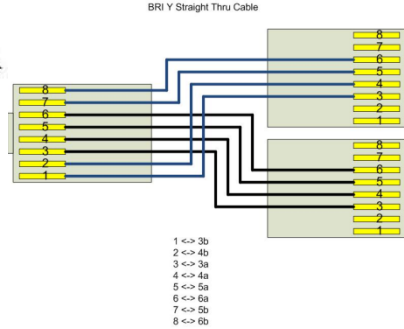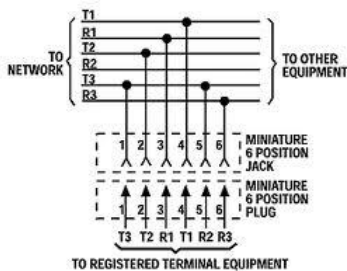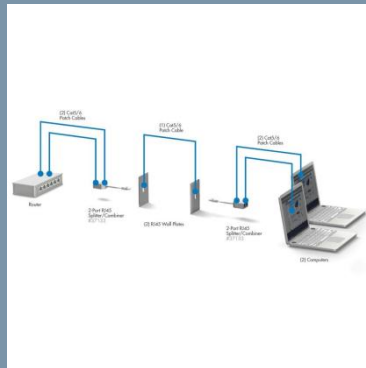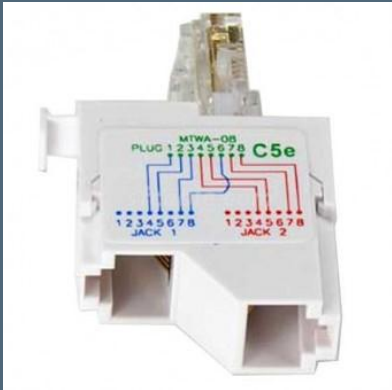# PoE vs.
Splitters, Y Cables, Non IEEE Power Injectors, and Misconnections
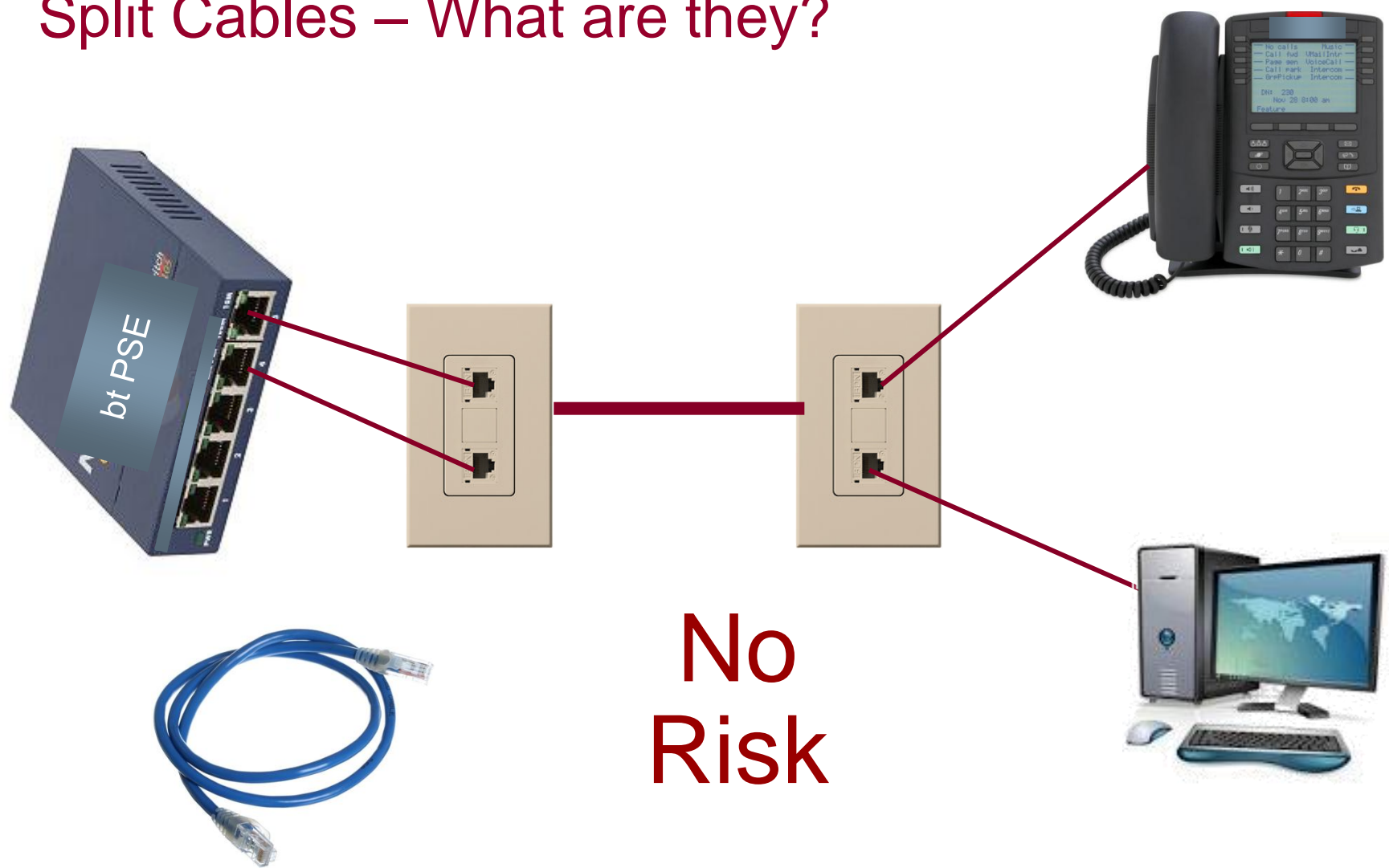
Supporters

