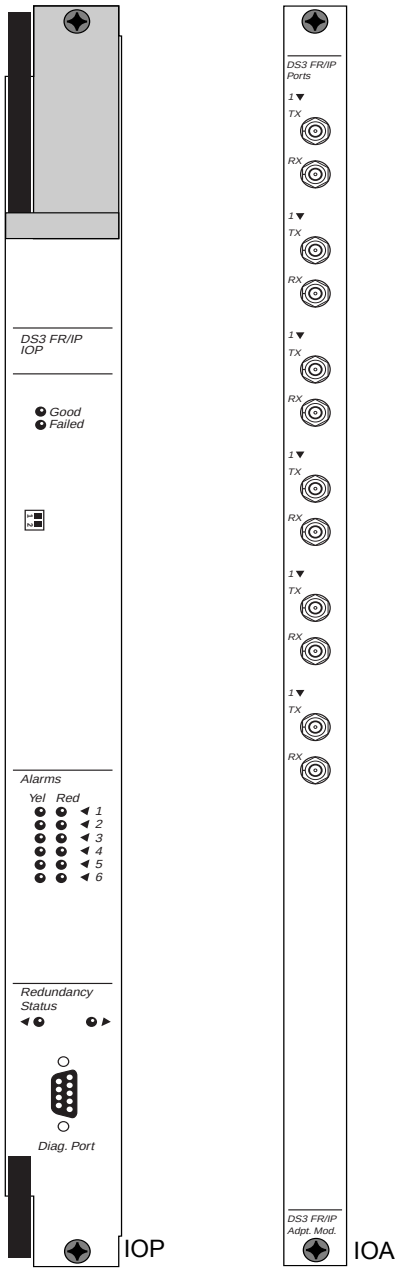


Figure A-4. 6-port DS3 Frame/IP IOP and IOA Modules

4-port Channelized DS3 Frame/IP IOP Module

The 4-port channelized DS3 Frame/IP modules provide a channelized DS3 interface with up to 28 DS1 connections. You can individually configure each of the DS1 channels to provide any Frame Relay logical port function on the CBX 500 switch.

The 4-port channelized DS3 Frame/IP module is available in two versions:

- The DS3/1 version provides up to 112 logical ports per module with a maximum of 28 logical ports per physical port. This module provides 28 DS1 connections at data rates of 1.544 Mbps per port.
- The DS3/1/0 version provides up to 1024 logical ports per module with up to 128 logical ports per physical port (on ports 1 and 2) and 384 logical ports per physical port (on ports 3 and 4). The channelized DS3/1/0 module provides 28 DS1 connections at variable data rates from 56 Kbps to 1.544 Mbps. These connections can be further divided into a maximum of 24 logical ports (at data rates of 56 Kbps).

Specifications

Physical Dimensions

Table A-7. 4-port Channelized DS3 Frame/IP IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weight	3 lb (1.36 kg)	1.6 lb (.73 kg)

Power Requirements

75 Watts

Agency Approvals and Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN55022 (CISPR Class A)
- UL 1950 (cUL)
- EN 60950
- EN61000

- NEBS GR-63-CORE, GR-1089-CORE

Temperature Range

0° to 50°C (32° to 122°F)

Physical Interfaces

Four channelized DS3 (44.736 Mbps) ports (providing up to 28 independent DS1 channels per physical port)

Physical Connectors

Dual 75-ohm BNC connectors (transmit/receive) per port

Interface Standards

- ANSI T1.102
- AT&T Publication 62415
- International ITU Standards

Table A-8 on page A-21 lists the supported DS3 and DS1 standards.

Table A-8. DS3 and DS1 Standards

Level	Standard
DS3	ANSI T1.103, ANSI T1.107/T1.107a, ANSI T1.231, ANSI T1M1.3/91-003R3, GR-499-CORE, AT&T TR54016, RFC 1407
DS1	AT&T Publication 62411, GR-499-CORE, ANSI T1.403, ANSI T1.107, RFC 1406

Line Coding

B3ZS

Framing

- D4
- ESF (CCITT)
- M13 mode
- C-Bit parity mode

Diagnostics and Loopback Tests

This module supports:

- Channel level BERT testing
- Near end diagnostics
- Near end line loopbacks
- Far end loopbacks

The module also supports:

- Performance Monitoring
- Standard Alarms, such as, Loss of Signal (LOS), Loss of Frame (LOF), and Alarm Indication Signal (AIS.)

Signal Levels

- Receive: Peak pulse amplitude from 0.2 to 0.85 volts
- Transmit: Conform to ANSI T1.102 pulse template and amplitude (0.36 volts to 0.85 volts) for cable up to 450 feet

Status Indicators

Table A-9 and Table A-10 describe the module LED and physical port status indicators.

Table A-9. Module LED Status Indicators

LED State	Status
Good ON	Normal operation
Failed ON	Module failure
Redundant ON	Redundant module on-line (redundant module is active)
Good and Failed LEDs BLINKING simultaneously	Operating system software image currently being downloaded from active SP

Table A-10. Physical Port Status Indicators

LED State	Status
Red ON	Loss of frame or signal
Red BLINKING	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)
Yellow ON	Downstream equipment sees loss of signal resulting in a Remote Alarm Indication (RAI)

Figure A-5 on page A-24 shows the 4-port channelized DS3 Frame/IP IOP and IOA modules. Both versions (DS3/1 and DS3/1/0) look the same.

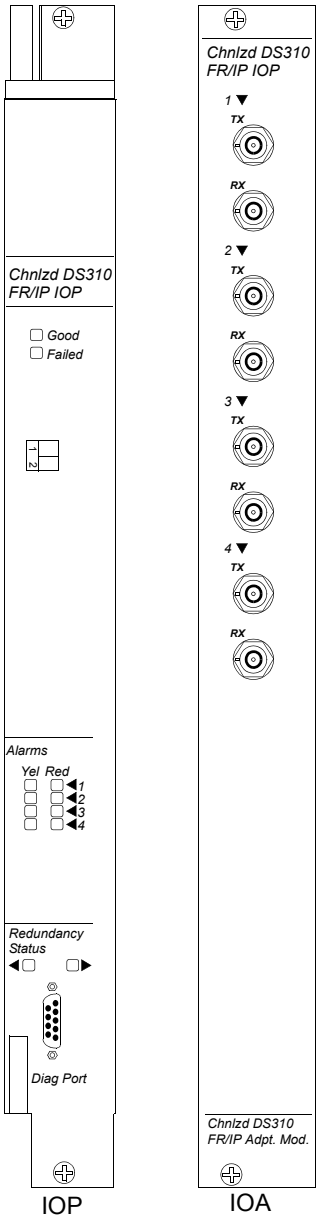


Figure A-5. 4-port Channelized DS3 Frame/IP IOP and IOA Modules

4-port ATM UNI OC-3c/STM-1 IOP Module

The 4-port OC-3c/STM-1 IOP module provides four 155.52 Mbps interfaces for both optical and electrical connections. You can configure each port as one of the following:

- User-to-Network Interface (UNI)
- Interim Inter-switch Signalling Protocol (IISP) port
- Direct trunk
- OPTimum cell trunk

The CBX 500 16-slot, modular architecture provides 56 OC-3c/STM-1 ports per switch. The OC-3c/STM-1 module has 24K cell buffers per port, enabling you to customize your network for specific traffic needs. The port buffers and the 128K cell buffers on the SP are based on the CBX 500 switch quad-plane architecture.

Specifications

Physical Dimensions

Table A-11. 4-port ATM UNI OC03c/STM-1 IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weigh	5 lb (2.3 kg)	1.6 lb (.73 kg)

Power Requirements

65 Watts (optical and electrical)

Agency Approvals

Electromagnetic Emissions Certifications: FCC Part 15 Class A, and CISPR Class A

Temperature Range

0° to 50°C (32° to 122°F)

Physical Interfaces

- 4 UNI 3.0/3.1 cell bearing OC-3c/STM-1 155.52 Mbps ports (optical)
- 4 electrical G.703-based STM-1 155.52 Mbps ports (electrical)

Interface Standards (OC-3c)

- ANSI T1.105
- ANSI T1.106

Interface Standards (STM-1)

- ITU G.703 (electrical)
- ITU G.957 (optical)
- ITU G.709 (optical)

Physical Connectors

- Subscriber Connector (SC)
- BNC 75-ohm Coaxial Connectors (STM-1 electrical)

Cable Specifications (STM-1 Electrical)

Table A-12. Cable Specifications

Interface Type	Number Twisted Pairs	DC Res. Ω/km	Nom. Imp Ω	Nom. Capacitance pf/m	% Shield	Max. Length
G.703 - 75 Ω	N/A	49.2	75	66.7	95%	120 m

Signal Distance/Levels (Single-mode Laser Optics)

- *Medium-Reach:*
  - Up to 15 kilometers
  - TX Power: -15dBm to -8dBm
  - RX Sensitivity: -8dBm, -28dBm
  - Nominal Wavelength: 1310 nm
- *Long-Reach:*
  - Up to 40 kilometers
  - TX Power: -5dBm to 0dBm
  - RX Sensitivity: -10dBm, -34dBm
  - Nominal Wavelength: 1310 nm

Signal Distance/Levels (Multimode LED Optics)

- Up to 2 kilometers
- 62.5/125 micron fiber
- TX Power: -14dBm, -20dBm
- RX Sensitivity: -14dBm, -29dBm

Other OC-3c Standards

- ATM Forum UNI 3.0/3.1
- ANSI T1M1.3/92-005R1
- Bellcore TR-NWT-001112
- Bellcore GR-253-CORE
- RFC SONET 1595

Other STM-1 Standards

- ATM Forum UNI 3.0/3.1
- ANSI T1M1.3/92-005R1
- Bellcore GR-253-CORE
- RFC SONET 1595

Loopback Tests

The module supports Near End Line loopback tests.

It also supports:

- Performance Monitoring
- Standard Alarms, such as, Loss of Signal (LOS), Loss of Frame (LOF), and Alarm Indication Signal (AIS).

