

Cisco Catalyst 4000 Series Inline Power Solution

Enabling inline power and simplifying IP telephony deployment in the enterprise wiring closet and branch office.

The Cisco® Catalyst® 4000 Series switches extend the Cisco AVVID (Architecture for Voice, Video and Integrated Data) networking capabilities of the Cisco Catalyst backbone to the enterprise wiring closet and branch office. The Cisco Catalyst 4000 Inline Power Fast Ethernet line card enables the modular wiring-closet infrastructure to provide centralized power for Cisco AVVID IP telephony networks. The line card prepares the network infrastructure for IP-based, converged business applications that will provide transparent communications and collaboration between branch and corporate sites (refer to Figure 1).

The Cisco Catalyst 4000 Inline Power solution includes:

- The Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching line card
- The auxiliary DC power shelf
- The Cisco Catalyst 4006 Power Entry Module (PEM)

Enabling Leading-Edge Features

- Inline power
- Phone discovery
- Auxiliary virtual LANs (VLANs)

Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching Line Card

The Cisco Catalyst 4000 Inline Power 10/100BASE-TX Ethernet Switching line card supports up to 48 ports per line card (RJ-45 interfaces). Along with phone discovery, these line cards support autosensing and autonegotiation to determine the speed and duplex mode of the attached device. The Cisco Catalyst 4006, with support for up to 240 multiservice ports, directly provides inline power. To support the demand for phone power on the Cisco Catalyst 4006, Cisco has developed an auxiliary DC power shelf that supplies the Cisco Catalyst 4006 with the 48 volts needed for inline power.

Auxiliary DC Power Shelf

The auxiliary DC power solution includes:

- The Cisco Catalyst 4000 Auxiliary DC Power Shelf
- The 1050W Cisco Catalyst 4000 Auxiliary Power Supply Unit (PSU)
- The Cisco Catalyst 4000 PEM for the Cisco Catalyst 4006 chassis

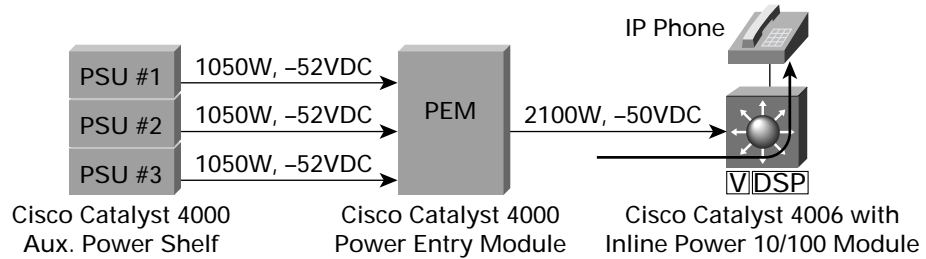
Figure 1
 Cisco Catalyst 4000 Series Inline Power Solution Enables Multiservice IP Telephony and Wireless Access Network Deployments





Figure 2 shows the connectivity between each of these inline power components.

Figure 2
Cisco Catalyst 4006 Inline Power Solution (shown with N + 1 redundancy)

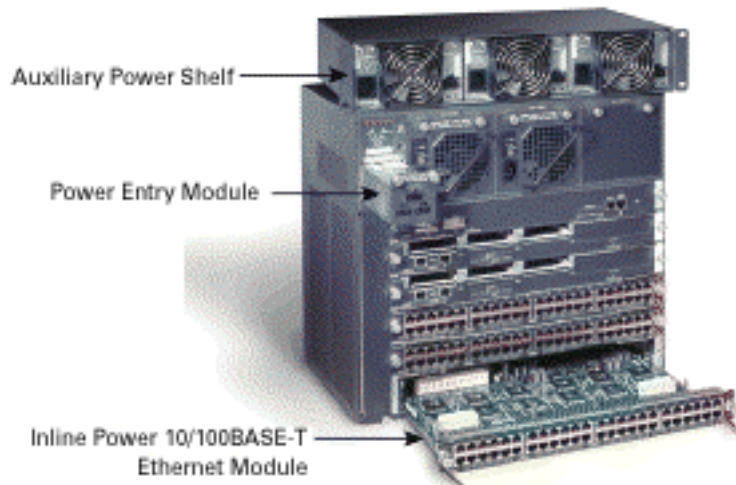


The auxiliary DC power shelf is a 3-slot chassis that supports two or three auxiliary PSUs that generate the 48 VDC required for IP phones. Each PSU delivers 1050W of power, and two PSUs can be combined to provide up to 2100W of power. Two PSUs are required in the nonredundant configuration as a minimum, supporting the full 240-port capacity of the Cisco Catalyst 4006. The third PSU is an optional, fault-tolerant supply, providing N + 1 redundancy. The auxiliary power shelf connects to a 110-VAC 12A power source.

