

Technical Troubleshooting 101 Guide

Ethernet Networking Basics:

Ethernet - LAN (local area network) technology standard that is used typically within a single building, connecting LAN devices in close proximity. i.e 328ft or 100m Ethernet is a copper wire topology standard for LAN devices to communicate through electronic pulses in a several formats (protocols). 15yrs ago there were dozens of these protocols, depending on the LAN device manufacturer such as Digital Equipment Corp had DECnet, IBM had SNA, Microsoft had NetBEUI, Novell had Netware IPX, Unix systems used Tcp/Ip. Today most all systems now standardize on only Tcp/Ip as a result of needing to connect to the Internet. Also Ethernet is referred to as the IEEE 802.3 standard.

All the early issues with Ethernet LAN's for traffic congestion, segmentation, collisions, etc. Have all been resolved in LAN devices today such as in Hubs and Switches. Because of the distance limitations of IEEE 802.3 standard Ethernet, repeaters have to be used in order to extend it another 328ft / 100m. Repeaters are simple electrical retiming devices and are the core of an Ethernet Hub / Switch. Other options for extending Ethernet are using fiber transceivers (modules that convert the electrical pulses of copper Ethernet to light pulses on fiber). Using fiber one can extend Ethernet hundreds or thousands of miles.

Extended Ethernet Networking Basics:

In 2000, Enable-IT coined the term Ethernet Extender for use with simple devices that would convert IEEE 802.3 standard Ethernet electrical pulse into Telecom Carrier based DSL signaling for transport longer distances before converting back to Ethernet. Since 1997 Enable-IT has built many point to point and multipoint to point Extended Ethernet solutions for the marketplace.

Category 2 Telephone wire delivers approx 50Mbps throughput Full Duplex

Category 3 wire delivers approx 80Mbps throughput Full Duplex

Category 5 wire delivers approx 100Mbps throughput Full Duplex

Category 5e wire delivers approx 1,000Mbps (Gigabit) throughput Full Duplex

Category 6 / 7 wire delivers approx 1,000Mbps (Gigabit) throughput Full Duplex with less interference from the surrounding environment.

Ethernet Troubleshooting:

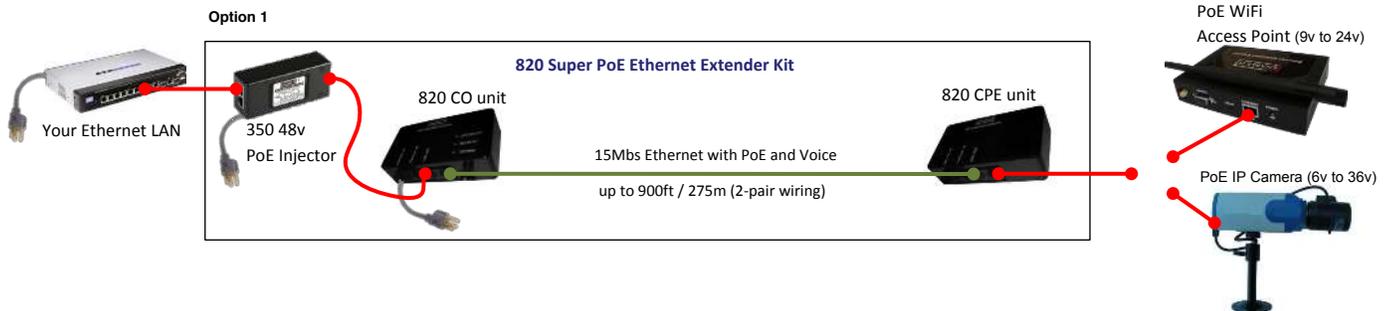
The first rule of any troubleshooting is to always understand the complete layout of a topology solution. This means diagram out all the parts and how they are connected together. Always draw out your layout as completely as possible so that you don't miss any of the connections. Most times people wont go into much detail and can provide misleading information, so it's important to be the detective.

Once you have a basic diagram of the layout the very very next step is to start breaking down each segment of price of equipment from the standpoint of proving it sound and working properly. With time and experience you can easily narrow in on suspected components to troubleshoot first. Even the most experienced troubleshooting engineer can be delayed in finding the source by little things such as a faulty Ethernet Patch cord or bent pins in a RJ-45 LAN jack, so be thorough as possible.

For Enable-IT Ethernet Extenders, we have gone to great lengths to engineer out a lot of potential issues with the products by making them with a lot of built in automatic unseen programming and technology so that they act as if they were a piece of Ethernet cable wire. This way an installer can't really mess up too badly - its like a light bulb, it works right away or it doesn't have power. For all products we highly recommend customers to always perform and out of the box test first so they see the simplicity of the products and understand how they work and to troubleshoot.