Status Indicators

LEDs: Good (green), Failed (red), Redundant (green)

LED State	Status
Good ON	Normal operation
Failed ON	Module failure
Redundant ON	Active module (that is, this module is online)
Good and Failed LEDs BLINKING simultaneously	OS software image currently being downloaded from the active SP

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow ON	Downstream equipment sees loss of signal
Red BLINKING	Downstream equipment failure
Red ON	Loss of signal

Figure A-6 on page A-29 shows the OC-3c/STM-1 IOP and IOA modules.

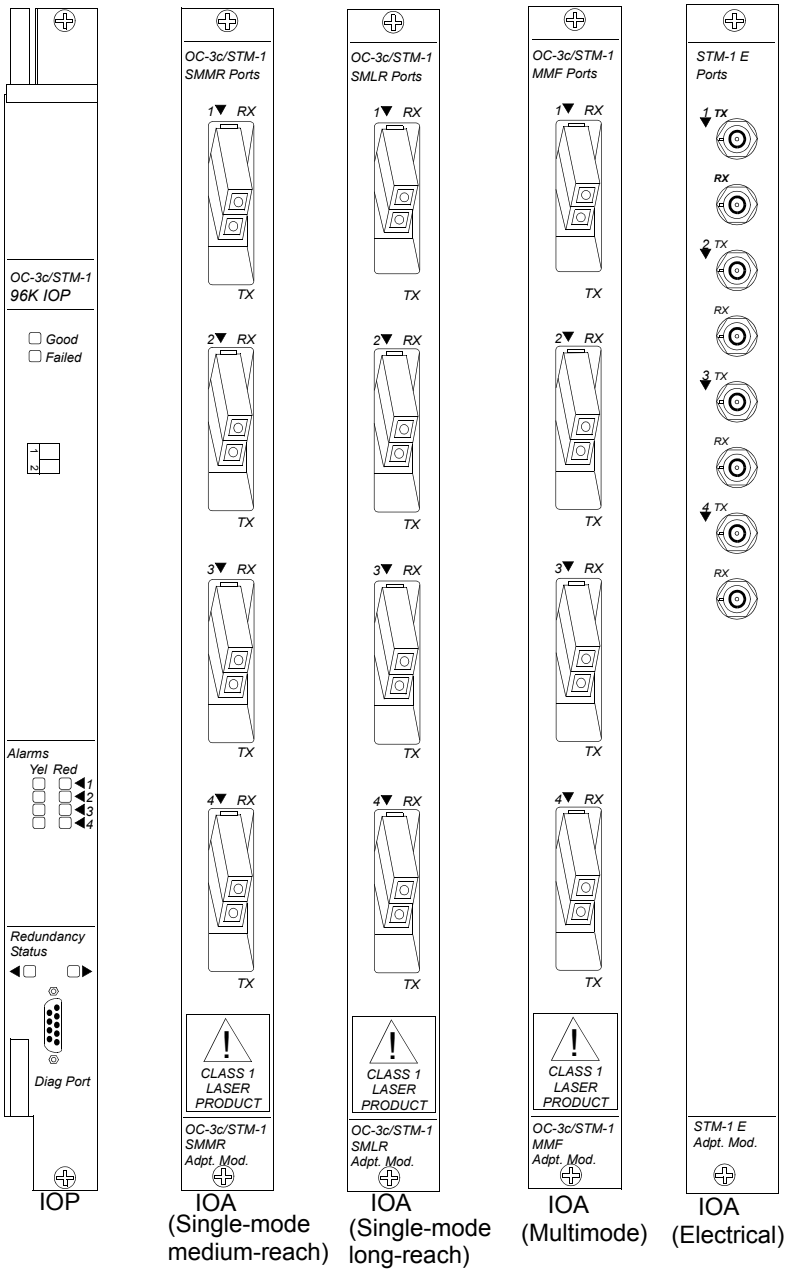


Figure A-6. OC-3c/STM-1 IOP and IOA Modules

1-port OC-12c/STM-4 IOP Module

The 1-port OC-12c/STM-4 IOP module provides a high-speed 622 Mbps interface for the CBX 500 switch. The port can be configured as a User-to-Network Interface (UNI), an Interim Inter-switch Signalling Protocol (IISP) trunk, or a Lucent trunk. With the CBX 500's 16-slot modular architecture, the CBX 500 can support up to 14 OC-12c/STM-4 ports per switch, with up to eight ports configured for full bandwidth.

The OC-12c/STM-4 IOP module has 12K cell buffers, enabling you to customize your network to specific traffic requirements. The port buffers and 128K cell buffers in the switch firmware are based on the CBX 500 quad-plane architecture.

Specifications

Physical Dimensions

Table A-13. 1-port OC-12c/STM-4 IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weigh	5 lb (2.3 kg)	1.6 lb (.73 kg)

Power Requirements

65 Watts

Agency Approvals

Electromagnetic Emissions Certifications: FCC Part 15 Class A, EN55022 Class A (CISPR), and EN50082

Temperature Range

0° to 50°C

Physical Interfaces

1 UNI 3.0/3.1 cell bearing OC-12c/STM-4 622 Mbps port

Physical Connectors

Subscriber Connector (SC)

Signal Distance/Levels (Single-mode Laser Optics)

- *Medium-Reach:*
  - Distance: up to 15 km
  - Loss budget: 0 dB to 12 dB
  - Attenuation: 0 dB to 12 dB
  - Nominal Wavelength: 1310 nm
  - Tx Power: between -15 dBm and -8 dBm
  - Rx Sensitivity: -8 dBm (max.), -28 dBm (min.)
- *Long-Reach:*
  - Distance: up to 40 km
  - Loss budget: 10 dB to 28 dB
  - Attenuation: 10 dB to 24 dB
  - Nominal Wavelength: 1310 nm
  - Tx Power: between -3 and +2 dBm
  - Rx Sensitivity: -8 dBm (max.), -28 dBm (min.)

NEBS

- GR-63-CORE
- GR-1089-CORE

Interface Standards

- ANSI T1.105
- ANSI T1.106
- ANSI T1.624
- ANSI T1.640
- ANSI T1-646
- IEC 825 (Laser Safety)

Other OC-12c Standards

- ATM Forum UNI 3.0/3.1
- ANSI T1.231
- Bellcore TR-NWT-001112
- Bellcore GR-253-CORE
- RFC SONET 1595 Far End Statistics

Other STM-4 Standards

- ITU G.707
- ITU G.708
- ITU G.709
- ITU G.783
- RFC SONET 1595 Far End Statistics
- ATM Forum UNI 3.0/3.1
- ANSI T1.231
- Bellcore TR-NWT-001112
- Bellcore GR-253-CORE

Loopback Tests

The module supports Near End Line loopback tests.

It also supports:

- Performance Monitoring
- Standard Alarms, such as, Loss of Signal (LOS), Loss of Frame (LOF), and Alarm Indication Signal (AIS).

Status Indicators

LEDs: Good (green), Failed (red)

LED State	Status
Good ON	Normal operation
Failed ON	Indicates module failure

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow ON	Downstream equipment sees loss of signal
Red ON	Loss of signal
Red BLINKING	Downstream equipment failure

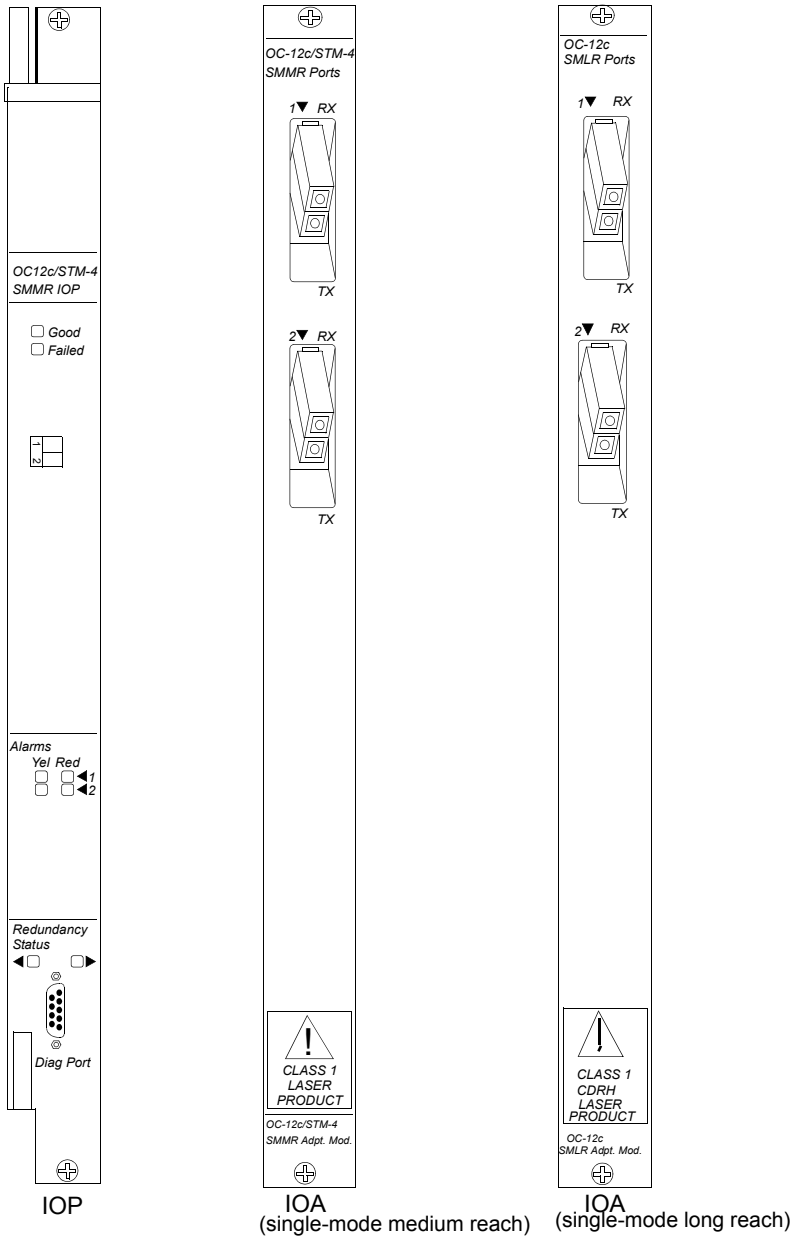


Figure A-7. OC-12c/STM-4 IOP and IOA Modules

4-port Ethernet IOP Module

The 4-port Ethernet module provides high-speed Ethernet access to Lucent's switching platforms. When using IP Services software, the 10/100-Mbps Ethernet module provides IP forwarding and routing decisions for IP traffic arriving from common Ethernet ports on the same module, from any ATM port(s) on the same switch, or from any ATM Multipoint-to-Point Tunnel (MPT) in the network. CBX 500 IP routing tables are distributed to all modules performing IP routing. The Ethernet module also provides high-speed links to local Internet/Intranet hosting servers.