Power Entry Module

The Cisco Catalyst 4006 PEM is the interface between the auxiliary DC power shelf and the Cisco Catalyst 4006 chassis. The PEM has a dedicated bay in the power section of the Cisco Catalyst 4006 chassis, as shown in Figure 3. The PEM enables the chassis to draw -48-VDC power directly from the auxiliary DC power shelf and distribute it over the Cisco Catalyst 4006 backplane traces to the inline power 10/100 Ethernet line cards in the Cisco Catalyst 4006 chassis.

Figure 3
Cisco Catalyst 4006 PEM





Inline Power

Inline power is 48-VDC power provided over standard Category 5 unshielded twisted-pair (UTP) cable up to 100 meters. Instead of requiring wall power, terminal devices such as IP telephones can utilize power provided from the Cisco Catalyst 4000 Switch. This capability gives the network administrator centralized power control, which translates into greater network availability. By deploying Cisco Catalyst 4000 switches with uninterruptible-power-supply (UPS) systems in secured wiring closets, network administrators can ensure that power outages in a building will not affect network telephony connections.

The inline power feature works using a customer's existing Category 5 UTP installations. The Cisco Catalyst Inline Power implementation passes the required domestic and international safety regulations and compliance measures. These line cards are fully compliant with the 802.3 standard when no inline power is supplied. The 802.3 standard does not include specifications for providing power over Ethernet. Cisco is committed to standards-based operation and will support the IEEE in its efforts to add Ethernet power specifications to the 802.3 Ethernet standard.

IEEE 802.3af

Although the IEEE draft for power over Ethernet standards are not yet fully defined, the Cisco Catalyst 4006 chassis, auxiliary power shelf, and PEM are ready to support delivery of up to 15.4 watts per Ethernet port. New inline power line cards supporting both the IEEE 802.3af standard and Cisco inline power implementation will be available when the standard is ratified. For IEEE 802.3af compliance, an existing Cisco 48-port 10/100 Inline Power line card (part number WS-X4148-RJ45V) must be replaced with a new IEEE 802.3af-compliant line card.

Phone Discovery

The Cisco phone-discovery feature eases the network management burden by automating the inline-power feature. With phone discovery, the Cisco Catalyst switch automatically detects the presence of an IP phone and supplies inline power. This means that network administrators can maintain centralized control without the need to manually enable each port to supply inline power. The phone-discovery mechanism is intelligent enough to differentiate between an IP phone and a network interface card (NIC), and will not supply inline power to a NIC or other device not designed to use inline power. Network administrators can depend on automatic and centralized control of inline power that is safe to deploy and maintain.

Auxiliary VLAN

A unique feature that demonstrates advanced Cisco IP telephony leadership is the auxiliary VLAN feature. This feature provides automatic VLAN configuration for IP telephones, and overcomes the complexity of overlaying a voice topology on a data network. Network administrators can easily segment phones into separate logical networks, even though the data and voice infrastructure are physically the same. The auxiliary VLAN feature places the phones in their own VLANs without any end-user intervention. These VLAN assignments can be transparently maintained, even if the phone is moved to a new location. The user simply plugs the phone into the switch, and the switch provides the phone with the necessary VLAN information. By placing phones in their own VLANs, network administrators gain the advantages of network segmentation and control. Network administrators can preserve their existing IP topology for the data end stations. IP phones can be easily assigned to different IP subnets using standards-based Dynamic Host Configuration Protocol (DHCP) operation. With the phones in their own IP subnets and VLANs, network administrators can more easily identify and troubleshoot network problems. Additionally,



network administrators can create and enforce quality-of-service (QoS) or security policies. With the auxiliary VLAN feature, Cisco enables network administrators to gain all the advantages of physical infrastructure while maintaining separate logical topologies for voice and data terminals, creating the most effective way to manage a multiservice network.

The auxiliary VLAN feature uses 802.1Q as the standards-based VLAN tagging mechanism between the switch and the phone. On the link between the phone and the switch, voice packets going to and from the phone are tagged with VLAN information. Packets going to and from the data end station remain untagged in the default configuration. Because the configuration between the switch and the phone is fully automated, the network administrator enjoys the benefits of VLANs without configuration complexity.

