# 11

# Power Over Ethernet (PoE) Operation for the Series 2600-PWR Switches

## Contents

# Overview

Power Over Ethernet (PoE) technology allows IP telephones, wireless LAN access points, and other powered devices (PDs) to receive power and transfer data over existing LAN cabling.

The PoE feature described in this chapter operates on the following switches (referred to collectively as the Series 2600-PWR switches):

- ProCurve Switch 2600-8-PWR (J8762A)
- ProCurve Switch 2626-PWR (J8164A)
- ProCurve Switch 2650-PWR (J8165A)

The switches provision their 10/100Base-TX ports with power for PoE applications compatible with the IEEE 802.3af standard. The PoE ports on your switch support both standard networking links and PoE links. Thus, you can connect either a non-PoE device or a powered device (PD) to a PoE-enabled port without reconfiguring the port.

## Configuration Options

In the default configuration, all 10/100Base-TX ports on the switch support PoE operation. Using the commands described in this chapter, you can:

- Configure a power threshold for SNMP and Event Log reporting of PoE consumption on the switch.
- Configure per-port priority for allocating power in case the switch becomes oversubscribed and must drop power for some lower-priority ports to support the demand on other, higher-priority ports.
- Disable or re-enable per-port PoE operation on some ports to help control power usage and avoid oversubscribing PoE on the switch. (In the default configuration, the switch enables PoE on all 10/100-TX ports, subject to PoE priority in the case of oversubscription of PoE resources.)
- Disable or re-enable PoE for pre-802.3af-standard powered devices (Switch 2600-8-PWR only).
- Monitor PoE status and performance on the switch.

See “Configuring PoE Operation” on page 11-7 for further details.

## Related Publications

This chapter introduces general PoE operation, PoE configuration and monitoring commands, and event log messages related to PoE operation on the ProCurve Series 2600-PWR switches. The following two manuals provide further information:

- For information on installation, refer to the *ProCurve Series 2600 Switches Installation and Reference Guide* provided with the switch.
- To help you plan and implement a PoE system in your network, refer to the *PoE Planning and Implementation Guide*, which is available from either of the following sources:
  - The Documentation CD-ROM (version 3.5 or greater) shipped with your Series 2600-PWR switch
  - The ProCurve website at **http://www.procurve.com**. (Click on **Technical support**, then **Product manuals**.)

## Terminology

The following PoE terms and concepts are used in this manual.

| Term | Use in this Manual |
|---|---|
| active PoE port | A PoE-enabled port connected to a PD requesting power. |
| priority class | Refers to the type of power prioritization where the switch uses Low (the default), High, and Critical priority assignments to determine which groups of ports will receive power. Note that power priority rules apply only if PoE provisioning on the switch becomes oversubscribed. |
| EPS | External Power Supply; for example, a ProCurve 600 RPS/EPS or a ProCurve 610 EPS. An EPS device provides power to provision PoE ports on a switch. See also "RPS" below. |
| MPS | Maintenance Power Signature; the signal a PD sends to the switch to indicate that the PD is connected and requires power. Refer to Figure 11-4 on page 13. |
| PD | Powered Device. A device that receives power through a direct connection to a 10/100 Base-TX PoE RJ-45 port on the switch. Examples of PDs include Voice-over-IP (VoIP) telephones, wireless access points, and remote video cameras. |
| port-number priority | Refers to the type of power prioritization where, within a priority class, the switch assigns the highest priority to the lowest-numbered port, the second-highest priority to the second lowest-numbered port, and so-on. Note that power priority rules apply only if PoE provisioning on the switch becomes oversubscribed. |
| RPS | Redundant Power Supply; for example, a ProCurve 600 RPS/EPS. An RPS device provides power to a switch if the switch's internal power supply fails. RPS power does not provision PoE ports on a switch whose internal power supply has failed. See also "EPS" above. |

# Power Availability and Provisioning

## Powered Device (PD) Support

The switch must have a minimum of 15.4 watts of unused PoE power available when you connect an 802.3af-compliant PD, regardless of how much power the PD actually uses. On the Switch 2626-PWR and Switch 2600-8-PWR, there will always be enough power available to connect and support 802.3af PoE operation on all 10/100-TX ports. On the Switch 2650-PWR, however, it is possible to oversubscribe the available PoE power. In this case, one or more PoE devices connected to the switch will lose power. That is:

- **Sufficient PoE Power Available:** When a Switch 2650-PWR detects a new PD, and if the switch has a minimum of 15.4 watts of PoE power available, the switch supplies power to the port for that PD.
- **Insufficient PoE Power Available:** When a Switch 2650-PWR detects a new PD, and if the switch does not have a minimum of 15.4 watts of unused PoE power available:
  - If the new PD is connected to a port "X" having a *higher* PoE priority than another port "Y", the switch removes PoE power from port "Y" and delivers it to port "X". In this case the PD on port "X" receives power and the PD on port "Y" is denied power.
  - If the new PD is connected to a port "X" having a *lower* priority than all other PoE ports currently providing power to PDs, then the switch does not deliver PoE power to port "X".

Note that once a PD connects to a port and begins operating, the port retains only enough PoE power to support the PD's operation. Unneeded power becomes available for supporting other PD connections. Thus, while 15.4 watts must be available for the switch to begin supplying power to a port with a PD connected, 15.4 watts per port is not continually required if the connected PD requires less power.

For example, with 20 watts of PoE power remaining available on the switch, you can connect one new PD without losing power to any currently connected PDs. If that PD draws only 3 watts, then 17 watts remain available and you can connect at least one more PD without interrupting power to any other devices. If the next PD you connect draws 5 watts, then only 12 watts remain unused. With only 12 watts available, if you connect yet another PD, the lowest-priority port will lose PoE power until the switch once again has 15.4 or more watts available. (For information on power priority, refer to "Power Priority" on page 11-5.)

Disconnecting a PD from a port causes the switch to stop providing PoE power to that port and makes the power available to other ports configured for PoE operation. If the PoE demand becomes greater than the available power, the switch transfers power from lower-priority ports to higher-priority ports. (Ports not currently providing power to PDs are not affected.)

**Note**

15.4 watts of available power is required for the switch to begin delivering power to a port, such as when a newly connected PD is detected or when power is released from higher priority ports. Depending on power demands, lower-priority ports on a switch with high PoE power demand may occasionally lose power due to the demands of higher-priority ports. (Refer to "Power Priority" for further details.)

## Power Priority

In the default configuration PoE power priority is determined by port number, with the lowest numbered port having the highest priority.

**When Does the Switch Prioritize Power Allocations?** If the switch can provide power for all existing PD demands, it does not use its power priority settings to allocate power. However, if the PD power demand oversubscribes the available power, then the switch prioritizes the power allocation to the ports that present a PD power demand. This causes the switch to remove power from one or more lower-priority ports to meet the power demand on other, higher-priority ports. (This operation occurs, regardless of the order in which PDs connect to the switch's PoE-configured ports.)

**How Does the Switch Prioritize Power Allocations?** The switch simultaneously uses two priority methods:

- The *priority class* method enables port PoE priority class assignments of **Low** (the default), **High**, and **Critical**.
- The *port-number priority* method gives a lower-numbered port priority over a higher-numbered port within the same configured priority class.

On the Switch 2650-PWR, the ports configured with the highest priority of either bank (1-24 or 25-48) will receive PoE power, regardless of position. There is also an option to provision ports 1-24 with 406 watts of internal power and ports 25-48 with 408 watts of external power by adding an external power supply. For more information on using external power supplies with PoE-capable switches, refer to the *PoE Planning and Implementation Guide*.

Table 11-1 provides examples of how PoE priority settings impact operation.

**Table 11-1. Example of PoE Priority Operation**

| Port | Priority Setting | Configuration Command[1] and Resulting Operation |
|---|---|---|
| 25 - 48 | Critical | This priority class always receives power. If there is not enough power to provision PDs on all of the ports configured for this class, then no power goes to ports configured for High and Low priority. If there is enough power to provision PDs on only some of the "Critical" ports, then power is allocated to the "Critical" ports in ascending order, beginning with the lowest-numbered port in the class, which, in this case, is port 25. For this example, the CLI command to set ports to "Critical" is:<br><br>`ProCurve(config)# interface e 25-48 power critical` |
| 9 - 12 | High | This priority class receives power only if all PDs on ports with a Critical priority setting are receiving full power. If there is not enough power to provision PDs on all ports with a High priority, then no power goes to ports with a Low priority. If there is enough power to provision PDs on only some of the "High" ports, then power is allocated to the "High" ports in ascending order, beginning, in this example, with port 9, until all available power is in use. For this example, the CLI command to set ports to "High" is:<br><br>`ProCurve(config)# interface e 9-12 power high` |
| 1 - 8 | Low | This priority class receives power only if all PDs on ports with High and Critical priority settings are receiving power. If there is enough power to provision PDs on only some Low priority ports, then power is allocated to the ports in ascending order, beginning with the lowest-numbered port in the class (port 1, in this case), until all available power is in use. For this example, the CLI command to set ports to "Low"[2] is:<br><br>`ProCurve(config)# interface e 1-8 power low` |
| 13 - 24 | - *n/a* - | For this example, PoE is disabled on these ports. The CLI command for this setting is:<br><br>`ProCurve(config)# no interface e 13-24 power` |

