Preface

Objectives

The *Cisco VCO/4K Mechanical Assemblies* describe the physical architecture and assemblies of a VCO/4K system, including system enclosures, subracks, power subsystems, storage subsystems, and other general system components.

Each technical description reflects the most current information available about the product. The information contained in a technical description is specific to a single component within a system. Other system documents point to technical descriptions as containing the most detailed information available for a component.

A technical description contains information to service and maintain the component. For system-level servicing, refer to the *Cisco VCO/4K System Maintenance Manual*. The maintenance manual assists in isolating the cause of a system malfunction and serves as a pathfinder to the more detailed information contained in technical descriptions.

Note This document represents the most current information about VCO/4K mechanical assemblies. If you need information pertaining to VCO/4K assemblies, circuit cards, or other components that are not included in this document, see the following URL on Cisco's web site for legacy VCO/4K information:

http://www.cisco.com/univercd/cc/td/doc/product/tel_pswt/index.htm

Audience

This manual is intended for VCO/4K system users and third-party support personnel. If you are unfamiliar with the VCO/4K system, refer to one or more of the related documents listed in the "Related Documentation" section on page viii.

This manual assumes that the host application (if it is a hosted system) is written to conform to the VCO API as described in the *Cisco VCO/4K Standard Programming Reference* or *Cisco VCO/4K Extended Programming Reference.* However, that does not preclude problems occurring between the application and the VCO/4K system.

Each release of the VCO/4K system software is described in the *Cisco VCO/4K Release Notes* that contain detailed information on changes from one release to the next. If your VCO/4K System includes the SS7 subsystem, refer to the *Cisco VCO/4K SS7 Release Notes*.

Document Conventions

This document uses the following conventions:

Note Means *reader take note.* Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful.* In this situation, you might do something that could result in equipment damage or loss of data.

Warning **Means *danger.* You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translated versions of the warning, refer to the *Regulatory Compliance and Safety* document that accompanied the device.**

Document Organization

The *Cisco VCO/4K Mechanical Assemblies* is organized as follows:

- Chapter 1, “System Enclosure,” describes the VCO/4K cabinet.
- Chapter 2, “Fan Unit,” describes the cooling fan assembly and associated hardware.
- Chapter 3, “VCO/4K Power Subsystem,” describes the power supplies, power entry modules, and the power backplane.
- Chapter 4, “Storage/Control I/O Module,” describes the hardware that connects the VCO/4K to external interfaces and the associated hard disk drive.
- Chapter 5, “I/O Modules,” provides removal and replacement procedures for the VCO/4K I/O Modules.

Related Documentation

The following documents are referenced from this guide or contain information that is directly related to system performance and configuration.

Knowledge of PSTN communication protocols is also important.

VCO/4K System

- *Cisco VCO/4K System Software Release Note*
- Cisco *VCO/4K SS7 ISUP Release Notes*
- *Cisco VCO/4K Product Overview*
- *Cisco VCO/4K Hardware Planning Guide*

- *Cisco VCO/4K System Maintenance Manual*
- *Cisco VCO/4K Standard Programming Reference*
- *Cisco VCO/4K Extended Programming Reference*
- *Cisco VCO/4K System Administrator's Guide*
- *Cisco VCO/4K Ethernet Guide*
- *Cisco VCO/4K Site Preparation Guide*
- *CiscoVCO/4K Hardware Installation Guide*
- *Cisco VCO/4K Card Technical Descriptions*
- *Cisco VCO/4K Troubleshooting Guide*

Third-party Documents

The following third-party documents are recommended by Cisco:

- Theodore Frankel's *ABC Of the Telephone: Traffic Series – Tables For Traffic Management And Design*
- International Telecommunications Union ITU-T Q.931 ISDN documentation
- ANSI T1.113-1992, SS7 ISUP documentation
- OEM manuals supplied with peripheral equipment installed as part of the system configuration
- The documentation set produced for the host computer system
- Documentation for the application software package developed to run on the host

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

Ordering Documentation

Cisco documentation is available in the following ways:

- Registered Cisco Direct Customers can order Cisco Product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered CCO users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS(6387).

Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, for your convenience many documents contain a response card behind the front cover. Otherwise, you can mail your comments to the following address:

Cisco Systems, Inc.
Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

Cisco.com provides a broad range of features and services to help customers and partners streamline business processes and improve productivity. Through Cisco.com, you can find information about Cisco and our networking solutions, services, and programs. In addition, you can resolve technical issues with online technical support, download and test software packages, and order Cisco learning materials and merchandise. Valuable online skill assessment, training, and certification programs are also available.

Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

CHAPTER 1

System Enclosure

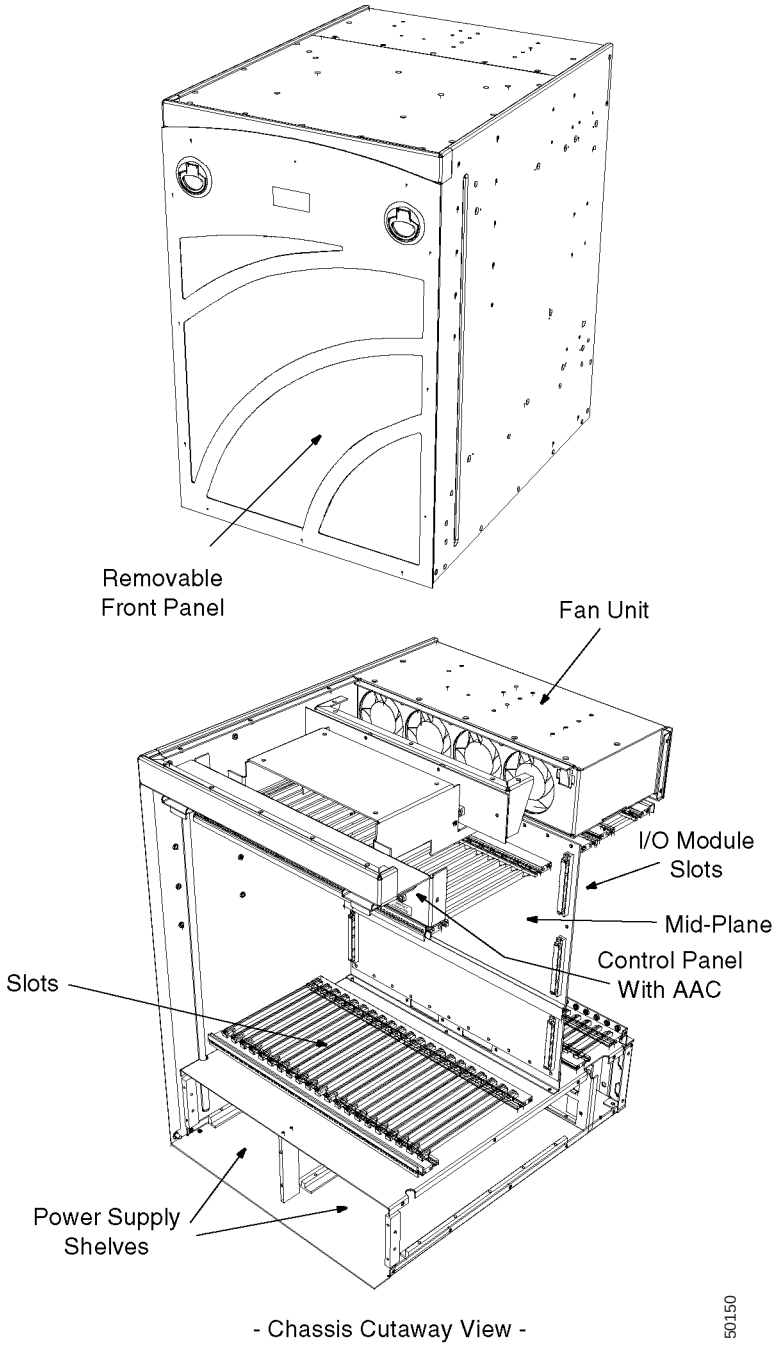
The VCO/4K system enclosure is a metal-based cabinet that houses all the VCO/4K critical system components including: the fan cooling unit; the alarm arbiter and interface cards; and high-density system hardware cards. It also accommodates the power subsystem, either single or dual for system redundancy. Figure 1-1 shows the front of a VCO/4K system. Figure 1-2 shows a cutaway view of the chassis underneath the enclosure.

The system enclosure meets or exceeds the following enclosure requirements:

- *UL 1950 Standard for Information Technology Equipment*
- *Network Equipment-Building System (NEBS) GR-63-CORE with Zone 4 Earthquake* and *Bellcore's GR-1089-CORE Safety and Physical Protection*
- General safety, including *UL/CUL* and *EMI/EMC FCC Part 15*

Figure 1-1 The VCO/4K

Figure 1-2 VCO/4K Switch Enclosure and Chassis



- Chassis Cutaway View -

Specifications

Part Number	Contact your Cisco Systems sales representative
Front Door	Removable front door with locking feature
Enclosure Dimensions	Height: 26.13 inch (67.73 cm)
	Width: 17.5 inch (45.33 cm)
	Depth: 22.5 inch (58.57 cm)
Footprint	22.50 in. by 17.5 in. (57.15 cm by 45.33 cm)

Component Description

The VCO/4K system enclosure is designed for environments that require UL 1950 enclosures. Venting holes on the front door provide air flow to cool system components when the system fan units are operational. A removable air filter is held in place by a cross-member and two screws on the inside of the front door. Four screw-in rubber foot pads for bench use are provided as an option. All cable access is through the back of the system enclosure. Figure 1-3 shows the front of a VCO/4K with the door off. Figure 1-4 shows the back of the system enclosure.

Figure 1-3 VCO/4K (Front View—Door Off)

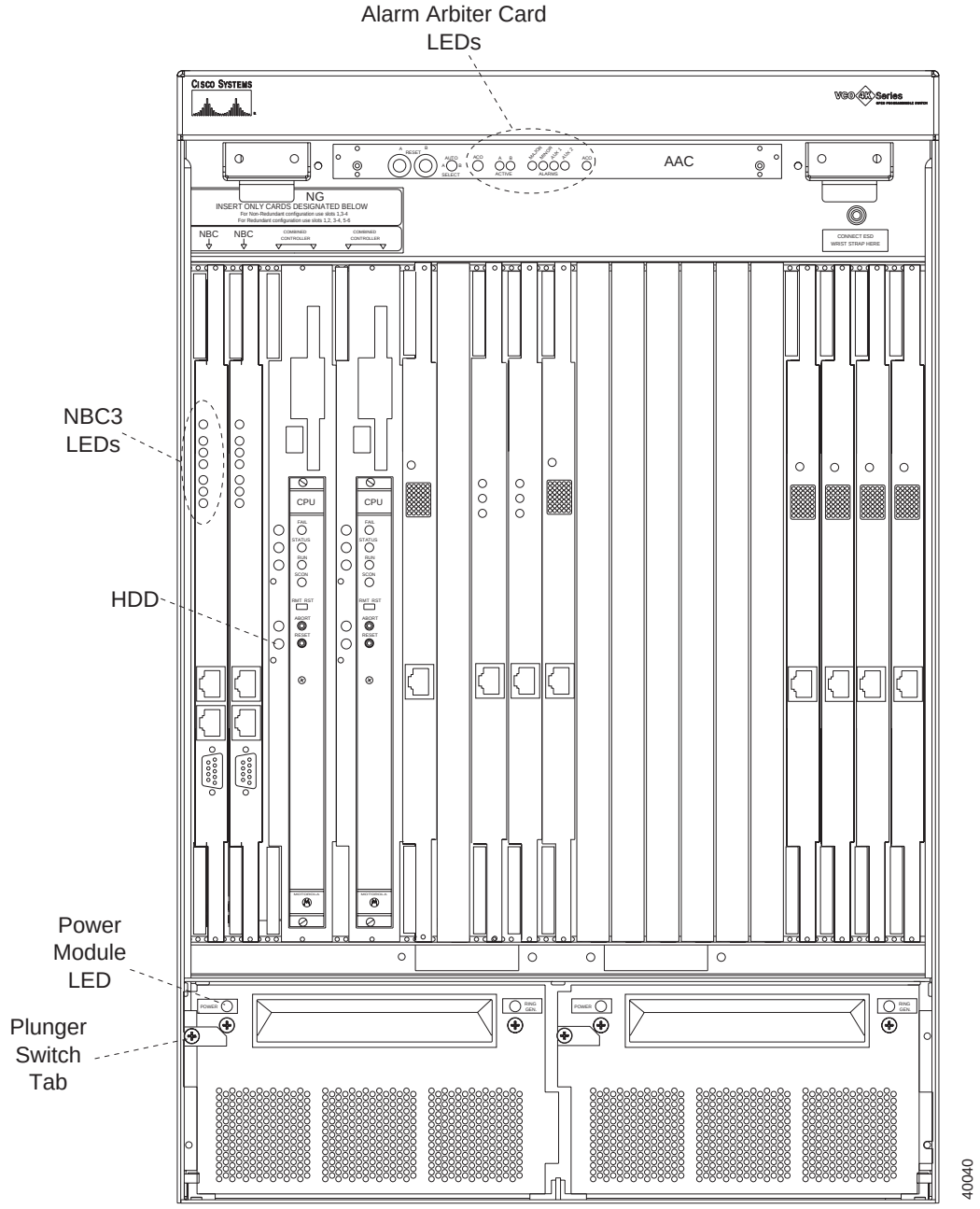
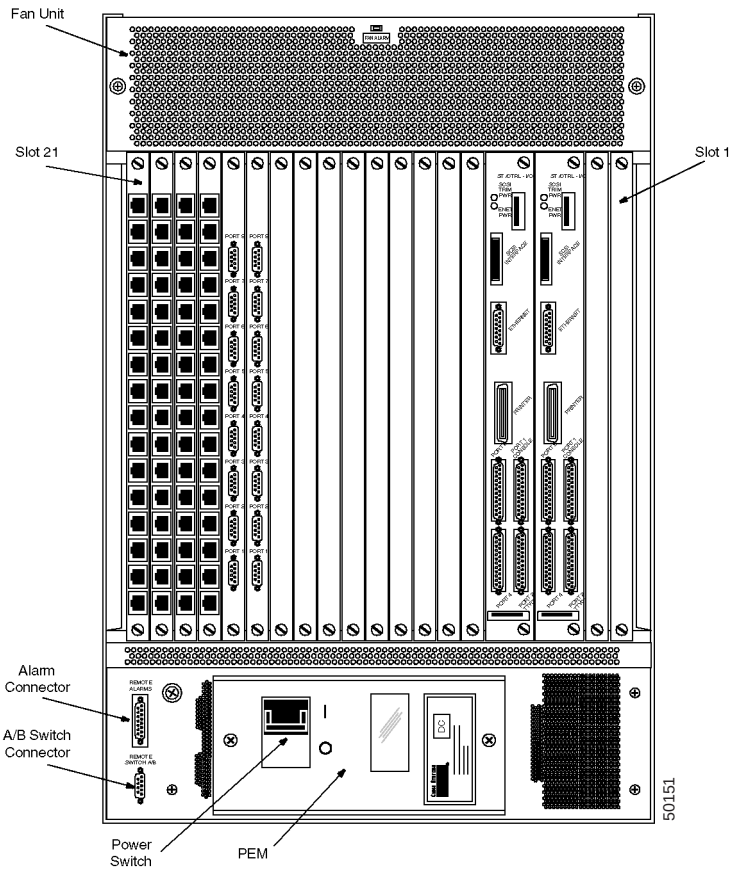


