

# Power Over Ethernet (PoE, PoE+, and PoE++)

## Feature Overview and Configuration Guide

### Introduction

This guide provides an introduction to Power over Ethernet technology, the PoE standards, PoE devices, and how to configure PoE on your switch.

PoE is a method of supplying power to network devices by utilizing the same cabling used to carry network traffic. PoE is appropriate for devices that have a low power consumption—PDs (Powered Devices) such as wireless access points, IP telephones, Webcams, and even other Ethernet switches. The benefits of PoE are lower installation costs and greater flexibility of device placement.

For example, deploying IP Video Security cameras on ceilings and building perimeters can be expensive if separate Ethernet cabling and power outlets are required. With PoE, you can install PoE-compatible devices wherever they are needed without having to worry about whether there are power sources nearby.

### PoE

PoE distributes both data and power over the same cabling. This eliminates the need for having one set of cables and outlets for data, and another set for power. Also, because the voltage and power requirements are much lower than for mains powered devices, the cabling and installation costs are significantly reduced.

There are two types of equipment involved in a PoE installation:

- **Power Sourcing Equipment (PSE)**, such as an Ethernet LAN switch, supplies power to the cable together with the data.
- **Powered Devices (PDs)**, such as Wireless Access Points or IP Phones, receive power and data over this same cabling.

The PSE employs various methods of power classification (depending on the standard) for distinguishing compatible PDs from non-compatible devices and will only provide power to compatible PDs, based on their PoE device class. The PSE continuously monitors the PDs and stops providing power when it is no longer requested or it detects an overload or short circuit condition on a port.

## Products and software version that apply to this guide

This guide applies to AlliedWare Plus products that support PoE, running software version **5.4.4** or later.

The following features are only supported on later versions:

- High-power PoE mode, supported from 5.4.6-1.x
- Continuous PoE, available on:
  - IE200 and IE300 Series switches, supported from 5.4.6-2.1, and
  - x220-52GP switches, supported from 5.4.8-2.1.
- Dynamic power allocation on FS980M Series switches, supported from 5.4.7-1.4
- Single-signature mode on high-power ports on IE300 Series switches, supported from 5.4.7-2.x

However, support and implementation of PoE varies between products. To see whether a product supports a feature or command, see the following documents:

- The product's [Datasheet](#)
- The product's [Command Reference](#)

These documents are available from the above links on our website at [alliedtelesis.com](http://alliedtelesis.com).

Feature support may change in later software versions. For the latest information, see the above documents.

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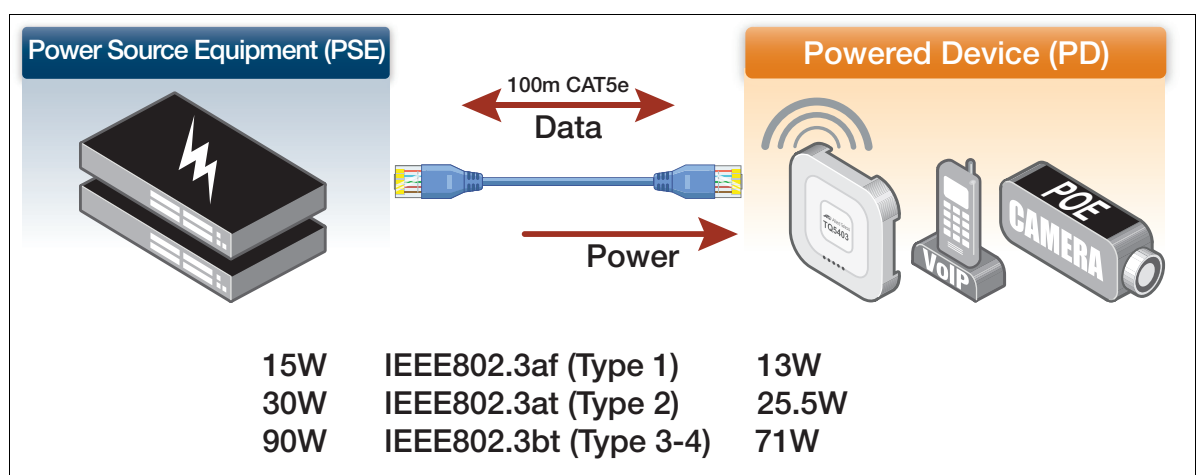
## Advantages of PoE

Network devices require both a data connection and a power supply. Just as standard phones are supplied power and also communicate over the same wiring, the same provision can be made for Ethernet network devices. Benefits and applications of PoE switches include:

- **Cost Saving:** PDs only require a single Ethernet cable for the network and power connection. This feature reduces the power line installation cost for electrical wiring, conduits, and power outlets. PoE provides maximum flexibility for device installation. You can install PDs almost anywhere without the need for DC/AC power inputs.
- **Reliability:** Using a single cabling system for power and data improves network reliability and deployment flexibility.
- **Safety:** You can set the power limitation for each port on the PoE switch. Power limit configuration can protect PoE switches from providing too much power to a single PD, even when requested by the PD.
- **Security:** For added protection, the network administrator can remotely control the PSE power on or power off to a PD. The network administrator can also disable the PSE when it is not in use or is accessed by unauthorized PDs.

Further advantages of PoE include:

- PD installation is simplified and space is saved.
- PD placement is not limited to nearby power sources.
- PDs can be easily moved to wherever there is LAN cabling.
- Little to no extra management complexity.
- A UPS (Uninterruptible Power Supply) can guarantee power to devices even during mains failure.



## PoE standards

The IEEE (Institute of Electrical and Electronics Engineers) currently defines three PoE standards:

### 1. IEEE 802.3af Power Ethernet standard

- Approved 2003.
- Supplies **15.94W** of power of which 13W is available to each powered device.
- Superseded by IEEE IEEE802.3at.

