Hardware Installation Guide

ACEdirector™ 4

10/100/1000 Web Switch

Part Number: 050086, Revision A, May 2000

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Regulatory Compliance

FCC Class A Notice: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1. This device may not cause harmful interference. 2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the 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 communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Do not make mechanical or electrical modifications to the equipment.

VCCI Class A Notice: This is a Class A product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may occur, in which case, the user may be required to take corrective actions.

CE Notice: The CE mark on this equipment indicates that this equipment meets or exceeds the following technical standards: EN50082-1, EN55022, EN60555-2, EN61000-4-1, EN61000-4-2, EN61000-4-3, EN61000-4-4, and EN61000-4-5.

Safety Information

Caution—This Product Contains a Lithium Battery. Batteries are not customer replaceable parts. They may explode if mishandled. Do not dispose of the battery in fire. Do not disassemble or recharge.

Caution—This product is designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electric shock, do not plug this product into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.

Caution—Not all power cords have the same ratings. Household extension cords do not have overload protection and are not meant for use with computer systems. Do not use household extension cords with this product.

Caution—This product is shipped with a grounding type (three-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

Caution—This product uses a 3A/250V fast-acting fuse. For continued protection against the risk of fire, replace only with the same type and rating fuse.

Attention—Utiliser un fusible de rechange de meme type.

Nordic Lithium Battery Cautions

(Norge) A D V A R S E L—Litiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

(Sverige) VARNING—Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

(Danmark) ADVARSEL! Litiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

(Suomi) VAROITUS—Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

Taiwan EMC Statement

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

Contents

Preface

This manual describes the features and installation process of the ACEdirector 4 Web switch hardware.

For full documentation on configuring and using the switch's many software features (such as Server Load Balancing and Application Redirection), see the WebOS switch software manuals.

Who Should Use This Book

This manual is intended for network installers and system administrators engaged in configuring and maintaining a network. It assumes that you are familiar with Ethernet concepts, IP addressing, the IEEE 802.1d Spanning-Tree Protocol, and SNMP configuration parameters.

How This Book Is Organized

Chapter 1, "Preparing for Installation," provides a brief overview of the ACEdirector 4, including a description of switch features, ports, and LEDs.

Chapter 2, "Installing the ACEdirector 4," describes how to install the switch, and how to connect network cables.

Chapter 3, "Testing the Switch," describes how to connect a terminal for viewing system messages, and provides suggestions for troubleshooting.

Chapter 4, "Configuring the ACEdirector 4," describes any important differences you may find when using the WebOS switch software manuals to configure the ACEdirector 4.

Appendix A, "Specifications," describes the physical characteristics of the ACEdirector 4.

Contacting Alteon WebSystems

Use the following information to access Alteon WebSystems support and sales.

- URL for Alteon WebSystems Online:

  `http://www.alteonwebsystems.com`

  This website includes product information, software updates, release notes, and white papers. The website also includes access to Alteon WebSystems Customer Support for accounts under warranty or that are covered by a maintenance contract.

- E-mail access:

  `support@alteon.com`

  E-mail access to Alteon WebSystems Customer Support is available to accounts that are under warranty or covered by a maintenance contract.

- Telephone access to Alteon WebSystems Customer Support:

  1-888-Alteon0 (or 1-888-258-3660)
  1-408-360-5695

  Telephone access to Alteon WebSystems Customer Support is available to accounts that are under warranty or covered by a maintenance contract. Normal business hours are 8 a.m. to 6 p.m. Pacific Standard Time.

- Telephone access to Alteon WebSystems Sales:

  1-888-Alteon2 (or 1-888-258-3662), and press 2 for Sales
  1-408-360-5600, and press 2 for Sales

  Telephone access is available for information regarding product sales and upgrades.

Warranty

Alteon WebSystems provides a limited warranty on all its switches for a period of one year from the date of shipment. Free technical support and free replacement of hardware is provided for the first 90 days after shipment. Alteon WebSystems provides a limited warranty on all its switch software for a period of 90 days from date of shipment. You may choose to purchase additional service and support from Alteon WebSystems. Please contact your local sales representative for more information.