- David Tremblay (HP)
- Lennart Yseboodt (Philips)
- Matthias Wendt (Philips)
- Musa Unmehopa (Philips)
- Gaoling Zou (MAXIM)
- Sterling Vaden (Independent)
- Bill Delveaux (Avaya)
- Phil Brownlee (Coilcraft)
- Conditional Supporter (i.e. Cabling and Data only) Valerie Maguire (Siemon)

LINEAR TECHNOLOGY

SPLITTERS AND 'Y' CABLES (TIA 'SHARED SHEATH')

What happens when a 4 pair, single bt PSE connects through a 'Y' cable to two devices?

- Concern has been expressed that things will "blow up."

    - What type of devices will get damaged?

    - Under what conditions will a device get damaged?

    - What will the damage be?

    - What are the consequences?

- What other non-IEEE configurations are there to consider?

    - Is their collective risk more or less than the 'Y' cable risk?

Split Cables – What are they?

bt PSE

No Risk

'Y' Cables – What are they?

Violates Channel Spec

6 CONNECTOR NOT SUPPORTED

bt PSE

1

2   3   4   5   6

BRI Y Straight Thru Cable

1 <-> 3b
2 <-> 4b
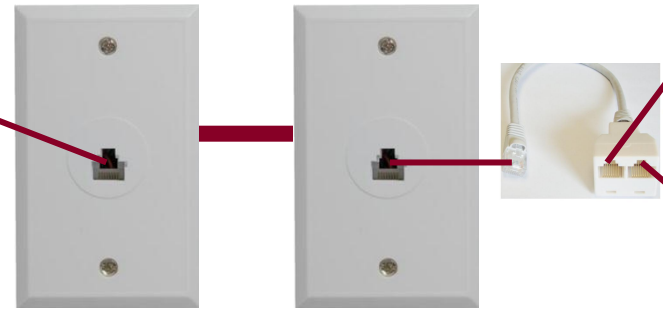3 <-> 3a
4 <-> 4a
5 <-> 5a
6 <-> 6a
7 <-> 5b
8 <-> 6b
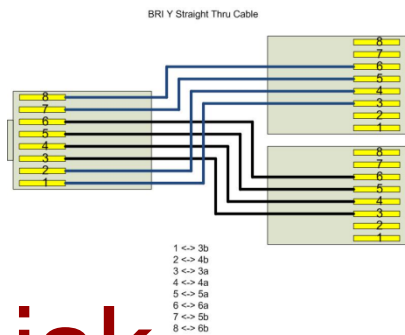
No Risk

