USER MANUAL

MODELS 2156 & 2157
CopperLink Ethernet Extenders

PATTON Electronics Co.

SALES OFFICE
(301) 975-1000
TECHNICAL SUPPORT
(301) 975-1007

ISO 9001 CERTIFIED

An ISO-9001 Certified
Company

CONTENTS

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 performs 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** spe-
cifically 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** 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 televi-
sion 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 deter-
mined 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 out-
let (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 Cer-
tificate of Compliance is available by contacting Technical Support.

1.3 FCC PART 68

Caution

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

1. You are required to request service from the telephone company before you connect the Model 2156 or 2157 to a network. When you request service, you must provide the telephone company with the following data.

   — The required Universal Service Order code (USOC) jack: RJ-11C

   — The make, model number, Ringer Equivalence Number (REN), and FCC Registration number of the Model 2156 or 2157.

   The REN helps you determine the number of devices you can connect to your telephone line and still have all of those devices ring when your number is called. In most, but not all, areas, the sum of the RENs of all devices should not exceed five (5.0). To be certain of the number of devices you can connect to your line, you should call your local telephone company to determine the maximum REN.

   — The Facility Interface Code: **02LS2**

   — The Service Order Code(s) (SOC): **9.0F**

   — REN No.: **0.2**

2. Your telephone company may make changes to its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. The telephone company will notify in advance of such changes to give you an opportunity to maintain uninterrupted telephone service.

3. If your Model 2156 or 2157 causes harm to the telephone network, the telephone company may temporarily discontinue your service. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible and will be informed of your right to file a complaint with the FCC.

4. If you experience trouble with the Model 2156 or 2157, contact Patton Electronics Company for service or repairs. Repairs should be performed only by Patton Electronics Co.

5. You are required to notify the telephone company when you disconnect the Model 2156 or 2157 from the network.

1.4 INDUSTRY CANADA NOTICE

NOTICE: This equipment meets the applicable Industry Canada Terminal Equipment Technical Specifications. This is confirmed by the registration number. The abbreviation *IC*, before the registration number signifies that registration was performed based on a Declaration of conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

1.5 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 15)

• 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.
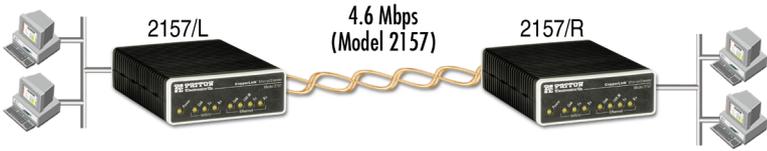
Figure 1. Typical application

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 8)

   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 9).

• Connect the power plug (refer to section 3.3, "Connecting Power" on page 11).
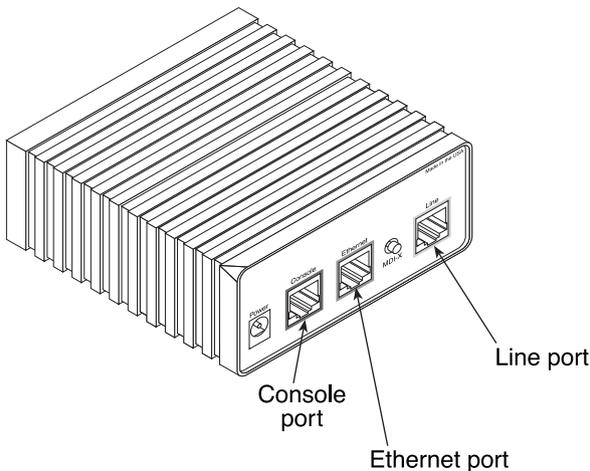
Figure 2. CopperLink Ethernet Extender rear panel

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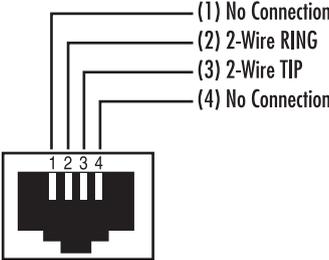
Figure 3. CopperLink Ethernet Extender (RJ-11) twisted pair line interface.

