



Configuring Power over Ethernet

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <https://cfng.cisco.com/>. An account on Cisco.com is not required.

Information About PoE

Power over Ethernet Ports

A PoE-capable switch port automatically supplies power to one of these connected devices if the switch senses that there is no power on the circuit:

- a Cisco pre-standard powered device (such as a Cisco IP Phone or a Cisco Aironet Access Point)
- an IEEE 802.3af-compliant powered device
- an IEEE 802.3at-compliant powered device

A powered device can receive redundant power when it is connected to a PoE switch port and to an AC power source. The device does not receive redundant power when it is only connected to the PoE port.

After the switch detects a powered device, the switch determines the device power requirements and then grants or denies power to the device. The switch can also sense the real-time power consumption of the device by monitoring and policing the power usage.

Supported Protocols and Standards

The switch uses these protocols and standards to support PoE:

- CDP with power consumption—The powered device notifies the switch of the amount of power it is consuming. The switch does not reply to the power-consumption messages. The switch can only supply power to or remove power from the PoE port.
- Cisco intelligent power management—The powered device and the switch negotiate through power-negotiation CDP messages for an agreed-upon power-consumption level. The negotiation allows a high-power Cisco powered device, which consumes more than 7 W, to operate at its highest power mode. The powered device first boots up in low-power mode, consumes less than 7 W, and negotiates to obtain enough power to operate in high-power mode. The device changes to high-power mode only when it receives confirmation from the switch.

High-power devices can operate in low-power mode on switches that do not support power-negotiation CDP.

Cisco intelligent power management is backward-compatible with CDP with power consumption; the switch responds according to the CDP message that it receives. CDP is not supported on third-party powered devices; therefore, the switch uses the IEEE classification to determine the power usage of the device.

- IEEE 802.3af—The major features of this standard are powered-device discovery, power administration, disconnect detection, and optional powered-device power classification. For more information, see the standard.
- IEEE 802.3at—The PoE+ standard increases the maximum power that can be drawn by a powered device from 15.4 W per port to 30 W per port.

Powered-Device Detection and Initial Power Allocation

The switch detects a Cisco pre-standard or an IEEE-compliant powered device when the PoE-capable port is in the no-shutdown state, PoE is enabled (the default), and the connected device is not being powered by an AC adaptor.

After device detection, the switch determines the device power requirements based on its type:

- A Cisco prestandard powered device does not provide its power requirement when the switch detects it, so the switch allocates 15.4 W as the initial allocation for power budgeting.

The initial power allocation is the maximum amount of power that a powered device requires. The switch initially allocates this amount of power when it detects and powers the powered device. As the switch receives CDP messages from the powered device and as the powered device negotiates power levels with the switch through CDP power-negotiation messages, the initial power allocation might be adjusted.

- The switch classifies the detected IEEE device within a power consumption class. Based on the available power in the power budget, the switch determines if a port can be powered. [Table 1: IEEE Power Classifications, on page 2](#) lists these levels.

Table 1: IEEE Power Classifications

Class	Maximum Power Level Required from the Switch
0 (class status unknown)	15.4 W

Class	Maximum Power Level Required from the Switch
1	4 W
2	7 W
3	15.4 W

The switch monitors and tracks requests for power and grants power only when it is available. The switch tracks its power budget (the amount of power available on the switch for PoE). The switch performs power-accounting calculations when a port is granted or denied power to keep the power budget up to date.

After power is applied to the port, the switch uses CDP to determine the *CDP-specific* power consumption requirement of the connected Cisco powered devices, which is the amount of power to allocate based on the CDP messages. The switch adjusts the power budget accordingly. This does not apply to third-party PoE devices. The switch processes a request and either grants or denies power. If the request is granted, the switch updates the power budget. If the request is denied, the switch ensures that power to the port is turned off, generates a syslog message, and updates the LEDs. Powered devices can also negotiate with the switch for more power.

If the switch detects a fault caused by an undervoltage, overvoltage, overtemperature, oscillator-fault, or short-circuit condition, it turns off power to the port, generates a syslog message, and updates the power budget and LEDs.

Power Management Modes

The switch supports these PoE modes:

- **auto**—The switch automatically detects if the connected device requires power. If the switch discovers a powered device connected to the port and if the switch has enough power, it grants power, updates the power budget, turns on power to the port on a first-come, first-served basis, and updates the LEDs. For LED information, see the hardware installation guide.

