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# Smart Wireless Gateway 1420 with Power over Ethernet (PoE)

The new Gateway hardware supports IEEE 802.3af and IEEE 802.3at PoE.

## 1 Introduction

With the growth of ethernet, many have wanted to save time and cost on wiring by sending power down to an ethernet device over the same ethernet cable used to haul data. This is possible because there are four extra wires in an ethernet cable that are typically not used. In the past there was no formal standard, people came up with their own wiring schemes for using these wires to provide power. This resulted in a number of different schemes to exist and lead to confusion as people were damaging their computers because they did not know there was power available over the ethernet cable.

In 2003, IEEE 802.3af standard for PoE was adopted. It specified:

- The wires that would carry power and how
- Devices that could source power and devices that could be powered
- Supplied wattage would be up to 15 Watts (in 2009, IEEE 802.3at was adopted, which allowed power up to 25 Watts)
- The voltage used
- A method of protecting against damaging non-PoE devices

## 2 There are two types of IEEE 802.3 PoE devices

1. PSE (Power Sourcing Equipment) is a device that acts as a voltage source and supplies PoE to devices via the ethernet cable.
2. PD (Powered Device) is a device that is supplied with power via PoE from a PSE device via the ethernet cable.

The Gateway can be configured by jumpers to work in either one of the modes referenced above. Therefore the Gateway can source power or be powered via the ethernet cable.

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### Note

The Gateway cannot be a PSE and a PD at the same time. PoE can only be configured on one Gateway port at a time.

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## 3 PoE advantages

To save costs on planning, wiring and installation of networks, devices are supplied with power directly via the ethernet cable (e.g. via a Cat 5/5e cable up to 100m). PoE makes the network planning flexible, independent of power supply cabinets, and junction boxes. There are no extra costs for the electrical wiring. An advantage of PoE is that you can install devices with an ethernet interface in places of difficult access or in areas in which running cable would be inconvenient. This in turn saves installation time and costs. This technology is in use today typically in IP telephones, cameras, or wireless transmission devices such as WLAN Access Points.

An excellent application is a Gateway connected to a Wi-Fi back haul unit; such as a Cisco® or ProSoft® unit. For example a Cisco unit could power the Gateway or in another case the Gateway could power the ProSoft unit as in a PFN with the addition of an external power supply.

## 4 Selecting devices to work with a PoE Gateway

The connecting device to the Gateway whether it is a PSE or a PD must be labeled as compliant with IEEE 802.3af or IEEE 802.3at. Many companies use labels on their packaging such as PoE for IEEE 802.3af or PoE+ for IEEE 802.3at. Check the specific manufacturer's specifications of any device to make sure somewhere it references IEEE 802.3; otherwise it may not work.

The Gateway works as either a PoE PSE for IEEE 802.3af (sourcing 15 Watts) or PoE+ PSE for IEEE 802.3at (sourcing 25 Watts) depending on the input voltage to the Gateway from the power supply. For 12 VDC nominal input, the Gateway can source 15 Watts. For 24 VDC nominal input, the Gateway can source up to 25 Watts. No additional adjustment is necessary.

In the PoE PD mode, the Gateway draws its power over the selected ethernet cable from another PoE IEEE 802.3 device either 802.3af or 802.3at.

Caution is needed in selecting a companion device to the Gateway for PoE. Not all devices labeled PoE will function. Before 2003, there was no standard and companies developed their own techniques for powering over an ethernet cable. These techniques are not always interoperable. Before the standard, they used the term PoE on many of their products. Most new products labeled PoE are IEEE compatible. Cisco products can be ordered with their old standard (Online Power as it is sometimes referred to) or with the IEEE 802.3 PoE standard. Check with the appropriate manufacturer if in doubt before purchasing/installing the connecting equipment.

For reference, Cisco offers the following four versions:

1. Prestandard PoE (Online Power)
2. 802.3af-compliant PoE (15W)
3. 802.3at-compliant PoE Plus (PoE+) (25W)
4. Universal PoE (UPoE) (60W). (New Cisco standard, which Cisco claims is compatible with IEEE 802.3af PoE and IEEE 802.3at PoE +)

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#### Note

When using a Gateway as IEEE 802.3 PSE device, check the total power levels of all the PD equipment connected (including the Gateway itself 3.6 Watts) to make sure the power supply to the gateway can source enough power. It is always a good design practice to make sure the power supply has more than enough power capability to handle startup loads and future expansion.

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## 5 IEEE 802.3 PoE gives protection from damaging a computer or another piece of equipment

When using IEEE 802.3 PoE, one of the important new features of this standard is that PSE devices have a test mechanism to protect connected incompatible devices from being damaged. Only devices which have an authenticating characteristic based on the IEEE 802.3 standard, receive power via the ethernet cable. To determine whether a PD is connected, the input parameters are checked by the PSE. This method is called “Resistive Power Discovery”. During the discovery process resistance, capacitance, and current are checked.