Specifications

Physical Dimensions

Table A-14. 4-port Ethernet IOP/IOA Physical Dimensions

Dimension	IOP	IOA
Height	17.25 in (43.18 cm)	23 in (58.4 cm)
Width	1.06 in (2.69 cm)	1.06 in (2.69 cm)
Depth	12.25 in (30.48 cm)	5 in (12.7 cm)
Weigh	2 lb (.91 kg)	1.6 lb (.73 kg)

Power Requirements

90-91 watts

Temperature Range

0-50°C (32-122°F)

Physical Interfaces

Four RJ45-8 (modular jack) connectors (two-pair, category 5 UTP) or four Media Independent Interface (MII) connectors

Interface Standards

802.3-compliant 100Base-TX (10 or 100 Mbps operation), full- or half-duplex, and internal and external loopback, full- or half-duplex.

Management Standards

- RFC 1398 Ethernet MIB
- RFC 1213 TCP/IP-based Internet MIB

NEBS

- GR-63-CORE
- GR-1089-CORE

Agency Approvals

EN55022 Class A (CISPR), EN50082, FCC Part 15 Class A

Module Status Indicators

LEDs: Good (green), Failed (red)

LED State	Status
Good ON	Normal operation
Failed ON	Module failure
Redundant ON	Module online; redundant module installed and offline
Redundant OFF	Module online; no redundant module installed
Redundant BLINKING	Module offline; redundant module installed and online

Port Alarm Indicators

LEDs: Green, Yellow

LED State	Status
ON (Green) / OFF	TX activity
ON (Green) / OFF	RX activity
ON (Green) / OFF	Link established
ON (Green) / OFF	Full duplex
ON (Yellow) / OFF	Collision detected

Figure A-8 on page A-36 shows the 4-port Ethernet IOP and IOA modules.

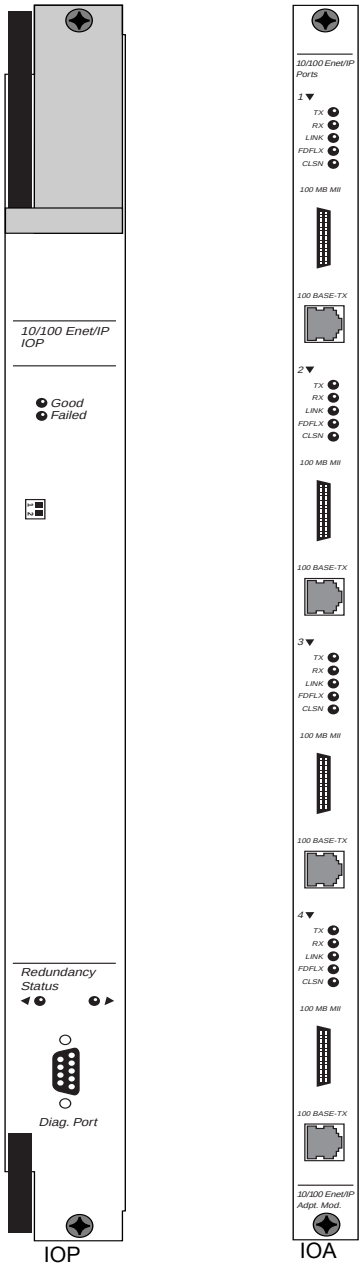


Figure A-8. 4-port Ethernet IOP and IOA Modules

8-port Subrate Module

The 8-port Subrate DS3 FR/IP Input/Output module (IOM) enables the CBX 500 to operate at various speeds that are less than the DS3 line rate of 45 Mbps, and to operate as a multiservice switch by providing Internet Protocol (IP) routing for cell-based IP traffic, Frame Relay (FR) switching, and Frame Relay-to-ATM interworking.

Specifications

Physical Dimensions

Height: 17.2 in. (43.64 cm)

Width: 92 in. (2.3 cm)

Depth: 11 in. (27.9 cm)

Weight: 5 lb (2.3 kg)

Power Requirements

105 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN55022 (CISPR Class A)
- NEBS GR-63-CORE, GR-1089-CORE
- UL 1950, EN 60950
- International Telecommunications Union (ITU) standards

Interface Standards

- ANSI T1.102
- ANSI T1.107a (DS3 format specifications)
- ANSI T1.231 (DS1/DS3 performance monitoring)

Other Standards

- Frame Relay Forum (FRF)
- RFC 1483
- RFC 1407 (DS3 link statistics)
- DS3 MIB, January 1993 (DS3 link statistics)
- Bellcore TR-NWT-000820

Physical Interfaces

Eight DS3 ports, each configurable to a vendor-specific DS3 subrate.

Physical Connectors

Two 75-ohm BNC connectors for each port (transmit/receive)

Line Coding

B3ZS or vendor proprietary

Framing

- M13 mode
- C-Bit parity mode

Signal Levels

- Receive: Peak pulse amplitude from 0.2 to 0.85 volts
- Transmit: Conformance to ANSI T1.102 pulse template and amplitude (0.36 volts to 0.85 volts) for cable lengths up to 450 feet

Clocking Options

- Loop timing
- Internal timing (better than Stratum 4 - +/- 20 PPM [pulse position modulation])
- External timing via 1.544 MHz T1 source

Link Performance Monitoring

- DS3 MIB (RFC 1407) near-end statistics
- User-configurable thresholds for DS3 performance parameters

Diagnostics and Loopback Tests

- Background and Foreground diagnostic tests
- BERT
- NMS initiated loopbacks
  - Line loopback
  - Local loopback (outbound DS3 data looped back towards the switch)
- Recognition of link codes and patterns loopback
  - DS3 line loopback via C-bit parity command message

The module also supports standard alarms, such as, Loss of Signal (LOS), Loss of File (LOF), and Alarm Indication Signal (AIS)

Miscellaneous Link Message Support

- Application identification channel signal (identifies link as M13 or C-bit parity mode)
- Recognition and generation of far-end block error (FEBE) events in C-bit parity mode

Module Status Indicators

Table A-15. Module LED Status Indicators

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Redundant module online
Good and Failed LEDs blinking simultaneously	OS software image currently being downloaded from active switch processor (SP)

Port Alarm Indicators

Table A-16. Port Alarm Status Indicators

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal resulting in a Remote Alarm Identification (RAI)
Red LED lit	Loss of frame or signal
Red LED blinking	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)

Figure A-9 shows the 8-port Subrate DS3 FR/IP IOP and IOA modules.

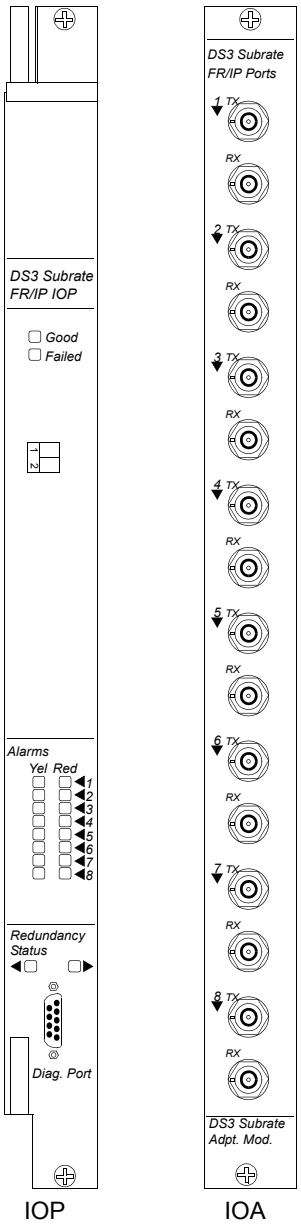


Figure A-9. 8-Port Subrate DS3 FR/IP IOM Front and Back Panel

1-port Channelized Inverse Multiplexing over ATM (IMA) Module

The 1-port Channelized STM-1/E1 IMA IOM enables the CBX 500 Multiservice WAN switch to provide increased scalability and port density for low-speed Asynchronous Transfer Mode (ATM) aggregation in the central office.

