

# USER MANUAL

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## MODELS 2156 & 2157 CopperLink Ethernet Extenders



**PATTON**  
Electronics Co.



Part# 07M2156\_2157  
Doc# 032131U Rev. B  
Revised 1/15/08

SALES OFFICE  
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(301) 975-1007

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## 1.0 WARRANTY INFORMATION

**Patton Electronics** warrants all Model 2156 or 2157 components to be free from defects, and will—at our option—repair or replace the product should it fail within one year from the first date of the shipment.

This warranty is limited to defects in workmanship or materials, and does not cover customer damage, abuse or unauthorized modification. If this product fails or does not perform as warranted, your sole recourse shall be repair or replacement as described above. Under no condition shall **Patton Electronics** be liable for any damages incurred by the use of this product. These damages include, but are not limited to, the following: lost profits, lost savings and incidental or consequential damages arising from the use of or inability to use this product. **Patton Electronics** specifically disclaims all other warranties, expressed or implied, and the installation or use of this product shall be deemed an acceptance of these terms by the user.

**Note** Conformity documents of all Patton products can be viewed online at [www.patton.com](http://www.patton.com) under the appropriate product page.

### 1.1 RADIO AND TV INTERFERENCE

The Model 2156 or 2157 generate and use radio frequency energy, and if not installed and used properly—that is, in strict accordance with the manufacturer's instructions—may cause interference to radio and television reception. The Models 2156 and 2157 have been tested and found to comply with the limits for a Class A computing device in accordance with specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the Model 2156 or 2157 does cause interference to radio or television reception, which can be determined by disconnecting the unit, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

### 1.2 CE NOTICE

The CE symbol on your Patton Electronics equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the European Union (EU). A Certificate of Compliance is available by contacting Technical Support.



**Caution**

**The Models 2156 and 2157 are not intended to be connected to the public telephone network.**

### **1.3 SERVICE**

All warranty and non-warranty repairs must be returned freight prepaid and insured to Patton Electronics. All returns must have a Return Materials Authorization number on the outside of the shipping container. This number may be obtained from Patton Electronics Technical Services at:

- Telephone: **+1(301) 975-1007**
- Email: **support@patton.com**
- URL: **http://www.patton.com**

Technical support is available from 8 AM to 5 PM EST (8:00 to 17:00 UTC-5), Monday through Friday

**Note** .Packages received without an RMA number will not be accepted.

## 2.0 GENERAL INFORMATION

Thank you purchasing this Patton Electronics product. This product has been thoroughly inspected and tested and is warranted for one year for parts and labor. If questions arise while installing or using this product, contact **Technical Support** at **+1 (301) 975-1007**.

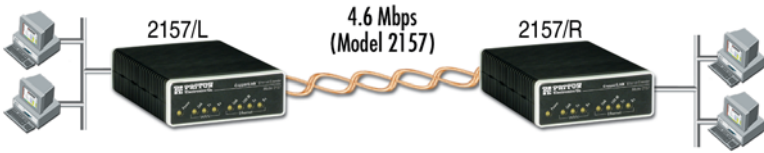
### 2.1 FEATURES

- Easy-to-install Ethernet Extenders—*no configuration required*
- Auto-rate adaption ensures the highest rate possible for each extension distance
- Data rates to 2.3 Mbps (for Model 2156) and 4.6 Mbps (for Model 2157)
- Auto-sensing 10/100Base-T
- Extends network connections up to 30,000 ft (9,144 m) over 2-wire 24-AWG unconditioned lines (see Appendix A on page 14)
- Transparent operation to higher level protocols such as TCP/IP, DECnet, NETBIOS, IPX, etc.
- Compatible with 802.1Q VLAN
- LED indicators for Power; Ethernet Link, 100Base-T Operation, Transmit, Receive; WAN Link, Transmit, Receive
- Made in the USA

### 2.2 DESCRIPTION

The Patton Electronics CopperLink Ethernet Extenders provide high-speed LAN connections between peered Ethernet LANs, remote PCs, or any other network enabled 10/100Base-T device.