Figure 1-4 VCO/4K (Rear View)



Front Door

The VCO/4K front door has a lock for security purposes. Two door frame latches at the top and two studs at the bottom hold the door in place.

Caution The front door must remain on during system operation for NEBS EMI compliance.

The inside of the door contains an air filter made of UL 94 HF-1 foam. The removable air filter should be regularly vacuumed to remove any accumulated dust.

To remove the front door:

Step 1 If necessary, unlock the front door. The lock is located at the center of the door between the door latches.

Step 2 Flip up the two door latches located to the right and left of the lock. Hold the latches and pull the door approximately three inches away from the system enclosure. Grasp the sides of the door and lift it up and away to clear the studs located at the base of the enclosure.

Step 3 Carefully remove the door and place it in an area where it will not become damaged.

To install the front door:

Step 1 Grasp the sides of the door and position it so that the bottom is aligned with the studs located at the base of the enclosure.

Step 2 Flip up the two door latches located to the right and left of the lock. Hold the latches in the open position and push the door toward the system enclosure until it snaps closed. Press the door latches in.

Step 3 Lock the door.

Caution To ensure security, always lock the front door of the enclosure after you have performed service procedures.

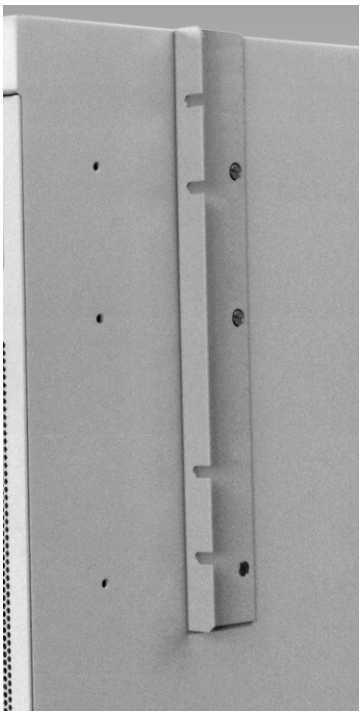
Mounting Options

The VCO/4K may be installed in an EIA standard cabinet that is 19 inches wide. If the VCO/4K will be installed in a cabinet or rack, a mounting shelf must be secured to the cabinet/rack and a mounting brace must be secured to the VCO/4K before it is lifted and placed in the cabinet or rack. Figure 1-5 shows the mounting brace (one on each side) for the VCO/4K.

Refer to the *Cisco VCO/4K Site Preparation Guide* for specifications on the mounting brace and shelf. Refer to the *Cisco VCO/4K Hardware Installation Guide* for information on attaching the mounting brace and shelf.

Two rear support holes are located at the base of the each side panel. You have the option of fabricating and attaching brackets for additional support when mounting the VCO/4K in a cabinet or rack.

Figure 1-5 Mounting Brace



Moving the System Enclosure

If the VCO/4K is mounted in a cabinet or rack, you must remove it from the cabinet or rack before moving it to another location.

Caution Follow ESD rules when removing system components. Be sure to use a wrist strap for grounding. At least two people are required to move the system enclosure.

To move the system enclosure:

Step 1 Power down the system by turning off the power switch at the rear of the enclosure.

Step 2 Disconnect the power connector from the power entry module.

Step 3 Remove the EIA/TIA-232 serial cables, parallel printer cables, and optional Ethernet transceiver cables connected to the rack. Be sure that all EIA/TIA-232 cables are properly labeled so that they can be rerouted and reinstalled, as necessary.

Step 4 Remove the network cables from the I/O modules. Be sure that all cables are properly labeled so that they can be rerouted and reinstalled, as necessary.

Step 5 Disconnect earth ground to the system at the ground point within the enclosure.

Step 6 Remove the power supply module(s) to decrease the weight of the system. For more information, refer to Chapter 3, “VCO/4K Power Subsystem.”

Step 7 If the VCO/4K is installed in a cabinet or rack, remove the VCO/4K from the cabinet or rack.

Step 8 Move the system as follows:

a. To move the system to another location in the same room, lift it into position.

b. To move the system to another location outside the room, repack the system enclosure, including the power supply modules, in the original shipping container.

The VCO/4K system enclosure must be installed to meet the clearance, environmental, and power criteria specified in the *Cisco VCO/4K Site Preparation Guide.* To reinstall the system enclosure, follow the procedures in the *Cisco VCO/4K Hardware Installation Guide.*

Troubleshooting

The system enclosure provides passive mechanical and electrical connections to the card rack and power subsystem. It is highly unlikely that the system enclosure will cause a system failure in the course of normal operation. The most likely cause of damage to a system enclosure is mechanical damage resulting in a misalignment of racks or an electrical short circuit within the rack cabling. More specific causes of damage include:

- Bumping into the enclosure
- Sudden or sharp pulling on network or EIA/TIA-232 cables attached to the I/O modules
- Electrical surge or short circuit at power input feeds
- Short circuit caused by placing or dropping a conductive tool (i.e., screwdriver or pliers) in the enclosure
- Electrical surge induced through network connections caused by lightning or other high-voltage conditions

To minimize any chance of mechanical or electrical damage to the enclosure, follow the recommended system clearances and central office practices for handling the MDF/digital cross-connectors and power connections. If mechanical or electrical damage does occur, refer to the troubleshooting information in the appropriate Cisco Systems technical description for the damaged component.

CHAPTER 2

Fan Unit

The fan unit in the VCO/4K system draws hot air from inside the VCO/4K and discharges it through the rear of the enclosure. The fan unit has an alarm indicator (LED) that illuminates when any of the four cooling fans has failed.

Power is provided to the fan unit from the power backplane. The fan unit is powered automatically when one or both power supply modules is powered on.

The fan unit consists of an aluminum tray that holds the following components:

- Eight 12-VDC cooling fans
- Three controller cards
- One temperature-sensitive thermal link (fuse)
- One LED indicator

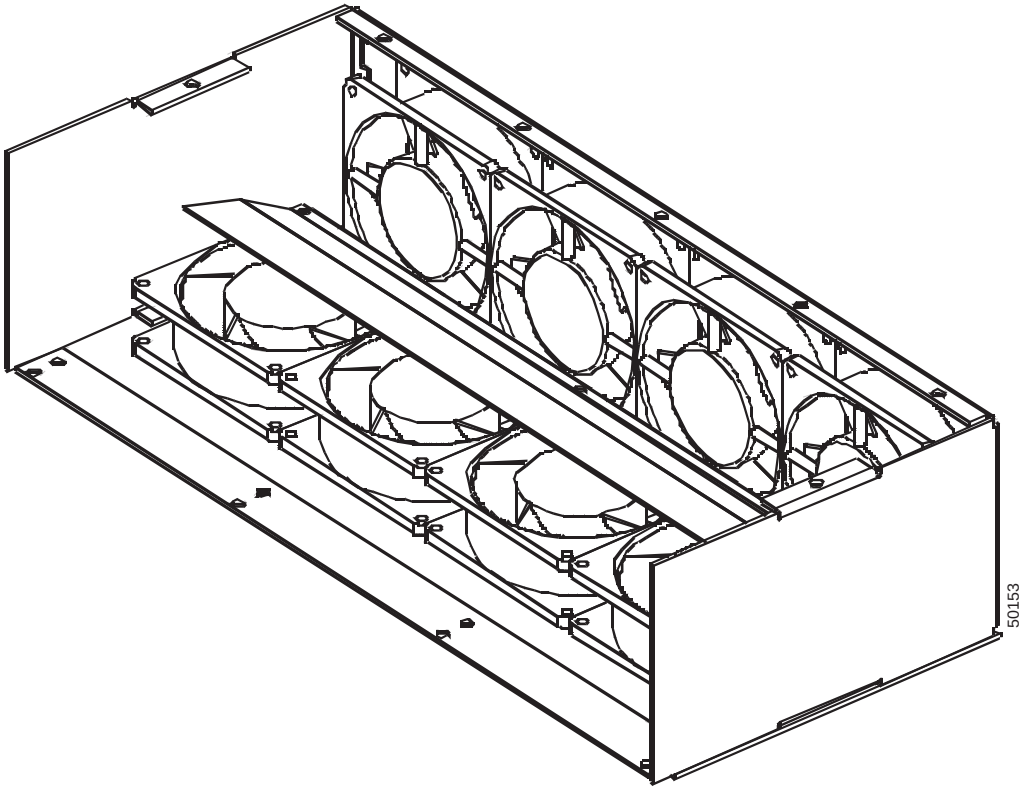
Specifications

Part Number	Contact your Cisco Systems sales representative
Indicator LED	Fan Alarm
Fan Type	Brushless, 47 cfm, 12 VDC
Power	6 –15 VDC, 24 watts
Physical Dimensions	Height: 3.5 inches (8.89 cm) Width: 17.5 inches (44.45 cm) Depth: 7.0 inches (17.78 cm)

Component Description

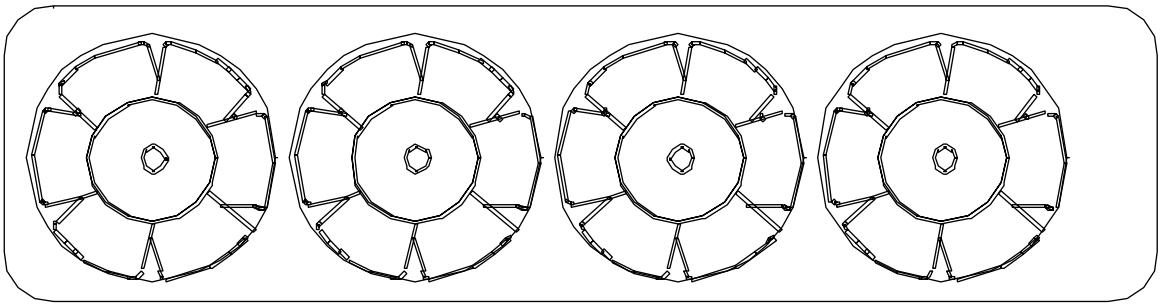
The fan unit is in the top 2U of the VCO/4K cabinet height. When the system is powered on, the fan unit draws hot air from inside the VCO/4K and discharges it through the rear of the system enclosure. Figure 2-1 shows the interior of the fan unit.

Figure 2-1 Fan Unit—Internal View



Note that the rear of the fan unit (see Figure 2-2) refers to the part of the unit which is *not* visible when the unit is installed in the VCO/4K. When installed, the rear of the fan unit is facing the front of the system enclosure.

Figure 2-2 Fan Unit—Rear View



The front of the fan unit (see Figure 2-3) refers to the part of the unit which is visible when the unit is installed in the VCO/4K. The front is visible when looking in the rear of the system enclosure.

