Configuring Power over Ethernet

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Information About Power over Ethernet

The following sections provide information about Power over Ethernet (PoE), the supported protocols, and standards and power management.

PoE and PoE+ Ports

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

- A Cisco prestandard powered device (such as a Cisco IP phone)
- An IEEE 802.3af-compliant powered device
- An IEEE 802.3at-compliant powered device
- An IEEE 802.3bt-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.

Note The following Cisco Catalyst 9300 Switches do not support PoE:

- C9300-24T
- C9300-48T
- C9300-24S
- C9300-48S
- C9300L-24T
- C9300L-48T

Supported Protocols and Standards

The device uses the following protocols and standards to support PoE:

- **Cisco Discovery Protocol (CDP) with power consumption:** The powered device notifies the device of the amount of power it is consuming. The device does not reply to the power-consumption messages. The device can only supply power to or remove power from the PoE port.
- **Cisco intelligent power management:** The powered device and the device negotiate through power-negotiation CDP messages for an agreed-upon power-consumption level. The negotiation allows a high-power 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 device.

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

  Cisco intelligent power management is backward-compatible with CDP with power consumption; the device responds according to the CDP message that it receives. CDP is not supported on third party-powered devices. Therefore, the device 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.
- **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.
- The **Cisco Universal Power Over Ethernet (UPOE)** feature provides the capability to source up to 60 W of power (2 x 30 W) over both signal and spare pairs of the RJ-45 Ethernet cable by using the Layer 2 power negotiation protocols such as CDP or LLDP. An LLDP and CDP request of 30 W and higher in the presence of the 4-wire Cisco proprietary spare-pair power type, length, and value descriptions (TLV) can provide power to the spare pair.

  When enabled in IEEE 802.3bt mode, Cisco UPOE devices function as 802.3bt Type 3 devices, supporting up to Class 6 (see IEEE Power Classification table in the document) on every port.

Note Only the following UPOE switches are IEEE 802.3bt-complaint Type 3 devices:

- C9300-24U
- C9300-48U
- C9300-24UX
- C9300-48UXM
- C9300-48UN
- C9300L-24UXG-4X
- C9300L-24UXG-2Q
- C9300L-48UXG-4X
- C9300L-48UXG-2Q
- C9300LM-24U-4Y
- C9300LM-48U-4Y
- C9300LM-48UX-4Y

- **Cisco UPOE+**: Cisco UPOE+ combines the new IEEE 802.3bt standard and Cisco UPOE, which means Cisco UPOE+ switches are in complete compliance with the 802.3bt standard and also support all previous standards, such as 802.3af and IEE 802.3at, as well as Cisco UPOE. This feature provides the capability to source up to 90 W on the IEEE 802.3bt-compliant Type 4 devices.

  A Type 3 PSE can power up a Type 4 powered device through a power demotion to 60 W.

  Some legacy Cisco powered devices (such as 7910, 7940, 7960 IP phones and AP350 wireless access points) are incompatible with Type 4 Power Supply Equipments (PSEs), as defined in the IEEE 802.3bt standard. If connected, the PSE will report a Tstart or Imax fault with each periodic attempt at providing power to the powered device. For continued use of these legacy Cisco powered devices, connect them to Cisco PoE+ or UPOE PSEs.

  Powered devices that do not meet the standard detection signature capacitance (such as CIVS-IPC-6000P) can be detected properly with PoE+ or Cisco UPOE devices running in UPOE mode, but may not be detected properly when running in 802.3bt mode.

Powered-Device Detection and Initial Power Allocation

The switch detects a Cisco prestandard 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 powered by an AC adaptor.

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

- 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. Because the switch receives CDP messages from the powered device, and because 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. The following table lists these levels.

Table 1: IEEE Power Classifications

Class	Maximum Power Level Required from the Device
0 (class status unknown)	15.4 W
1	4 W
2	7 W
3	15.4 W
4	30 W
5	45 W
6	60 W
7	75 W
8	90 W

The switch monitors and tracks requests for power and grants power only when it is available. The switch tracks the power budget (the amount of power available on the device for PoE). The switch also 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. Note that CDP 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 the 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.