[1] For a listing of PoE configuration commands, with descriptions, refer to "Configuring PoE Operation" on page 11-7.
[2] In the default PoE configuration, the ports are already set to the **low** priority. In this case, the command is not necessary.

# Configuring PoE Operation

By default, PoE support is enabled on the switch's 10/100Base-TX ports, with the power priority set to **Low** and the power threshold set to **80** (%). The following commands allow you to adjust these settings.

***Syntax:*** power threshold < 1 - 99 >

*The power threshold is a configurable percentage of the* ***total*** *PoE power available on the switch. When PoE consumption exceeds the threshold, the switch automatically generates an SNMP trap and also sends a message to the Event Log. For example, if the power threshold is set to 80% (the default), and an increasing PoE power demand crosses this threshold, the switch sends an SNMP trap and generates this Event Log message:*

```
PoE usage has exceeded threshold of 80 %.
```

*If the switch is configured for debug logging, it also sends the same message to the configured debug destination(s).*

*The switch automatically invokes the power threshold at the global configuration level with a default setting of 80%. You can configure the power threshold to a value in the range of 1% to 99%.*

*If an increasing PoE power load (1) exceeds the configured power threshold (which triggers the log message and SNMP trap), and then (2) later begins decreasing and drops below the threshold again, the switch generates another SNMP trap, plus a message to the Event Log and any configured Debug destinations. To continue the above example:*

```
PoE usage is below configured threshold
of 80 %.
```

*(Refer to "PoE Event Log Messages" on page 11-14.)*

***Syntax:*** [no] interface [e] < *port-list* > power

*Re-enables PoE operation on* < *port-list* > *and restores the priority setting in effect when PoE was disabled on* < *port-list* >*. The* [**no**] *form of the command disables PoE operation on* < *port-list* >*. (Default: All 10/100Base-TX ports on the switch enabled for PoE operation at* **Low** *priority.)*

***Syntax:*** interface [e] < *port-list* > power [ critical | high | low ]

*Reconfigures the PoE priority level on* < port-list >. *For a given level, the switch automatically prioritizes ports by port number (in ascending order). If there is not enough power available to provision all active PoE ports at a given priority level, then the lowest-numbered port at that level will be provisioned first, and so on. The switch invokes configured PoE priorities only when it cannot provision all active PoE ports.*

- **Critical:** *Specifies the highest priority PoE support for* < port-list >. *The switch provisions active PoE ports at this level before PDs connected to any other ports.*
- **High**: *Specifies the second highest priority PoE support for* < port-list >. *The switch provisions active PoE ports at this level before PDs connected to Low-priority ports.*
- **Low** *(the default): Specifies the lowest priority PoE support for* < port-list >. *The switch provisions active PoE ports at this level only if there is power available after provisioning any active PoE ports at the higher priority levels.*

## Cycling Power on a Port

Simply disabling a PoE port does *not* affect power delivery through that port. To cycle the power on a PD receiving power from a PoE port on the switch, disable, then re-enable the power to that port.

For example, to cycle the power on a PoE device connected to port 1 on a 2600-PWR switch:

```
ProCurve(config)# no interface 1 power
ProCurve(config)# interface 1 power
```

# PoE for Pre-802.3af-standard PDs (Switch 2600-8-PWR)

By default, all ProCurve PoE switches support 802.3af-standard PDs. In addition, the Switch 2600-8-PWR (J8726A) has the ability to supply power to pre-802.3af-standard devices, such as legacy (non-standard) IP phones.

**Note**

For a current listing of PDs supported by this feature, visit the ProCurve Networking website at **http://www.procurve.com**. Click on **Technical support**, and then on **FAQs**, and then select the switch model **2600-8-PWR**.