### 2. IEEE 802.3at Power Ethernet standard—known as PoE+

- Approved 2009.
- Supplies **30W** of power of which 25.5W is available to each powered device.

### 3. IEEE 802.3bt Power Ethernet standard—known as PoE++

- Supplies up to **90W** of power, of which 71W is available to each powered device, for some device classes.
- Uses all 8 wires in the cable
- Adds new power classes: 5-8
- Extends PoE to 10GbaseT

PoE++ is available on:

- ports 1-8 of GS980EM/10H and x320-10GH switches
- all GS980MX series switches whose model names end in HSm
- all x530 and x530L series switches whose model names end in GHXm. It does not apply to x530DP series switches

The following table summarizes the major differences in terms of their capabilities. Note that the maximum power available to the PD is less than the power supplied by the PSE. This is because the system provides the 'extra' power to compensate for line loss.

STANDARD	PSE TYPE	POWER SUPPLIED BY PSE	POWER AVAILABLE TO PD	CABLING	MAX CABLE LENGTH	POWER OVER	NOMINAL CURRENT
<b>IEEE 802.3af (PoE)</b>	Type 1	15.4W	13W	CAT 3 or better	100M	2 pairs	350mA
<b>IEEE 802.3at (PoE+)</b>	Type 2	30W	25.5W	CAT 5 or better	100M	2 pairs	600mA
<b>IEEE802.3bt (PoE++)</b>	Type 3	60W	51-60W	CAT 5 or better	100M	2 pairs class 0-4 4 pairs class 0-4 4 pairs class 5-6	600mA
<b>IEEE802.3bt (PoE++)</b>	Type 4	90W	71-90W	CAT 5 or better	100M	4 pairs class 7-8	1000mA

In advance of the 802.3bt standard, Allied Telesis developed High-power PoE mode on **IE300** Series switches to provide similar functionality. See ["Configuring high-power PoE mode on IE300 Series switches" on page 19](#).

## How PoE works

PoE requires little configuration or management. The PSE automatically determines when a device connected to a port is a powered device, and can determine the power class of the device.

### Power through the cable

An Ethernet cable has four twisted pairs. The standards describe two methods for applying PoE over the twisted pairs, termed "alternatives A and B". An IEEE compliant PD should be able to receive PoE using either of the two wiring methods.

- Alternative **A** applies power using pins 1, 2, 3, and 6. For 10/100M connections, this means it supplies power over the data-carrying cable pairs.
- Alternative **B** applies the power using pins 4, 5, 7, and 8. For 10/100M connections, this means it supplies power over the spare cable pairs.

For Gigabit and 10 Gigabit transmission, all four pairs are used for data but the same PoE pinning alternatives apply. Most devices running AlliedWare Plus use alternative A to supply power to the PDs, except for:

- x310 and GS900MPX Series switches, which use alternative B
- IE300-12GP switches, which use alternative A on ports 5-8, and either or both alternatives on ports 9-12. This is because ports 9-12 support high-power mode (see ["Configuring high-power PoE mode on IE300 Series switches" on page 19](#))

### Cable types

The cable requirements for ports operating at 10 or 100Mbps are given in the table below:

Cable Type	10 Mbps				100Mbps			
	NON-POE	POE	POE+	POE++	NON-POE	POE	POE+	POE++
Standard TIA/EIA 568 A compliant Category 5 shielded or unshielded cabling with 100 ohm impedance and a frequency of 100 MHz.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard TIA/EIA 568-B compliant Enhanced Category 5 (Cat 5e) shielded or unshielded cabling with 100 ohm impedance and a frequency of 100 MHz.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard TIA/EIA 568 B compliant Category 6 or 6a shielded cabling.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The cable requirements for ports operating at 1000Mbps are given in the table below:

Cable Type	1000 Mbps			
	NON-POE	POE	POE+	POE++
Standard TIA/EIA 568-A-compliant Category 5 shielded or unshielded cabling with 100 ohm impedance and a frequency of 100 MHz.	No	No	No	No
Standard TIA/EIA 568-B-compliant Enhanced Category 5 (Cat 5e) shielded or unshielded cabling with 100 ohm impedance and a frequency of 100 MHz.	Yes	Yes	Yes	Yes
Standard TIA/EIA 568-B-compliant Category 6 or 6a shielded cabling.	Preferred	Preferred	Preferred	Preferred

## PD Discovery

The first step for PSE equipment is to determine whether a device plugged into a port is a valid Powered Device. If it is, it will require power as well as network communication through the attached LAN cable.

Device detection involves applying a DC voltage between the transmit and receive wire pairs, and measuring the received current. The PSE will check for the presence of PDs on connected ports at regular intervals, so that power can be removed when a PD is no longer connected.

If the device connected to a port is not a PD (i.e. it obtains its power from another source), then the port will function as a regular Ethernet port, without PoE. The PoE feature remains activated on such ports but no power is delivered to the devices.

### Legacy PD Detection

Some AlliedWare Plus switches offer a second type of PD discovery, to support legacy PDs that were designed before the IEEE standards were finalized. This involves measuring for a large capacitance value to confirm the presence of a legacy PD. The IEEE method will be tried first and failing the discovery of a valid PD, the legacy capacitance measurement will be tried.

## Power Classes

Once a PD is discovered, the PSE initiates a PD classification test by applying a DC voltage to the port. If the PD supports optional power classification it will apply a load to the line to indicate to the PSE the classification the device requires.

Since PDs may require differing power ranges, the standards classifies PDs according to their power consumption. By providing the PSE with its power range, the PD allows the PSE to supply power with greater efficiency.