With PoE+, powered devices use IEEE 802.3at and LLDP power with medium-dependent interface (MDI) type, length, and value descriptions (TLVs) and power-via-MDI TLVs, for negotiating power up to 30 W. Cisco prestandard devices and Cisco IEEE powered devices can use CDP or the IEEE 802.3 at power-via-MDI power-negotiation mechanism to request power levels up to 30 W.

Note The initial allocation for Class 0, Class 3, and Class 4 powered devices is 15.4 W. When a device starts up and uses CDP or LLDP to send a request for more than 15.4 W, it can be allocated up to the maximum of 30 W.

Note The CDP-specific power consumption requirement is referred to as the *actual* power consumption requirement in the Cisco Catalyst Switches software configuration guides and command references.

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.

The PoE feature operates the same whether or not the device is a stack member. The power budget is per device and independent of any other devices in the stack. Election of a new active device does not affect PoE operation. The active device keeps track of the PoE status for all devices and ports in the stack and includes the status in output displays.

The stacking-capable device also supports StackPower, which allows the power supplies to share the load across multiple systems in a stack when you connect the device with power stack cables. You can manage the power supplies of up to four stack members as one large power supply.

Note Cisco Catalyst 9300L Series Switches do not support StackPower.

Power Management Modes

The device supports these PoE modes:

- **auto**: The auto mode is the default setting. The device automatically detects if the connected device requires power. If the device discovers a powered device connected to the port, and if the device has enough power, it grants power, updates the power budget, and 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 device has enough power for all the powered devices, they all come up. If enough power is available for all the powered devices connected to the device, power is turned on to all the devices. If enough PoE is not available, 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 exceeds the system's power budget, the device denies power, ensures that power to the port is turned off, generates a syslog message, and updates the LEDs. After power is denied, the device periodically rechecks the power budget and continues to attempt to grant the request for power.

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

  If a powered device is removed, the device 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 device does not provide power to the port. If the device powers a powered device, but the powered device later requests, through CDP messages, more than the configured maximum value, the device 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 device delivers the maximum value. Use the **auto** setting on any PoE port.

- **static**: The device preallocates power to the port (even when no powered device is connected) and guarantees that power will be available for the port. The device 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 preallocated, 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's IEEE class is greater than the maximum wattage, the device does not supply power to it. If the device learns through CDP messages that the powered device is consuming more than the maximum wattage, the device shuts down the powered device.

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

- **never**: The device 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, 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.

Stacking-capable device also support StackPower, which allows device power supplies to share the load across multiple systems in a stack by connecting up to four device with power stack cables.

Power Monitoring and Power Policing

When policing of the real-time power consumption is enabled, the device takes action when a powered device consumes more power than the maximum amount allocated, which is also referred to as the *cutoff-power value*.

When PoE is enabled, the device senses and monitors the real-time power consumption of the connected powered device. This is called *power monitoring* or *power sensing*. The device also polices the power usage with the *power policing* feature.

Power monitoring is backward-compatible with Cisco intelligent power management and CDP-based power consumption. It works with these features to ensure that the PoE port can supply power to a powered device.

The device senses the real-time power consumption of the connected device as follows:

1. The device monitors the real-time power consumption by individual ports.
2. The device records the power consumption, including peak power usage, and reports this information through the CISCO-POWER-ETHERNET-EXT-MIB.
3. If power policing is enabled, the device polices power usage by comparing the real-time power consumption with the maximum power allocated to the device. The maximum power consumption is also referred to as the *cutoff power* on a PoE port.

   If the device uses more than the maximum power allocation on the port, the device can either turn off the power to the port, or can generate a syslog message and update the LEDs (the port LED is now blinking amber) while still providing power to the device based on the device configuration. By default, power-usage policing is disabled on all the PoE ports.

   If error recovery from the PoE error-disabled state is enabled, the device automatically takes the PoE port out of the error-disabled state after the specified amount of time.

If error recovery is disabled, you can manually re-enable the PoE port by using the **shutdown** and **no shutdown** interface configuration commands.

4. If policing is disabled, no action occurs when the powered device consumes more than the maximum power allocation on the PoE port, which could adversely affect the device.

Power Consumption Values

You can configure the initial power allocation and the maximum power allocation on a port. However, these values are the configured values that determine when the device should turn on or turn off power on the PoE port. The maximum power allocation is not the same as the actual power consumption of the powered device. The actual cutoff power value that the device uses for power policing is not equal to the configured power value.

