CBX 500 Hardware Installation Guide

Ascend Communications, Inc.

Product Code: 80011
Revision 02
June 1997

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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:

1. This device may not cause harmful interference, and
2. 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 Ascend Communications Inc. or a Ascend-authorized representative.

Maintenance Agreements

Ascend 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 the Ascend Technical Assistance Center (TAC) at:

- 1-800-DIAL-WAN (U.S. and Canada)
- 0-800-96-2229 (U.K.)
- 1-978-952-7299 (all other areas)

Ascend has adopted a maintenance strategy based on customer-initiated requests to the Ascend Technical Assistance Center (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 Ascend Technical Assistance Center so that action can be initiated, either to repair or replace the damaged items.

Do not return any items to Ascend until you obtain instructions from a Technical Assistance Center representative. Report the problem or deficiency, along with the model, type, and serial number. Upon receipt of this information, the Ascend Technical Assistance Center 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 Ascend Communications Inc., or an authorized Ascend representative. For information, contact the Ascend Technical Assistance Center at:

- 1-800-DIAL-WAN (U.S. and Canada)
- 0-800-96-2229 (U.K.)
- 1-978-952-7299 (all other areas)

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About This Guide

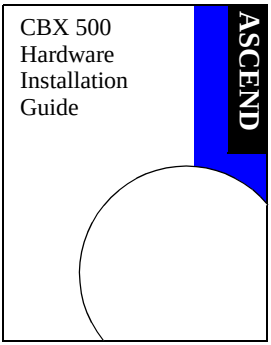
This guide describes the procedures you need to set up, install, and test the CBX 500 Switch hardware. This guide also provides basic troubleshooting solutions for potential hardware-related problems. The *CBX 500 Hardware Installation Guide* is intended for systems integrators and other qualified service personnel responsible for the installation of the CBX 500 Switch.

What You Need to Know

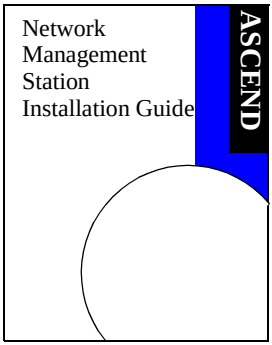
The procedures in this guide require you to understand and follow the safety practices at your site, as well as those identified in this guide. Before installing any hardware, check the installation location for adequate temperature, humidity, and electrical requirements. Chapter 2 describes the electrical, physical, and environmental specifications for the CBX 500. You should work closely with the Network Management Station (NMS) operator and other systems integration personnel to ensure a functional installation.

Documentation Reading Path

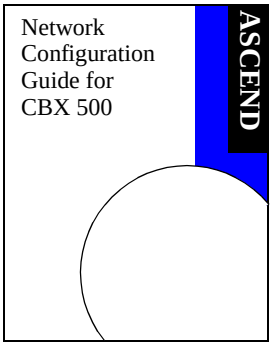
Use the following guides to install and manage the CBX 500 Switch:



Describes how to install, test, and troubleshoot the CBX 500 Switch hardware.



Describes how to install CascadeView and supporting applications on the Network Management Station (NMS).



Describes how to configure and manage a CBX 500 Switch network through CascadeView/UX.

How to Use This Guide

The following table summarizes the information in this guide.

Table 1. Chapter Contents

Read	To Learn About...
Chapter 1	The CBX 500 Switch and its interface and features.
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 supply, cooling-fan modules, and PCMCIA cards.
Chapter 7	How to determine hardware operational status and perform general troubleshooting. Also includes customer-support contact information (Technical Response Center).
Appendix A	The hardware IOP modules available for the CBX 500 Switch.
Appendix B	The various types of 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 and an example of the affidavit that must be filed with the Telco.
Appendix D	Switch processor (SP) redundancy features.
Appendix E	Terminology associated with the CBX 500 Switch and other data communications terms.

Related Documents

The following Cascade documents may be useful for reference:

- *Networking Services Technology Overview* (Product Code: 80001)
- *Network Management Station Installation Guide* (Product Code: 80014)
- *Network Configuration Guide for CBX 500* (Product Code: 80049)
- *Diagnostic and Troubleshooting Guide for CBX 500* (Product Code: 80050)
- *ATM Flow-Control Processor User's Guide* (Product Code: 80048)

For product codes and pricing information, contact your Cascade Account Manager.

Conventions

This guide uses the following conventions:

Convention	Indicates	Example
Blue boxes surrounding text	Notes and warnings.	See examples below.
Italics	Filenames, pathnames, directories, book titles, new terms, and emphasized text.	*Network Management Station Installation Guide*

Provides helpful suggestions or reference to materials not contained in this manual.

Warns the reader to proceed carefully in order to avoid equipment damage or personal harm.

Acronyms

Table 2 defines some commonly used acronyms.

Table 2. Acronyms

Acronym	Meaning
ABR	Available Bit Rate
ATM	Asynchronous Transfer Mode
CBR	Constant Bit Rate
CDV	Cell Delay Variation
CIT	Computer Integrated Telephony
CLR	Cell Loss Ratio
CPE	customer premise equipment
CSU	channel service unit
DCE	data communications equipment
DLCI	data link connection identifier
DSU	data service unit
DTE	data terminal equipment
DXI	Data Exchange Interface
EPD	Early Packet Discard
Gbps	gigabits per second
HDLC	High-level Data Link Control
ILMI	Interim Link Management Interface
IOA	I/O adapter
IOP	I/O processor

Table 2. Acronyms (Continued)

Acronym	Meaning
ISDN	Integrated Services Digital Network
Kbps	kilobits per second
LAP	Link Access Protocol
Mbps	megabits per second
MIB	Management Information Base
MPOA	Multiprotocol over ATM
NMS	Network Management Station
NNI	Network-to-Network Interface
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PAD	packet assembler/disassembler
PPP	Point-to-Point Protocol
PRAM	Parameter Random Access Memory
PRI	Primary Rate Interface
PVC	permanent virtual circuit
QoS	Quality of Service
RFC	Request for Comments
SLIP	Serial Line over Internet Protocol
SMDS	Switched Multimegabit Data Service
SNMP	Simple Network Management Protocol
SP	switch processor
SVC	switched virtual circuit

Table 2. Acronyms (Continued)

Acronym	Meaning
UBR	Unspecified Bit Rate
UIO	Universal Input/Output
UNI	User-to-Network Interface
VBR	Variable Bit Rate
VCC	virtual channel connection
VNN™	Virtual Network Navigator

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Overview

This chapter describes the CBX 500 Switch features, component modules, and architecture.

CBX 500 Product Description

The CBX 500 Switch provides Asynchronous Transfer Mode (ATM) services for public carrier and private networks. In a typical application, the 16-slot, high-performance CBX 500 is an ATM backbone switch, which provides standards-based ATM WAN services. The CBX 500 uses high port densities (up to 64,000 nodes per network), dedicated signal processing, advanced distributed processing, and network topology management. These features provide integrated access to the full range of ATM services and support a virtually unlimited number of end users.

The CBX 500 Switch extends Cascade's family of WAN switches with the capacity and throughput to support high-speed ATM network environments. This addition ensures that the Frame Relay, SMDS, and ATM services provided by Cascade B-STDX switches can scale to meet your growing network-traffic demands.

Features

The CBX 500 Switch provides the following features:

- Line speeds ranging from T1 to OC-12c
- VPC/PVC Point-to-Point and Point-to-Multipoint support
- ATM virtual channel connection (VCC) and internetworking services
- Cell rate monitoring for network accounting and design
- Thousands of virtual circuits per physical port, 16K virtual circuits per IOP module, and 240K virtual circuits per switch
- Guaranteed hardware multicast and Quality of Service (QoS)
- Expansive cell buffers per line card for bursty data traffic
- Support for flow-control processing enabling service providers to manage traffic proportionately on a per-circuit basis according to service agreements (refer to the *ATM Flow-Control Processor User's Guide* for details)
- Cascade's Call-Master™ Connection Admission Control (CAC)
- Protocol translation features
- Usage-based billing capability
- Congestion management, based on Cascade's Virtual Network Navigator™ (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
- Optional redundant switch processor (SP) and power supply for high-reliability networking

- 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)
- Flow-control processing support for ABR, UBR, and VBR-NRT service classes
- 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, NSAP, Data Country Code (DCC) ATM End System Addresses, and International Code Designator (ICD) ATM End System Addresses
- Encapsulated Forward Congestion Indicator (EFCI) marking and discard
- 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

Hardware Components

The CBX 500 has the following hardware components:

- Switch processor (SP)
- Switch processor adapter (SPA)
- Input/output processor (IOP)
- Input/output adapter (IOA)
- Power supply
- Cooling fan
- Optional air filters

Figure 1-1 shows the CBX 500 Switch.

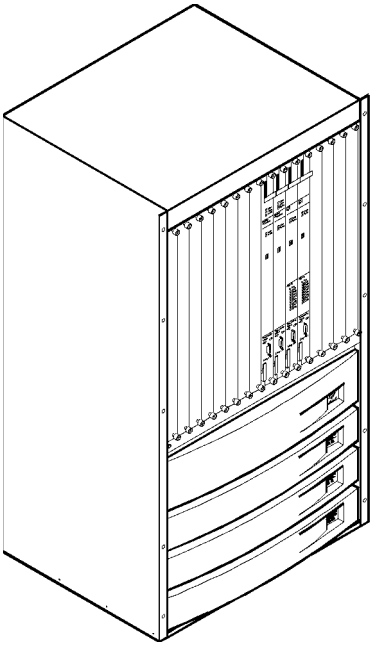

Figure 1-1. CBX 500 ATM Switch

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.

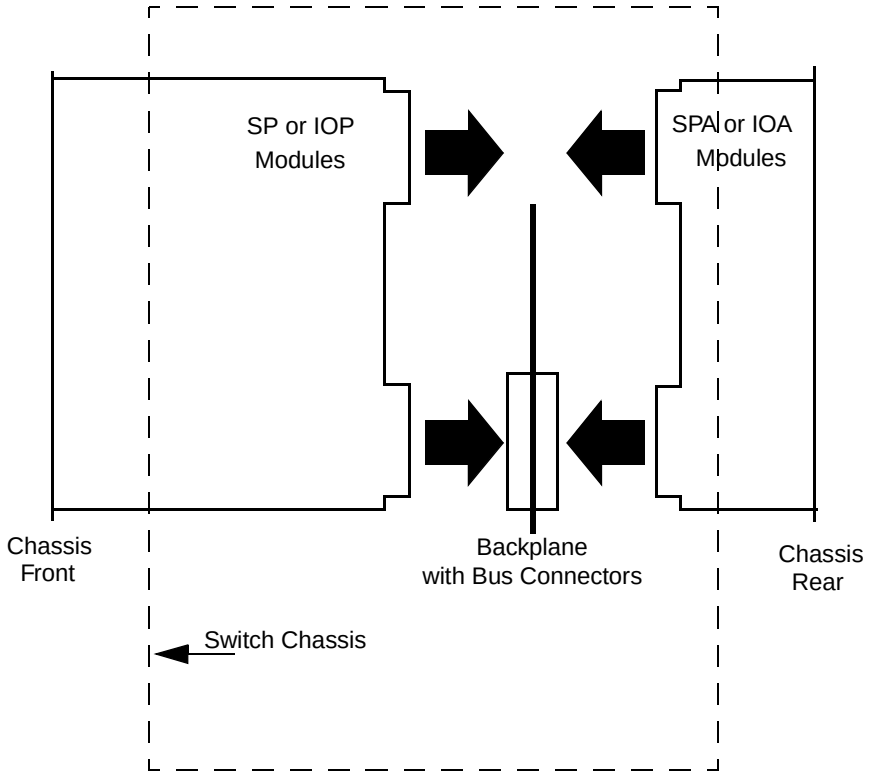

Figure 1-2. Relationship of SP and IOP Modules to Backplane

SP Modules

The SP provides background management and static networking functions for the IOPs. SPs are available in two models: The Model 10 supports throughputs up to 2.5 Gbps and the Model 20 supports throughputs up to 5 Gbps.

SPs have the following 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 (hot swapping)

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. Refer to Appendix D for details about how redundancy works on a CBX 500 Switch.

Table 1-1 shows the SP configurations that are supported on the CBX 500. Note that you cannot configure a switch with one Model 10 SP and one Model 20 SP. In a redundant SP configuration, both SPs must be the same model.

Table 1-1. Supported Redundant SP Configurations

Slot 1 SP	Slot 2 SP
Model 10	Empty
Empty	Model 10
Model 10	Model 10
Model 20	Empty
Empty	Model 20
Model 20	Model 20

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). The IOPs can also communicate with each other, and the SPs, via a separate backplane connection. All IOP modules are supported on both the Model 10 and Model 20 switch. When upgrading (or downgrading) your switch, you do not have to replace the IOP modules. Table 1-2 lists the IOP modules supported on the CBX 500 Switch and identifies the port speed and port capacity for each module type.

Table 1-2. CBX 500 IOP Modules

IOP Module	Port Speeds	Port Capacity
DS3	44.738 Mbps	8 DS3 ports (up to 112 ports per Model 20 switch; up to 48 ports per Model 10 switch)
E3	34.386 Mbps	8 E3 ports (up to 112 ports per Model 20 switch; up to 48 ports per Model 10 switch)
OC-3c/STM-1	155.52 Mbps	4 OC-3c/STM-1 ports (up to 56 ports per Model 20 switch; up to 24 ports per Model 10 switch) (optical and electrical)
OC-12c/STM-4	622 Mbps	1 OC-12c/STM-4 port (up to 14 ports per Model 20 switch; up to 6 ports per Model 10 switch)
T1	1.544 Mbps	8 T1 ports (up to 112 ports per Model 20 switch; up to 48 ports per Model 10 switch)
E1	2.048 Mbps	8 E1 ports (up to 112 ports per Model 20 switch; up to 48 ports per Model 10 switch)

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).

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.

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Specifications and Safety Warnings

This chapter describes CBX 500 Switch specifications and safety warnings relating to the use of this equipment. Specifications include:

- Electronic/Electrical
- Physical
- Site

Electronic/Electrical Specifications

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 power level for each type of power supply. Table 2-1 describes CBX 500 Switch electronic/electrical specifications.

Table 2-1. CBX 500 Electronic/Electrical Specifications

Application	Specification
90-132 VAC	90-132 VAC, 12 amps max, 1440 watts max, 50-60 Hz, single phase
180-264 VAC	180-264 VAC, 7.5 amps max, 1440 watts max, 50-60 Hz, single phase
-48 VDC	-48 to -60 VDC, 70 amps max, 2880 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, E3, OC3c/STM-1 (optical and electrical), OC12c/STM-4
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

Operating Environment

Table 2-3 describes the environmental requirements for selecting an installation site for the CBX 500 hardware. The site requirements are based on Network Equipment Building System (NEBS) GR-1063-CORE and GR-1089-CORE.

Table 2-3. CBX 500 Site Specifications

Parameter	Requirement
Ambient Operating Temperature	0°C to +50°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

Product Information and Warnings

This equipment is approved by Cascade for operation in the following environment when installed per the requirements in this chapter:

Temperature Range	0° to 50°C
Humidity	10-80% (noncondensing)
Atmospheric Pressure	10,000 ft (3050 m)
Power Input Range	AC version: 100 to 240 VAC at 50 to 60 Hz DC version: -40 to -60 VDC

DC Power Supply Warnings

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 Electric 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 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.

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.

5. The wall circuit breaker provides the main protection for the unit. For 100-120 VAC operation, the unit must reside on its own circuit with a breaker rated for 15A. For 200-240 VAC operation, the unit must reside on its own circuit with a breaker rated for 10A. In redundant power situations, both cords can be plugged into the same circuit. However, if separate circuits are desired, each power supply must reside by itself on its own circuit.

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.

5. Le coupe-circuit muraille fournit la protection principale pour le système. Pour l'opération 100-120 VAC le système doit résider sur son propre circuit avec un disjoncteur courant nominal 15A. Pour l'opération 200-240 VAC le système doit résider sur son propre circuit avec un disjoncteur courant nominal 10A. En situation de pouvoir rédondant les deux cordons peuvent être branché dans le même circuit. Cependant, si on desire des circuits séparés, chaque cordon doit résider sur son propre circuit.

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.
- Die Haushaltssicherung stellt die Hauptsicherung für das Gerät dar. Bei 110-120V Betrieb muß die Einheit mit 15A, bei 220-240V Betrieb mit 10A intern abgesichert sein. Wenn beide Netzteile verwendet werden sollen, können beide Zuleitungen in den Stromkreis eingesteckt werden. Wenn getrennte Stromkreise erwünscht sind können die Netzteile auch an getrennten Stromkreisen angeschlossen werden.

Achtung: *Dieses Gerät hat mehr als eine Zuleitung. Um einen elektrischen Strom-schlag zu vermeiden muß die entsprechende Strom-Zuleitung vor der Wartung vom Netz getrennt werden.*

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 that 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 CBX 500 hardware components and the corresponding Accessory Kit. This chapter also describes the preparations and prerequisites for installing the switch.

Selecting the Installation Site

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

Select the setup location carefully. Keep in mind that the switch requires proper 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 “Setting Up the Switch” on page 4-2.

Unpacking the Switch

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).