Figure 2-3 Fan Unit – Front View

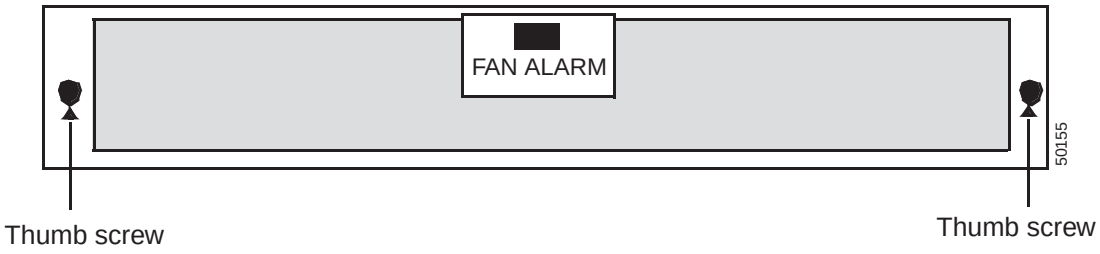
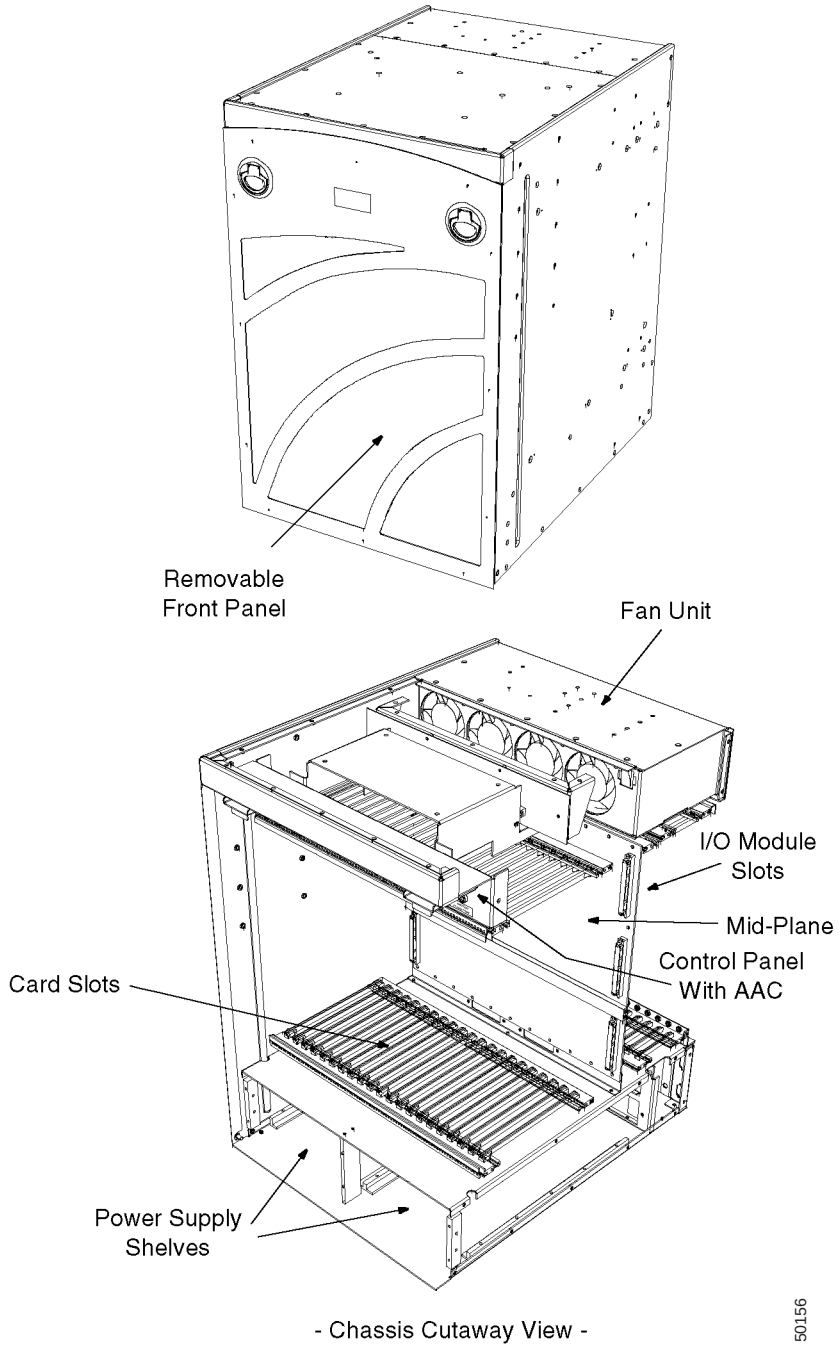


Figure 2-4 shows a cutaway view of the chassis and where the fan unit resides.

Figure 2-4 VCO/4K Switch Enclosure and Fan Location



Fan Controller Cards

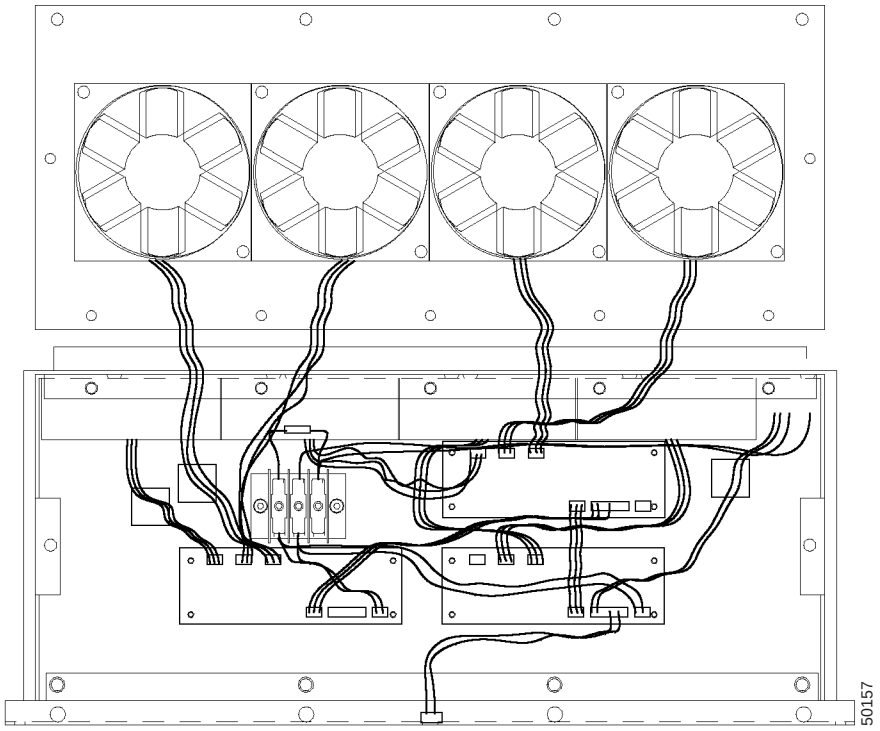
The fan unit contains three controller cards located between the fans and the front panel, inside the tray. Power is supplied to the fan unit from the VCO/4K power backplane through the plug located on the rear right side of the unit. Power goes onto the fan control cards through the J5 connectors. Refer to Figure 2-5.

Operation

The fan unit operates whenever at least one power module is powered on. If no power modules are on, or if the power connector is not plugged in, the fans do not run.

The power plug on the fan unit supplies power to the two fan control cards through the J5 connectors. The J1 and J2 connectors on the fan control cards supply power to the fans. Refer to Figure 2-5.

Figure 2-5 Fan Unit - Internal Wiring and Pin Locations



Alarm Indicator

The fan control card monitors its own cooling fans. If current fails to flow through any of its fans, the FAN ALARM LED is illuminated and a signal is sent to the AAC to trip MAJOR and AUX1 alarms.

Removal and Replacement Procedures

Only replace your fan unit if a fan or fan-control card fails. The VCO/4K system can operate without severe damage if up to two fans fail. However, replace your fan unit as soon as possible. Call Cisco Systems for a replacement as soon as you detect a failure, or replace the unit immediately with a spare unit if one is available.

Caution Do not operate the VCO/4K without the fan unit or if more than two fans have failed unless the fan unit is being removed and immediately replaced.

Removal Procedures

You can remove fan units while the system is operating. If you remove the unit while the system is operating, ensure that no objects become lodged or tangled in the operating fans while the unit is being removed.

To remove a fan unit:

Step 1 Unscrew the thumb screws located on the right and left sides of the fan unit. Refer to Figure 2-3.

Step 2 Slide the fan unit directly back about half way.

Caution Do not fully remove the fan unit from the VCO/4K until the power supply plug on the fan unit has been disconnected.

Step 3 While the unit rests on the shelf, locate the power supply plug on the back, left side of the fan unit. Squeeze the sides of the plug to release it and disconnect the plug.

Step 4 After disconnecting the power supply, grasp the fan unit on both sides and continue sliding it out until it is clear of the system enclosure.

Step 5 Pack and ship the fan unit to Cisco Systems for service.

Note Individual components of the fan unit are not field replaceable.

Replacement Procedures

You can replace fan units while the system continues to operate. If you replace the unit while the system is operating, ensure that no objects can become lodged or tangled in the fans when they begin to operate during the replacement procedure (see Step 3).

To replace a fan unit:

Step 1 Unpack the replacement fan unit. Be sure all packing materials have been removed.

Step 2 Lift the fan unit into position so the top of the unit is flush with the top of the VCO/4K enclosure, and guide about halfway into the system enclosure. If you cannot guide or lift the unit into the enclosure, make certain that the top of the unit has been correctly positioned.

Step 3 Connect the power supply located on the back, left side of the fan unit. The fans will operate at this time if the system power is on.

Step 4 Continue sliding in the fan unit until the front is flush with the back of the VCO/4K enclosure, then tighten the thumb screws located on the left and right sides of the unit. Refer to Figure 2-3 for the location of the thumb screws.

Note Do not force the fan unit into the cabinet because the wires may be blocking the installment of the unit. Make certain that the fan power supply wires do not get pinched between the fan unit and the enclosure.

Troubleshooting

Note More extensive troubleshooting information is contained in the *Cisco VCO/4K Troubleshooting Guide*.

If the MAJOR and AUX1 alarms are tripped by the AAC, suspect problems with the fan unit. Check the status of the alarm indicator on the fan unit.

Refer to Chapter 3, “VCO/4K Power Subsystem,” for information on LED states.

Fan Failure

If the Fan Alarm LED on a fan unit illuminates, check the following to identify and correct the problem. These troubleshooting procedures require that the fan unit be removed from the VCO/4K.

Refer to the “Removal and Replacement Procedures” section on page 2-6 for instructions on how to remove the fan unit.

- Check to determine if a foreign object is blocking fan rotation.
- Check that the internal connectors have not become disconnected.
- Make certain that the J5 power connector has not become disconnected.

If the failed fan does not operate, and you have checked all troubleshooting details, remove the fan unit, pack, and ship it to Cisco Systems for service.

Caution Do not operate the VCO/4K until the fan unit has been replaced.

Power Failure

If a fan unit fails to operate, be sure that power is being provided to the system. Check that the power supply LED is illuminated.

If the power LED is illuminated and the fan unit's front panel LED is extinguished, suspect that no power is being supplied to the fan unit. Remove the fan unit and check that the power plug on the back, left side of the fan unit is plugged in.

If the fan unit still does not operate, contact and report your findings to Cisco Systems Technical Support and request further assistance.

Fan Failure Problem Fails to be Detected by LED or AAC

If a fan fails to operate and the LED does not illuminate, or an alarm is not sent to the AAC, check the following troubleshooting procedures. These procedures require that you remove the fan unit from the VCO/4K. Refer to the "Removal and Replacement Procedures" section on page 2-6 for removal procedures.

If the LED does not illuminate, check that:

- The internal connectors have not become disconnected between the three fan control cards.
- The plug to the LED has not become disconnected.

If an alarm is not sent to the AAC, check that:

- The internal connectors have not become disconnected.

CHAPTER 3

VCO/4K Power Subsystem

The power subsystem in the VCO/4K Open Programmable Switch consists of the following main components:

- Power entry module
- Power backplane
- Power supply module (two modules in redundant systems)

This subsystem is in the lower portion of the VCO/4K system. Figure 3-1 shows the front of a redundant system with the door removed and two power supply modules visible. Figure 3-2 shows the power entry module in the rear of the system. The power backplane is located internally, between the power supply modules and the power entry module.

