

Stealth Laboratories, LLC

PoE

(Power over Ethernet)

Handbook



Revision 1.0

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What exactly is PoE (Power over Ethernet) ?

PoE is a term that was coined to describe how power is to be placed upon a structured wiring system and the various components that may attach to the system. This system may be a simple Local Area Network (LAN) that connects one computer to another, or it may be as complicated as a Category 3, 4, 5, or 6 wiring system that combines telephones, data, video, and voice for a single business or residence.

In either scenario, power (voltage & current) might be necessary in order to operate devices on the network, and PoE is the term that describes how this power is delivered.

Why is this relevant to security ?

Recently, the security market has seen a proliferation of IP-based cameras. Structured wiring systems require to deliver power to these devices. In many cases, the cable in existing structured wiring systems include unused pairs of copper wires which can now be utilized for powering devices.

As the need for structured wiring arrangements and Ethernet Local-Area-Networks (LANs) continues to grow, so does the need to supply various voltages and accommodate different types of sensors, terminals, speakers, and a multitude of other devices.

Is there a standard for PoE ?

Absolutely. It is defined by an internationally-recognized standard called IEEE 802.3af.

What are the basics of this standard?

The IEEE standard defines the voltage and current requirements of PoE. Voltage which is input to the system must be in the range of 40V to 52V and should supply a minimum of 300mA per port. The maximum current draw of any single device on the system should be 350mA. One drawback to the standard is that it does not specify exactly which wires in a jacket are assigned to power. This is due to the fact that various manufacturers use different pairs of wire to power their devices and on which to transmit and receive data, video, etc.

What are some of the specifics of Power over Ethernet ?

The purpose of the IEEE spec is to define a method of how to deliver both data and power to appliances such as cameras, etc. over existing CAT-5 Ethernet cables and other structured wiring systems.

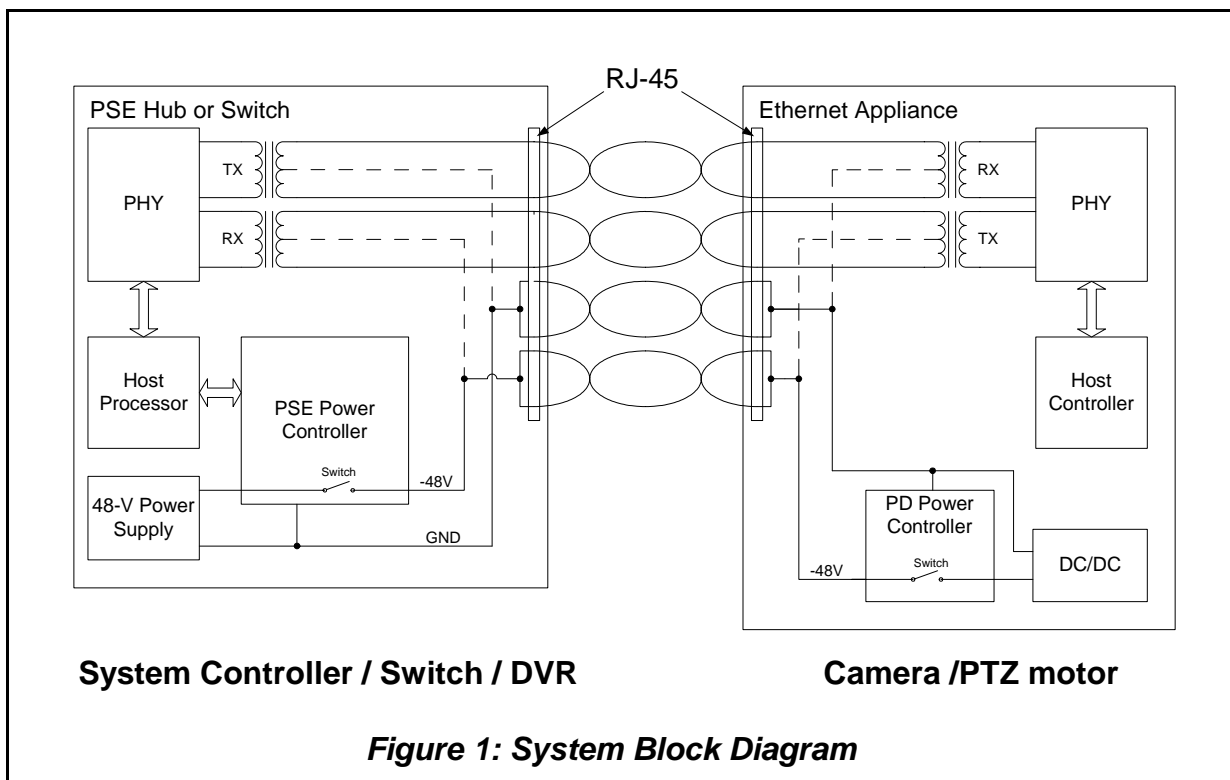
At the front end, where a typical camera power supply might go, a device is classified as Power Service Equipment (PSE). It is designed to deliver power with the following parameters:

Voltage = 44-57VDC
Current = 350mA Max per port
Power = 15.4W continuous

At the back end of the system, where a camera might be, the equipment needing the power is defined as a Powered Device, or rather, a PD. PD's are divided into 3W, 7W, and 14W classes. Some of their more important specifications are:

Input voltage = 37-57VDC
Average Power = 12.95W
Peak Inrush Current = 400mA

A very important note about IEEE 802.3af is that it is NOT merely a means of supplying and using power. Both ends of the system must incorporate power management support that supports the Ethernet or network data.



That sounds fine, but what do I REALLY need PoE for ? Why can't I just put 12V or 24V on the line and power my cameras or devices like that?

The big reason is that you could damage Ethernet network devices by placing power voltages in places that they do not belong. This applies to both installation and service scenarios. PoE is NOT merely a terminology for connecting power to a device. It is also a power management system that determines if and when power is actually needed.

One important feature of the specification is that it truly distinguishes the differences between PoE compliant and non-compliant terminals that do not accept power (eg, data). This detection guarantees a backwards compatibility in existing networks and provides a measure of protection during service routines as well.

How does the PoE system accomplish this ?

This is done by the PSE slowing ramping voltage to detect a particular resistance in a PD, such as a camera. Typically, this resistor is measured at 25K Ohms. This Voltage-Current-Measurement is known as Signature Detection.

Once a PD is detected, the class of the unit (3W, 7W, or 14W) is determined by another Voltage-Current-Measurement that is called Signature Classification. Once the signatures are defined, the electronic management of the power system kicks in and supplies the requisite amount of power to ONLY the ports that require it. See Figure 2 below.