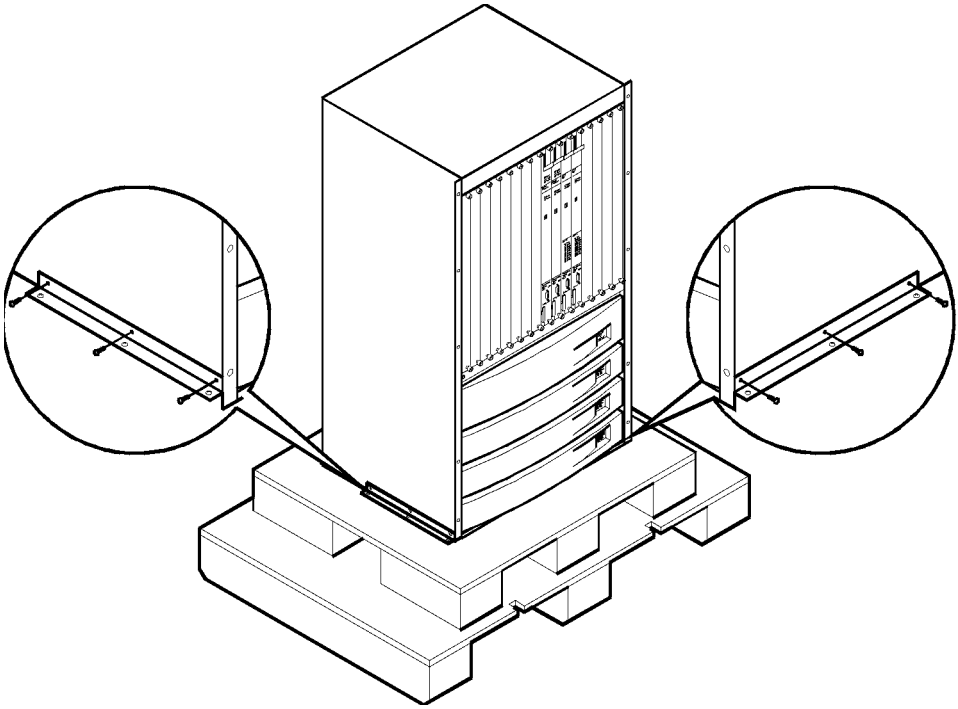


Figure 3-1. CBX 500 Switch, Typical Shipping Configuration

Before you remove the CBX 500 Switch from the shipping carton and delivery pallet, check it for damage. If you see any damage, follow the instructions described in "If the Product Is Damaged" on page v.

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

A fully configured switch weighs up to 200 pounds. To avoid potential injury, use a hand lift for moving or rack-mounting 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 screwdriver, remove the screws from the L-brackets on the delivery pallet.
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 Hardware Installation Guide*, Product Code: 80011

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

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

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 down load installation scripts to the switch.
- An ASCII/VT100 console terminal or equivalent that runs at 19,200 bps and can down load 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 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).

Verifying the Hardware Configuration

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.

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

Wear an antistatic strap before handling any of the switch components (an antistatic strap is provided in the Accessory Kit).

The cable connectors and power supply inlets are also located at the back of the chassis. An ESD grounding jack (banana jack) is located at the bottom right corner for installing the antistatic wrist strap.

Checking the SP Modules

Figure 3-2 shows the front slots of the CBX 500 and an example configuration that includes a redundant SP module.

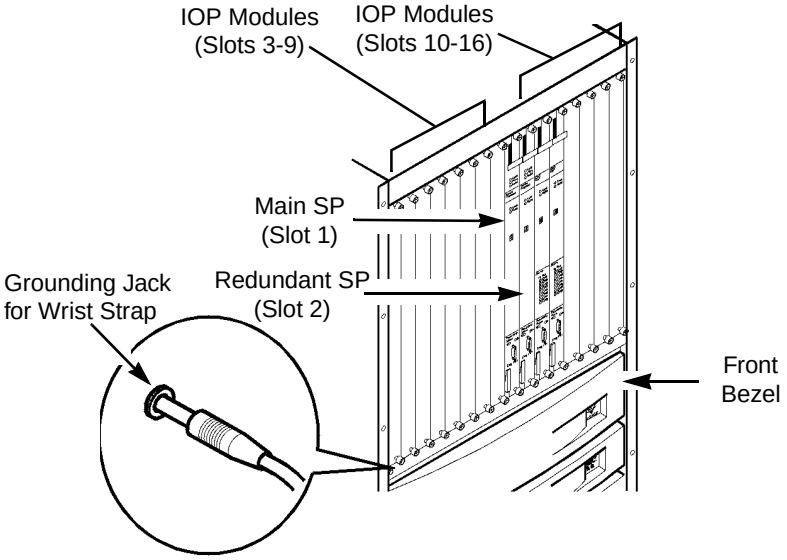


Figure 3-2. Front View of the CBX 500

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 SPs are the same model (both Model 10 or both Model 20). Also verify that they are the model type you ordered.

Checking the IOP Modules

If you have a Model 10 switch, Slots 7 through 12 contain the IOP modules. (Note that Slots 3 through 6 and Slots 13 through 16 cannot be used in a Model 10 switch.) If you have a Model 20 switch, Slots 3 through 16 contain the IOP modules.

Slots that are not occupied by 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.

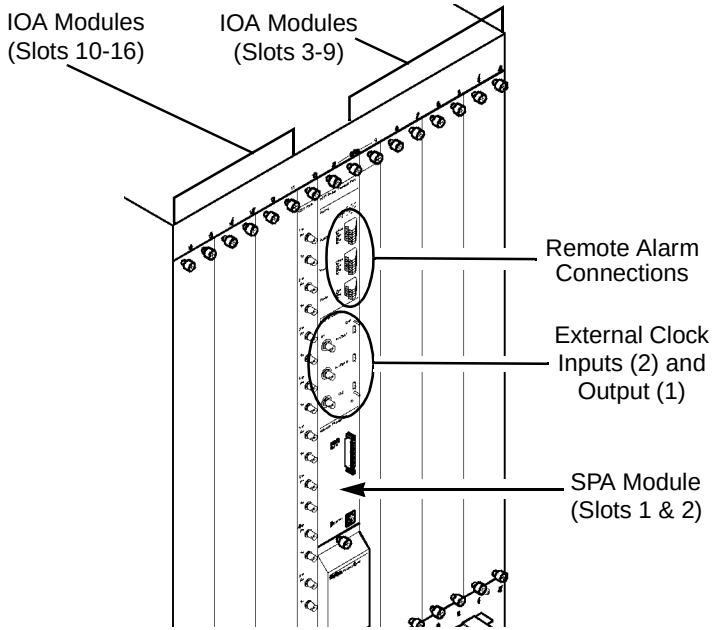


Figure 3-3. CBX 500 Showing SPA and IOA Module Locations

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.

Check the PCMCIA Configuration

Figure 3-4 shows the location of the PCMCIA bay on the SPA. Note that there are four PCMCIA slots in this bay.

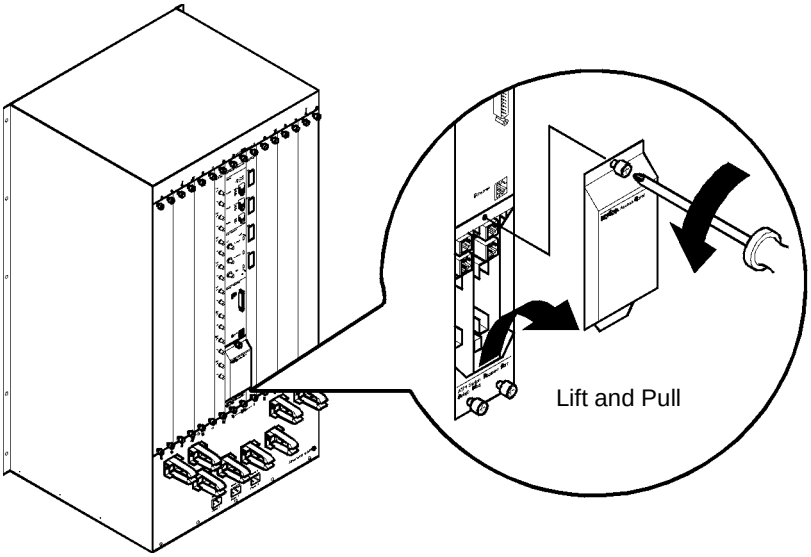


Figure 3-4. PCMCIA Card Bay

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 (i.e., two SPs), there are two pairs of Ethernet and IDE hard drive cards.

The Ethernet card(s) are connected via an internal cable 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 provides step-by-step instructions for setting up and installing the switch. This chapter also describes how to:

- Connect the switch (gateway switch) to a SPARCstation (Network Management Station (NMS))
- Connect an ASCII/VT100 console terminal to the switch

Before you begin, verify the following tasks are complete:

- ☑ Select the installation site
- ☑ Unpack the switch
- ☑ Unpack the Accessory Kit
- ☑ Gather the tools and equipment needed for installation
- ☑ Check the module configuration in the switch

Setting Up the Switch

Position the switch for installation keeping in mind that all cables connect 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 involved for each method of installation.

As a Free-Standing Switch

Position the switch on the selected flat surface. Remember that all cables connect to the back of the switch and the switch requires proper ventilation. (Refer to Chapter 2 for ventilation and cable space requirements.)

As a Rack-Mounted Switch

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

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

Determine whether you want the switch to be flush-mounted or mid-mounted into the cabinet. The switch is delivered with 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 Cascade. For a current product code/price list, contact your Cascade Account Manager.

The weight and position of the CBX 500 Switch within the cabinet may make the cabinet top-heavy or unstable. Take all necessary precautions to anchor the cabinet securely before installing the switch. This is particularly important with mid-mount installations.

Installing the Mid-Mount Brackets

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

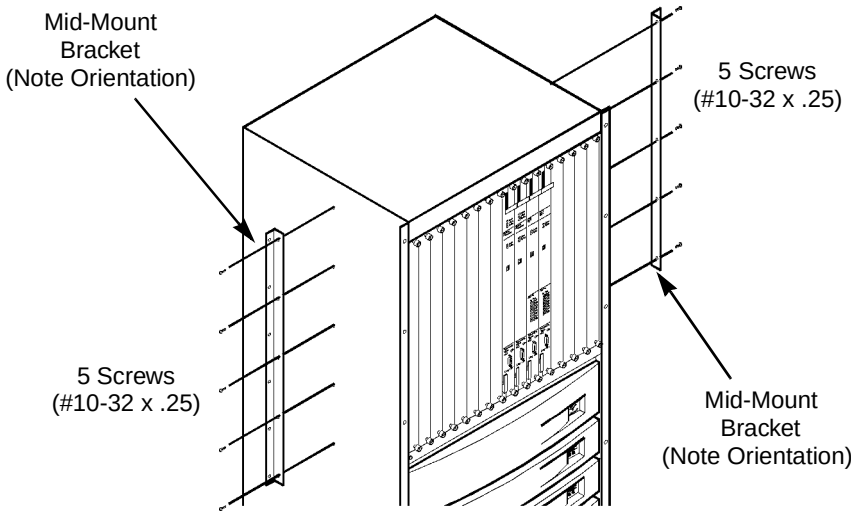


Figure 4-1. Installing Mid-Mount Brackets

To install 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. Note the bracket's proper orientation as shown in Figure 4-1.
2. Using a #2 Phillips screwdriver, install the five #10-32 x .25 truss head screws that came with the brackets through the mid-mount bracket holes into the switch.
3. Repeat Steps 1 and 2 to install the second mid-mount bracket onto the other side of the switch.

Failure to use the proper screws may damage the switch.

Installing the Switch into the Cabinet

The procedure for rack-mounting the switch requires more than one installer. Because a fully configured switch weighs up to 200 pounds, Cascade recommends using 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 or three installers).
2. Align the six screw holes on the mounting bracket with the screw holes on the equipment cabinet.
3. Install truss head screws of the appropriate size through the mount bracket on the switch into the mount bracket on the equipment cabinet using a #2 Phillips screwdriver.

Connecting Cables to the Switch

Once the switch is set up 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 needed to connect the switch to the NMS or console. Refer to Appendix B 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 provides a means for the NMS to manage the switch through a single router or through an ATM network interface card (NIC) UNI-DCE connection.

Figure 4-2 shows the CBX 500 Switch connected to an NMS and console terminal.

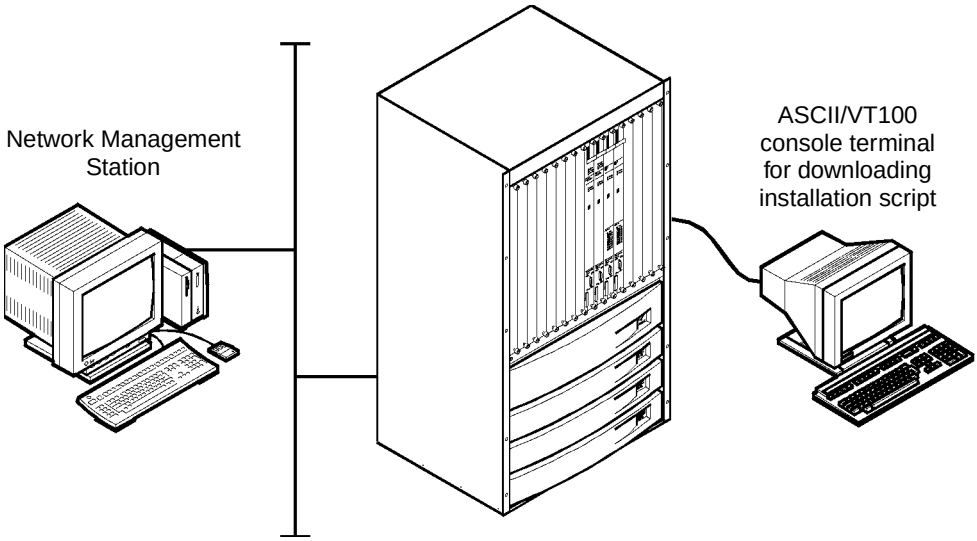


Figure 4-2. CBX 500 Switch Connected to NMS and Console Terminal

Connecting the Console

Figure 4-3 shows a cable connection from the switch to the console terminal.

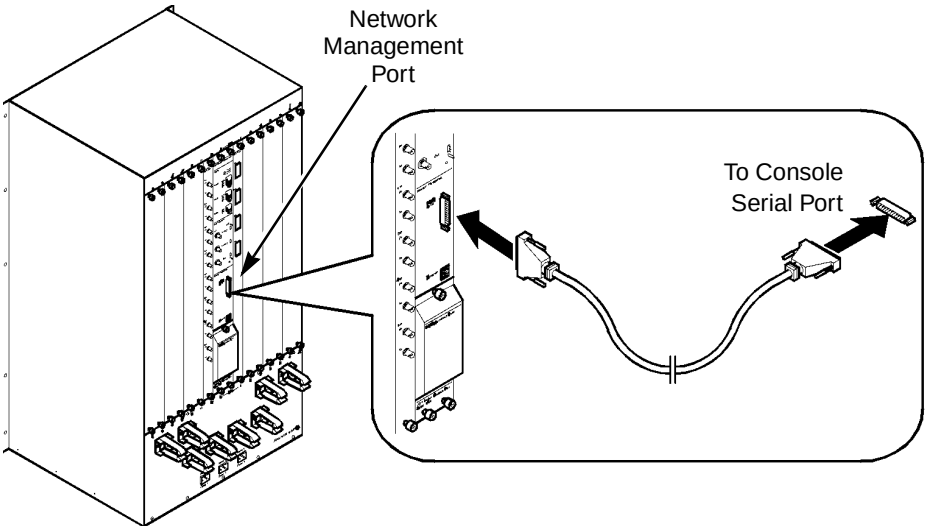


Figure 4-3. Console Connection to CBX 500 Switch

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.

For a remote dial-up connection from the console to the switch, use the RS-232 shielded straight-through cable (refer to Appendix B).

Refer to Appendix B for detailed information about the cables used to 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; otherwise proceed to Chapter 5, "Determining the Operating Status".

For information on the hardware requirements and appropriate configuration for your NMS workstation, refer to the *Network Management Station Installation Guide*. Once you have the appropriate hardware, you can begin installing the OS and network management software.

The SPARCstation(s) you are using for network management should be dedicated for that purpose. Using the NMS hardware for other tasks slows the performance of the network management functions. To install the OS and the network management software for use in configuring, monitoring, and controlling the Cascade network, refer to the *Network Management Station Installation Guide* and the *Network Configuration Guide for CBX 500*.

After installing the OS and network management software, you can connect the NMS to the switch using the instructions 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.

Indirect Ethernet — Connects the switch and the NMS when they are on separate LANs. This option requires a router.

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. Refer to the *Network Configuration Guide for CBX 500* for information about configuring a Management VPI/VCI connection.

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. Refer to the *Network Configuration Guide for CBX 500* for information about configuring a Management PVC connection.

Direct or indirect Ethernet is recommended as the primary connection method from the NMS to the switch.