What is the 'Y' cable mistake?
'Y' cable is added only on the non-PSE side

NO Installed Base because the

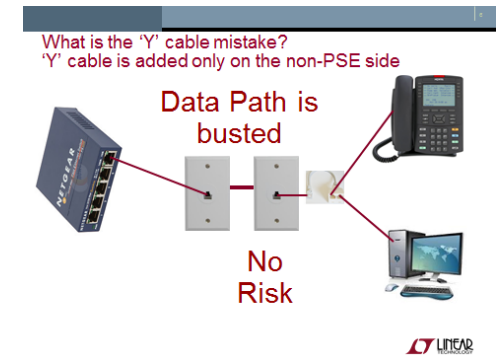## Data Path is busted

bt PSE

No Risk

'Y' Cable 4 Pair Single PSE Detection Results
At time zero, all devices are plugged into the system

AltA / AltB	PD	NIC/Swtich Non Isolated Termination	NIC/Swtich Isolated Termination	PSE
PD	Rlow	Rlow	Rgood	Rlow/Chigh
NIC/Swtich **Non** Isolated Termination		Rlow	Rlow	Rlow
NIC/Swtich Isolated Termination			Rhigh	Rlow/Chigh
PSE				Rlow/Chigh

Rgood -> No Damage

Rlow/Chigh -> No Damage

What is the 'Y' cable mistake?
'Y' cable is added only on the non-PSE side

Data Path is busted

No Risk

Remember, Data Path is Busted

So how does something go wrong?
PoE PSE and PD are in a 'normal' configuration
PSE is a bt 4 pair PSE

bt PSE

Then: next slide

LINEAR
TECHNOLOGY
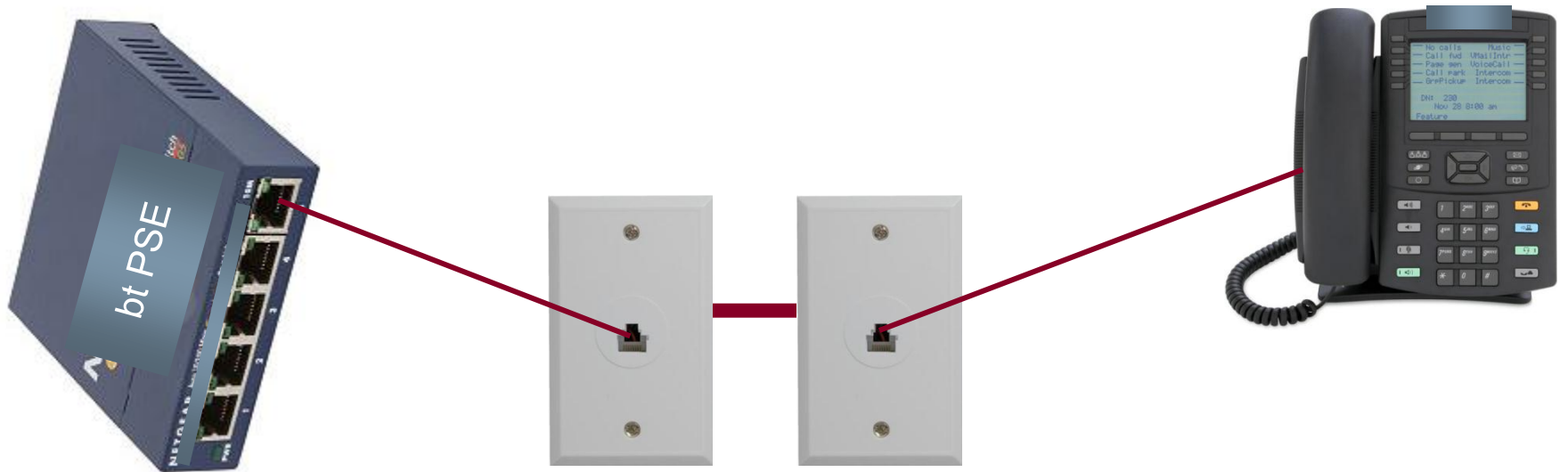
So how does something go wrong?
Somebody puts a 'y' cable in, plugs back in a real PD first, THEN plugs in something in.

