VIGITRON

POWER SOLUTIONS FOR SECURITY APPLICATIONS

INTRODUCTION

Security systems require different types of power sources depending on their applications. The process of determining which power source to use goes beyond just determining the required power level.

When choosing a power source for your security system one should answer many questions. Does the power source meet the requirements of connected devices over specific type and length cable? Do power source specifications meet PoE requirements for connected devices? Does the PoE source device provide enough power at required voltage level to power the connected device?

The other consideration is the type of cable. Each cable type has its own specification and limitations. Also the environment your power supply will be operating in is important. Power supply circuits generate heat. While this is an advantage in colder climates, it can prevent a power supply to operate under high temperature conditions.

This application booklet addresses these questions and considerations with the goal of helping you in choosing the correct power source for your application.

Vigitron offers solutions for virtually all your power source needs. Most importantly, our Design Center, staffed by experienced engineers, is ready to help you in choosing the most reliable solution for your application.

Network designs are as unique as their requirements. Vigitron provides a wide range of networking solutions. We invite you to contact our Design Center where our engineers can help with your network design specific to your application. This service is provided free and without obligation with the goal of providing you with the most reliable and cost effective solution. Please contact us at support@vigitron.com or call us as 1-858-484-5209 with any of your networking IP/PoE requirements. We look forward to working with you.

Regards,

Neil Heller
Vice President
Business Development
Vigitron, Inc
nheller@vigitron.com
1-714-305-7044

There are two common ways of powering security devices; local power supplies and PoE sources.

Choosing a power source for security devices that are directly powered by an AC or DC power source is relatively simple. The power source specification just needs to match the required voltage and power level of the device.

Selecting a PoE solution is more complex and involves considering level of power, voltage, the type and length of wires that power is transmitted over and the way that the connected device handles the received power.

Vigitron offers several educational documents and recorded webinars on PoE. We invite you to visit our website and YouTube channel to learn more about PoE.

Terms:

Let's review a few of power related terms:

AC (Alternating Current): This is the type of power running through your home electrical system. The changing voltage produces a sine wave with the amplitude centered around zero volts.

DC (Direct Current): this is power that current flows only in one direction.

PSE (Power Source Equipment): this is a term used in the PoE standards. It refers to the PoE source and notes that it complies to the safety within the PoE standard that prevents damages from over current and over/under voltage.

PD (Powered Device): This is a term used in PoE standards. It refers to the device that is capable of receiving PoE from the PSE and conforms to the safety within the PoE standard that prevents damages from over current and over/under voltage.

Injector: This is a passive device that combines DC power with Ethernet signal. They usually provide very simple or no protection against over current or voltage. Some Injectors only accept DC power and some can accept AC power and convert it to DC. It is a common mistake to call a PSE an Injector.

Power Supply Packaging Types: There are 3 main packaging for AC or DC power supplies used for security applications:

Wall Mount

Desktop

DIN Rail

Power supply Protections:

Inrush Current: When an electrical device powers up, it can takes more power than what they need during normal operation. The same applies when IP/PoE cameras turn on functions such as day/night, LEDs and PTZ start up and other extra functions.

Short Circuit Protection: A short circuit draws extreme current levels. In a short circuit condition, most power supplies are designed to shut-down and typically recover to normal operation when the short is removed.

Over Load Protection: It either limits output current draw or allows it only for a short time to prevent damage to the power supply. When power supplies are first turned on, a high input current surge is experienced caused by the charging of the bulk input capacitors. Also called Input Surge Current most commonly referenced in AIR-DC power supplies.

Over Voltage Protection: A circuit that shuts down the power supply when the output voltage exceeds a certain level.

Over Temperature protection: When a power supply's circuit reaches a higher than specified level the internal protection circuit will shut down

Power Supplies and Temperature:

Ambient temperature not only affects a cable's current carrying capacity, it also affects the performance and reliability of power supplies.

The efficiency of a power supply decreases as temperature increases, so it is important to operate within the recommended temperature range. While in most applications the high temperature limit is a concern, in some applications the low temperature limit is important. There are usually 2 types of low temperature limits; operating temperature and "Cold start". The "Cold Start" limit is the lowest environment temperature that the power supply can start working. After power up, the internal circuit of the power supply generate heat and can tolerate a lower operating temperature.

When choosing a power supply for a cold climate the "Cold Start" limit is the main parameter that needs to be considered.

Power supply Connections:

When using AC or DC power supplies, power is transmitted over a pair of wires to the powered device. There are several factors such as wire length, wire size and environmental temperature that affect the connection cable's total resistance and resulting power loss.

Distance: In most cases the distance between a power source and the device is limited to a few feet resulting in little or no power and voltage loss. In some situations a device might be located at a distance away from the power source. In these situations the wire resistance is a critical factor in loss of power over the wire and the power and voltage level that the device receives. The longer the distance the greater the cable resistance and the power loss.

Wire size: The other important factor in wire resistance is the thickness of the wire. The most common wire sizes in security starts with 24-gauge wire which is the size of Cat5/e cabling, progressing to 16/2 which is just about the limit found in common applications.