The power subsystem powers the following:

- Programmable switch logic
- Disk storage units
- Analog functions
- Ring voltage (if optional ring generator is installed)
- Cooling fans

Figure 3-1 VCO/4K Redundant System (Front View)

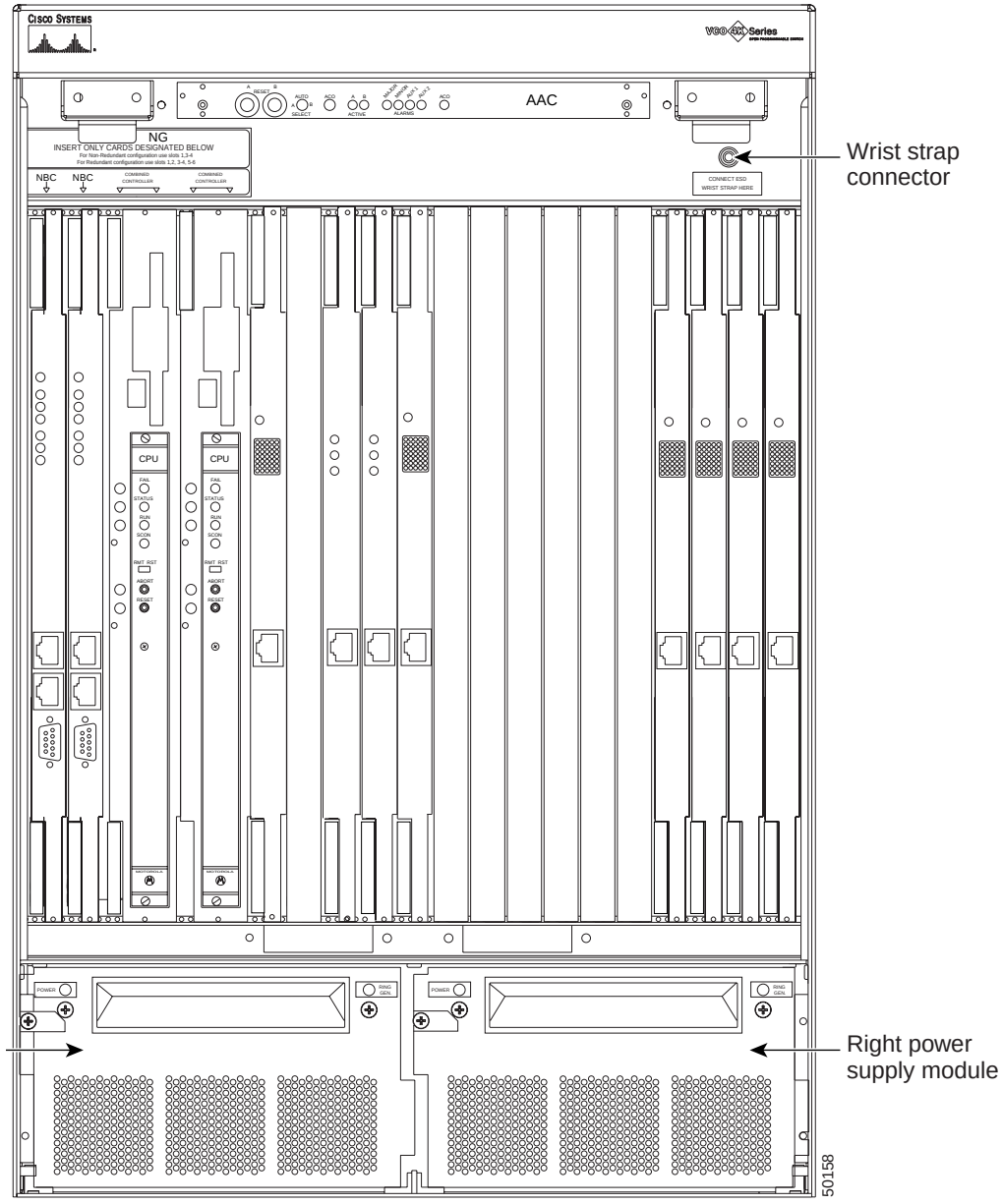
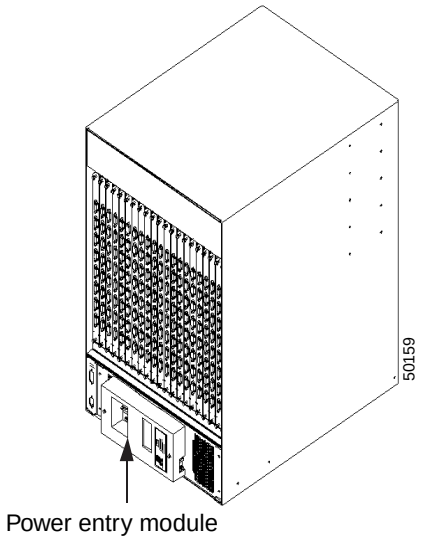


Figure 3-2 VCO/4K System (Rear View)



Specifications

The following specifications apply for the three power subsystem components, and the ring generator:

Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	20 to 80% (noncondensing); temperature rise or fall should not exceed 10°C (18°F) per hour

Specifications for Power Entry Module

Part Number	DC:	Contact your Cisco Systems sales representative
	AC:	Contact your Cisco Systems sales representative
	Dual DC Kit:	Contact your Cisco Systems sales representative
Physical Dimensions	Height:	5 in. (12.5 cm)
	Width:	16 in. (40 cm)
	Depth:	3 in. (7.5 cm)
Nominal Input Voltages	DC:	–48 VDC
	AC:	120 VAC or 240 VAC

Specifications for Power Supply Module

Part Number	AC	Contact your Cisco Systems sales representative
	DC	Contact your Cisco Systems sales representative
Physical Dimensions	Height:	5 in. (12.5 cm)
	Width:	8 in. (20 cm)
	Depth:	7 in. (42.5 cm
Output Voltages	All VDC:	+5, +15, –15, +12, +24, –48

Specifications for Ring Generator (optional)

Part Number	Contact your Cisco Systems sales representative	
Physical Dimensions	Height:	4 in. (10 cm)
	Width:	4 in. (10 cm)
	Depth:	1 in. (2.5 cm)
Output Voltag:	77 VAC	

Power Entry Module

The power entry module (PEM) serves as a mechanical connection point for site power. It includes the following (refer to Figure 3-4):

- Power connector
- Power switch
- Power line filter

The PEM accepts AC or DC source voltages listed in Table 3-1.

Note The power entry module accepts either a single-line AC feed, a dual-line DC feed, or a single-line DC feed. The factory-installed power supply modules are compatible with the power entry module configuration. The label on the power entry module will either specify your system's type of input power (see Figure 3-4) or list both possibilities (see Figure 3-5). Aways verify the input power type by looking at the front of each power supply module. Ensure that the power source is the correct current and voltage for your facility before cabling the power source.

The line filter ensures that electromagnetic interference (EMI) neither enters nor exits the system.

Figure 3-3 Power Entry Module With Input Power Type Specified

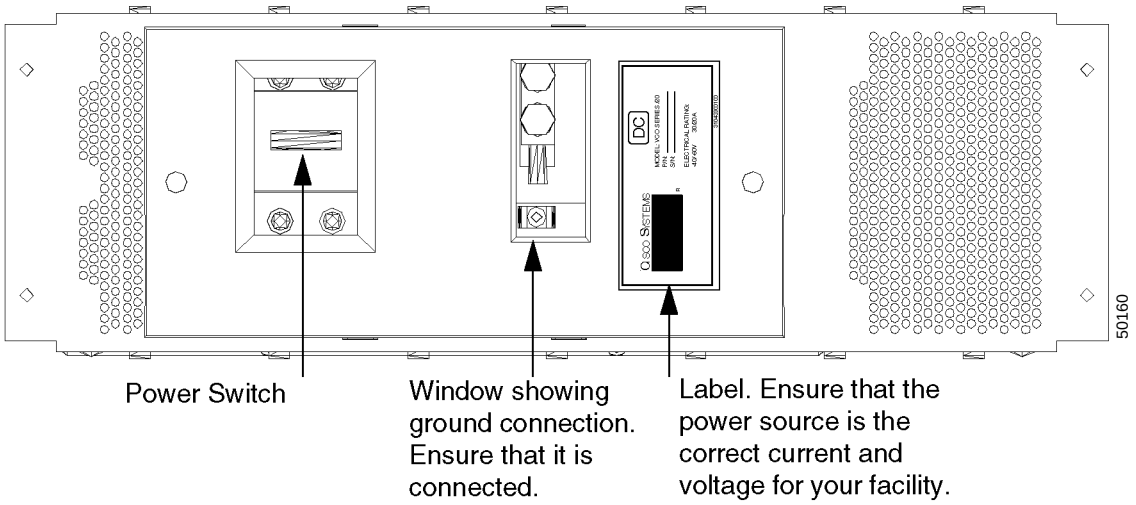
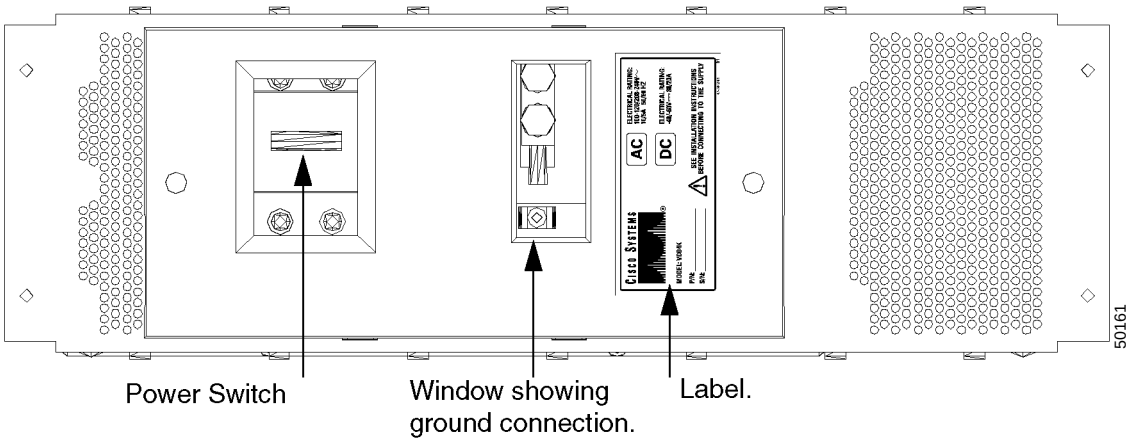


Figure 3-4 Power Entry Module With Both Input Power Types Specified



Input Power

The VCO/4K can be purchased for AC or DC operation. Your system will come with either AC or DC power supplies, accordingly. Table 3-1 lists the power input ratings for AC or DC sources.

Table 3-1 VCO/4K Power Input Ratings

Nominal	Range	Current	Frequency
–48 VDC (per feed)	–40 to –60 VDC	20 amps	DC
120 VAC, single phase	100 to 120 VAC	10 amps	50/60 Hz
240 VAC, single phase	208 to 240 VAC	5 amps	50/60 Hz

Refer to the *Cisco VCO/4K Hardware Installation Guide* for information on proper wiring of input power. The VCO/4K system is shipped with a kit containing lugs for the input power cabling.

Warning **Do not open the power entry module (PEM) or you will void your Cisco Systems warranty.**

Table 3-2 indicates the required terminal (labeled TB1 through TB5) for each conductor, for the four possible input power sources. Refer to the *Cisco VCO/4K Hardware Installation Guide* for illustrations.

Table 3-2 Input Wiring Connections for AC and DC VCO/4K Systems

Conductor	Terminal
Single Feed –48 VDC (nominal)	
Jumper 1	TB1 to TB4
Jumper 2	TB2 to TB5
Battery return (+)	TB4
Battery (–)	TB5
Ground	TB3
Dual Feed –48 VDC (nominal)	
Battery Return A(+)	TB1
Battery A(–)	TB2
Battery Return B (+)	TB4
Battery B (–)	TB5
Ground	TB3
Single Feed 120 VAC (nominal)	
Neutral	TB5
Line	TB2
Ground	TB3
Single Feed 240 VAC (nominal)	
Line 1	TB2
Line 2	TB5
Ground	TB3

Indicator LEDs

There are two LEDs on the front of the power supply module: the power LED on the left side, and the Ring Generator LED on the right side. See Figure 3-5.

Power LED

The power LED is on the upper left side of the power supply module. When illuminated, it is either green or red.

- Green indicates that the power is on and operation is normal.
- Red indicates a voltage failure although the interlock switch is closed and the power is on.

  Replace either the fuse or the power supply module. Refer to the "Spare Fuse Kit" section on page 3-14 for information on the fuse, and the "Removal and Replacement Procedures" section on page 3-11.
- Red could also indicate that you failed to install the external jumper needed for single-line feed DC operation (refer to Table 3-2).
- When the LED is off, or if it glows a faint red (reduced illumination), the interlock switch is open (power to the module is turned off).

Ring Generator LED

The Ring Generator LED is on the upper right side of the power supply module. When illuminated, it is either green or red.

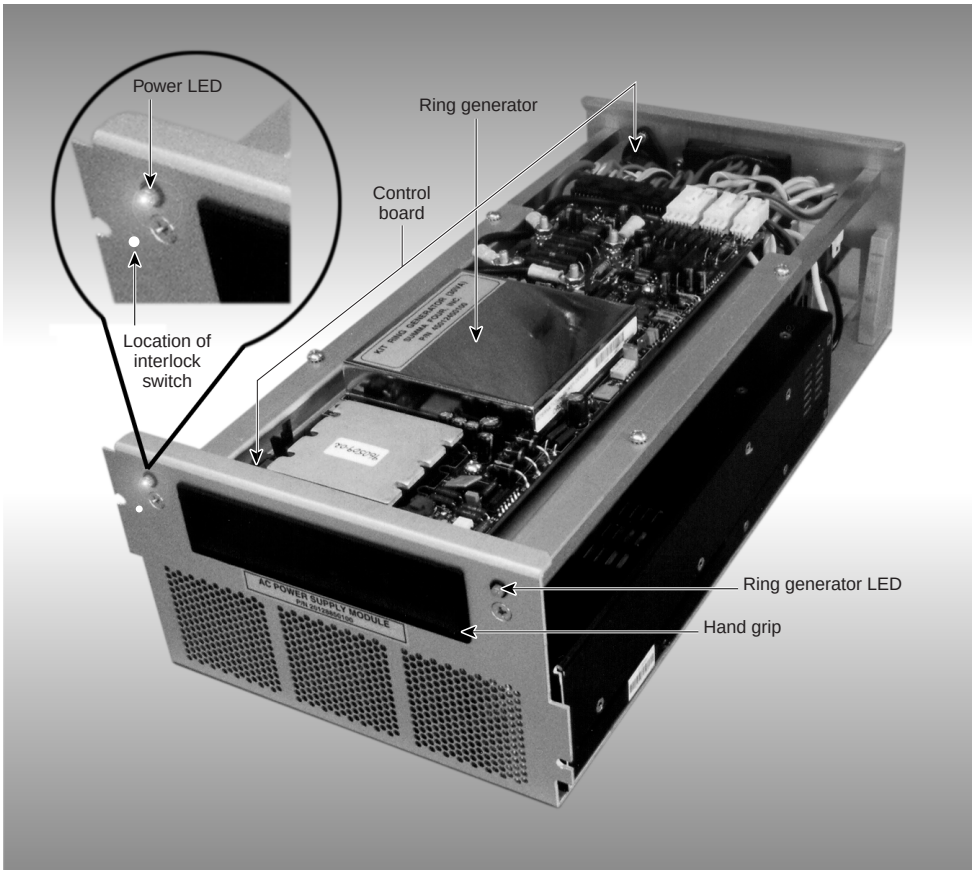
- Green indicates that a ring generator is installed and working correctly.
- Red indicates a ring generator failure.
- When the LED is off, there is no ring generator present in that power supply module.

