CHAPTER 1

Overview of the Cisco 4000 Series Routers

The Cisco 4000 series consists of the Cisco 4000-M, the Cisco 4500-M, and the Cisco 4700-M. All models provide a configurable modular router platform using network processor modules—individual modules that when installed in the router are ready for external network connections. Performance is the key distinction between the Cisco 4000-M, Cisco 4500-M, and Cisco 4700-M.

For maximum performance in the Cisco 4000 series, the Cisco 4700-M contains a 133-MHz RISC microprocessor, 16 to 64 MB main memory, and a 512-KB secondary cache. The faster speed of the Cisco 4700-M allows higher throughput for high-speed interfaces. The 512-KB secondary cache is useful for process switching applications such as compression and encryption.

The Cisco 4500-M contains a 100-MHz RISC microprocessor and 8 to 32 MB of main memory. The Cisco 4000-M contains a 40-MHz CISC microprocessor and 4 to 32 MB of main memory.

All Cisco 4000 series routers provide flexibility, allowing network managers to easily reconfigure the router when needs change.

The Cisco 4000 series routers support up to three network processor modules at a time. The following network processor modules are available at the publication date of this guide:

- Single-port Fast Ethernet with 100BaseT and MII connectors provided for the port
- Single-port and dual-port Ethernet with 10BaseT and AUI connectors provided for each port
- Six-port Ethernet with 10BaseT connectors provided for each port
- Dual-port and four-port synchronous serial supporting EIA/TIA-232, EIA/TIA-449, V.35, X.21, NRZ/NRZI, DTE/DCE, or EIA-530 DTE interfaces on each port

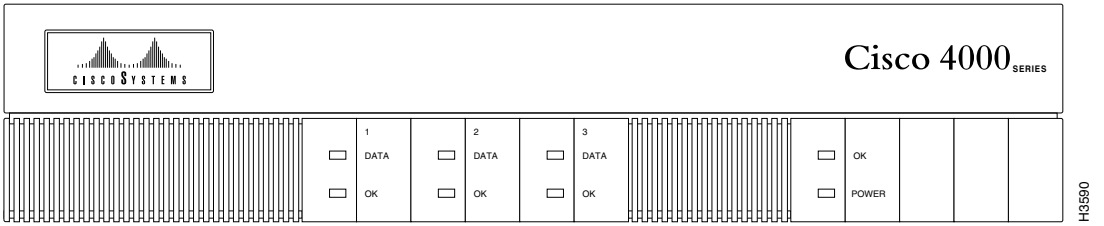
- Dual-port high-speed synchronous serial and 16-port low-speed synchronous/asynchronous serial. The high-speed ports supports EIA/TIA-232, EIA/TIA-449, V.35, X.21, NRZ/NRZI, DTE/DCE, or EIA-530 DTE interfaces. The low-speed ports support EIA/TIA-232, V.35, or X.21 interfaces in DTE or DCE mode. Each low-speed port can be individually configured for synchronous or asynchronous.
- Single-port HSSI
- Single-port and dual-port Token Ring
- Dual attachment single-mode FDDI
- Single attachment or dual attachment multimode FDDI
- Four-port or eight-port ISDN BRI
- Four-port balanced or unbalanced G.703/G.704
- Single-port channelized T1/ISDN PRI
- Single-port balanced or unbalanced channelized E1/ISDN PRI
- Single-port ATM with single-mode OC-3 and long-reach capability, multimode OC-3, DS-3, or E3 interfaces

Note For information about modules released after publication of this guide, see the configuration note packet shipped with your router.

Note EIA/TIA-232 and EIA-TIA-449 were known as recommended standards RS-232 and RS-449 before their acceptance as standards by the Electronics Industries Association (EIA) and Telecommunications Industry Association (TIA)

Figure 1-1 shows the front panel of a Cisco 4000 series router.

Figure 1-1 Cisco 4000 Series Chassis—Front Panel


Cisco 4000 SERIES
1
DATA
OK
2
DATA
OK
3
DATA
OK
OK
POWER
H3590

Series Specifications

Design specifications for the Cisco 4000 series are as follows:

- Modular router platform.
- Flash memory capability.
- User-upgradable network processor modules, shared memory, and processor local memory.
- Hardware thermal alarm to warn of excessively high operating temperature.
- Can be rack-mounted in either a standard 19-inch rack or a telco rack.
- Can be mounted on a wall or placed on a desk or table.
- Support for up to three network processor modules at a time. Network processor modules can be placed in any of the three available positions in almost any desired combination. See the *Cisco Product Catalog* for complete configuration details.