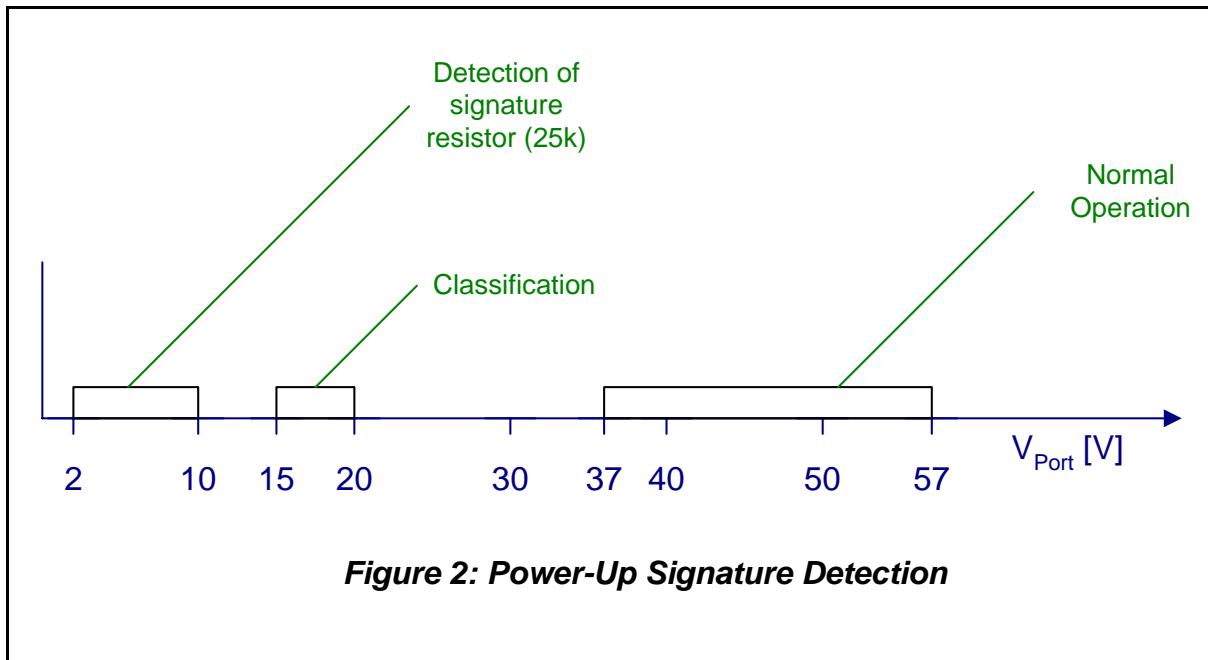


Figure 2: Power-Up Signature Detection

What is a power injector ?

The term “power injector,” or a derivative, is nothing more than a fancy term that describes how and where an installer may place power on any given structured wiring system. In general, power may be placed anywhere in the wire jacket that does not interfere with pairs of wire already assigned to a device or group of devices.

Ok, I have my power source and injector, now what?

The power you have placed on the system and assigned a pair of wires to is conducted to your IP camera, your phone, or your security device. Now, at the end of the system, your power is ready to be defined, distributed, and regulated.

In short, if you have 48V input, that means you have 48V at the device (or less, depending upon the voltage drop/distance you have between your power source and the device needing power. In any event, in the IEEE spec, you will need another module that supports the signature and type of the device, as well as the ability to convert the 40V source voltage to 12VDC or some other necessary voltage.

In essence, this last step completes the necessary requirements if one is to have an IEEE-compliant system. The compliant system may graphically be shown as:

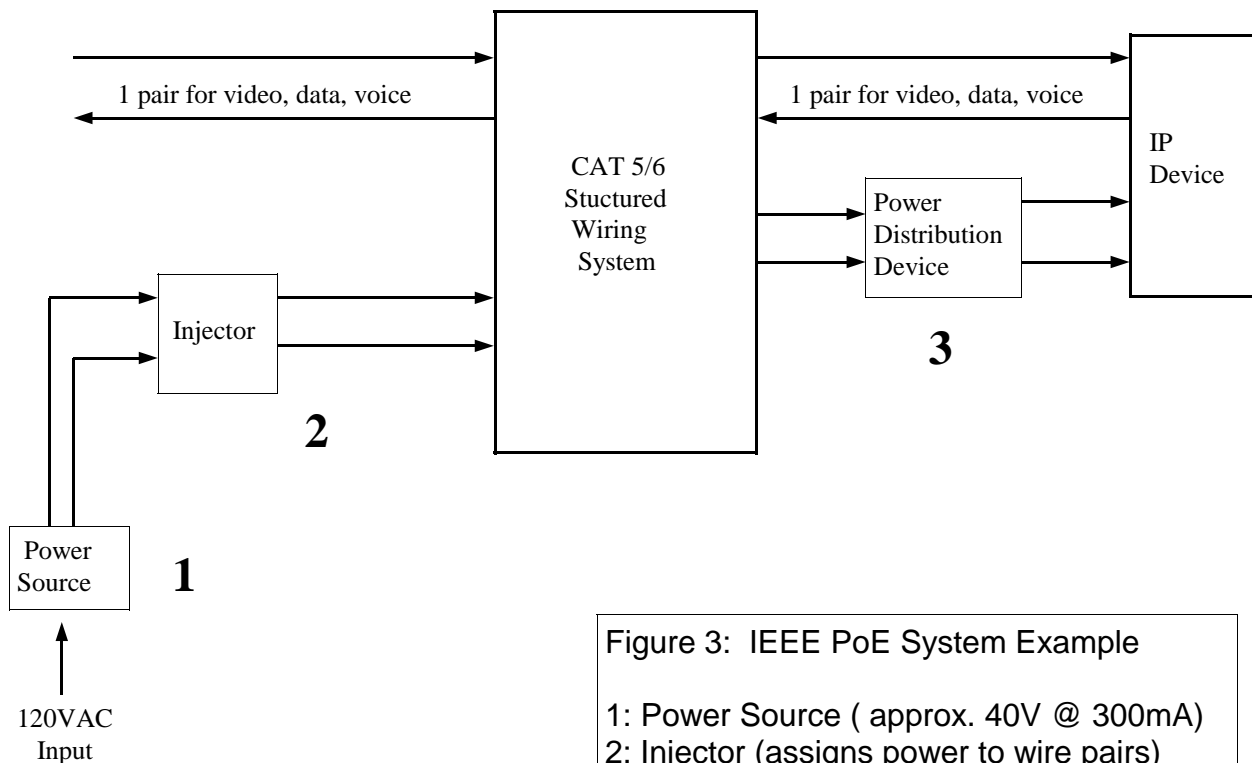


Figure 3: IEEE PoE System Example

- 1: Power Source (approx. 40V @ 300mA)
- 2: Injector (assigns power to wire pairs)
- 3: Power Distributor (Converts 40V to 12V)

Wow, that sounds like a lot of cost and a lot of steps to come up with an IEEE Compliant System. Plus, it doesn't cover 24VAC devices like cameras. What can we do?

The compliant system we have just been discussing is also called an “active” PoE system. It is “active” because you start with something around 48VDC, inject the power on the correct pairs of wire, transmit it over wire (letting the corresponding voltage drop take effect), and then the system regulates it down to the necessary voltage even further. Stealth Labs offers all the products you need for an active, IEEE compliant system.

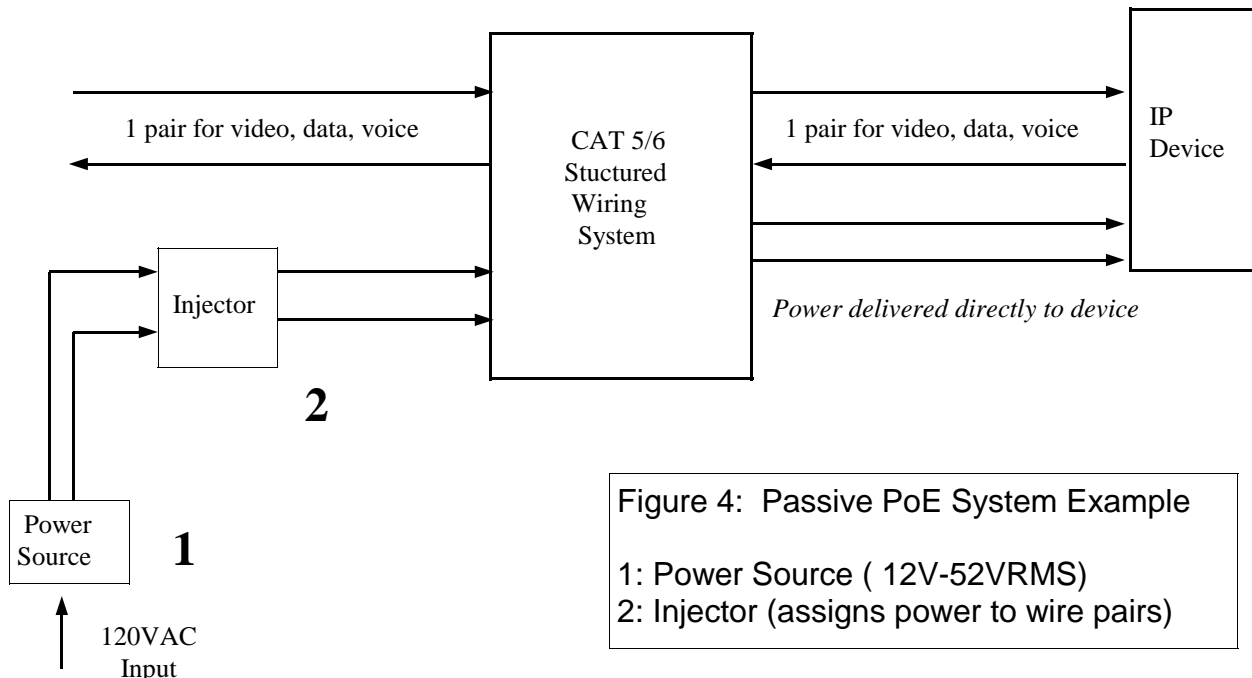
However, this approach, while well-defined, is also modular. Any modular design will cost more than one that is not. To combat this, and understanding how cost-sensitive the security industry is, Stealth Labs has also introduced a “passive” PoE system. Though not compliant to IEEE802.3af, it addresses the needs of the security industry while retaining the best features of the standard. We call it “Power over Twisted Pair,” or PoTP.