To view the PD class that has been configured for each PoE port, use the following command:

```
awplus# show power-inline
```

### Power classes on PoE (IEEE802.3af) and PoE+ (IEEE802.3at)

The power classes for PoE and PoE+ are:

PD CLASS	POWER AVAILABLE AT PD	MAX POWER OUTPUT FROM A SWITCH PORT
0	0.44 W to 12.95 W	15.4 W
1	0.44 W to 3.84 W	4.0 W
2	3.84 W to 6.49 W	7.0 W
3	6.49 W to 12.95 W	15.4 W
4	12.95 W to 25.5 W	30 W

### Power classes on PoE++ (IEEE802.3bt) - single-signature and dual-signature PDs

The 802.3bt standard includes two Powered Device (PD) topologies: single-signature and dual-signature. AlliedWare Plus supports both architectures.

- For a single-signature PD, both wire pairsets share the same detection, classification, and maintain power signatures.
- A dual-signature PD has independent detection signatures between two pairsets. Dual-signature PDs allow support for two independent loads, each with different power class; e.g. in a surveillance camera built with dual-signature PD, one pair may be connected to a camera and the other pair may be connected to an IP phone.

The following table shows the maximum PD power per PD interface for both of these topologies:

PD REQUESTED CLASS	ASSIGNED CLASS	PD INPUT POWER (PAIRSET) WATTS	PD INPUT POWER (MIN) WATTS
PSE CONNECTED TO A SINGLE-SIGNATURE PD			
1	1	-	3.84
2	2	-	6.49
0,3 to 8	3	-	13
4 to 8	4	-	25.5
5	5	-	40
6 to 8	6	-	51
7	7	-	62
8	8	-	71.3
PSE CONNECTED TO A DUAL-SIGNATURE PD (per pairset)			
1	1	3.84	7.68
2	2	6.49	12.98
3	3	13	26
4 or 5	3	14	26
4 or 5	4	25.5	51
5	5	35.6	71.2



## Power allocation

Some common PoE device power requirements are:

POE DEVICE	POE POWER REQUIREMENT- WATTS
IP phone	3-6
Wireless access point	4-11
IP security camera	5-12
Wireless Access Point (with LLDP-MED support)	12-24
Pan Tilt and Zoom powered IP security camera	12-24

On x320-11GPT, GS980EM/11PT, x530, x220, IE340, GS980MX, GS980M, and FS980M series switches, PoE power is allocated **dynamically**, based on the current usage of each PD attached to the switch's ports. When you connect a new PD to the switch, the switch determines whether it can power that device by measuring the power the existing PDs are currently using. If there is sufficient power available, the switch will allocate it to the new device.

On other switches, PoE power is allocated **statically**. By default, each port is allocated the maximum amount of power that is required for the power class of the PD that is attached to that port. However, this value may be too high, so it is also possible to statically allocate fixed power levels to each port. For example, ports with class 4 PDs attached are allocated 30W, but if you have cameras attached that only require 18W each, you can set each port to a maximum of 18W. This enables you to connect more cameras to the switch. For a configuration example, see ["Configuring power allocation and priority on a port" on page 14](#).

LLDP-MED can also be used to allocate PoE power. See ["LLDP-MED \(TIA-1057\) with PoE" on page 12](#) for more information.

### Autoclass on single-signature PDs on PoE++

Autoclass is an optional feature introduced as part of the 802.3bt standard and is available on x320-10GH and GS980EM/10H switches.

When a port (belonging to a PSE) and powered device both support autoclass, the power on the port is limited to the maximum power consumption by the powered device rather than the default power limit allocated on the port. Typically, this limit is based on the class of the powered device.

There are two ways to get the PSE to perform autoclass on a port:

- **Physical Layer classification** - both the PSE and the PD must support autoclass. For the switch, you need to enable autoclass on the port.
- **LLDP classification** - using the extended LLDP-MED Power-via-MDI TLV which includes extensions for 802.3bt, a PD can request for autoclass measurement by setting the autoclass field (part of the 802.3bt extensions).

Once the PSE has observed an autoclass measurement for a port, it can limit the power on this port based on this measurement. If this limit is lower than the original class-based power limit for the port, the extra power will go back to the budget for other ports to use.

## Power supplies

Some switches with customer-selectable power supplies (PSUs) have several power supply options available. For example, x930 Series switches can use AT-PWR250, AT-PWR800 or AT-PWR1200 PSUs. Make sure you select a power supply that delivers enough power to meet the requirements of the PDs you plan to connect to the switch. See your switch's Installation Guide for details of available power supplies and their power budget.

The following table indicates the PSU to use if you need to supply 30W per switch port.

NUMBER OF PORTS ON SWITCH	PSU THAT SUPPORTS 30W PER PORT
24	AT-PWR800
48	AT-PWR1200

Some switches support dual power supplies. On such switches, for resiliency, each of these PSUs has its own external mains connection. When ports are supplying PoE, the dual PSU facility enables you to run the switch in one of two modes:

- standard (redundant) mode
- boost mode

In **standard** (redundant) mode you apply power to both PSUs but restrict the power demands of your PDs to be within the capabilities of a single power supply.

In **boost** mode you employ both PSUs, and utilize more power than is available from a single PSU. However, if power from one of the PSUs is lost, the result will be a loss of PoE capability to a number of ports - the exact number will depend on your particular port configuration.

For information on using and configuring the boost mode feature, see ["Activating the redundant power budget" on page 16](#).

## Port prioritization

If the PDs connected to a switch require more power than the switch is capable of delivering, the switch will deny power to some ports.

Port prioritization is the way the switch determines which ports are to receive power in the event that the needs of the PDs exceed the available power resources of the switch.

- Critical** The highest priority level. Ports set to Critical level are guaranteed power before any ports assigned to the other two priority levels. Ports assigned to the other priority levels receive power only if all the Critical ports are receiving power. Your most critical powered devices should be assigned to this level.
- High** The second highest level. Ports set to High level receive power only if all the ports set to the Critical level are already receiving power.