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

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

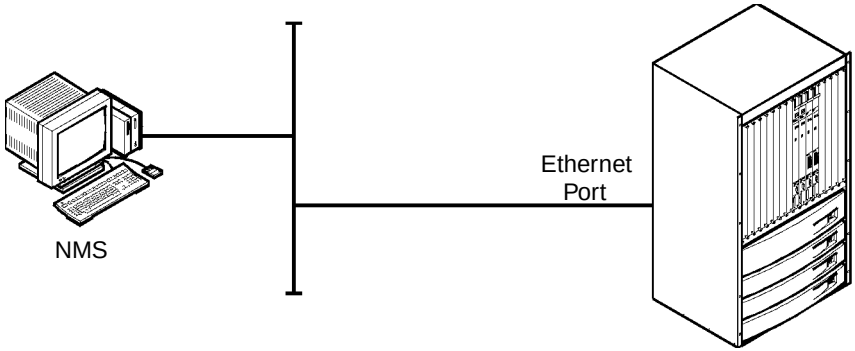


Figure 4-4. Direct Ethernet Method

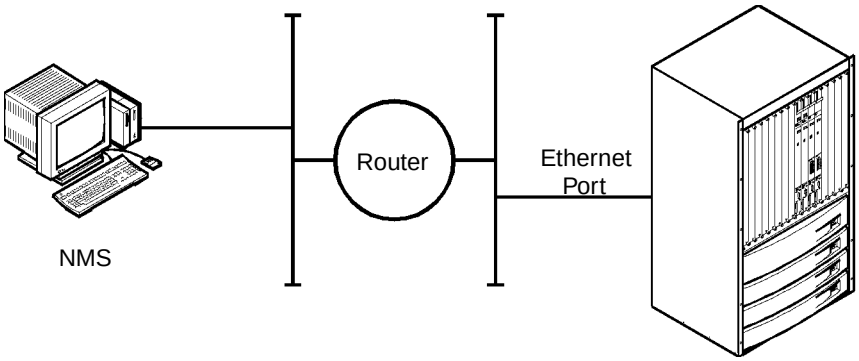


Figure 4-5. Indirect Ethernet Method

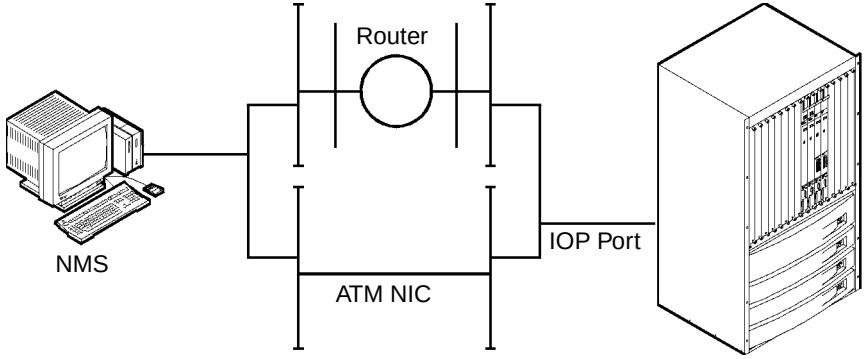


Figure 4-6. Management VC/PVC Method

Using Direct Ethernet

Figure 4-7 shows how to make a direct Ethernet connection from the switch to the NMS.

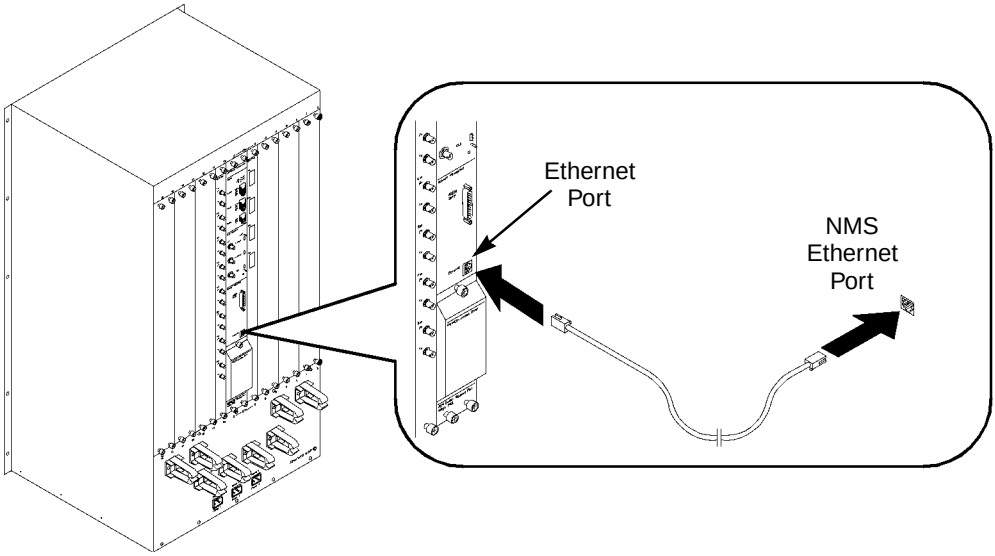


Figure 4-7. Direct Ethernet Connection

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 the Ethernet transceivers are properly connected to the network.

Using Indirect Ethernet

Figure 4-8 shows an indirect Ethernet connection from the switch to the NMS.

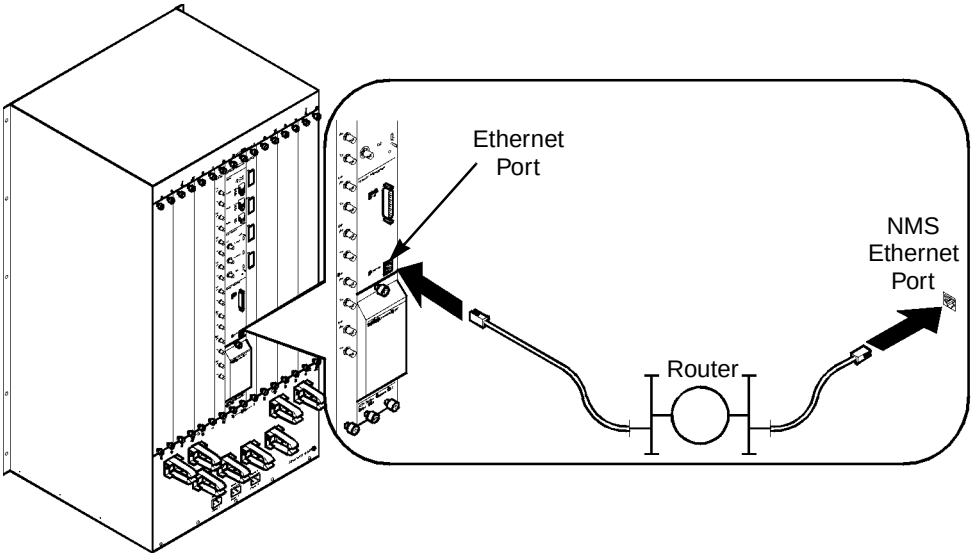


Figure 4-8. Indirect Ethernet Connection

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 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 4-9 shows a Management VC/PVC connection.

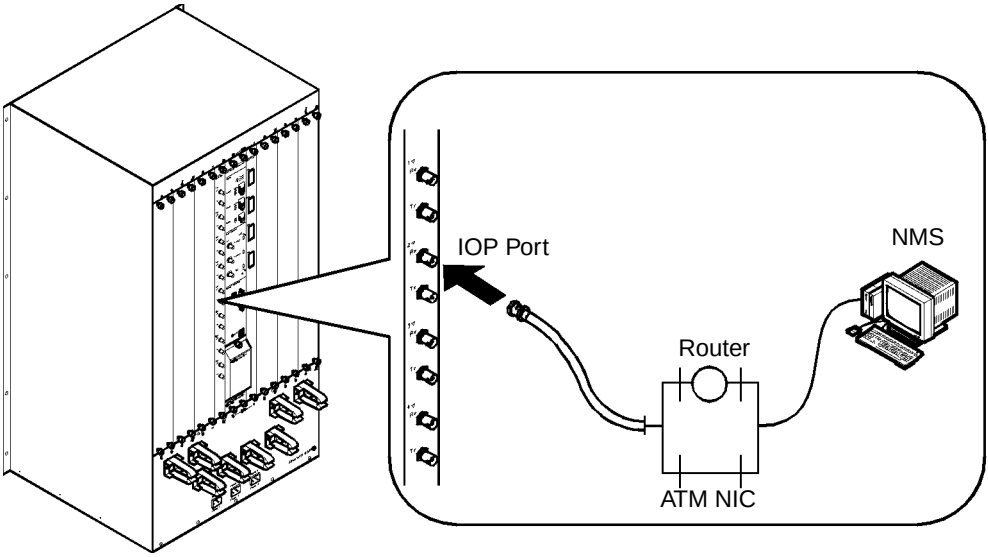


Figure 4-9. Management VC/PVC Connection

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). Refer to the *Network Configuration Guide for CBX 500* for instructions.
3. Configure the switch to route management traffic through the designated Management VC/PVC connection. Refer to the *Network Configuration Guide for CBX 500* for instructions.
4. Configure the router or ATM NIC with a “static route” to the Cascade 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, refer to the *Network Configuration Guide for CBX 500*.

> *Through CascadeView/UX software, you can configure the clock sources and clock-source priorities. For example, you can adjust the line buildouts over a range of 0 to 655 feet for T1 timing outputs. You cannot adjust the line buildouts for E1 timing outputs. For instructions, refer to the* Network Configuration Guide for CBX 500.

Figure 4-10 shows the location of the clock inputs/outputs on the SPA module.

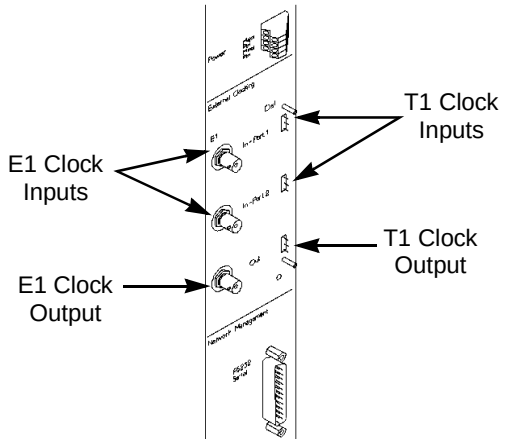


Figure 4-10. External Clock Inputs and Clock Outputs

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 4-11. These alarm relays alert you to critical, major, and minor alarm conditions in the switch. The alarm conditions are (from top to bottom):

- Critical Switch Error Condition (connects to audible alarm)
- Major Switch Error Condition (connects to audible alarm)
- Minor Switch Error Condition (connects to audible alarm)
- Critical Switch Error Condition (connects to visual alarm)
- Major Switch Error Condition (connects to visual alarm)
- Minor Switch Error Condition (connects to visual alarm)
- Major Switch Error Condition (connects to power relay)
- Minor Switch Error Condition (connects to power relay)

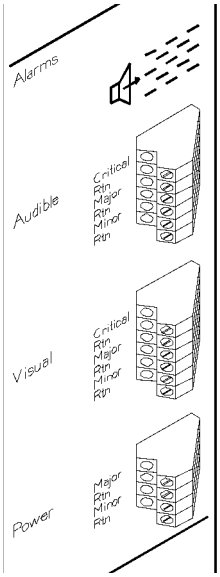


Figure 4-11. Remote Alarm Terminals

To connect a remote alarm:

1. Locate the appropriate terminal for the alarm connection 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.

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 connection 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%	50m

5

Determining the Operating Status

This chapter describes how to do the following:

- Interpret the LEDs on the modules to determine their operating status
- Connect power to the switch
- Power up the switch

Before you begin, verify that the following tasks are complete:

- ☑ Set up the switch hardware (either as a free-standing or rack-mounted unit)
- ☑ Connect cables and console terminal to the switch
- ☑ Set up NMS
- ☑ Connect the NMS to the switch
- ☑ *(Optional)* Connect the external clock source inputs and outputs
- ☑ *(Optional)* Connect the remote alarms

Status LEDs

The status LEDs on the modules in the CBX 500 indicate the operating status of the switch and each module. The condition of each status LED is sent back to, and can be displayed on, 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, not the SP module itself.

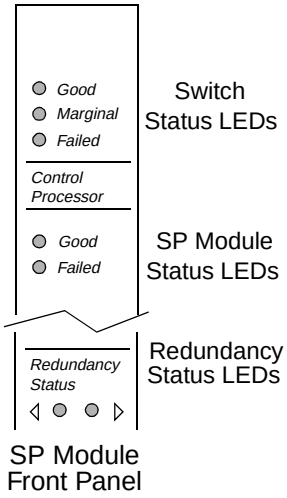


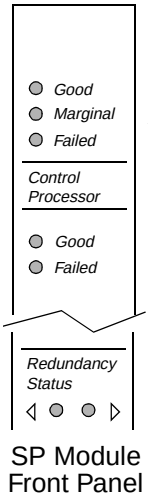
Table 5-1. Switch Status LEDs on SP Module

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

Table 5-2. Module Status LEDs

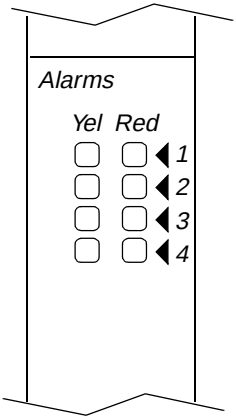


LED Condition	Indicates
Good (Green) ON	The module is fully operational; no errors have been detected.
Failed (Red) ON	The module detected an operational error condition. Contact the Technical Response Center for assistance (see page 7-6).
Good and Failed BLINKING	The OS software image is currently being 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	A loss of signal has been detected at downstream equipment on the circuit for the indicated port.
Red Alarm BLINKING (also called a Blue Alarm)	A downstream equipment failure has been detected on the circuit for the indicated port.
Red Alarm ON	A loss of signal has occurred on the port.

During the boot process, which follows a cold boot or power cycle, the good/failed LEDs on the IOPs change states according to the schedule shown in Table 5-4:

Table 5-4. IOP LED State During Boot Process

IOP State	IOP Good (Green) LED	IOP Failed (Red) LED
Extended POST failure	Off	Flashing slowly, one second on, then one second off
Boot Flash image update from the hard disk	Continuously on	Flashing 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	Flashing	Off
PRAM image being read from hard disk	On/off in sequence that alternates with Failed LED	On/off in sequence that alternates with Good LED
PRAM image being uncompressed	Flashing	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 a member of a redundant pair.

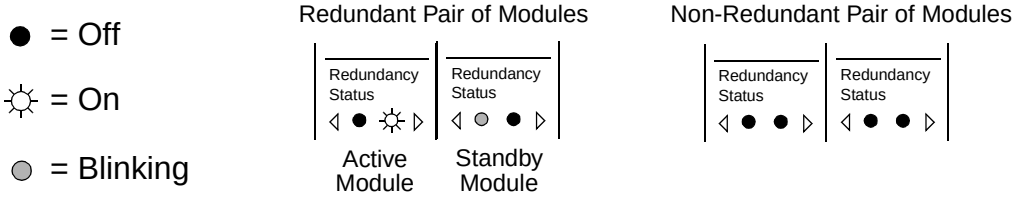


Figure 5-1. Redundancy Status LEDs

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.

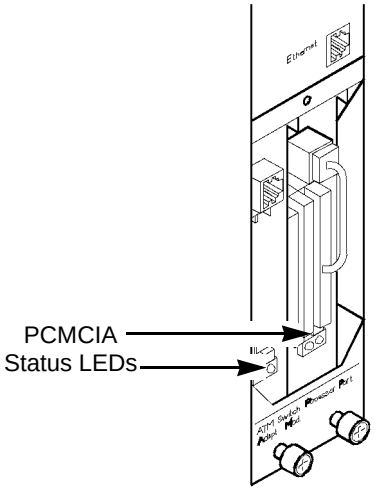


Figure 5-2. PCMCIA Status LEDs

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. 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.

Connecting Power to the Switch

The CBX 500 is powered by either two AC or two DC power supplies. This section describes how to connect both AC and DC power supplies. In addition, an optional third power supply can be installed for redundancy, ensuring 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. (Refer to Chapter 2, "Specifications and Safety Warnings", for power specifications.)

Before connecting the AC power cords, refer to "Electronic/Electrical Specifications" on page 2-2. Also, refer to 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.

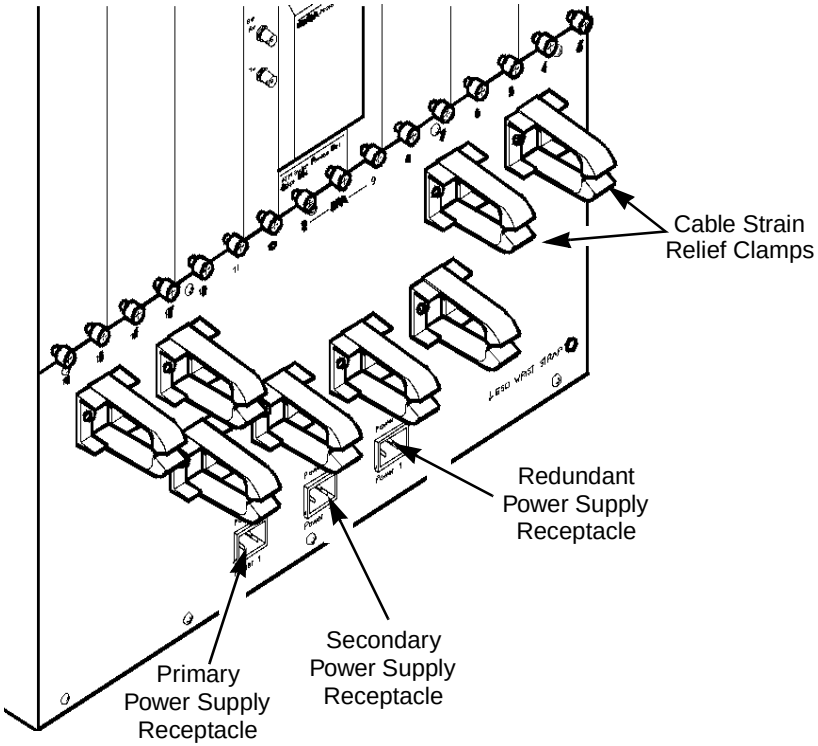


Figure 5-3. Connecting an AC Power Supply

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. (Refer to Chapter 2, "Specifications and Safety Warnings", for power specifications.)