**How to disable/re-enable PoE for pre-802.3af-standard powered devices (Switch 2600-8-PWR only).** PoE for pre-802.3af-standard powered devices is enabled by default. This feature is available only on the ProCurve Switch 2600-8-PWR.

***Syntax:*** [no] power pre-std-detect

*The above command enables PoE for pre-802.3af-standard powered devices. The* **no** *form of the command sequence disables PoE for pre-802.3af-standard powered devices. (Default: Enabled)*

To disable this feature, you would enter:

```
ProCurve(config)#no power pre-std-detect
```

PoE for pre-802.3af-standard powered devices can be disabled or re-enabled only from the switch's CLI. This feature cannot be disabled or re-enabled through either the switch's menu or web browser interfaces.

Executing the **show power-management** command on the Switch 2600-8-PWR lists the system power status as follows:

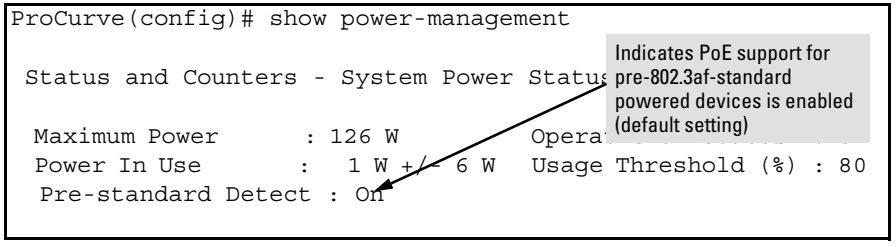


**Figure 11-1. PoE Support for Pre-802.3af-standard Powered Devices Enabled**

For information on the meaning of other power status parameters, refer to "Viewing PoE Configuration and Status" on page 11-10.

# Viewing PoE Configuration and Status

## Displaying the Switch's Global PoE Power Status

***Syntax:*** show power-management

*Displays the switch's global PoE power status, including:*

- **Max Power:** *Lists the maximum PoE wattage available to provision active PoE ports on the switch.*
- **Power In Use:** *Lists the amount of PoE power presently in use.*
- **Operational Status:** *Indicates whether PoE power is available on the switch. (Default:* **On** *; shows* **Off** *if PoE power is not available. Shows* **Faulty** *if internal or external PoE power is oversubscribed or faulty.)*
- **Usage Threshold (%)***: Lists the configured percentage of available PoE power provisioning the switch must exceed to generate a usage notice in the form of an Event Log message and an SNMP trap. If this event is followed by a drop in power provisioning below the threshold, the switch generates another SNMP trap and Event Log message. Event Log messages are also sent to any optionally configured debug destinations. (Default:* **80%***)*
- **Pre-standard Detect** (Switch 2600-8-PWR only)*: Shows whether PoE for pre-802.3af-standard powered devices is enabled on the switch. (Default:* **On** *; shows* **Off** *when PoE for pre-802.3af-standard powered devices has been disabled.)*

For example, in the default PoE configuration, when the switch is running with several ports supporting PD loads, **show power-management** displays data similar to the following on a Switch 2626-PWR device:

```
ProCurve-PWR# show power-management

 Status and Counters - System Power Status

  Maximum Power   : 406 W           Operational Status  : On
  Power In Use    :  75 W +/- 6 W   Usage Threshold (%) : 80
```

**Figure 11-2. Example of Show Power-Management Output**

# Displaying an Overview of PoE Status on All Ports

***Syntax:*** show power-management brief

*Displays the following port power status:*

- **Port:** *Lists all PoE-capable ports on the switch.*
- **Power Enable:** *Shows* **Yes** *for ports on which PoE is enabled (the default) and* **No** *for ports on which PoE is disabled.*
- **Priority:** *Lists the power priority (***Low**, **High**, and **Critical***) configured on ports enabled for PoE. (For more on this topic, refer to the command description on page 11-8.)*
- **Configured Type:** *Lists the type of PD connected to each port (as configured by the user on the PD device). For example:* `Telephone`, `Webcam`, `Wireless`, `Other`.
- **Detection Status:**
  - **Searching:** *The port is trying to detect a PD connection.*
  - **Delivering:** *The port is delivering power to a PD.*
  - **Disabled:** *PoE support is disabled on the port. To re-enable, refer to "Configuring PoE Operation" on page 11-7.*
  - **Fault:** *The switch detects a problem with the connected PD.*
- **Power Class:** *Shows the 802.3af power class of the PD detected on the indicated port (as configured by the user on the PD device). Classes include:*