Most kits include all the cables and equipment they need to perform this out of the box test. However occasionally the sealed packed Ethernet patch cords we provide will be faulty or bad - which is extremely rare but it does happen.

The following pages will step through several of our products and how to troubleshoot each one for basic customer scenarios. Customers often will combine out solutions with others so it is key to understand how to prove out our equipment to the customer and help them identify where their potential issues are with their cabling, their environment or other equipment.

Enable-IT 820 Kit:**The Diagram**

The out of the Box test for the 820 kit is very straightforward.

As can be seen in the diagram above we have 10 or 12 devices or segments to prove out. These consist of the 4 or 5 LAN patch cords, the interlink wiring and all the LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination. For example prove out the Ethernet patch cords by taking the end device (PoE or not) and connecting to the source LAN switch. Test connectivity with or without the PoE injector if needed. This proves out the end device and the patch cords, PoE Injector and source LAN switch as working if they all pass.

- Step 1 - Enable-IT 820 out of the Box test - Using one of the provided Ethernet patch cords, connect the CO and CPE units via the LINE port (This is considered the Interlink cabling).
- Step 2 - Next use another Ethernet patch cord to attach a LAN device to the Data/PoE – OUT port of the 820 CPE.
- Step 3 - Use another Ethernet patch cord to attach your originating LAN to the Data/PoE – IN port of the 820 CO. If the end device attached to the 820 CPE requires PoE power, make sure to use provided Enable-IT 350 PoE Injector as shown above.
- Step 4 - Next step is to apply power through the 5v power adapter to the 820 CO unit. The LED indicators on the 820 CO will provide visual operational status of the 820 kit.

CPE Sync / Act – Indicates remote LAN is visible and connected with activity.

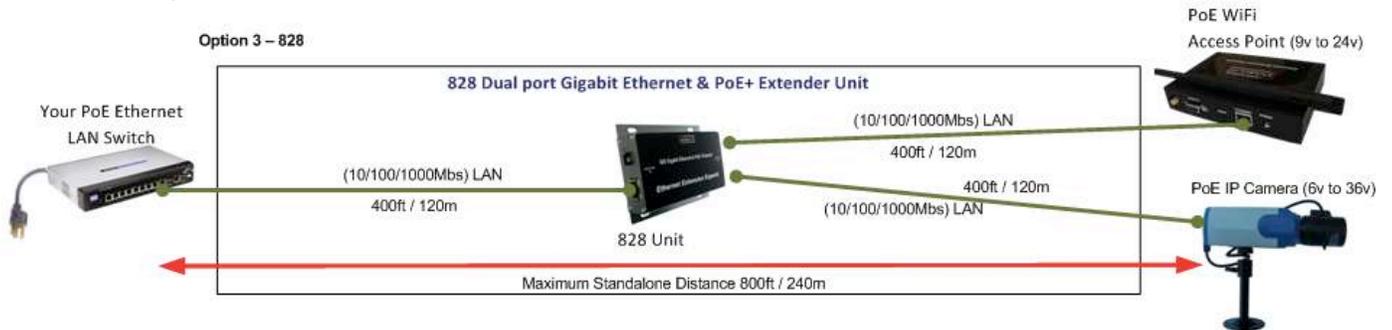
If this LED fails to light, the wiring between the CO and CPE is incorrect, the wiring may have a short or the distance from the 820 CO through the 820 CPE to your remote LAN device exceeds 900ft or 275m.

CO LAN Act - Indicates local LAN is visible and connected with activity. This LED will not light up if no device is attached to the 820 CPE Data/PoE OUT port

CO Power - should be lit when 5v adapter is connected and powered

- Step 5 - If all equipment passes testing, the last step is the Interlink wiring. For the 820 kit it requires a minimum of 2-pair wiring on RJ-45 pins 1,2,3 & 6 straight through - provides data and 1 voice line only. If PoE and or voice 2 is also needed, then use 4-pair wiring on all RJ-45 pins straight through. (data, PoE, dual voice)
This interlink wiring can be over twisted pair or telephone wiring. If telephone wiring is used, like a 25, 50 or 100 pair trunk, we highly recommend pulling off the pairs of wire used from any telephone connection blocks and bridge the wires together using gel filled butt clips (Jellybeans).