> *Before connecting the power cords, refer to "Electronic/Electrical Specifications" on page 2-2. Also, refer to Appendix C for circuit regulatory information.*

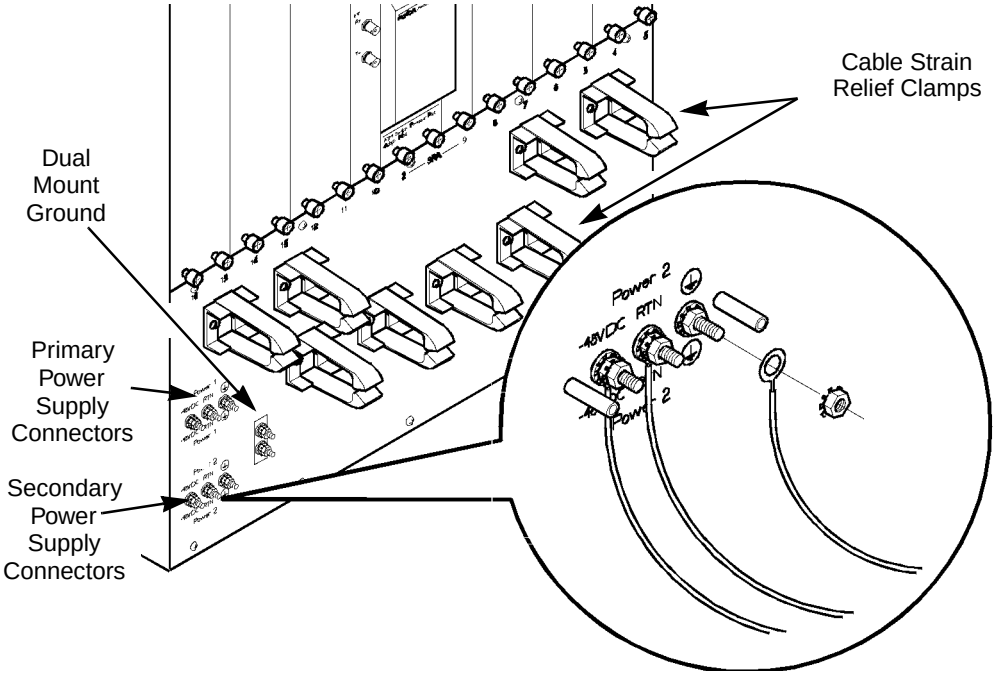


Figure 5-4. Connecting the -48 VDC Power Supplies

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.

The DC power cord wires should terminate in 1/4-in. diameter ring lugs. Also, the wire gauge you use depends on the distance from the connection point.

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 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.

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 5-8).

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.

3. Insert the 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 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

Before proceeding, check the SP modules to ensure they are both the same type (both Model 10 or both Model 20). If they are not the same, do not power up the switch; either remove one of the SP modules, or contact the Cascade Technical Response Center for assistance (see page 7-6).

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

The switch initializes by performing its 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 speed of the blinking 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 stays on. The SP card is now operational.

The state of the other LEDs depends on whether or not 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 no configuration is present on the switch. Also, the Good LED on each IOP module blinks. For information about configuring the switch, refer to the *Network Configuration Guide for CBX 500*.

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?

Once the hardware installation is complete and the switch is powered up, you can download the software configuration to the switch.

For instructions on how to install and configure the NMS on a UNIX platform, refer to the *Network Management Station Installation Guide*.

For instructions on downloading the installation script and configuring the switch through CascadeView/UX, refer to the *Network Configuration Guide for CBX 500*.

6

Installing or Removing Modules

This chapter describes how to install, remove, and replace the following:

- SP and SPA modules
- PCMCIA cards
- IOP and IOA modules
- Power supply modules
- Cooling fan modules
- Optional air filters

Installation and Replacement Considerations

The CBX 500 Switch design enables you to install, remove, and replace most modules without shutting off the switch. However, you may choose to power down the switch as a precaution, if the switch is not currently operational.

1.) Never attempt to repair parts or modules yourself. Return all defective modules to Cascade for repair. Only Cascade-trained service representatives are authorized to service parts.

2.) Never attempt to remove or install modules without using appropriate static guard measures. Cascade includes a grounded wrist strap in the Accessory Kit.

3.) If the switch is not powered down, an electrical energy hazard will be present within the card cage. Remove all metallic objects from hands and wrist to prevent bridging of live contact points.

Replacing and Installing Switch Processors

1.) You cannot hot swap the main SP module on an operational switch unless a redundant SP module is installed and active at replacement. Hot-swap replacement of the active SP module is not allowed.

2.) If the switch contains a redundant SP configuration, and only one of the SP modules is being replaced, verify that the module being replaced is not the active card. If it is the active card, perform a "switch to redundant card" operation via the NMS before continuing (refer to the Network Configuration Guide for CBX 500*).*

Removing an SP Module

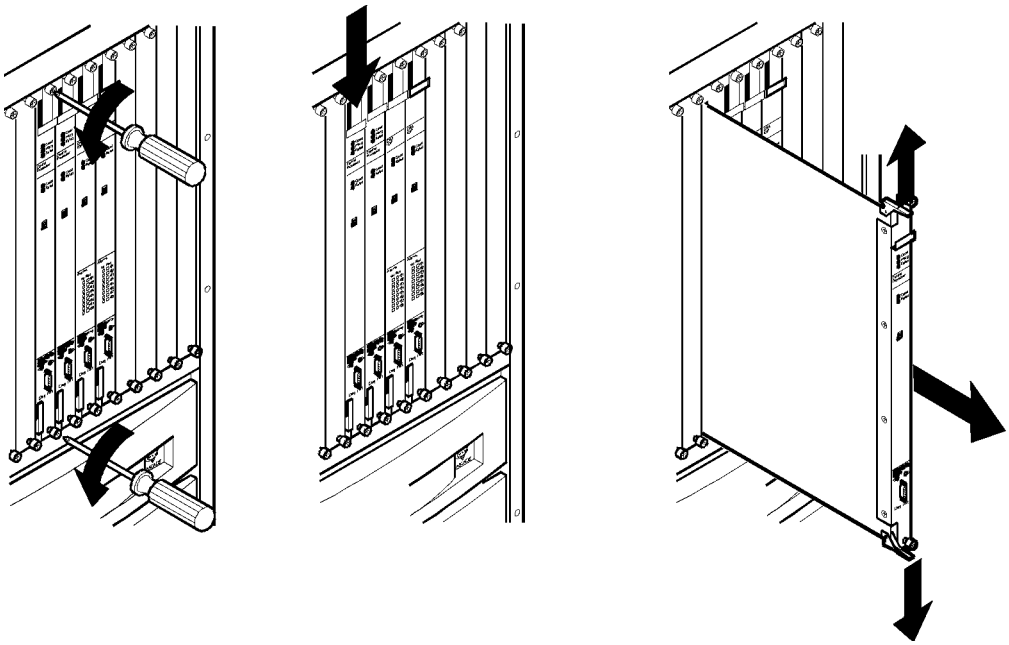


Figure 6-1. Removing a Switch Processor Module

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 screwdriver, loosen the thumb screws 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

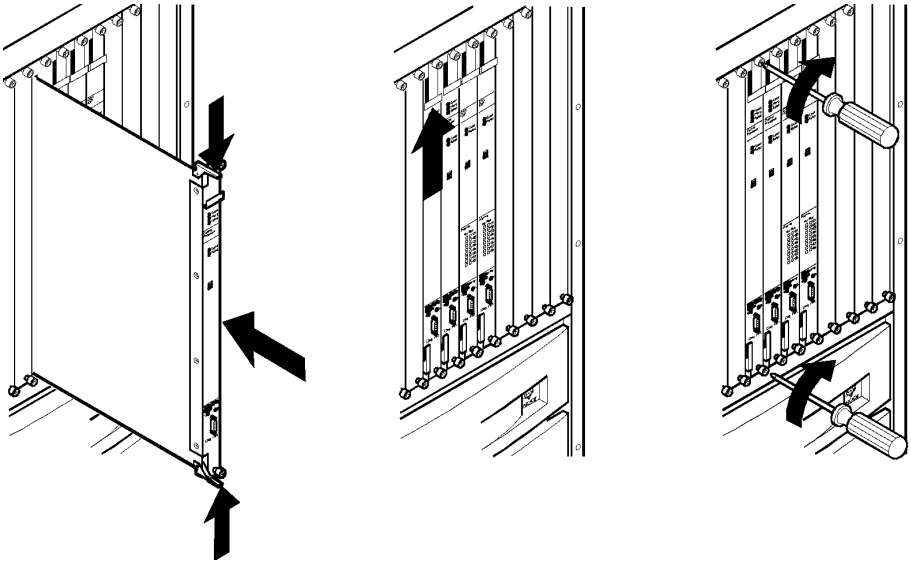


Figure 6-2. Installing an SP Module

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 screwdriver, tighten the two thumb screws.
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 that 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.

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

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 screwdriver to loosen the thumb screws, 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 screwdriver, secure the module into the chassis by tightening the two thumb screws.
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 the card is in standby mode. The active SP's Redundancy Status LED should be solid green, indicating the card is in active mode.

9. Configure the switch for a redundant SP configuration via the NMS software. For instructions, refer to the *Network Configuration Guide for CBX 500*. Note that 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.

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.

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

To replace the SPA:

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. 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 screwdriver, loosen the thumb screws located on the top and bottom of the SP module. Failure to use a #2 Phillips 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. Tag the cables and wires for identification and reconnection.

5. Using a #2 Phillips screwdriver, loosen the two thumb screws on the top of the SPA and the two thumb screws at the bottom of the SPA. Figure 6-3 shows the procedure for removing the SPA module from the back of the switch.

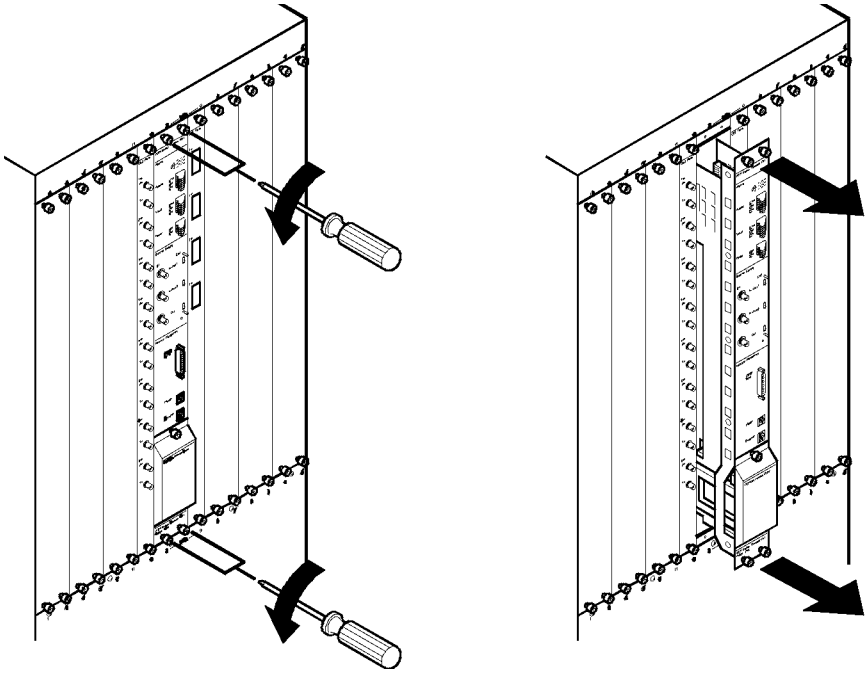


Figure 6-3. Removing the SPA Module

6. Holding on to the thumb screws for leverage, carefully slide the SPA module out of the switch and place it into an antistatic container.

7. Align the replacement SPA module with the card guides and slide it into the switch.

8. *Hand tighten* the thumb screws on the SPA.

9. Reconnect the external cables and wires, and remove the tags you placed on them.

10. In the front of the switch, install the SP(s). Make sure that you push the ejector lock up and tighten the thumb screws.

11. On the back of the switch, finish tightening the thumb screws 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 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.

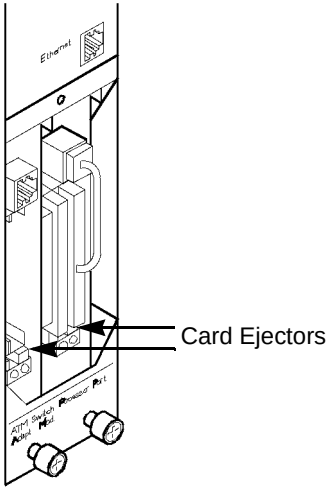


Figure 6-4. PCMCIA Card Bay

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), line the card edge up 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, refer to Chapter 5). After several minutes, the green Good LED on the SP(s) 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 screwdriver, tighten the screw at the top of the PCMCIA cover.

Installing and Replacing PCMCIA Cards

You may remove and replace the PCMCIA cards with the switch powered on. To remove the PCMCIA cards from the SPA module:

1. Using a #2 Phillips screwdriver, loosen the screw at the top of the PCMCIA cover.
2. Remove the cover by lifting it up and away from the switch.
3. Disconnect the cable on the Ethernet card from the socket on the SPA.
4. Push the square, flat black buttons at the bottom of each PCMCIA card to eject the cards. After the cards are removed, make sure they remain guarded against static discharge.

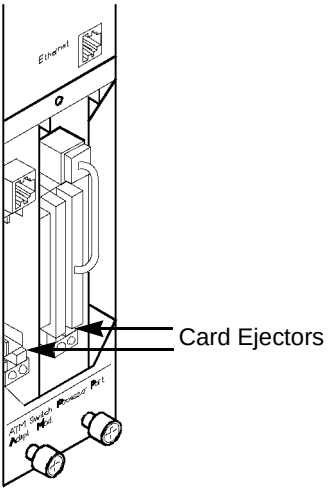


Figure 6-5. PCMCIA Card Slot Configuration

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.)

5. 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), line the card edge up 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.

6. Restore power to the switch.

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

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

9. Slide the PCMCIA cover back into position, and using a #2 Phillips screwdriver, tighten the screw at the top of the PCMCIA cover.

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 prior to installing the IOP module that it supports.

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

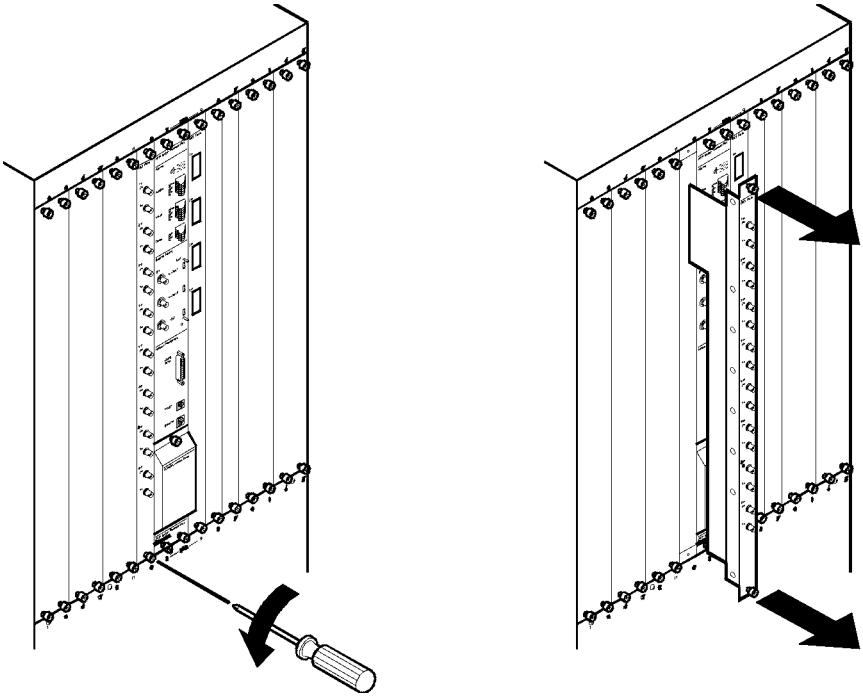


Figure 6-6. Removing IOA Modules

Installing IOA Modules

To install an IOA 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. Complete this step only if there is an IOP module installed for the IOA. You must disengage the IOP from the backplane before the IOA is installed.
   a. Using a #2 Phillips screwdriver, loosen the thumb screws 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 thumb screws. The screws are fully tightened only after the IOP is installed.

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

Replacing IOA Modules

Any circuits running through the IOP module are terminated when the module is removed, which may result in possible data loss. Cascade recommends setting the IOP module's Administrative Status to Down via the NMS before removing the module from the switch. For instructions, refer to the Network Configuration Guide for CBX 500.

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 screwdriver, loosen the thumb screws 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 cable(s) for identification and reconnection.
6. Using a #2 Phillips screwdriver, loosen the thumb screws at the top and bottom of the IOA.
7. Grasp the thumb screws 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, lining it up with the card guides.
9. Gently slide the module into the card guide, and *hand-tighten* the thumb screws 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, refer to "Installing and Replacing IOP Modules" on page 6-15 for instructions.)

11. Return to the back of the switch and secure the IOA module by tightening the thumb screws at the top and bottom of the module.

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

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

13. If necessary, synchronize the IOP card from the NMS. For instructions, refer to the *Network Configuration Guide for CBX 500*.

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

Installing and Replacing IOP Modules

IOP modules may be installed in Slots 7 through 12 in Model 10s, and Slots 3 through 16 in Model 20s. Slots 1 and 2 are reserved for SP modules only.