**Low** The lowest priority level. This is the default setting. Ports set to Low level only receive power if all the ports assigned to the other two levels are already receiving power.

If power needs to be removed from some of the PoE ports, where if for example, one of the power supplies is disconnected; power will be removed from these ports in the order Low, High, and Critical.

If there is not enough power to support all the ports set for a given priority level, power is provided to the ports based on the switch port number:

- **SBx8100 switches:** the port number, in ascending order, and on the slot number in the chassis the PoE line card is installed in, in ascending order. Therefore, the lowest numbered port on the **lowest numbered line card** has priority.
- **Other switches:** the port number, in ascending order.

Power allocation is dynamic. Ports supplying power may stop powering a PD if the switch's power capacity has reached maximum usage and new PD's are connected to ports with a higher priority, which become active.

To ensure continued operation of a PD if the power resources of the switch are exceeded you should install a PD to a lower numbered PoE port with the Critical priority level configured.

For a configuration example, see ["Configuring power allocation and priority on a port" on page 14](#).

## Power threshold for SNMP traps

The switch can be configured to send a Simple Network Management Protocol (SNMP) trap to your management workstation. This enables the management workstation to record an entry in the event log whenever the total power requirements of the powered devices exceed the specified percentage of the total maximum power available on the switch:

- With the default setting of 80% applied, the switch sends an SNMP trap when the PoE devices require more than 80% of the maximum available power on the switch. The trap is: ***pethMainPowerUsageOnNotification*** from RFC 3621, Power Ethernet MIB.
- The switch sends another SNMP trap when its power consumption drops below the power limit threshold again. The trap is: ***pethMainPowerUsageOffNotification*** from RFC 3621, Power Ethernet MIB.
- You can set the threshold to any value between 1% and 99%. The example ["Remotely monitoring power for all connected PDs" on page 26](#) changes the threshold to 75%.

## LLDP-MED (TIA-1057) with PoE

The IEEE 802.1AB standard, Link Layer Discovery Protocol (LLDP) was designed to provide a multi-vendor solution for the discovery of network devices and accurate physical topology of how these devices are connected to one another. LLDP allows network devices to advertise their basic configuration and device capabilities to other network devices on the same LAN.

An extension to LLDP, Link Layer Discovery Protocol Media Endpoint Discovery (LLDP-MED), allows Media Endpoint Devices, such as VoIP phones, to exchange configuration information, including Power over Ethernet management.

LLDP-MED provides:

- Fine-grained PoE power allocation (1 watt granularity instead of wider power class bands) which allows unused power to be allocated to other ports
- Power priority of the PD being supplied power
- Backup power conservation to extend UPS battery life

For a configuration example, see ["Configuring LLDP-MED for power management" on page 21](#).

If LLDP is enabled on the switch, LLDP will read the LLDP-MED TLV from the PD and pass that information to the PoE system on the switch. PoE will then adjust the power limit on the port and use that value as part of its power calculations.

Note that if you **manually** configure a power limit on the port, that manual value overrides the LLDP value. So when determining the power limit for a port, the precedence is: Manual configuration, then LLDP, then Class.

In other words, if you have not specified a manual limit, the LLDP-MED value is used, and if LLDP-MED has not specified a limit, then the Class limit of the PD is used. For details on PD Class limits, see ["Power Classes" on page 7](#).

On IE300 Series switches, LLDP is only applied to the default pair of 60W enabled ports.

## Configuring PoE

AlliedWare Plus enables you to configure the following aspects of PoE:

### PoE port management

PoE is enabled by default on all non-SFP (or SFP+) RJ-45 ports. You can connect either a powered or non-powered device to a PoE-enabled port without having to re-configure the port. This is because PD detection is carried out before any power is supplied to the connected device.

PoE can be administratively enabled or disabled on each port using the **power-inline enable** command in Interface Configuration mode. To disable PoE on a selected port, use the command:

```
awplus(config-if)# no power-inline enable
```

A port that has PoE disabled will operate as a normal Ethernet port and will not supply power to its cable connection.

### Adding a description for a PoE port

You can add a description (for example, the device type) for a PoE port, which the switch will display in certain **show** commands. Knowing the type of PD is useful when inspecting PD Class power usage. The description entered will appear in the following commands under Device, or Powered Device Type, for each port:

```
show power-inline interface
show power-inline interface detail
```

In the following example a description is added for the **port1.0.2** to display the words “**Desk Phone**” in the show output of the commands mentioned above.

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode.
<code>awplus(config)# interface port1.0.2</code>	Specify the port to be configured and enter Interface mode.
<code>awplus(config-if)# power-inline description Desk Phone</code>	The description “Desk Phone” will be displayed in all PoE show command output for port1.0.2.
<code>awplus(config-if)# exit</code>	Return to Global Configuration mode.
<code>awplus(config)# exit</code>	Return to Privileged Exec mode.

COMMAND (CONTINUED)	DESCRIPTION (CONTINUED)
<pre>awplus# show power-inline interface port1.0.2</pre>	Display the PoE status for port1.0.2 to confirm that your PoE configuration on the PSE has been successful. If a PD is connected to the configured PoE port then power consumption as well as power allocation values will display.
<pre>awplus# copy running-config startup-config</pre>	Save your running-config to the startup-config to keep your PoE configuration after a switch restart or reboot.

## Configuring power allocation and priority on a port

The following commands set a higher priority and a lower maximum power for a port. This maximizes the number of PDs that can be connected to the switch, by preventing PDs from tying up more power than necessary.

Note that this configuration is not necessary on all AlliedWare Plus switches. Many AlliedWare Plus switches are able to supply 802.3at (PoE+) power levels to all their PoE-capable ports. Also, some switches allocate power dynamically, so you do not need to set it statically on these switches. See ["Power allocation" on page 9](#).