The BRI four-port and eight-port network interface modules can not be used in the same chassis with the channelized T1/ISDN PRI network interface module or the channelized E1/ISDN PRI network interface module.

The Cisco 4000-M does not support Fast Ethernet, HSSI, 2T16S, ATM, or six-port Ethernet network processor modules.The Cisco 4000-M can support only one FDDI network processor module in combination with any two other types of network processor modules.

The Cisco 4500-M and Cisco 4700-M can support two FDDI network processor modules. If you are only using one FDDI module, install it in the center slot for optimum heat dissipation.

The Cisco 4500-M and Cisco 4700-M can support one ATM network processor module or up to three six-port Ethernet network processor modules. The single-port Ethernet module is not supported on the Cisco 4500-M or the Cisco 4700-M.

Note The Cisco 4500-M and Cisco 4700-M support all network processor modules except the single-port Ethernet network processor module.

For complete configuration information, refer to the Cisco Product Catalog, which is available on the Web at http://www.cisco.com.

Table 1-1 lists the network processor module interface options available for the Cisco 4000 series when this guide was printed. For current modules, see the configuration note packet that shipped with your router.

Interface Options	Port Options	Part Numbers
Ethernet	Single port, dual port, or six port	NP-1E=, NP-2E=, NP-6E=
Fast Ethernet	Single port	NP-1FE=
Synchronous serial	Dual port or four port	NP-2T=, NP-4T=
Synchronous/asynchronous serial[1]	Dual high-speed ports and 16 low-speed ports	NP-2T16S=
HSSI	Single HSSI port	NP-1HSSI=
Token Ring	Dual port or single port	NP-1RV2=, NP-2R=
Multimode FDDI	Single attachment or dual attachment	NP-1F-D-MM=, NP-1F-S-M=
Single-mode FDDI	Dual attachment	NP-1F-D-SS=
BRI	Four port or eight port	NP-4B=, NP-8B=
G.703	Four port (balanced or unbalanced)[2]	NP-4GB=, NP-4GU=
Channelized T1/ISDN PRI	Single channelized T1/PRI port	NP-CT1=
Channelized E1/ISDN PRI	Single channelized E1/PRI port	NP-CE1=
ATM	Single ATM port	NP-1A-SM=,NP-1A-MM=, NP-1A-DS3=, NP-1A-E3=

1. Each low-speed port can be individually configured for synchronous or asynchronous.
2. For G.703 and G.704 connections, balanced or unbalanced ports must be matched with the corresponding balanced or unbalanced cable.

Table 1-1 lists the specifications of the Cisco 4000 series routers.

Table 1-1 System Specifications

Description	Specification
Dimensions (H x W x D)	3.4 x 17.6 x 17.7" (8.6 x 44.7 x 45 cm)
Weight	24 lb (10.9 kg) (including the chassis and network processor modules)
Power	100–240 VAC, 50–60 Hz, 3.0–1.5A or 40–72 VDC, 5–2.8A
Wire gauge for DC-input power connections	14 AWG[1]
Network interface options	Ethernet, serial, Token Ring, FDDI, BRI, G.703, channelized T1/PRI, channelized E1/PRI, ATM
Serial interfaces	EIA/TIA-232, EIA/TIA-449, V.35, X.21, NRZ/NRZI, DTE/DCE, EIA-530 DTE
Console port	EIA/TIA-232 DB-25 female connector
Auxiliary port	EIA/TIA-232 DB-25 male connector
Nonoperating temperature	– 40–185°F (– 40–85°C)
Operating humidity	5–95%, noncondensing
Operating temperature	32–104°F (0–40°C)
Regulatory compliance	FCC Class A, FCC Part 68, Canadian DOC Class A, CS-03, UL 1950 2nd edition, CAN/CSA 950-M93, EN60950 with Amendments 1 and 2, AN/NZS 3260, NOM 019 Additional regulatory compliance is in the *Cisco 4000 Series Public Network Certification* document that shipped with your router.)