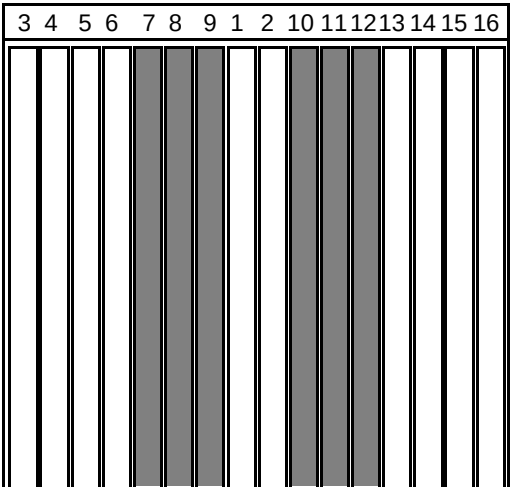


Figure 6-7. IOP Slots in the Model 10

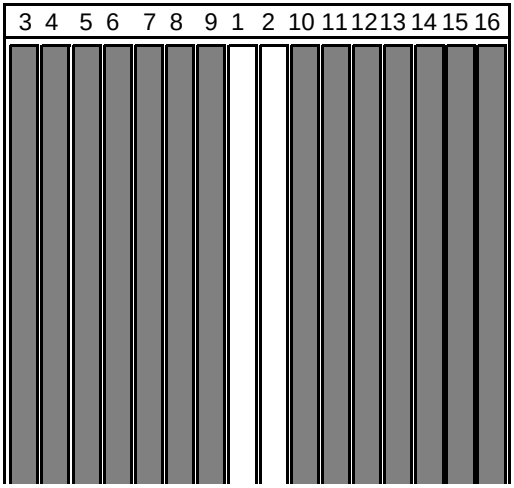


Figure 6-8. IOP Slots in the Model 20

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 section.

Installing a New IOA Module

Unused IOA slots contain blank filler covers.

1. Put on an antistatic wrist strap (one is 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 thumb screws.

Installing a New IOP Module

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 it has engaged the backplane connectors.
3. Depress the ejectors simultaneously.
4. Slide the card ejector lock up.
5. Using a #2 Phillips screwdriver, secure the IOP module by tightening its thumb screws.
6. Using a #2 Phillips screwdriver, secure the IOA module by tightening the thumb screws.
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.

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

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 prior to downloading the application code. The IOP card may reboot several times before the download process completes. Please be patient.

When the Good LED on the IOP is flashing slowly, the NMS operator can synchronize the IOP card. For instructions, refer to the *Network Configuration Guide for CBX 500*.

Replacing an IOP Module

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

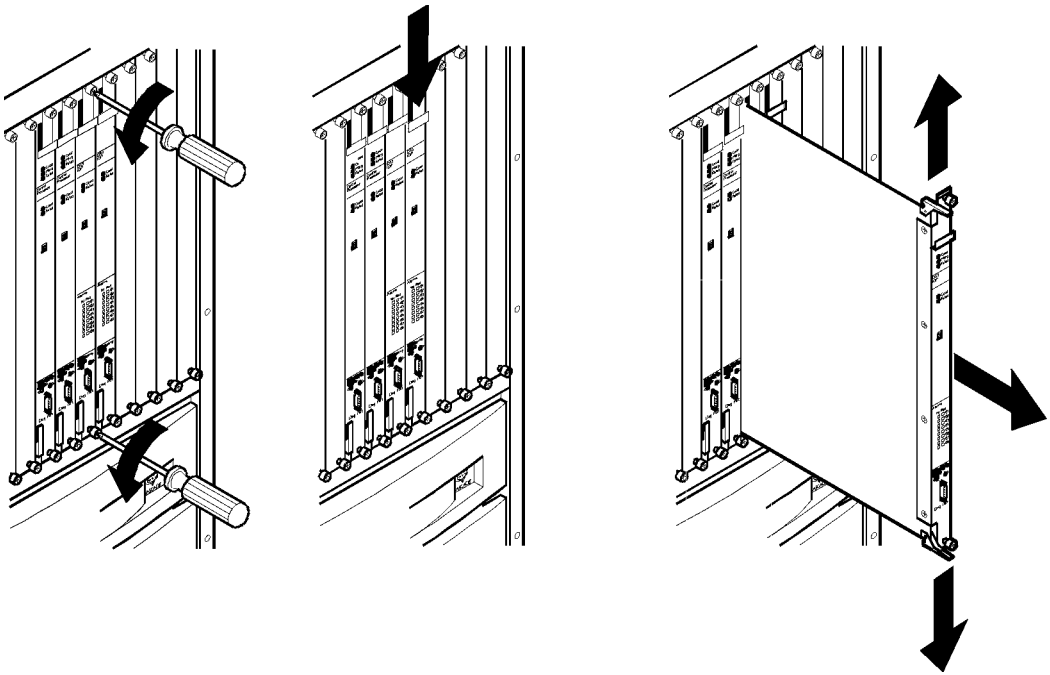


Figure 6-9. Removing IOP Modules

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 screwdriver to loosen, but not remove, the corresponding IOA module. Failure to use a #2 Phillips 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. Carefully 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 it has engaged the backplane connectors.
7. Depress the ejectors simultaneously.
8. Slide the card ejector lock up.
9. Using a #2 Phillips screwdriver, secure the module into the switch by tightening the thumb screws on the IOP and IOA modules.

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 prior to downloading the application code. The IOP card may reboot several times before the download process completes. Please be patient.

When the Good LED on the IOP is flashing slowly, the NMS operator can synchronize the IOP card. For instructions, refer to the *Network Configuration Guide for CBX 500*.

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, the switch must be shut down before the new power supply can be installed.

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

Before replacing the power supply, refer to "Product Information and Warnings" on page 2-5.

CBX 500 switches support both AC and DC power supplies. Figure 6-10 shows the Power Distribution Unit for the AC power supply module.

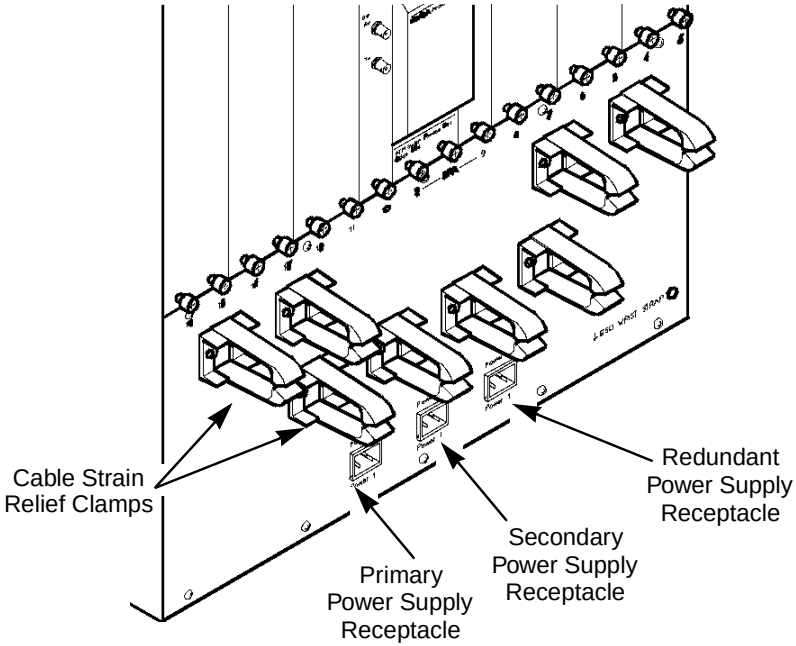


Figure 6-10. Power Distribution Unit for the AC Power Supply

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

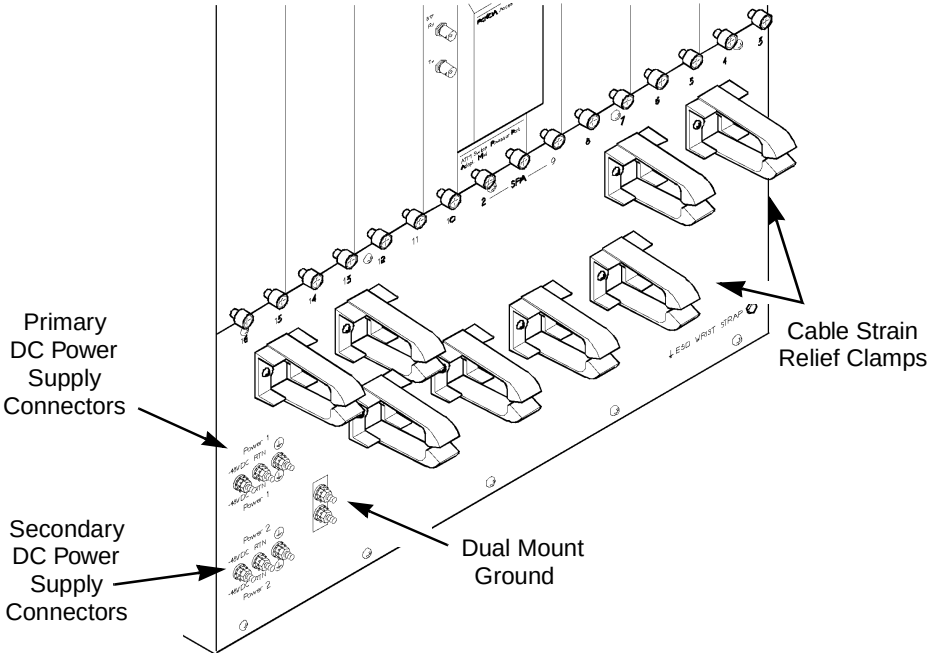


Figure 6-11. Power Distribution Unit for a -48 VDC Power Supply

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

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

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 screwdriver, remove the two screws located on either side of the power supply module, as shown in Figure 6-12.

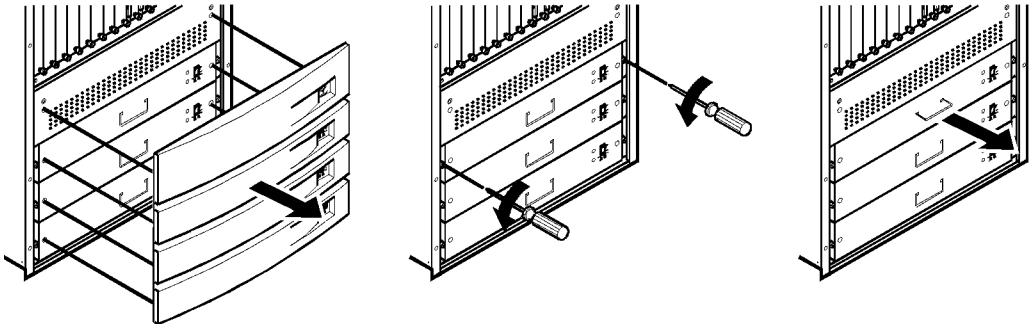


Figure 6-12. Removing the Power Supply Module

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

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

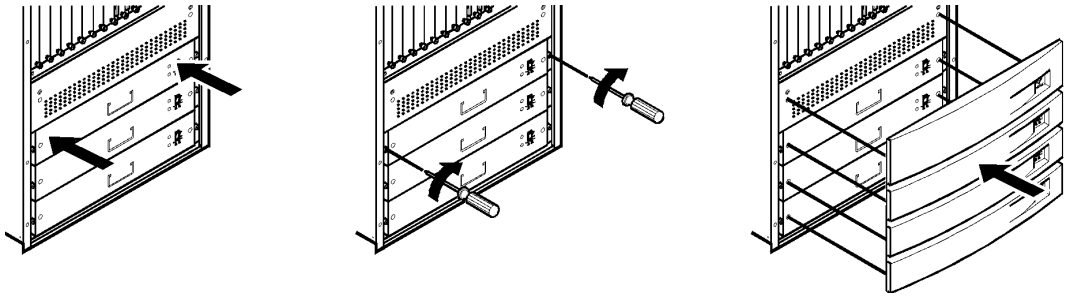


Figure 6-13. Installing a Power Supply Module

3. Gently push the power supply module into the backplane and align the two screw holes.
4. Tighten the two screws with a #2 Phillips screwdriver.
5. Reconnect or reinstall the power cords.

> *Before connecting the power cords, refer to "Electronic/Electrical Specifications" on page 2-2. Also refer to Appendix C for circuit regulatory information.*

To attach an AC power cord:

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 other power supplies are using.

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

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 screwdriver, remove the two screws that secure the protective cover over the studs. Then remove the protective cover.

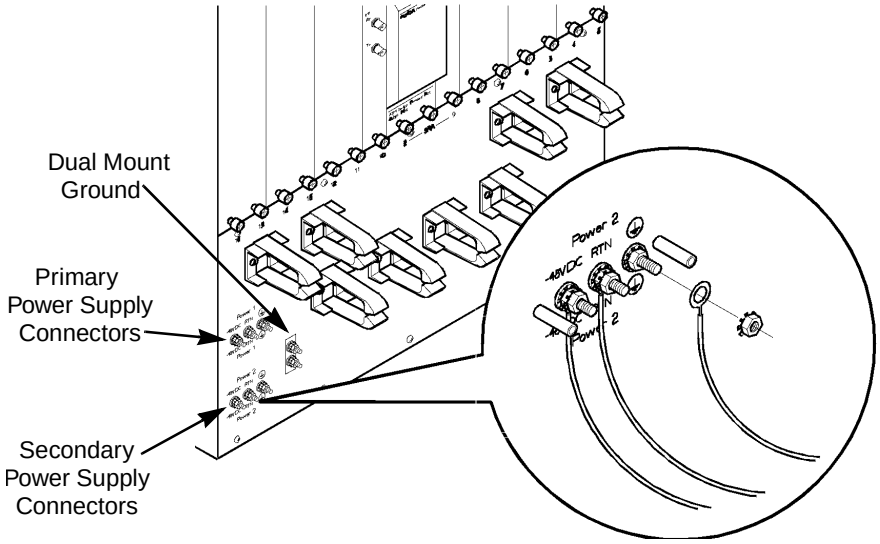


Figure 6-14. Connecting the -48 VDC Power Supply

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.

> *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 5-8).*

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 sources, 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 “Site Specifications” on page 2-4.

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.

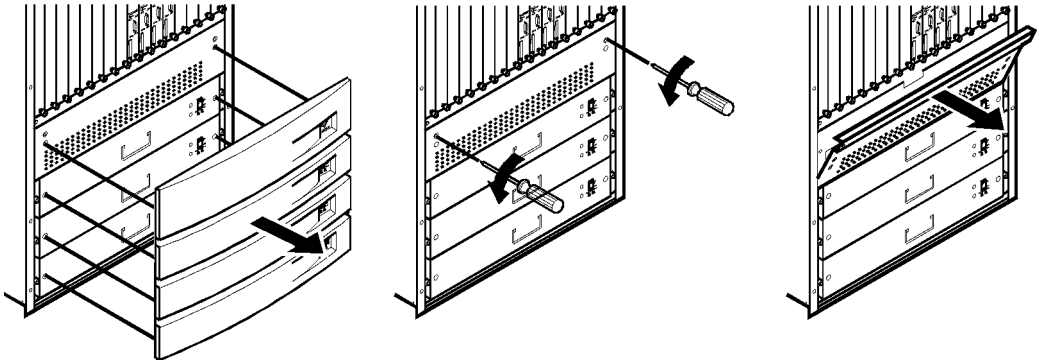


Figure 6-15. Accessing the Cooling Fan Module

Removing the Cooling Fan Module

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.

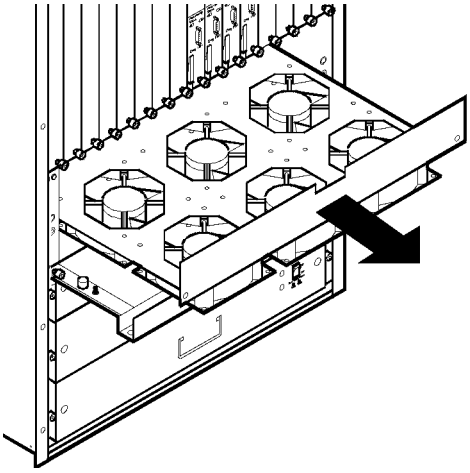


Figure 6-16. Removing the Cooling Fan Module

Installing the Cooling Fan Module

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.

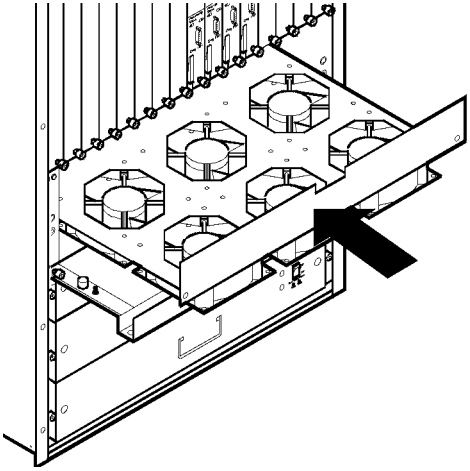


Figure 6-17. Installing the Cooling Fan Module

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.

Air filters must be vacuumed or replaced once a month to prevent heat from building up inside the chassis.

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).

