2024 Vigitron Seminar Series

Configure Network For Success

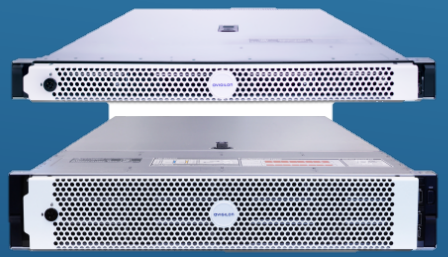
VIGITRON

Security Industry is Rapidly moving towards Higher PoE

Reasons for growing number of cameras requiring IEEE 802.3.bt PoE:

- Increased sales of multisensory cameras
- Increased sales of thermal cameras
- Increased use of higher power
- IR LED with greater range

Summary: The addition of 4 new PoE classes and difference in PoE operation from different manufacturers is adding confusion and potential more reliance on Vigitron's Design Center services and knowledge base.



Jumbo Frame/
1G Port

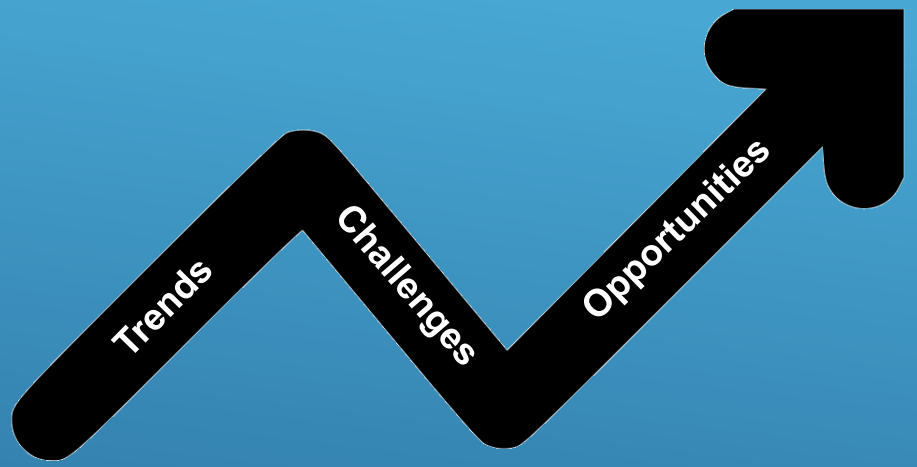
UPoE
802.3bt

10G Uplink

PoE Volume

- The technical demands on IP/PoE systems are growing
- 1000Mbps camera ports
- Multisensor Cameras
- Higher MP cameras
- 10G server and network connections
- 802.3bt – confusion over 8 different PoE classes

Security Industry Trends



Move from PTZ to Multi-Sensor

- Camera ports move from 100Mbps to 1G
- Image Packet sizes move to Jumbo Frame
- The Power of Rings

Problem: Network Transmission loses images

PoE power moves from UPoE to 802.3bt

- PoE incompatibility
- PoE power devices (cameras) shutting down
- Adding PoE devices to existing incompatible sources

Problem: Many existing network switches will need to be replaced.

Move from UTP to Fiber

- Need to transmit higher bandwidth at longer distances-IDF to MDF

Problem: Lack of SFP compatibility
Lack of SFP standards
Switches lack AMS (automatic media sensing) for combo ports
Switches and SFPs lack DDMI (Digital Diagnostic Monitoring Interface) to help determine interfaces

The camera determines:

- Individual picture size known as packet size
- The number of images per second
- The compression ratio
- The amount and type of PoE

What is OM Fiber Cable: OM stands for Optical Multimode - all are 850nm

OM Fiber Specifications and Applications							
OM Type	**Image**	**Jacket Color**	**Core Size**	**Data Rate**	**Wavelength**	**Maximum Distance**	**Application**
OM 1		Orange	62.5um	1000Mbps (1G)	850nm	990 feet (300m)	Short distance - primary used in existing applications
OM 2		Orange	50 um	1000Mbps (1G)	850nm	1,980 feet (600m)	New fiber installations
OM 3		Agua	50um	10,000Mbps (10G)	850nm	990 feet (300m)	Short distance 10G applications

Fiber type and class	Diameter (µm)	Jacket color
Multimode Ia	50/125	Orange
Multimode Ia	62.5/125	Slate
Multimode Ia	85/125	Blue
Multimode Ia	100/140	Green
Singlemode IVa	All	Yellow
Singlemode IVb	All	Red

These are general guidelines. There are no industry standards fiber suppliers have to conform to. Also note both OM2 and OM3 have similar data rates and wavelengths but for different bandwidth applications

IDENTIFYING EXISTING CABLES

DO THIS - NOT THAT

Make certain you have followed the previous steps:

1. Make certain the SFPs on both ends of the cable are the same
    a. This is due to the non- standardization of SFP

2. Make certain the SFP match the bandwidth of there connected devices
    a. This is important when the connected devices are not managed and have fixed port bandwidths.

    b. Higher nm fiber can be used with lower nm fiber but its not recommended

3. Make certain the SFP match the fiber cable.
    a. You cannot mix single and multimode
    b. Core frequency must be match- do not cross 1310nm with 850nm fiber

4. Single mode and multimode cannot be mixed

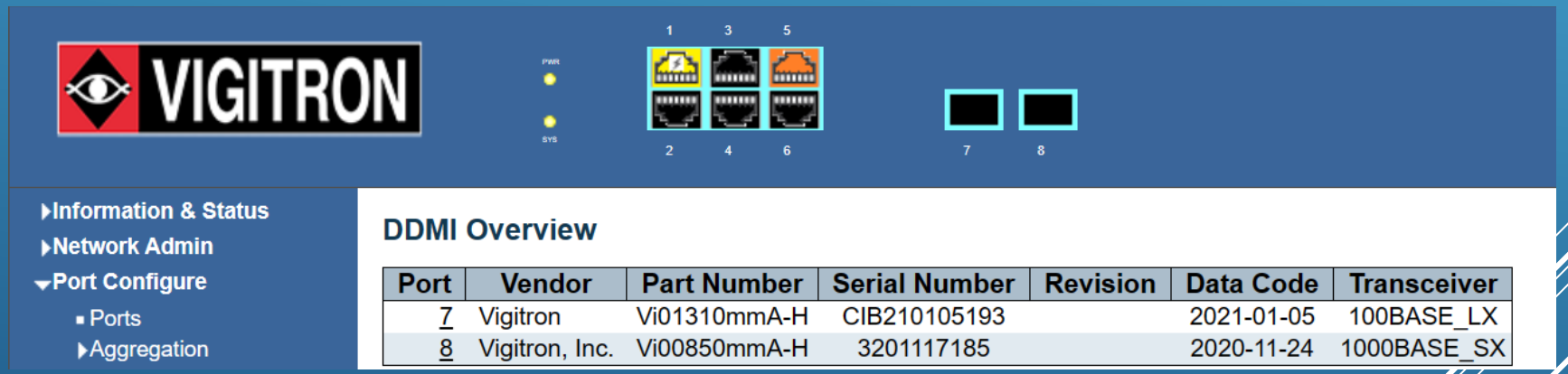
Integrating Fiber- Does your Switch recognize the SFP

Does your SFP have **DDMI built into its firm?** Can your **switch read DDMI?**

DDMI stands for **Digital Diagnostic Monitoring Interface** – reads status information from an SFP to a network Switch

SFP Information for Port 22

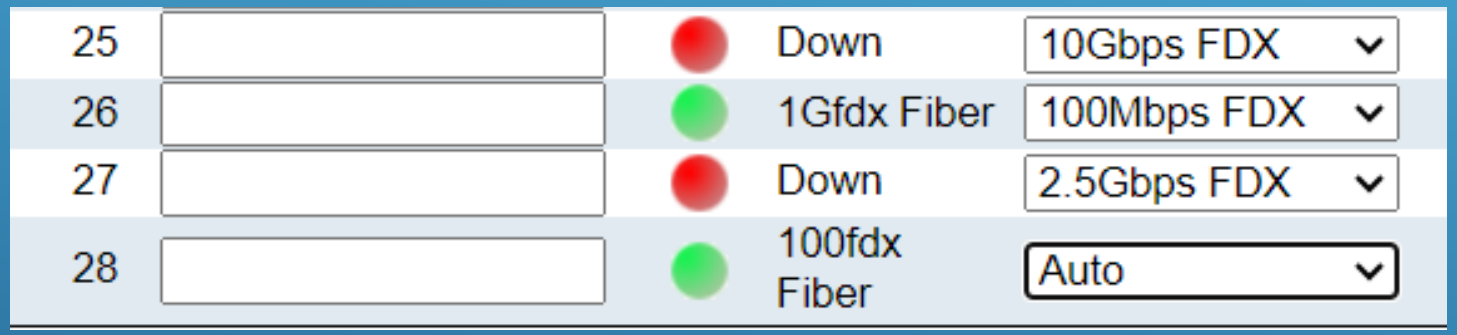
Connector Type	SFP - LC
Fiber Type	Multi-mode (MM)
Tx Central Wavelength	850
Bit Rate	1000 Mbps
Vendor OUI	
Vendor Name	Vigitron
Vendor P/N	Vi00850MM
Vendor Revision	0000
Vendor Serial Number	DA29020002
Date Code	131029
Temperature	none
Vcc	none
Mon1 (Bias)	none
Mon2 (TX PWR)	none
Mon3 (RX PWR)	none



A network switch must have the ability to read DDMI messaging from an SFP.