When power policing is enabled, the device polices the power usage *at the switch port*, where the power consumption is greater than that by the device. When you manually set the maximum power allocation, you must consider the power loss over the cable from the switch port to the powered device. The cutoff power is the sum of the rated power consumption of the powered device and the worst-case power loss over the cable.

We recommend that you enable power policing when PoE is enabled on your device. For example, for a Class 1 device, if policing is disabled and you set the cutoff-power value by using the **power inline auto max 6300** interface configuration command, the configured maximum power allocation on the PoE port is 6.3 W (6300 mW). The device provides power to the connected devices on the port if the device needs up to 6.3 W. If the CDP power-negotiated value or the IEEE classification value exceeds the configured cutoff value, the device does not provide power to the connected device. After the device turns on the power on the PoE port, the device does not police the real-time power consumption of the device, and the device can consume more power than the maximum allocated amount, which could adversely affect the device and the devices connected to the other PoE ports.

Because a standalone device supports internal power supplies, the total amount of power available for the powered devices varies depending on the power supply configuration.

- If a power supply is removed and replaced by a new power supply with less power and the device does not have enough power for the powered devices, the device denies power to the PoE ports in auto mode in descending order of the port numbers. If the device still does not have enough power, the device then denies power to the PoE ports in static mode in descending order of the port numbers.
- If the new power supply supports more power than the previous one and the device now has more power available, the device grants power to the PoE ports in static mode in ascending order of the port numbers. If it still has power available, the device then grants power to the PoE ports in auto mode in ascending order of the port numbers.

The stacking-capable device also supports StackPower, which allows power supplies to share the load across multiple systems in a stack by connecting the device with power stack cables. You can collectively manage the power supplies of up to four stack members as one large power supply.

Cisco Universal Power Over Ethernet

Cisco Universal Power Over Ethernet (Cisco UPOE) is a Cisco-proprietary technology that extends the IEEE 802.3 at PoE standard to provide the capability to source up to 60 W of power over standard Ethernet cabling infrastructure (Class D or better) by using the spare pair of an RJ-45 cable (wires 4,5,7,8) with the signal pair (wires 1,2,3,6). Power on the spare pair is enabled when the switch port and end device mutually identify themselves as Cisco UPOE-capable using CDP or LLDP and the end device's requests for power to be enabled

on the spare pair. When the spare pair is powered, the end device can negotiate up to 60 W of power from the switch using CDP or LLDP.

If the end device supports detection and classification on both signal and spare pairs, but does not support the CDP or LLDP extensions required for Cisco UPOE, a 4-pair forced mode configuration automatically enables power on both signal and spare pairs from the switch port.

A device can support Cisco UPOE and 802.3bt Type 3 on the same port. Note that while an 802.3bt-compliant Type 3 device and a Cisco UPOE device offer 60 W, they operate differently. 802.3bt-compliant devices mutually identify the maximum power requirements during physical classification (see IEEE Power Classification table). An 802.3bt-compliant Type 3 powered device cannot ask for more power over LLDP than what is requested over the physical layer, which means that an 802.3bt-compliant Class 4 powered device cannot ask for more than 30 W using CDP or LLDP. However, an 802.3bt-compliant Class 6 powered device requests 60 W from the physical layer immediately before the data link layer is established.

In essence, 802.3at devices support ALT-A (signal pair) 30 W. Cisco UPOE devices support up to 60 W through CDP or LLDP negotiation. 802.3bt-compliant Type 3 4-pair devices can support up to 60 W across Alt-A and Alt-B (both pairs of wires) directly from the physical classification. 802.3bt-compliant Cisco UPOE PSEs support a powered device as physically requested. In addition, Cisco UPOE PSEs continue to support UPOE-powered devices. When you upgrade a Cisco UPOE device to 802.3bt mode, there is no change in the behavior of the UPOE-powered devices that are connected to the upgraded PSE.

How to Configure PoE and UPOE

The following tasks describe how you can configure PoE and UPOE.