Follow the configuration table below to configure **port1.0.2**:

COMMAND	DESCRIPTION
<pre>awplus# configure terminal</pre>	Enter Global Configuration mode.
<pre>awplus(config)# interface port1.0.2</pre>	Specify the port to be configured and enter Interface mode.
<pre>awplus(config-if)# power-inline priority high</pre>	Specify a higher priority for the port than the default low setting.
<pre>awplus(config-if)# power-inline max 12000</pre>	Specify the highest available power that the PSE can supply to the PD. In the example, this is 12000 mW, which is 12W.
<pre>awplus(config-if)# exit</pre>	Return to Global Configuration mode.
<pre>awplus(config)# exit</pre>	Return to Privileged Exec mode.
<pre>awplus# show power-inline interface port1.0.2</pre>	Display the PoE status for port1.0.2 to confirm that your PoE configuration on the PSE has been successful. If a PD is connected to the configured PoE port then power consumption as well as power allocation values will display.
<pre>awplus# copy running-config startup-config</pre>	Save your running-config to the startup-config to keep your PoE configuration after a switch restart or reboot.

## Configuring autotclass on PoE++ ports

To set autotclass via Physical Layer classification on port1.0.1, use the following commands:

```
awplus #configure terminal
awplus(config)#interface port1.0.1
awplus(config-if)#power-inline autotclass
```

To check autotclass is enabled on port1.0.1, use the command:

```
show power-inline interface port1.0.1 detail
```

```
awplus#show power-inline interface port1.0.1 detail
Interface port1.0.1/D
  Powered device type: n/a
  PoE admin: on
  Configured Priority: Low
  Actual Priority: Low
  Detection status: Fault
  Powered pairs: Data
  Autotclass: Yes
```

There is no port-specific setting to enable/disable autotclass via LLDP request, but this requires LLDP-MED with PoE configured. When a port's power limit is set via autotclass, the power budget will be different than if the port's PD had its power limit set via the default class-based method. The output below shows a 'Power Allocated' value of 166W with 1 PD's limit set via autotclass [A]. If both ports' power limit were class-based, the 'Power Allocated' would be equal to 191W:

```
awplus#show power
PoE Status:

Stack member 1
Nominal Power: 240W
Power Allocated: 166W
Power Requested: 166W
Actual Power Consumption: 154W
Operational Status: On
Power Usage Threshold: 80% (192W)
Detection of legacy devices is disabled
Power Source: PSU
High Availability Network Power: Disabled
Power management mode: Static

PoE Interface:


| Interface/<br>Pair | Admin          | Pri        | Oper           | Power<br>(mW) | Device     | Class    | Max<br>(mW)      |
|--------------------|----------------|------------|----------------|---------------|------------|----------|------------------|
| <b>port1.0.1/D</b> | <b>Enabled</b> | <b>Low</b> | <b>Powered</b> | <b>70770</b>  | <b>n/a</b> | <b>8</b> | <b>70792 [A]</b> |
| port1.0.2/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |
| port1.0.3/D        | Enabled        | Low        | Powered        | 83168         | n/a        | 8        | 95580 [C]        |
| port1.0.4/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |
| port1.0.5/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |
| port1.0.6/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |
| port1.0.7/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |
| port1.0.8/D        | Enabled        | Low        | Off            | 0             | n/a        | n/a      | n/a              |


```

The following example shows the two ports with both limits set via the class-based method [C]. The Power Allocated value is the sum of the max power limits for all ports with a PD powered (63720 + 95580 = 159300 => 159.3W).

```
awplus#show power
PoE Status:

Stack member 1
Nominal Power: 240W
Power Allocated: 159W
Power Requested: 159W
Actual Power Consumption: 142W
Operational Status: On
Power Usage Threshold: 80% (192W)
Detection of legacy devices is disabled
Power Source: PSU
High Availability Network Power: Disabled
Power management mode: Static

PoE Interface:


| Interface/<br>Pair | Admin   | Pri | Oper    | Power<br>(mW) | Device | Class | Max<br>(mW) |
|--------------------|---------|-----|---------|---------------|--------|-------|-------------|
| <b>port1.0.1/D</b> | Enabled | Low | Powered | 61117         | n/a    | 6     | 63720 [C]   |
| port1.0.2/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |
| <b>port1.0.3/D</b> | Enabled | Low | Powered | 83080         | n/a    | 8     | 95580 [C]   |
| port1.0.4/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |
| port1.0.5/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |
| port1.0.6/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |
| port1.0.7/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |
| port1.0.8/D        | Enabled | Low | Off     | 0             | n/a    | n/a   | n/a         |


```

If an attempt to configure autoclass is done on a port where the PSE does not support it, then the following message is displayed:

```
awplus#conf t
Enter configuration commands, one per line. End with CNTL/Z.
awplus(config)#int port1.0.1
awplus(config-if)#power-inline autoclass
% Autoclass is not supported on interface port1.0.1
```

## Activating the redundant power budget

For dual-PSU x930 and x530 series PoE+ switches, you can use the **power-inline rps boost** command to provide backup and boosted power. These switches have two power supplies. When the power boost feature is enabled the switch uses the PoE power from both supplies to increase its available power budget. When the feature is disabled, the switch uses the PoE power of only one of its power supplies and keeps the other in reserve in case the primary power supply should fail or lose power.

As an example, assume an x930 series switch has two PWR1200 power supplies. When the power boost feature is enabled, the switch uses the PoE power from both supplies, for a total power budget of 1440W. When the power boost feature is disabled, the switch has an active PoE power of 740W and a redundant budget of the same amount. The switch activates the redundant power budget only if the power supply providing the active power budget fails or loses power.