An SFP must have DDMI built into their firmware

Fiber – Programming Port Bandwidth

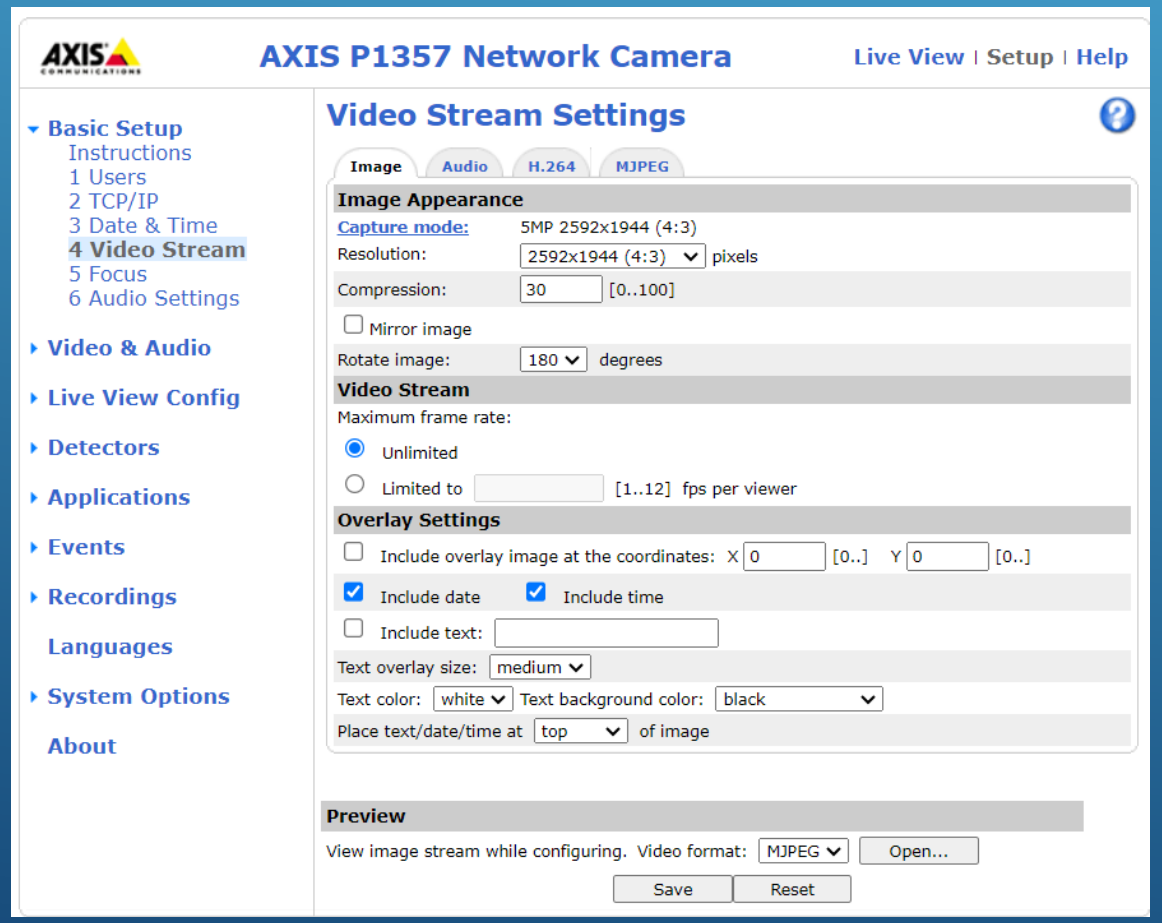


When using SFPs do not use the Auto bandwidth setting

Use the fixed bandwidth setting associated with the SFP

Correcting Network Packet and Bandwidth Issues

- Bandwidth

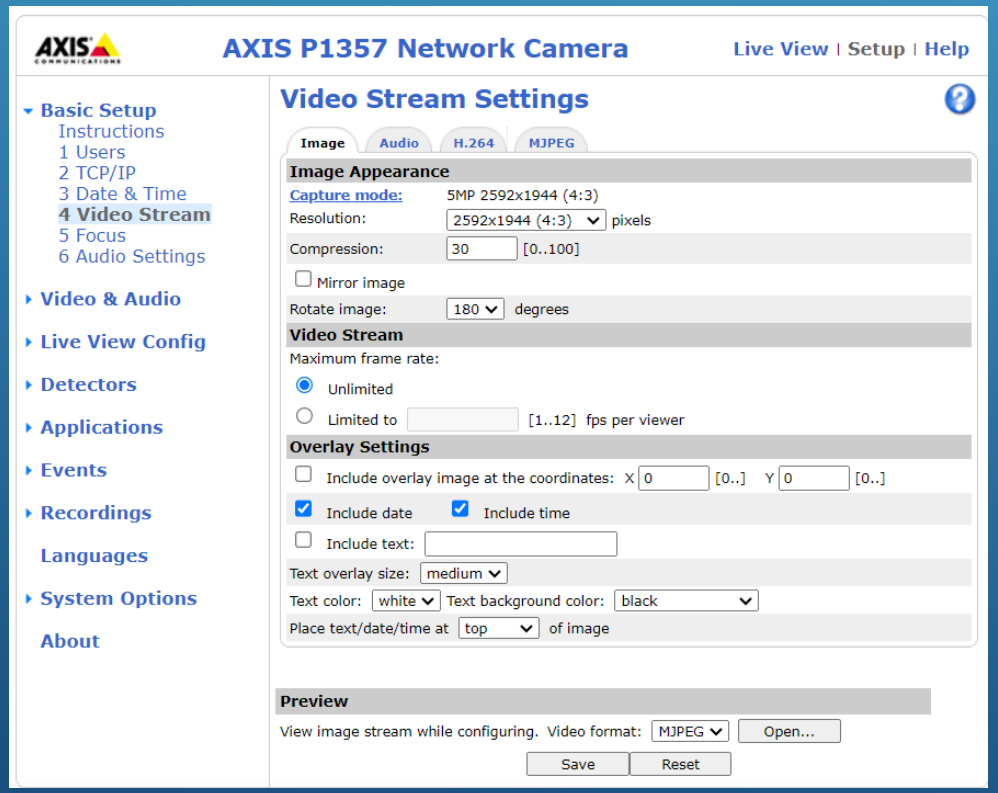


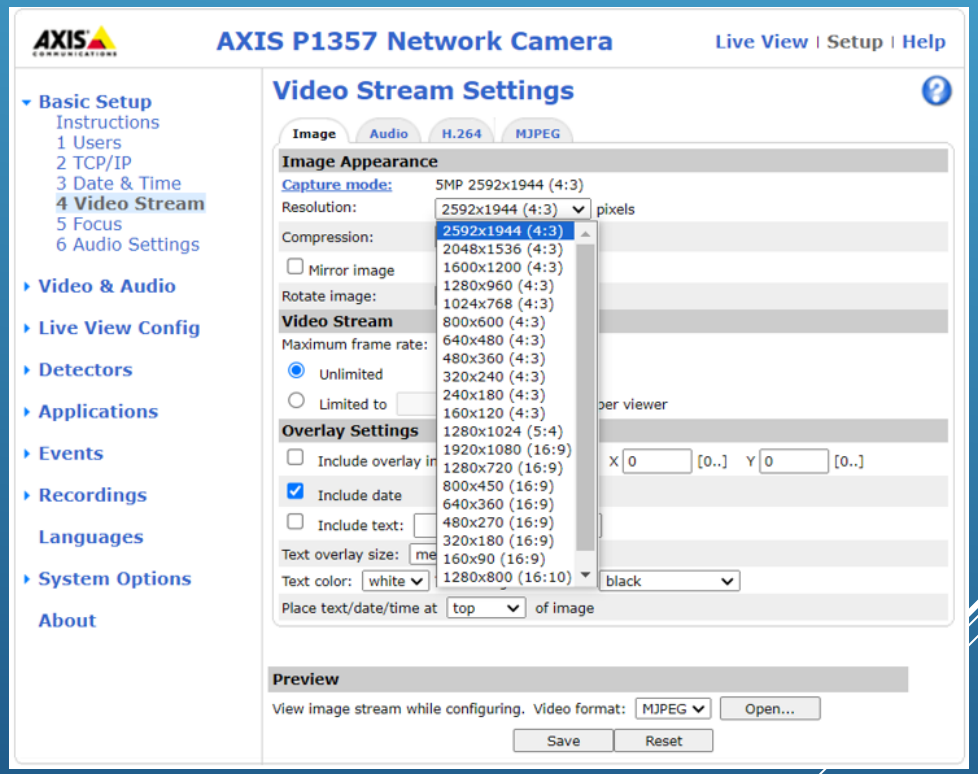
Reduce frame Rate

5. Correcting Network Packet and Bandwidth Issues

- Packet Size

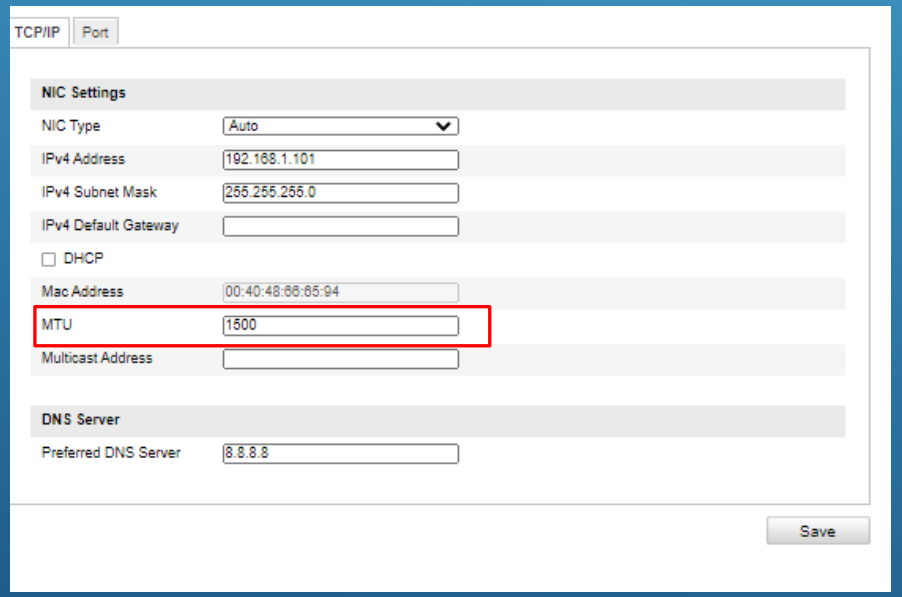
Reduce the Pixel Size which reduces the Packet size

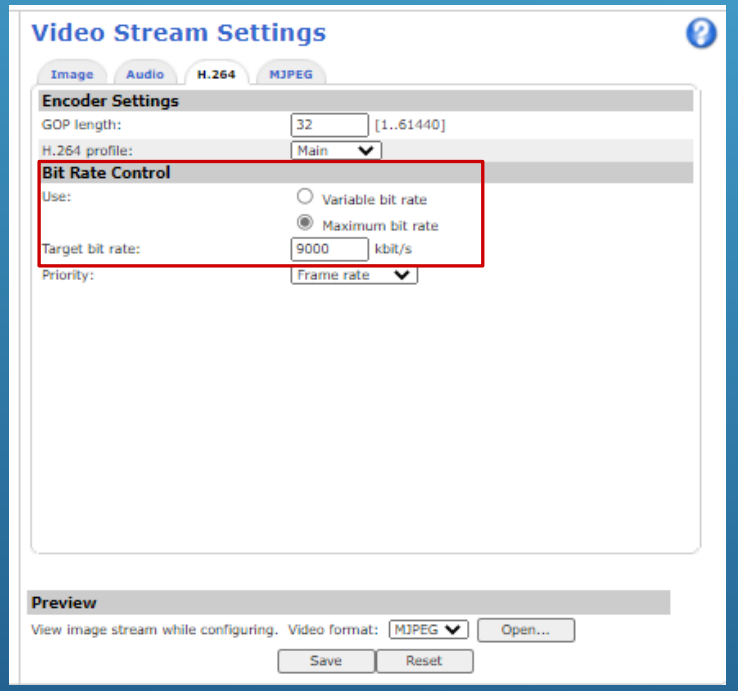




I still have problems- Packet Size

The previously outlined steps do not address individual packet sizes. This cannot only result in blocking the frame but can also result in CRC errors.



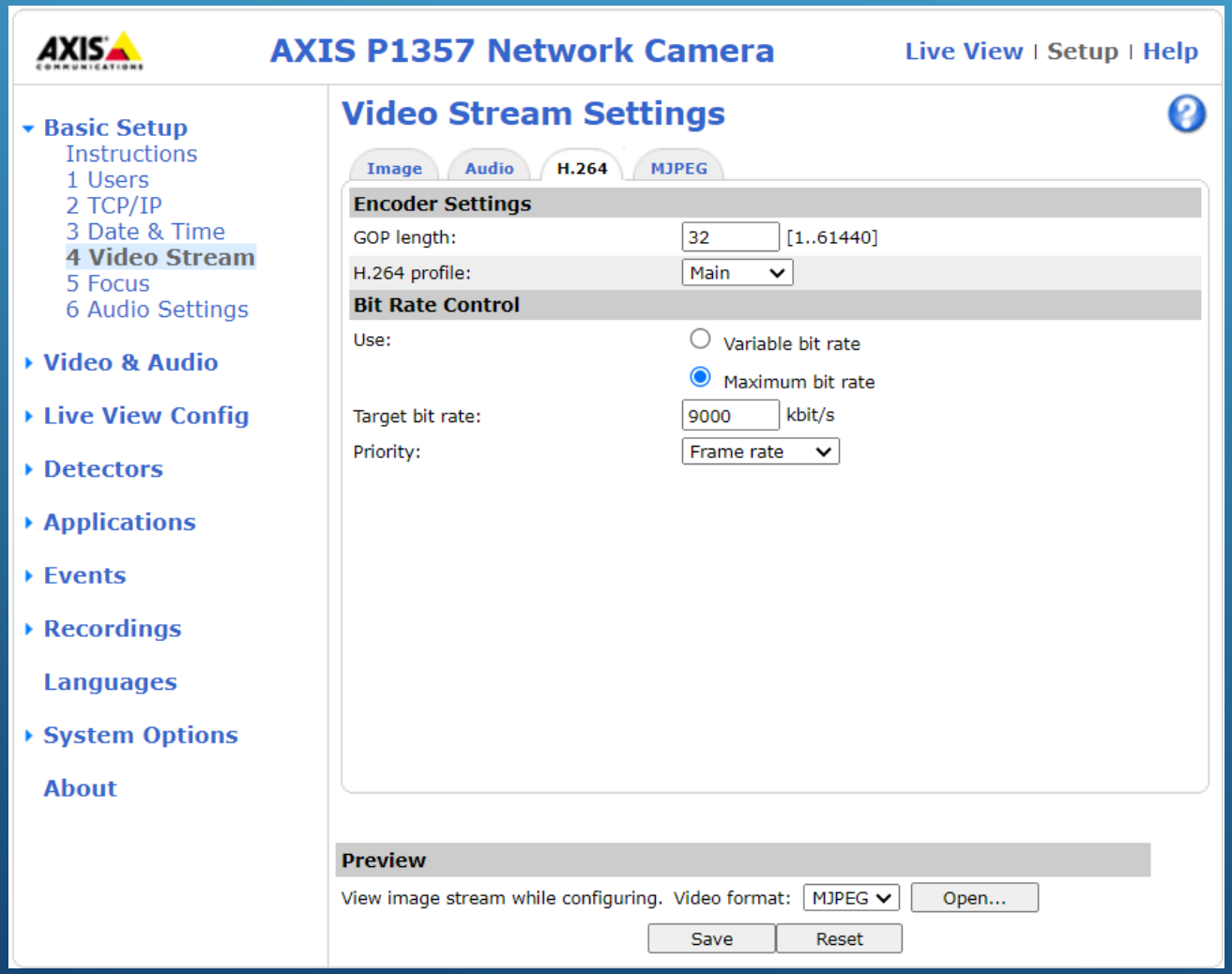


These adjustments are found in the camera set up. There are no standards. Some cameras may refer to packet size as MTU **(Maximum Transfer Unit).** Others may allow settings for a maximum rate or **allow the rate to vary.**

All settings will affect picture quality and is compromise between transmission reliability and image quality.