Configuring a Power Management Mode on a PoE Port

Note When you make PoE configuration changes, the port that are 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 device 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 device removes power from the port and then redetects the powered device. The device repowers the port only if the powered device is a class 1, class 2, or a Cisco-only powered device.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface** *interface-id* **Example:** `Device(config)# interface gigabitethernet2/0/1`	Specifies the physical port to be configured, and enters interface configuration mode.
Step 4	**power inline** {**auto** [**max** *max-wattage*] | **never** | **static** [**max** *max-wattage*] } **Example:** `Device(config-if)# power inline auto`	Configures the PoE mode on the port. The following are the keywords: • **auto**: Enables detection of powered devices. If enough power is available, automatically allocates power to the PoE port after device detection. This is the default setting. • **max** *max-wattage*: Limits the power allowed on the port. The range for Cisco UPOE ports is 4000 to 60000 milliWatts (mW). If no value is specified, the maximum is allowed. • **never**: Disables device detection and power to the port. **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 in the error-disabled state. • **static**: Enables detection of powered devices. Preallocate (reserve) power for a port before the device discovers the powered device. The device reserves power for this port even when no device is connected, and guarantees that power will be provided upon device detection. The device allocates power to a port configured in static mode before it allocates power to a port configured in auto mode.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 6	**show power inline** [*interface-id* | **module** *switch-number*] **Example:**	Displays the PoE status for a device or a device stack, for the specified interface, or for a specified stack member.

	Command or Action	Purpose
	`Device# show power inline`	The **module** *switch-number* keywords are supported only on stacking-capable devices.
Step 7	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Enabling Power on Signal and Spare Pairs

Note Do not peform this task if the end device cannot source inline power on the spare pair, or if the end device supports the CDP or LLDP extensions for Cisco UPOE.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface** *interface-id* **Example:** `Device(config)# interface gigabitethernet2/0/1`	Specifies the physical port to be configured, and enters interface configuration mode.
Step 3	**power inline four-pair forced** **Example:** `Device(config-if)# power inline four-pair forced`	(Optional) Enables power on both signal and spare pairs from a switch port.
Step 4	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode, and returns to privileged EXEC mode.

Configuring Power Policing

By default, the device monitors the real-time power consumption of connected powered devices. You can configure the device to police the power usage. By default, policing is disabled.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-id* **Example:** `Device(config)# interface gigabitethernet2/0/1`	Specifies the physical port to be configured, and enters interface configuration mode.
Step 4	**power inline police** [**action** {**log** | **errdisable**}] **Example:** `Device(config-if)# power inline police`	Configures the device to take one of these actions if the real-time power consumption exceeds the maximum power allocation on the port: • **power inline police**: Shuts down the PoE port, turns off power to it, and puts it in the error-disabled state. **Note** You can enable error detection for the PoE error-disabled cause by using the **errdisable detect cause inline-power** global configuration command. You can also enable the timer to recover from the PoE error-disabled state by using the **errdisable recovery cause inline-power interval** *interval* global configuration command. • **power inline police action errdisable**: Turns off power to the port if the real-time power consumption exceeds the maximum power allocation on the port. • **power inline police action log**: Generates a syslog message while still providing power to the port. If you do not enter the **action log** keywords, the default action shuts down the port and puts the port in the error-disabled state.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode, and returns to global configuration mode.

Step 6	Use one of the following:
	• **errdisable detect cause inline-power**
	• **errdisable recovery cause inline-power**
	• **errdisable recovery interval** *interval*
	Example:
	`Device(config)# errdisable detect cause inline-power`
	`Device(config)# errdisable recovery cause inline-power`
	`Device(config)# errdisable recovery interval 100`
		(Optional) Enables error recovery from the PoE error-disabled state, and configures the PoE recovery mechanism variables.
		By default, the recovery interval is 300 seconds.
		interval *interval*: Specifies the time in seconds, to recover from the error-disabled state. The range is 30 to 86400.

Step 7	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.

Step 8	Use one of the following:
	• **show power inline police**
	• **show errdisable recovery**
	Example:
	`Device# show power inline police`
	`Device# show errdisable recovery`
		Displays the power-monitoring status, and verifies the error recovery settings.

Step 9	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Enable the 802.3bt Mode on Type 3 Cisco UPOE Modules

The Cisco Catalyst 9300 UPOE switches that support IEEE 802.3bt standard for Type 3 powered devices are in 802.3at mode, by default. You can enable 802.3bt mode on them using the **hw-module switch** *switch_no* **upoe-plus** command in the global configuration mode. Note that the **hw-module switch** *switch_no* **upoe-plus** command power cycles the switch upon configuration.

```
Device(config)# hw-module switch 2 upoe-plus
!!!WARNING!!!This configuration will power cycle the switch to make it effective. Would you
 like to continue y/n?
Device#y
```

You can revert to 802.3at mode using the **no** form of the command: **no hw-module switch** *switch_no* **upoe-plus**.