This is not an IT guy, this is a rookie

bt PSE

Remember, this makes no sense whatsoever for a data connection

What is the Risk?

Termination Resistor value change

LINEAR
TECHNOLOGY

'Y' Cable 4 Pair Single PSE Detection Results
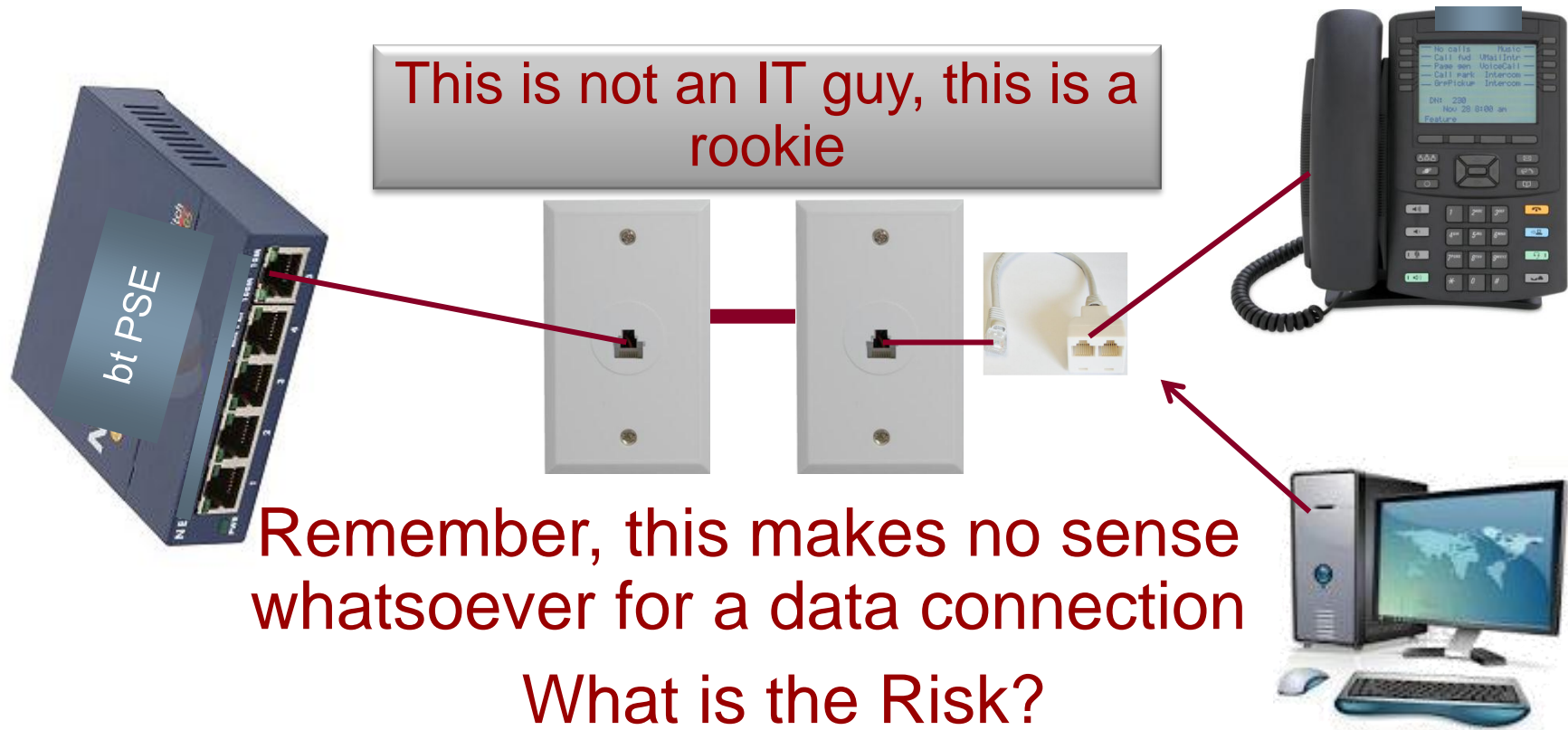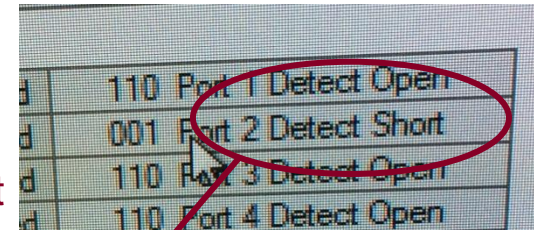## At time zero, A PDS is plugged into the system bt PSE
Later 2nd device is plugged in