Interlock Switch

The interlock switch is under the power LED. Use this switch to remove and replace power supply modules while the system is running. To safely remove the power supply module, turn off the output power (switch in the open position). Remove the upper left screw to open the interlock switch. Refer to Figure 3-5. Refer to the "Removal and Replacement Procedures" section on page 3-11 for instructions on removing a redundant power supply module.

When you close the interlock switch, the output power is turned on, and the power supply module is operational.

Figure 3-5 Power Supply Module



Power Backplane

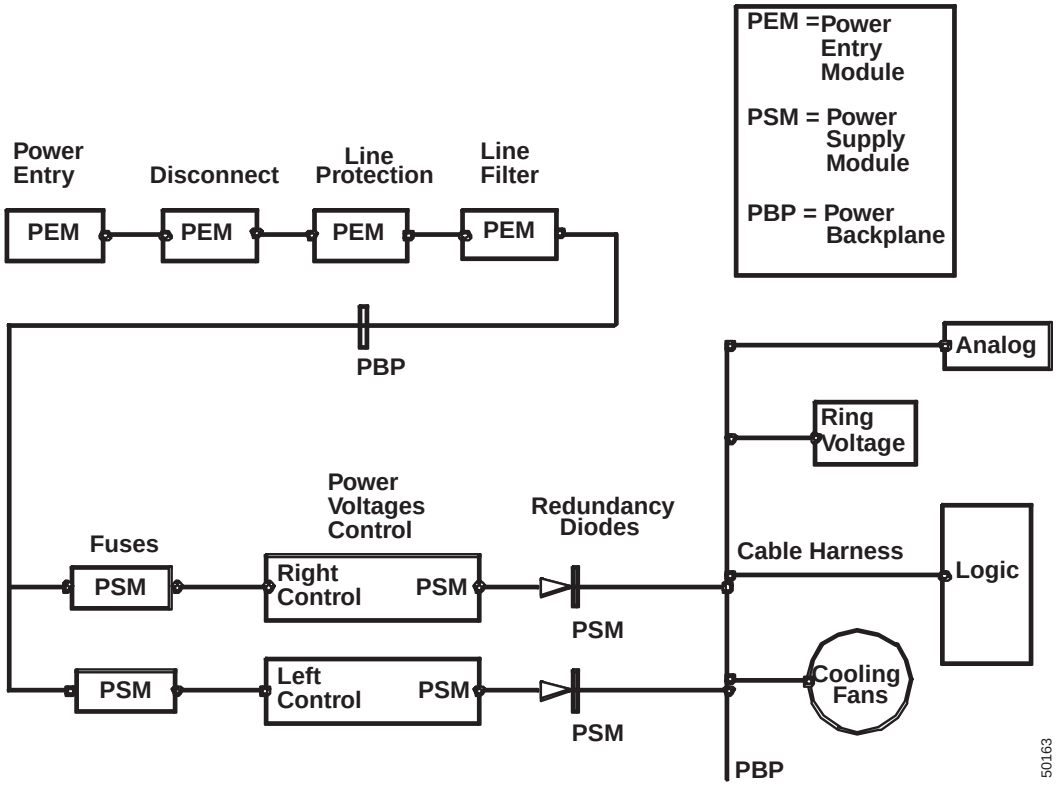
Input power from the power entry module travels through the power backplane to the power supply module where it is converted to usable voltages. The power supply module distributes the voltages to the power backplane, which distributes it to the rest of the system.

The power backplane contains:

- Four fuses (can be automatically reset)
- Connections for alarm signals
- Internal equipment safety connection

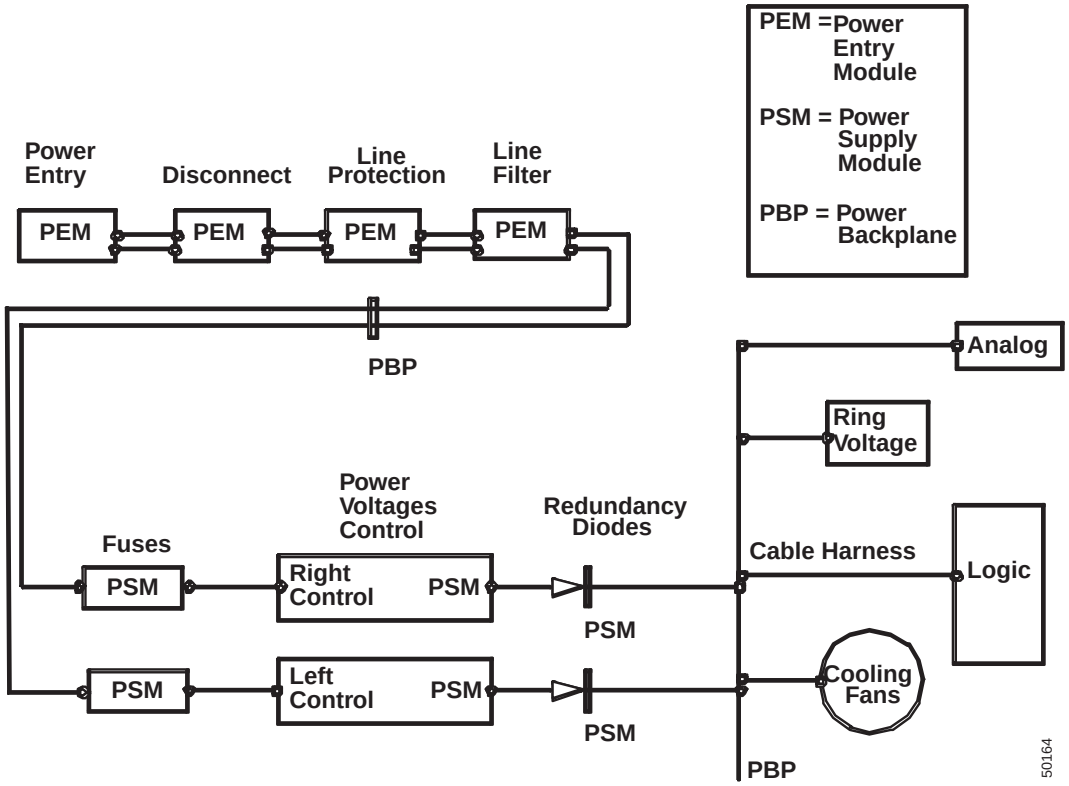
Figure 3-6 is a system-level functional diagram of the power subsystem for single-feed AC/DC operation. Figure 3-7 is the diagram for dual-feed DC operation.

Figure 3-6 Power Subsystem Functional Diagram for Single-Feed AC/DC Operation



Note If you want single DC input power, you must install two external jumpers: a/rtn to b/rtn and a/bat to b/bat. This way, both power supply modules are powered from a common feed.

Figure 3-7 Power Subsystem Functional Diagram for Dual-Feed DC Operation



Output Power Redundancy and Load Sharing

The main power supply module is on the left of all VCO/4K systems. In nonredundant systems, ensure that the power supply module is on the left.

The following describes the power supply load-sharing and redundancy in VCO/4K systems:

- The modules share the total load on each voltage in redundant systems.
- The system automatically remains in operation without interruption, during and after a power supply module failure. The system disconnects the failed module and switches all power to the redundant module.
- The power supply modules provide individual load-sharing for each voltage. If a voltage failure occurs, it continues to load-share the remaining voltages.

  For example, if the +5 VDC voltage fails in a power supply module, the remaining voltages are not affected, and continue to load-share with the other module.
- Each module is equipped with a 25-amp fuse, ensuring that redundancy is maintained in the event of an overcurrent fault. If a fuse blows in one power supply module, the system does not shut down.

The power supply module provides six regulated DC voltages for system operation, as shown in Table 3-3.

Table 3-3 DC Voltages for System Operation

Voltage	Tolerance	Current
+5 VDC	±0.25V	84 amps
+15 VDC	±0.5V	4 amps
–15 VDC	±0.5V	4 amps
+12 VDC	+3V, -0V	1 amp
+24 VDC	±1.0V	1 amp
–48 VDC	±4.0V	3 amps

Ring Generator

The ring generator is active only when it is installed in the left power supply module. Ring generators can be installed in both power supply modules in a redundant system. However, the ring generator in the right power supply module is not connected to the system and is considered a spare. Power loss to the left power supply module results in loss of the ring generator (if installed).

The two circuit configuration jumpers, JP6 and JP7, on the power supply module, are configured as shown in Table 3-4 when the VCO is shipped with a ring generator installed. This configuration is required for proper operation of the ring generator alarm and its LED. Refer to the “Indicator LEDs” section on page 3-7 for information about the LED.

If your system has a ring generator, you must install JP7, in the left module only.

Table 3-4 JP6 and JP7 Configuration

Configuration	JP6	JP7
Right Power Supply Module	Install when ring generator is present	Remove
Left Power Supply Module without a ring generator	Remove	Remove
Left Power Supply Module with a ring generator	Install	Install

Note If you install a ring generator, configure the JP6 and JP7 jumpers. The ring generator kit includes installation instructions.

Removal and Replacement Procedures

Follow ESD rules when removing or replacing a system component. Use a wrist strap connected to the system for grounding. See Figure 3-1.

Warning **Voltages present on the power backplane and at other test points produce severe, perhaps fatal electrical shock. Observe all precautions normally associated with the testing of electrical equipment.**

Turn off power at the source before performing any service.

Removal Procedures

Caution Follow ESD rules when removing a system component. Use a wrist strap for grounding.

To remove a nonredundant power supply module:

Step 1 Turn the switch off on the power entry module if the system does not contain redundant power supply modules, or if both power supply modules are to be removed simultaneously. The power disconnect switch is located in the rear of the system on the power entry module (see Figure 3-4).

Step 2 Remove the front door of the VCO/4K system to access the power supply module.

Step 3 Connect your wrist strap to the system (upper right corner). See Figure 3-1.

Step 4 Remove the two mounting screws on the front panel of the power supply module.

When the upper left screw is removed, the power is cut off from the module (the power LED is off).

Note If the LED is faintly illuminated red, and the interlock switch screw is removed, it is safe to remove the power module.

Step 5 Grasp the black hand grip on the front of the module with one hand and pull the module out. Use your other hand to provide support underneath the module as you remove it from the system.

To remove a redundant power supply module:

Step 1 Remove the front door of the VCO/4K system to access the power supply module.

Step 2 Connect your wrist strap to the system (upper right corner). See Figure 3-1.

Step 3 Remove the two mounting screws on the front panel of the power supply module.

When the upper left screw is removed, the power is cut off from the module (the power LED is off).

Note If the LED is faintly illuminated red, and the interlock switch screw is removed, it is safe to remove the power module.

Step 4 Grasp the black hand grip on the front of the module with one hand and pull the module out. Use your other hand to provide support underneath the module as you remove it from the system.

Replacement Procedures

Caution Follow ESD rules when removing a system component. Use a wrist strap for grounding.

To replace a power supply module:

Step 1 If the power supply module is nonredundant, ensure that the power is off.

Step 2 Remove the front door of the VCO/4K system to access the power supply module.

Step 3 Connect your wrist strap to the system (upper right corner). See Figure 3-1.

Step 4 Grasp the black hand grip on the front of the module with one hand and use your other hand to provide support underneath the module as you push it into its compartment.

Step 5 Fasten the two mounting screws on the front panel of the power supply module.

Note Ensure that you rotate the plate into position to align the left mounting screw before fastening the screw into place.

Step 6 If necessary, turn the VCO/4K system on.

Step 7 Remove your wrist strap.

Step 8 Check the power LED and ensure that the power supply module is operating. Refer to the "Indicator LEDs" section on page 3-7 for information on the LED.

Step 9 Replace the front door.

Caution The front door must remain on during system operation for EMI compliance.

Troubleshooting

Note More extensive troubleshooting information is contained in the *Cisco VCO/4K Troubleshooting Guide*.

Alarms

The following two events occur simultaneously when voltage monitoring on the control board of the power supply module detects either an over- or undervoltage condition:

- An alarm is sent to the Alarm Arbiter Card (AAC) and is displayed on the AAC. The red MAJOR LED turns on; the yellow AUX1 LED turns on.
- The power LED on the power supply module turns red.

When these two events occur, you must replace the power supply module. Refer to the “Removal and Replacement Procedures” section on page 3-11.

Spare Fuse Kit

One spare fuse kit containing two 25-amp fuses comes with the VCO/4K. A fuse is on the back of each power supply module.