In short distances the amount of power loss over the wire is negligible. But in long distance the loss can be significant. As the gauge number of wire decreases the size (diameter) increases and the resistance decreases.

Current limitations of Wires:

Wire size is expressed as AWG (American Wire Gauge). The size also determines how much current a wire can carry. The more the cable resistance, the higher the heat generated. The higher the heat generated the greater the resistance. This also accounts for the differences in cable distance performance.

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AWG	Dia mm	SWG	Dia mm	Max Amps	Ohms / 100 m
11	2.30	13	2.34	12	0.47
12	2.05	14	2.03	9.3	0.67
13	1.83	15	1.83	7.4	0.85
14	1.63	16	1.63	5.9	1.07
15	1.45	17	1.42	4.7	1.35
16	1.29	18	1.219	3.7	1.48
18	1.024	19	1.016	2.3	2.04
19	0.912	20	0.914	1.8	2.6
20	0.812	21	0.813	1.5	3.5
21	0.723	22	0.711	1.2	4.3
22	0.644	23	0.610	0.92	5.6
23	0.573	24	0.559	0.729	7.0
24	0.511	25	0.508	0.577	8.7

PoE SOURCES

DC power supply for PoE Applications

PoE has specific requirements regarding both power and voltage at the powered device. The IEEE PoE standard, depending on the power class, requires a DC power source ranging between 37-57 VDC for PoE powered devices at the device location. On average, the DC voltage required to reach a PoE powered device at less than 328 feet (100m) is 42.5 VDC.

The IEEE 802.3af Standard requires a 15.4W source while 802.3at requires a 30W source. For example a DC source of 15VDC @ 1 amp will produce 15W power and a 15VDC @ 2A, 30W, but since the voltage is not within 37V-57V DC, it would not work for PoE applications.

How much PoE power do you really need?

Determining the actual required PoE power can be complex. A product specifications may indicate the power requirement or the class level of PoE. If the former, such as a number like 7W you must take into account, the potential for the connected devices to surge perhaps at much as 20%, so a 7W indicates really an 8.4W required power. If the device's required power is expressed as a PoE Class, such as Class 3 or Class 4, it may or may not have taken a surge into account.

The following table defines PoE class requirements:

IEEE Standard	802.3af	802.3at	802.3bt*	802.3bt*
Type	Type 1	Type 2	Type 3	Type 4
Status	Released	Released	Draft	Draft
Maximum number of energized pairs	2 Mode A (Endspan) Mode B (Midspan)	2	4	4
Maximum DC current per pair	350 mA	600 mA	600 mA	960 mA
Maximum power provided by the Power Sourcing Device (PSE)	15.4W (Class 0) 4.0W (Class 1) 7.0W (Class 2) 15.4W (Class 3)	15.4W (Class 0) 4.0W (Class 1) 7.0W (Class 2) 15.4W (Class 3) 30.0W (Class 4)	45.0W (Class 5) 60.0W(Class 6)	45.0W (Class 5) 60.0W (Class 6) 75.0W (Class 7) 90.0W (Class 8)
Minimum power required at the Powered Device (PD)	12.95W (Class 0) 3.84W (Class 1) 6.49W (Class 2) 12.95W (Class 3)	12.95W (Class 0) 3.84W (Class 1) 6.49W (Class 2) 12.95W (Class 3) 25.5W (Class 4)	40.0W (Class 5) 51.0W (Class 6)	40.0W (Class 5) 51.0W (Class 6) 62.0W (Class 7) 71.3W (Class 8)
PSE Output Voltage	42-57 VDC	50-57 VDC	50-57 VDC	52-57 VDC
PD Input Voltage	37-57 VDC	42.5-57 VDC	42.5-57 VDC	41.1-57 VDC

PoE Classes and Wiring Requirements:

The IEEE PoE standard defines 8 power classes for category cables such as Cat5, 5e,6, 6a. Each class specifies not only the level of power and voltage, but also the number of conductors that PoE is transmitted over. The PoE standard is based on using CAT5/e wiring which is 24 gauge. This limits the amount of current can be carried over any pairs. The Cat 5e/6/6a has 4 pairs of conductors where the limit for a 2 pairs defined by PoE standards is 30W.

In order to transmit more than 30W, all four pairs of conductors need to be used. It also requires the powered device to be able to receive power on all four pair. Powered devices that require more than 30W, such as 60W cameras, use 2 PDs or 802.3at x 2 requiring the source of PoE also provide 2 PSEs, one on each 2 pairs.