Expected Throughput speeds 328ft to 900ft - 10Mbps Full Duplex - Actual chip performance is 15Mbps FD

Enable-IT 828 Gigabit Ethernet Extender:

The Diagram

The out of the Box test for the 828 kit is very straightforward.

As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 3 LAN patch cords, and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out the Ethernet patch cords by taking your end PoE device/s and connecting to your source PoE LAN switch or injector. Test connectivity and PoE. This proves out your end PoE device/s, the patch cords and your PoE LAN switch or injector as working if they all pass.

Step 2 -

Prove out the 828 unit by making sure the DIP switches are set to ON for the Output port. By default they are set to OFF to protect your standard LAN equipment. Using a good known patch cord attach your PoE switch or injector to the 828 LAN In port and then use another good known patch cord to attach the 828 LAN out port to your end PoE device/s. Using a PoE midspan switch you can daisy chain up to (2) 828 units. If using a standalone PoE Injector with no power detection you can daisy chain up to (4) 828 units.

The LED indicators on the 828 LAN ports will provide visual operational status of the 828 standalone unit.

Input RJ-45 Port:

Power LED - Solid Green LED (left side of DC input jack) indicates the 5v power input is on and good.

Input LEDs - Solid Yellow LED only (left side of RJ-45 port) indicates Gigabit Ethernet connectivity detected.
 - Solid Green LED (right side of RJ-45 port) indicates 10Mbps or 100Mbps Ethernet connectivity detected. Yellow LED will be lit and blinking showing Link and LAN Activity.

Output RJ-45 Ports:

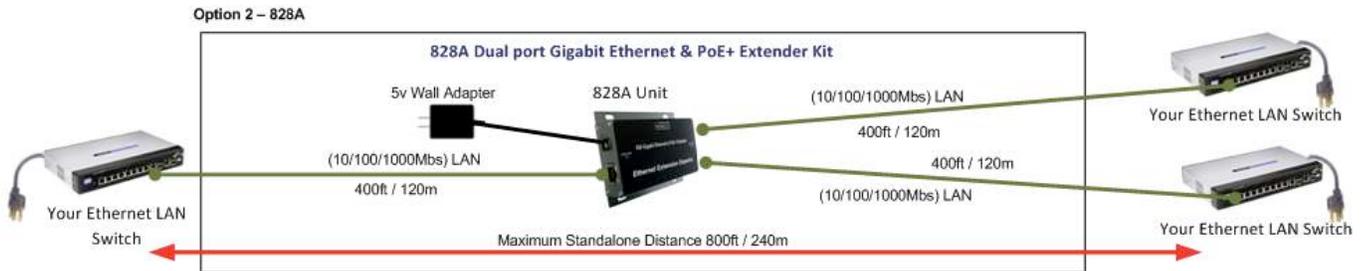
Gigabit LED - Solid Yellow LED (left side of RJ-45 port) indicates Gigabit Ethernet connectivity and activity.

10/100 LED - Solid Green LED (right side of RJ-45 port) indicates 100Mbps Ethernet connectivity and activity.
 - No LED lit (right side of RJ-45 port) indicates 10Mbps Ethernet connectivity.

Step 3 -

If all equipment passes testing, the last step is the long distance wiring for in between the standalone 828 unit. The standalone 828 is an inline solution that cannot be more than 400ft / 120m from the source PoE Switch or the end PoE device. The 828 requires 4-pair wiring on all RJ-45 pins straight through and is recommended to use category rated twisted pair such as CAT5e minimum for Gigabit throughput. - Kind of the reason why buy a Gigabit Extender.

Expected Throughput speeds 328ft to 2,000ft - 1000Mbps Full Duplex

Enable-IT 828A Gigabit Ethernet Extender Kit:**The Diagram**

The out of the Box test for the 828A Pro kit is very straightforward.

As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 3 LAN patch cords, and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out the Ethernet patch cords by taking the end device and connecting to your source LAN switch. Test connectivity. This proves out the end devices, the patch cords and your LAN switches as working if they all pass.

Step 2 -

Prove out the 828A unit by placing inline (between the LAN devices). Attach the provided 5v Power adapter to the 828A.

The PoE Output ports should be set to OFF (up). By default the Output DIP switches are set to OFF to protect your standard LAN equipment. Next using a good known patch cord attach your end device to either of or both of the Output ports of the 828A Extender and then use another good known patch cord to attach the 828A LAN in port to the source LAN Switch.

The LED indicators on the 828A LAN ports will provide visual operational status of the 828A unit.

Input RJ-45 Port:

Power LED - Solid Green LED (left side of DC input jack) indicates the 5v power input is on and good.