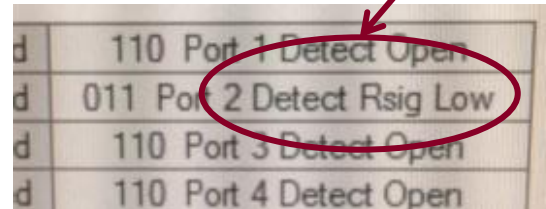| 2nd / 1st	PD	NIC/Swtich Non Isolated Termination	NIC/Swtich Isolated Termination	PSE
PD	OK	Resistors change value	OK	OK

Dell Computer Operating with Gigibit Connection
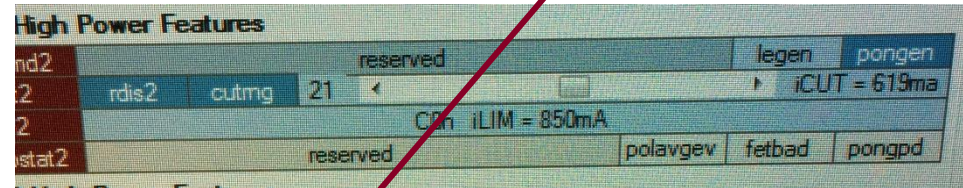

Initial Detection Result

.at Cut and Limits 60mS

New Detection Result

Hot Plugged

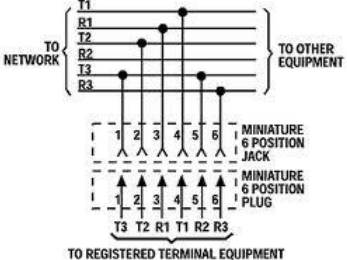## Dell Computer Still Operating 1G

This problem actually exists today and will still exist with 2-by-n PSE solutions

This is not an IT guy, this is a rookie
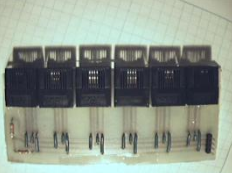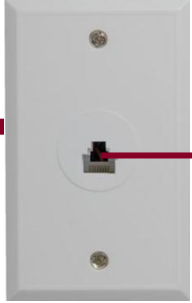
bt PSE

The 'Y' could also be wired as a bridge tap which even 2 x n & at/af configurations will cause the same problem

Splitter and 'Y' Cable used with bt PSEs Risk Summary

- Splitter
  - No Risk
- 'Y' cable when configured properly
  - No Risk
- 'Y' cable is misconfigured (data path not working)
  - 'PD' only has a 'Y' Cable and both PD side devices are plugged in
  - No Risk
  - And no installed base
- 'Y' cable is misconfigured PD and PSE are plugged in and operating then isolated termination device or PSE is plugged in
  - No Risk
  - And No installed Base

Splitter and 'Y' Cable used with bt PSEs Risk Summary

- 'Y' cable is misconfigured PD and PSE are plugged in and operating then, non-isolated termination device is plugged in

  - Termination resistors change value

  - EMI/EMC are effected by "n db"

- Bridge causes the same problem

  - af/at PSEs cause the same problem

  - 2 by n bt PSEs cause the same problem

What other non-IEEE configurations are there to consider?