The following table provides a brief information on the PoE classes:

Comparison of IEEE 802.3 PoE Amendments				
IEEE Standard	**802.3af – 2003[1]**	**802.3at – 2009[1] "POE+"**	**802.3bt – 2018 "POE++" (draft)[2]**	**802.3bt – 2018 "POE++" (draft)[2]**
Type	Type 1	Type 2	Type 3	Type 4
Power/Port	15.4 W	30 W	60 W	90-100 W
Volts Source (Min.-Max.)	44 - 57 VDC	50 - 57 VDC	50 - 57 VDC	52 - 57 VDC
Volts Device (Min.-Max.)	37 - 57 VDC	42.5 - 57 VDC	42.5 - 57 VDC	41.1 - 57 VDC
Current (Max.)	350 mA	600 mA	600 mA /pair	960 mA /pair
Assured Power	12.95 W	25.50 W	51 W	71 W
Supported Cabling (min.)	Category 3	Category 5	Category 5	Category 5

DIN Rail DC Power Supplies for PoE Applications

Vi10120
120W @ 56VDC

Vi10240
240W @ 56VDC

Vi10480
480W @ 56VDC

These hardened power supplies have an operating temperature range of -25ºC to +70ºC with the ability to provide back up power and power sharing with DIN Rail mounting.

Desktop DC Power Supplies for PoE Applications

Vi1120
120W @ 56VDC

Vi0017
40W @ 48VDC

These DC power supplies can provide power to PoE sourcing devices.

Wall-mount DC Power Supplies for general applications

Vi0012
12W @ 12VDC

Vi0014
36W @ 12VDC

Small DC supplies are used to provide power to DC devices with different power requirements.

PoE Splitters

PoE splitters accept combined PoE and Ethernet data and provides separate DC power and data ports. It is used to power non-PoE IP devices over long distances.

Vi22101
Single Port PoE Splitter
PoE input: 802.3af/at (15.4W)
Power Output: 12VDC
Data: 10/100Mbps

Vi22201
Single Port PoE Splitter
PoE input: 802.3af/at (30W)
Power Output: 12/24VDC
Data: 10/100Mbps

Vi22301
Single Port PoE Splitter
PoE input: 802.3af/at/bt (60W)
PoE Output: 802.3af/at (30W)
Power Output: 12/24VDC (30W)
Data: 10/100Mbps

Single Port PoE Midspan

Single port PoE Midspan provide power and transmission over all 8 PoE classes up to 90W with extended temperature range operation.

Vi2201
Single Port PoE Midspan
Power Input: 110/240VAC
PoE Output: 802.3at (30W)
Data: 10/100/1000Mbps

Vi22401
Single Port PoE Midspan
Power Input: 110/240VAC
PoE Output: 802.3af/at/bt (60W)
Data: 10/100/1000Mbps

Vi22001
Single Port PoE Midspan
Power Input: 110/240VAC
PoE Output: 802.3af/at/bt (90W)
Data: 10/100/1000Mbps

Special Application Midspans

Vi3202
Single Port Coax PoE Midspan
Power Input: 24VAC/DC
PoE Output: 802.3af/af/bt (60W)
Distance: up to 5000feet (1524m)
Data: 10/100Mbps

Vi3004LV
4-Port L2 PoE Switch
2 Copper Ports, 2 Fiber Ports
Power Input: 24VDC
PoE Output: 802.3af/at/bt (60W)
Data: 10/100/1000Mbps

Multi-port Managed PoE Midspans

Managed midspans provide port power up 74W per individual port. Some features include automatic port/PoE restart, configurations, status reporting, SNMP and email alerts. Free management software provides security, and the ability to monitor up to 400 ports.

Vi2208A
8-Port PoE Midspan
PoE Output: 802.3af/at/bt (74W)
Data: 10/100/1000Mbps

Vi2216A
16-Port PoE Midspan
PoE Output: 802.3af/at/bt (74W)
Data: 10/100/1000Mbps

Managed Extended UTP Midspan

Extended Midspans reduce required rack space and port cost by providing both PoE power and Ethernet extenders in one package.

Vi2508
8-Port Extended UTP PoE Midspan
PoE Output: 802.3af/at/bt (74W)
Distance: up to 3000feet (909m)
Data: 10/100Mbps

Vi2516
16-Port Extended UTP PoE Midspan
PoE Output: 802.3af/at/bt (74W)
Distance: up to 3000feet (909m)
Data: 10/100Mbps

Managed Extended Coax Midspan

Coax Midspans reduce rack space and port cost by providing both PoE power and Coax Ethernet extenders in one package.

Vi2608
8-Port Coax PoE Midspan
PoE Output: 802.3af/at (36W)
Distance: up to 5000feet (1524m)
Data: 10/100Mbps

Vi2616
16-Port Coax PoE Midspan
PoE Output: 802.3af/at (36W)
Distance: up to 5000feet (1524m)
Data: 10/100Mbps

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- SINGLE-PAIR EXTENDERS
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- MANAGED FIBER SWITCHES
- HARDENED POE SWITCHES
- MANAGED POE MIDSPANS
- POE SPLITTERS
- ACCESSORIES
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- PoE & ETHERNET REPEATERS
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- HEALTH MONITORING APPS

7810 Trade St., Suite 100
San Diego, CA 92121, USA

Tel: (+1) 858-484-5209
Fax: (+1) 858-484-1205

Email: support@vigitron.com
Website: www.vigitron.com