Input LEDs - Solid Yellow LED only (left side of RJ-45 port) indicates Gigabit Ethernet connectivity detected.
- Solid Green LED (right side of RJ-45 port) indicates 10Mbps or 100Mbps Ethernet connectivity detected. Yellow LED will be lit and blinking showing Link and LAN Activity.

Output RJ-45 Ports:

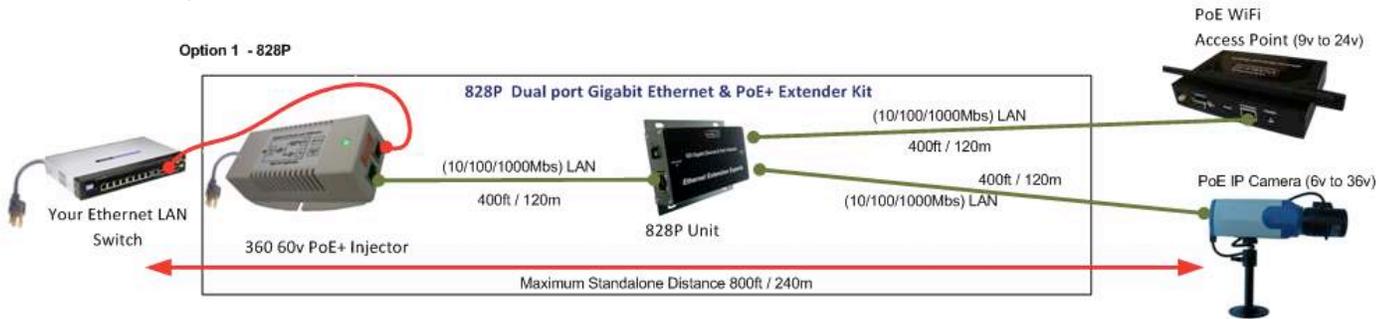
Gigabit LED - Solid Yellow LED (left side of RJ-45 port) indicates Gigabit Ethernet connectivity and activity.

10/100 LED - Solid Green LED (right side of RJ-45 port) indicates 100Mbps Ethernet connectivity and activity.
- No LED lit (right side of RJ-45 port) indicates 10Mbps Ethernet connectivity.

Step 3 -

If all equipment passes testing, the last step is the long distance wiring for in between the 828A unit. The 828A is an inline solution that cannot be more than 400ft / 120m from your source LAN Switch or your end LAN device. The 828A requires 4-pair wiring on all RJ-45 pins straight through and is recommended to use category rated twisted pair such as CAT5e minimum for Gigabit throughput. - Kind of the reason why buy a Gigabit Extender.

Expected Throughput speeds 328ft to 2,000ft - 1000Mbps Full Duplex

Enable-IT 828P Gigabit Ethernet Extender Kit:

The Diagram

The out of the Box test for the 828P kit is very straightforward.

As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 3 LAN patch cords, and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out the Ethernet patch cords by taking your end PoE device and connecting to your source PoE LAN switch. Test connectivity and PoE. This proves out your end PoE device, the patch cords and your PoE LAN switch as working if they all pass.

Step 2 -

Prove out the 828P unit by making sure the DIP switches are set to ON (down) for the Output ports. By default they are set to OFF (up) to protect your standard LAN equipment. Next using a good known patch cord, attach your end PoE device to either of the Output ports of the 828P Extender and then use another good known patch cord to attach the 828P LAN In port to your PoE LAN Switch.

The LED indicators on the 828P LAN ports will provide visual operational status of the 828P unit.

Input RJ-45 Port:

Power LED - Solid Green LED (left side of DC input jack) indicates the 5v power input is on and good.

Input LEDs - Solid Yellow LED only (left side of RJ-45 port) indicates Gigabit Ethernet connectivity detected.
 - Solid Green LED (right side of RJ-45 port) indicates 10Mbps or 100Mbps Ethernet connectivity detected. Yellow LED will be lit and blinking showing Link and LAN Activity.

Output RJ-45 Ports:

Gigabit LED - Solid Yellow LED (left side of RJ-45 port) indicates Gigabit Ethernet connectivity and activity.