How does this PoTP System work?

The passive system is a simplified version of the IEEE system. An input signal is generated to the structured wiring system. This signal can be AC or DC, as long as it is between 12 and 52VRMS (This is the reading you would get on a hand-held voltmeter).

This input signal then goes to the injector, where the power is assigned to its pair of wires. The injector in this case works EXACTLY like it does in the active system.

The signal then goes into the structured wiring system and goes directly to the device or group of devices requiring the power. This is ideal for 24VAC cameras that are not affected as badly as 12VDC regarding voltage drop and small gauge wire. An example of a “passive” PoE system is below in Figure 4:



All this theory sounds good, but how do I apply it. Say I want to design an IEEE compliant system for my 12VDC cameras? How do I do it? What would I do to design a passive system for 24VAC cameras?

See the application notes for design and product information. If you need more, please feel free to call our technical support or customer service folks toll free at 1-800-360-4146.

Stealth Laboratories, LLC

Power over Ethernet Abbreviated Product List

<u>Product Name</u>	<u>Description</u>
C5-NJ02	48V Source Supply (IEEE compliant)
C5-P1215	12VDC 1.5A Source Supply (PoTP)
C5-P1225	12VDC 2.5A Source Supply (PoTP)
C5-P2440C	24VAC Source Supply/Injector (PoTP)
C5-NJ06	Power Injector (IEEE compliant)
C5-PD01	48V to 12V Distributor (IEEE compliant)
C5-KIT1SB	All in 1 compliant 12VDC PoE Kit
C5-KIT4AC	All in 1 Passive 24VAC PoTP Kit

Sample Solutions/Applications

Solution A: IEEE802.3af Compatible Products & Kits

The IEEE802.3af standard calls for three components, a power supply, an injector and a converter. Figure A1 below shows an integrated solution using the NJP-02 power supply/injector for up to two cameras.

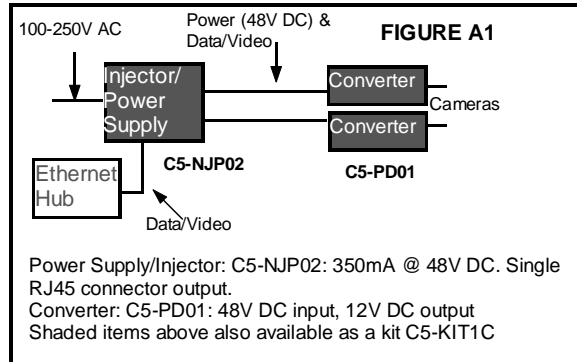
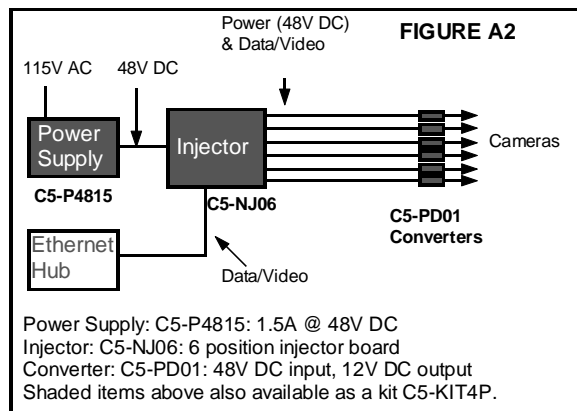


Figure A2 below shows a compliant six camera system utilizing Stealth Laboratories, LLC components.



Solution B: Economical Power over Twisted Pair

This economical solution eliminates the converter and allows a simpler power supply to be used, providing 12V DC or 24V AC and still using the benefits of unshielded twisted pair or CAT-5 wire.