Correcting Network Packet and Bandwidth Issues

- Packet Size



Reduce the Packet Size below Jumbo frame size <1518bytes

UPoE: Incompatibility issue

802.3af (15.4W)
802.3at (30W)
up to 37W

2-Pair Wires

Class 4- 25.5 W Device

One PD

Up to 74W

4-Pair Wires

Up to 90W Device

Two PD

IP/PoE Connections – Importance Factors & Terminologies

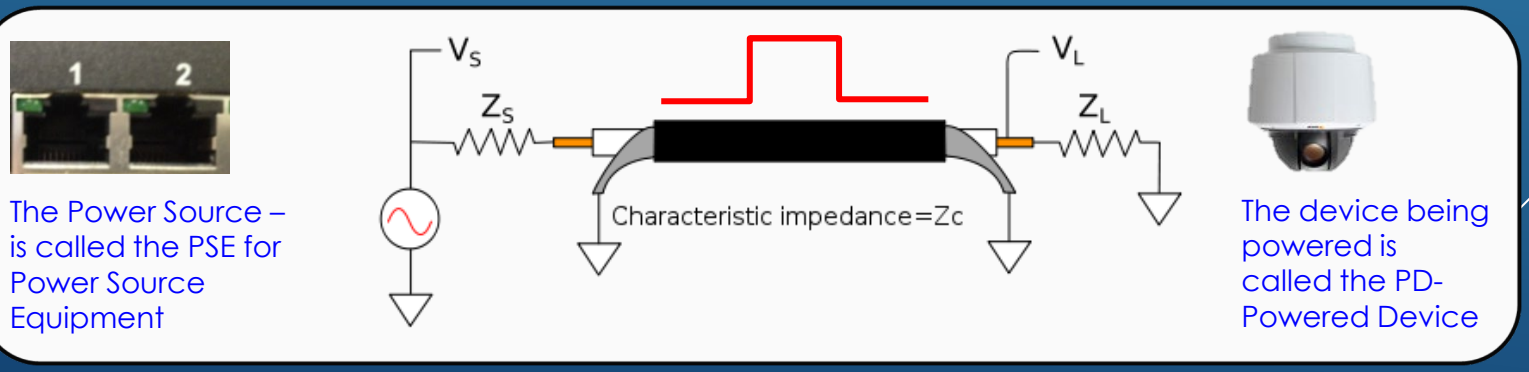
PD Acceptance Criteria

- Characteristic resistance =GOOD (19k − 26, 5k)
- Typical resistance value = RTY P (25k)
- Extended Distance =22K @ 1,000 feet
- Characteristic capacitance = CGOOD (max.150nF)

PD Rejection Criteria

- Resistance less than or equal RBADmin (<= 15k) or
- Resistance greater than or equal RBADmax (>= 33k)
- Capacitance greater than or equal CBADmin (>= 10µF)

The effect is greater on the detection pulse .



Step 3: PoE Transmission & Cables

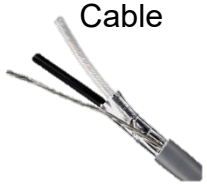
The following cable specs are useful experimental values that are used to Accept or Reject cables for PoE/IP Transmission:

UTP Cat Cable Acceptance Criteria

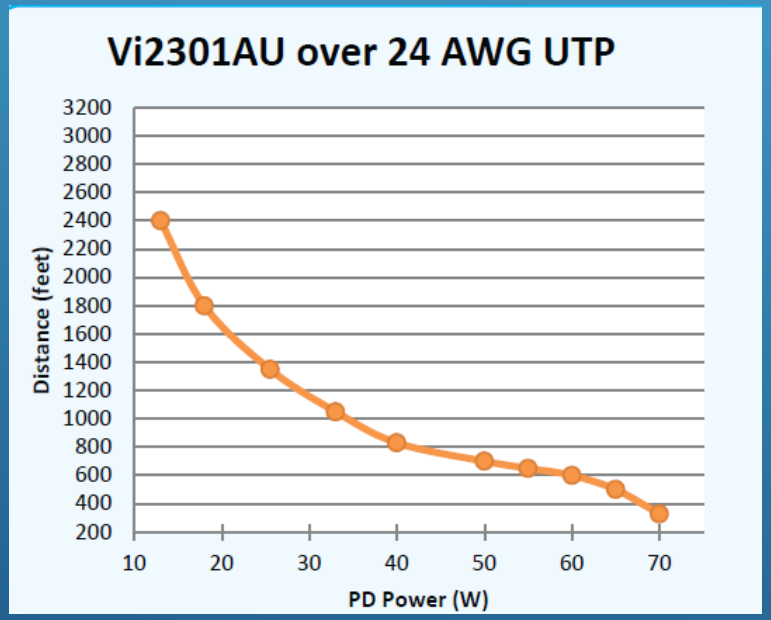
- Cable resistance per 303 meters =< 22 ohms
- Cable Capacitance =<10uf

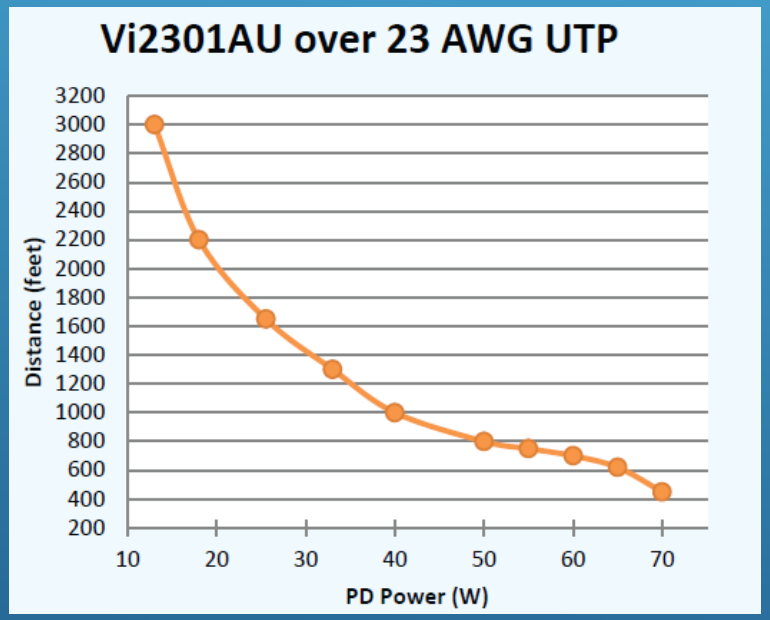
RG59U & RG6 Rejection Criteria

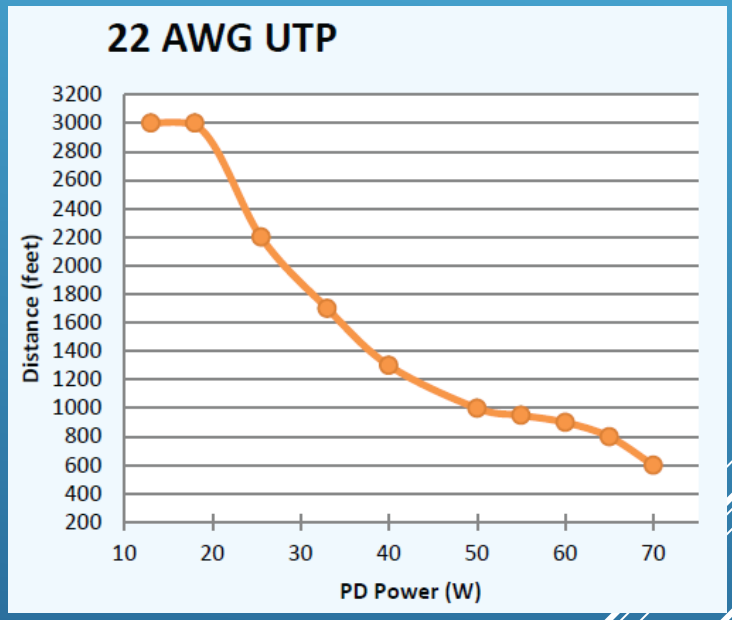
- Resistance <19 ohm >=33
- Capacitance >=10uf

	Cat 5e/Cat 6	Non Twisted Cable	Shielded Twisted Pair	Single Pair	Coax
					
	Standard	Non-Standard	Non-Standard	Non-Standard	Non-Standard
Resistance/ Capacitance	Standard by IEEE	Decreased outside inference affects performance	Increased resistance and capacitance from shielding lowers performance	Various by wire gauge, and shielding	Most performance is based on RG59U, capacitive differences exist for other versions

Step 3: Transmitting 802.3bt Over Long Distances







Power				Cat5E 24AWG Can run to 26AWG	Cat6 23AWG Can run 22-26 AWG	Cat5E 22AWG
25.5				650	650	650
33				650	652	650
40				650	650	650
50				650	650	650
55				650	650	650
60				**600**	**650**	**650**
65				**530**	**650**	**650**
70				**450**	**550**	**650**

As PoE power increases so does the heat generated- so in the 22AWG range special cable is required

Not Standard 22AWG

The Vigitron 802.3bt Solution for any type of cables

- Vigitron PSE solutions cover all major transmission cables
- All Solutions are applying to:

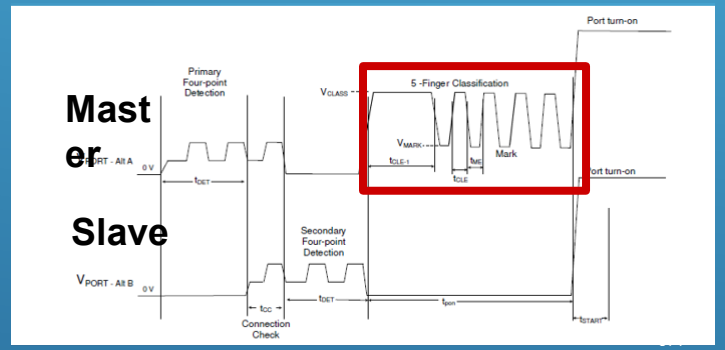
802.3bt	802.3bt	802.3at	X
PoE Class 0-8 90W	PoE Class 0-8 90W	PoE Class 0-4 36W	No PoE Transmission

Cat 5e/Cat 6	Shielded Twisted Pair	Coax	Fiber
			
Standard For PoE	Non-Standard	Non-Standard	Non-Standard

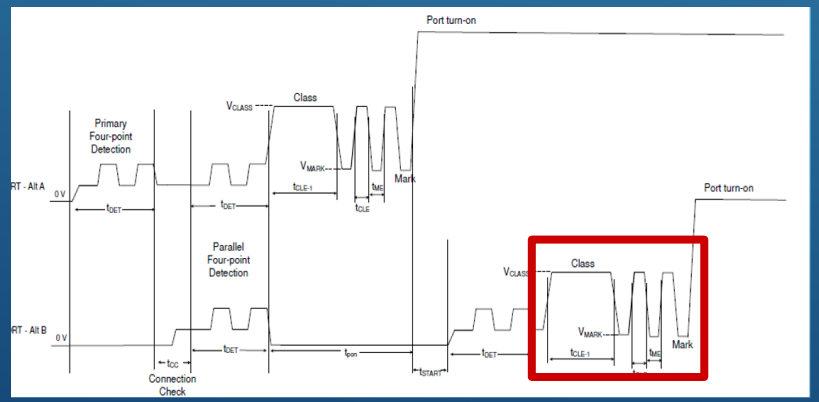
Based on Vigitron "U" Solutions				
	PoE Class 0-8 90W	PoE Class 0-8 90W	PoE Class 0-6 60W	PoE Class 0-6 60W

802.3bt

How Does Vigitron achieve “Universal” compatibility with UPoE and 802.3bt



Both UPoE and 802.3bt use all 4 pairs



Power Over Ethernet Configuration

Reserved Power determined by	○ Auto	◉ Manual
Power Management Mode	○ Actual Consumption	◉ Reserved Power

For UPoE and high power applications at long distance both use PoE manual – port is automatically set to 90W the amount of channels providing PoE is limited to 90W equal to the total PoE budget.