Specifications

Physical Dimensions

Height: 16 in. (40.6 cm)

Width: 1 in. (2.54 cm)

Depth: 11 in. (27.9 cm)

Weight: 5 lb (2.3 kg)

Power Requirements

65 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN55022 (CISPR Class A), EN 6100
- NEBS GR-63-CORE, GR-1089-CORE
- ETSI EN 300 019, ETSI EN 300386
- UL 60950, EN 60950
- International Telecommunications Union (ITU) standards

Interface Standards

- American National Standards Institute (ANSI) T1.102
- AT&T Publication 62415

SONET Interface Standards (STM-1)

- ANSI T1M1.3/92-005RI

Telcordia Bellcore

- ITU G.703 (electrical)
- G.709, G.957 (optical)
- RFC SNONET 1595

ATM Interface Standards (STM-1)

- ATM UNI 3.0, 3.1
- ATM TM 4.0
- ATM Forum IMA v1.0 and v1.1
- ATM Forum test specification af-test-0022.000

Physical Interfaces

One E1 port, conforming to relevant ANSI, Bellcore, and International Telecommunication Union (ITU) specifications

Physical Connectors

Two SC connectors

Laser Optics Signal/Distance Levels

- Single-mode Intermediate-reach
- Range: Up to 15 km
- Tx Power: -8 dBm, -15 dBm
- Rx Sensitivity: -8 dBm, -28 dBm
- Nominal Wavelength: 1310 nm
- Loss Budget: 0-12 dB

Line Coding

B8ZS line coding

Signal Levels

- Receive: Peak pulse amplitude from 0.2 to 0.85 volts
- Transmit: Conformance to ANSI T1.102 pulse template and amplitude (0.36 volts to 0.85 volts) for cable lengths up to 450 feet

Clocking Options

- Loop timing
- Internal timing (better than Stratum 4 - +/- 20 PPM [part per million])
- External timing via 1.544 MHz T1 source

Link Performance Monitoring

- E1-IMA software shall support per-SDH port performance monitoring functionality in accordance with the RFC1595
- The E1-IMA software shall also provide support for nearend section, line and path as well as far-end line, path performance monitoring functionality
- User-configurable thresholds for E1 performance parameters

Diagnostic and Loopback Tests

- The E1-IMA card shall support internal and external diagnostics.
- The E1-IMA card shall support BERT (Bit Error Rate Test) with patterns x^21 on the lineside.
- The E1-IMA card shall support line and diagnostic loopback

Alarm Handling

Supports E1 alarm detection

Module LED Status

Table A-17. Module LED Status Indicators

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Redundant module online
Good and Failed LEDs blinking simultaneously	Operating system software image currently being downloaded from active switch processor (SP)

Port Alarm Status

Table A-18. Port Alarm Status Indicators

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal (LOS) resulting in a remote alarm identification (RAI)
Red LED lit	Loss of framing (LOF) or LOS
Red LED blinking	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)

Figure A-10 shows the 1-port Channelized DS3/1 IMA IOP and IOA modules.

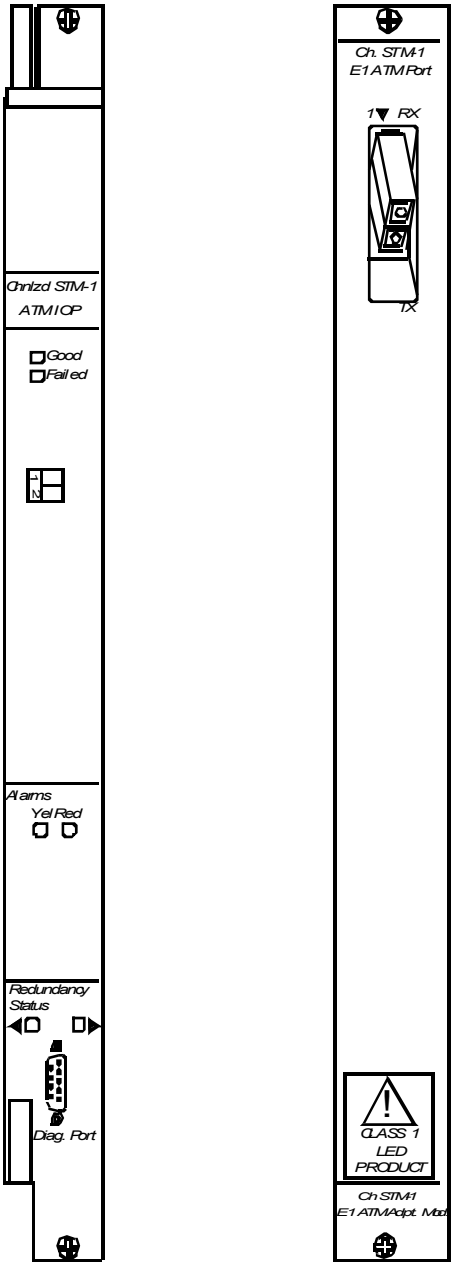


Figure A-10. 1-Port Channelized STM-1/E1 IMA IOM IOP and IOA Panel

3-port Channelized Inverse Multiplexing over ATM (IMA) Module

The 3-port Channelized DS3/1 IMA IOM enables the CBX 500 Multiservice WAN switch to provide increased scalability and port density for low-speed Asynchronous Transfer Mode (ATM) aggregation in the central office.

Specifications

Physical Dimensions

Height: 16 in. (40.6 cm)

Width: 1 in. (2.54 cm)

Depth: 11 in. (27.9 cm)

Weight: 5 lb (2.3 kg)

Power Requirements

105 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN55022 (CISPR Class A)
- NEBS GR-63-CORE, GR-1089-CORE
- UL 1950, EN 60950
- International Telecommunications Union (ITU) standards

Interface Standards

- American National Standards Institute (ANSI) T1.102
- AT&T Publication 62415

DS3 Standards

- ANSI T1.103
- ANSI T1.107
- ANSI T1.107a (DS3 format specifications)

- ANSI T1.231 (DS1/DS3 performance monitoring)
- ANSI T1M1.3/91-003R3
- Bellcore TR-NWT-000499
- At&T TR54016
- Request for comments (RFC) 1407
- AT&T 62411

DS1 Standards

- AT&T Publication 62411
- Bellcore TR-TSY-000312
- Bellcore TR-NWT-000499
- ANSI T1.403
- ANSI T1.107
- ANSI T1.231
- RFC 1406

Physical Interfaces

Three DS3 ports, conforming to relevant ANSI, Bellcore, and International Telecommunication Union (ITU) specifications

Physical Connectors

Two 75-ohm BNC connectors for each port (transmit/receive)

Line Coding

B8ZS line coding

Signal Levels

- Receive: Peak pulse amplitude from 0.2 to 0.85 volts
- Transmit: Conformance to ANSI T1.102 pulse template and amplitude (0.36 volts to 0.85 volts) for cable lengths up to 450 feet

Clocking Options

- Loop timing
- Internal timing (better than Stratum 4 - +/- 20 PPM [part per million])
- External timing via 1.544 MHz T1 source

Link Performance Monitoring

- DS3 MIB (RFC 1407) near-end statistics collection
- User-configurable thresholds for DS3 performance parameters

Diagnostics and Loopback Test

- The DS3-IMA card shall support internal and external diagnostics.
- The DS3-IMA card shall support BERT on DS1 interfaces
- The DS3-IMA card shall support shall support Unframed Inband Line Loopback, Diagnostic/Local Loopback, Framed and Unframed Line Loopback and ESF FDL Line loopback tests on DS1 interface.

Module LED Status

Table A-19. Module LED Status Indicators

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Redundant module online
Good and Failed LEDs blinking simultaneously	Operating system software image currently being downloaded from active switch processor (SP)

Port Alarm Status

Table A-20. Port Alarm Status Indicators

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal (LOS) resulting in a remote alarm identification (RAI)
Red LED lit	Loss of framing (LOF) or LOS
Red LED blinking	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)

Figure A-11 shows the 3-port Channelized DS3/1 IMA IOP and IOA modules.

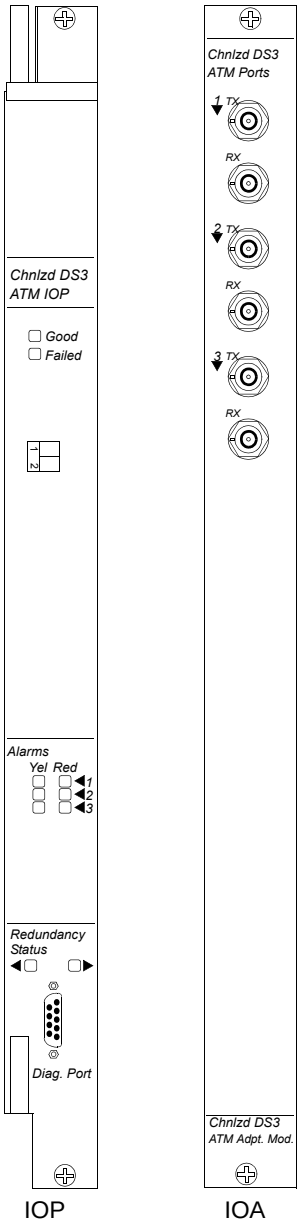


Figure A-11. 3-Port Channelized DS3/1 IMA IOM IOP and IOA Panel

3-Port DS3/1 and 1-Port STM-1/E1 Channelized ATM IMA Enhanced Module

3-Port DS3/1 and 1-Port STM-1/E1 Channelized module with Inverse Multiplexing for ATM (IMA) Enhanced module allows you to create a cost-effective, scalable service that provides interim ATM access between DS1/E1 and DS3/STM-1 to meet the growing bandwidth needs of your customers. You can increase the density of your existing DS1/E1 services to support more customers. This module also enables you to create cost-efficient network trunks in areas where STM-1 lines are not cost-effective or not available.

You can also use the module with certain IMA-capable Customer Location Equipment (CLE) to allow end-user access from non-ATM interfaces, such as Frame Relay, Ethernet, private line and voice.