Operating in pairs, a Model 2156 or 2157 can automatically forward LAN broadcasts, multicasts, and frames across a 2-wire voice-grade twisted-pair link. The data is passed transparently (unmodified) through the Ethernet Extenders. They automatically add and delete MAC addresses, only passing packets across the CopperLink line that are meant for the remote peered LAN.



**Figure 1.** Typical application

The 2157/L and 2157/R work together to create a transparent extension between two peered Ethernet LANs. Figure 1 shows a typical point-to-point application.

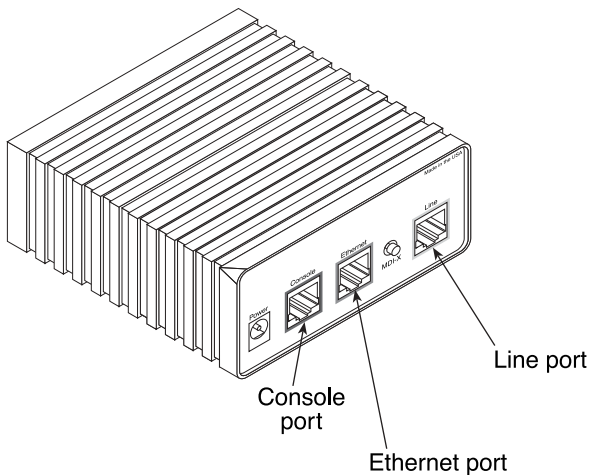
### 3.0 INSTALLATION

Because the CopperLink Ethernet Extenders require no configuration, they can be installed quickly. Installation consists of the following:

- Connect the line interface between the units (refer to section 3.1, “Connecting the Twisted-Pair Line Interface” on page 7)

**Note** See Figure 2 for the rear-panel connectors locations.

- Connect the Ethernet interface (refer to section 3.2, “Line Interface—Connecting the 10/100Base-T Ethernet Interface” on page 8).
- Connect the power plug (refer to section 3.3, “Connecting Power” on page 10).



**Figure 2.** CopperLink Ethernet Extender rear panel

#### 3.1 CONNECTING THE TWISTED-PAIR LINE INTERFACE

The Models 2156 and 2157 support communication between two peer Ethernet LAN sites over a distance greater than 30,000 ft (9,144 m) over 24 AWG (0.5 mm) twisted-pair wire.

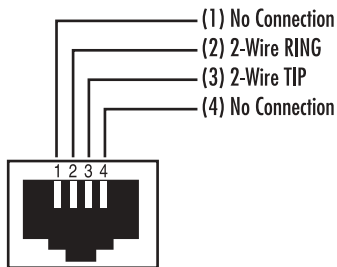
**Note** The Models 2156 and 2157 use an auto-rate adaption feature to provide the fastest data rate possible over the wire and distance of each Ethernet extension. The actual distance and rate achieved for Ethernet extension may vary depending on the environment and type/gauge of the wire used.

Follow the steps below to connect the CopperLink interfaces.

**Note** The Model 2156 or 2157 units work in pairs. One of the units must be a Model 2156/L (local) or 2157/L, and the other unit must be a Model 2156/R (remote) or 2157/R.

1. To function properly, the two Ethernet Extenders must be connected together using twisted-pair, unconditioned, dry, metal wire, between 19 (0.9mm) and 26 AWG (0.4mm). Leased circuits that run through signal equalization equipment are not acceptable.
2. The Models 2156 and 2157 are equipped with an RJ-11 interface. The CopperLink interfaces are a two-wire interface. Observe the signal/pin relationships on the CopperLink interface jack.

The RJ-11 connector on the CopperLink Ethernet Extender's twisted pair interface is polarity insensitive and is wired for a two-wire interface. The signal/pin relationship is shown in Figure 3.

