Product Model	**2156 and 2157 Auto-Rate LAN Extenders**
Product Name	**CopperLink Auto-Rate Ethernet LAN Extenders**
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Applications

What is the primary application for the Model 2156 and 2157 Auto-Rate LAN Extenders?

The Patton Model 2156 and 2157 CopperLink Ethernet Extenders let customers establish a high-speed long-distance communications link interconnecting two geographically separated LANs or network enabled devices. They are used in pairs and take advantage of the existing copper infrastructure for high-speed Ethernet extensions.

They can be used for several purposes:

LAN-to-LAN Bridging: The Model 2156 and 2157 CopperLink Ethernet Extenders connect remote LANs over a high-speed, symmetrical link. One unit is placed at each end of a voice-grade wire to provide a high-speed LAN-to-LAN connection over extended distances.

Ethernet Extension: Overcome the 328 ft (100m) limitations of Ethernet with The Model 2156 and 2157 Ethernet Extenders. Without the need for Ethernet repeaters, extend the reach of you Ethernet connection to distances greater than 9 km.

Dedicated Internet Services: The Patton CopperLink Ethernet Extenders enable ISP's to deliver dedicated high-speed Internet access from a Point-of-Presence (POP) to a customer premise. The Plug-N-Play operation of the CopperLink Extenders makes installation a snap for customers, and the auto-rate technology ensures the best reach/rate combination possible.

The Model 2156 provides data rates up to 2.3 Mbps and the Model 2157 provides data rates up to 4.6 Mbps, and they both are capable of distances that can reach as far as 9.4 km (5.7 mi) on a standard 0.5 mm (24 AWG) twisted pair. The Model 2156 and 2157 Auto-rate LAN Extenders utilize an auto-rate adaptation algorithm to determine the highest achievable speed for the specific distance of each LAN extension.

How is the CopperLink connection established?

The plug-n-play operation of the Model 2156 and 2157 CopperLink Ethernet Extenders make set-up simple. Just follow these four easy steps:

1) Connect the 10/100Base-T devices to the Ethernet port of each Ethernet Extender unit.
2) Connect each end of the twisted-pair wire to the Line port of each extender unit.
3) Plug the power supplies into a suitable power source.

4) Plug the output jack of each power supply to the rear power jack of each CopperLink Ethernet Extender. Once powered up, a communications link is established between the two units they will automatically set themselves to the highest speed achievable on the particular twisted pair used to make the connection.

What are the typical distance/speed combinations of the model 2156 and model 2157 CopperLink Ethernet Extenders?

Actual distance and link performance will vary based on the environment (cross talk/noise) and type/gauge of wire used. The charts below show examples of how the gauge of wire affects the distance/rate achievable for each model.

Distance Table Patton CopperLink Ethernet Extender: **Model 2156**																
		NO NOISE														
DSL Line Rate		26g (0.4mm)			24g (0.5mm)			22g (0.6mm)			20g (0.8mm)			19g (0.9mm)		
N	kbps	feet	miles	km	feet	miles	km	feet	miles	km	feet	miles	km	feet	miles	km
3	200	22800	4.3	7.4	30400	5.7	9.4	42500	8.0	13.1	54700	10.3	16.8	63900	12.1	19.7
6	392	21400	4.0	6.6	28500	5.4	8.8	39900	7.5	12.3	51300	9.7	15.8	57000	10.8	17.5
8	520	20200	3.8	6.2	26900	5.1	8.3	37600	7.1	11.6	48400	9.2	14.9	51200	9.7	15.8
12	776	18300	3.5	5.6	24400	4.6	7.5	31700	6.0	9.8	41400	7.8	12.7	46400	8.8	14.3
18	1160	15800	3.0	5.1	21000	4.0	6.5	27300	5.2	8.4	35700	6.7	11.0	39900	7.5	12.3
24	1544	14900	2.8	4.8	19800	3.7	6.1	25700	4.9	7.9	33600	6.4	10.3	35700	6.7	11.0
32	2056	13000	2.5	4.4	17300	3.3	5.3	22400	4.2	6.9	29400	5.6	9.0	31200	5.9	9.6
36	2312	12300	2.3	4.3	16400	3.1	5.0	21300	4.0	6.6	27800	5.3	8.6	29600	5.6	9.1