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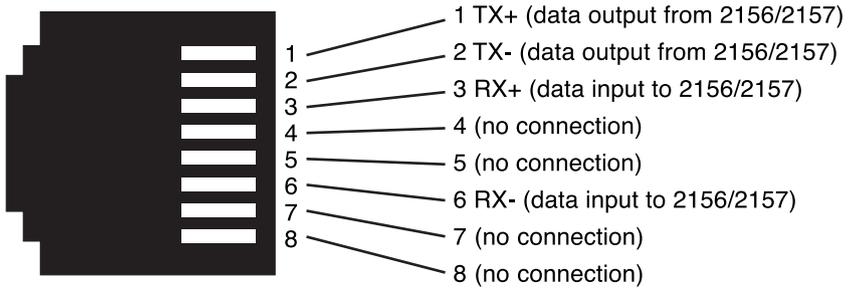
Figure 4. CopperLink Ethernet Extender 10/100Base-T RJ-45 Connector Pinout.

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 elimininating 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 con-nections (see Figure 6) or in its inserted position the MDI-X switch per-forms the crossover function (see Figure 7 on page 11).

2157 10/100Base-T Port   10/100Base-T Hub
RJ-45 Pin No.   RJ-45 Pin No.

    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)

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2157 10/100Base-T Port RJ-45 Pin No.   **10/100Base-T DTE RJ-45 Pin No.**

1 (TX+)   1 (TX+)
2 (TX-)   2 (TX-)

3 (RX+)   3 (RX+)
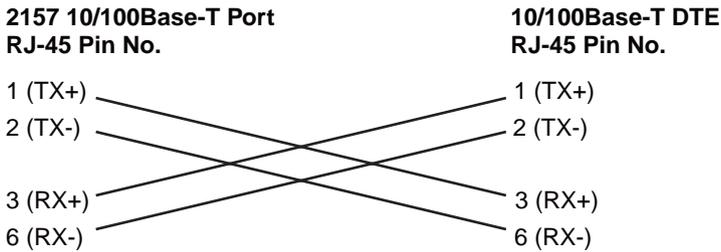6 (RX-)   6 (RX-)

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 18 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).
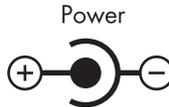
Power

(+) ●━━○ (−)

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 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 ± 5%, 5W

  - Rated current; 1 A DC

  - 6-inch cable terminated with 2.5 mm barrel plug, center positive

Caution

An approved 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.
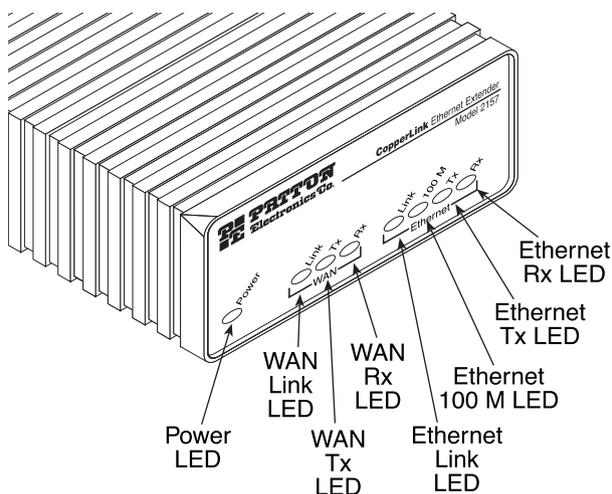
Figure 9. CopperLink Ethernet Extender standalone unit front panel

Table 1: Front panel LED description

LED		Description
Power		When lit, indicates the unit is powered on
WAN	Link	• On solid—link is connected • Off—No signal detected
	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 8021.d 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