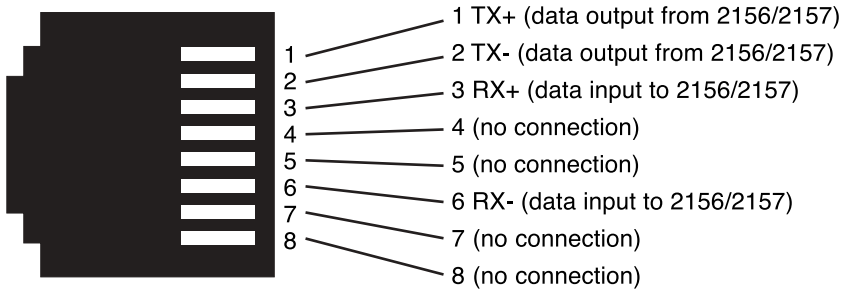


**Figure 3.** CopperLink Ethernet Extender (RJ-11) twisted pair line interface.

### **3.2 LINE INTERFACE—CONNECTING THE 10/100BASE-T ETHERNET INTERFACE**

The shielded RJ-45 port labeled *Ethernet* is the 10/100Base-T interface. This port is designed to connect directly to a 10/100Base-T network. Figure 4 shows the signal/pin relationships on this interface. You may connect this port to another Ethernet device via a Type 4 or Type 5 cable that is up to 328 ft (100 m) long.



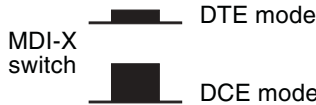


**Figure 4.** CopperLink Ethernet Extender 10/100Base-T RJ-45 Connector Pinout.

### Connecting the 10/100Base-T Ethernet Port to a Hub or PC

The Models 2156 and 2157 are equipped with an MDI-X switch that enables connections to a hub (DCE) or PC (DTE) interface, thereby eliminating confusion over whether a straight-through or crossover cable is needed.

When using a straight-through cable for connecting to a hub, the MDI-X switch should be in its released (DCE mode) position (see Figure 5). When connecting to a PC, the MDI-X switch should be pushed in to engage the crossover function so you won't have to use a crossover cable



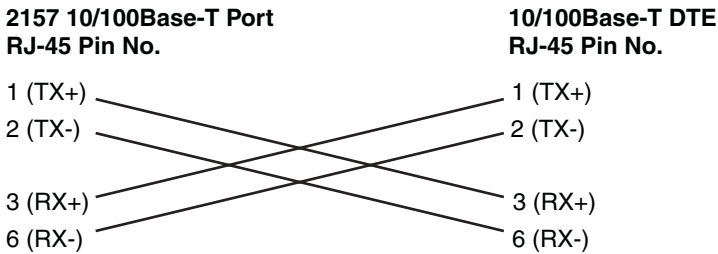
**Figure 5.** MDI-X switch positions

**Note** If you have difficulty achieving a working connection between the CopperLink Ethernet Extender's Ethernet port and the hub or PC, change the position of the MDI-X switch and try again.

In its released position, the MDI-X switch enables straight-through connections (see Figure 6) or in its inserted position the MDI-X switch performs the crossover function (see Figure 7 on page 10).

<b>2157 10/100Base-T Port RJ-45 Pin No.</b>	<b>10/100Base-T Hub RJ-45 Pin No.</b>
1 (TX+)	1 (RX+)
2 (TX-)	2 (RX-)
3 (RX+)	3 (TX+)
6 (RX-)	6 (TX-)

**Figure 6.** Wiring diagram for connecting the CopperLink Ethernet Extender to a 10/100Base-T hub (MDI-X switch released)



**Figure 7.** MDI-X switch pressed in performs 10/100Base-T crossover function

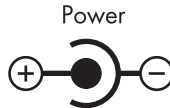
### 3.3 CONNECTING POWER

An external AC or DC power supply is available separately. This connection is made via the barrel jack on the rear panel of the Models 2156 and 2157. No configuration is necessary for the power supply (See Appendix B on page 17 for domestic and international power supply and cord options).

### 3.4 POWER INPUT CONNECTOR

The CopperLink Ethernet Extender comes with an AC or DC power supply.

- The supplies connection to the CopperLink Ethernet Extender is a 2.5 mm barrel receptacle with the center conductor positive (see Figure 6).