CHAPTER 1

Preparing for Installation

The ACEdirector 4 Web switch provides innovative value-added services such as Server Load Balancing, IP Filtering and Application Redirection, while simultaneously functioning as a 10/100 Mbps network switch with Gigabit uplink capability.

This chapter lists the operational features of the ACEdirector 4 and describes the switch's physical features.

Features

The ACEdirector 4 offers the following features:

- Eight 10/100 Mbps auto-negotiating Fast Ethernet ports at half- or full-duplex modes
- One dedicated, dual-media uplink port with one full-duplex fiber optic Gigabit Ethernet connector and 10/100 Mbps auto-negotiating Fast Ethernet connector
- Concurrent Layer 2, Layer 3, and Layer 4 switching
- Layer 4 Server Load Balancing software enables thousands of IP address destinations to be hosted, including up to 256 load-balanced real servers
- Layer 4 Application Redirection software allows the interception and redirection of client IP requests
- Layer 3 IP Routing software forwards frames between as many as 256 subnets
- Layer 3 and Layer 4 Filtering creates secure server networks
- EtherChannel-compatible Trunk Groups support, allowing the creation of up to four Trunk Groups each, with two to four configured switch ports
- VLAN support for up to 256 VLANs per switch
- Jumbo frame support for frame sizes up to 9022 octets
- Up to 224 Allow/Deny filters
- Configuration and management is performed via local console port (DCE), Telnet, or through the built-in Browser-based Interface (BBI)
- Command line interface (CLI) setup reduces the initial setup time
- SNMP Private MIBs

- TFTP download to Flash memory for software updates and upgrades
- Switching Processor (SP) capability to learn up to 4095 MAC addresses
- Master Forwarding Database supports up to 8192 MAC address entries per switch
- IEEE 802.1d Spanning-Tree Protocol support
- IEEE 802.3x Flow Control support for full-duplex ports
- IEEE 802.3z Link-Negotiation support
- IEEE 802.1Q Frame Tagging on all ports when VLANs are enabled
- SNMP support: RFC 1213 MIB-II, RFC 1493 Bridge MIB, RFC 1398 Ethernet-like MIB, RFC 1757 RMON1 (groups 1-4), and RFC 1573 Interface Extensions MIB compliant. Alteon WebSystems Enterprise MIB supporting the configuration and monitoring of all Alteon WebSystems specific features.
- Hot Standby Support for Layer 4 Switching

Physical Description

The following sections describe the ACEdirector 4 hardware.

Front Panel

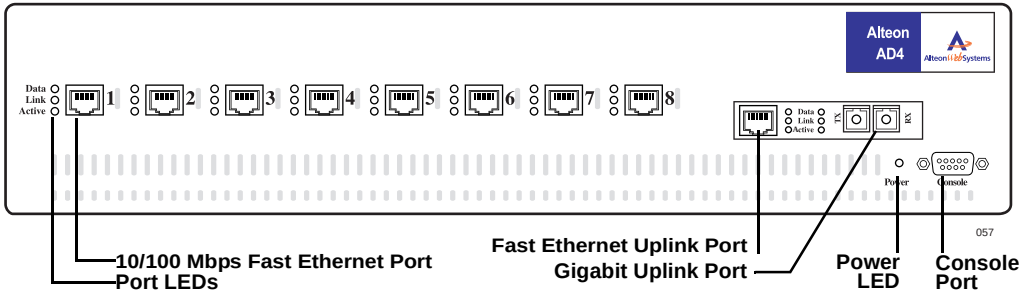


Figure 1 ACEdirector 4 Front Panel

The front panel of the ACEdirector 4 has the following features:

- Port 1 through Port 8: Network ports

  The RJ-45 jack is for connecting 10/100 Mbps Ethernet segments to the port. The ports are auto-negotiating and support half- or full-duplex operation.

- Three LEDs for each network port

  The table below describes the lights and conditions represented by the state of the LEDs.