Additionally, the Cisco Catalyst 4000 Series offers more-advanced network management features. Each line card has extensive interface-level statistics, including four Remote Monitoring (RMON) groups: alarms, events, history, and statistics. For in-depth network analysis, users can employ the Enhanced Switched Port Analyzer (ESPA) feature to redirect traffic from each switched port to a specific VLAN, allowing the user to add, move, and easily change group access to network resources from centralized locations using CiscoWorks. The Cisco Catalyst 4000 Series delivers comprehensive tools that enable network managers to control their fast-growing multiservice networks.

Increased Link Resiliency and Bandwidth Aggregation

Cisco Catalyst 4000 Series Fast Ethernet line cards fully support Cisco Fast EtherChannel[®] technology and the IEEE 802.3ad Link Aggregation standard, giving network managers a reliable high-speed solution for the campus network backbone. Cisco Fast EtherChannel technology provides flexible, incremental bandwidth aggregation in multiple 200-Mbps increments, up to 1.6 Gbps per Fast EtherChannel link.

Customers can take advantage of the new multimodule-channeling feature that combines ports from the same line card or from different line cards into a Fast EtherChannel link. This is ideal for customers requiring scalable, flexible bandwidth within the network. Customers also benefit from Fast EtherChannel automatic recovery and redistribution of loads across the remaining links, ease of management, and technology that is transparent to network applications.

Superior Traffic Management

The Cisco Catalyst 4000 Series Fast Ethernet switching line cards offer superior traffic management with large per-interface buffers and multiple queues for QoS. These features allow users to configure a higher priority for mission-critical applications on any switched interface. The Cisco Catalyst 4000 Series of switches maintains up to 32,000 active Media Access Control (MAC) addresses in the bridge lookup table. The standard 802.1d spanning-tree algorithm is supported on a VLAN basis for fault-tolerant connectivity.

Features

The Cisco Catalyst 4000 Inline Power 10/100BASE-T Ethernet Switching line card features:

- *48 ports 10/100BASE-TX per line card (RJ-45)*—Each Cisco Catalyst 4006 Series switch has up to 240 10/100 Fast Ethernet ports.
- *Inline power*—48-VDC power is provided over standard Category 5 UTP cable up to 100 meters.
- *Phone discovery*—The Cisco Catalyst 4000 Switch automatically detects the presence of an IP phone and supplies inline power.



- *Auxiliary VLAN via 802.1Q*—The Cisco Catalyst 4000 Switch automatically segments phones and data endpoints into separate, logical networks.
- *Support for IEEE 802.3u autonegotiation process*—This process allows the switch to negotiate speed (10 or 100 Mbps) or duplex mode (half or full duplex) with an attached device.
- *Capacity of up to five line cards per platform*—Line cards require one slot, they can be “mixed and matched” with other switching line cards, and they can be hot-swapped or added as needed without interrupting the Cisco Catalyst 4000 Switch.
- Superior traffic management with large per-interface buffers and multiple priority queues.
- *Support for multiple active MAC addresses (up to 32,000) on a switching port*—The addresses can be dynamically allocated to any port.
- *Spanning-tree algorithm on logical VLANs for fault-tolerant connectivity*—The line cards are capable of supporting up to 1000 VLANs.
- Extensive management tools using Simple Network Management Protocol (SNMP) network management platforms such as CiscoWorks for switched internetworks.
- *Four RMON groups*—Statistics, history, alarms, and events RMON groups are supported in hardware.

Features of the Cisco Catalyst 4000 Auxiliary DC Power Shelf include:

- 3-slot chassis
- Two PSUs required as a minimum allowable configuration (included as default)
- Dedicated AC input circuit for each PSU
- At least two DC power inputs with a total 2100W at -52 VDC required for the Cisco Catalyst 4000 PEM

Ordering Information

Part Number	Description
WS-X4148-RJ45V(=)	Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching line card
WS-X4095-PEM(=)	Cisco Catalyst 4000 PEM for WS-C4006
WS-P4603-2PSU	Cisco Catalyst 4000 Auxiliary DC Power Shelf with two PSUs
WS-X4608(=)	Cisco Catalyst 4000 Auxiliary PSU
WS-P4603=	Cisco Catalyst 4000 Auxiliary DC Power Shelf, spare