Reserved Power is determined by the auto or manual setting- for auto- is 90W, but manual you can setting.

Programming PoE

Case 1: Programming more total Port Power than available PoE Budget

Power Over Ethernet Configuration

Reserved Power determined by	○ Auto ◉ Manual
Power Management Mode	◉ Actual Consumption ○ Reserved Power

PoE Power Supply Configuration

Primary Power Supply [W]
480

PoE Port Configuration

Port	PoE Mode	Priority	Maximum Power [W]	Description
*	<>	<>	90	
1	PoE++	Low	90	
2	PoE++	Low	90	
3	PoE++	Low	90	
4	PoE++	Low	90	
5	PoE++	Low	90	
6	PoE++	Low	90	
7	PoE++	Low	90	
8	PoE++	Low	90	

In this case all ports have the same priority
Operation is dependent upon the firmware
- a. No ports will have PoE
- b. System will provide its own priority starting with Port 1

Case 2: Programming PoE Port Priority

Power Over Ethernet Configuration

Reserved Power determined by	○ Auto ◉ Manual
Power Management Mode	◉ Actual Consumption ○ Reserved Power

PoE Power Supply Configuration

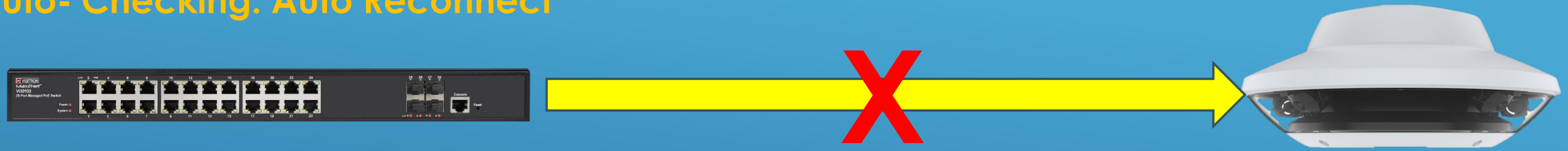
Primary Power Supply [W]
480

PoE Port Configuration

Port	PoE Mode	Priority	Maximum Power [W]	Description
*	<>	<>	90	
1	PoE++	Critical	90	
2	PoE++	High	90	
3	PoE++	Low	90	
4	PoE++	Low	90	
5	PoE++	Low	90	
6	PoE++	Low	90	
7	PoE++	Low	90	
8	PoE++	Low	90	

In this case Port PoE priority is provided based on the programmed priority – in general if all ports with have the same setting, PoE application will revered to port priority

Auto- Checking: Auto Reconnect



Disconnections can happen for any reason

Most often it occurs when due to the operation of “accessory functions: such as day/night, LED, autoback focus, PTZ, Heater/Blower operation cause the PoE required to increase greater than the source can provide

The Power of Rings

Power AXIS Q6100-E with Solo Kit (without a PTZ):
Power consumption: typical 9 W, max 23 W

External power input 24 V DC: typical 8.6 W, max 75 W
AXIS Midspan 30 W 1-port: 100-240 V AC, max. 30 W

AXIS Q6100-E with AXIS Q61-E PTZ Network Cameras:
AXIS High PoE midspan 1-port 100-240 V AC, max
60 W recommended

AXIS Q6100-E with AXIS Q63-E PTZ Network Cameras:
AXIS High PoE midspan 1-port 100-240 V AC, max
60 W recommended, plus AXIS Camera Heater Power Supply
(required when used with AXIS Q63-E PTZ Network Camera)

Ring Power

Fixed → Fixed Field of Light

Variable → Fixed Field of Light

Variable → Fixed Field of Light

With IR: 52 W with 24 VDC 74 VA with
24 VAC 51 W with high power PoE

(PoE++) Without IR: 26 W with 24 VDC
37 VA with 24 VAC 25.5 W with IEEE
802.3at Type 2 (PoE+)

Programming the correct PoE power

Start by Reading the Product Specification Sheets

Power	Axis High PoE 60 W SFP midspan 1-port: 100–240 V AC, max 1.5 A IEEE802.3bt Type 3 Class 6 Possibility to optimize power consumption of camera: Full power: typical 15 W (no IR), max 51 W Low power: typical 15 W (no IR), max 30 W. With IR: 44 W

Identifying the most used High Power PoE Version

PoE*	25.5 W PoE+, IEEE 802.3at Type 2 PoE Plus	With IR: High Power 51 W PoE++* Without IR: 25.5 W PoE+, IEEE, 802.3at Type 2 PoE Plus

Most found High Power PoE = 802.3at X 2

What PoE Power Level Should I Program For

What is the type of power?
802.3af/at/bt

How are you operating the device?
IR/Heaters/Blowers on/off

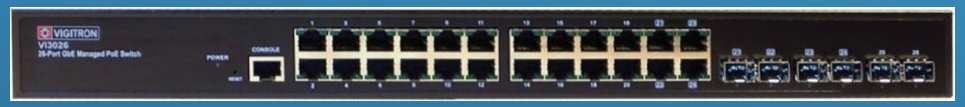
What is the Class Power

Do not program for the numeric PoE value – Program for the full class power

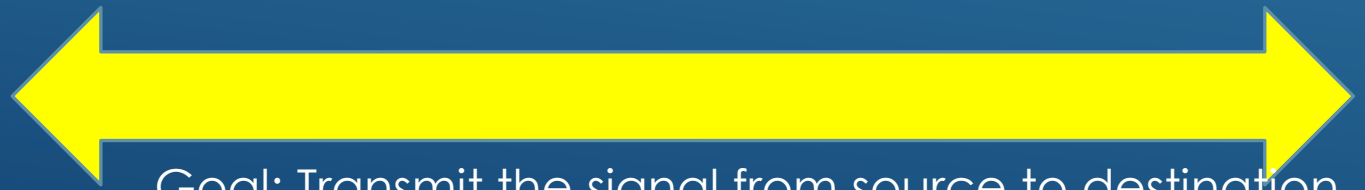
Configuring a Network

Don't

Purchase a individual product without knowing all the products in the network and their connections



All components within a network interact. Performance is dependent upon the weakest link



Goal: Transmit the signal from source to destination with the last amount of loss

5 Steps to Network Design for Security Systems

Step 1

The connected Device

Step 2

PoE Compatibility

Step 3

Transmission and cable

Step 4

How many devices at one location

Step 5

The end point: Switches and Servers

PoE Transmission & Cables

Cat 5e/Cat 6

Standard

Coax

Non-Standard

Single Pair

Non-Standard

Wire Pairs- 4

Max Bandwidth 10G

PoE Range
1-90W

PoE Capacity

All Classes
Class 0-Class 8
All Types
802.3af
802.3at
PoE++
UPoE
802.3bt

Wire Pairs- 2

Max Bandwidth 100Mbps

PoE Range
1-36W

PoE Capacity

All Classes
Class 0-Class 4
All Types
802.3af
802.3at

Wire Pairs- 2

Max Bandwidth 100Mbps

PoE Range
1-36W

PoE Capacity

All Classes
Class 0-Class 4
All Types
802.3af
802.3at

PoE & Bandwidth
dependent on Wire Gauge

PoE Transmission & Cables-Distance and Bandwidth

Cat 5e/Cat 6

Standard

100Mbps=328 feet

1000Mbps =328feet

10G =181feet

(Extended) 100Mbps =2,000 feet

(Extended) 10Mbps = 3,000 feet

Coax

Non-Standard

100Mbps=328 feet

1000Mbps =328feet

(Extended) 100Mbps =2,000 feet

(Extended) 10Mbps = 3,000 feet
w/PoE

(Extended) 10Mbps = 5,000 feet
wo/PoE

Single Pair

Non-Standard

Vigitron Only -100Mbps Source

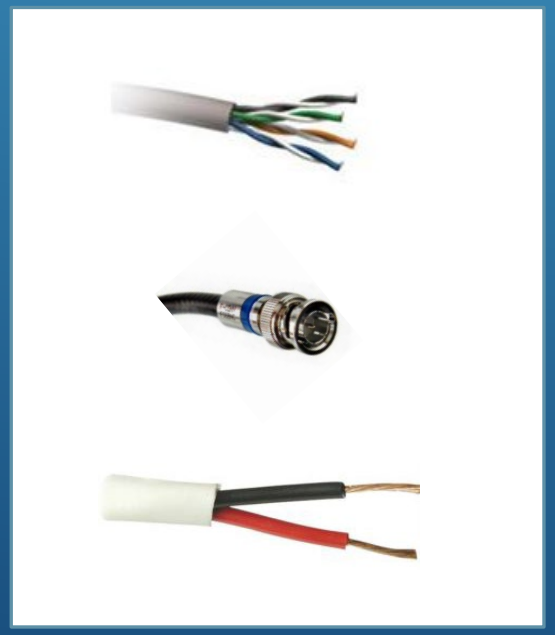
Depends on Wire AWG

24/2
200 feet= 98Mbps
1600feet =32Mbps

18/2
200 feet=72Mbps
1000 feet =12Mbps

Step 3: Cable Verses PoE Transmission

802.3af
802.3at
37W



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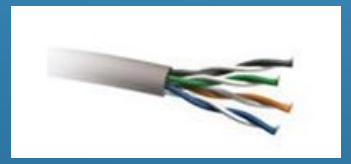
PoE+
PoE++
UPoE
37-74W



X

X

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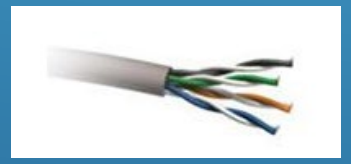
802.3 bt
Classes 5-8
37W-90W



X

X

Two Device have the same PoE source requirements

Which is the right source?

PoE over Coax Cables and Single Pair wires

- The resistance of different Coax cables and Single Pairs wires can vary drastically based on the material or thickness of these cables.
- To be safe, the PoE level over these wires should be limited to 37W.

Two Conductor Cables
Total Power: 57V x 0.75A = 42.75W
Safe PoE Power Level: 37W

Single pair cable is limited to 37W

Step 4: How much Bandwidth do I need ?