**Syntax** `power-inline rps boost [member <1-8>]`  
`no power-inline rps boost [member <1-8>]`



To configure boosted power for all stack members, use the following commands:

```
awplus# configure terminal
awplus(config)# power-inline rps boost
```

To configure boosted power for stack member 1, use the following commands:

```
awplus# configure terminal
awplus(config)# power-inline rps boost member 1
```

To reset to the default functionality of no boosted power, use the following commands:

```
awplus# configure terminal
awplus(config)# no power-inline rps boost
awplus(config)# power-inline rps boost [member <1-8>]
```

## Configuring maximum power levels for PoE++

To supply up to 90W, PoE++ uses both the data and spare pairs to supply power.

You can set the maximum power level for each pair. You can give each pair the same maximum power level or you can split the power unequally by giving each pair different maximums. In most circumstances, it is unnecessary to split the power unequally.

For example, to set the maximum power level on ports 1.0.1-1.0.4 to 40W, split equally between the pairs, use the following commands:

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)# interface port1.0.1-1.0.4</code>	Enter Interface Configuration mode
<code>awplus(config-if)# power-inline max 20000</code>	Set the maximum power level to 20W (20000 milliwatts). This sets the limit on each of the data and spare pairs to 20W, and therefore sets the limit on the port to 40W.

Note that the **power-inline max** command specifies the maximum power that can be supplied across **each cable pair** (the data and spare pairs). For example, if you specify 20,000mW on port 1.0.1, each pair on the port will supply a maximum of 20,000mW, so the port will supply a maximum of 40,000mW.

To set the maximum power level on ports 1.0.1-1.0.4 to 40W, split unequally with 30W on the data pair and 10W on the spare pair, use the following commands:

COMMAND	DESCRIPTION
<code>awplus#</code> <code>configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)#</code> <code>interface port1.0.1-1.0.4</code>	Enter Interface Configuration mode
<code>awplus(config-if)#</code> <code>power-inline pair data max 30000</code>	Set the maximum power level to 30W (30000 milliwatts) on the data pair.
<code>awplus(config-if)#</code> <code>power-inline pair spare max 10000</code>	Set the maximum power level to 10W (10000 milliwatts) on the spare pair.

## Configuring Continuous PoE

Continuous PoE enables switches to perform actions such as software upgrades without forcing the Powered Devices to power cycle. This means, for example, if you are rebooting a switch connected to a PD such as a camera, Continuous PoE allows the camera to buffer while the switch is rebooted.

Continuous PoE is available on various switches. To find out whether a product supports this feature, see the [product's Datasheet](#). You can configure Continuous PoE on a global or per port level. Enabling it globally enables it on all PoE ports.

To enable it globally, use the following commands:

COMMAND	DESCRIPTION
<code>awplus#</code> <code>configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)#</code> <code>power-inline hanp</code>	Enable Continuous PoE (hanp) globally ('hanp' is High Availability Network Power)
<code>awplus(config)#</code> <code>exit</code>	Return to Privileged Exec mode.
<code>awplus#</code> <code>write</code>	Save the configuration file. You must save the configuration file to turn Continuous PoE on.

To enable it on all PoE ports except port1.0.2, use the following commands:

COMMAND	DESCRIPTION
<code>awplus#</code> <code>configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)#</code> <code>power-inline hanp</code>	Enable Continuous PoE globally

COMMAND	DESCRIPTION
<code>awplus (config) # interface port1.0.2</code>	Enter Interface Configuration mode
<code>awplus (config-if) # no power-inline hanp</code>	Disable Continuous PoE on port1.0.2
<code>awplus (config-if) # end</code>	Return to Privileged Exec mode.
<code>awplus # write</code>	Save the configuration file. You must save the configuration file to turn Continuous PoE on.

You can see whether Continuous PoE is enabled globally and on each port by using the command **show power-inline**. Note that the Continuous PoE status of individual ports only displays if Continuous PoE has been enabled globally.

## Configuring high-power PoE mode on IE300 Series switches

IE300 Series switches support high-power PoE mode on ports 1.0.9-1.0.12. High-power mode enables these ports to supply up to 60W of power per port.

To do this, the switch uses both the data and spare pairs to supply power, and supplies up to 30W of power per pair. On the data pair, pins 1, 2, 3, and 6 can carry power. On the spare pair, pins 4, 5, 7, and 8 can carry power.

By default, the data pair is enabled and the spare pair is disabled. Therefore, ports 1.0.9-1.0.12 can supply a maximum of 30W of power by default.

The switch has a total PoE budget of 240W, divided between the 8 PoE ports.

### Enabling high-power mode

To enable high-power mode on ports 1.0.9-1.0.12, use the following commands:

COMMAND	DESCRIPTION
<code>awplus # configure terminal</code>	Enter Global Configuration mode
<code>awplus (config) # interface port1.0.9-1.0.12</code>	Enter Interface Configuration mode
<code>awplus (config-if) # power-inline pair enable</code>	Enable high-power mode.

### Single-signature support for IE300 high-power mode

From AlliedWare Plus version 5.4.7-2.1 onwards, IE300 Series switches support single-signature mode on their high-power ports, along with dual signature mode.

If your PD requires single-signature mode, you can enable it on the port that the PD is connected to. To enable it on port1.0.9, use the following commands:

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)# interface port1.0.9</code>	Enter Interface Configuration mode
<code>awplus(config-if)# power-inline four-pair mode single-signature</code>	Enable single-signature mode.

The default mode is dual-signature mode. To return to the default, use the commands **power-inline four-pair mode dual-signature** or **no power-inline four-pair mode**.

### Setting IE300 port power maximums

You can set the maximum power level for each pair. You can give each pair the same maximum power level or you can split the power unequally by giving each pair different maximums. In most circumstances, it is unnecessary to split the power unequally.