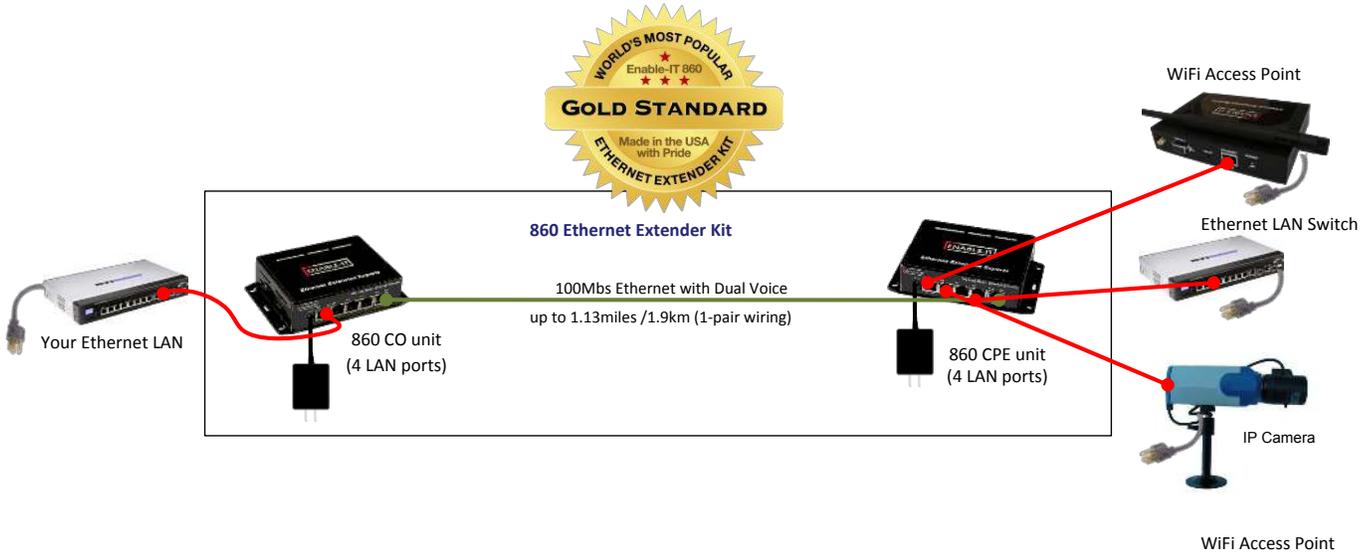
10/100 LED - Solid Green LED (right side of RJ-45 port) indicates 100Mbps Ethernet connectivity and activity.
 - No LED lit (right side of RJ-45 port) indicates 10Mbps Ethernet connectivity.

Step 3 -

If all equipment passes testing, the last step is the long distance wiring for in between the 828P unit. The 828P is an inline solution that cannot be more than 400ft / 120m from the 360 PoE injector or the end LAN device. This means you can run 328ft / 100m of LAN cabling from your source LAN switch to the 360 PoE injector and then another 400ft / 120m of LAN cabling to the 828P. The 828P requires 4-pair wiring on all RJ-45 pins straight through and is recommended to use category rated twisted pair such as CAT5e minimum for Gigabit throughput.
 - Kind of the reason why buy a Gigabit Extender.

Expected Throughput speeds 328ft to 2,000ft - 1000Mbps Full Duplex

Enable-IT 860 Kit:



The Diagram

The out of the Box test for the 860 kit is very straightforward. As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 3 LAN patch cords, and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out each of the Ethernet patch cords by taking the remote end LAN device and connecting to the local LAN device. This proves out the end LAN devices and the Ethernet patch cords if they all pass.

Step 2 -

Prove out the 860 kit by making sure the DIP switches are set to defaults - all down (OFF) except 860 one unit will have DIP switch 1 enabled up (ON). Using a good known Ethernet patch cord connect the 860 Interlink ports together, apply the power to each 860 unit through the supplied wall adapter. You can also connect your proven out end device LAN equipment to the LAN ports on each 860 unit. The LED indicators on the 860 LAN ports will provide visual operational status of the 860 units.

Sync LED - Slow to fast flicker on power up – indicates negotiation of a link. Solid Green LED indicates link established and rapid pulse is traffic.

Pwr - Solid Green LED indicates that both units are receiving 5v power.

Mode - Solid Yellow LED on CPE unit only – No LED lit on CO

ACT - Yellow LEDs – Lit solid indicates the presence of local LAN
 - Blinking indicates the presence of local LAN traffic

Step 3 -

If all equipment passes local testing, the last step is the long distance Interlink wiring for in between the 860 units. You can run 328ft / 100m of LAN cabling from each 860 LAN port to your LAN devices. The 860 requires 1-pair wiring for either the RJ-45 Interlink port or the RJ-11 one with or without the DSL filter dongles. It is recommended to use category rated twisted pair such as CAT5e for maximum distance and highest throughput.