Table 1 Front Panel Port LEDs

LED	State	Description
Data	Blinking	Data detected on the port.
	Off	No data detected on the port.
Link	On	Good link.
	Off	No link; could be a result of a bad cable or bad connector.
	Blinking	Port has been disabled by software.
Active	On	The jack indicated (either the RJ-45 or the SC) is selected for this port's use.
	Off	The jack is not selected.

- Port 9: Dedicated dual-media uplink port

  The ACEdirector 4 uplink port has dual-media network connectors: One SC-style fiber optic connector for Gigabit Ethernet segments, and one RJ-45 connector for 10/100 Mbps Fast Ethernet segments. The uplink Data and Link LEDs behave the same as the network ports in Table 1. Only one connector on Port 9 can be operational at a given time.

- A female DB-9 serial connector labeled "Console" for the console (DCE) connection
- A green "Power" LED which lights to indicate that the ACEdirector 4 is on and receiving proper power

Rear Panel

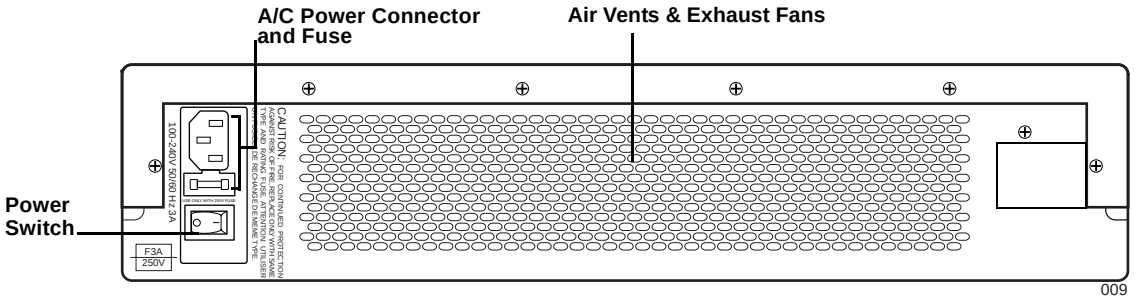


Figure 2 ACEdirector 4 Rear Panel

The rear panel of the ACEdirector 4 has the following components:

- A power switch
- A fuse housing
- An A/C power connector

WebOS Software Features

Built-in WebOS Server Switching software features Server Load Balancing as well as Application Redirection filters. These features benefit your network in a number of ways:

- Increased efficiency for server utilization and network bandwidth

  With Server Load Balancing (SLB), the ACEdirector 4 is aware of the shared services provided by your server pool. The switch can then load balance session traffic among the available servers. For even greater control, traffic is distributed according to a variety of user-selectable rules.

  Redirection filters further increases network efficiency by enabling storage of high-demand HTTP or application data on local servers.

  HTTP content-based SLB allows for preferential service based on HTTP cookie information.

- Increased reliability of services to users

  With Server Load Balancing, if any server in a server pool fails, the remaining servers continue to provide access to vital applications and data. Later, the downed server can be brought back up transparently.

- Increased scalability of services

  Server Load Balancing lets you scale seamlessly. As users are added and the server pool's capabilities are saturated, new servers can be added to the pool without interrupting access to services.

For detailed information on configuring and using these software features, refer to the WebOS switch software manuals.

Virtual Matrix Architecture

Virtual Matrix Architecture (VMA) is a hybrid architecture that realizes the full potential of distributed processing by taking advantage of any unused resources within a Web switch. It combines the strengths of central and distributed processing to deliver improvements in processing power and switch concurrent session capacity.

All Alteon web switches incorporate the Virtual Matrix Architecture (VMA) in WebOS Release 8.0 and higher.

IP Routing

IP Routing allows the network administrator to seamlessly connect server IP subnets to the rest of the backbone network, using a combination of configurable IP switching interfaces and IP routing options.

Filtering

Layer 3 (IP) and Layer 4 (Application/Protocol) filtering gives the network administrator a powerful tool to protect their server networks. Filters can allow or deny traffic and can optionally log results, based on a variety of user-specified address, protocol, and port criteria.