If the PSE detects a PD it starts classification, i.e. determination of the power requirement of the connected device. For this the PSE applies a small defined voltage to the power input of the PD's and measures the resulting current. The PD is assigned to a power class based on the value of the current. Only now the total voltage is supplied to the power input.

This sophisticated system prevents computers and other devices from being damaged when connected to these cables.

### CAUTION

Older non-IEEE standard PoE offerings may not have this protection and could damage computers and other devices.

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## 6 Proper PoE installation considerations

In all electrical installations, local codes and prevailing regulations must be observed. Only use properly trained/licensed installers, approved materials, have installations inspected as required and if in doubt seek help from a qualified person. PoE+ and the load of the Gateway (approximately 3 to 4 Watts) can add up to 30 Watts of power; because of this the proper ethernet cable must be selected depending on the length of the cable run. Please check with the manufacturer for the specifications of the cable being used to determine the power versus length requirements. Multiple powered ethernet cables running in the same location must be considered for total temperature rise. Most ethernet cable suppliers have charts for PoE usage on their websites.

Typically, Cat 5 should handle most installations with runs up to 100 meters (approximately 300 feet). The use of Cat 3 is not recommended in any installation PoE or non-PoE, Cat 3 may work for some lower power short run applications, but overall it has poorer data handling and lower power capability. Cat 6 and Cat 7 are respectively better than Cat 5.

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## 7 PoE FAQs

### Does the old 1420 Gateway hardware have PoE?

No, not IEEE PoE; in the current 1420 there is a third ethernet port on the far left of the connector board (closest to the hinge). This port has a cover on it; in the manual it is labeled “Ethernet 2 with Power.” This connector is connected to ethernet port 2 and the spare ethernet wires in this connector are bridged to the input power lines to the Gateway. This was designed for special applications and is not recommended for normal use. This connector can damage computer and other equipment connected to it if used improperly and has been removed as it is not needed in the new PoE design.

### What do I have to do to order IEEE PoE on a 1420 Gateway?

There is no specific option code for PoE. In time, all 1420s will have PoE. Initially PoE will be offered by approvals codes as PoE is approved for that application. For example, typically N5 or N6 approvals take the least time. These approvals codes when approved for PoE would automatically ship with the new hardware. Approval codes like N3 or N4, which typically take a longer time, would ship with PoE at a later date. Contact your Emerson Sales Representative to find out if a particular code has been approved for PoE.

It should be also noted that all PoE units shipped are configured as a PoE PD on port 1. By using the jumpers included with the unit, the installer configures the unit during installation as to mode and port of PoE operation if desired. See the last section of this paper for jumpering diagrams.

### If I am not using PoE, how should I program the Gateway?

Program the 1420 as a PoE PD on either port; then connect up the local power supply (24 or 12 VDC) to the power input terminals of the Gateway. There is no problem if the Gateway is programmed as a PD and has local power too. The Gateway working as a PD when it sees local power switches to the local power instead of the ethernet PoE. See the last section of this paper for jumpering diagrams.

### What type of power supply should I use with the PoE Gateway in the PSE mode?

A Class 1 power supply is strongly recommended for all Gateway applications for improved safety. The power supply should be a 24 or 12 VDC unit. 24 VDC allows more power to be sourced in the PSE mode. The power supply should be able to handle at least 30 Watts if using PSE; for good operating margin it would be advisable to consider at least a 50 Watt supply.

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#### Note

Solar or battery power is not recommended for PoE PSE operation as there are additional power losses caused by the PoE circuitry.

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## What is the maximum Voltage PoE PSE can source?

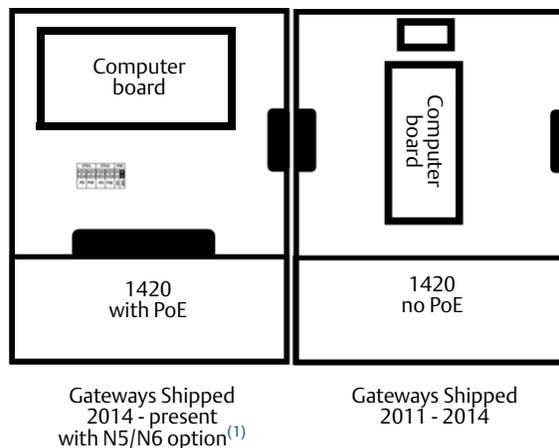
Maximum Voltage is normally 48 VDC; up to 25 Watts.