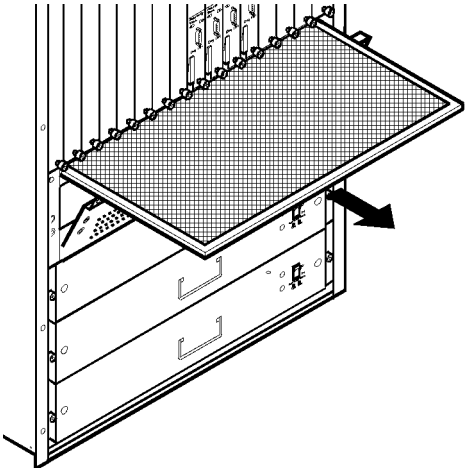


Figure 6-18. Installing or Replacing the Top Air Filter

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

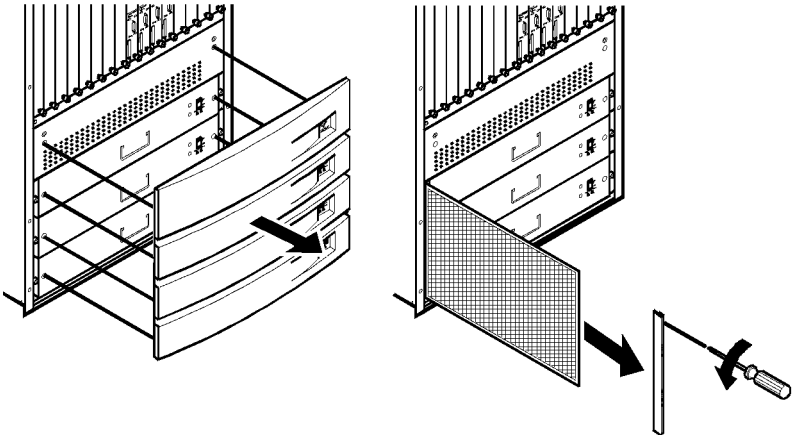


Figure 6-19. Installing or Replacing the Side Air Filter

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 solution. If you suspect software problems, refer to the troubleshooting information in the *Diagnostic and Troubleshooting Guide for CBX 500.*

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, refer to Chapter 5, “Determining the Operating Status”.

Power-up Diagnostics for SP and IOP Modules

To display the status of any SP or IOP module’s power-up diagnostics, a console terminal must be connected to the Diagnostic Port located on the module’s front panel.

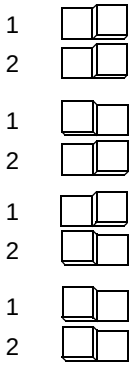
Whether diagnostics are run, and whether they are displayed, depends on the position of the two-position DIP switches located on the front of each module. To run diagnostics and display the results on the terminal, the DIP switches have to be in opposite states (one ON the other OFF).

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.

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 shoots the slot to reboot the card. If either position on the SP module DIP switch is in the OFF (left) position, the SP is prevented from shooting the cards.

Switch Status

Table 7-2 describes switch problems indicated by the SP switch status LEDs.

Table 7-2. Switch Status

Problem	Cause	Solution
Marginal LED (yellow) remains solid at the top of the SP module.	A marginal error condition exists on the switch. May indicate the failure of a redundant power supply, fan module, or IOP. May also indicate that no configuration is present in the SP.	Check the status LEDs on the power supply, fan module, and IOP modules. If a failure is detected, replace the failed module. If no configuration is present, download the configuration as described in the *Network Configuration Guide for CBX 500*.
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, refer to the appropriate switch-code release note.
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 all IOP ejector locks are fully up and locked. Refer to "Installing and Replacing IOP Modules" on page 6-15. The NMS operator must check the switch and download the OS. For instructions, refer to the appropriate switch-code release note. Check the LEDs on the PCMCIA cards. Reseat or replace the cards as needed.

IOP Module Status

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. Refer to "Powering Up the Switch" on page 5-10.
All LEDs on the module remain solid.	One of the following conditions exists: • The card is in reset mode • The card 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 it is fully up and locked. Contact the Technical Response Center (page 7-6). Replace the affected module.
Failed LED (red) remains solid.	Power up diagnostics detected a fatal error on the IOP module.	Contact the Technical Response Center (page 7-6). Replace the affected module.
Redundancy LED (green) was on and is now blinking.	An error condition may exist on the IOP module.	The IOP module changed from active to standby. Refer to the *Diagnostic and Troubleshooting Guide for CBX 500* for instructions on checking the Traps Alarm log.

Power Supply Status

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, temperature out of range • The power supply microprocessor failed to load	Replace the power supply module. Refer to "Installing or Replacing Power Supplies" on page 6-20 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. Refer to "Installing or Replacing Power Supplies" on page 6-20 for instructions.

Technical Assistance Center

Ascend provides a full range of support services to ensure that maximum network uptime is achieved with low equipment cost. The staff at Ascend's Technical Assistance Center can assist you with any problems you may encounter when using the NMS software. Contact Ascend's Technical Assistance Center by phone, electronic mail, or fax.

Calling by Phone

Ascend offers support 24 hours a day, 7 days a week. To contact Ascend's Technical Assistance Center by phone, call:

1-800-DIAL-WAN (1-508-692-2600) (USA and Canada)

0-800-96-2229 (United Kingdom)

1-978-952-7299 (all other areas)

Sending an E-Mail or a Fax

Include the following information when requesting assistance electronically or by fax:

- Your name and telephone number
- Name of contact person and telephone number (if different from above)
- Brief description of the problem
- List of identifiable symptoms

To contact Ascend's Technical Assistance Center by electronic mail, address your requests to:

cs@casc.com

To contact Ascend's Technical Assistance Center by fax, call:

1-978-392-9768

A

IOP Modules

This appendix provides technical information and specifications for the following IOP modules, which are currently available for the CBX 500 Switch:

- 8-Port DS3 and E3 ATM UNI IOP Modules
- 4-Port ATM UNI OC-3c/STM-1 IOP Module (optical and electrical)
- 1-Port OC-12c/STM-4 IOP Module
- 8-Port T1 and E1 IOP Modules

8-Port DS3 and E3 ATM UNI IOP Modules

The 8-port DS3 and E3 ATM UNI IOP modules enable the CBX 500 to provide trunk or user connections at data rates of 44.738 Mbps (DS3) and 34.368 Mbps (E3) at each of the modules' eight ports. You can configure each port as one of the following:

- User-to-Network Interface (UNI)
- Interim Inter-Switch Signalling Protocol (IISP) connection
- Cascade 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, give the DS3/E3 module the flexibility, performance, and data integrity required for high-speed networking.

Operational Features

The DS3/E3 ATM UNI IOP modules provide or support the following:

- Eight DS3 or E3 ATM connections at wire speed
- ATM UNI 3.0/3.1 and ATM IISP 3.1 (also known as P-NNI Phase 0), Cascade direct trunking, and Cascade OPTimum cell trunking
- All four ATM classes of service: Constant Bit Rate (CBR), Variable Bit Rate – Real-Time (VBR-RT), Variable Bit Rate – Non-Real Time (VBR-NRT), and Available Bit Rate (ABR)
- A programmable QoS scheduler
- UNI 3.0/3.1 signalling, with high signalling throughput via an i960 signal processor
- UNI 3.0/3.1 cell-bearing DS3 physical interfaces that support PLCP and direct (HEC) mapping modes of operation
- 16,000 Multicast source connections (global to switch)

- 16,000 Unicast connections (combined VCCs and VPCs) per module, with 2,000 connections per port
- An 8K output cell buffer per port
- Path switching based on virtual path only
- Extensive Operation and Maintenance (OAM) cell processing (F4, F5 flows, and fault management)
- A wide range of MIB support (ILMI, AToM, and DS3)
- Ingress Usage Parameter Control (UPC) for cell policing based on UNI 3.0/3.1 GCRA algorithm
- Guaranteed availability via 1 for 1 redundancy
- Future egress traffic shaping
- Statistics collection on ATM and physical layers
- Internal, loop-timed, and system-timing transmit-clocking options
- Performance monitoring and reporting on a single unicast connection per port

Specifications

Physical Dimensions

Height: 18 in. (45.72 cm)

Width: 1.06 in. (2.69 cm)

Depth: 11 in. (27.94 cm)

Weight: 5 lb

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

Module Status Indicators

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

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Active module (i.e., this module is online)
Good and Failed LEDs blinking simultaneously	OS software image currently being downloaded from active SP

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal
Red LED blinking	Downstream equipment failure
Red LED lit	Loss of signal

Figure A-1 shows the DS3 and E3 IOP and IOA modules.

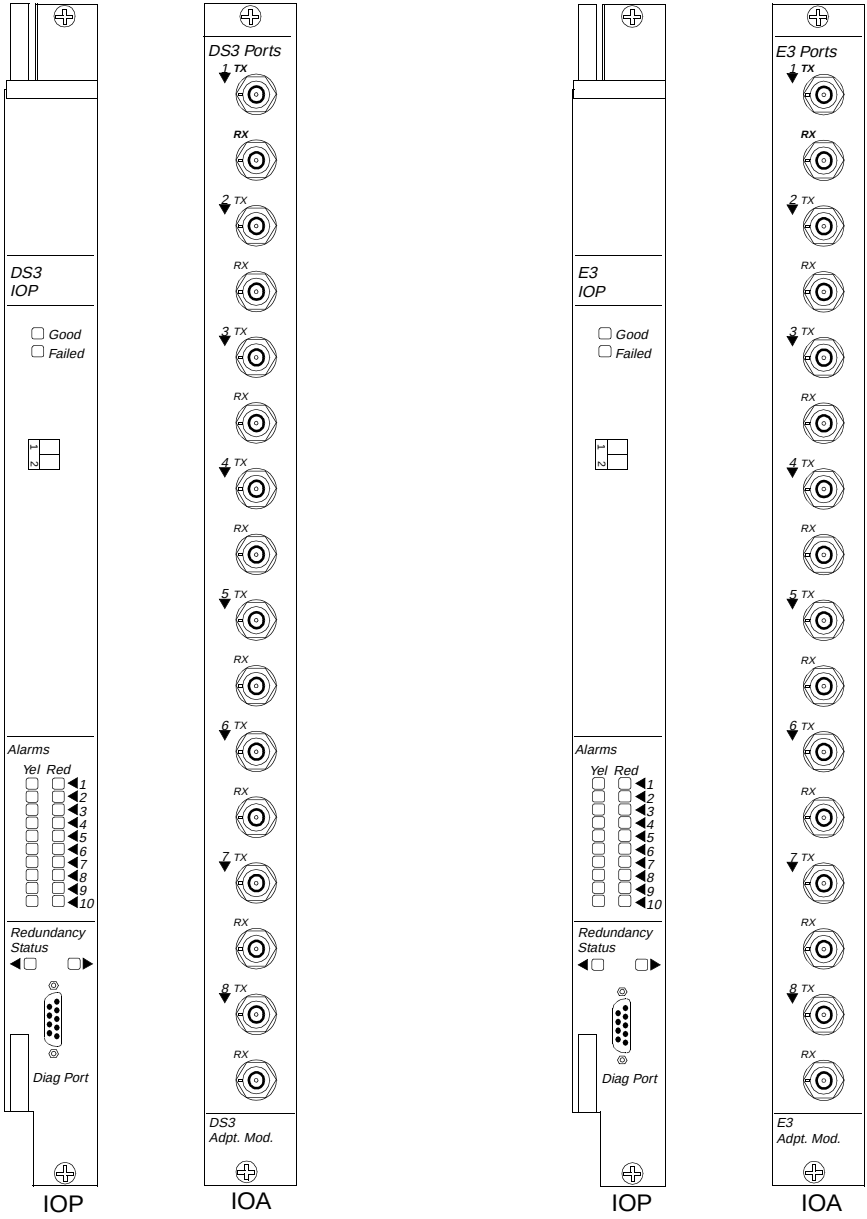


Figure A-1. DS3 IOP and IOA Modules

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

The Cascade 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
- Cascade 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 comes with 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 switch quad-plane architecture.

Operational Features

The 4-port OC-3c/STM-1 IOP module provides or supports the following:

- Four OC-3c/STM-1 ATM interfaces at 155.52 Mbps
- ITU G.703 interface with Coded Mark Inversion (CMI) encoding/decoding (STM-1 electrical)
- 24K cell buffers per port
- ATM UNI 3.0/3.1, IISP 3.1, Cascade direct trunks, and OPTimum cell trunks
- The CBR, VBR-RT, VBR-NRT, and UBR Quality of Service (QoS) classes
- UNI 3.0/3.1 signalling, with high-signalling throughput via state-of-the-art hardware switching
- Up to 16,000 virtual circuits (combined VCCs and VPCs) per IOP module
- Path switching based on virtual paths
- Up to 16,000 point-to-multipoint source connections per IOP module

- Extensive Operations and Management (OAM) cell processing (F4, F5 flows, and fault management)
- A wide range of MIB support (ILMI, AToM, and SONET MIBs)
- RFC 1595 provisioning and monitoring
- Ingress Usage Parameter Control (UPC) for cell policing based on the UNI 3.0/3.1 Generic Cell Rate Algorithm (GCRA)
- Egress Encapsulated Forward Congestion Indicator (EFCI) marking
- Single-mode (medium- and long-reach) and multimode fiber-optic transceivers (optical)
- Diagnostics: Internal, External, and Line Loopback

Specifications

Physical Dimensions

Height: 18 in. (45.72 cm)

Width: 1.06 in. (2.69 cm)

Depth: 11 in. (27.94 cm)

Weight: 5 lb

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-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%	50m

Signal Distance/Levels (Single-mode Laser Optics)

Medium-Reach:

- Up to 15 kilometers
- TX Power: -8dBm, -15dBm
- RX Sensitivity: -8dBm, -28dBm

Long-Reach:

- Up to 40 kilometers
- TX Power: -10dBm, -5dBm
- RX Sensitivity: -10dBm, -34dBm

Signal Distance/Levels (Multimode LED Optics)

- Up to 2 kilometers
- 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

Status Indicators

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

LED State	Status
Good LED lit	Normal operation
Failed LED lit	Module failure
Redundant LED lit	Active module (i.e., this module is online)
Good and Failed LEDs blinking simultaneously	OS software image currently being downloaded from active SP

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal
Red LED blinking	Downstream equipment failure
Red LED lit	Loss of signal

Figure A-2 shows the OC-3c/STM-1 IOP and IOA modules.

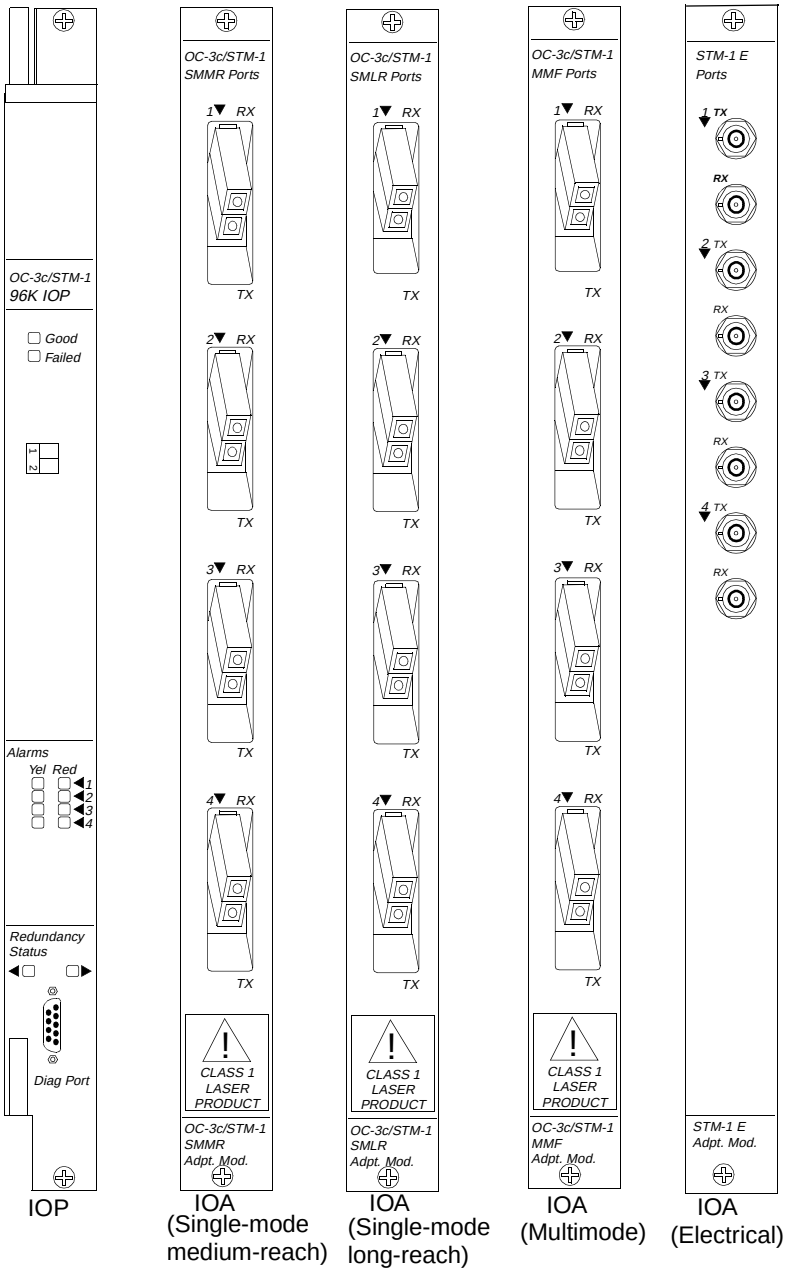


Figure A-2. OC-3c/STM-1 IOP and IOA Modules

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

The Cascade 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), Interim Inter-switch Signalling Protocol (IISP) trunk, or Cascade 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's quad-plane architecture.