Specifications

Physical Dimensions

Height: 16 in. (40.6 cm)

Width: 1 in. (2.54 cm)

Depth: 11 in. (27.9 cm)

Weight: 3 lb (1.36 kg)

Power Requirements

92 Watts

Temperature Range

0° to 50°C (32° to 122°F)

Agency Approvals Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN55022 (CISPR Class A), EN6100
- NEBS GR-253-CORE, GR-63-CORE, GR-1089-CORE
- UL 1950, EN 60950
- International Telecommunications Union (ITU) standards

Interface Standards

- American National Standards Institute (ANSI) T1.102
- AT&T Publication 62415

DS3/DS1 Standards

- ANSI T1.102
- ANSI T1.107
- ANSI T1.105
- ITU-T G.707
- ITU-T G-747
- TR-TSY-000009
- ATM Forum T1 specification
- AF-PHY/0016.0000

Sonet Interface Standards (STM-1)

Telcordia Bellcore **(DOES THIS BELONG HERE?)**

- ANSI T1M1.3/92-005RI
- ITU G.703 (electrical), G.709 (optical), G.957 (optical)
- RFC SONET 1595
- ITU-T G.704 for 63 E1 termination

ATM Standards

- ATM UNI 3.0, 3.1
- ATM TM 4.0, 4.1
- ATM Forum IMA v1.0 and v1.1;
- ATM Forum test specification af-test-0022.000;
- AT&T Publications 62415

Physical Interfaces

Three DS3/DS1 ports, conforming to relevant ANSI, Bellcore, and International Telecommunication Union (ITU) specifications

Physical Connectors

- SC Connectors for E1 IMA enhanced IOM
- Two 75-ohm BNC connectors for each port (transmit/receive) for DS3 IMA enahnced card

Line Coding

B8ZS line coding

Signal Levels

- Receive: Peak pulse amplitude from 0.2 to 0.85 volts
- Transmit: Conformance to ANSI T1.102 pulse template and amplitude (0.36 volts to 0.85 volts) for cable lengths up to 450 feet

Clocking Options

- Loop timing
- Internal timing (better than Stratum 4 - +/- 20 PPM [part per million])
- External timing via 1.544 MHz T1 source

Link Performance Monitoring

- E1-IMA Enhanced software shall support per-SDH port performance monitoring functionality in accordance with the RFC1595.
- The E1-IMA Enhanced software shall also provide support for nearend section, line and path as well as far-endline, path performance monitoring functionality.
- User-configurable thresholds for E1 performance parameters

Module LED Status

Table A-21. Module LED Status Indicators

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Redundant module online
Good and Failed LEDs blinking simultaneously	Operating system software image currently being downloaded from active switch processor (SP)

Port Alarm Status

Table A-22. Port Alarm Status Indicators

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal (LOS) resulting in a remote alarm identification (RAI)

Table A-22. Port Alarm Status Indicators

LED State	Status
Red LED lit	Loss of framing (LOF) or LOS
Red LED blinking	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)

Figure A-12 shows the Channelized DS3/1 and STM-1/E1 ATM with IMA Module.

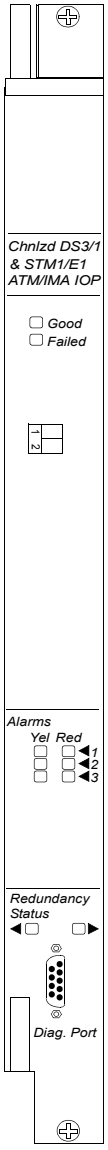


Figure A-12. Channelized DS3/1 and STM-1/E1 IOM IOP and IOA Panel

60-Port Channelized T1/E1 CE I/O Module

The 60-Port Channelized T1/E1 Circuit Emulation I/O Module for the CBX 500 Multiservice Edge switch provides 60 T1/E1 physical ports on the input/output adapter (IOA). The CBX 500 switch supports a maximum of 14 CBX 60-Port Channelized T1/E1 Circuit Emulation Modules per chassis.

The 60-Port Channelized T1/E1 Circuit Emulation module supports both structured and unstructured T1/E1 circuit emulation services (CES). For structured CES, it supports full channelization down to the DS0 level. The IOM supports both CE services as described in the corresponding ATM Forum Standards documents, af-vtoa-0078.000 and ITU-T I.363.1.

Specifications

Power Requirements

- **IOM:** 105 W, max

Temperature Range

- Operating range: 5°C to 40°C (41°F to104°F)

Relative Humidity

- 0 to 90%

Physical Connectors

- RJ48H

Patch (Connector) Panel and Cable Requirements

It is the customers' responsibility to obtain and install the patch panel(s) and the cables that connect the IOA(s) to the patch panel(s).

RJ48c Interface Conversion

The IOM connects to the network via a patch panel. To convert to an RJ48c interface, a third party patch panel is required. It is up to the user to obtain and install the third party patch panel and cables from the vendor, such as Ortronics. As an example, below are the Ortronics part numbers and requirements.

- Part Numbers
  - 60 Port T1 Patch Panel Part Number: 808045669
  - Plug-Plug Cable: 804025PPxxx-1GY (where xxx is the length in feet)

Caution – To ensure EMI standards compliance, we suggest that shielded cables be used to connect the 60-Port Channelized T1/E1 CE IOA(s) to the patch panel(s).

ATM Protocols

- AAL1
- AAL5 for control traffic

Circuit Emulation Protocols

- AAL1
- af-vtoa-0078.000
- ITU-T I.363.1
- CES-IS 2.0 MIB

Safety

- UL 60950
- CAN/CSA-C22.2 No. 60950
- EN 60950, IEC 60950, EN 60825-1
- FDA CDRH Title 21 CFR Sub-chapter J

Agency Approvals Electromagnetic Emissions Certifications

- FCC 47 CFR Part 15 Class A
- AS/NZS 3548/CISPR 22
- EN 55022 Class A
- VCCI Class A ITE

Standards

- N55024 ITE Immunity
- EN61000-4-2 ESD
- EN61000-4-3 Radiated Immunity
- EN61000-4-4 EFT
- EN61000-4-5 Surge
- EN61000-4-6 Low Frequency Common Immunity
- EN61000-4-8 Magnetic Field

Other Standards

- NEBS-GR-63-CORE
- GR-1089-CORE
- ETSI EN 300 386

Physical Interfaces

Table A-23 shows the physical interfaces per IOA for the 60-Port Channelized T1/E1 CE IOM.

Table A-23. 60-Port Channelized T1/E1 CE IOM Physical Interfaces

Interface Type	Channel Type	Channels
60-Port T1	Clear-Channel DS1 Fractional DS1 Channelized DS1	60 60 to 1440 1440
60-Port E1	Clear-Channel DS1 Fractional DS1 Channelized DS1	60 60 to 1860 1860

Link Framing

The Link Framing types for the 60-Port Channelized T1/E1 CE IOM are:

- T1
  - Structured: D4/SF (Super Frame), ESF (Extended SF)
  - Unstructured: Unframed
- E1
  - Structured: CRC4 (Cyclic Redundancy Check) and CAS (Channel Associated Signalling) combinations
  - Unstructured: Unframed

Line Coding Types

The Line Code types for the 60-Port Channelized T1/E1 CE IOM are:

- T1 - AMI (Alternate Mark Inversion) and B8ZS (Binary 8-Zero Substitution)
- E1 - AMI (Alternate Mark Inversion) and HDB3 (High Density Binary-3)

Loopbacks

The following NMS-initiated loopbacks are supported for both T1 and E1 modes:

- Near End Line Loopback

- Near End Diag Loopback
- Far End Loopback (outbound data looped back towards the switch, only for T1 mode)
- Payload Loopback

Clocking Options

Clocking options for the 60-Port Channelized T1/E1 CE IOM include:

- Loop timing
- Internal timing

Any of the 60 physical ports can be selected as the timing source of port timing reference A or port timing reference B.

Standard Alarm Handling

- Loss of Signal (LOS), Alarm Indication Signal (AIS), Out of Frame (OOF), RED, Loss of Multi Frame (LOMF), YEL, IDLE.
- Performance monitoring for both T1/E1 as per ANSI specification.
- Bit Error Rate Test (BERT) for both T1/E1

Module LED Status

Table A-24. Module LED Status Indicators

LED State	Status
Good and Failed LEDs: Indicate module status	
Good ON (Green LED)	Normal operation
Failed ON (Red LED)	Module failure
Good and Failed LEDs BLINKING simultaneously	OS software image currently being downloaded from the active SP 90

Port Alarm Status

Table A-25. Port Alarm Status Indicators

LED State	Status
Yellow ON	Downstream equipment sees loss of signal (LOS) resulting in a remote defect indication (RDI)
Red BLINKING	Downstream equipment failure resulting in an Alarm Indication Signal (AIS)
Red ON	Loss of signal
Redundancy Status LEDs	In this release, redundancy is not supported for this IOM

Figure A-13 shows the faceplates of the 60-Port Channelized T1/E1 Circuit Emulation IOP and IOA.

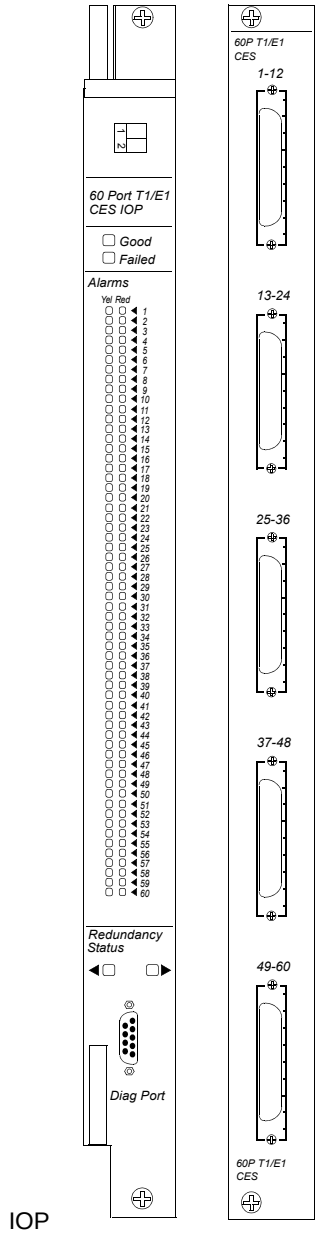


Figure A-13. 60-Port Channelized T1/E1 CE IOP and IOA Faceplates

B

Cables and Pinout Assignments

This appendix provides cable diagrams and pinout assignments for the following CBX 500 cables/connectors:

- RS-232 Shielded Null-Modem Cable
- RS-232 Shielded Straight-through Modem Cable
- RS-232 DB-9 to DB-25 Shielded Crossover Cable
- T1 Straight-through Cable (DB-15)
- T1 Crossover Cable (DB-15)
- Media Independent Interface (MII)

You can purchase cabling equipment from Lucent Technologies. Be sure to use the appropriate product code when ordering. To obtain a list of current product codes, contact your Lucent account manager.