VLANs

Virtual Local Area Networks (VLANs) are commonly used to split up groups of network users into manageable broadcast domains, to create logical segmentation of workgroups, and to enforce security policies among logical segments.

The ACEdirector 4 software (Release 8.0 or greater) supports up to 256 VLANs per switch. IEEE 802.1Q VLAN *tagging* is also supported to allow multiple VLANs per port, and to provide standards-based VLAN support for Ethernet systems.

See the *WebOS Switch Software User's Guide* for implementation details.

Jumbo Frames

When sending Ethernet traffic at Gigabit speeds, considerable bandwidth is consumed by the overhead of handling a multitude of standard 1,500 byte packets. Alteon WebSystems Gigabit Ethernet switches and ACEnic Adapters, both running operating software version 2.0 or greater, support Ethernet frames of up to 9,000 bytes. Host CPU utilization is significantly reduced and network throughput is enhanced when enabling Jumbo Frames between servers that have Alteon ACEnic adapters.

The ACEdirector 4 can support standard Ethernet frames and Jumbo Frames at the same time. Jumbo Frames are sent only between servers that have Jumbo Frames capable Alteon ACEnic adapters. Jumbo Frames are automatically fragmented by the switch into standard Ethernet frames when sending to all standard Ethernet devices on other ports.

Additional VLANs can be configured on the same NICs and switches to support non-Jumbo Frame VLANs and to support other servers and end workstations that do not support extended frame sizes. End-stations with Alteon ACEnic adapters installed and attached to Alteon web switches can communicate across both Jumbo Frame VLANs and regular frame VLANs at the same time.

Port Trunk Groups

Ports in a trunk group combine their bandwidth to create a single, larger virtual link. Trunk connections support third-party devices such as Cisco routers and switches with EtherChannel technology, and Sun's Quad Fast Ethernet Adapter.

Spanning Tree

When Spanning Tree is enabled on the switch, it detects and eliminates logical loops in a bridged or switched network. When multiple paths exist, Spanning Tree configures the network so that a switch uses only the most efficient path. If the path fails, Spanning Tree automatically sets up another active path on the network to sustain network operations.

CHAPTER 2

Installing the ACEdirector 4

This chapter describes how to install the ACEdirector 4 Web switch.

Your ACEdirector 4 is shipped with the following items:

- An A/C power cord
- A console cable
- Two mounting brackets (for rack or wall mounting)
- Six Phillips screws for installing the mounting brackets
- Four rubber feet (for tabletop placement of the switch)

Switch installation involves these tasks:

- Unpacking the switch
- Mounting the switch
- Connecting the power cord and plugging it into a power outlet
- Connecting network cables to the switch
- Powering on the switch

Preparing for Installation

Before installing the ACEdirector 4:

1. **Unpack the switch from the box.**
2. **Turn the power switch to the OFF (O) position.**
3. **Choose a suitable location to install the switch.**

CAUTION—Observe the following precautions when selecting a site and installing the switch:

Make sure the equipment is properly grounded electrically, and that power connections are safe, particularly when using power strips.

Avoid overloading your electrical supply circuits. Electrical ratings are printed on the nameplates of all your equipment. Be sure that your supply circuits and wiring can support the rated power draw of whatever equipment is used.

The ambient temperature of an operating ACEdirector 4 must not exceed 40° C. When installing the switch in a closed or multi-unit rack assembly, please consider that the operating ambient temperature of the switch may be higher than the ambient temperature of the room. Take any appropriate steps to ensure that the switch does not overheat.

For proper air circulation, the vents on the front, back, and sides of the switch should not be blocked or obstructed by cables, panels, rack frames, or other materials.

Do not place or rack-mount the switch in any way which would exceed the maximum weight bearing capacity of the surface or rack, or which would cause potentially hazardous uneven mechanical loading.

Installing the ACEdirector 4

Always observe the precautions outlined in the manuals for this and all other equipment you are installing (see above).