Specifications

Physical Specifications

Cisco Catalyst 4000 Inline Power 10/100 BASE-TX Switching Line Card

- Occupies one slot in a Cisco Catalyst 4000 Series platform

Cisco Catalyst 4000 PEM

- Occupies the dedicated bay in a Cisco Catalyst 4006 chassis



Cisco Catalyst 4000 Auxiliary DC Power Shelf

- Dimensions (H x W x D): 3.48 x 17.45 x 12 in. (8.8 x 44.3 x 30.5 cm)
- Two rack units (RU) high
- Rack-mount hardware included

Cisco Catalyst 4000 Auxiliary PSU

- Occupies one slot in a Cisco Catalyst 4000 Auxiliary DC Power Shelf

Power Specifications

Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching Line Card

- Inline power output per port: 48 VDC power
- Pin assignment: 1, 2, 3, 6

Cisco Catalyst 4000 Auxiliary PSU

- Single-unit output: 1050W at -52 VDC
- Dual-unit output: 2100W at -52 VDC
- Input current: 12A max @ 110 VAC, 60 Hz
- 6A max @ 240 VAC, 50 Hz
- Heat dissipation: 1000 BTU/hr per unit

Cisco Catalyst 4000 PEM

- Input: -52 VDC nominal
- Output: -50 VDC nominal

Standard Network Protocols

- Ethernet: IEEE 802.3, 10BASE-T
- Fast Ethernet: IEEE 802.3u, 100BASE-TX

Environmental Conditions

- Operating temperature: 32 to 104 F (0 to 40 C)
- Storage temperature: -4 to 167 F (-20 to 75 C)
- Operating relative humidity: 10 to 90 percent, noncondensing
- Operating altitude: Up to 4000m

Frame Processing

- Transparent bridging (802.1d)

Network Management

- ETHERLIKE-MIB (RFC 1643)
- IF-MIB (RFC 1573)
- Bridge MIB (RFC 1493)
- CISCO-STACK- MIB



- CISCO-VTP-MIB
- CISCO-CDP-MIB
- RMON MIB (RFC 1757)
- CISCO-PAGP-MIB
- CISCO-STP-Extensions-MIB
- CISCO-VLAN-Bridge-MIB
- CISCO-VLAN-Membership-MIB
- CISCO-UDLDP-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-COPS-CLIENT-MIB
- ENTITY-MIB (RFC 2037)
- HC-RMON
- RFC1213-MIB (MIB-II)
- SMON-MIB

Maximum Station-to-Station Cabling Distance

- 10/100BASE-TX Fast Ethernet: Category 5 UTP: 328 ft (100m), 100-ohm shielded twisted-pair (STP): 328 ft (100m) half or full duplex

Indicators and Interfaces

Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching Line Card

- Board status LED: Green, operational; Red, fault
- Port status LED: Green, operational; Red, fault
- Power status LED: Green, inline power OK and requesting devices powered OK; Orange, inline power OK, at least one requesting device denied power; Off, inline power fault

Cisco Catalyst 4000 Auxiliary PSU

- Input OK: Green, operational; Off, fault
- Output OK: Green, operational; Off, fault

Compliance

Cisco Catalyst 4000 Inline Power 10/100BASE-TX Switching Line Card and Cisco Catalyst 4000 Auxiliary DC Power Shelf

- CE Marking

Safety Certifications

Cisco Catalyst 4000 Inline Power 10/100 BASE-TX Switching Line Card and Cisco Catalyst 4000 Auxiliary DC Power Shelf

- UL1950, CSA C22.2 No. 950, EN60950, IEC60950, AS/NZS 3260t

Electromagnetic Emissions Certifications

Cisco Catalyst 4000 Inline Power 10/100 BASE-TX Switching Line Card

- FCC Part 15 (CFR47) Class A with UTP
- EN55022 Class A with UTP and Class B with foil twisted-pair (FTP)
- CISPR22 Class A with UTP and Class B with FTP

- VCCI Class A with UTP and Class B with FTP
- AZ/NZS 3548 Class A with UTP and Class B with FTP
- EN55024
- EN 300 386-1
- EN 300 386-2

Cisco Catalyst 4000 Auxiliary DC Power Shelf

- FCC Part 15 (CFR47) Class A
- EN55022 Class B
- CISPR22 Class B
- VCCI Class B
- AZ/NZS 3548 Class B
- EN55024
- EN 300 386-1
- EN 300 386-2



Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
Capital Tower
168 Robinson Road
#22-01 to #29-01
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

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