RS-232 Shielded Null-Modem Cable

Table B-1. RS-232 Shielded Null-Modem Cable Pinouts

RS-232 Male Connector #1 Pin Number	RS-232 Male Connector #1 Signal	RS-232 Female Connector #2 Pin Number	RS-232 Female Connector #2 Signal
7	Signal Ground	7	Signal Ground
3	Receive Data	2	Transmit Data
2	Transmit Data	3	Receive Data
DB-25 Male Connector #1 Pin Number	**DB-25 Male Connector #1 Signal**	**DB-25 Male Connector #1 Pin Number**	**DB-25 Male Connector #1 Signal**
20	Data Terminal Ready	8	Data Carrier Detect
8	Data Carrier Detect	6	Data Set Ready
5	Clear To Send	4	Request To Send
DB-25 Female Connector #2 Pin Number	**DB-25 Female Connector #2 Signal**	**DB-25 Female Connector #2 Pin Number**	**DB-25 Female Connector #2 Signal**
20	Data Terminal Ready	8	Data Carrier Detect
8	Data Carrier Detect	6	Data Set Ready
5	Clear To Send	4	Request To Send

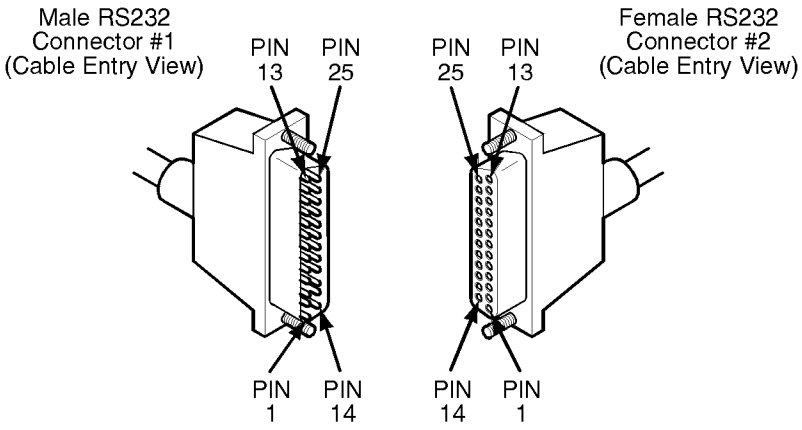


Figure B-1. RS-232 Shielded Null-Modem Cable

Product Code: 40034Y

RS-232 Shielded Straight-through Modem Cable

Table B-2. RS-232 Shielded Straight-through Cable Pinouts

RS-232 Male Connector #1		RS-232 Female Connector #2	
Pin	**Signal**	**Pin**	**Signal**
2	Transmit	2	Transmit
3	Receive Data	3	Receive Data
7	Signal Ground	7	Signal Ground
1	Frame Ground	1	Frame Ground
4	Request To Send	4	Request To Send
5	Clear To Send	5	Clear To Send
6	Data Set Ready	6	Data Set Ready
8	Data Carrier Detect	8	Data Carrier Detect
20	Data Terminal Ready	20	Data Terminal Ready
Product Code: 40021Y			

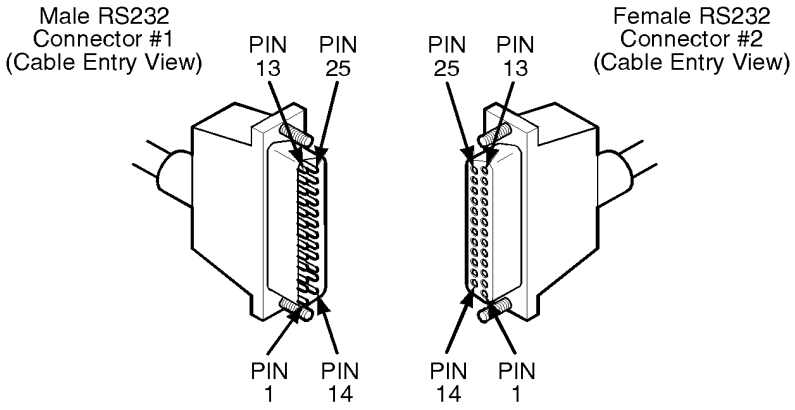


Figure B-2. RS-232 Shielded Straight-through Modem Cable

RS-232 DB-9 to DB-25 Shielded Crossover Cable

Table B-3. RS-232 DB-9 to DB-25 Shielded Crossover-Cable Pinouts

DB-9 Female Connector #1		DB-25 Female Connector #2	
Pin	**Signal**	**Pin**	**Signal**
2	RX (Receive)	2	TX (Transmit)
3	TX (Transmit)	3	RX (Receive)
5	GND (Signal Ground)	7	GND (Signal Ground)
DB-9 Female Connector #1		**DB-9 Female Connector #1**	
Pin	**Signal**	**Pin**	**Signal**
1	DCD (Data Carrier Detect)	4	DTR (Data Terminal Ready)
4	DTR (Data Terminal Ready)	6	DSR (Data Set Ready)
7	RTS (Request To Send)	8	CTS (Clear To Send)
DB-25 Female Connector #2		**DB-25 Female Connector #2**	
Pin	**Signal**	**Pin**	**Signal**
4	RTS (Request To Send)	5	CTS (Clear To Send)
6	DSR (Data Set Ready)	8	DCD (Data Carrier Detect)
8	DCD (Data Carrier Detect)	20	DTR (Data Terminal Ready)

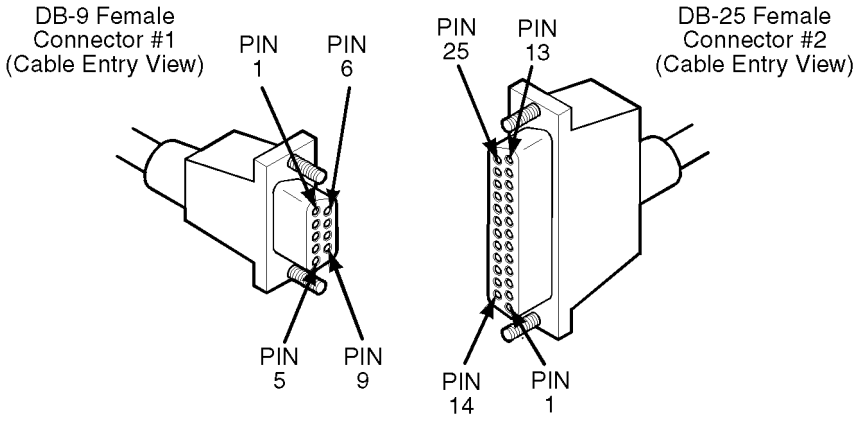


Figure B-3. RS-232 DB-9 to DB-25 Shielded Crossover Cable

T1 Straight-through Cable (DB-15)

Table B-4. T1 Straight-through Cable Pinouts (DB-15)

Pin	Male Connector #1 Signal	Pin	Male Connector #2 Signal
1	Transmit Tip	1	Transmit Tip
3	Receive Tip	3	Receive Tip
9	Transmit Ring	9	Transmit Ring
11	Receive Ring	11	Receive Ring
	Required Twisted Pairs		
	1 and 9		
	3 and 11		
Product Code: 40004			

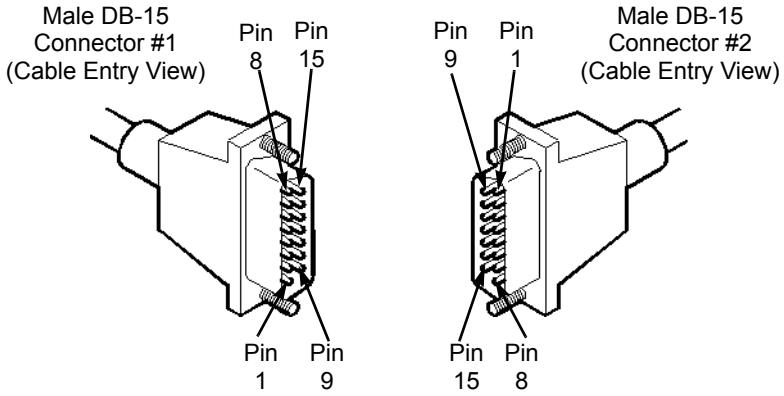


Figure B-4. T1 Straight-through Cable

T1 Crossover Cable (DB-15)

Table B-5. T1 Crossover Cable Pinouts (DB-15)

Pin	Male Connector #1 Signal	Pin	Male Connector #2 Signal
1	Transmit Tip	3	Receive Tip
3	Receive Tip	1	Transmit Tip
9	Transmit Ring	11	Receive Ring
11	Receive Ring	9	Transmit Ring
	Required Twisted Pairs		
	1 and 9		
	3 and 11		
Product Code: 40020			

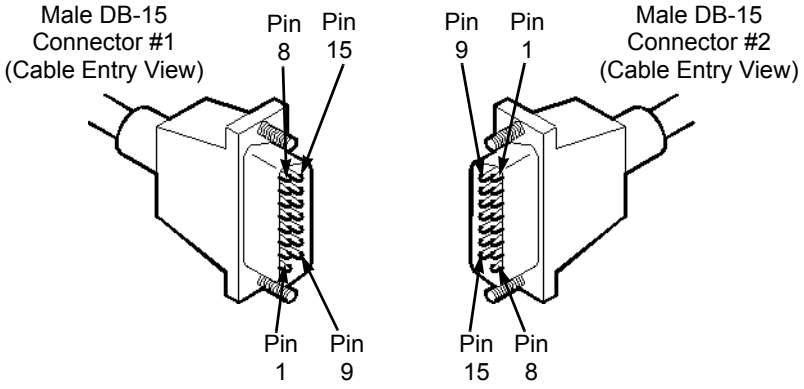
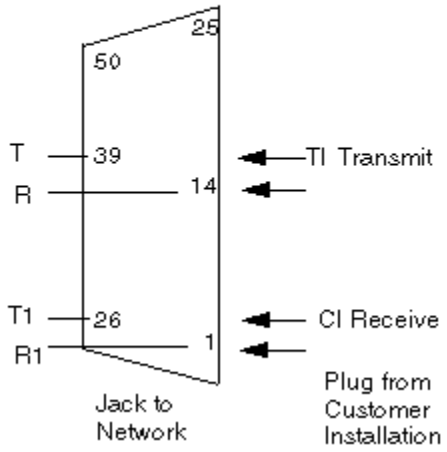


Figure B-5. T1 Crossover Cable Diagram

RJ48H Connector Pinout

The pinout for the 50 pin RJ48H connector used on the 60-Port Channelized T1/E1 Circuit Emulation IOA is shown below:



	Pinout			
Line	T1	R1	T	R
1	26	1	39	14
2	27	2	40	15
3	28	3	41	16
4	29	4	42	17
5	30	5	43	18
6	31	6	44	19
7	32	7	45	20
8	33	8	46	21
9	34	9	47	22
10	35	10	48	23
11	36	11	49	24
12	37	12	50	25

Figure B-6. RJ48H Connector Pinout

Media Independent Interface (MII)

Table B-6 lists the pinout assignments on the Ethernet I/O module's MII connector.