DSL line rate		No Noise								
		26g (0.4 mm)		24g (0.5 mm)		22g (0.6 mm)		20g (0.8 mm)		19g (0.9 mm)	
N	kbps	miles	km	miles	km	miles	km	miles	km	miles	km
3	200	4.4	7.0	5.7	9.4	8.0	13.1	10.3	16.8	12.1	19.7
6	392	4.0	6.6	5.4	8.8	7.5	12.3	9.7	15.8	10.8	17.5
8	520	3.8	6.2	5.1	8.3	7.1	11.6	9.2	14.9	9.7	15.8
12	776	3.5	5.6	4.6	7.5	6.0	9.8	7.8	12.7	8.8	14.3
18	1160	3.0	4.9	4.0	6.4	5.2	8.4	6.7	11.0	7.5	12.3
24	1544	2.8	4.6	3.7	6.1	4.9	7.9	6.4	10.3	6.7	11.0
32	2056	2.5	4.0	3.3	5.3	4.2	6.9	5.6	9.0	5.9	9.6
36	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

DSL line rate		No Noise								
		26g (0.4 mm)		24g (0.5 mm)		22g (0.6 mm)		20g (0.8 mm)		19g (0.9 mm)	
N	kbps	miles	km	miles	km	miles	km	miles	km	miles	km
3	200	4.4	7.0	5.7	9.4	8.0	13.1	10.3	16.8	12.1	19.7
6	392	4.0	6.6	5.4	8.8	7.5	12.3	9.7	15.8	10.8	17.5
8	520	3.8	6.2	5.1	8.3	7.1	11.6	9.2	14.9	9.7	15.8
12	776	3.5	5.6	4.6	7.5	6.0	9.8	7.8	12.7	8.8	14.3
18	1160	3.0	4.9	4.0	6.4	5.2	8.4	6.7	11.0	7.5	12.3
24	1544	2.8	4.6	3.7	6.1	4.9	7.9	6.4	10.3	6.7	11.0
32	2056	2.5	4.0	3.3	5.3	4.2	6.9	5.6	9.0	5.9	9.6
36	2312	2.3	3.8	3.1	5.0	4.0	6.6	5.3	8.6	5.6	9.1
42	2696	2.3	3.7	3.0	5.0	4.0	6.4	5.2	8.4	5.5	8.9
48	3080	2.2	3.6	3.0	4.8	3.9	6.3	5.0	8.2	5.4	8.7
54	3464	2.1	3.4	2.7	4.5	3.6	5.8	4.7	7.6	4.9	8.0
60	3848	1.9	3.1	2.5	4.1	3.3	5.3	4.3	7.0	4.5	7.4
66	4232	1.7	2.8	2.3	3.7	2.9	4.8	3.9	6.3	4.1	6.6
72	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 ±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

Patton Model #	Description
2156 Base Models	
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
2157 Base Models	
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
2156 and 2157 User Manual	
07M2156_2157	User Manual
Power Supplies	
08055DCUI	100–240VAC (+5V reg. DC/2A) Universal Input Adapter.
Power Cords*	
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

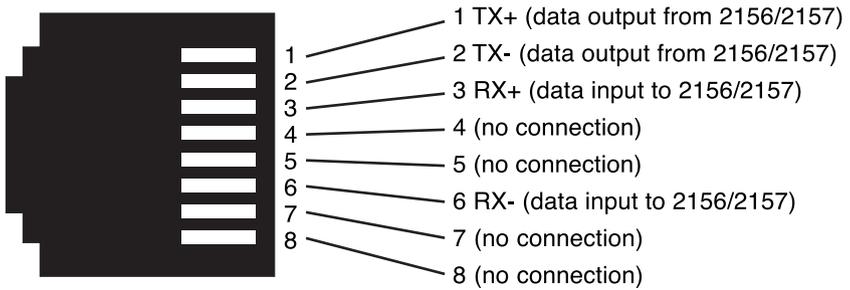*Only required with optional UI power supply (08055DCUI)

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

1 TX+ (data output from 2156/2157)
2 TX- (data output from 2156/2157)
3 RX+ (data input to 2156/2157)
4 (no connection)
5 (no connection)
6 RX- (data input to 2156/2157)
7 (no connection)
8 (no connection)

C.2 COPPERLINK INTERFACE

RJ-11

- Pin 2: RING

- Pin 3: TIP

- Pins 1 & 4: no connection

(1) No Connection
(2) 2-Wire RING
(3) 2-Wire TIP
(4) No Connection

1 2 3 4

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Notes

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