If the switch has enough power for all the powered devices, they all come up. If enough power is available for all powered devices connected to the switch, power is turned on to all devices. If there is not enough available PoE, or if a device is disconnected and reconnected while other devices are waiting for power, it cannot be determined which devices are granted or are denied power.

If granting power would exceed the system power budget, the switch denies power, ensures that power to the port is turned off, generates a syslog message, and updates the LEDs. After power has been denied, the switch periodically rechecks the power budget and continues to attempt to grant the request for power.

If a device being powered by the switch is then connected to wall power, the switch might continue to power the device. The switch might continue to report that it is still powering the device whether the device is being powered by the switch or receiving power from an AC power source.

If a powered device is removed, the switch automatically detects the disconnect and removes power from the port. You can connect a nonpowered device without damaging it.

You can specify the maximum wattage that is allowed on the port. If the IEEE class maximum wattage of the powered device is greater than the configured maximum value, the switch does not provide power to the port. If the switch powers a powered device, but the powered device later requests through CDP messages more than the configured maximum value, the switch removes power to the port. The power that was allocated to the powered device is reclaimed into the global power budget. If you do not specify a wattage, the switch delivers the maximum value. Use the **auto** setting on any PoE port. The auto mode is the default setting.

- **static**—The switch pre-allocates power to the port (even when no powered device is connected) and guarantees that power will be available for the port. The switch allocates the port configured maximum wattage, and the amount is never adjusted through the IEEE class or by CDP messages from the powered device. Because power is pre-allocated, any powered device that uses less than or equal to the maximum wattage is guaranteed to be powered when it is connected to the static port. The port no longer participates in the first-come, first-served model.

However, if the powered-device IEEE class is greater than the maximum wattage, the switch does not supply power to it. If the switch learns through CDP messages that the powered device is consuming more than the maximum wattage, the switch shuts down the powered device.

If you do not specify a wattage, the switch pre-allocates the maximum value. The switch powers the port only if it discovers a powered device. Use the **static** setting on a high-priority interface.

- **never**—The switch disables powered-device detection and never powers the PoE port even if an unpowered device is connected. Use this mode only when you want to make sure that power is never applied to a PoE-capable port, making the port a data-only port.

For most situations, the default configuration (auto mode) works well, providing plug-and-play operation. No further configuration is required. However, perform this task to configure a PoE port for a higher priority, to make it data only, or to specify a maximum wattage to disallow high-power powered devices on a port.

Budgeting Power for Devices Connected to a PoE Port

When Cisco powered devices are connected to PoE ports, the switch uses Cisco Discovery Protocol (CDP) to determine the *protocol-specific* power consumption of the devices, and the switch adjusts the power budget accordingly. This does not apply to IEEE third-party powered devices. For these devices, when the switch grants a power request, the switch adjusts the power budget according to the powered-device IEEE classification. If the powered device is a class 0 (class status unknown) or a class 3, the switch budgets 15,400 mW for the device, regardless of the CDP-specific amount of power needed. If the powered device reports a higher class than its CDP-specific consumption or does not support power classification (defaults to class 0), the switch can power fewer devices because it uses the IEEE class information to track the global power budget.

By using the **power inline consumption wattage** interface configuration command or the **power inline consumption default wattage** global configuration command, you can override the default power requirement specified by the IEEE classification. The difference between what is mandated by the IEEE classification and what is actually needed by the device is reclaimed into the global power budget for use by additional devices. You can then extend the switch power budget and use it more effectively.



Caution

You should carefully plan your switch power budget, enable the power monitoring feature, and make certain not to oversubscribe the power supply. If the power supply is over-subscribed to by up to 20 percent, the switch continues to operate but its reliability is reduced. If the power supply is subscribed to by more than 20 percent, the short-circuit protection circuitry triggers and shuts the switch down.



Note

When you manually configure the power budget, you must also consider the power loss over the cable between the switch and the powered device.

How to Configure PoE

Configuring a Power Management Mode on a PoE Port



Note When you make PoE configuration changes, the port being configured drops power. Depending on the new configuration, the state of the other PoE ports, and the state of the power budget, the port might not be powered up again. For example, port 1 is in the auto and on state, and you configure it for static mode. The switch removes power from port 1, detects the powered device, and repowers the port. If port 1 is in the auto and on state and you configure it with a maximum wattage of 10 W, the switch removes power from the port and then redetects the powered device. The switch repowers the port only if the powered device is a class 1, class 2, or a Cisco-only powered device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface-id*
4. **power inline** {**auto** [**max** *max-wattage*] | **never** | **static** [**max** *max-wattage*]}
5. **end**
6. **show power inline** [*interface-id* | **module** *switch-number*]
7. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Switch> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Switch# configure terminal	Enters global configuration mode.
Step 3	interface <i>interface-id</i> Example: Switch(config)# interface gigabitethernet 2/0/1	Specifies the physical port to be configured, and enters interface configuration mode.
Step 4	power inline { auto [max <i>max-wattage</i>] never static [max <i>max-wattage</i>]} Example: Switch(config-if)# power inline auto	Configures the PoE mode on the port. The keywords have these meanings: <ul style="list-style-type: none"> • auto—Enables powered-device detection. If enough power is available, automatically allocates power to