1. AWG = American Wire Gauge

Software Compatibility

Network processor modules must be supported by the appropriate level of system software. The minimum system software version for the original Cisco 4000 was Software Release 9.1; for the Cisco 4000-M, Software Release 9.14; for the Cisco 4500, and Cisco 4500-M, Cisco Internetwork Operating System (Cisco IOS) Release 10.2; for the Cisco 4700-M, Cisco IOS Release 10.3(10). Table 1-2 lists the minimum system software versions for network processor modules.

Table 1-2 Minimum Software Release Version

Network Processor Module Type	Minimum Software Release Version
Multimode FDDI	Software Release 9.14(1)
Fast Ethernet	Cisco IOS Release 11.1(5) or 11.2(2)P
Dual Ethernet	Software Release 9.14(2)
Six-port Ethernet	Cisco IOS Release 10.3(6)
Single-mode FDDI	Software Release 9.14(3)
Dual and Version 2 Token Ring	Software Release 9.14(5)
Four-port serial	Software Release 9.14(6)
2T16S-RS232 and 2T16S-V.35	Cisco IOS Release 11.2(3)P for synchronous operation Cisco IOS Release 11.2(4)P for asynchronous operation
2T16S-X.21	Cisco IOS Release 11.2(5)P
HSSI	Cisco IOS Release 11.2(5)P
ISDN BRI	Cisco IOS Release 10.2
G.703	Cisco IOS Release 10.2(7)
Channelized T1/ISDN PRI	Cisco IOS Release 10.3(4)
Channelized E1/ISDN PRI	Cisco IOS Release 10.3(4)
ATM OC-3C	Cisco IOS Release 10.3(4)
ATM DS-3 and E3	Cisco IOS Release 11.0(5)

Note The Cisco 4000 can no longer be ordered, but Cisco IOS Releases 10.0, 10.2, and 10.3 are supported on installed Cisco 4000 routers. The Cisco 4500 can no longer be ordered, but Cisco IOS Releases 10.1, 10.2, and 10.3 are supported on installed Cisco 4500 routers. The Cisco 4700 can no longer be ordered, but Cisco IOS Release 10.3 is supported on installed Cisco 4700 routers.

Table 1-3 lists the processor and memory specifications of the Cisco 4000 series routers.

Table 1-3 Cisco 4000 Series Processor and Memory Specifications

Description	Cisco 4000-M	Cisco 4500-M	Cisco 4700-M
Processor	40-MHz Motorola 68EC030	100-MHz IDT Orion RISC[1]	133-MHz IDT Orion RISC
Main memory (DRAM)[2]	4, 8, 16, or 32 MB	8, 16, or 32 MB	16, 32, or 64 MB
Secondary cache memory	None	None	512 KB
Shared memory (DRAM)	4 or 16 MB	4, 8, or 16 MB	4, 8, or 16 MB
Flash memory	4 or 8 MB	4, 8, 16, 32, or 64 MB	4, 8, 16, 32, or 64 MB
NVRAM[3]	128 KB	128 KB	128 KB
Boot ROM	128 KB–8 MB	128–512 KB	128–512 KB
Boot Flash	Not available	4–16 MB	4–16 MB

1. The Orion microprocessor is based on the MIPS R4400 and is pin-compatible.
2. DRAM = dynamic random-access memory.
3. NVRAM = nonvolatile random-access memory.

Memory Systems

The Cisco 4000 series memory systems (see Figure 1-2) have the following functions:

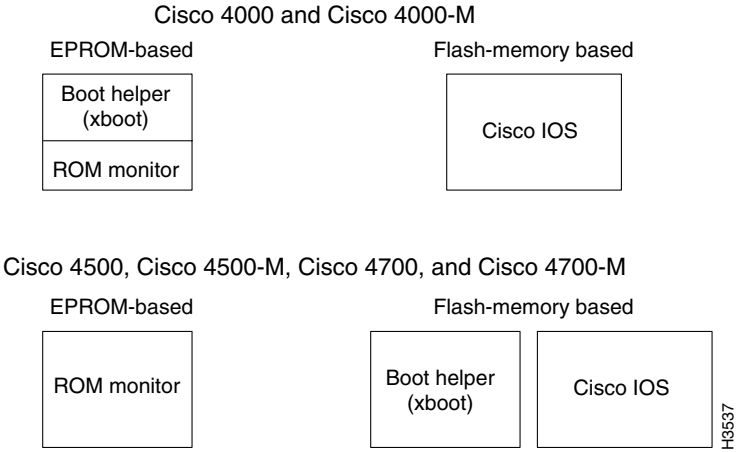
- Main memory—Stores the running configuration and routing tables. The Cisco IOS software executes from main memory.
- Shared memory—Used for packet buffering by the router's network interfaces.
- Flash memory—Stores the operating system software image. In the Cisco 4500-M and 4700-M, the Flash memory also stores the boot helper software.
- NVRAM—Stores the system configuration file and the virtual configuration register.
- Boot EPROM—In the Cisco 4000-M, erasable programmable read-only memory (EPROM)-based memory stores the boot helper—a subset of the Cisco IOS software—and the ROM monitor. In the Cisco 4500-M and Cisco 4700-M, only the ROM monitor is EPROM based. The boot helper image allows you to boot the router