Note C9300X-48HX, C9300X-24HX and C9300X-48HXN modules are Type 4 PSEs that supports IEEE 802.3bt standard. These modules are in 802.3bt mode by default. Therefore, the mode-conversion **hw-module slot** *slot* **upoe-plus** command is not supported on these modules.

Monitoring Power Status

Use the following **show** commands to monitor and verify the PoE configuration.

Table 2: show Commands for Power Status

Command	Purpose
show env power switch [*switch-number*]	(Optional) Displays the status of the internal power supplies for each switch in the stack or for the specified switch. The range is 1 to 9, depending on the switch member numbers in the stack. These keywords are available only on stacking-capable switches.
show power inline [*interface-id* | **module** *switch-number*]	Displays PoE status for a switch or switch stack, for an interface, or for a specific switch in the stack.
show power inline police	Displays power-policing data.
show power inline meter	Displays metered PoE power consumption.
show power inline upoe-plus [*interface-id*] [**module**]	Displays the PoE status for an interface that is enabled for 802.3bt-compliant mode.

Examples

```
Device# show power inline upoe-plus

Module   Available     Used     Remaining
          (Watts)     (Watts)    (Watts)
------   ---------   --------   ---------
3          1310.0      660.0       650.0
Codes: DS - Dual Signature device, SS - Single Signature device
       SP - Single Pairset device

Interface   Admin  Type Oper-State       Power(Watts)     Class   Device Name
            State       Alt-A,B       Allocated Utilized  Alt-A,B
----------- ------ ---- ------------- --------- --------- ------- -----------

Te3/0/1     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/2     auto   DS   on,on         60.0      6.7       3,3     Ieee PD
Te3/0/3     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/4     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/5     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/6     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Codes: DS - Dual Signature device, SS - Single Signature device
       SP - Single Pairset device
```

```
Interface   Admin  Type Oper-State       Power(Watts)     Class   Device Name
            State       Alt-A,B       Allocated Utilized  Alt-A,B
----------- ------ ---- ------------- --------- --------- ------- -----------

Te3/0/7     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/8     auto   DS   on,on         60.0      6.8       3,3     Ieee PD
Te3/0/9     auto   n/a  off           0.0       0.0       n/a
Te3/0/10    auto   SS   on,off        30.0      5.4       4       Ieee PD
Te3/0/11    auto   SS   on,off        30.0      9.0       4       Ieee PD
Te3/0/12    auto   SS   on,off        30.0      9.7       4       Ieee PD
Te3/0/13    auto   n/a  off           0.0       0.0       n/a
Te3/0/14    auto   n/a  off           0.0       0.0       n/a
Te3/0/15    auto   n/a  off           0.0       0.0       n/a
Te3/0/16    auto   n/a  off           0.0       0.0       n/a
Te3/0/17    auto   n/a  off           0.0       0.0       n/a
Codes: DS - Dual Signature device, SS - Single Signature device
       SP - Single Pairset device

Interface   Admin  Type Oper-State       Power(Watts)     Class   Device Name
            State       Alt-A,B       Allocated Utilized  Alt-A,B
----------- ------ ---- ------------- --------- --------- ------- -----------

Te3/0/18    auto   n/a  off           0.0       0.0       n/a
Te3/0/19    auto   n/a  off           0.0       0.0       n/a
Te3/0/20    auto   n/a  off           0.0       0.0       n/a
Te3/0/21    auto   n/a  off           0.0       0.0       n/a
Te3/0/22    auto   SS   on,off        30.0      12.0      4       Ieee PD
Te3/0/23    auto   SS   on,off        30.0      12.3      4       Ieee PD
Te3/0/24    auto   SS   on,off        30.0      5.3       4       Ieee PD
--------- ------ ---------- ---------- ---------- ------------------- -----

Totals:            14   on          660.0    107.9
```

The following are descriptions of the fields that you see in the output of the **show power inline upoe-plus** command:

Table 3: Fields Displayed in the Output of the show power inline upoe-plus Command

Field	Description
Type	Type of PD: Single Pairset device (SP), Single Signature device (SS), Dual Signature device (DS)
Oper-State	The state of each pair on the port
Power Allocated	Power allocated to the port
Power Utilized	Power consumed by the Powered Device on the port.
Class Alt-A, B	Signal, Spare-pair respectively
Device Name	Name of the Powered Device as advertised by CDP.