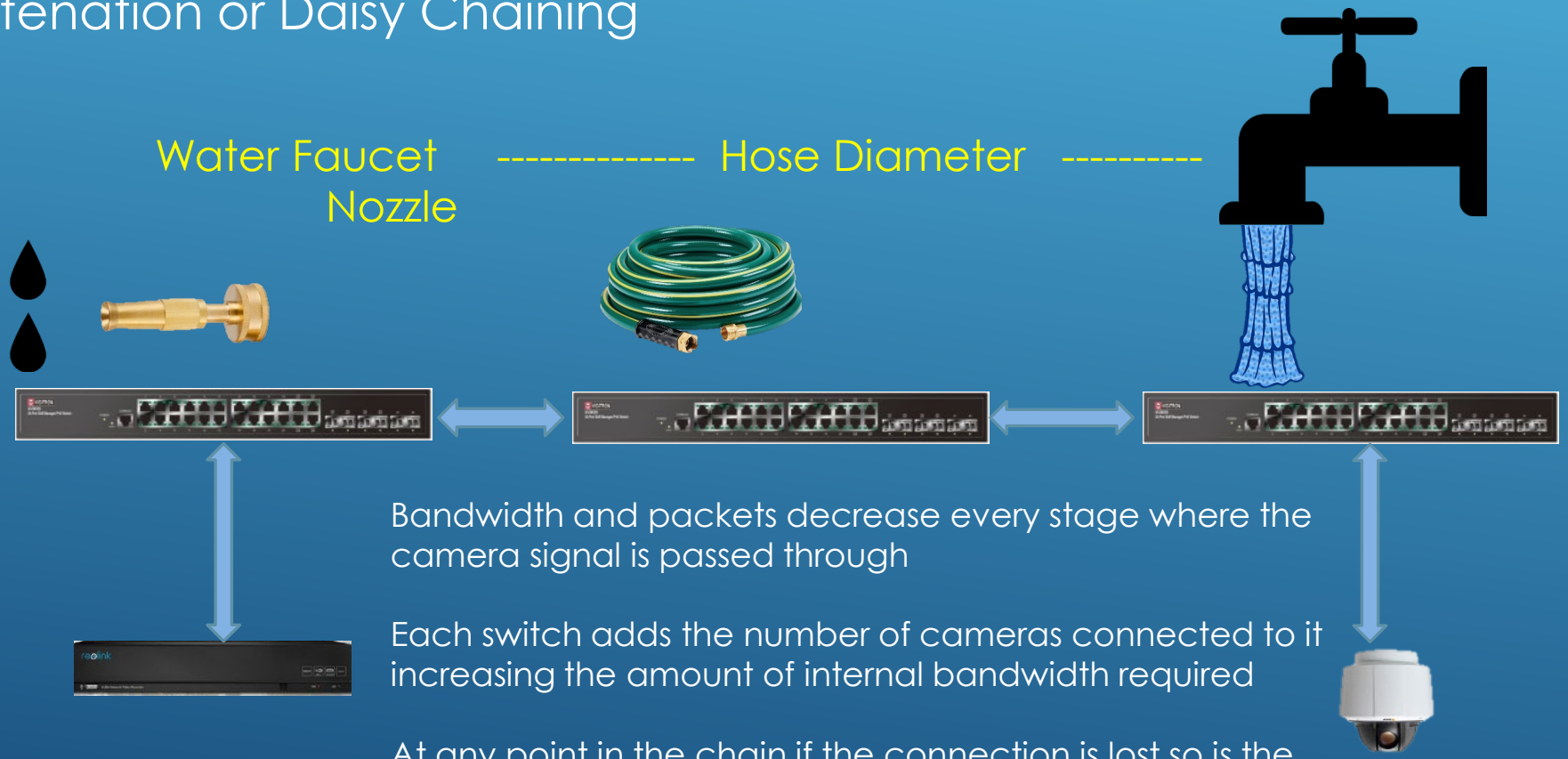
	H.264 (AVC)		H.265 (HEVC)
Supported container formats	mkv, mp4, qtff, asf, avi, mxf, ps, ts, m2ts, evo, 3gp, f4v		mkv, mp4, qtff, asf, avi, mxf, ps, ts, 3gp
Recommended bandwidth for video encoding	**Recommend** **2.0Mbps** 480p — 1.5 Mbps **5.0Mbps** 720p — 3 mpbs **8.0 Mbps** 1080p — 6 Mbps **40.0Mbps** 4K — 32 mbps	**Times the total number of cameras**	480p — 0.75 Mbps 720p — 1.5 mpbs 1080p — 4 Mbps 4K — 15 mbps
Required bandwidth for 4K broadcasting	**Overheads 1080 X4 =16,320** 32 mbps		15 mbps

The amount of total bandwidth available for video transmission is approximately 50% of the total port bandwidth

		Usable Bandwidth	Per Port	Per 24 Switch	Uplink
100Mbps	===	50Mbps	50/32Mbps	**1.2G/768Mbps**	**1G**
1000Mbps (1G)	===	500Mbps	500Mbps/32Mbps	1.2G/768Mbps	10G

Step 5: End Point

Concatenation or Daisy Chaining



Bandwidth and packets decrease every stage where the camera signal is passed through

Each switch adds the number of cameras connected to it increasing the amount of internal bandwidth required

At any point in the chain if the connection is lost so is the connection to the connections after that point

Distance between switches restricted to 290 feet

Recommendation is for 10G uplink, however server must also have the ability to receive 10G

Step 5: Switch Configuration

IDF to Core MDF

Distance between switches restricted to 290 feet

Each port represents the sum of the switches and the number of cameras connected to that switch

All connections to the IDF must still be within 328 feet from the IDF switch port. AC power must be available at the IDF switch point

Recommendation is for 1G uplinks and all 1G ports

Step 5: Connection to Server/NVR

Video servers can have 3 different internal networks. One for recording, one for playback and one for viewing. Each can have different bandwidth and packet handling characteristics

How many NIC cards

What is the bandwidth of the NIC cards- 1G or 10G

(Remember the weakest link- theory)

How is video viewed:

Does the server have 3 different paths

1. Recording
2. Viewing
3. Playback

Or:

1. Recording- Viewing
2. Playback

How is video processed by the individual server ?

What is the maximum Mbps for processing

Network Troubleshooting

- Fiber
- Bandwidth
- Packet size
- Problem point

Two Most Important Tools in Testing Your Network

PoE PSE
PoE Power Supply

Laptop

Major Sources of Network Failures

- **Inability to establish network connections during set-up**
- **Device powers up and goes off line**
- **Devices drop offline and stay offline**
- **Intermittent loss of transmission**
- **Changed the switches/Camera IP address – cannot access**

Troubleshooting Questions

General Question- have the customer define the problem in their own words

Existing Installation:

Under what previous conditions was the system working?
What changed?

New Installations :

Treat is as a design center project

Problems and Solutions

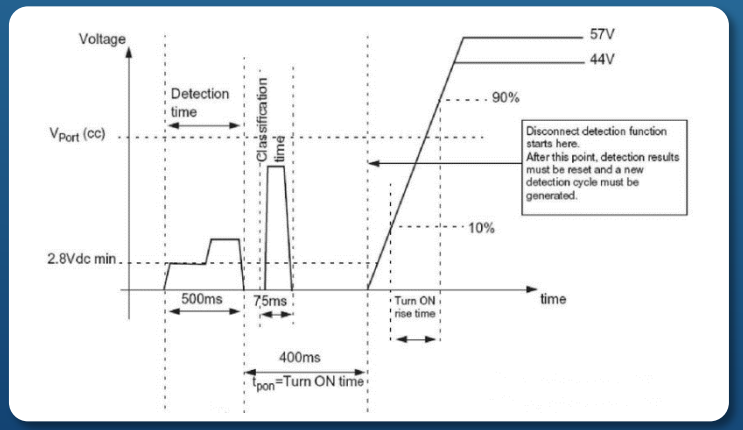
My Camera will not power up

My Camera Powers up and Immediately Drops off Line

Solution – My camera powers up and immediately drops off

How PoE works?

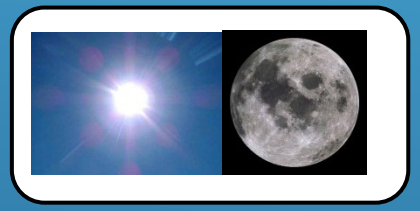
- The PSE such as a PoE Midspan or Switch sends a Detection (Discovery) Pulse to the PD (i.e. a PoE Camera).
- The PD places specific resistor on line to acknowledge that it is a valid PoE device.
- The “802.3at/bt” PSE sends Classification pulse(s) to know how much power the PD needs.
- The PD places specific resistor on line to let the PSE know how much power it needs. 22ohms
- The PSE provides requested power level to PD. If the voltage at PD is lower than expected the PD does not start.
- If the PSE does not see the resistive element in 40ms, it assumes that there is no valid PD present.
- The PSE continuously monitors the current to the PD. If it exceeds the requested power level, PSE shuts down power.
- If PoE disconnected the PSE, depending on programing, sends Detection pulses until the whole cycle starts and power is restored.



“My camera keeps shutting down”

Many IP cameras have several auxiliary features such as:

Day/night



LED

Auto back focus

PTZ operation

Surges can be as great as 20% over the operating power.

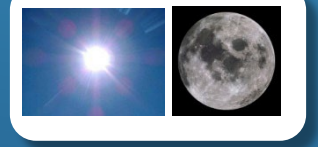
If the surge is results in more power than the PSE can provide or continuous to rise for 40MS- the port shuts down.

All of these functions not only result in increased power demands but create a power surge when they are first turned on. The surge required power is almost never shown on specifications and can exceed the ability of the source to provide it, resulting a Port Power Shut down.

“I added new cameras & they keep shutting down”

- Many IP cameras have several auxiliary features such as:

Day/Night



Auto Back Focus

IR LED

- All of these functions not only result in increased power demands but create a power surge when they are first turned on. The surge required power is almost never shown on specifications and can exceed the ability of the source to provide it, resulting a Port Power shut down.
- With proper features, a Midspan cannot only provide the required increased power, but also apply it during surges.

Problems :

My camera will not power up
My camera powers up and shuts down
My camera intermittently shuts down
Add more cameras, not operating or all cameras shutting down

Causes

The network switch is not:

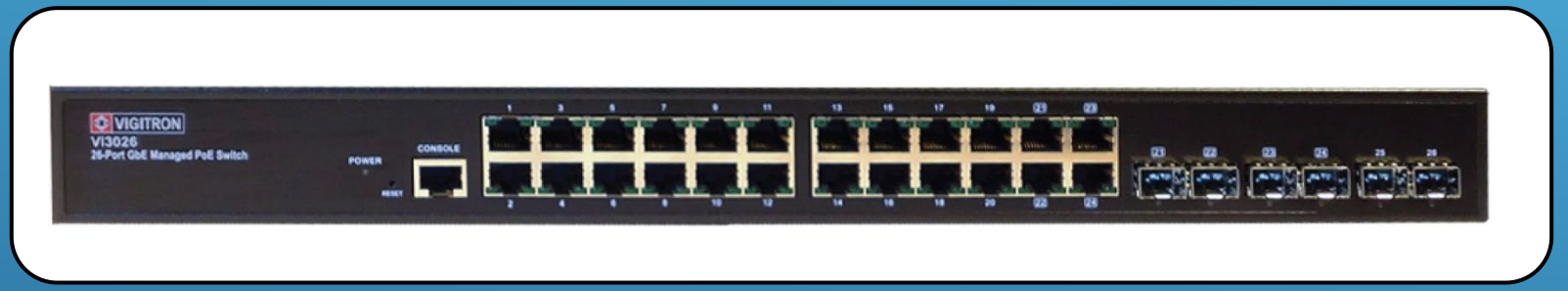
A. Providing the necessary PoE

B. Is not providing the power required when surges occur

C. The switch is introducing additional signal requirements such a LLDP related to PoE communications.

D. Switch does not have the ability to allocate PoE as required by the application

How is power allocated by the switch?

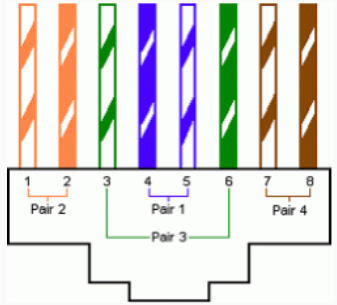


1. Port priority – starting with Port 1
2. Divided PoE- Total PoE is divided as cameras are added
3. Host programmed –fixed at 802.3af/at
4. Class programmed
5. Operator value programmed

Only Managed PoE is recommend- PoE Port Power must be fixed and always available

The Effect of Cables

The Effect of Cabling

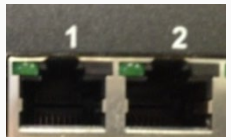


As cable distance increases

Cable resistance increases

Voltage which is also part of Wattage Decreases

30 Watts



15.4 Watts

802.3at

Difference is due to cable Resistance

802.3af

25.5 Watts

12.95 Watts

PoE over Coax Cables and Single Pair wires

- The resistance of different Coax cables and Single Pairs wires can vary drastically based on the material or thickness of these cables.
- To be safe, the PoE level over these wires should be limited to 37W.

Two Conductor Cables
Total Power: 57V x 0.75A = 42.75W
Safe PoE Power Level: 37W

Single pair cable is limited to 37W

“According to the manufacturer, I have the proper cable distance for my switch to provide PoE, but why it doesn’t work?”

UTP= STP is not the same as UTP. Differences in cable capacity affect PoE.