CHAPTER 4

Storage/Control I/O Module

The Storage/Control I/O Module performs two functions: to connect outside interfaces to the system controller and to house the hard disk drive. It plugs into the back of the VCO/4K system and provides the I/O interfaces for system peripheral devices and host communication links using four serial ports, one Ethernet port, one printer port and one SCSI connector. Figure 4-1 shows the front panel of the Storage/Control I/O Module.

Physical interfaces to host computers and peripheral devices are provided on the front panel of the Storage/Control I/O Module. Two serial ports are available for SIO host links, and another two are dedicated to supporting the local system administration console and a remote maintenance modem. An Ethernet Transceiver interface and parallel printer connector are also located on the Storage/Control I/O Module.

Specifications

Part Number	Contact your Cisco Systems sales representative		
Interfaces	Four EIA/TIA-232 serial ports (master console, remote maintenance modem, and two SIO host links)		
	One Ethernet transceiver interface		
	One Centronics-type parallel interface (system printer)		
	One SCSI connector (reserved for future use)		
Power Requirements:		Maximum	Typical
Hard Disk Drive	+5 VDC	0.4A	0.33A
	+12 VDC	1.0A	0.17A
Ethernet	+5 VDC	0.5A	0.5A
	+12 VDC	0A	0A
EIA/TIA-232	+5 VDC	0A	0A
	+12 VDC	0.1A	0.05A

Total Current	+5 VDC	0.9A	0.85A
	+12 VDC	1.1A	.22A
Total Power	+.5 VDC	7.7 Watts	
	+12 VDC	6.89 Watts	
Operating Temperature	10 to 40°C (50 to 104°F)		
Relative Humidity	20 to 80% (noncondensing)		
Physical Dimensions	Height:	14.4 inch (36.6 cm)	
	Depth:	5.6 inch (14.2 cm)	
	Width:	1.6 inch (4.1 cm)	

Description

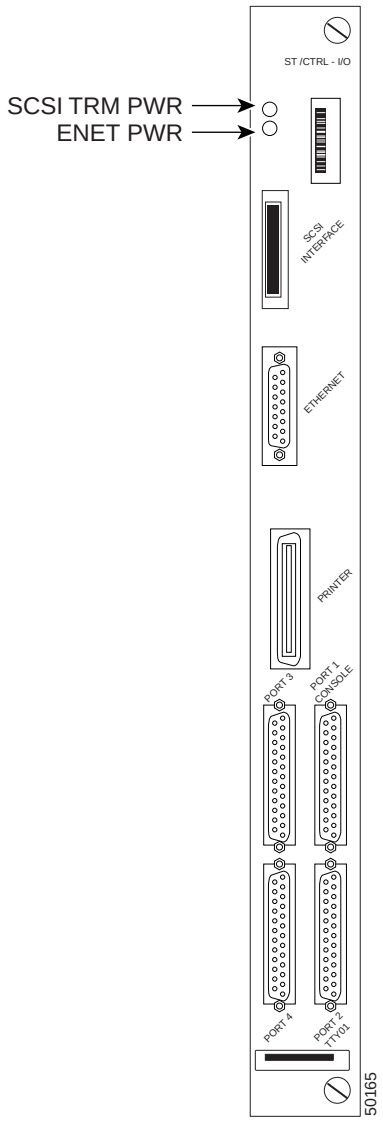
The Storage I/O Module is two card slots wide and slides into the back of the VCO system where it plugs into the control midplane. All outside connections are mounted on the faceplate of the module. All internal connectors are mounted on the board itself for easy access to system internals (for example, SCSI and Ethernet).

The VCO/4K system hard drive is mounted on the upper portion of the I/O Module. The board is built to accommodate a 3.5-inch hard drive. Physical mounting points are provided for the hard drive as well as a 50-pin SCSI interface to the system controller. There is also a provision for an external SCSI connection on the front panel. The SCSI connection is reserved for future use.

Front Panel Indicators and Ports Assignments

Figure 4-1 shows the front panel of the Storage/Control I/O Module.

Figure 4-1 Storage/Control I/O Module Front Panel



Power is supplied to the Storage/Control I/O Module via the midplane from the Combined Controller card. The hard drive LED signal is brought to the system controller board via the midplane and brought out to the front panel to show hard drive activity. It is located on the Combined Controller in the front of the VCO (see Figure 4-3).

SCSI terminations are provided as an option to be populated on the Storage/Control I/O Module depending on the system configuration. They are currently not being used.

The connectors mounted on the front pane are:

:

4 serial ports	DB-25
SCSI port	50-pin mini-SCSI connector
Ethernet	DB-15
Printer	36-pin Centronics

The connectors mounted on the board are:

SCSI	DIN 64
MODEM	20-pin IDC connector
MODEM power	5-pin header

The LEDs mounted on the board are:

ENET	If illuminated, shows that power is available to the Ethernet
SCSI	If illuminated, shows that there is SCSI termination power

Hard Disk Drive

The hard disk drive is a SCSI-compatible drive that is used as the system controller's main data storage facility. The hard disk drive requires +5 volts and +12 volts DC to operate. The hard disk drive is shown in Figure 4-2. The Storage/Control I/O Module supports the hard disk drive LED. The LED is located on the Combined Controller and is visible from the front of the system (see Figure 4-3).

Figure 4-2 Location of the Hard Disk Drive on the Storage/Control I/O Module

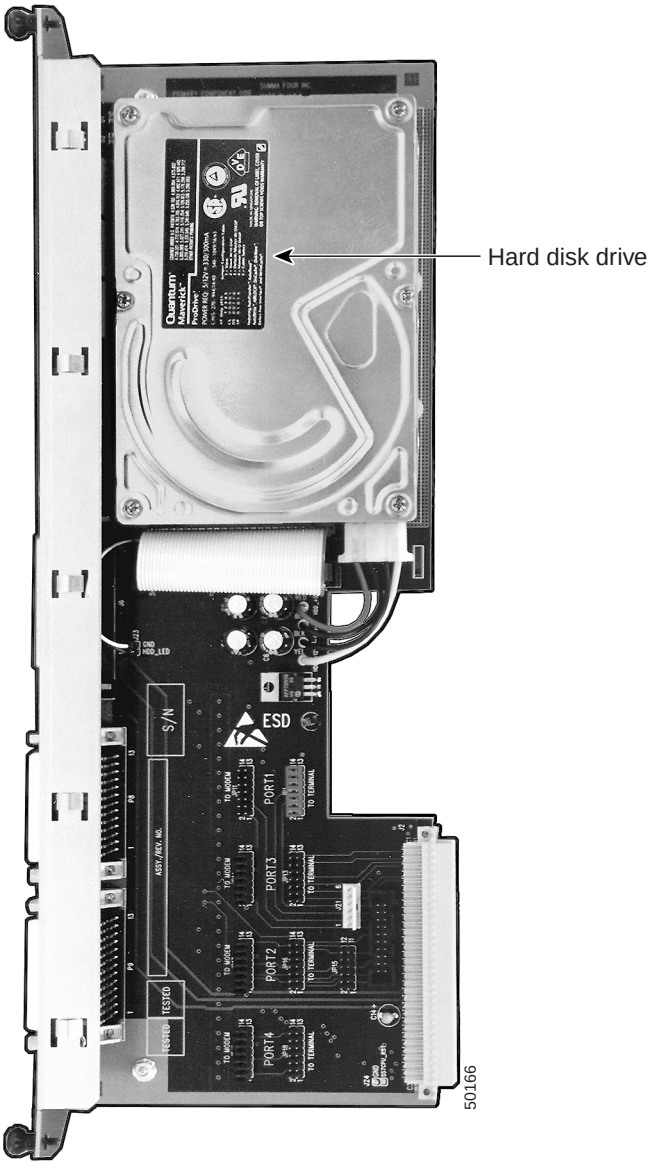
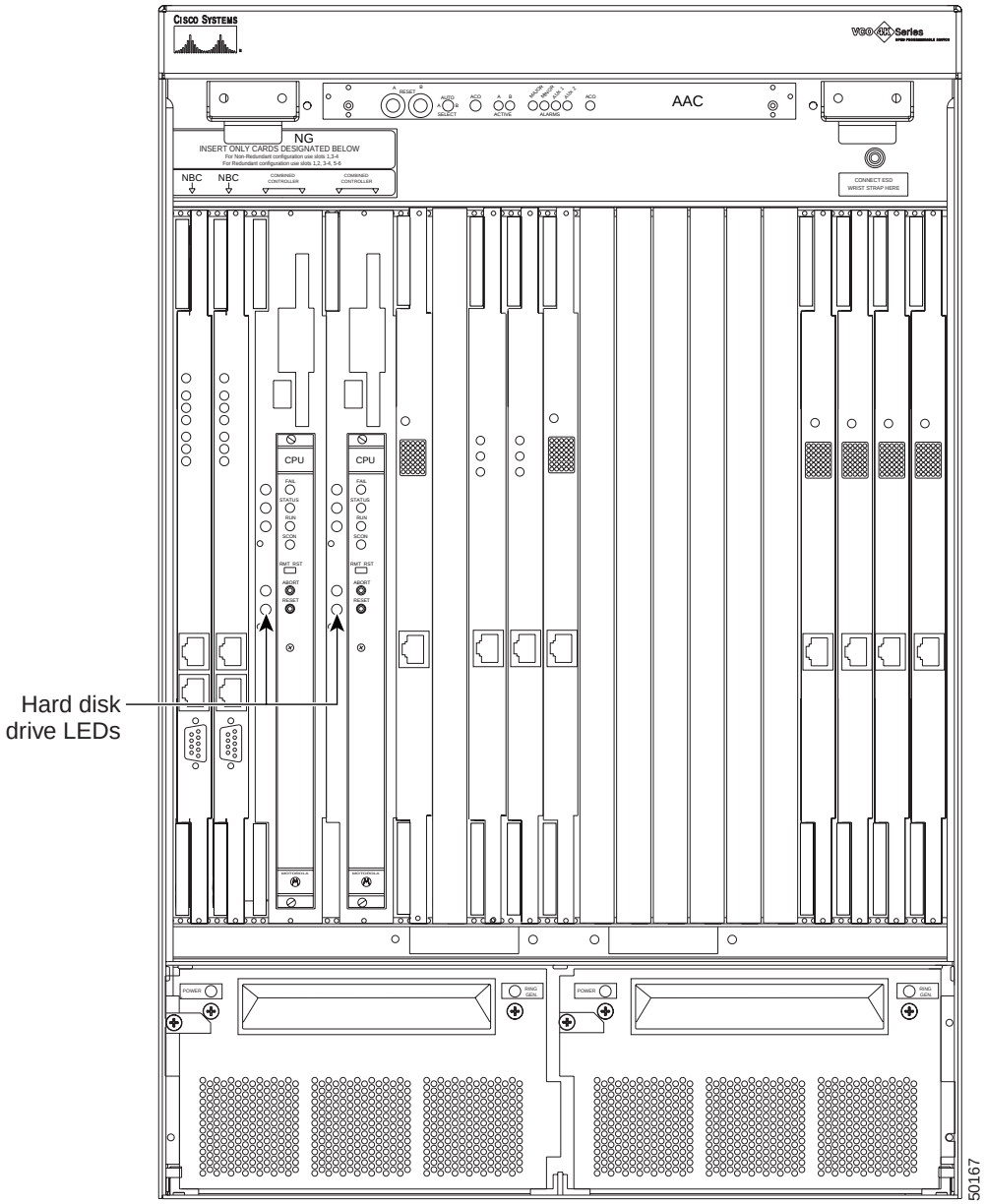


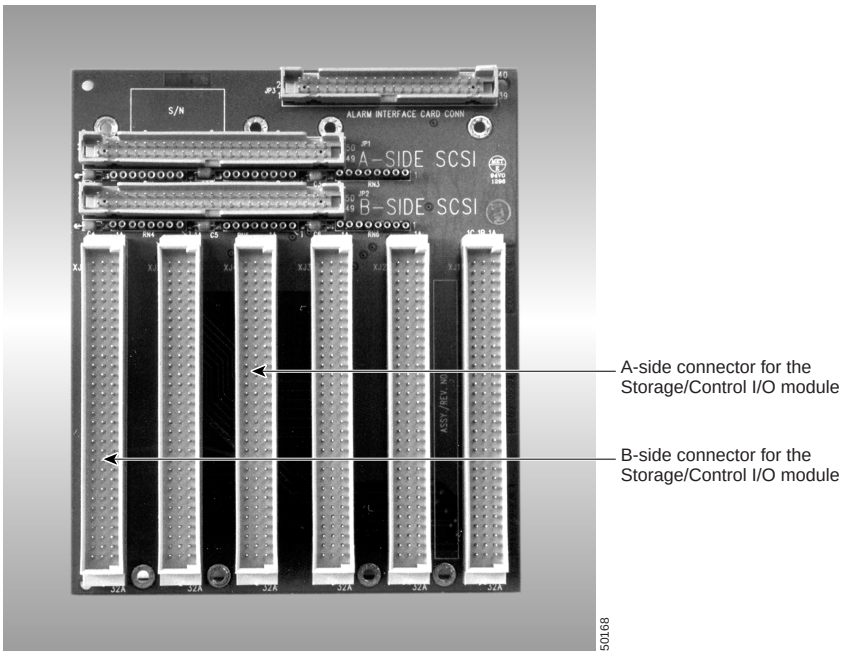
Figure 4-3 Location of Hard Disk Drive LED on the Combined Controller



Midplane Connectors

The Storage/Control I/O Module plugs into the midplane through standard DIN 41612 triple-row, 96-pin male connectors. Figure 4-4 shows the control midplane connectors.