when Flash memory does not contain a valid system image. In the Cisco 4500-M and 4700-M, the ROM monitor allows you to boot a system image from Flash memory if a boot helper image is not present in boot Flash memory.

The differences between the memory systems in the Cisco 4000 series allows enhanced software upgradability in the Cisco 4500-M and Cisco 4700-M.

Note See the appendixes "Cisco 4000 Series Virtual Configuration Register," "Cisco 4000-M ROM Monitor," and "Cisco 4500-M and Cisco 4700-M ROM Monitor" for more information on the ROM Monitor.

Figure 1-2 Cisco 4000 Series Memory Systems and Software Images



Memory Requirements in the Cisco 4000 Series

Each module in the Cisco 4000 series can change memory configurations to accommodate internetworking demands. The memory requirements are affected by the following factors:

- The number of Cisco IOS software images a system stores can be increase by adding Flash memory.
- Network expansion, the use of additional protocols or Cisco IOS services, or newer Cisco IOS releases may require additional main memory
- I/O performance or more physical or virtual interfaces may require additional shared memory.

Shared Memory Requirements

The standard configuration for shared memory is 4 MB for the Cisco 4000 series. 4 MB of memory is enough for most configurations with fewer than 24 physical or virtual interfaces. Routers with multiple ISDN BRI network processor modules or with 24 or more physical and virtual interfaces require 8 to 16 MB of shared memory.

Note The types and numbers of network processor modules installed in a system does not affect main or flash memory requirements.

Table 1-4 Cisco 4000-M Shared Memory Requirements

Network Processor Module	Per-Module Shared Memory Requirements
Single-port Ethernet	0.1 MB
Dual-port Ethernet and dual-port serial	0.2 MB
Dual-port Token Ring, four-port serial, and G.703/G.704 serial	0.4 MB
Eight-port BRI, CT1/PRI, and CE1/PRI	1.0 MB
FDDI	2.0 MB

Table 1-5 Cisco 4500-M and Cisco 4700-M Shared Memory Requirements

Network Processor Module	Per-Module Shared Memory Requirements
Dual-port Ethernet and dual-port serial	0.4 MB
Single-port Fast Ethernet	1.7 MB
Dual-port Token Ring, four-port serial, and G.703/G.704 serial	0.6 MB
Six-port Ethernet, Eight-port BRI, CT1/PRI, and CE1/PRI	1.2 MB
ATM and one FDDI[1]	2.0 MB
Two FDDI[2]	3.0 MB
Dual-port high-speed synchronous serial and 16-port low-speed synchronous serial	0.6 MB
HSSI	1.0 MB

1. FDDI modules are an exception in that two FDDI modules do not require double the shared memory of one FDDI module.
2. FDDI modules are an exception in that two FDDI modules do not require double the shared memory of one FDDI module.

Note For more information, see product bulletin number 419, "Memory Options for Cisco 4000 Series," on the Web at http://www.cisco.com. This bulletin contains information such as minimum memory requirements for each Cisco IOS image, current shared memory requirements, and sample configurations.

Main Memory Requirements

The amount of main memory required by a Cisco 4000 series router is affected by the size of the network and by the access list configurations. However, it is difficult to quantify the exact main memory requirements based only on network size. Use the following guidelines to determine approximate main memory requirements.

Note If your memory requirements fall near the upper end of one of the available main memory options, consider installing the next larger memory option to allow for network growth.