The **show power inline** command is enhanced to display 802.3bt-complaint device information such as the Operational Status of the device, IEEE Class of the device, Physical Assigned Class, Allocated Power, (Power) Measured at the port.

```
Device# show power inline Te3/0/1 detail

 Interface: Te3/0/1
 Inline Power Mode: auto
```

```
 Operational status (Alt-A,B): on,on
 Device Detected: yes
 Device Type: Ieee PD
 Connection Check: DS
 IEEE Class (Alt-A,B): 3,3
 Physical Assigned Class (Alt-A,B): 3,3
 Discovery mechanism used/configured: Ieee and Cisco
 Police: off

 Power Allocated
 Admin Value: 60.0
 Power drawn from the source: 60.0
 Power available to the device: 60.0
 Allocated Power (Alt-A,B): 30.0,30.0

 Actual consumption
 Measured at the port(watts) (Alt-A,B): 3.4,3.3
 Maximum Power drawn by the device since powered on: 6.9

 Absent Counter: 0
 Over Current Counter: 0
 Short Current Counter: 0
 Invalid Signature Counter: 0
 Power Denied Counter: 0

 Power Negotiation Used: None
 LLDP Power Negotiation       --Sent to PD--      --Rcvd from PD--
 Power Type:                  -                    -
 Power Source:                -                    -
 Power Priority:              -                    -
 Requested Power(W):          -                    -
 Allocated Power(W):          -                    -

Four-Pair PoE Supported: Yes
Spare Pair Power Enabled: Yes
Four-Pair PD Architecture: Independent
```

The following is a sample output of the **show power inline police** command:

```
Device# show power inline police

 Module   Available     Used     Remaining
          (Watts)     (Watts)    (Watts)
------   ---------   --------   ---------
3          1310.0      660.0       650.0
Interface Admin  Oper       Admin      Oper       Cutoff Oper
          State  State      Police     Police     Power  Power
--------- ------ ---------- ---------- ---------- ------ -----
Te3/0/1   auto   on         none       n/a        n/a    6.8
Te3/0/2   auto   on         none       n/a        n/a    6.7
Te3/0/3   auto   on         none       n/a        n/a    6.9
Te3/0/4   auto   on         none       n/a        n/a    6.8
Te3/0/5   auto   on         none       n/a        n/a    6.8
Te3/0/6   auto   on         none       n/a        n/a    6.8
Te3/0/7   auto   on         none       n/a        n/a    6.8
Te3/0/8   auto   on         none       n/a        n/a    6.8
Te3/0/9   auto   off        none       n/a        n/a    n/a
Te3/0/10  auto   on         none       n/a        n/a    5.4
Te3/0/11  auto   on         none       n/a        n/a    8.9
Te3/0/12  auto   on         none       n/a        n/a    9.5
Te3/0/13  auto   off        none       n/a        n/a    n/a
Te3/0/14  auto   off        none       n/a        n/a    n/a
Te3/0/15  auto   off        none       n/a        n/a    n/a
Interface Admin  Oper       Admin      Oper       Cutoff Oper
          State  State      Police     Police     Power  Power
```

```
--------- ------ ---------- ---------- ---------- ------ -----
Te3/0/16  auto   off        none       n/a        n/a    n/a
Te3/0/17  auto   off        none       n/a        n/a    n/a
Te3/0/18  auto   off        none       n/a        n/a    n/a
Te3/0/19  auto   off        none       n/a        n/a    n/a
Te3/0/20  auto   off        none       n/a        n/a    n/a
Te3/0/21  auto   off        none       n/a        n/a    n/a
Te3/0/22  auto   on         none       n/a        n/a    12.0
Te3/0/23  auto   on         none       n/a        n/a    12.2
Te3/0/24  auto   on         none       n/a        n/a    5.3
--------- ------ ---------- ---------- ---------- ------ -----
Totals:                                                  107.6
```