Determine whether the unit will be mounted into an equipment rack, or placed free-standing on a shelf or tabletop. The following sections detail each type of installation.

Rack-Mounting the Web Switch

NOTE – Do not use the rubber feet for a rack installation.

1. **Connect the two mounting brackets to the switch using the supplied screws as shown in Figure 3.**

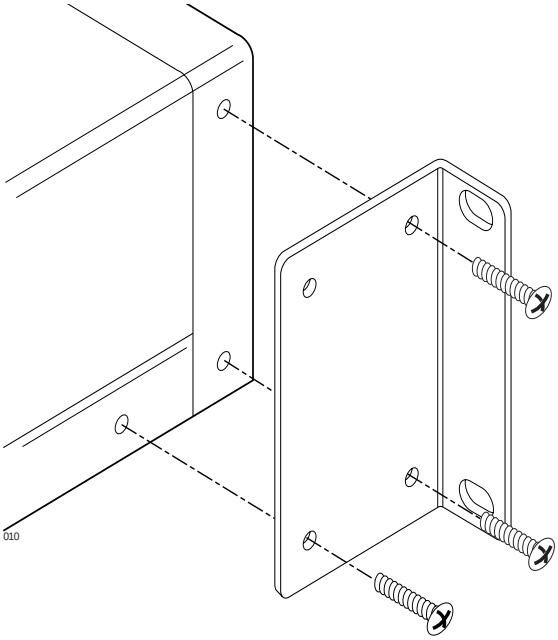


Figure 3 Position Mounting Brackets for Rack Mount

2. **Then, install the switch as shown in Figure 4 using the appropriate screws for your rack-mount system (four 10-32, 12-24, M5X.8-6H, or M6X1-6H type screws).**

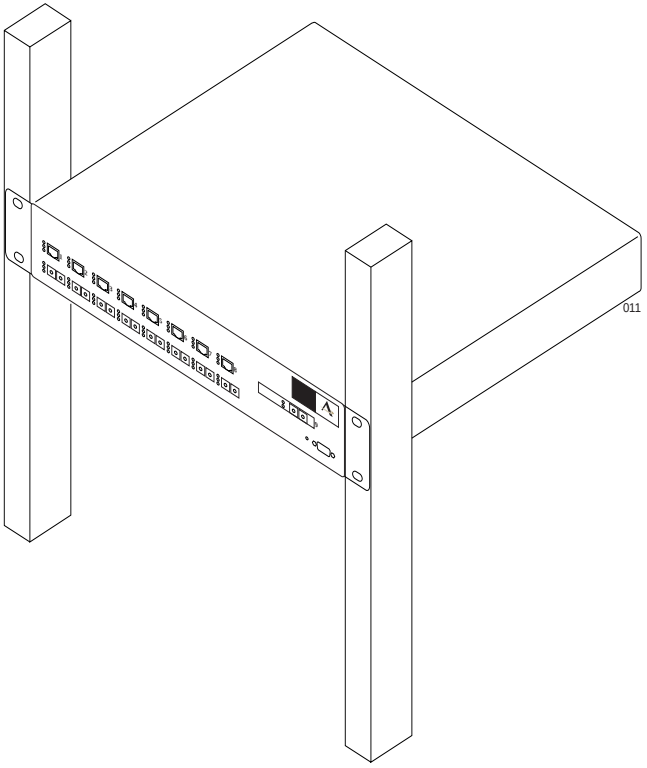


Figure 4 Rack-Mounted ACEdirector 4

Table-Mounting the Web Switch

1. **Attach the four rubber feet to the bottom of the switch.**
2. **Place the switch onto a level tabletop.**

Connecting Power

CAUTION—The switch uses a 3A/250V fast-acting fuse. For continued protection against risk of fire, replace only with the same type and rating fuse. French: *Attention–Utiliser un fusible de rechange de meme type.*

Connect the power cord to the Web switch 4. Verify that the power switch is in the off position, and plug the cord into a properly fused outlet, then power on (|) the switch.