Expected Throughput speeds	Up to 700ft (200m)	- 100Mbps Full Duplex
	700ft (200m) to 1,350ft (400m)	- 90Mbps Full Duplex
	1,350ft (400m) to 1,970ft (600m)	- 70Mbps Full Duplex
	1,970ft (600m) to 2,625ft (800m)	- 52Mbps Full Duplex
	2,625ft (800m) to 3,280ft (1000m)	- 42Mbps Full Duplex
	3,300ft (1005m) to 6,000(1,828m)	- 30Mbps Full Duplex

Enable-IT 860C Kit:



The Diagram

The out of the Box test for the 860C kit is very straightforward. As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 2 LAN patch cords, 1 Coax segment and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out each of the Ethernet patch cords by taking the remote end LAN device and connecting to the local LAN device. This proves out the end LAN devices and the Ethernet patch cords if they all pass.

Step 2 -

Prove out the 860C kit by making sure the DIP switches are set to defaults - all down (OFF) except 860C one unit will have DIP switch 1 enabled up (ON). Using a good known Coax cable connect the 860C Coax Interlink ports together, apply the power to each 860C unit through the supplied wall adapter. You can also connect your proven out end device LAN equipment to the LAN ports on each 860C unit. The LED indicators on the 860C LAN ports will provide visual operational status of the 860C units.

Sync LED - Slow to fast flicker on power up – indicates negotiation of a link. Solid Green LED indicates link established and rapid pulse is traffic.

Pwr - Solid Green LED indicates that both units are receiving 5v power.

Mode - Solid Yellow LED on CPE unit only – No LED lit on CO

ACT - Yellow LEDs – Lit solid indicates the presence of local LAN
 - Blinking indicates the presence of local LAN traffic

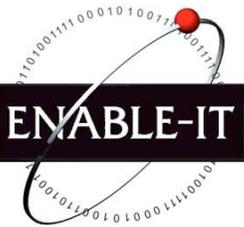
Step 3 -

If all equipment passes local testing, the last step is the long distance Interlink Coax wiring for in between the 860C units.

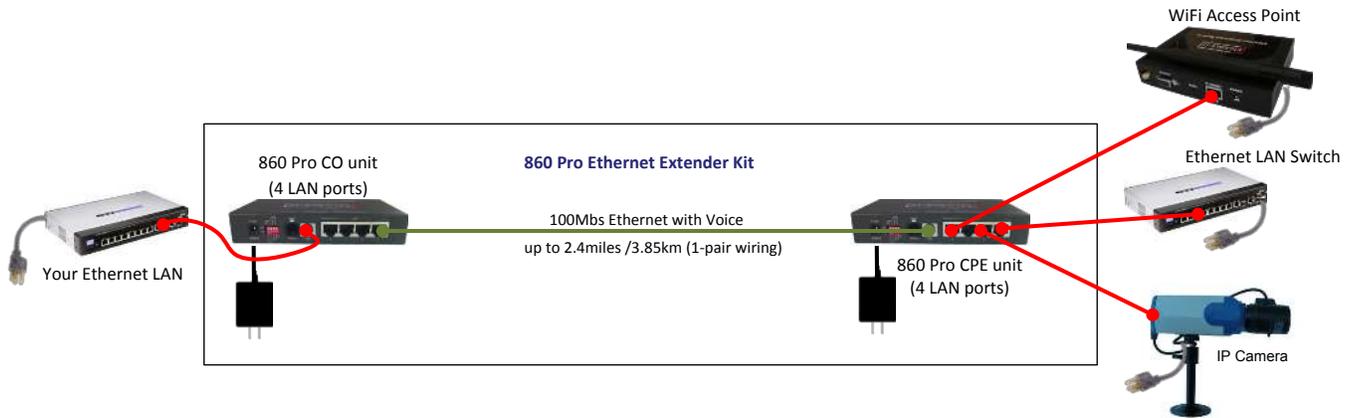
You can run 328ft / 100m of LAN cabling from each 860C LAN port to your LAN devices.

Expected Throughput speeds

Up to 700ft (200m)	- 100Mbps Full Duplex
700ft (200m) to 1,350ft (400m)	- 90Mbps Full Duplex
1,350ft (400m) to 1,970ft (600m)	- 70Mbps Full Duplex
1,970ft (600m) to 2,625ft (800m)	- 52Mbps Full Duplex
2,625ft (800m) to 3,280ft (1,000m)	- 42Mbps Full Duplex
3,300ft (1,005m) to 6,000(1,828m)	- 30Mbps Full Duplex



Enable-IT 860 Pro Kit:



The Diagram

The out of the Box test for the 860 Pro kit is very straightforward. As can be seen in the diagram above we have 7 devices or segments to prove out. These consist of the 3 LAN patch cords, and all the 4 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out each of the Ethernet patch cords by taking the remote end LAN device and connecting to the local LAN device. This proves out the end LAN devices and the Ethernet patch cords if they all pass.