To set the maximum power level on ports 1.0.9-1.0.12 to 40W, split equally between the pairs, use the following commands:

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)# interface port1.0.9-1.0.12</code>	Enter Interface Configuration mode
<code>awplus(config-if)# power-inline pair spare enable</code>	Enable high-power mode.
<code>awplus(config-if)# power-inline max 20000</code>	Set the maximum power level to 20W (20000 milliwatts). This sets the limit on each of the data and spare pairs to 20W, and therefore sets the limit on the port to 40W.

Note that the **power-inline max** command specifies the maximum power that can be supplied across **each cable pair** (the data and spare pairs). For example, if you specify 20,000mW on port 1.0.9, each pair on the port will supply a maximum of 20,000mW, so the port will supply a maximum of 40,000mW.

To set the maximum power level on ports 1.0.9-1.0.12 to 40W, split unequally with 30W on the data pair and 10W on the spare pair, use the following commands:

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode
<code>awplus(config)# interface port1.0.9-1.0.12</code>	Enter Interface Configuration mode
<code>awplus(config-if)# power-inline pair spare enable</code>	Enable high-power mode.
<code>awplus(config-if)# power-inline pair data max 30000</code>	Set the maximum power level to 30W (30000 milliwatts) on the data pair.
<code>awplus(config-if)# power-inline pair spare max 10000</code>	Set the maximum power level to 10W (10000 milliwatts) on the spare pair.

## Configuring LLDP-MED for power management

To configure LLDP-MED with PoE, simply enable LLDP using the following commands:

```
awplus# configure terminal
```

```
awplus(config)# lldp run
```

Optionally, you can also configure LLDP-MED location information and assign it to switch ports by entering the address (civic location), the coordinates, or the ELIN location ID, or a combination of these using the following commands:

COMMAND	DESCRIPTION
<code>awplus (config)# location civic-location identifier                   &lt;civic-loc-id&gt;</code>	If you want to specify location by specifying the address: specify a civic location ID, and enter configuration mode for this identifier.
<code>awplus (config-civic)# country &lt;country&gt; awplus (config-civic)# city &lt;city&gt; awplus (config-civic)# primary-road-name &lt;primary-road-name&gt; awplus (config-civic)# street-suffix &lt;street-suffix&gt; awplus (config-civic)# house-number &lt;house-number&gt; awplus (config-civic)# &lt;other-civic-location-parameters...&gt;</code>	Specify the civic address location information for the civic address location ID. You must specify a country first, using the upper-case two-letter country code, and then at least one more parameter.  For the full set of parameters you can use to specify civic address location, see the <b>location civic-location</b> configuration command in the LLDP chapter of the command reference.

COMMAND (CONTINUED)	DESCRIPTION (CONTINUED)
<pre>awplus (config-civic) # exit</pre>	Return to global configuration mode
<pre>awplus (config) # location coord-location identifier &lt;coord-loc-id&gt;</pre>	If you want to specify location by specifying the coordinates: specify a coordinate location identifier, and enter configuration mode for this identifier.
<pre>awplus (config-coord) # latitude &lt;latitude&gt;  awplus (config-coord) # lat-resolution &lt;lat-resolution&gt;  awplus (config-coord) # longitude &lt;longitude&gt;  awplus (config-coord) # long-resolution &lt;long-resolution&gt;  awplus (config-coord) # altitude &lt;altitude&gt; {meters floor}  awplus (config-coord) # alt-resolution &lt;alt-resolution&gt;  awplus (config-coord) # atum {wgs84 nad83-navd nad83-mllw}</pre>	Specify the coordinate location for the coordinate location identifier.
<pre>awplus (config-coord) # exit</pre>	Return to global configuration mode.
<pre>awplus (config) # location elin-location &lt;elin&gt; identifier &lt;elin-loc-id&gt;</pre>	If you want to specify location by specifying the ELIN: specify an ELIN location identifier, and the ELIN for this identifier.
<pre>awplus (config) # interface &lt;port-list&gt;</pre>	Enter interface configuration mode for one or more switch ports which require the same location information.
<pre>awplus (config-if) # location civic-location-id &lt;civic- loc-id&gt; awplus (config-if) # location coord-location-id &lt;coord- loc-id&gt; awplus (config-if) # location elin-location-id &lt;elin-loc-id&gt;</pre>	<p>Assign the civic, coordinate, and/or ELIN location identifier to these ports.</p> <p>LLDP-MED will send the location information associated with a port to the voice endpoint device attached to it.</p>

## Turning on legacy PD detection

From 5.4.9-0.1 onwards, detection of legacy PoE devices is disabled by default on all AlliedWare Plus PoE switches except FS980M Series. To enable detection of legacy devices, use the command:

```
awplus(config)#power-inline allow-legacy
```

On 5.4.8-2.x and earlier, detection of legacy PoE devices is enabled by default on all AlliedWare Plus PoE switches. To disable legacy PD detection, use the command:

```
awplus(config)#no power-inline allow-legacy
```

On x530L-10GHXm switches, if you enable or disable legacy detection, all powered devices connected to the port will restart.

## Monitoring PoE

There are four **show** commands available that return information about the PoE settings on your switch.