  **0**: *0.44w to 12.95w*
  **1**: *0.44w to 3.84w*
  **2**: *3.84w to 6.49w*
  **3**: *6.49w to 12.95w*
  **4:** *reserved*

For example, **show management-brief** displays this output:

```
ProCurve-PWR(config)# show power-management brief
 Status and Counters - Port Power Status

        | Power            Configured       Detection   Power
  Port  | Enable  Priority Type             Status      Class
  ----- + ------- -------- ---------------- ----------- ------
  1     | Yes     Critical Telephone        Delivering  1
  2     | Yes     Critical Telephone        Delivering  1
  3     | Yes     High     Wireless         Delivering  3
  4     | Yes     High     Wireless         Delivering  3
  5     | Yes     Low                       Searching   0
  6     | Yes     Low                       Searching   0
  7     | Yes     Low                       Searching   0
  8     | Yes     Low                       Searching   0
  .       .       .        .                .           .
  .       .       .        .                .           .
  .       .       .        .                .           .
```

Ports 1 through 4 are delivering power. The remaining ports are available to supply power, but currently do not detect a connected PD.

**Figure 11-3. Example of Show Management-Brief Output**

## Displaying the PoE Status on Specific Ports

***Syntax:*** show power-management [e] < *port-list* >

*Displays the following PoE status and statistics (since the last reboot) for each port in* < port-list >:

- **Power Enable:** *Shows* **Yes** *for ports enabled to support PoE (the default) and* **No** *for ports on which PoE is disabled.*
- **Priority:** *Lists the power priority (***Low**, **High**, and **Critical***) configured on ports enabled for PoE. (For more on this topic, refer to the power command description under "Configuring PoE Operation" on page 11-7.)*
- **Detection Status:**
  - **Searching:** *The port is available to support a PD connection.*
  - **Delivering:** *The port is delivering power to a PD.*
  - **Disabled:** *PoE support is disabled on the port. To re-enable PoE support, refer to "Configuring PoE Operation" on page 11-7.*
  - **Fault:** *The switch detects a problem with the connected PD.*
- **Over Current Cnt:** *Shows the number of times a connected PD has attempted to draw more than 15.4 watts. Each occurrence generates an Event Log message.*
- **Power Denied Cnt:** *Shows the number of times PDs requesting power on the port have been denied due to insufficient power available. Each occurrence generates an Event Log message.*
- **Voltage:** The total voltage, in dV, being delivered to PDs.
- **Power:** The total power, in mW, being delivered to PDs.
- **Configured Type:** *Shows the type of PD detected on the port.*
- **Power Class:** *Shows the power class of the PD detected on the indicated port. Classes include:*

  **0**: *0.44w to 12.95w*
  **1**: *0.44w to 3.84w*
  **2**: *3.84w to 6.49w*
  **3**: *6.49w to 12.95w*
  **4:** *reserved*

- **MPS Absent Cnt:** *This value shows the number of times a detected PD has no longer requested power from the port. Each occurrence generates an Event Log message. ("MPS" refers to the "Maintenance Power Signature". Refer to "Terminology" on page 11-3.)*
- **Short Cnt:** *Shows the number of times the switch provided insufficient current to a connected PD.*
- **Current:** *The total current, in mA, being delivered to PDs.*

For example, if you wanted to view the PoE status of port 5 on a Series 2600-PWR switch, you would use **show power-management 5** to display the data:

```
ProCurve(config)# show power-management 1

 Status and Counters - Port Power Status for port 1

  Power Enable      : Yes

  Priority          : Low               Configured Type   :
  Detection  Status : Delivering        Power Class       : 0

  Over Current Cnt  : 0                 MPS Absent Cnt    : 2
  Power Denied Cnt  : 0                 Short Cnt         : 0

  Voltage          : 545 dV           Current          : 13 mA
```

**Figure 11-4. Example of Show Power-Management < *port-list* > Output**

# Planning and Implementing a PoE Configuration

This section provides an overview of some considerations for planning a PoE application. For additional information, refer to the ProCurve *PoE Planning and Implementation Guide*.