The following is a sample output of the **show power inline priority** command:

```
Device# show power inline priority

Interface  Admin  Oper       Admin
           State  State      Priority
---------- ------ ---------- ----------
Te3/0/1    auto   on         low
Te3/0/2    auto   on         low
Te3/0/3    auto   on         low
Te3/0/4    auto   on         low
Te3/0/5    auto   on         low
Te3/0/6    auto   on         low
Te3/0/7    auto   on         low
Te3/0/8    auto   on         low
Te3/0/9    auto   off        low
Te3/0/10   auto   on         high
Te3/0/11   auto   on         high
Te3/0/12   auto   on         high
Te3/0/13   auto   off        high
Te3/0/14   auto   off        high
Te3/0/15   auto   off        high
Te3/0/16   auto   off        high
Te3/0/17   auto   off        low
Te3/0/18   auto   off        low
Te3/0/19   auto   off        low
Te3/0/20   auto   off        high
Te3/0/21   auto   off        high
Te3/0/22   auto   on         high
Te3/0/23   auto   on         high
Te3/0/24   auto   on         high
```

The following is a sample output of the **show power inline meter** command:

```
Device# show power inline meter

Module   Available     Used     Remaining
          (Watts)     (Watts)    (Watts)
------   ---------   --------   ---------
1          1625.0       85.6      1539.4
Interface    Meter Update             Three Hours Metered    Metered Energy in MilliWattSec
 (15min Buckets)
             Time                      Value (MilliWattSec)

----------   ------------------------   --------------------
-------------------------------------------------------------------------------------------------------------
Tw1/0/1      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/2      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/3      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/4      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/5      2024-06-25 20:59:28 UTC              29439712
2373112-2460600-2460600-2460600-2460600-2460600-2460600-2460600-2460600-2460600-2460600-2460600
```

```
Tw1/0/6      2024-06-25 20:59:28 UTC               29166857
2355512-2440250-2439315-2443385-2430515-2443000-2438380-2436620-2435080-2427600-2433650-2443550
Interface    Meter Update             Three Hours Metered    Metered Energy in MilliWattSec
 (15min Buckets)
             Time                      Value (MilliWattSec)

----------   ----------------------   --------------------
-------------------------------------------------------------------------------------------------------------------
Tw1/0/7      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/8      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/9      2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/10     2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/11     2024-06-25 20:59:28 UTC               29375104
2367904-2455200-2455200-2455200-2455200-2455200-2455200-2455200-2455200-2455200-2455200-2455200
Tw1/0/12     2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/13     2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/14     2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Tw1/0/15     2024-06-25 20:59:28 UTC               89776174
7238706-7499648-7504958-7500310-7502066-7509576-7499730-7508690-7501684-7504556-7505350-7500900
Tw1/0/16     2024-06-25 20:59:28 UTC                     0   0-0-0-0-0-0-0-0-0-0-0-0
Interface    Meter Update             Three Hours Metered    Metered Energy in MilliWattSec
 (15min Buckets)
             Time                      Value (MilliWattSec)

----------   ----------------------   --------------------
-------------------------------------------------------------------------------------------------------------------
```

Additional References for Power over Ethernet

Related Documents

Related Topic	Document Title
For complete syntax and usage information pertaining to the commands used in this chapter.	See the "Interface and Hardware Commands" section in the *Command Reference Guide*.
For complete information on IEEE 802.3bt standard	See Cisco UPOE+: The Catalyst for Expanded IT-OT Convergence

Feature History for Power over Ethernet

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Power over Ethernet (PoE)	Power over Ethernet (PoE) allows the LAN switching infrastructure to provide power to an endpoint, called a powered device, over a copper Ethernet cable. The following types of end points can be powered through PoE: • A Cisco prestandard powered device An IEEE 802.3af-compliant powered device An IEEE 802.3at-compliant powered device
Cisco IOS XE Gibraltar 16.12.1	Support for IEEE 802.3bt Type 3	Support for 802.3bt Type 3 compliance on the Cisco Catalyst 9300 UPOE Series Switches was introduced. The command **hw-module switch upoe-plus** was introduced to enable the 802.3bt mode on the device.
Cisco IOS XE 17.15.1	Energy Consumption Visibility Enhancement	The **show power inline meter** command was introduced. The output displays the energy meter with values of the system's PoE energy consumed.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to Cisco Feature Navigator.