## Can you do redundant power with PoE?

Yes, as PoE becomes more popular many network appliance (switch) providers are supplying innovative switches and other hardware to create redundantly powered networks. Typically, many switch suppliers offer switches that allow multiple power inputs. Check your local switch supplier as to available configurations. Also, the Gateway will work with a local power supply connected to the power input terminals of the Gateway and as a PD with power coming over the ethernet at the same time. If both sources are present, the Gateway selects the local power supply first. If the local power fails, the Gateway automatically switches to ethernet power. When the local power is restored, the Gateway automatically returns to local power.

## How do I know if my 1420 Gateway has IEEE PoE capability?

The simplest way to check for IEEE PoE capability is to open the upper door on the 1420 Gateway and see how the computer board is mounted. In the newer hardware, the board is mounted horizontally. The old hardware the computer board was mounted vertically.



## Are there other changes in the 1420 with the new hardware?

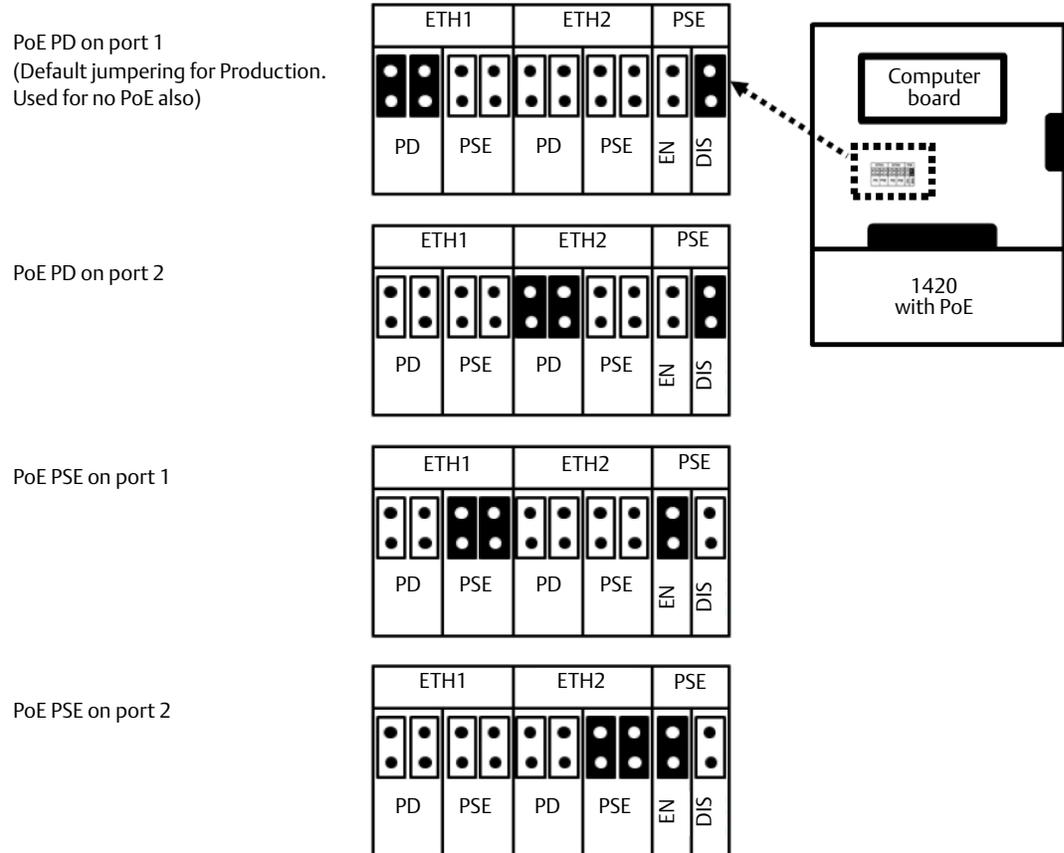
Emerson's Quality Policy is to continuously improve our products year after year. The following is a list of some improvements with the new hardware:

- Ethernet connectors in line with conduit holes
- A fast disconnect circuit protects from someone inadvertently wiring Gateway to high voltage or AC Mains (circuit resets when improper power is removed)
- More area freed up for installer wiring in lower section
- Total number of circuit boards, wires and connectors is greatly reduced

(1) Depending on approval status.

## 8 1420 PoE jumpering

Figure 1-1. Jumpering Matrix Located on 1420 Main Board



Legend:

- ETH1 Ethernet port 1 selected for PD or PSE
- ETH2 Ethernet port 2 selected for PD or PSE
- PD Gateway gets its power off the ethernet port selected
- PSE Gateway gets its power from a local power supply and sends power down the ethernet port selected to another device
- EN Enabled; this enables the PSE operation
- DIS Disabled; this disables the PSE operation

**Note**

Only one port and one mode of operation (PD or PSE) can be selected at a time. Any other combination of jumpers is invalid.



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