## Assigning PoE Ports to VLANs

If your network includes VLANs, you may want to assign various PoE-configured ports to specific VLANs. For example, if you are using PoE telephones in your network, you may want to assign ports used for telephone access to a VLAN reserved for telephone traffic.

## Applying Security Features to PoE Configurations

You can utilize security features built into the switch to control device or user access to the network through PoE ports in the same way as non-PoE ports.

- **MAC Address Security:** Using Port Security, you can configure each switch port with a unique list of up to eight MAC addresses for devices that are authorized to access the network through that port. For more information, refer to the chapter titled "Configuring and Monitoring Port Security" in the *Access Security Guide* for your switch.
- **Username/Password Security:** If you are connecting a device that allows you to enter a username and password that is forwarded to a networked server for authentication, then you can also configure the following security features:
  - TACACS+
  - RADIUS Authentication and Accounting
  - 802.1X Authentication

  For more information, refer to the *Access Security Guide* for your switch.

# PoE Event Log Messages

PoE operation generates these Event Log messages. You can also configure the switch to send these messages to a configured debug destination (terminal device or Syslog server).

`I 1`*`MM/DD/YY HH:MM:SS`* `chassis:`

*Message header, with severity, date, system time, and system module type. For more information on Event Log operation, refer to the "Troubleshooting" appendix in the Management and Configuration Guide for your switch.*

`Ext Power Supply connected, supplying<`*actual-power*`>W of <`*avail-power*`> W max.`

*The switch detected an EPS (External Power Supply) and began receiving the wattage indicated by <* actual-power *>.* The *<* avail-power *> field indicates the maximum power (wattage) the detected EPS is capable of delivering*

`Ext Power Supply disconnected`

*The switch has lost contact with an external power supply.*

`POE usage is below configured threshold of <1 - 99> %`
`<slot-#> POE usage is below configured threshold of <1-99> %`

*Indicates that POE usage in the switch or indicated slot (if the switch includes module slots) has decreased below the threshold specified by the last execution of the global* **power threshold <1 - 99>** *command. This message occurs if, after the last reboot, the PoE demand on the switch exceeded the power threshold and then later dropped below the threshold value.*

`Port <port-#> applying power to PD.`

*A PoE device is connected to the port and receiving power.*

`Port <port-#> PD detected.`

*The switch has detected a PoE device connected to the port.*

`W MM/DD/YY HH:MM:SS chassis:`

*Message header, with severity, date, system time, and system module type. For more information on Event Log operation, refer to the "Troubleshooting" appendix in the Management and Configuration Guide for your switch.*

`Ext Power Supply connected but not responding.`

*The switch detects an external power supply, but is not receiving power from the device.*

`Ext Power Supply failure: <fault-type> Failures:`

*Indicates an external power supply failure where <fault-type> is one of the following:*

- *Over Current fault: The ProCurve 600 RPS/EPS or ProCurve 610 EPS reported a fault condition. Contact your ProCurve support representative.*
- *Fan fault: A fan in an external power supply has failed.*
- *Temperature fault: The operating temperature in an external power supply has exceeded the normal operating range.*
- *50V fault: The ProCurve 600 RPS/EPS or ProCurve 610 EPS reported a fault condition. Contact your ProCurve support representative.*
- *12V fault: The ProCurve 600 RPS/EPS or ProCurve 610 EPS reported a fault condition. Contact your ProCurve support representative.*

`POE usage has exceeded threshold of <1-99> %`
`<slot-#> POE usage has exceeded threshold of <1-99> %`

*Indicates that POE usage in the switch or indicated slot (if the switch includes module slots) has exceeded the configured threshold for the switch, as specified by the last execution of the* **power threshold <1-99>** *command. (Note that the switch also generates an SNMP trap for this event.)*

`Port <port-#> PD Denied power due to insufficient power allocation.`

*There is insufficient power available to power the PD on the indicated port and the port does not have sufficient PoE priority to take power from another active PoE port.*

`Port <port-#> PD Invalid Signature indication.`

*The switch has detected a non 802.3af-compliant load.*

`Port <port-#> PD MPS Absent indication.`

*The switch no longer detects a device on <port-#>. The device may have been disconnected, powered down, or stopped functioning.*

`Port <port-#> PD Other Fault indication.`

*There is a problem with the PD connected to the port.*

`Port <port-#> PD Over Current indication.`

*The PD connected to <port-#> has requested more than 15.4 watts of power. This may indicate a short-circuit or other problem in the PD.*