Table B-6. Media Independent Interface (MII) Pinouts

Pin	Signal	Pin	Signal
1	+5V	21	+5V
2	MDIO	22	common
3	MDC	23	common
4	RXD<3>	24	common
5	RXD<2>	25	common
6	RXD<1>	26	common
7	RXD<0>	27	common
8	RX_DV	28	common
9	RX_CLK	29	common
10	RX_ER	30	common
11	TX_ER	31	common
12	TX_CLK	32	common
13	TX_EN	33	common
14	TXD<0>	34	common
15	TXD<1>	35	common
16	TXD<2>	36	common
17	TXD<3>	37	common
18	COL	38	common
19	CRS	39	common
20	+5V	40	+5V
Connector Panel Product Code:11108			

C

Regulatory Information

This appendix lists the regulatory agencies that have approved the CBX 500 switch, and includes a sample affidavit that you need to file with your local telephone company (U.S. only) concerning connecting customer premise equipment (CPE) to wide area network (WAN) services.

This appendix includes the following topics:

Regulatory Standards Compliance (Pending)

The following regulatory agencies have approved the CBX 500 and have found it to be fully compliant with their environmental, safety, and emissions standards:

- Network Equipment Building System (NEBS) GR-63-CORE and GR-1089-CORE
- British Approval Board for Telecommunications (BABT) — Safety and Factory Compliance
- TUV — Safety and Factory Compliance to EN60950
- Canadian Standards Association (CSA) — Safety and Factory Compliance CSA 22.2, No. 950
- Underwriter's Laboratory (UL) — Safety and Factory Compliance UL 1950
- Federal Communications Commission (FCC) — EMC compliance (Part 15 Class A)

In addition, Lucent's CBX 500 switches meet the following country standards:

- Australia Safety - Austel
- New Zealand (EMC and Telecommunications Function)

Emissions

- FCC Part 15 Class A
- EN55022 Class A (CISPR)
- VCCI Class 1

Canadian IC CS-03 Requirements

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements documents. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, user should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Warning - Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

To contact an authorized Lucent representative in Canada, call: (613) 566-7039.

Avis D'Industrie Canada

L'étiquette d'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme aux normes de protection, d'exploitation et de sécurite des réseaux de télécommunications, comme le prescrivent les documents concernant les exigences techniques relatives au matériel terminal. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également étre installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la comformité aux conditions énoncées ci-dessus n'empêche pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être coordonnées par un représentant désigné par le fournisseur. L'entreprise de télécommunications peut demander a l'utilisateur de débrancher un appareil a la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

Pour sa propre protection, l’utilisateur doit s’assurer que tous les fils de mise a la terre de la source d’énergie électrique, des lignes téléphoniques et des canalisations d’eau métalliques, s’il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales. Avertissement: L’utilisateur ne doit pas tenter de faire ces raccordements lui-méme; il doit avoir recours a un service d’inspection des installations électriques, ou à un électricien, selon le cas.

AVIS: L’indice d’ équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent étre raccordés a une interface. La terminaison d’ une interface téléphonique peut consister en une combinaison de quelques dispositifs, a la seule condition que la somme d’indices d’équivalence de la sonnerie de tous les dispositifs n’excède pas 5.

FCC Part 68 General Information

Read the following FCC Part 68 information before you connect the CBX 500 switch to the public telecommunications network.

- This equipment complies with Part 68 of the FCC rules. On the back of this equipment is a label that contains (among other information) the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.
- This equipment uses the following USOC jacks as defined in Table C-1.

Table C-1. CBX 500 FCC Information

Type of Interface	USOC Jack Connector	Service Code	Facility Code
1.544 Mbps Superframe format (SF) without line power	RJ-48C	6.0N	04DU9-BN
1.544 Mbp Superframe format (SF) and B8ZF without line power	RJ-48C	6.0N	04DU9-DN
1.544 Mbp ANSI ESF without line power	RJ-48C	6.0N	04DU9-1KN
1.544 Mbp ANSI ESF and B8ZF without line power	RJ-48C	6.0N	04DU9-1SN

- An FCC compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant.
- This equipment cannot be used on telephone company-provided coin service. Connection to Party Line Service is subject to state tariffs.
- If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.
- The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice for you to make the necessary modifications to maintain uninterrupted service.
- If trouble is experienced with this equipment, please contact Lucent Technologies for repair and warranty information. If the trouble is causing harm to the telephone network, the telephone company may request that you remove the equipment from the network until the problem is resolved.

- It is recommended that the customer install an AC surge protector in the AC outlet to which this device is connected. This is to avoid damage to the equipment caused by local lightning strikes and other electrical surges.

FCC and Telephone Company Procedures and Requirements

To connect this system to the network, you must provide the local operating company with the registration number of this equipment, and you must order the proper connections.

To order the proper service, provide the telephone company with the following information:

- Quantities and USOC numbers of the required jacks
- Sequence in which the trunks are to be connected
- Facility interface codes, by position
- Ringer equivalence number or service code, as applicable, by position

Radio Frequency Interference

The CBX 500 switch is designed for Class A use only. Do not attempt to use this equipment in a domestic environment, which requires Class B distinction. These switches cause interference with domestic products.

Caution - In accordance with FCC Part 15 Subpart B requirements, changes or modifications made to this equipment not expressly approved by Lucent Technologies could void user's authority to operate this equipment.

This equipment produces electromagnetic energy at radio frequencies and, if not installed and operated in accordance with the manufacturer's instructions as contained in this document, could cause interference to radio communications and/or interfere with the operation of other RF devices. The equipment has been tested and found to comply with the limits for a Class A Computing Device pursuant to Subpart B of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of the equipment in a residential area may cause interference. Should this occur, the user may be required to discontinue operation of the equipment, or take other such measures as may be adequate to rectify the condition at the user's expense.

VCCI Statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Translation: This is a Class-A product based on the standards of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

BSMI Statement

警告使用者:

這是甲類的資訊產品, 在居住的環境中使用時, 可能會造成射頻干擾, 在這種情況下, 使用者會被要求採取某些適當的對策.

If Problems Arise

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. The telephone operating company must be notified before removal of equipment that is connected to 1.544 Mbps digital services. If the telephone company notes a problem, it may temporarily discontinue service. When practical, the telephone company will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC.

In the event repairs are needed on this equipment, they should be performed by Lucent Technologies or an authorized representative of Lucent Technologies.

For information about contacting the Lucent Technical Assistance Center, see “Technical Support” on page -xxvii.

Example Affidavit (United States)

This is an example of the affidavit that needs to be filed with the Telco concerning connection of customer premise equipment (CPE) to 1.544 Mbps services:

For the work to be performed in the certified territory of _____ (name of Telco), State of _____, County of, _____, I, _____ (Name), of _____ (Business Address), _____(phone number) being duly sworn, state the following:

I have responsibility for the operation and maintenance of the terminal equipment to be connected to 1.544 Mbps digital services. The terminal equipment to be connected complies with Part 68 of the FCC rules except for the encoded analog content and billing protection specifications. With respect to the encoded analog content and billing protection:

( ) I attest that all operations associated with the establishment, maintenance of the terminal equipment to be connected to 1.544 Mbps digital services complies with Part 68 of the FCC Rules and Regulations.

( ) The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.

( ) The encoded analog content and billing protection is factory set and is not under control of the customer.

I attest that the operator(s)/maintainer(s) of the digital CPE responsible for the establishment, maintenance and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully having completed one of the following:

( ) A training course provided by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) A training course provided by the customer or authorized representative, using training materials and instructions provided by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) An independent training course (e.g. trade school or technical institution) recognized by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) In lieu of the proceeding training requirements, the operator(s)/maintainer(s) is (are) under control of a supervisor trained in accordance with _____ (circle one) above.

I agree to provide _____ (name of Telco) with proper documentation to demonstrate compliance with the information as provided in the preceding paragraph, if so requested.

_____ (Signature)

_____ (Title)

_____ (Date)

Subscribe and sworn to before me, this _____ day of _____, 19__.

_____ Notary Public, my commission expires _____.

D

Redundancy

This appendix describes the redundancy features of the CBX 500 switch, in the following topics:

IOM Redundancy

On the CBX 500 switch, you can configure IOM redundant pairs only between modules/slots that share a common bus thread in the chassis. These slots include:

- 3 and 4
- 5 and 6
- 7 and 8
- 11 and 12
- 13 and 14
- 15 and 16

Figure D-1 shows the slot combinations in which you can configure redundant IOMs.