Step 2 -

Prove out the 860 Pro kit by making sure the DIP switches are set to defaults - all down (OFF) except 860 Pro one unit will have DIP switch 1 enabled up (ON). Using a good known Ethernet patch cord connect the 860 Pro VDSL ports together, apply the power to each 860 Pro unit through the supplied wall adapter. You can also connect your proven out end device LAN equipment to the LAN ports on each 860 unit. The LED indicators on the 860 Pro LAN ports will provide visual operational status of the 860 Pro units.

Link LED - Slow to fast flicker on power up – indicates negotiation of a link. Solid Green LED indicates link established and rapid pulse is traffic.

Power ACT - Solid Green LED indicates that both units are receiving 5v power.
 - Yellow LEDs – Lit solid indicates the presence of local LAN
 - Blinking indicates the presence of local LAN traffic

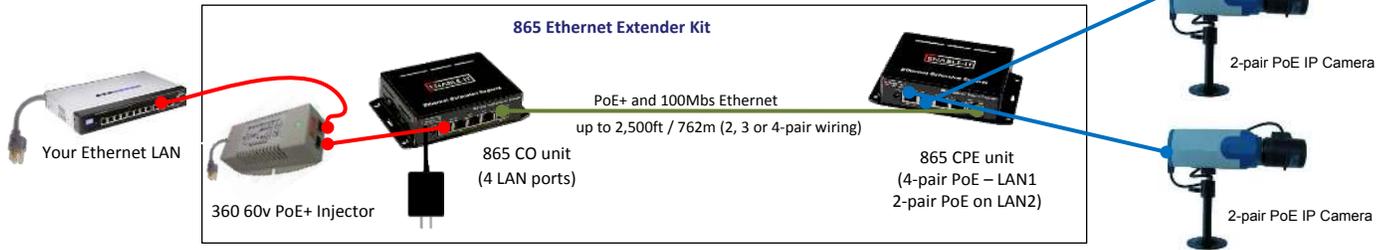
Step 3 -

If all equipment passes local testing, the last step is the long distance Interlink wiring for in between the 860 Pro units. You can run 328ft / 100m of LAN cabling from each 860 Pro LAN port to your LAN devices. The 860 Pro requires 1-pair wiring for the RJ-11 VDSL port. It is recommended to use category rated twisted pair such as CAT5e for maximum distance and highest throughput.

Expected Throughput speeds	Up to 700ft (200m)	- 100Mbps Full Duplex
	700ft (200m) to 1,350ft (400m)	- 95Mbps Full Duplex
	1,350ft (400m) to 1,970ft (600m)	- 75Mbps Full Duplex
	1,970ft (600m) to 2,625ft (800m)	- 55Mbps Full Duplex -17a mode
	2,625ft (800m) to 3,280ft (1,000m)	- 44Mbps Full Duplex -17a mode
	3,300ft (1,005m) to 6,000 (1,828m)	- 30Mbps Full Duplex -17a mode
	6,100ft (1,860m) to 8,500 (2,590m)	- 10Mbps Full Duplex -17a mode
	8,600ft (2,622m) to 10,000 (3,048m)	- 6Mbps Full Duplex -17a mode
	10,500 (3,200m) to 12,000 (3,657m)	- 4Mbps Full Duplex -17a mode

Enable-IT 865 Kit: - Option 1

Option 1 – Normal Remote PoE+ use up to 2,500ft



The Diagram

The out of the Box test for the 865 kit is very straightforward. As can be seen in the diagram above we have 9 devices or segments to prove out. These consist of the 4 LAN patch cords, and all the 5 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

- Step 1 - Prove out each of the Ethernet patch cords by taking the remote end LAN device and connecting to the local LAN device. This proves out the end LAN devices and the Ethernet patch cords if they all pass.
- Step 2 - Prove out the 860 Pro kit by making sure the DIP switches are set to defaults - all down (OFF) except 860 Pro one unit will have DIP switch 1 enabled up (ON). Using a good known Ethernet patch cord connect the 860 Pro VDSL ports together, apply the power to each 860 Pro unit through the supplied wall adapter. You can also connect your proven out end device LAN equipment to the LAN ports on each 860 unit. The LED indicators on the 860 Pro LAN ports will provide visual operational status of the 860 Pro units.