Main memory requirement guidelines for Cisco 4000 series routers are as follows:

- The 4 MB of main memory standard in the Cisco 4000-M will only suffice on routers with knowledge of very small networks and which run very few protocols.
- The 8 MB of main memory standard in the Cisco 4500-M and the 16 MB of main memory standard in the Cisco 4700-M generally suffices on routers running Cisco IOS Release 10.2.
- 16 MB of main memory, optional in the Cisco 4500-M and standard in the Cisco 4700-M, generally suffices on routers using Cisco IOS Release 10.3 or later.
- The 64 MB main memory option for the Cisco 4700-M is recommended for routers using Border Gateway Protocol (BGP).

Cisco RPS Support

The Cisco 4000-M, 4500-M, or 4700-M router now supports connection to the Cisco Redundant Power System (RPS). The router supports an RPS in two ways:

- The chassis ships with an RPS adapter plate installed by the factory
- The user installs an RPS adapter plate at the site

For more information, refer to the *Cisco RPS Hardware Installation Guide* and *Installing the Cisco RPS Adapter Plate in Cisco 4000 Routers*. This section provides an overview of the Cisco RPS and describes basic features.

Figure 1-3 shows the front panel of the Cisco RPS, and Figure 1-4 shows the rear panel.

Figure 1-3 Cisco RPS Front Panel

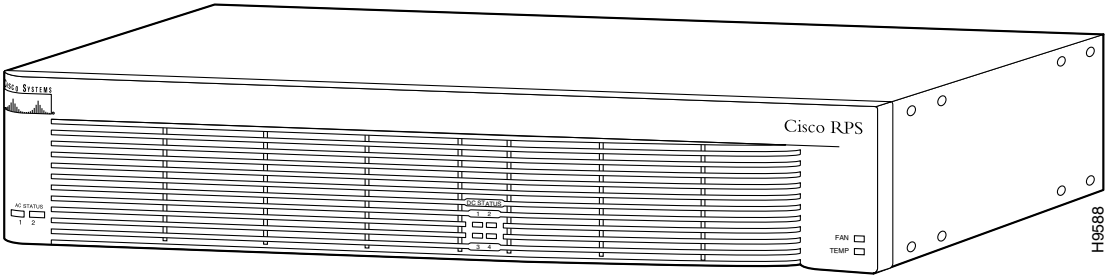
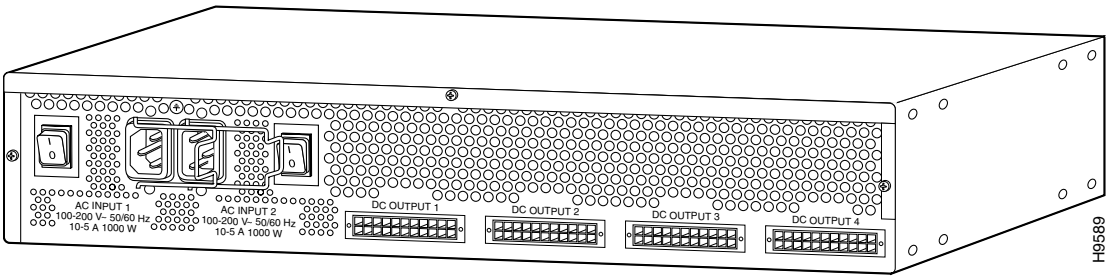


Figure 1-4 Cisco RPS Rear Panel



Caution Use the Cisco RPS (model PWR600-AC-RPS) only to power the external device.

Seul le système d'alimentation redondant Cisco (RPS modèle PWR600-AC-RPS) doit servir à alimenter le dispositif externe.

Das externe Gerät darf nur mit einer redundanten Stromversorgung von Cisco, Modell PWR600-AC-RPS, betrieben werden.

外付部品の電源には、必ず Cisco RPS（モデル番号 PWR600-AC-RPS-CAB/PWR600-AC-RPS-NC

Para alimentar el dispositivo externo, usar exclusivamente el sistema de alimentación redundante (redundant power system = RPS) Cisco, modelo PWR600-AC-RPS.