**Figure 8.** Power connection barrel receptacle diagram

- CopperLink Ethernet Extender's rated voltage: 5.0 VDC
- CopperLink Ethernet Extender's rated current: 1 A DC

#### External AC universal power supply

- Output from power supply: 5 VDC, 2A
- Input to power supply: universal input 100–240 VAC 50/60 Hz 0.3A



**Caution**

An approved LPS external power supply that incorporates a disconnect device must be used and positioned within easy reach of the operator's position.



**Caution**

Connect the equipment to a 5 VDC source that is electrically isolated from the AC source. The 5 VDC source is to be reliably connected to earth.

### **External 48 VDC power supply**

- **Input**

- Rated voltage: 36–60 VDC
- Rated current: 0.25 A DC at nominal 48 VDC
- 3-pin locking connector, 3.5 mm pitch
- Reverse polarity protection
- Transient over-voltage protection, 100 VDC at 2 ms

- **Output**

- Rated voltage: 5 VDC  $\pm$  5%, 5W
- Rated current; 1 A DC
- 6-inch cable terminated with 2.5 mm barrel plug, center positive



**Caution**

An approved LPS external power supply that incorporates a disconnect device must be used and positioned within easy reach of the operator's position.



**Caution**

Connect the equipment to a 36–60 VDC source that is electrically isolated from the AC source. The 36–60 VDC source is to be reliably connected to earth.

### **3.5 CONSOLE PORT**

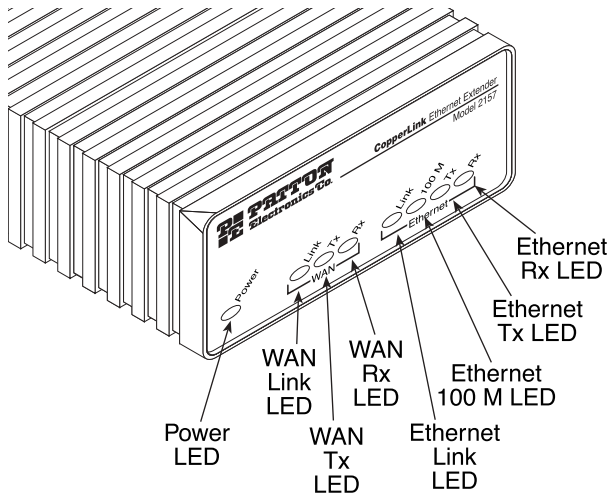
The Console Port is only intended for use by Patton Electronics Technical Support technicians.

## 4.0 OPERATION

Once the CopperLink Ethernet Extenders are properly installed, they should operate transparently. No user settings required. This section describes reading the LED status monitors.

### 4.1 FRONT PANEL LED STATUS MONITORS

The Models 2156 and 2157 feature eight front-panel LEDs that monitor power, Ethernet signals, and the CopperLink connection. Figure 9 shows the front panel location of each LED. Table 1 describes the LED functions.



**Figure 9.** CopperLink Ethernet Extender standalone unit front panel

**Table 1:** Front panel LED description

LED		Description
Power		When lit, indicates the unit is powered on
WAN	Link	<ul style="list-style-type: none"> <li>On solid—link is connected</li> <li>Off—No signal detected</li> </ul>
	TX	Flashing—Data is being transmitted from the local unit to the remote unit
	RX	Flashing—Data is being received at the local unit from the remote unit
Ethernet	Link	On—Ethernet is linked
	100 M	On—100 Mbps Ethernet is selected
	TX	Flashing—When data is transmitted from the unit to the LAN
	RX	Flashing—When data is received from the LAN

## **APPENDIX A**

### **SPECIFICATIONS**

#### **A.1 GENERAL CHARACTERISTICS**

- Compact low cost plug-and-play router
- 10/100 Ethernet
- Unlimited host support
- Eight front panel LEDs indicate Power, WAN, Ethernet LAN speed and status
- Convenient and standard RJ connectors for Ethernet and line
- External UI or 48 VDC power supply options
- Standard 1-year warranty