Operational Features

The 1-port OC-12c/STM-4 IOP module provides or supports the following features:

- One OC-12c/STM-4 ATM interface at 622 Mbps
- 12,000 cell buffers per module
- ATM UNI 3.0/3.1, IISP, and Cascade trunks
- The CBR, VBR-RT, VBR-NRT, and UBR Quality of Service (QoS) classes
- UNI 3.0/3.1 signalling, with high signalling throughput via i960 signal processor
- 16,000 virtual circuits (combined VCCs and VPCs) per IOP module
- Path switching based on virtual path
- Up to 16,000 multicast source connections per IOP module
- Extensive Operations and Management (OAM) cell processing (F4, F5 flows, and fault management)
- A wide range of MIB support (ILMI, AToM, and SONET MIBs)
- RFC 1595 performance monitoring
- Ingress Usage Parameter Control (UPC) for cell policing based on the UNI 3.0/3.1 Generic Cell Rate Algorithm (GCRA)

- Guaranteed availability through Automatic Protection Switching (APS)
- Egress Encapsulated Forward Congestion Indicator (EFCI) marking
- Provision for future Available Bit Rate (ABR) processing subsystem hosting
- Single-mode medium-reach, fiber-optic transceiver

Specifications

Physical Dimensions

Height: 17 in. (43.18 cm)

Width: 1.06 in. (2.69 cm)

Depth: 12 in. (30.48 cm)

Weight: 5 lb

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)

- Up to 15 km
- Tx Power: -8dBm, -15dBm
- Rx Sensitivity: -8dBm, -28dBm
- Loss budget: 0-12dBm

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

Status Indicators

LEDs: Good (green), Failed (red)

LED State	Status
Good LED lit	Normal Operation
Failed LED lit	Indicates module failure

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal
Red LED lit	Loss of signal
Red LED blinking	Downstream equipment failure

Figure A-3 shows the OC-12c/STM-4 IOP and IOA modules.

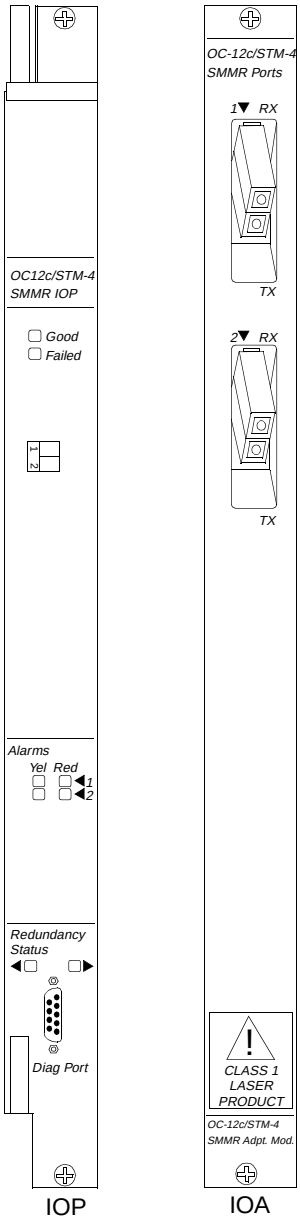


Figure A-3. OC-12c/STM-4 IOP and IOA Modules

8-Port T1 and E1 IOP Modules

The Cascade 8-port T1 and E1 IOP modules are optional line interface modules for the CBX 500 Switch. The T1 and E1 modules enable the CBX 500 to provide user connections at a data rate of 1.544 Mbps (T1) or 2.048 Mbps (E1) on each of the eight ports. Each port can be individually configured as a User-to-Network Interface (UNI). With the CBX 500's 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, combined with the 128K cell buffers provided for the CBX 500's quad-plane switch architecture, give the T1 and E1 modules the flexibility, performance, and data integrity required in today's networking environments.

Features

The 8-port T1 and E1 IOP modules provide or support the following features:

- Eight T1 or E1 ATM connections at wire speed
- 8,000 cell buffers per port
- ATM UNI 3.0/3.1, IISP, and Cascade trunking
- The CBR, VBR-RT, VBR-NRT, and UBR Quality of Service (QoS) classes
- UNI 3.0/3.1 signalling, with high signalling throughput via an i960 signal processor
- Up to 16,000 Virtual Circuits (combined VCCs and VPCs) per module
- Path switching based on virtual path (VP)
- Up to 16,000 multicast source connections per module
- Extensive Operations and Maintenance support: OAM cell processing (F4, F5 flows, and fault management)
- Wide range of MIB support: ILMI, AToM and T1 MIBs
- Ingress Usage Parameter Control (UPC) for cell policing based on UNI 3.0/3.1 GCRA algorithm

- Provision for future Available Bit Rate processing subsystem hosting
- Statistics collection on ATM and physical layers
- Transmit clocking options for loop-timed, port recovered, and internal/external reference
- ESF data link (FDL) support compliant to ANSI T1.403
- DS1 Physical Layer Performance Monitoring support compliant to ANSI T1.231

Specifications

Physical Dimensions

Height: 17 in. (43.18 cm)

Width: 1.06 in. (2.69 cm)

Depth: 12 in. (30.48 cm)

Weight: 3 lb

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 (0° to 122°F)

Physical Interfaces

8 ATM UNI 3.0/3.1 cell bearing T1 (1.544 Mpbs) 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

Status Indicators

LEDs: Good (green), Failed (red)

LED State	Status
Good LED lit	Normal Operation
Failed LED lit	Indicates module failure

Port Alarm Indicators

LEDs: Yellow, Red

LED State	Status
Yellow LED lit	Downstream equipment sees loss of signal
Red LED lit	Loss of signal
Red LED blinking	Downstream equipment failure

Figure A-4 shows the T1 IOP and IOA, as well as the E1 IOP and 75-ohm and 120-ohm E1 IOA modules.

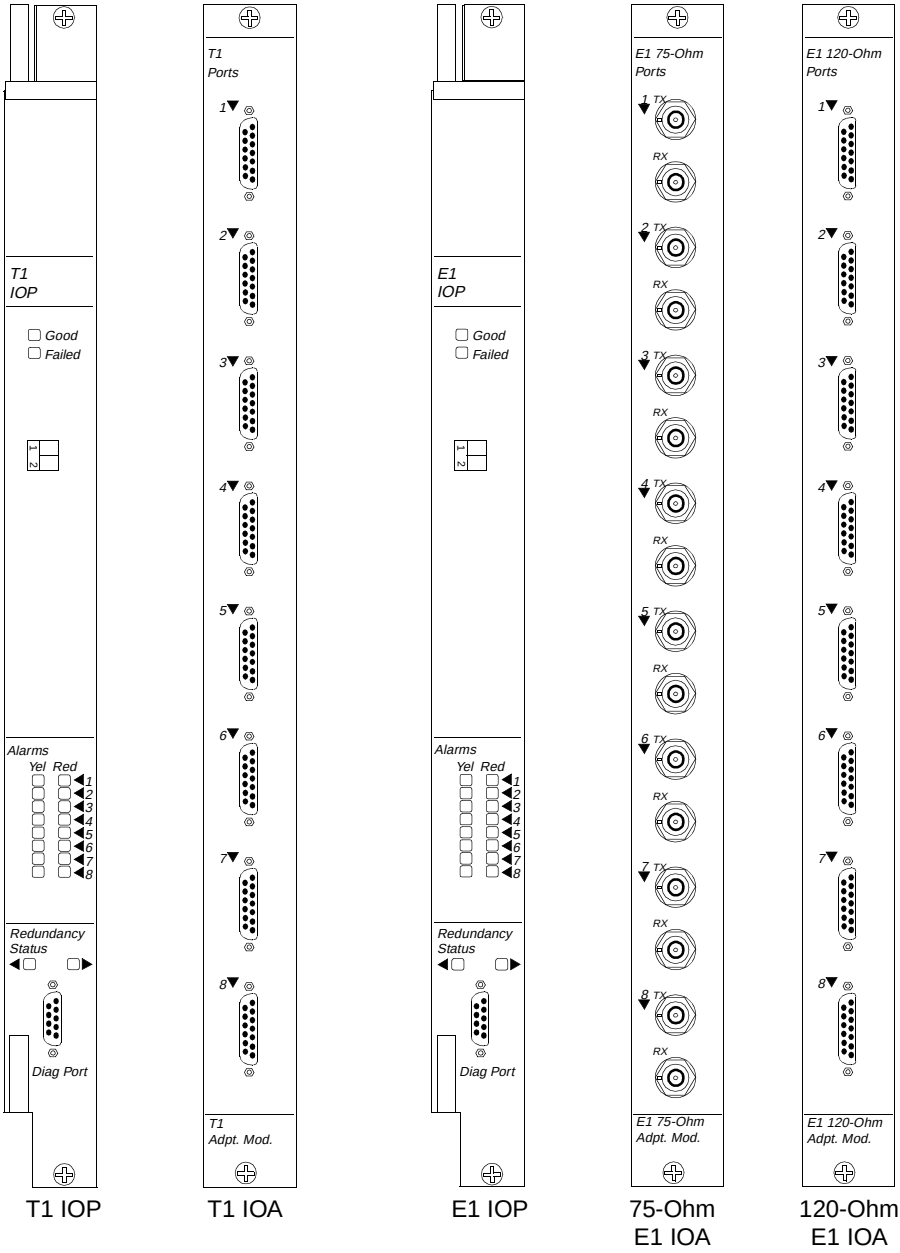


Figure A-4. T1/E1 IOP and IOA Modules

Ordering Information

To obtain a list of current product codes and pricing information, contact your Cascade Account Manager.

T1 and E1 IOP/IOA product codes are as follows:

Description	Product Code
8-port T1 ATM Processor Card	11050
8-port T1 ATM IOA (100 ohm)	11051
8-port E1 ATM Processor Card	11053
8-port E1 ATM IOA (75 ohm)	11054
8-port E1 ATM IOA (120 ohm)	10055

B

Cables and Pinout Assignments

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

- 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 - DB15
- T1 Crossover Cable - DB15

You can purchase these cables from Cascade Communications. Be sure to use the appropriate product code when ordering. To obtain a list of current product codes, contact your Cascade Account Manager.

RS-232 Shielded Null Modem Cable

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

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

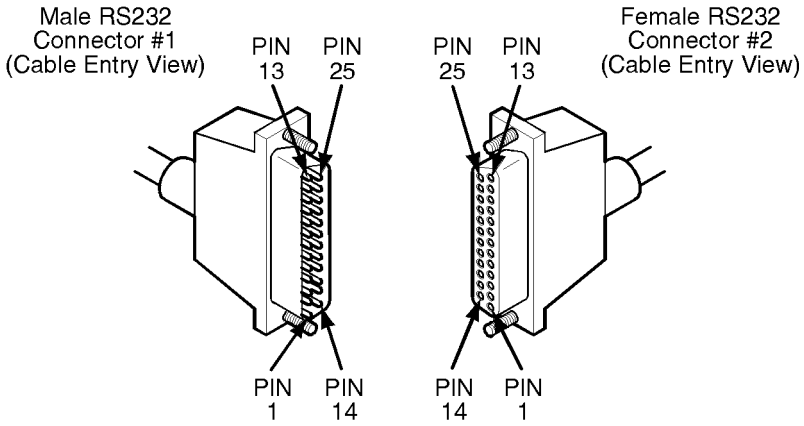


Figure B-1. RS-232 Shielded Null Modem Cable Diagram

Product Code: 40034Y

RS-232 Shielded Straight-Through Modem Cable

Table B-2. Pinouts for RS-232 Shielded Straight-Through Cable

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

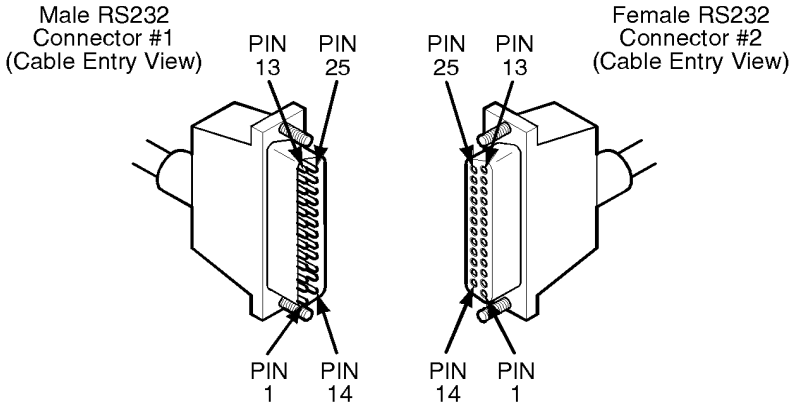


Figure B-2. RS-232 Shielded Straight-Through Modem Cable Diagram

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

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

DB-9 Female Connector #1

Pin	Signal
2	RX (Receiving Data)
3	TX (Transmit Data)
5	GND (Signal Ground)

DB-25 Female Connector #2

Pin	Signal
2	TX (Transmit Data)
3	RX (Receiving Data)
7	GND (Signal Ground)

DB-9 Female Connector #1

Pin	Signal
1	DCD (Data Carrier Detect)
4	DTR (Data Terminal Ready)
7	RTS (Request To Send)

DB-9 Female Connector #1

Pin	Signal
4	DTR (Data Terminal Ready)
6	DSR (Data Set Ready)
8	CTS (Clear To Send)

DB-25 Female Connector #2

Pin	Signal
4	RTS (Request To Send)
6	DSR (Data Set Ready)
8	DCD (Data Carrier Detect)

DB-25 Female Connector #2

Pin	Signal
5	CTS (Clear To Send))
8	DCD (Data Carrier Detect)
20	DTR (Data Terminal Ready)

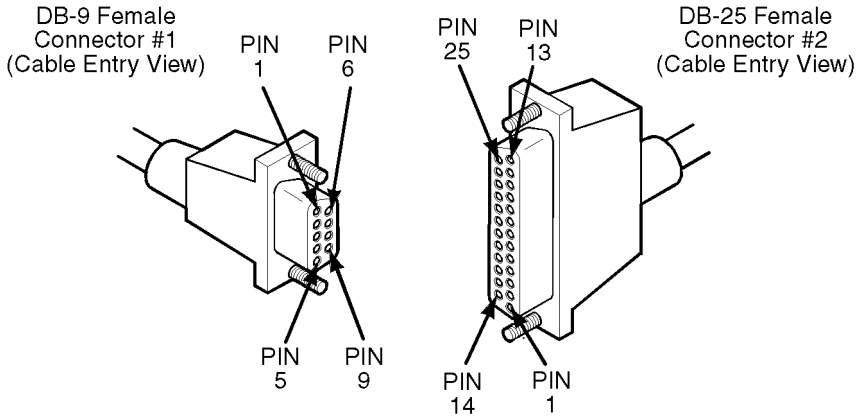


Figure B-3. RS-232 DB-9 to DB-25 Shielded Crossover Cable Diagram

T1 Straight-Through Cable - DB15

Table B-4. Pinouts for T1 Straight-Through Cable, 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 & 9

3 & 11

Product Code: 40004

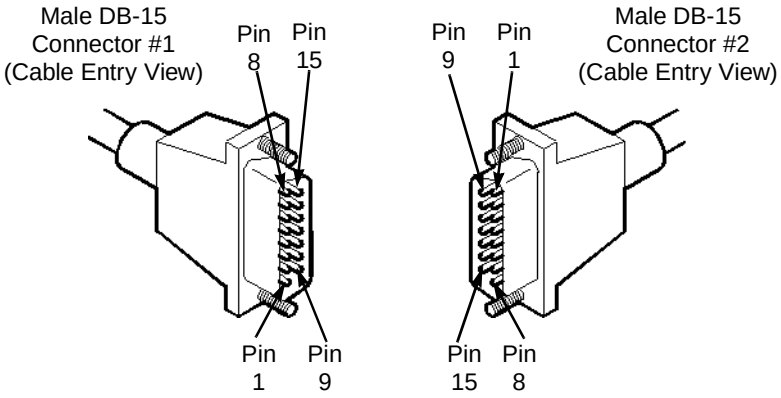


Figure B-4. T1 Straight-Through Cable Diagram

T1 Crossover Cable - DB15

Table B-5. Pinouts for T1 Crossover Cable, 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 & 9		
	3 & 11		

Product Code: 40020

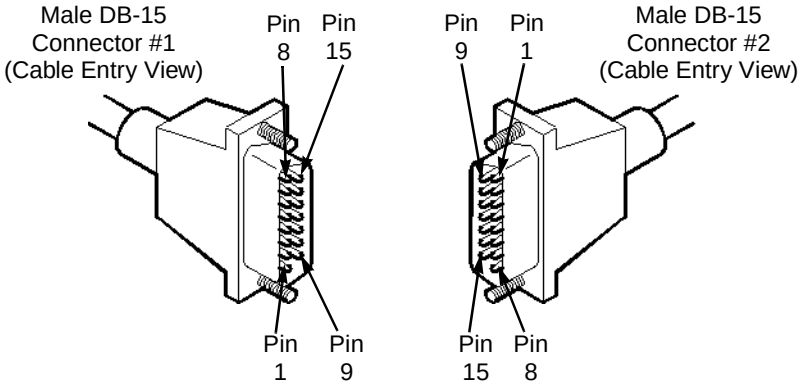


Figure B-5. T1 Crossover Cable Diagram

C

Regulatory Information

This appendix lists the regulatory agencies that have approved the CBX 500 Switch. This appendix also includes a sample affidavit that you need to file with your local Telco (telephone company) concerning connecting customer premise equipment (CPE) to WAN services.

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-1063-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
- Underwriter's Laboratory (UL) — Safety and Factory Compliance UL 1950

- Federal Communications Commission (FCC) — EMC compliance (Part 15 Class A)

In addition, Cascade'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.

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 Cascade 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 Cascade Communications for repair and warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.
- It is recommended that the customer install an AC surge protecter 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

In order 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.

In accordance with FCC Part 15 Subpart B requirements, changes or modifications made to this equipment not expressly approved by Cascade Communications Corporation 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.

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 Cascade Communications or an authorized representative of Cascade Communications. You can contact the Technical Response Center 24 hours a day, 7 days a week at:

1-800-DIAL-WAN (1-800-508-692-2600) (in the USA and Canada)

0-800-96-2229 (in the United Kingdom)

1-508-952-1299 (outside the USA, Canada, and United Kingdom)

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.

CBX 500 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.