	Command or Action	Purpose
		<p>the PoE port after device detection. This is the default setting.</p> <ul style="list-style-type: none"> • max <i>max-wattage</i>—Limits the power allowed on the port. The range is 4000 to 15400 mW. If no value is specified, the maximum is allowed. • never—Disables device detection, and disable power to the port. <p>Note If a port has a Cisco powered device connected to it, do not use the power inline never command to configure the port. A false link-up can occur, placing the port into the error-disabled state.</p> <ul style="list-style-type: none"> • static—Enables powered-device detection. Pre-allocate (reserve) power for a port before the switch discovers the powered device. The switch reserves power for this port even when no device is connected and guarantees that power will be provided upon device detection. <p>The switch allocates power to a port configured in static mode before it allocates power to a port configured in auto mode.</p>
Step 5	<p>end</p> <p>Example:</p> <pre>Switch(config-if) # end</pre>	Returns to privileged EXEC mode.
Step 6	<p>show power inline [<i>interface-id</i> module <i>switch-number</i>]</p> <p>Example:</p> <pre>Switch# show power inline</pre>	<p>Displays PoE status for a switch or a switch stack, for the specified interface, or for a specified stack member.</p> <p>The module <i>switch-number</i> keywords are supported only on stacking-capable switches.</p>
Step 7	<p>copy running-config startup-config</p> <p>Example:</p> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

Budgeting Power to All PoE ports

SUMMARY STEPS

1. enable
2. configure terminal

3. **no cdp run**
4. **power inline consumption default *wattage***
5. **end**
6. **show power inline consumption default**
7. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Switch> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Switch# configure terminal	Enters global configuration mode.
Step 3	no cdp run Example: Switch(config)# no cdp run	(Optional) Disables CDP.
Step 4	power inline consumption default <i>wattage</i> Example: Switch(config)# power inline consumption default 5000	Configures the power consumption of powered devices connected to each PoE port. The range for each device is 4000 to 15400 mW (PoE+). The default is 15400 mW.
Step 5	end Example: Switch(config)# end	Returns to privileged EXEC mode.
Step 6	show power inline consumption default Example: Switch# show power inline consumption default	Displays the power consumption status.
Step 7	copy running-config startup-config Example: Switch# copy running-config startup-config	(Optional) Saves your entries in the configuration file.

Budgeting Power to a Specific PoE Port

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no cdp run**
4. **interface** *interface-id*
5. **power inline consumption** *wattage*
6. **end**
7. **show power inline consumption**
8. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Switch> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Switch# configure terminal	Enters global configuration mode.
Step 3	no cdp run Example: Switch(config)# no cdp run	(Optional) Disables CDP.
Step 4	interface <i>interface-id</i> Example: Switch(config)# interface gigabitethernet 1/0/1	Specifies the physical port to be configured, and enter interface configuration mode.
Step 5	power inline consumption <i>wattage</i> Example: Switch(config-if)# power inline consumption 5000	Configures the power consumption of a powered device connected to a PoE port on the switch. The range for each device is 4000 to 15400mW. The default is 15400mW.
Step 6	end Example: Switch(config-if)# end	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 7	show power inline consumption Example: Switch# <code>show power inline consumption</code>	Displays the power consumption data.
Step 8	copy running-config startup-config Example: Switch# <code>copy running-config startup-config</code>	(Optional) Saves your entries in the configuration file.

Configuration Examples for Configuring PoE

Budgeting Power: Example

When you enter one of the following commands,

- **[no] power inline consumption default *wattage*** global configuration command
- **[no] power inline consumption *wattage***
interface configuration command

this caution message appears:

```
%CAUTION: Interface Gi1/0/1: Misconfiguring the 'power inline consumption/allocation'
command may cause damage to the
switch and void your warranty. Take precaution not to oversubscribe the power supply. It
is recommended to enable power
policing if the switch supports it. Refer to documentation.
```

Additional References

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/support