Figure 4-4 Control Midplane



Serial Ports 1 and 2

Serial Port 1/Console and Serial Port 2/TTY01 are dedicated ports for connecting the system master console and remote maintenance modem, respectively. These standard female DB-25 ports connect to the console and modem via EIA/TIA-232 cables. Table 4-1 shows the pin and signal assignments for these ports. For additional information on connecting peripheral equipment, refer to the *Cisco VCO/4K Hardware Installation Guide*.

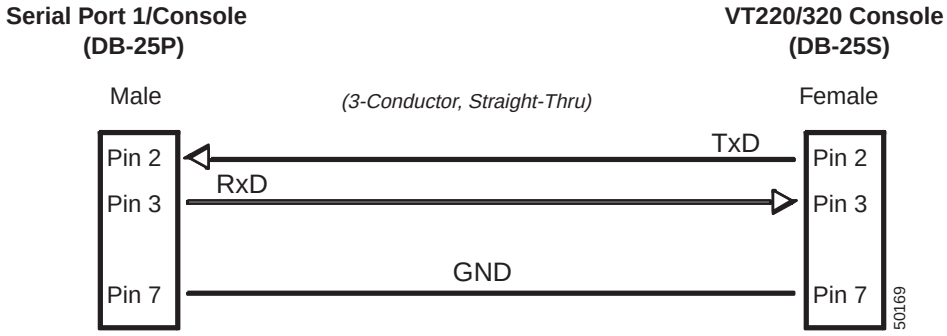
Table 4-1 Serial Ports 1 and 2 Pin and Signal Assignments[1]

Pin	Signal Name	Description/Direction
2	TxD	Transmit Data (terminal to modem)
3	RxD	Receive Data (modem to terminal)
4	RTS	Request to Send (terminal to modem)
5	CTS	Clear to Send (modem to terminal)
6	DSR	Data Set Ready (modem to terminal)
7	GND	Chassis Ground
8	DCD	Data Carrier Detect (modem to terminal)
20	DTR	Data Terminal Ready (terminal to modem)

1. All pins not identified are no-connection.

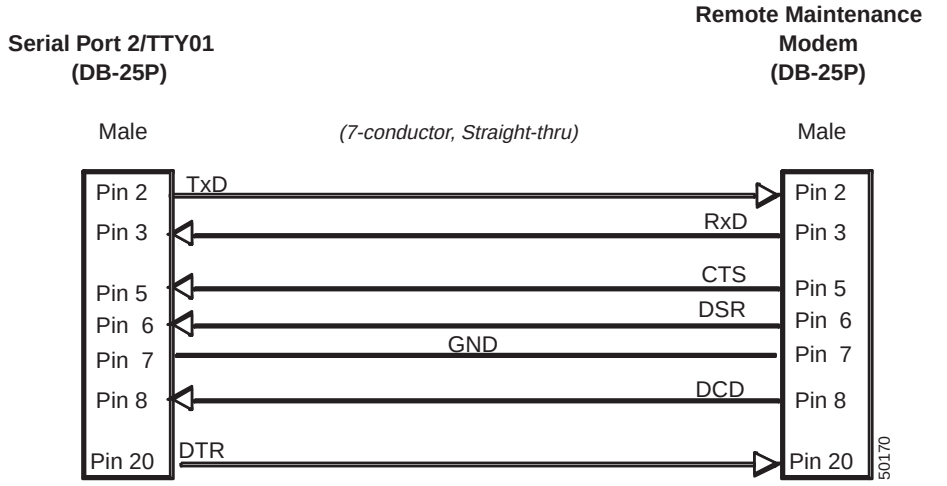
Master console and remote maintenance modem operating parameters (Baud Rate, Stop Bits, Bits per Character and Parity) are defined in the system database via the Peripheral Configuration screen. Wiring for serial port connection to the Master Console is shown in Figure 4-5. Wiring for the remote maintenance modem connection is shown in Figure 4-6. Refer to the *Cisco VCO/4K System Administrator's Guide* for more information.

Figure 4-5 I/O Module to Master Console—Cable Wiring Diagram



Note You can use a 25-conductor, straight-through cable to connect a master console to the Storage/Control I/O Module. However, only the conductors shown in Figure 4-5 are used.

Figure 4-6 I/O Module to Remote Maintenance Modem—Cable Wiring Diagram



Note You must use a 9-pin connector (available from Cisco Systems). A 25-pin connector can be used after the switch box.

Serial Ports 3 and 4

Serial Ports 3 and 4 are available for Serial I/O (SIO) links between the system and a host computer. These standard female DB-25 ports carry Asynchronous Data Link Control (ADLC) protocol signals between the host and the system over EIA/TIA-232 cables. Pin and signal assignments for port 3 is the same as Serial Ports 1 and 2. Refer to Table 4-2 for port 4 pin and signal assignments.

Wiring conventions for physically connecting a host computer to a SIO port are provided in the *Cisco VCO/4K Hardware Installation Guide*. Jumpers on the Storage/Control I/O Module allow Serial Ports 3 and 4 to be configured as modem (DCE) terminations for connection to a terminal or configured as terminal (DTE) terminations for connection to a modem. Refer to the "Serial Ports 1 Through 4 and Jumper Settings" section on page 4-11 for more information on jumper configurations.

Data communication parameters for each host link must be defined in the system database using the Host Configuration screen following system power-on. Refer to the *Cisco VCO/4K System Administrator's Guide* for instructions on defining host links.

Table 4-2 Serial Ports 3 and 4 Pin and Signal Assignments[1]

Pin	Signal Name	Description/Direction
2	TxD	Transmit Data (terminal to modem)
3	RxD	Receive Data (modem to terminal)
4	RTS	Request to Send (terminal to modem)
5	CTS	Clear to Send (modem to terminal)
6	DSR	Data Set Ready (modem to terminal)
7	GND	Chassis Ground
8	DCD	Data Carrier Detect (modem to terminal)
15	RTxC	Tx Clock to output data (terminal to modem)
17	RRxC	Rx Clock to input data (terminal to modem)
20	DTR	Data Terminal Ready (terminal to modem)
24	TTxC	Tx Clock to output data (terminal to modem)

1. All pins not identified are no-connection.

Ethernet Interface

The CPU employs a Local Area Network Controller for Ethernet (LANCE) to implement an Ethernet transceiver interface. The balanced transceiver signal lines from the CPU are coupled to an onboard transformer to signal lines that go through the SWI, Outer B/P and control midplane cards, and terminate on the industry-standard DB-15 connector on the Storage/Control I/O Module faceplate. Pin and signal assignments for this DB-15 port are listed in Table 4-3.

Table 4-3 Ethernet Port Pin and Signal Assignments

Pin	Signal	Signal Name
2	C+	Collision + (Input)
3	T+	Transmit + (Output)
5	R+	Receive + (Input)
6	GND	Ground
9	C–	Collision – (Input)
10	T–	Transmit – (Output)
12	R–	Receive – (Input)

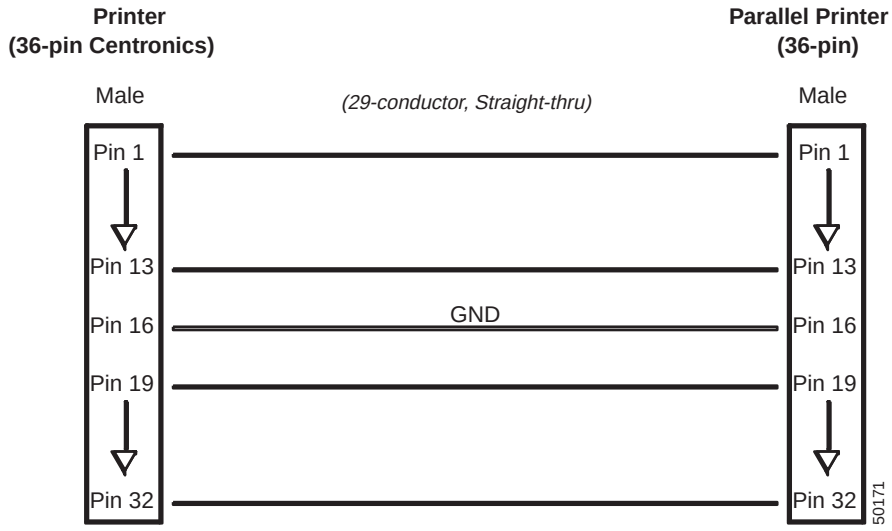
To implement Ethernet links, you must purchase the optional Ethernet Communications Package available from Cisco Systems. This package contains supporting software and the *Cisco VCO/4K Ethernet Guide* which covers the cabling requirements and implementation strategies. You must provide cables, transceivers and other components to establish Ethernet links.

Printer Interface

The printer interface on the Storage/Control I/O Module front panel supports parallel system printers through a 36-pin Centronics-type connector. Figure 4-7 shows the cable wiring diagrams for connecting the Storage/Control I/O Module parallel port to the system printer.

Note The End of Line (EOL) terminator for the system printer must be defined in the system database via the Peripheral Configuration screen prior to use (refer to the *Cisco VCO/4K System Administrator's Guide* for more information).

Figure 4-7 I/O Module to System Printer—Cable Wiring Diagram



Note You can use a 36-conductor, straight-through parallel cable to connect a printer to the system controller. However, only the conductors shown in Figure 4-7are used. For more information on the parallel 36-pin Centronics cable available from Cisco Systems, refer to the *Cisco VCO/4K Hardware Planning Guide*.

SCSI Interface

The SCSI mass storage bus interface on the Storage/Control I/O Module is not used in system operation.

Hardware Configuration

This section outlines hardware configuration options.

SCSI Termination Configuration

The SCSI Interface connector is reserved for future use.

Serial Port Configuration

Serial Ports 1 Through 4 and Jumper Settings

Serial ports 1 through 4 on the Storage/Control I/O Module can be configured as modem (DCE) terminations for connection to a terminal or configured as terminal (DTE) terminations for connection to a modem. (Refer to the "Serial Ports 1 Through 4" section on page 4-12 for more information.)

Jumpers are positioned in J1 for Serial Port 1 (master console), JP17 for Serial Port 2 (remote maintenance modem, and JP13 and JP18 for Serial Ports 3 and 4 (SIO host links), respectively.

For Serial Ports 1 and 2, these jumper settings assume that straight-through EIA (DCE to DTE) cables are used to connect the system to the master console and remote maintenance modem. If the jumpers are moved to position JP11 (for the master console) and JP16 (for the remote modem), crossover cables can be used.

Note Straight-through cables directly link the connector pinouts from end-to-end. In crossover cables, Pins 2 and 3 are crosswired; Pin 2 at one end is wired to Pin 3 at the opposite end, and vice versa.

Jumper settings for Serial Ports 3 and 4 (SIO host links) are determined by two factors: the type of cable employed (straight-through or crossover) and the host termination at the end of the cable (terminal or modem).

The default jumper settings for Serial Ports 3 and 4 configure the CPU as a DTE termination. This configuration supports the following arrangements:

- Straight-through cables connecting the system to a modem (DTE to DCE)
- Crossover (null modem) cables connecting the system to a terminal (DTE to DTE)

You can position the jumpers in locations JP13 and JP18 (under the "To Terminal" etching) to configure the CPU as a DCE termination. Moving the jumpers to these locations supports the following SIO connections:

- Straight-through cables connecting the system to a host terminal (DCE to DTE)
- Crossover (null modem) cables connecting the system to a modem (DCE to DCE)

Refer to the *Cisco VCO/4K Hardware Installation Guide* for more information on serial cable requirements.

Note When modifying jumper positions on Storage/Control I/O Module boards, you must move all seven jumpers to the new location to ensure operation.

Serial Ports 1 Through 4

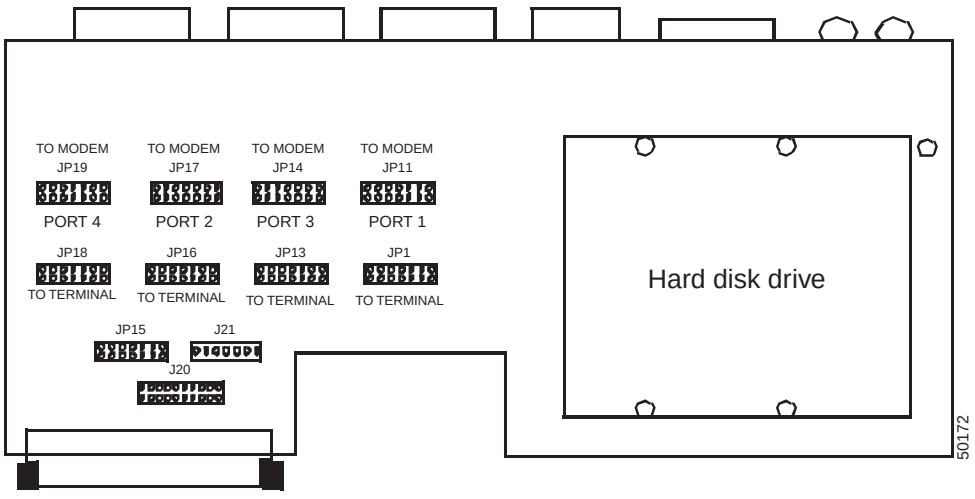
Serial ports 1 through 4 can be configured as a modem (DCE) for connection to a terminal, or terminal (DTE) for connection to a modem. The Storage/Control I/O Module card's serial ports are configured for shipment in the DCE configuration. Table 4-4 illustrates jumper positions for DCE and DTE.