- Non-IEEE PoE Phantom Power

- Miss-wired cable plants

  - Cables

  - Connectors

  - Punch down panels

  - Passive Hubs & network 'Taps'

- *Is their collective risk more or less than the 'Y' cable risk?*

LINEAR TECHNOLOGY

NON IEEE POWER INJECTORS

Blind Power Injectors are everywhere

Wifi-soft
Helping unwire the World

Multi Port Passive POE injector

Power 12 gigabit devices from one supply 12v to 56v

WS-GPOE-12-1U

- 12 Port Gigabit Ethernet Injector
  - 12 Shielded RJ-45 LAN
  - 12 Shielded RJ-45 LAN+POE
  - all 4 data pairs connected

- 1U high standard rack mount
- 650 ma automatic resettable fuse on each port
- Same voltage to all ports
  power is equally shared as needed by the devices
- Use with any Ethernet switch
- Standard power connector - 2.1mm x 5.5mm
  - Dual connectors – for one or two power supplies
  - Use two power supplies for redundancy

- 4 LED status indicators
  - master power **GREEN** LED
  - for each group of 4 sockets
    - off if < 20 ma
    - **GREEN** if < 300 ma
    - **RED** if > 300 ma (15 watts @ 48v)

- Ideal for IP Cameras, VOIP phone, WiFi Access Points
- Technical support from Austin
- Supports 802.3at or 802.3af devices
  - Mode A operation – minus on pins 1-2, plus on 3-6
- Select the power supply you need 15 to 56 volts
  - we offer kits with power supplies
- Online PoE Distance calculator: http://wifiqos.com/poe-calc.html
- Provides power to:
  - Mikrotik, Ubiquiti, similar 24v devices
  - IP Cameras – most use 48v (802.3af PoE)
  - IP Phones – most use 48v (802.3af PoE)
  - WiFi Access Points – like Aruba, Cisco, HP – 802.3af

http://wifiqos.com/   Skype: wifiqos Phone 512-479-0317
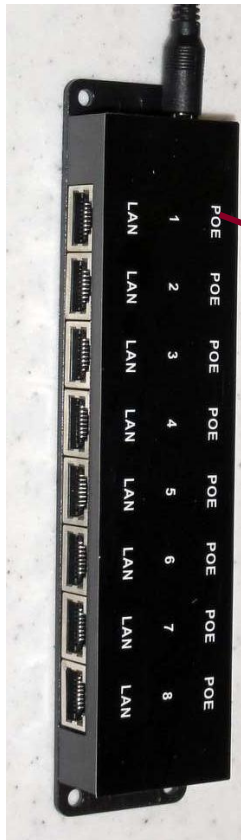
LINEAR TECHNOLOGY

Worst Case Phantom Power

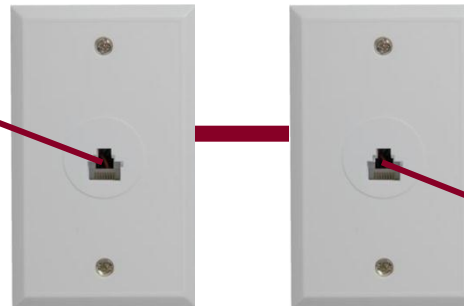This guy is MOST definitely a rookie!

# Power Injectors – No detection, no IEEE current limit

IT Guy? Rookie?

- Ideal for IP Cameras, VOIP phone, WiFi Access Points
- Technical support from Austin
- Supports 802.3at or 802.3af devices
    - Mode A operation – minus on pins 1-2, plus on 3-6
- Select the power supply you need 15 to 56 volts
    - we offer kits with power supplies

LINEAR TECHNOLOGY

Power Injectors – No detection, no IEEE current limit

This is not an IT guy, this is a rookie
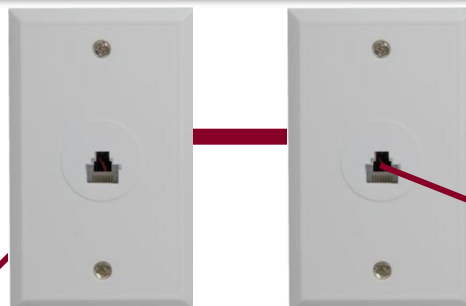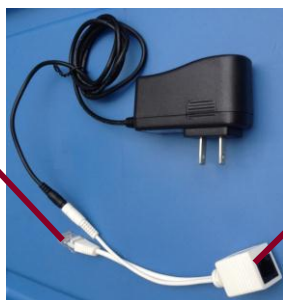
In	LAN	POE	Out
1	Data	Data	1
2	Data	Data	2
3	Data	Data	3
4	N.C.	+Volt	4
5	N.C.	+Volt	5
6	Data	Data	6
7	N.C.	GND	7
8	N.C.	GND	8