Connecting Cables to Network Ports

All ports are auto-negotiating and support full-duplex operation. The 10/100 Mbps ports also support half-duplex operation. The port LEDs light to indicate various port connection conditions. See Table 1 on page 11 for details.

Port 9 (the uplink port) has two connectors:

- A gigabit Ethernet fiber optic SC connector
- A 10/100 Mbps Fast Ethernet auto-negotiating RJ-45 connector

Only one of the two jacks on Port 9 can be active at any given time.

Gigabit Ethernet via the SC Connector

The figure below illustrates an SC-type connector used for fiber optic Gigabit Ethernet connections:

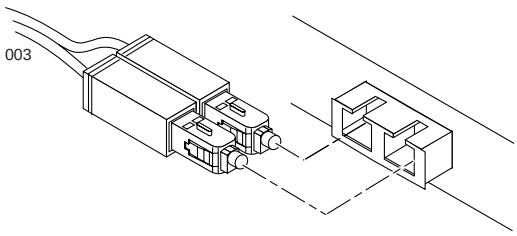


Figure 5 Fiber Optic Connector for Alteon WebSystems Switches

The following table lists the cable characteristics for connecting to 1000Base-SX ports.

Table 2 1000Base-SX Link Characteristics

Description	62.5 Micron	50 Micron
	Shortwave (850 nm multimode fiber)	
Operating Range	2 to 260 meters	2 to 550 meters (in compliance with IEEE 802.3z)

10/100 Mbps Ethernet via the RJ-45 Connector

Use a straight-through cable on the 10/100 Mbps ports if the device attached to the port is a computer. If the device is a switch, hub, or router, use a crossover cable. See the figure below for cabling details. You can use a straight-through cable with a switch, hub, or router if it has an “uplink” enable/disable switch that you can set.

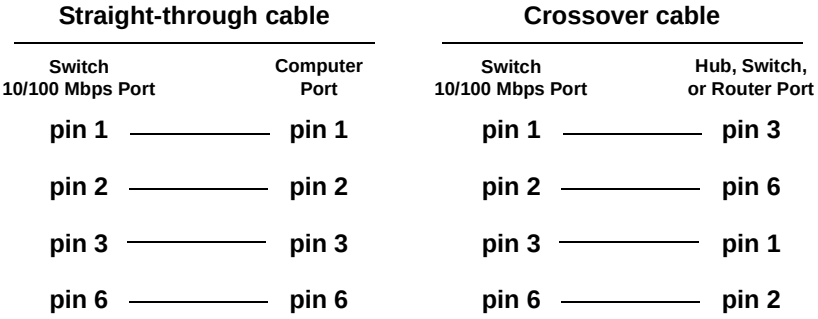


Figure 6 Pin assignments for 10/100 Mbps port cables

CHAPTER 3

Testing the Switch

The ACEdirector 4 has a console port which is used for configuring the switch. This chapter explains how to connect a terminal to the console port and collect system information. For instructions on using the console to view and configure switch settings, see the WebOS switch software manuals.

Connecting a Terminal to the Switch

To establish a console (DCE) connection with the ACEdirector 4, the following is required:

- An ASCII terminal or a computer running ASCII terminal emulation software set to the parameters shown in the table below:

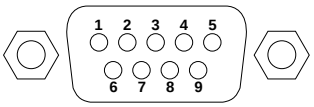
  Table 3 Console Configuration Parameters

Parameter	Value
Baud Rate	9600
Data Bits	8
Parity	None
Stop Bits	1

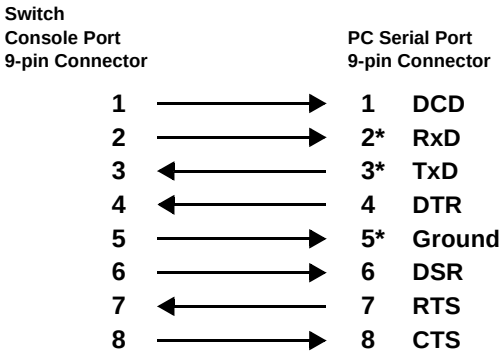
- Console Cable

  The console port accepts a straight-through serial cable with a male DB9 connector.