#### **A.2 WAN CHARACTERISTICS**

- 2.3 Mbps (Model 2156) or 4.6 Mbps speed (Model 2157)
- RJ-11 connector
- Uses two-wire unconditioned twisted-pair

#### **A.3 ETHERNET**

- Full-duplex, auto-sensing, 10Base-T/100Base-TX Ethernet
- Standard RJ-45 and built-in MDI-X crossover switch
- IEEE 802.1d transparent learning bridge up to 1,024 addresses and spanning tree
- Compatible with 802.1Q VLAN
- Addresses deleted after 5 minutes of inactivity

#### A.4 EXTENSION DISTANCE AND RATE

- 2.3 Mbps (Model 2156) or 4.6 Mbps speed (Model 2157)
- Distances up to 30,000 ft (9,144 m) on 24 AWG (0.4 mm) wire
- Auto-adjusting rate picks best rate for a given extension distance (see tables below)

**Table 2:** Model 2156 Extension Distances

Line Rate	No Noise									
	26g (0.4 mm)		24g (0.5 mm)		22g (0.6 mm)		20g (0.8 mm)		19g (0.9 mm)	
kbps	miles	km	miles	km	miles	km	miles	km	miles	km
200	4.4	7.0	5.7	9.4	8.0	13.1	10.3	16.8	12.1	19.7
392	4.0	6.6	5.4	8.8	7.5	12.3	9.7	15.8	10.8	17.5
520	3.8	6.2	5.1	8.3	7.1	11.6	9.2	14.9	9.7	15.8
776	3.5	5.6	4.6	7.5	6.0	9.8	7.8	12.7	8.8	14.3
1160	3.0	4.9	4.0	6.4	5.2	8.4	6.7	11.0	7.5	12.3
1544	2.8	4.6	3.7	6.1	4.9	7.9	6.4	10.3	6.7	11.0
2056	2.5	4.0	3.3	5.3	4.2	6.9	5.6	9.0	5.9	9.6
2312	2.3	3.8	3.1	5.0	4.0	6.6	5.3	8.6	5.6	9.1

**Table 3:** Model 2157 Extension Distances

Line Rate	No Noise									
	26g (0.4 mm)		24g (0.5 mm)		22g (0.6 mm)		20g (0.8 mm)		19g (0.9 mm)	
kbps	miles	km	miles	km	miles	km	miles	km	miles	km
200	4.4	7.0	5.7	9.4	8.0	13.1	10.3	16.8	12.1	19.7
392	4.0	6.6	5.4	8.8	7.5	12.3	9.7	15.8	10.8	17.5
520	3.8	6.2	5.1	8.3	7.1	11.6	9.2	14.9	9.7	15.8
776	3.5	5.6	4.6	7.5	6.0	9.8	7.8	12.7	8.8	14.3
1160	3.0	4.9	4.0	6.4	5.2	8.4	6.7	11.0	7.5	12.3
1544	2.8	4.6	3.7	6.1	4.9	7.9	6.4	10.3	6.7	11.0
2056	2.5	4.0	3.3	5.3	4.2	6.9	5.6	9.0	5.9	9.6
2312	2.3	3.8	3.1	5.0	4.0	6.6	5.3	8.6	5.6	9.1
2696	2.3	3.7	3.0	5.0	4.0	6.4	5.2	8.4	5.5	8.9
3080	2.2	3.6	3.0	4.8	3.9	6.3	5.0	8.2	5.4	8.7
3464	2.1	3.4	2.7	4.5	3.6	5.8	4.7	7.6	4.9	8.0
3848	1.9	3.1	2.5	4.1	3.3	5.3	4.3	7.0	4.5	7.4
4232	1.7	2.8	2.3	3.7	2.9	4.8	3.9	6.3	4.1	6.6
4616	1.5	2.5	2.0	3.3	2.6	4.2	3.4	5.5	3.6	5.9

## **A.5 LED INDICATORS**

- Eight LED indicators
- Power
- WAN Link, Transmit, and Receive
- Ethernet Link, 100M, Transmit, and Receive