Distance Table Patton CopperLink Ethernet Extender: **Model 2157**																
		NO NOISE														
DSL Line Rate		26g (0.4mm)			24g (0.5mm)			22g (0.6mm)			20g (0.8mm)			19g (0.9mm)		
N	kbps	feet	miles	km	feet	miles	km	feet	miles	km	feet	miles	km	feet	miles	km
3	200	22800	4.3	7.0	30400	5.7	9.4	42500	8.0	13.1	54700	10.3	16.8	63900	12.1	19.7
6	392	21400	4.0	6.6	28500	5.4	8.8	39900	7.5	12.3	51300	9.7	15.8	57000	10.8	17.5
8	520	20200	3.8	6.2	26900	5.1	8.3	37600	7.1	11.6	48400	9.2	14.9	51200	9.7	15.8
12	776	18300	3.5	5.6	24400	4.6	7.5	31700	6.0	9.8	41400	7.8	12.7	46400	8.8	14.3
18	1160	15800	3.0	4.9	21000	4.0	6.5	27300	5.2	8.4	35700	6.7	11.0	39900	7.5	12.3
24	1544	14900	2.8	4.6	19800	3.7	6.1	25700	4.9	7.9	33600	6.4	10.3	35700	6.7	11.0
32	2056	13000	2.5	4.0	17300	3.3	5.3	22400	4.2	6.9	29400	5.6	9.0	31200	5.9	9.6
36	2312	12300	2.3	3.8	16400	3.1	5.0	21300	4.0	6.6	27800	5.3	8.6	29600	5.6	9.1
42	2696	12100	2.3	3.7	16100	3.0	5.0	20900	4.0	6.4	27300	5.2	8.4	29000	5.5	8.9
48	3080	11800	2.2	3.6	15700	3.0	4.8	20400	3.9	6.3	26600	5.0	8.2	28300	5.4	8.7
54	3464	10900	2.1	3.4	14500	2.7	4.5	18800	3.6	5.8	24600	4.7	7.6	26100	4.9	8.0
60	3848	10000	1.9	3.1	13300	2.5	4.1	17200	3.3	5.3	22600	4.3	7.0	24000	4.5	7.4
66	4232	9000	1.7	2.8	12000	2.3	3.7	15600	2.9	4.8	20400	3.9	6.3	21600	4.1	6.6
72	4616	8000	1.5	2.5	10600	2.0	3.3	13700	2.6	4.2	18000	3.4	5.5	19100	3.6	5.9

*NOTE: Distances are based on a minimum to no cross talk environment. These distance tables do NOT include the potential 328ft (100 m) Ethernet connections on both ends of the communications link.

How many wires are needed to connect at the maximum rates?

Both the Model 2156 and the Model 2157 use just a single twisted pair (2 wires) to transmit data up to the maximum data rates (up to 2.3 Mbps for the Model 2156 and up to 4.6 Mbps for the Model 2157).

Do the Model 2156 or Model 2157 include any management capabilities or test modes?

No, these models do not have any management capabilities or test modes. However, they do feature eight status LED indicators to provide operational status at a glance and assist with troubleshooting.

Can the line rates be manually altered on the Model 2156 or Model 2157?

No, The Models 2156 and 2157 Ethernet Extenders utilize a special algorithm to determine the best rate that can be achieved for each connection between two units.

Do the Model 2156 and Model 2157 Ethernet Extenders operate with symmetrical or asymmetrical transmission?

These Ethernet extenders are completely symmetrical ensuring that the same bandwidth is available regardless of which direction the transmission is occurring. This allows customers to place the Local and the remote at either location they prefer without affecting the overall performance.

Is surge protection provided within the Model 3201 and Model 3241?

Yes, these models of CopperLink Ethernet Extenders are protected in compliance with all FCC Part 68 and UL1950 specifications. A 58 – 77 V sidactor is utilized to provide isolation on the DSL link. In addition, these CopperLink Ethernet Extenders are designed to meet ITU-T recommendation K12.

Do these Ethernet Extenders work only in pairs?

Yes, the Model 2156 must operate in pairs and the Model 2157 must operate in pairs. For each link, a Local and Remote unit is required.

Does it matter which end of the link the   L   Local unit and   R   Remote unit are located?

No, the determination of which end of the link is local and which end is the remote is completely up to the customer, and will not affect the overall operation of the circuit. The designation of local and remote is used to ensure that there is one of each (one local and one remote) in each pair of extenders.

Do the Patton Models 2156 and 2157 Ethernet Extenders support VLAN?

Yes, these models (the model 2156 and the model 2157) will support VLAN (802.1Q) by passing the larger sized packets transparently. These models do not have configuration commands to add a VLAN tag to a packet, nor do they stripe outbound traffic with tags.

Do the Patton Model 2156 and Model 2157 pass higher layer protocol such as TCP/IP packets?

Yes, they both pass higher layer protocols such as TCP/IP. Neither model reads the TCP/IP packets, but they will pass the packets on transparently.

Do the Model 2156 and Model 2157 support bridging?
Yes, these models will automatically learn, age, and filter 1,024 source addresses. Destination addresses of incoming frames are compared with the Source Address in the address table and discarded if an entry exists; otherwise, they are forwarded over the CopperLink Ethernet Extension.

What devices typically connect to the Ethernet 10/100Base-T port?
Devices that typically connect to the Ethernet port are Ethernet Hubs/Switches, Remote PC's, and any other network enabled device.

What is the MDI-X switch used for?
The MDI-X switch is used provides an easy method of allowing the units to connect to either a hub (DCE) or PC (DTE) device eliminating the confusion over whether a straight-through connection or a cross-over connection is needed. With a simple push of the MDI-X switch, the unit itself will change the connection from straight-through to a crossover or back again.

How is the Ethernet port configured to accept 10 or 100Base-T?
The Ethernet port automatically senses 10 or 100Base-TX Ethernet connections.

Does the Ethernet port require configuration for full or half-duplex connections?
The Model 2156 and Model 2157 will automatically sense full or half-duplex Ethernet connections.

What are the power supply options for these Ethernet Extenders?
The Model 2156 and Model 2157 come standard with an external UI (100-240VAC) power supply.

Certifications

What Certifications/Approvals Do the Model 2156 and Model 2157 have?
They each have been tested and Certified/approved for the following:

Safety	Emissions	Telecommunications
Patton Internal Safety and UL/CSA testing per: UL1950 (MET), Canadian cMET ESD EN61000-4-2	EMC Directive 89/336/EEC Low Voltage Directive 73/23/EEC (EN60950) FCC Part 15 Sub Part B, Class A	FCC Part 68 CE Mark Canadian CS-03 CTR12 CTR13