  Table 4 Pinouts for DB9 Serial Connector

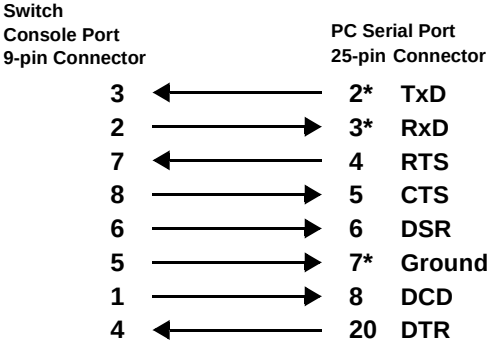
DB9 Serial Connector	Pin	Description
	1	DCD
	2	RxD
	3	TxD
	4	DTR
	5	Ground
	6	DSR
	7	RTS
	8	CTS
	9	Not used

The following figures show the pin assignments for the console to use to configure serial cables to terminal connectors with 9-pin or 25-pin connectors.



Note: Only the pins for RxD, TxD, and Ground are required.

Figure 7 9-pin to 9-pin Connector Pin Assignments



Note: Only the pins for RxD, TxD, and Ground are required.

Figure 8 9-pin to 25-pin Connector Pin Assignments

NOTE – Console cables are not intended for permanent installation and should be disconnected from the console port after configuring the switch.

Establishing a Console Connection

1. **Connect the terminal to the Console port using the serial cable that is included with your ACEdirector 4.**
2. **Power on the terminal.**
3. **To establish the connection, press <Enter> on your terminal.**
4. **Verify that your connection is set at the parameters listed in Table 3 on page 23.**
5. **Enter the password when prompted.**

   The default administrator password is `admin`. Once your password is verified, the Main menu is displayed. For instructions on using the menus to configure the switch, see the WebOS switch software manuals.

Troubleshooting

This section contains information about possible problems that may occur or error messages that might display if the switch is not properly installed or configured.

Link LED Does Not Light

Symptom: The “Link” LED (green) does not light. When you check the Link state using the console terminal (see the WebOS switch software manuals), the status is reported as “down.”

Cause: A port configuration mismatch between two devices or a cable problem.

- Port configuration mismatch. If the switch port is configured with a specific speed or duplex mode (for example, 100 Mbps, full duplex) check to see that the other device is set to the same configuration. If the switch port is configured to auto-negotiate, check to see that the other device is also set to auto-negotiate. Refer to the WebOS switch software manuals for more information about setting speed and mode.
- Cable problem. Make sure you are using the correct type of cable to connect the switch to other devices. Refer to Figure 6 on page 22 for information about crossover cables for connecting switches, hubs, or routers to the ACEdirector 4.

Temperature Sensor Error Message

The following message is displayed on the console if the ACEdirector 4 temperature exceeds the temperature threshold. Immediate attention is required.

```
Temperature at sensor xxx exceeds threshold
Current temperature is xx °C   Threshold is xx°C
```

Actions:

- Make sure that the air circulation vents on the front, back, and sides of the switch are free from obstruction by cables, panels, rack frames, or other materials.
- Make sure that all four cooling fans inside the switch are running. The fans are located behind the ventilation grill at the rear of the switch. The exhaust from all four fans should be blowing outward with roughly equal air pressure (although it is normal for the exhausts to have different temperatures). You can also use a flashlight to check whether the fan blades are moving. If any fan stops during switch operation, contact customer support.
- Remember that units in a closed or multi-unit rack assembly may have an operating ambient temperature higher than the ambient temperature of the room. The ambient temperature of an operating ACEdirector 4 must not exceed 40°C. If the operating ambient temperature cannot be lowered before this maximum is reached, turn off the switch and let it cool.
- It may be necessary to cool the room to a lower temperature or provide a fan for greater air circulation. Resolve the room's cooling and circulation problems before turning the switch back on.