## **A.6 POWER AND POWER SUPPLY SPECIFICATIONS**

- Either AC or DC options are available
- Connection to the CopperLink Ethernet Extender requires +5VDC  $\pm 5\%$  DC power (1.0A minimum). Center pin is +5V. The barrel type plug has a 2.5/5.5/10mm I.D./O.D./shaft length dimensions
- CopperLink Ethernet Extender's rated voltage: 5.0 VDC
- CopperLink Ethernet Extender's rated current: 1A DC

## **A.7 ENVIRONMENTAL**

- Temperature: 32–122°F (0–50°C)
- Relative Humidity: 5–90%, non-condensing
- Altitude: 0–15,000 ft (0–4,572 m)

## **A.8 DIMENSIONS**

1.5H x 4.2W x 5.8D in. (3.8H x 10.6W x 14.8D cm)



**APPENDIX B**  
**MODELS 2156 AND 2157 SERIES FACTORY**  
**REPLACEMENT PARTS AND ACCESSORIES**

<b>Patton Model #</b>	<b>Description</b>
<b>2156 Base Models</b>	
2156/L	CopperLink Ethernet Extender; Line: RJ-11 (Local)
2156/R	CopperLink Ethernet Extender; Line: RJ-11 (Remote)
2156-2PK	CopperLink Ethernet Extender Kit: includes one local (L) and one remote (R) Model 2156
<b>2157 Base Models</b>	
2157/L	CopperLink Ethernet Extender; Line: RJ-11 (Local)
2157/R	CopperLink Ethernet Extender; Line: RJ-11 (Remote)
2157-2PK	CopperLink Ethernet Extender Kit: includes one local (L) and one remote (R) Model 2157
<b>2156 and 2157 User Manual</b>	
07M2156_2157	User Manual
<b>Power Supplies</b>	
08055DCUI	100–240VAC (+5V reg. DC/2A) Universal Input Adapter.
<b>Power Cords*</b>	
0805US	American Power Cord
0805EUR	European Power Cord CEE 7
0805UK	United Kingdom Power Cord
0805AUS	Australian Power Cord
0805DEN	Denmark Power Cord
0805FR	France/Belgium Power Cord
0805IN	India Power Cord
0805IS	Israel Power Cord
0805JAP	Japan Power Cord
0805SW	Switzerland Power Cord

\*Only required with optional UI power supply (08055DCUI)

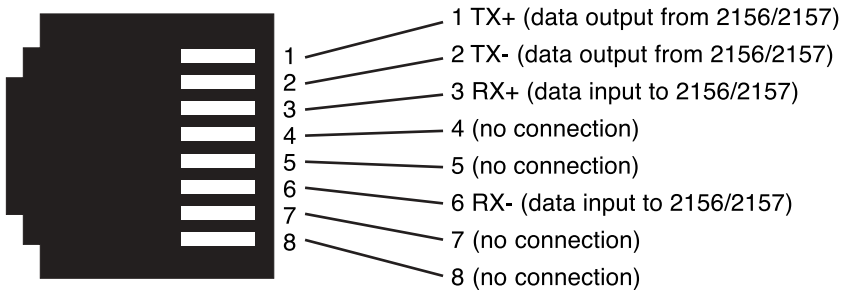
## APPENDIX C

### MODELS 2156 AND 2157 SERIES INTERFACE PIN ASSIGNMENT

#### C.1 10/100BASE-T INTERFACE

##### RJ-45

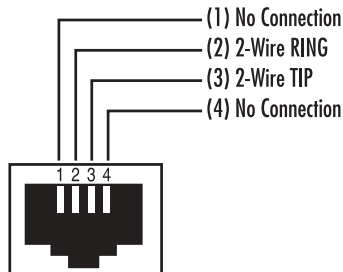
- Pin 1: TX+
- Pin 2: TX-
- Pin 3: RX+
- Pin 6: RX-
- Pins 4, 5, 7, 8: no connection



#### C.2 COPPERLINK INTERFACE

##### RJ-11

- Pin 2: RING
- Pin 3: TIP
- Pins 1 & 4: no connection







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