Coax=Our extenders were developed for RG59. Coax has no resistive standards nor do they exist for RG6, RG11. PoE limitation 36W

Single Pair: Differences exist between 24/2-16/2 for PoE and Bandwidth

- How many cables are in a bundle
- Are cables run along side of power cables

Fiber Considerations

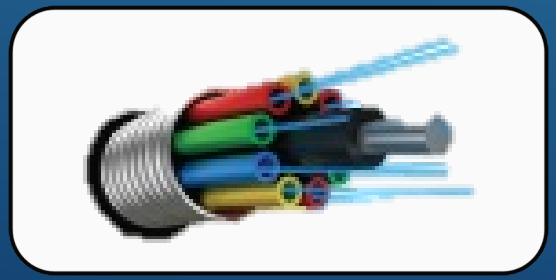
Matching SFPs

- The only standard the MSA (Multi-Source Agreement) which only applies to the physical interface.
- SPFs must match on both ends of the cable
- The ability of the switch to read bandwidth and the DDMI (Discovery and Dependency Mapping) is dependent upon the switch and SFP firmware

Warning: As there are no standards for interfacing. If a switch does not recognize the transmitting bandwidth it will not recognize the SFP.

Possible solutions:

- Fix the port speed,
- Run the port speed in auto
- Use a 1G SFP



Fiber Considerations-testing

1. If the SFP has DDMI capability (All Vigitron SFP do) plug the SFP into the switch port. Monitor the switch port GUI to confirm it reading the SFP.

2. Confirm the SFP matches the Fiber –Bandwidth/MM/SM

3. Confirm the fiber matches the application. Older 62.5mm distance limitation = approx 750 feet. 50mm = approx 1500 feet.

4. Many older analog to IP fiber conversions have ST (rarer ST connectors) and require jumpers to LC. The jumper must match the fiber.

UTP Distance Limitations

Vi2301A			
			Date: 12-01-14
Configuration	Midspan--------Vi2301A----------cat5e----------Vi2301A----------Camera		
Transceivers	Vi2301A (2pcs)		
Cable Distance (feet)	Power available at PD		
3000 feet	Class 2 (6.49 Watts) @10Mbps	Class 2 (6.49 Watts) @10Mbps	Class 0 or 3 (12.95 Watts) @10Mbps
2500 feet			
2000 feet	Class 2 (6.49 Watts) @100Mbps	Class 2 (6.49 Watts) @100Mbps	Class 0 or 3 (12.95 Watts) @100Mbps
1800 feet			
1500 feet		Class 0 or 3 (12.95 Watts) @100Mbps	
1300 feet			
1000 feet			
800 feet			Class 4 (25 Watts) @ 100Mbps
500 feet			
300 feet or less			
PoE PSE source	15.4 Watts	30 Watts	37 Watts

1-37Watts

Requires a signal PD for the connected Device

Vigitron Distance Chart							
		Cat5E (24AWG)					
						Date: 7-30-13	Date: 7-10-18
Transceiver	Vi2301A (2 pcs)	Vi2301A (2pcs)	Vi2301A (2pcs)	Vi2301A	Vi2701TX	Vi2701TX	Vi2301A (2pcs)
Distance feet/meters	Power @ PD	Power @ PD	Power @ PD	Power @ PD	Power @ PD	Power @ PD	Power @ PD
3000ft					12.95 watts Class 3 @10Mbps	12.95 watts Class 3 @10Mbps	12.95 watts Class 3 @10Mbps
2000ft							
1500ft					25.5 watts Class 4 @100Mbps	25.5 watts Class 4 @100Mbps	25.5 watts Class 4 @100Mbps
800ft							
750ft			50 watts @ 100Mbps	50 watts @ 100Mbps	50 Watts @100Mbps	50 Watts @100Mbps	50 Watts @100Mbps
600ft	50 watts @100Mbps	50 watts @100Mbps					
550ft							
500ft							60 watts @ 100Mbps
328ft			60 watts @ 100Mbps	60 watts @ 100Mbps	60 watts @ 100Mbps	60 watts @ 100Mbps	
PSE Power	ource Axis (T812	ource Sony (9501	urce Vigitron (Vi2208/16	urce Vigitron (Vi2508/	Source Vigitron (Vi2508/16)	Source Vigitron (Vi2701RX)	Source Vigitron (Vi22001)

Requires a dual PD to four at the connected Device

37 – 90 Watts
(802.3bt)

The Effects of Bandwidth

Common Problems

My camera disappeared

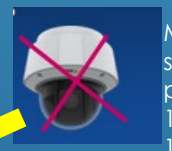
Picture looks pixelated

Picture looks scrambled

Packet and Bandwidth Problems and Vigitron Solutions

An NVR/VMS Server is it own internal network with multiple signal paths for recording and viewing

Switch fabric is not a standard specification and is dependent upon the cost



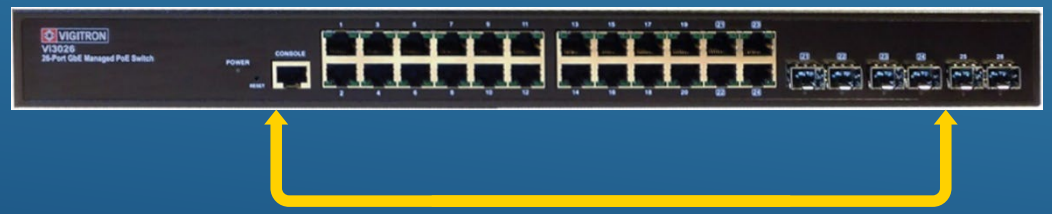
Most network switches limit packet sizes to 1518Bytes @ 100Mbps

To pass video when all ports are used the switch fabric must be 2x the bandwidth of the highest sum of the all the ports – Vigitron switches are.

Vigiron switches have the ability to pass Jumbo frames @ 100Mbps

The Switch as its own Network

1. With the port operating a 100Mbps, packet size is limite to 1518bytes
2. Transmitted Jumbo Frames will be dropped
3. When are frames lost:
    1. H.264/265- have an IBP codec configuration
    2. I= establishment frame
    3. Jumbo frames can be created when high activity is present



2x the sum of the highest bandwidth of all the ports is required for passing video

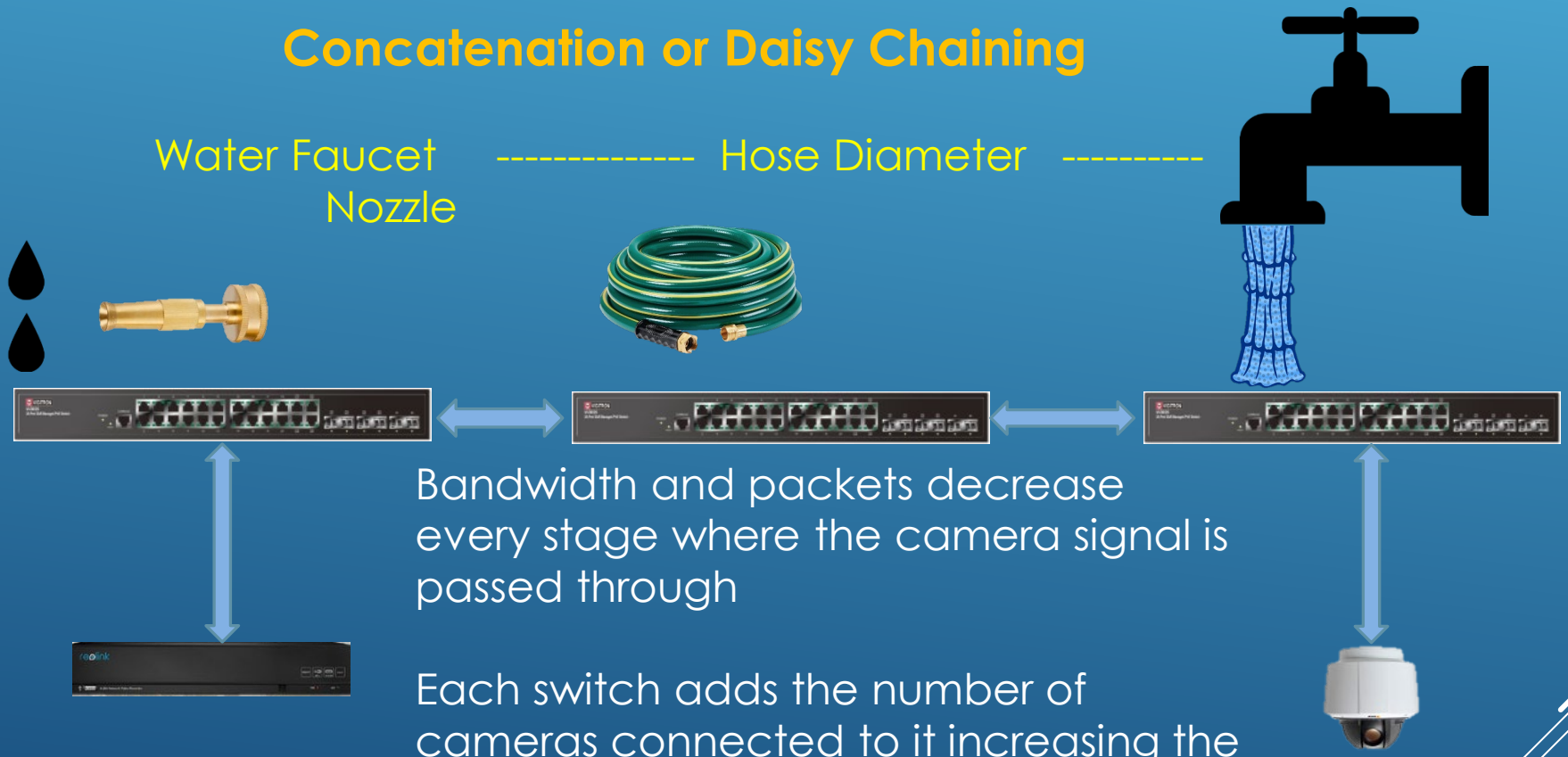
The Switch as its own Network

1. Directly to a recording device in the form of NVR or VMS server
2. To a core switch as an IDF (Intermediate Distribution Frame) to MDF (Main Distribution Frame) configuration.
3. To another switch know as Concatenation or Daisy Chaining.

2x the sum of the highest bandwidth of all the ports is required for passing video

Concatenation or Daisy Chaining

Water Faucet ---------- Hose Diameter ----------
Nozzle



Bandwidth and packets decrease every stage where the camera signal is passed through

Each switch adds the number of cameras connected to it increasing the amount of internal bandwidth required

At any point in the chain if the connection is lost so is the connection to the connections after that point

IDF to Core MDF

Distance between switches restricted to 290f

Each port represents the sum of the switches and the number of cameras connected to that switch

All connections to the IDF must still be within 328f from the IDF switch port. AC power must be available at the IDF switch point

Enterprise Switch Unique Programming Features

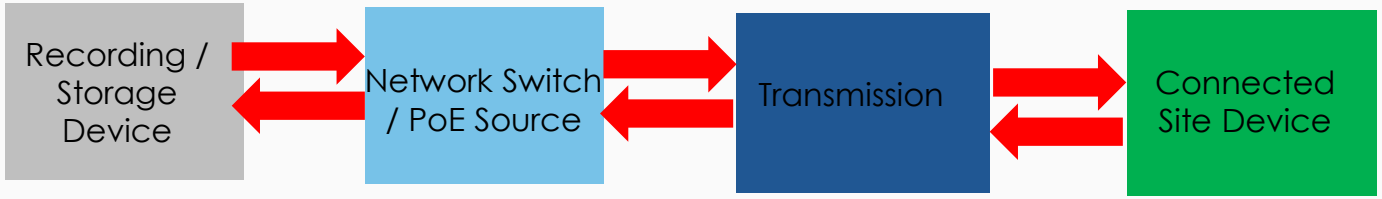
Easy to Read Ports Status

Link down but PoE Present

Link up and PoE Present

No PoE- Indicates Bandwidth

Bandwidth Limitation Points



A recording/ storage device is its own network.

Network connections must be matched. Internal bandwidth and disk recording speed will all affect the ability to handle all the cameras.

Most standard network switches limit packet size @100Mbps to1518bytes or about 2MP. Higher MP cameras can look blocky or out of focus.