Table 4-4 Jumper Positions for DCE and DTE Modem Connections

Port	DTE Operation	DCE Operation
1	Jumper –TO MODEM JP11	Jumper—JP1 TO TERMINAL
2	Jumper – TO MODEM JP17	Jumper—JP16 TO TERMINAL
3	Jumper – TO MODEM JP14	Jumper—JP13 TO TERMINAL
4	Jumper – TO MODEM JP19	Jumper—JP18 TO TERMINAL

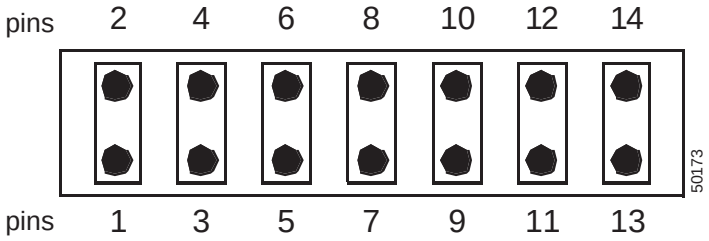
Refer to Figure 4-8 for the jumper locations on the Storage/Control I/O Module card.

Figure 4-8 Jumper Locations on the Storage/Control I/O Module Card



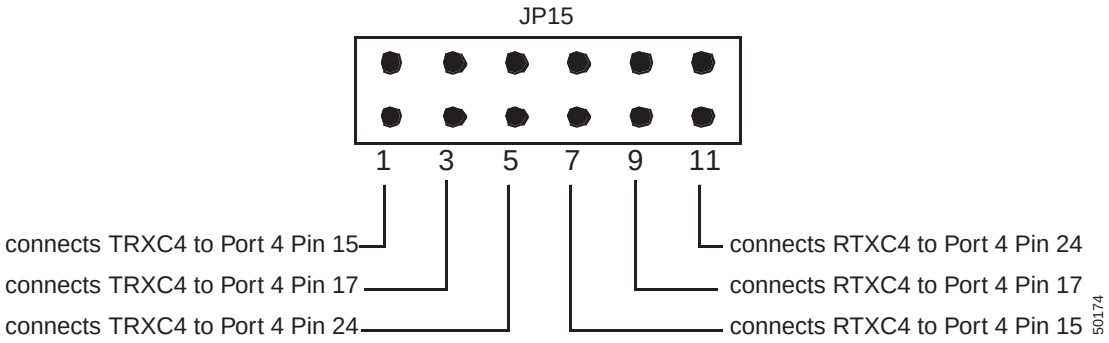
Seven jumpers are installed at jumper locations JP1, JP11, JP13, JP14, JP16, JP17, JP18 and JP19, connecting pins 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14 as shown in Figure 4-9.

Figure 4-9 Jumper Configuration for DCE/DTE, Serial Ports 1-4



Serial port 4 can be configured to use clock signals by the TRXC4 and RTXC4 signal lines. Jumper JP15 configurations of the clock lines are shown in Figure 4-10. The module is shipped without clock lines connected.

Figure 4-10 Jumper 15 Configuration of Clock Lines, Serial Port 4

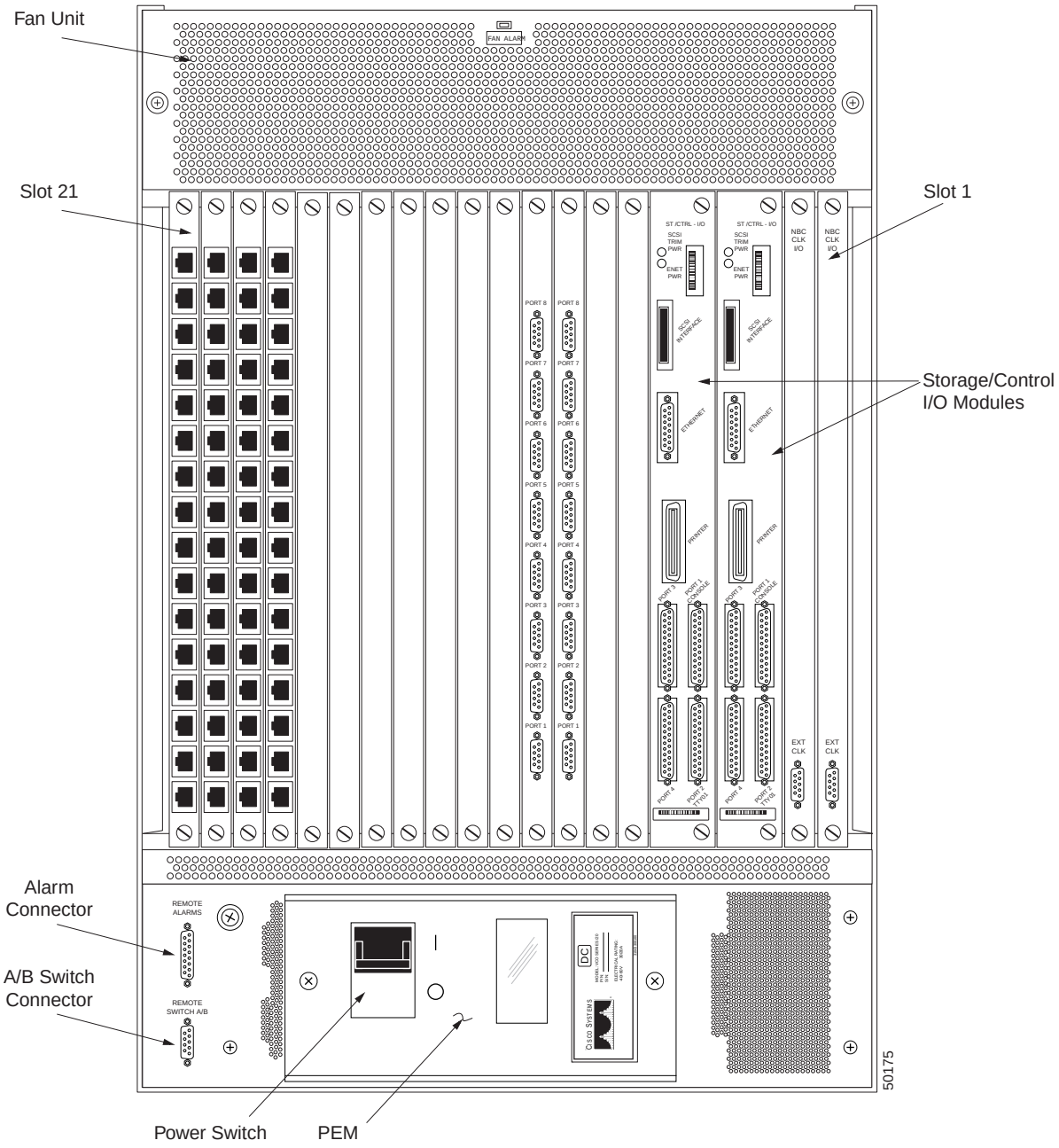


Removal and Replacement Information

Figure 4-11 shows the location of the Storage/Control I/O Module cards in the rear of the VCO system. The card is located in slots 3 to 4 in nonredundant systems, and in slots 3 to 4 and 5 to 6 in redundant systems. The label at the base of the card cage identifies where the card(s) is located.

There is a soft start circuit on the card which allows for the Storage/Control I/O Module to be removed and replaced while the system is running. This should only be done when the system contains redundant Storage/Control I/O Modules, and when the module to be removed is in standby mode.

Figure 4-11 Storage/Control I/O Module Location



Removal Procedures

Caution Follow ESD rules when removing a system component. Use a wrist strap for grounding.

To remove a Storage/Control I/O Module in a nonredundant system, do the following.

Caution In a nonredundant system, power down the system before removing the card.

Step 1 Remove the Combined Controller that is connected to the Storage/Control I/O Module to be serviced. Refer to the *Cisco VCO/4K Card Technical Descriptions* for information on how to remove the Combined Controller.

Step 2 Use a 1/8-inch bladed screwdriver to loosen the captive mounting screws at the top and bottom of card. Do not remove the screws from the cards.

Step 3 Grasp the screws at the top and bottom of the card and pull the card away from the midplane.

The card fits tightly into the midplane connectors and some force is required to pull it away from the midplane. However, do not exert excessive force on the card to remove it.

Step 4 When the card is free of the connector, grasp the sides of the front panel and pull the card free of the card slot.

Step 5 Grasp the card on its bottom edge as it is removed from the card rack.

Step 6 When you have removed the card from the slot, place it on an antistatic mat or in an antistatic envelope.

Note Do not replace the Combined Controller until the Storage/Control I/O Module is replaced. If the Storage/Control I/O Module is not replaced at the time of removal, do not replace the Combined Controller.

To remove and replace a Storage/Control I/O Module card in a redundant system:

Step 1 If servicing an active Storage/Control I/O Module, switch the active side to standby. Refer to the maintenance chapter in the *Cisco VCO/4K System Administrator's Guide* for information about how to switch the active side to standby.

Step 2 When the transition to standby is complete, remove and replace the Storage/Control I/O Module.

If you are permanently removing the Storage/Control I/O Module from a nonredundant system, back up the database before powering down the system and removing the module. Refer to the *Cisco VCO/4K System Administrator's Guide* for information on backing up the database.

Replacement Procedures

Caution Follow ESD rules when removing a system component. Use a wrist strap for grounding.

To replace the Storage/Control I/O Module:

Step 1 Place the replacement Storage/Control I/O Module on the antistatic mat or envelope.

Step 2 Verify that the Combined Controller that is to be connected to the Storage/Control I/O Module is *not* plugged into the backplane.

Step 3 Verify that all the jumpers on the replacement card correspond with those on the removed Storage/Control I/O Module.

Verify that the jumper configuration is appropriate for the system configuration.

Refer to the *"Serial Ports 1 Through 4 and Jumper Settings"* section on page 4-11 for details on jumper settings for the Storage/Control I/O Module.

Step 4 Grasp the replacement card by the sides of the front panel and align it with the top and bottom card guides.

Step 5 Push the card inward until it makes contact with the midplane.

Step 6 Firmly push the card toward the midplane. The card fits tightly into the midplane connectors and some force is required to seat the card back firmly into the midplane connectors.

Step 7 Use a 1/8-inch bladed screwdriver to tighten the mounting screws at the top and bottom of each card into the tapped holes on the mounting rail.

Step 8 Plug the Combined Controller into the backplane.

Step 9 If installing in a nonredundant system, make sure the system is powered on.

Step 10 If the hard disk drive does not contain the Generic software, install the software. Refer to the system release notes for instructions on installing the Generic software, backing up and restoring the database, and licensing.

Troubleshooting

Note More extensive troubleshooting information is contained in the *Cisco VCO/4K Troubleshooting Guide*.

LEDs Not Illuminated

If either of the LEDs on the Storage/Control I/O Module is not illuminated, corrective action should be taken. These LEDs are fused powered sources. The fuses are on the Combined Controller and are not field replaceable. Call Cisco Systems for technical support.

Note The ENET PWR LED should be illuminated only when Ethernet is being used. If the ENET PWR LED is not illuminated and Ethernet is being used, contact Cisco Systems Technical Support.

Troubleshooting Reference Materials

For detailed information covering all troubleshooting areas, refer to the *Cisco VCO/4K Troubleshooting Manual*.

The *Cisco VCO/4K System Maintenance Manual* describes corrective maintenance procedures for host communications links. In addition to this manual, refer to the *Cisco VCO/4K Ethernet Guide*, and the *Cisco VCO/4K Standard Programming Reference* and *Cisco VCO/4K Extended Programming Reference* for details relating to communication protocols and command/report formats. *Cisco VCO/4K System Messages* describes the network messages associated with problems detected with the host communications links.

Additional reference materials include the OEM manuals provided with any other peripheral devices connected to the Storage/Control I/O Module. This includes the printer and the serial terminal.

CHAPTER 5

I/O Modules

This chapter provides removal and replacement procedures for VCO/4K I/O Modules. For additional information and detailed specifications for each I/O module, refer to the *Cisco VCO/4K Card Technical Descriptions*.

Removal and Replacement Procedures

Removing an I/O Module

Follow these steps to remove an I/O module.

Step 1 Take the port interface cards, in the module locations, out-of-service (OOS). For information about taking cards OOS, refer to the *Cisco VCO/4K System Administrator's Guide.*

Step 2 From the back of the system, unscrew the top and bottom fasteners for the card.

Note The same mounting hardware is used for all I/O module assemblies.

Step 3 Pull the module away from the backplane.

Caution Do not attempt to pry the I/O module from the backplane using a screwdriver or some other tool. The tip of the prying tool could damage the backplane and/or DIN connectors.

Adding or Replacing an I/O Module

Follow these steps to replace or add an I/O module:

Step 1 Press the module firmly into the DIN connectors on the backplane.

Step 2 Tighten the mounting screws.

Step 3 Make the appropriate network connection to the module.

Note Verify that the system database entries correspond to the type of module and port interface cards installed at the adapter's R-L-S locations.

Troubleshooting

Note More extensive troubleshooting information is contained in the *Cisco VCO/4K Troubleshooting Guide*.

If problems occur with the network interface, check all cable and cross-wiring connections. Examine a suspect module for signs of physical damage (cracked connectors, damaged wires, etc.). Correct the cause of the damage by reconnecting network cables and cross-wiring and/or rerouting cables to avoid future problems.