INPUT: 12V-48V DC

Network Tap

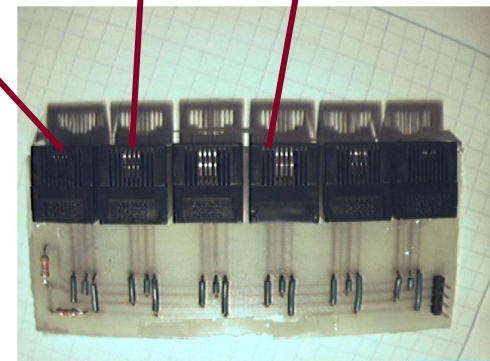This is an IT guy

Bridges or 'Passive Hubs'

This is an IT guy? Are passive hubs in our world?
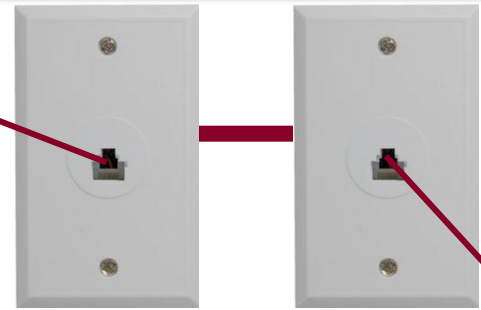
My Message about Blind Power Injectors, Passive hubs

- There are a lot of them – Ubiquitous
- They are as or more 'dangerous' than the corner case 'Y' cable that causes the termination resistor change
- The effects:
  - Termination resistors are being damaged
- There is little to do about non-standard IEEE802.3 systems w/o 'sniffing' every wire
- Even then the 'hot-plug' scenario is ever present.
- Overall risk:
  - Certainly possible to blow up some termination resistors
  - *This one can be a real safety issue*

MISCONNECTIONS

CATn Cables and Connections – RJ45s

- Correct connections:
  - Here are 2
- Possible connections:
  - 8! or 40,320 for one connection
  - 80,640 for two ends of a cable
  - Many of these will still work but hopefully you get the picture

RJ45 Pin #	Wire Color (T568A)	Wire Diagram (T568A)	10Base-T Signal 100Base-TX Signal	1000Base-T Signal
1	White/Green		Transmit+	BI_DA+
2	Green		Transmit-	BI_DA-
3	White/Orange		Receive+	BI_DB+
4	Blue		Unused	BI_DC+
5	White/Blue		Unused	BI_DC-
6	Orange		Receive-	BI_DB-
7	White/Brown		Unused	BI_DD+
8	Brown		Unused	BI_DD-

RJ45 Pin #	Wire Color (T568B)	Wire Diagram (T568B)	10Base-T Signal 100Base-TX Signal	1000Base-T Signal
1	White/Orange		Transmit+	BI_DA+
2	Orange		Transmit-	BI_DA-
3	White/Green		Receive+	BI_DB+
4	Blue		Unused	BI_DC+
5	White/Blue		Unused	BI_DC-
6	Green		Receive-	BI_DB-
7	White/Brown		Unused	BI_DD+
8	Brown		Unused	BI_DD-