Intermittent camera loss is an indication of limited switch fabric. To pass all cameras when fully loaded the switch fabric must be 2x the sum of total bandwidth of all ports

Type of cable and distance will affect transmission. Cat 5e/6 will offer the best PoE and bandwidth transmission. Coax will limit PoE transmission, single pair least PoE/IP Transmission.

For extended distances 100Mbps is limited to 2,000 feet. 10Mbps 3,000 feet

Most connected device's bandwidth is 100Mbps – network speeds must be matched at each connection point

Considerations for Security Network Design

Background: Standard Data networks are not designed for security applications. They lack the ability to:

1. Retry connections on start up- if a connected device is not detected the port shuts down
    a. Vigitron network switches and Midspans will retry several times

2. The ability to re-connect and reapply PoE in the even a connection is lost
    a. Vigitron network switches and Midspans will automatically attempt reconnections without the need of a service call.

3. The ability to monitor network connections do determine if they are valid
    a. Vigitron network switches and Midspans will monitor connected devices several times per minute to assure valid connections and take action if the connection is lost.

4. The ability to provide the required PoE and account for mag-lock and door strike surges:
    a. Vigitron switches and Midspans provide extra PoE to account for surges and monitor for the application of these conditions to avoid shut downs

5. You are selling a solution that works and integrates all aspects of their security system, Video, audio, access control, lighting

Why Network-Operational Testing is Important

Product specification are separate from how a product will perform in a network environment.

A. There are about six different manufacturers of Power Device Chips
B. They reactive differently based on their circuit design
C. Type of cabling and cable distance are all factors.
D. Amount of surge power required on start up when PoE is first applied on when accessory functions start.
E. For Security networks both individual products and product interaction must be taken into account.

What Questions Do I Ask to Design an Infrastructure?

Background: Each design is individualized. There is no cookie cutter approach to designing an infrastructure. Each design will require knowing the following information.

Cameras: What is the manufacturer and model number

Number of cameras routed to a single network switch (IDF- Intermediate Distribution Frame) If different cameras are going to the same location you need to know the manufacturer and model numbers for all the cameras routed to a single location

Cable: Type of cable:

- Coax
- UTP/ Cat5e or 6
- Single pair/ 18/2, 20/2, 22/2, 24/2
- Fiber/ single mode (9/1.25), multimode (62.5/1.25 or 50/1.25)

Cable length: Longest cable distance to a single point.

PoE source: Manufacturer and Model number

Never Design a System without studying all the component specifications…….Important.

Summary of our problems-

Camera doesn’t power up

Camera doesn’t power up go off line

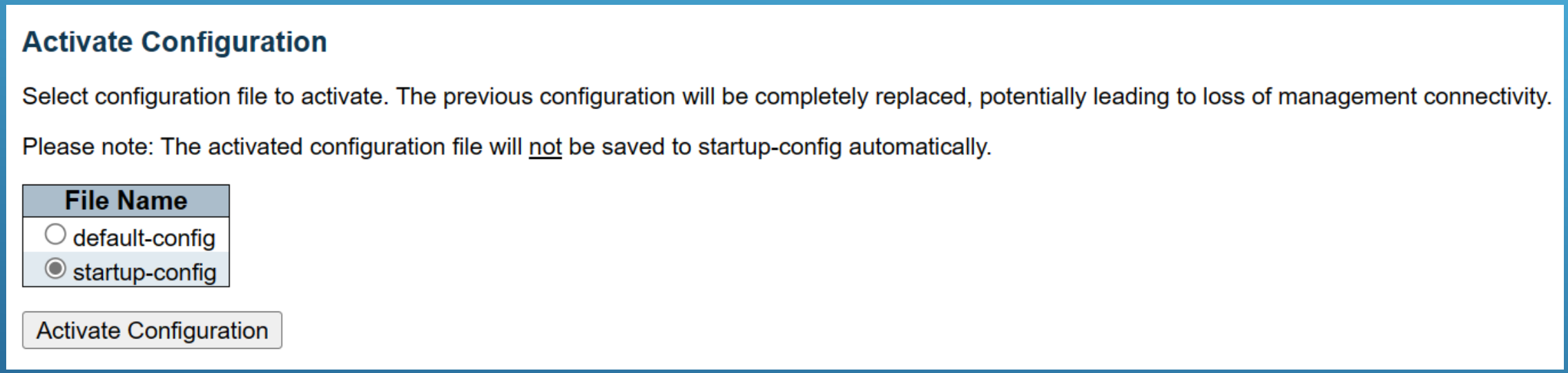
Intermittent Camera Shut down

Cable and all installation correct

Camera Disappears Intermittently

Picture is blurry or pixelated

Saving your Programming



One of the most overlooked but important programing operations is the need to save your switch programming.

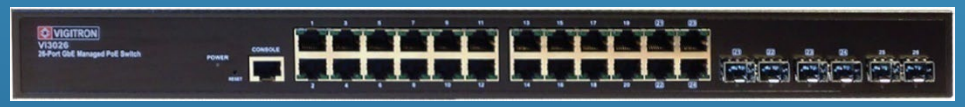
After you have finished programming your switch check to see if you need to save your total program.

If this is not performed and power is lost, switch programming will revert back to default

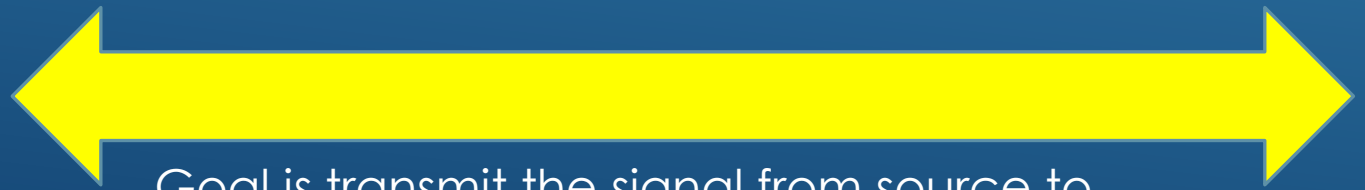
What do I need – In a Network? In a Network Switch?

Every part of the Network Interacts with Each Other affecting performance

Purchase a individual product without knowing all the products in the network and their connections



All components within a network interact. Performance is dependent upon the weakest link



Goal is transmit the signal from source to destination with the last amount of loss

How much Bandwidth do I need ?

	H.264 (AVC)		H.265 (HEVC)
Supported container formats	mkv, mp4, qtff, asf, avi, mxf, ps, ts, m2ts, evo, 3gp, f4v		mkv, mp4, qtff, asf, avi, mxf, ps, ts, 3gp
Recommended bandwidth for video encoding	**Recommend** **2.0Mbps** 480p — 1.5 Mbps **5.0Mbps** 720p — 3 mpbs **8.0 Mbps** 1080p — 6 Mbps **40.0Mbps** 4K — 32 mbps	**Times the total number of cameras**	480p — 0.75 Mbps 720p — 1.5 mpbs 1080p — 4 Mbps 4K — 15 mbps
Required bandwidth for 4K broadcasting	**Overheads** **1080 X4 =16,320** 32 mbps		15 mbps

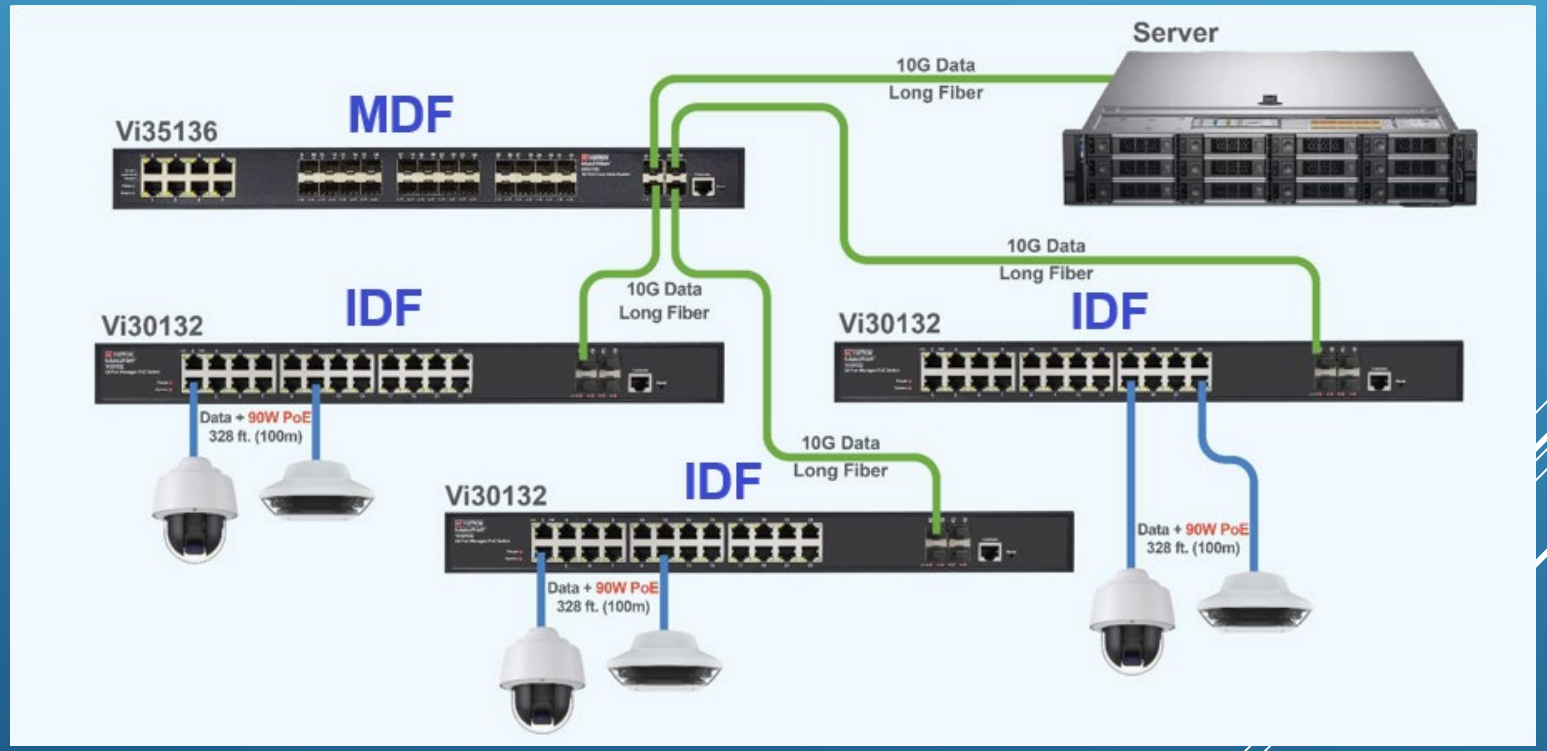
The amount of total bandwidth available for video transmission is approximately 50% of the total port bandwidth

		Usable Bandwidth	Per Port	Per 24 Switch	Uplink
100Mbps	===	50Mbps	50/32Mbps	**1.2G/768Mbps**	**1G**
1000Mbps (1G)	===	500Mbps	500Mbps/32Mbps	1.2G/768Mbps	10G

IEEE 802.3bt 90W PoE & 10G Ethernet IDF-MDF Solutions

In an IDF to MDF Configuration bandwidth losses are limited to a single link.