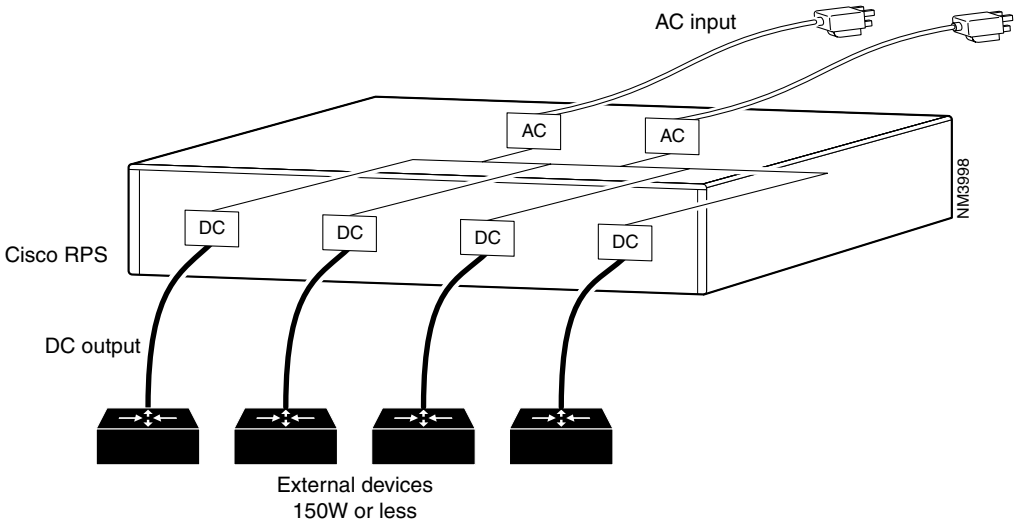
Overview

The Cisco RPS provides power system redundancy to external devices (such as routers, switches, or hubs). The system includes two fully redundant AC input power modules and four DC output power modules for connection to external devices. The Cisco RPS supports the following power source configurations: quasi-redundant and fully redundant.

Quasi-Redundant Power

The Cisco RPS can provide a quasi-redundant power source for up to four external devices that use 150W or less each. You can use a one-to-one cable (one connector at each end of the cable) to connect up to four external devices to the four DC output power modules, as shown in Figure 1-5. When using one-to-one cables, the power source is quasi-redundant because there are two AC input power modules for the Cisco RPS and one DC power output module for each external device. The AC input to the Cisco RPS is fully redundant, but the DC output to the external devices is not.

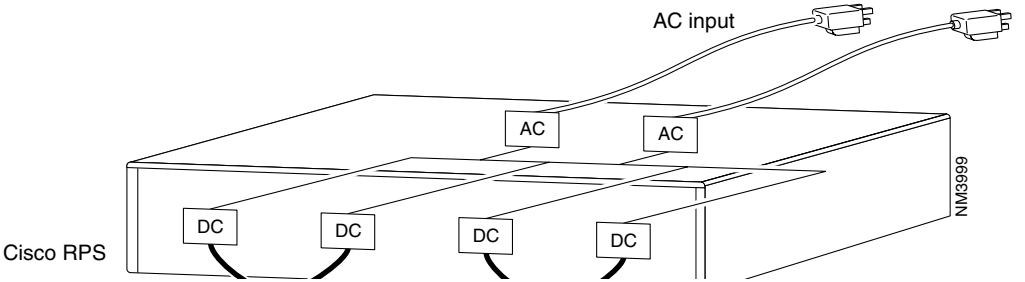
Figure 1-5 Quasi-Redundant Configuration



Fully Redundant Power

The Cisco RPS can provide a fully redundant power source for up to two Cisco 4000 series routers. You can use a two-to-one cable to connect up to two external devices to the four DC output power modules on the rear panel of the Cisco RPS, as shown in Figure 1-6. The two-to-one cable is a Y-shaped cable with two connectors at one end of the cable and one connector at the other end. Two connectors at one end of the Y-shaped cable connect to two DC output power modules. The other end of the cable connects to one external device. When using two-to-one cables, the power source is fully redundant because there are two AC input modules and two DC output power modules connected to each external device. If any power module fails, there is a full backup.

Figure 1-6 Fully Redundant Configuration



RPS Features

The following features are standard:

- Two AC input power cords
- Two fully redundant AC input power modules
- Four 150W DC output power modules
- Four one-to-one cables (PWR600-AC-RPS-CAB)
- Rack-mountable chassis (two rack units in height, 19-inch rack-mount brackets included)
- Redundant cooling
- LEDs for the AC and DC status, fans, and temperature