LINEAR TECHNOLOGY

CATn Connections – Punch Down Panels

- Good ones have helpful instructions

- Still, the possible number of connections boggles the mind for even two adjacent Cable locations: 16! or 21,000,000,000,000
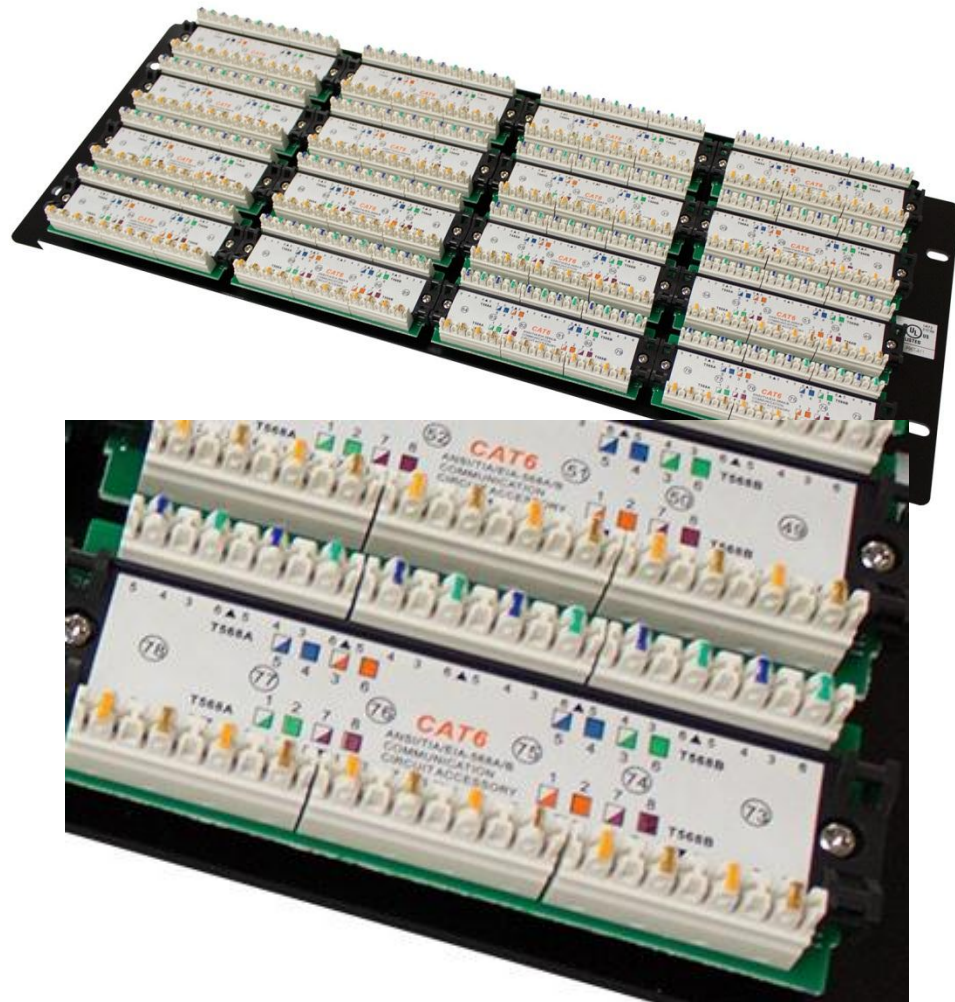
Why does this all work?

- After all, the beauty of CATn Ethernet and PoE is it can be installed with
  - Low Cost Labor
- Installations are
  - Checked and Certified?

My Message about mis-wired cable plants

- Pros likely get right almost all of the time

- Rookies….. More mistakes

- If even possible, making a PSE test all eight wires is a bit expensive.

- Overall risk: Possible to blow up some termination resistors.

LINEAR TECHNOLOGY

Conclusion

- All PoE systems have some risk

- Most of that risk already exists in af and at

- Detecting and preventing all possible risk
  - Is not be possible
  - Is not worth the cost

- There can be no relevant mis-connected 'Y' cable installed base because the data path does not work

Conclusion

- There can be no relevant mis-connected 'Y' cable installed base because the data path does not work

- The real world termination resistor damage is dominated by non-IEEE power injectors

- 2xn PSEs vs 1xn PSEs can detect mis-connected 'Y' cabled system

  - The consequences are not material (termination resistor shift)

  - Bridges and passive hubs, data taps do exist and have the same termination resistor risk even with af/at PSEs

  - *Not a reason to drive the cost to > 2X*