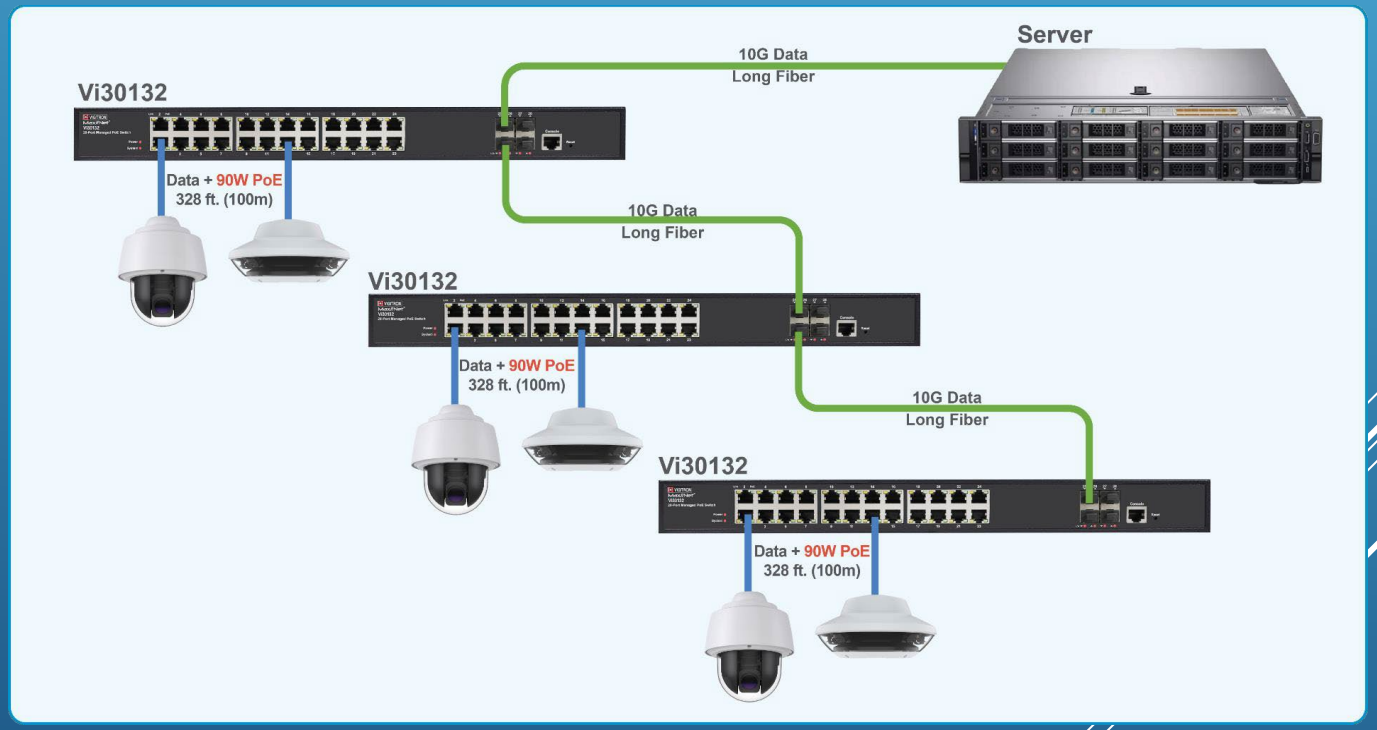
The key is the total bandwidth of the MDF to the server.



IEEE 802.3bt 90W PoE and 10G Ethernet Uplink Solutions

In a Daisy Chain configuration you need to account for almost a 50% loss from link to link.

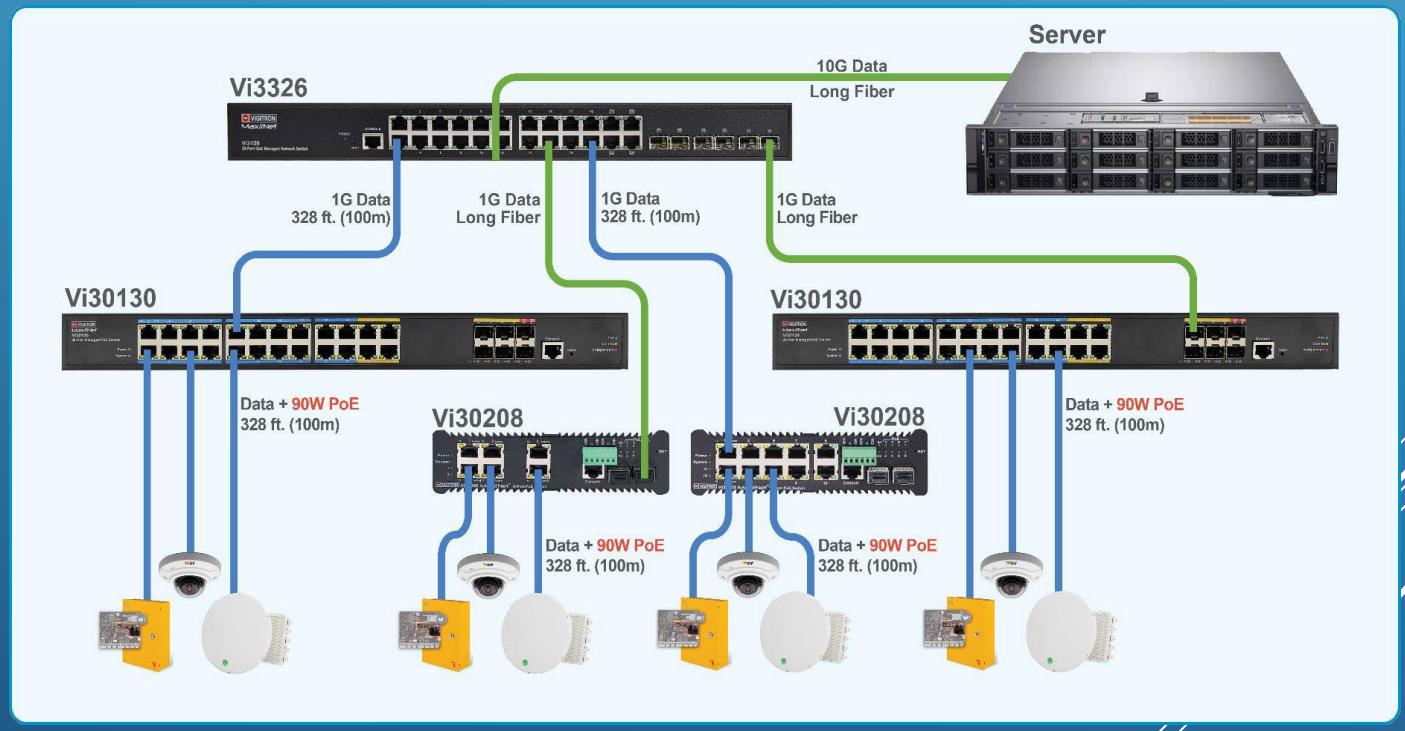
For this reason in almost all cases Daisy Chain configurations require 10G links



IEEE 802.3bt 90W PoE and 1G Ethernet Solutions

Both PoE power and PoE types must be taken into consideration.

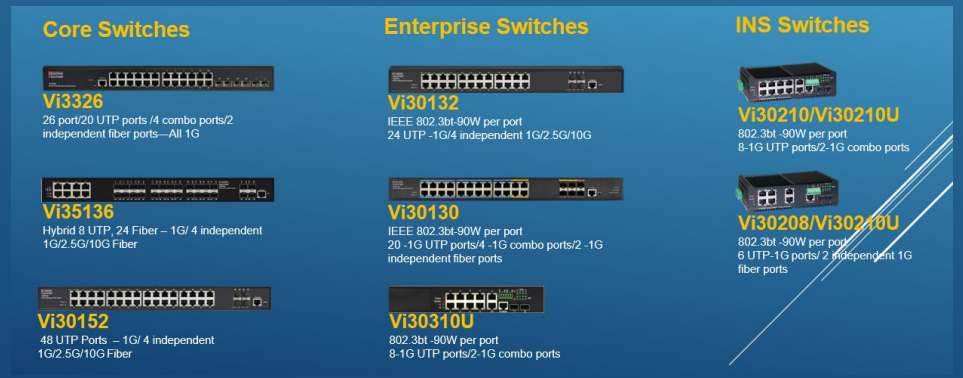
Does your switch just provide non standard PoE types such as UPoE or 802.3bt or both



Network Switch Considerations Bandwidth

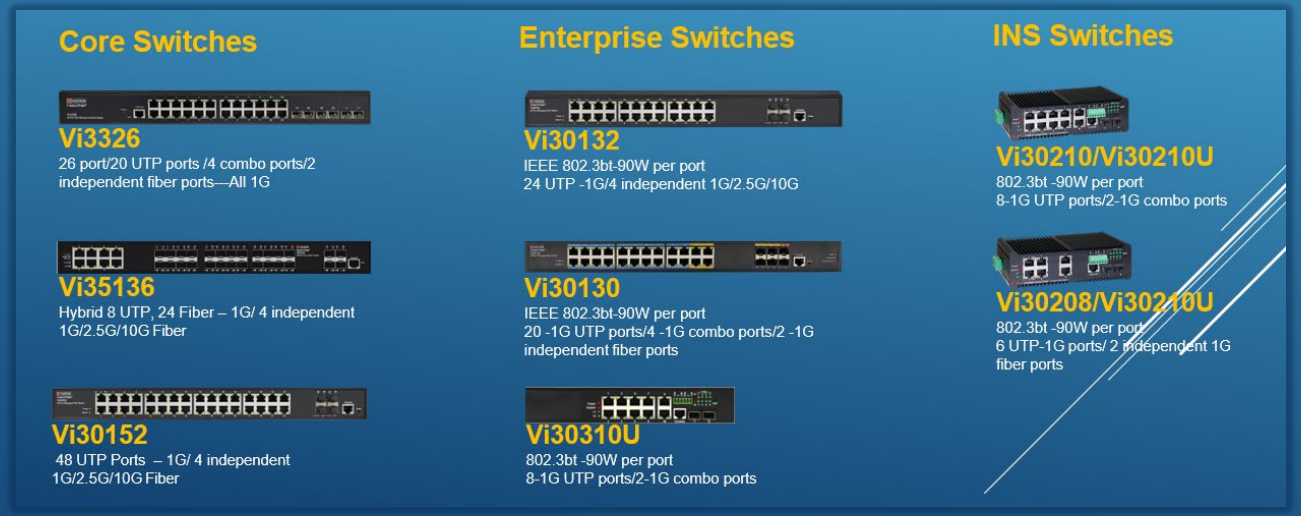
Summary

- Can it handle Jumbo frames at all port speeds (Frame sizes greater than 1518 bytes) and not just at 1G?
- Is the Switch Fabric bandwidth at least 2X the sum of the highest total port speeds?
- Does the programming of combo fiber ports provide an AMS setting?
- Can it read SFP DDMI messaging? (Works only if your SFP has DDMI capability)
- Does it provide for Layer 3 Lite – not just Layer 3 setting to avoid hacking?
- Does it provide the necessary uplink port speed to handle the connected cameras and system interface?



Network Switch Considerations: PoE

- Does it provide for 802.3bt – future proof your investment?
- Does it provide PoE power compatible to both 802.3bt and previous PoE such as UPoE?
- Does it have the ability to monitor a connection and if lost restore the connection and PoE to avoid system down time and service calls?
- Can you apply back up power equal to the main power?
- Do you need and does the switch have 10G uplink ports? (are you daisy chaining)



Why Choose Vigitron?

The Company that stands behind the product is just as important as the product

WE SELL SOLUTIONS NOT JUST PRODUCTS

Vigitron Advantages

Free Design Services:

Saves Dealers time, money, and reduces the potential for costly after sales service calls by developing networking with Vigitron's engineering staff.

Unique Warranty:

The industry's longest Lifetime warranty with complete protection for a full 3 years in even after a product goes end of life.

Wide Range of Products:

Over 200 IP/PoE Products covering every network category with the ability to provide complete network solutions

Educational material:

Vigitron provides a wide rang of educational materials such as Webinars, Application Notes., White Papers , etc.

Before Sales: Free Design Services

The Design Center is your most valuable resource for:

- Assuring the most reliable solution for your project.
- A Free and Without obligation service that protects your profits.
- A service, based on a knowledgeable and proven resource:
  - A company with 27 years of experience in design and
  - manufacturing transmission and networking products.
  - The Strength of Inter-operational product testing

During Sales: Excellent technical & Sales support

Unexpected things can occur during the installation.

- Is a real person technical support readily available?
- Will the manufacturer be able to work with you to determine the problem?
- If a replacement model or an additional product is needed, will the manufacturer work with you to get the part to your site as quickly as possible?

After Sales: Lifetime Warranty +3

- Vigitron provides the industry's longest warranty at no additional cost to customers: Production lifetime plus 3 years.
- A warranty is an expression of a manufacturer's confidence in their products.
- The shorter the warranty the less the confidence in long term performance.
- If you offer a service contract, will the manufacturer provide support for the complete term?
- What is the product or total products overall failure rate?
- A Lifetime Warranty only protects you while a product is in production. It may indicate that the manufacturer is buying an OEM product.
- **Be Aware** of the exceptions in a manufacturer's warranty.
- The manufacturer that protects you after "product end of life" provides time and protection. It can assure you the same or upgraded product replacement for much longer time

+3 Years

Your Turn

Thank you

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