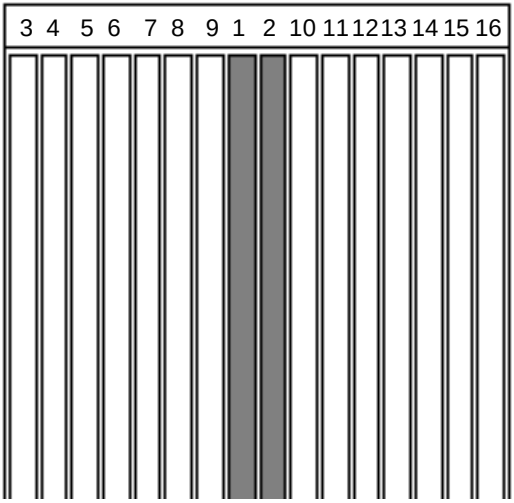


Figure D-1. SP Slots in a CBX 500 Switch

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, refer to Chapter 6, “Installing or 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 (i.e., online) member of a redundant pair. The Redundancy LEDs blink when a module is the redundant (i.e., standby) member of a redundant pair.

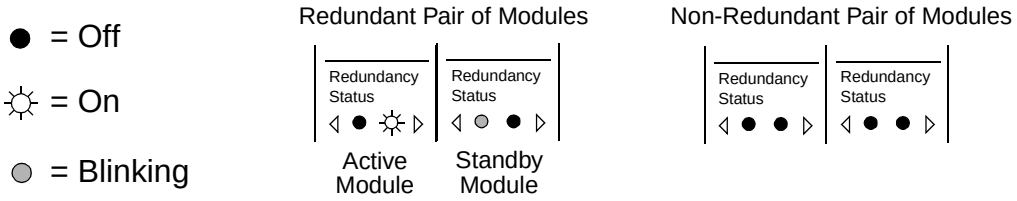


Figure D-2. Redundancy Status LEDs

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 "Keep-Alive Monitoring" on page D-4.)
- 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 its active partner. If an active module fails, the redundant module reboots it and takes over as the active module. The changeover does not have any direct effect on other modules in the switch. They may, however, be indirectly affected by not being able to access information on the resetting module.

The redundancy scheme is not meant to provide a fault-tolerant system. If an SP fails, the changeover will cause loss of data, since data transfer flows through the SP and it contains the Virtual Network Navigator (VNN) routing table. During the reboot, no new PVCs/SVCs can be established, no rerouting of existing PVCs/SVCs can occur, and no IP routing can occur through this node (i.e., 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. (The act of shooting 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 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.

The SP’s PRAM checksum of the sender is also contained in the keep-alive message.This number is used to ensure the PRAM remains identical between the two modules. (For more information, refer to “Checksum/Version Number Exchange” on page D-5.)

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.

E

Glossary

active hub

A device that amplifies transmission signals in a network, enabling signals to be sent over a much greater distance than is possible with a passive hub.

AMI (Alterable Mark Inversion)

A signaling format used in T1 lines. It provides for the “ones” pulses to have an alternating priority. Thus, if the nth one bit is represented by a positive pulse, the nth T1 would be a negative pulse.

asynchronous communications server

A LAN server that enables a network user to dial out of the network into the public switched telephone system, or to access leased lines for asynchronous communications. May also be called dial-in/dial-out servers or modem servers.

AT command set

A set of standard instructions used to activate features on a modem. Originally developed by Hayes Microcomputer Products, the AT command set is now used by almost all modem manufacturers.

ATM (Asynchronous Transfer Mode)

A method used for transmitting voice, video, and data over high-speed LANs. Also known as cell relay.

attenuation

The decrease in power of a signal over distance. Attenuation is measured in decibels.

auto-ranging

The ability for a power supply to detect the correct voltage that is being received from the power source.

backbone

That portion of a network that manages the bulk of the network traffic.

balun

A small device used to connect a balanced line (such as a twisted-pair cable) to an unbalanced line (such as a coaxial cable).

bandwidth

The transmission capacity of a computer or a communications channel. Also the difference between the highest and lowest frequencies available for transmission.

bandwidth-on-demand

A feature of WANs that enables the user to dial up additional bandwidth as the application demands it.

bits per second (bps)

The number of bits transmitted every second during a data transfer.

blue alarm

An alarm signal indicating that all one pulses are being received.

BNC connector

A small connector with a half-turn locking shell for coaxial cable. Normally used with thin Ethernet cabling.

bridge

A hardware device used to connect LANs (usually LANs that are using different wiring or network protocols). Bridges operate at the data-link layer of the ISO/OSI model.

broadband network

A technique for transmitting a large amount of information, including voice, data, and video, over long distances using the same cable.

broadcast

Send a message to all users currently logged in to the network.

brouter

A networking device that combines the attributes of a bridge and router.

burst mode

A method of data transmission in which information is collected and then sent in a single high-speed transmission, rather than one character at a time.

CascadeView/UX

The UNIX-based graphical user interface that you use to configure and monitor a Cascade-switch network.

cell

Any fixed-length packet. For example, ATM uses 53-byte cells.

cell relay

A form of packet transmission that used a fixed-length, 53-byte cell over a packet-switched network. Also known as ATM (Asynchronous Transfer Mode).

channel

Any connecting path that carries information from a sending device to a receiving device. May refer to a physical medium (e.g., coaxial cable) or a specific frequency within a larger channel.

circuit

A communications channel or path between two devices.

circuit switching

A temporary communications connection that is established as needed between a sending node and a receiving node.

client

A device that makes use of the services provided by a server.

communications protocol

A standard way of communicating between computers, or computers and terminals. Also, a hardware interface standard, such as RS-232C.

concentrator

A repeater or hub that joins communications channels from several different network nodes. Provides bridging, routing, and other management functions.

connectivity

The degree to which any given computer or application can cooperate with other network components in a network environment where resources are shared.

CRC (cyclic redundancy check)

A calculation method used to check the accuracy of digital transmission over a communications link.

CSU (channel service unit)

A device that functions as a certified safe electrical circuit, acting as a buffer between the customer's equipment and a public carrier's WAN.

CTS (Clear To Send)

A hardware signal defined by the RS-232-C standard, which indicates that the transmission can proceed.

data bits

In asynchronous transmissions, the bits that actually comprise the data being sent.

datagram

A message unit that contains source and destination address information, as well as the data itself, which is routed through a packet-switched network.

data-link layer

The second of seven layers of the ISO/OSI model for computer-to-computer communications. This layer validates the integrity of the flow of data from one node to another by synchronizing blocks of data and controlling the flow of data.

data packet

One unit of information transmitted as a discrete entity from one network node to another. In packet-switched networks, a data packet is a transmission unit of a fixed maximum length that contains a header, a set of data, and error control information.

DB (data bus) connector

A cable connector used for parallel or serial ports. The number following DB indicates the number of pins in the connector (e.g., DB-25 connectors have 25 pins).

DCD (Data Carrier Detect)

A hardware signal defined by the RS-232-C standard, which indicates that the device is online and ready for transmission.

DCE (data communications equipment)

Any device that connects a computer or terminal to a communications channel or public network.

D-Channel

The data channel in ISDN (Integrated Services Digital Network), used for control signals and customer data. In Primary Rate ISDN (PRI), it operates at 64 Kbps.

dedicated line

A communications circuit used for one specific purpose, and not used by or shared between other users.

dedicated server

A computer on the network that functions only as a server performing specific network tasks.

destination address

The address portion of a packet or datagram that identifies the intended recipient.

DIP (dual in-line position) switch

A small switch used to select the operating mode of a device.

DS (digital signal or digital service)

Defines the level of common carrier digital transmission service. DS-0 = 64 Kbps (Fractional T1), DS-1 = 1.544 Mbps (T1), DS-2 = 6.312 Mbps (T2), DS-3 = 44.736 Mbps (T3), and DS-4 =274.176 Mbps (T4).

DSR (Data Set Ready)

A hardware signal defined by the RS-232-C standard. It indicates that the device is ready to operate.

DSU (data service unit)

A device that connects DTE (data terminal equipment) to digital communications lines. It formats the data for transmission on the public carrier WAN, and ensures that the carrier's requirements for data formats are met.

DSX-1

A specification that indicates the physical and electrical characteristics of the standard T1 cross-connect.

DTE (data terminal equipment)

Any device, such as a terminal or computer, that is connected to a communications device, channel, or public network.

DTR (Data Terminal Ready)

A hardware signal defined by the RS-232-C standard. It is sent from a computer to a modem to indicate that the computer is ready to receive a transmission.

duplex

The ability to transmit and receive on the same channel at the same time. Also known as full duplex.

dynamic routing

A routing technique that allows a message's route to change as the message is in transit through the network.

EDAC (error detection and correction)

A mechanism used to determine whether transmission errors have occurred, and if so, to correct those errors.

error rate

The ratio between the number of bits received incorrectly, and the total number of bits in the transmission.

ESF (Extended Superframe Format)

Extends the DS1 superframe structure from 12 to 24 frames, for a total of 4632 bits. It redefines the 8 Kbps channel consisting of framing bits previously used exclusively for terminal and robbed-bit signalling synchronization.

Ethernet

A popular network protocol and cabling scheme with a transfer rate of 10 Mbps.

Ethernet packet

A variable-length unit in which information is transmitted on an Ethernet network.

FDDI (Fiber Distributed Data Interface)

A specification for fiber-optic networks transmitting at a speed up to 100 Mbps over a dual, counter-rotating token-ring topology.

FDM (frequency division multiplexing)

A method of sharing a transmission channel by dividing the bandwidth into several parallel paths. All signals are carried simultaneously.

FECN (Forward Explicit Congestion Notification)

A bit in the frame relay header that indicates the frame has passed through a node experiencing congestion in the same direction the frame is traveling.

Fractional T1

One portion of a T1 circuit. T1 circuits consist of 24 64-Kbps channels. Customers can lease as many of these circuits as are needed; they do not have to lease them all.

FRAD (Frame Relay Assembler/Disassembler)

Provides encapsulation for any HDLC-based protocol to be “enveloped” in a Frame Relay header and transported over the frame relay network.

frame

A block of data suitable for transmission as a single unit.

Frame Relay

A standard for a packet-switching protocol, running at speeds up to 2 Mbps. Frame relay provides for bandwidth on demand.

FTP (File Transfer Protocol)

A protocol that enables you to transfer information from one computer to another, either over a modem and telephone line, or over a network.

gateway

A shared connection between a LAN and a larger system (such as a mainframe computer) or a large packet-switched network whose communications protocols differ.

Hayes-compatible modem

Any modem that recognizes commands in the industry-standard AT command set.

HDLC (High-level Data Link Control)

An international protocol defined by ISO. In HDLC, messages are transmitted in variable-length units known as frames.

heterogeneous network

A network that consists of workstations, servers, network interface cards, operating systems, and applications from many different vendors, all operating together as a single unit.

homogeneous network

A network that consists of one type of workstation, server, network interface card, and operating system, with a limited number of applications, all purchased from a single vendor. All nodes use the same protocol and the same control procedures.

hop count

The number of links that must be crossed to get from any given source node to any given destination node.

HSSI (High-Speed Serial Interface)

A high-speed interface (up to 52 Mbps full duplex) between a DTE and a DCE. All timing for the interface is provided by the DCE. HSSI can drive a shielded twisted-pair cable of 50 feet (15m).

hub

A device that modifies transmission signals, allowing the network to be extended to accommodate additional workstations. An active hub amplifies signals to extend cable length. A passive hub splits the transmission signal, allowing additional workstations to be added.

ICMP (Internet Control Message Protocol)

That portion of TCP/IP that provides the functions used for network layer management and control.

IEEE standards

Various standards that define networks. Includes 802.1, 802.2, 802.3, 802.4, 802.5, and 802.6.

internal clocking

When the Cascade switch provides the transmit and receive clocks to the user equipment.

IP (Internet Protocol)

The TCP/IP session-layer protocol that regulates packet forwarding.

ISDN (Integrated Services Digital Network)

A standard for a worldwide digital communications network, intended to replace all current systems with a completely digital transmission system.

ISO (International Standards Organization)

An international standards-making group, based in Geneva, that establishes global standards for communications and information exchange.

jitter

A type of distortion found on analog communications lines that results in data transmission errors.

keep-alive monitoring

A monitoring/messaging system used in the Link Management Interface (LMI) of a Frame Relay port to verify link integrity. Also used between primary and standby modules to communicate status in redundant switch configurations.

LAP (Link Access Protocol)

The link-level protocol that is used for communications between DCD (Data Carrier Detect) and DTE (data terminal equipment).

LAP-B

A bit-oriented data-link protocol used to link terminals and computers to packet-switched networks.

LMI (Link Management Interface) Rev 1

A synchronous polling scheme used for the link management of a Frame Relay channel where the user polls the network to obtain status information of each PVC (permanent virtual circuit) configured on the channel. LMI exchanges this information using DLCI 1023.

loopback

Directing signals back towards the source along a communications path.

MIB (Management Information Base)

The set of variables forming a database contained in a CMOT or SNMP-manageable node on a network. Network management nodes can fetch/store information from/to this database.

multicast

A special form of broadcast in which copies of the message are delivered to multiple stations, but not to all possible stations.

multiplexer (mux)

A device that merges several lower-speed transmission channels into one high-speed channel at one end of the link. Another mux reverses this process at the other end.

multiplexing

A technique that transmits several signals over a single communications channel.

node

Any device attached to the network that is capable of communicating with other network devices.

node number

The number that uniquely identifies a network interface card.

noise

Extraneous signals on a transmission channel that degrade the quality or performance of the channel.

OSPF (Open Shortest Path First)

A routing protocol that takes into account network loading and bandwidth when routing information over the network. OSPF incorporates least-cost routing, equal-cost routing, and load balancing.

packet

Any block of data sent over a network. Each packet contains sender, receiver, and error control information, in addition to the actual message.

packet filter

A process used by bridges to limit protocol-specific traffic to one segment of the network, to isolate e-mail domains, and to perform other traffic-control functions.

packet-switched network

A network that consists of a series of interconnected circuits that route individual packets of data over one of several alternative routes.

PAD (packet assembler/disassembler)

A device connected to a packet-switched network that converts a serial data stream from a character-oriented device (e.g., a bridge or router) into packets suitable for transmission. It also disassembles packets back into character for transmission to the character device.

passive hub

A device used in some networks to split a transmission signal, allowing additional hubs to be added to the network.

PDN (Public Data Network)

Any government-owned or controlled commercial packet-switched network, offering wide-area services to data processing users.

PPP (Point-to-Point Protocol)

A protocol that provides router-to-router and host-to-network connections.

protocol

A set of rules governing communication (and the exchange of data) between two entities or systems.

PVC (permanent virtual circuit)

A logical connection across a packet-switched network that is always in place and always available along a predetermined network path.

Receive Data (RXD)

A hardware signal defined by the RS-232-C standard, which carries data from one device to another.

red alarm

A T1 alarm condition indicating a loss of signal or loss of frame at the device's local termination.

redundancy

The duplication of hardware or software within a network to ensure complete operation.

remote connection

A workstation-to-network connection made using a modem and telephone line. It enables data to be sent or received over greater distances than those allowed by conventional cabling.

repeater

A device that receives data on one communication link and transmits it, bit by bit, on another link as fast as it is received, without buffering.

RTS (Request To Send)

A hardware signal defined by the RS-232-C standard. It requests permission to transmit.

RFC (Request For Comment)

The name of a series of notes that contain surveys, measurements, ideas, techniques, and observations, as well as proposed and accepted Internet protocol standards.

RIP (Routing Information Protocol)

A routing protocol that maintains a list of reachable networks and calculates the degree of difficulty involved in reaching a specific network from a particular location (by determining the lowest hop count).

router

An intelligent connecting device that can send packets to the correct LAN segment to take them to their destination. Routers link LAN segments at the ISO/OSI network layer. The networks connected by routers can use similar or different network protocols.

routing

The process of directing message packets from a source node to a destination node.

SLIP (Serial Line over Internet Protocol)

A protocol used to run IP over serial lines or telephone connections using modems.

shielded cable

Cable protected against electromagnetic and radio frequency interference.

shortest path routing

A routing algorithm in which paths to all network destinations are calculated. The shortest path is then determined by a cost assigned to each link.

smart hub

A concentrator with certain network management facilities built into the firmware. They enable the network administrator to control and plan network configurations.

SMDS (Switched Multimegabit Data Service)

A high-speed WAN service based on the 802.6 standard for use over T1 or T3 circuits.

SNMP (Simple Network Management Protocol)

A standard protocol used to manage and monitor nodes on a network.

SVC (switched virtual circuit)

A logical connection across a packet-switched network. An SVC is established on an as-needed basis and can provide a connection to any other switched user in the network.

synchronization

The timing of separate elements or events to occur simultaneously. In communications, the hardware and software must be synchronized so that file transfers can take place.

synchronous transmission

A transmission method that uses a clock signal to regulate data flow.

T1

A long-distance, point-to-point circuit that provides 24 channels at 64 Kbps each (for a total of 1.544 Mbps).

T3

A long-distance, point-to-point circuit that provides up to 28 T1 channels. T3 can carry 672 channels of 64 Kbps (for a total of 44.736 Mbps).

topology

The map or configuration of a network. Physical topology refers to the location of hardware. Logical topology refers to the paths that messages take to get from one node to another.

transceiver

A device that connects a host interface to a LAN. A transceiver both transmits and receives data.

trunk

The communications circuit between two nodes.

twisted-pair cable

Cable that comprises two or more pairs of insulated wires twisted together. One wire carries the signal, and the other is grounded.

TXD (Transmit Data)

A hardware signal defined by the RS-232-C standard. It carries information from one device to another.

unshielded cable

Any cable not protected form electromagnetic or radio frequency interference.

yellow alarm

A T1 alarm that is generated when the interface receives a red alarm signal from the remote end.

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