1. **show power-inline**—displays the power threshold set, a power usage percentage, and power consumed by each switch port

```
awplus# show power-inline
```

2. **show power-inline counters**—displays PoE event counters from the PoE MIB

```
awplus# show power-inline counters
```

3. **show power-inline interface**—displays a summary of PoE information for the PoE ports, including power limit, power consumed, and power class

```
awplus# show power-inline interface
```

4. **show power-inline interface detail**—displays all PoE information for the PoE ports, including power limit, power consumed, and power class

```
awplus# show power-inline interface detail
```

You can also specify an individual PoE port, a range of PoE ports, or a selection of PoE ports with the **show power-inline interface detail** command when using the *<port-list>* option, as shown below for a PoE port, a selection of PoE ports, and a range of PoE ports

```
awplus# show power-inline interface port1.0.2 detail
```

```
awplus# show power-inline interface port1.0.2,port1.0.4 detail
```

```
awplus# show power-inline interface port1.0.2-port1.0.4 detail
```

## show power-inline

```
awplus#show power-inline
PoE Status:
```

```
Stack member 1
Nominal Power: 360W
Power Allocated: 39W
Power Requested: 39W
Actual Power Consumption: 34W
Operational Status: On
Power Usage Threshold: 80% (288W)
Detection of legacy devices is disabled
Power Source: PSU
High Availability Network Power: Enabled
Power management mode: Dynamic
```

```
PoE Interface:
```

Interface/ Pair	Admin	Pri	Oper	Power (mW)	Device	Class	Max (mW)	HANP
port1.0.1/D	Enabled	Low	Powered	4000	n/a	1	4000	[C] On
port1.0.2/D	Enabled	Low	Off	0	n/a	n/a	n/a	On
port1.0.3/D	Enabled	Low	Powered	14900	n/a	3	15400	[C] On
port1.0.4/D	Enabled	Low	Off	0	n/a	n/a	n/a	On
port1.0.5/D	Enabled	Low	Off	0	n/a	n/a	n/a	On

### Dual-signature devices

With PoE++, dual-signature devices are given two lines each in the output of **show power-inline**, one for the 'data' pairs, and another for the 'spare' pairs. The 'data' and 'spare' names come from 10/100 Ethernet, which didn't use all four pairs for data.

However, from 5.5.2-0.1 onwards, the power is displayed as follows:

- the data (/D) line displays the power for each pair. For example, if each pair is consuming 14900mW, then the data line will show 34800.
- the spare (/S) line always displays - .

The following example output has a single-signature PoE device on port1.0.1, and a dual-signature PoE device on port1.0.3:



```
awplus#show power-inline
PoE Status:
```

```
Stack member 1
Nominal Power: 360W
Power Allocated: 39W
Power Requested: 39W
Actual Power Consumption: 34W
Operational Status: On
Power Usage Threshold: 80% (288W)
Detection of legacy devices is disabled
Power Source: PD (Class 4)
High Availability Network Power: Enabled
Power management mode: Dynamic
```

PoE Interface:

Interface/ Pair	Admin	Pri	Oper	Power (mW)	Device	Class	Max (mW)	HANP
<b>port1.0.1/D</b>	Enabled	Low	Powered	4000	n/a	1	4000 [C]	On
port1.0.2/D	Enabled	Low	Off	0	n/a	n/a	n/a	On
<b>port1.0.3/D</b>	Enabled	Low	Powered	<b>34800</b>	n/a	3	15400 [C]	On
<b>port1.0.3/S</b>	Enabled	Low	Powered	-	n/a	3	15400 [C]	On
port1.0.4/D	Enabled	Low	Off	0	n/a	n/a	n/a	On
port1.0.5/D	Enabled	Low	Off	0	n/a	n/a	n/a	On

## IE300

On ports 1.0.9-1.0.12 on IE300 Series switches, the **show** commands display power settings for each cable pair separately. The data pair is identified by /D and the spare pair by /S, as highlighted in the following example:

Interface/ Pair	Admin	Pri	Oper	Power (mW)	Device	Class	Max (mW)	HANP
port1.0.9/D	Enabled	Low	Powered	1822	n/a	0	15400 [C]	On
port1.0.9/S	Disabled	Low	Disabled	0	n/a	n/a	n/a	On

## show power-inline interface

```
awplus#show power-inline interface port1.0.9
```

Interface/ Pair	Admin	Pri	Oper	Power (mW)	Device	Class	Max (mW)	HANP
port1.0.9/D	Enabled	Low	Powered	1822	n/a	0	15400 [C]	On
port1.0.9/S	Disabled	Low	Disabled	-	n/a	n/a	n/a	On

## show power-inline interface detail

```
awplus#show power-inline interface port1.0.9 detail
Interface port1.0.9/D
  Powered device type: n/a
  PoE admin: on
  Configured Priority: Low
  Actual Priority: Low
  Detection status: Powered
  High Availability Network Power: On
    Last negotiated time: Sat Jun 11 03:55:08 2016
  Current power consumption: 1822 mW
  Powered device class: 0
  Power allocated: 15400 mW (from powered device class)
  Powered pairs: Data

Interface port1.0.9/S
  Powered device type: n/a
  PoE admin: off
  Configured Priority: Low
  Actual Priority: Low
  Detection status: Disabled
  High Availability Network Power: On
  Powered pairs: Spare
```

## Remotely monitoring power for all connected PDs

Note that you will need to configure SNMP first for this. For more information on configuring SNMP, see the following documents:

- [SNMP Feature Overview and Configuration Guide](#)
- [Support for Allied Telesis Enterprise MIBs in AlliedWare Plus](#)

The following procedure allows you to remotely monitor power usage for all connected PDs, by sending traps when the power supplied exceeds 75% of the nominal PSE power available.

COMMAND	DESCRIPTION
<code>awplus# configure terminal</code>	Enter Global Configuration mode.
<code>awplus(config)# service power-inline</code>	Enable PoE globally for the PSE. This will also enable PoE globally for all PoE ports on all connected stacked switches.
<code>awplus(config)# snmp-server enable trap power-inline</code>	Configure SNMP notification so an SNMP trap is sent when the power usage threshold is exceeded to trigger an alarm.
<code>awplus(config)# power-inline usage-threshold 75</code>	Specify SNMP notifications are generated when the power supplied exceeds 75% of the nominal PSE power available.

COMMAND (CONTINUED)	DESCRIPTION (CONTINUED)
<pre>awplus (config) # exit</pre>	Return to Privileged Exec mode.
<pre>awplus# copy running-config startup-config</pre>	Save your running-config to the startup-config to keep your PoE configuration after a switch restart or reboot.

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