CHAPTER 4

Configuring the ACEdirector 4

Instructions on using the console port to view and configure switch software settings are contained in the WebOS switch software manuals:

- WebOS Command Reference
- WebOS Application Guide

Although the operation of the ACEdirector 4 is similar to the Alteon 180 series of Web switches featured in these manuals, some commands and menu screens for the ACEdirector 4 may not appear exactly as shown.

The following text defines any major configuration differences for the ACEdirector 4.

Additional Features

WebOS software for Layer 4 Server Load Balancing and Application Redirection is included as a standard feature on the ACEdirector 4. There is no need to purchase optional software or to activate it by entering a software key password.

Limitations

At this time, the ACEdirector 4 does not support the Server Dual Homing feature as discussed in the WebOS switch software manuals.

APPENDIX A

Specifications

Supported Standards

- Spanning Tree Protocol (IEEE 802.1d)
- Logical Link Control (IEEE 802.2)
- 10Base-T/100Base-TX (IEEE 802.3, 802.3u)
- 1000Base-SX (IEEE 802.3z)
- Flow Control (IEEE 802.3x)
- Link Negotiation (IEEE 802.3z)
- Frame Tagging (IEEE 802.1Q) on all ports when VLANs are enabled
- SNMP support: RFC 1213 MIB-II, RFC 1493 Bridge MIB, RFC 1398 Ethernet-like MIB, RFC 1757 RMON1 (groups 1-4), and RFC 1573 Interface Extensions MIB compliant. Alteon WebSystems Enterprise MIB supporting the configuration and monitoring of all Alteon WebSystems specific features.

Port Specifications

Port	Connector	Media	Maximum Distance
10Base-T	RJ-45	Cat. 3, 4, or 5 UTP	100 meters (325 feet)
100Base-TX	RJ-45	Cat. 5 UTP	100 meters (325 feet)
1000Base-SX	SC full-duplex	Shortwave (850 nm): 62.5 micron MM fiber 50 micron MM fiber	 2 to 275 meters (6.5 to 902 feet) 2 to 550 meters (6.5 to 1804 feet)
Console (DCE)	Female DB-9	RS-232C (serial)	25 meters (80 feet)

Physical Characteristics

Characteristic	Measurement
Width	43.18 cm (17.00 inches) (Standard 19" EIA rack mountable)
Height	8.81 cm (3.47 inches)
Depth	45.72 cm (18.00 inches)
Weight	8 kg (18 lb)

Power Requirements

Specification	Measurement
Auto-ranging power supply	100-240VAC @ 50-60 Hz, 3A
Maximum power consumption	90 Watts

Environmental Specifications

Condition	Operating Specification	Storage Specification
Temperature	0° to 40° C (+32° to +104° F)	–40° to +85° C (–40° to +185° F)
Relative humidity	5 to 85% non-condensing (40° C, 16 hour dwells at extremes)	5 to 95% non-condensing 10° C/hour
Altitude	up to 3,050 meters (10,000 feet)	up to 10,750 meters (35,000 feet)
Shock	10g, 1/2 sine wave, 11 msec	60g, 1/2 sine wave, 11 msec
Vibration, peak to peak displacement	0.005 in. max (5 to 32 Hz)	0.1 in. max (5 to 17 Hz)
Vibration, peak acceleration	0.25g (5 to 500 Hz) (Sweep Rate = 1 octave/minute)	0.25g (5 to 500 Hz) (Sweep Rate = 1 octave/minute)

Certifications

Category	Compliance
Emissions	FCC, CFR 47 Part 15, Subpart B ANSI C63.4-1992, Class A FCC OST 55 VCCI Class A CISPR 22 CSA C108.8-M1983 (R1989) EN55022 CE EN61000-3-2, EN61000-3-3
Safety	UL 1950, CUL DIN/VDE 0805 CSA 22.2, No. 950-93 IEC 950 EN 60950 TUV EMKO-TSE (74-SEC) 207/94 Nordic Deviations to EN 60950