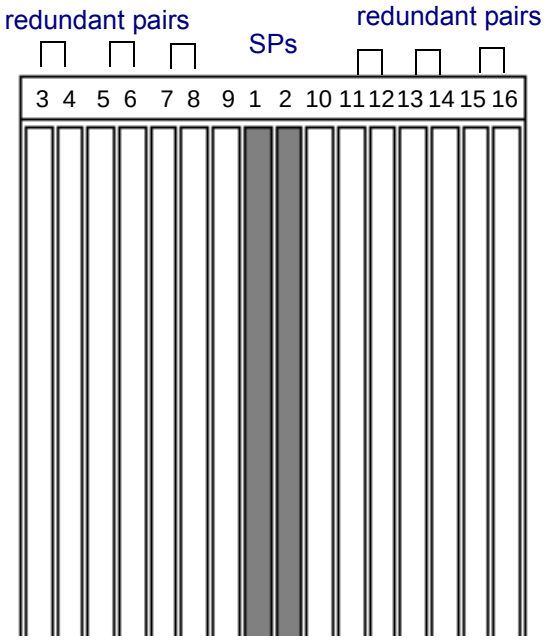


Figure D-1. Slot Assignments for IOM Redundancy

SP Redundancy

The CBX 500's switch processor (SP) module is available as a fully redundant pair of modules for high-reliability networking requirements. Redundancy is achieved by installing two identically configured SP modules of the same model type into the switch. They must be placed in Slots 1 and 2 and share the SPA module. The SPA presents a single interface to the network.

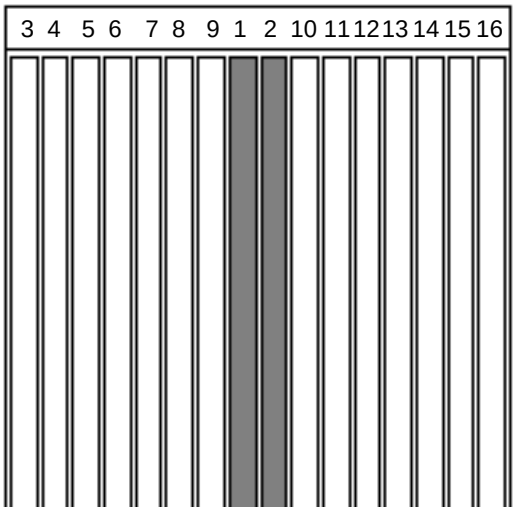


Figure D-2. SP Slots in a CBX 500 Switch

The SP module configured as the redundant partner (standby), continually polls the active SP module for its operational status. If the redundant module detects a failure in the active module, the redundant module automatically takes over to reduce service disruptions.

CBX 500 redundancy and recovery consists of both hardware and software mechanisms that enable the switch to continue operation after certain types of failure. The other module that currently supports redundancy is the power supply.

For installation instructions, see Chapter 6, "Installing and Removing Modules."

Status Indicators

All modules have Redundancy LEDs on the bottom of the module to indicate the redundancy status of the module. The Redundancy LEDs are ON when a module is the active (that is, online) member of a redundant pair. The Redundancy LEDs blink when a module is the redundant (that is, standby) member of a redundant pair.

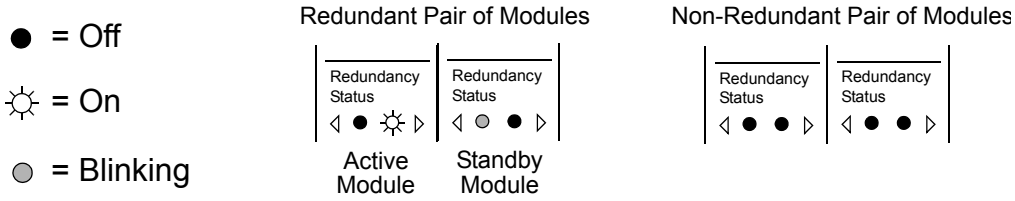


Figure D-3. Redundancy Status LEDs

Redundancy Manager

The Redundancy Manager is a background task that runs on each SP module installed in the switch. It performs the following functions:

- Establishes an active and redundant module for each pair of SPs.
- Monitors the integrity of active modules by means of keep-alive messages over the cell bus. (For more information, refer to the section, "Keep-Alive Monitoring" on page D-5.)
- Detects a failure in the active module and instructs the redundant module to disable the active module and perform a warm boot to become the active module.
- Monitors the PRAM in redundant modules to ensure identical configurations are maintained between the active and redundant module. If a mismatch is detected, the active module automatically updates PRAM on the redundant module.

The Redundancy Manager is distributed and runs on each module in the system. Redundant modules use a keep-alive mechanism to monitor their active partners. If an active module fails, the redundant module reboots it and takes over as the active module. The switchover does not have any direct effect on other modules in the switch. The modules may, however, not be able to access information on the resetting module.

During SP switchover, the CBX 500 can establish and reroute circuits, but cannot route IP traffic through this node (that is, no NMS traffic).

Keep-Alive Monitoring

Redundant modules (active and standby) monitor each other's integrity through the use of a keep-alive protocol. The Redundancy Manager in each module exchanges keep-alive messages over the cell bus, and the redundant or standby module initiates the poll.

The switch uses the following keep-alive timers and counters to determine the status of an active module:

Keep-Alive Poll Timer — Triggers the transmission of keep-alive messages from the redundant module to the active module. This value is set to expire every 0.5 seconds.

Keep-Alive Poll Counter — Dictates the number of consecutive keep-alive responses from the active module that the redundant module can miss before it "shoots" the active module. ("Shooting" the module reboots the active module and enables the redundant module.) This value is set to 3.

Keep-Alive Poll Verification Timer — Verifies the active module's receipt of keep-alive messages from the redundant module. This value is set for 1 second and is reset each time a keep-alive is received by the active module.

Keep-Alive Poll Verification Counter — Verifies the number of consecutive Keep Alive Poll Timer time-outs received before "shooting" the redundant module and reporting a problem. This value is set to 3.

In redundant configurations, keep-alive monitoring occurs as follows:

- The redundant module initiates a "Hello" message to the active module, as set by the expiration of the Keep-Alive Poll Timer.
- For each keep-alive poll the active module receives, the active module sends a response back to the redundant module.
- If the redundant module does not receive responses according to the value set in the Keep Alive Poll Counter, it assumes that the active module has failed and shoots the active module using special redundancy hardware.
- The redundant module performs a warm boot and takes over operation as the active module.
- The new active module keeps the "shoot" active until the old active module boots up. When the old active module finishes booting, it then acts as the redundant module and begins to send keep-alive polls to the new active module.

- If the polling exchange between the modules is successful, the new active module releases the shoot, and the old active module becomes the redundant module.

Note – The SP's PRAM checksum of the sender is also contained in the keep-alive message. This number is used to ensure that the PRAM remains identical between the two modules. (For more information, refer to the section, "Checksum/Version Number Exchange".)

TFTP Support

All PRAM downloads go to the active SP module. After the active module receives a new PRAM, it downloads the new PRAM to its redundant partner.

Checksum/Version Number Exchange

The SNMP and TFTP mechanisms are intended to keep the PRAM of redundant modules synchronized. To ensure identical images on both modules, the PRAM checksum version number is included in the keep-alive message. If the redundant module detects a difference in images, it automatically initiates a download of the PRAM from the active module.

If you install a redundant SP that does not contain boot flash or application code, the active SP automatically downloads them to the redundant SP. The active SP then monitors the PRAM in the redundant SP and automatically downloads the PRAM if a mismatch is detected.

NMS Support

Users are required to specify which modules in the switch are redundant and in which slots the modules reside. For redundant SPs, the NMS shows the back panel with a graphical representation of a redundant SP adapter module occupying the middle two slots in the switch. To initially bring up the switch, the NMS requires you to have an SP configured in Slot 1; however, the SP can physically reside in Slot 1 or Slot 2.

The NMS also enables a user to manually switch operation from an active SP module to the redundant SP module. The reset procedure is the same as if the redundant module detected a failure with the active module.

Acronyms

This guide uses the following acronyms:

Acronym	Description
ABR	available bit rate
APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
CBR	constant bit rate
DCE	data communications equipment
DLCI	Data Link Connection Identifier
DS	digital service
DTE	data terminal equipment
DXI	Data Exchange Interface
EPD	early packet discard
Gbps	gigabits per second
HDLC	High-level Data Link Control
IOA	input/output adapter
IOM	input/output module
IOP	input/output processor
Kbps	kilobits per second
Mbps	megabits per second
MIB	Management Information Base

Acronym	Description
MPT	Multipoint-to-Point Tunnel
MPOA	Multi-Protocol over ATM
MPLS	Multi-Protocol Label Switching
NMS	Network Management System
NNI	Network-to-Network Interface
OC	Optical Carrier
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PAD	packet assembler/disassembler
PPP	Point-to-Point Protocol
PRAM	parameter random access memory
PVC	permanent virtual circuit
QoS	Quality of Service
RFC	Request For Comments
SLIP	Serial Line Internet Protocol
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SP	switch processor
STS	Synchronous Transport Signal
SVC	switched virtual circuit
UBR	unspecified bit rate
UIO	Universal Input/Output
UNI	User-to-Network Interface
VBR	variable bit rate
VCC	virtual channel connection
VC	virtual circuit
VNN	Virtual Network Navigator

Acronym	Description
VPN	Virtual Private Network

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CBX 500 Multiservice WAN Switch Hardware Installation Guide Customer Comments

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Cut Here

- What tasks did you perform using this guide? _____
- Did you install the hardware/software? _____
- If you were having trouble performing a task, were you able to find the information you needed? Was the index useful? _____
- Were the examples and illustrations helpful for performing tasks? If not, how can they be improved? _____
- Was there any information you needed that was not in the manual? If so, how can we best deliver that information to you? _____
- What did you like/not like about the manual? _____
- Do you have any other comments about the manual? _____

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