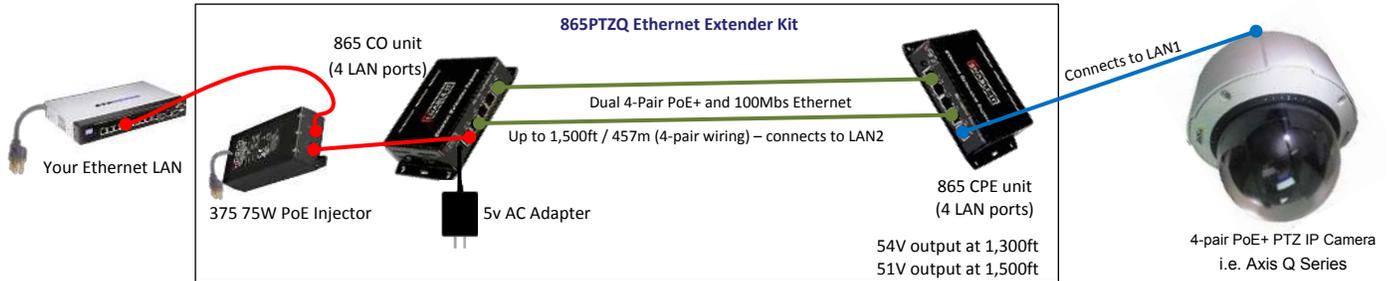
- Link LED** - Slow to fast flicker on power up – indicates negotiation of a link. Solid Green LED indicates link established and rapid pulse is traffic.
- Power** - Solid Green LED indicates that both units are receiving 5v power.
- ACT** - Yellow LEDs – Lit solid indicates the presence of local LAN
- Blinking indicates the presence of local LAN traffic

- Step 3 - If all equipment passes local testing, the last step is the long distance Interlink wiring for in between the 860 Pro units. You can run 328ft / 100m of LAN cabling from each 860 Pro LAN port to your LAN devices. The 860 Pro requires 1-pair wiring for the RJ-11 VDSL port. It is recommended to use category rated twisted pair such as CAT5e for maximum distance and highest throughput.

Expected Throughput speeds	Up to 700ft (200m)	- 100Mbps Full Duplex
	700ft (200m) to 1,350ft (400m)	- 95Mbps Full Duplex
	1,350ft (400m) to 1,970ft (600m)	- 75Mbps Full Duplex
	1,970ft (600m) to 2,625ft (800m)	- 55Mbps Full Duplex -17a mode

Enable-IT 865PTZQ Kit:

Long Distance 4-Pair PoE+ use – i.e Axis Q-series, Cisco Aironet 12xx



The Diagram

The out of the Box test for the 865PTZQ kit is very straightforward.

As can be seen in the diagram above we have 10 devices or segments to prove out. These consist of the 5 LAN patch cords, and all the 5 LAN devices. Each device or segment needs to be proved good. To do this is a process of elimination.

Step 1 -

Prove out each of the Ethernet patch cords by taking the remote end LAN device and connecting to the local LAN device. This proves out the end LAN devices and the Ethernet patch cords if they all pass.

Step 2 -

Prove out the 860 Pro kit by making sure the DIP switches are set to defaults - all down (OFF) except 860 Pro one unit will have DIP switch 1 enabled up (ON). Using a good known Ethernet patch cord connect the 860 Pro VDSL ports together, apply the power to each 860 Pro unit through the supplied wall adapter. You can also connect your proven out end device LAN equipment to the LAN ports on each 860 unit. The LED indicators on the 860 Pro LAN ports will provide visual operational status of the 860 Pro units.

Link LED - Slow to fast flicker on power up – indicates negotiation of a link. Solid Green LED indicates link established and rapid pulse is traffic.

Power ACT - Solid Green LED indicates that both units are receiving 5v power.
 - Yellow LEDs – Lit solid indicates the presence of local LAN
 - Blinking indicates the presence of local LAN traffic

Step 3 -

If all equipment passes local testing, the last step is the long distance Interlink wiring for in between the 860 Pro units. You can run 328ft / 100m of LAN cabling from each 860 Pro LAN port to your LAN devices. The 860 Pro requires 1-pair wiring for the RJ-11 VDSL port. It is recommended to use category rated twisted pair such as CAT5e for maximum distance and highest throughput.
 Notes: For OOTBT only 1 patch cord can be used