USER MANUAL

CopperLink™ Ethernet Extenders Models 2168A and 2158A

PATTON
Electronics Co.

CONTENTS

1.0 WARRANTY INFORMATION

Patton Electronics warrants all CopperLink Ethernet Extender 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** 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 under the appropriate product page.

1.1 COMPLIANCE

EMC Compliance:

- FCC Part 15, Class A

- EN55022, Class A

- EN55024

Safety Compliance:

- IEC/EN 60950-1

- AS/NZS 60950-1

PSTN Compliance:

> **Note** This device is not intended nor approved for connection to the PSTN.

1.2 RADIO AND TV INTERFERENCE (FCC PART 15)

This equipment generates and uses 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. This equipment has been tested and found to comply with the limits for a Class A computing device in accordance with the 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 equipment causes interference to radio or television reception, which can be determined by disconnecting the cables, 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).

1.3 CE DECLARATION OF CONFORMITY

We certify that the apparatus described above conforms to the requirements of Council Directive 2004/108/EC on the approximation of the laws of the member states relating to electromagnetic compatibility; and Council Directive 2006/95/EC on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits.

1.4 AUTHORIZED EUROPEAN REPRESENTATIVE

D R M Green
European Compliance Services Limited.
Avalon House, Marcham Road
Abingdon,
Oxon OX14 1UD, UK

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:

• Tel: **+1 (301) 975-1007**

• Email: **support@patton.com**

• URL: **http://www.patton.com**

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

1.6 SAFETY WHEN WORKING WITH ELECTRICITY

WARNING

- **This device contains no user serviceable parts. The equipment shall be returned to Patton Electronics for repairs, or repaired by qualified service personnel.**

- **The external power adapter shall be a listed Limited Power Source. Ensure that the power cable used meets all applicable standards for the country in which it is to be installed, and that it is connected to a wall outlet which has earth ground. The mains outlet that is utilized to power the devise shall be within 10 feet (3 meters) of the device, shall be easily accessible, and protected by a circuit breaker.**

- **Do not work on the system or connect or disconnect cables during periods of lightning activity.**

In accordance with the requirements of council directive 2002/96/EC on Waste of Electrical and Electronic Equipment (WEEE), ensure that at end-of-life you separate this product from other waste and scrap and deliver to the WEEE collection system in your country for recycling.

WARNING

This device is NOT intended nor approved for connection to the PSTN. It is intended only for connection to customer premise equipment.

WARNING

The Interconnecting cables shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

2.0 GENERAL INFORMATION

Thank you for your purchase of this Patton Electronics product. This product has been thoroughly inspected and tested and is warranted for one year for parts and labor. If any questions or problems arise during installation or use of this product, contact Patton Electronics Technical Support at +1 (301) 975-1007.

2.1 FEATURES

- Easy to install CopperLink Ethernet Extenders (no configuration required)

- Auto MDIX Ethernet

- Auto-sensing full or half-duplex Ethernet

- Auto-sensing 10/100Base-TX

- Extends network connections up to 6,000 ft (1.83 km) over 2-wire 24-AWG unconditioned lines

- Switch selectable line rates up to 16.67 Mbps

- 7 total symmetric or asymmetric settings via DIP switch (2168A and 2168A/TB45 models only)

- Transparent operation

- LED indicators for Power, Ethernet Link & Activity, CopperLink link & Quality of Line (QOL)

- Surge suppression up to 200 A (8/20 ms)

- Made in the USA

2.2 DESCRIPTION

The Patton Electronics CopperLink/L and CopperLink/R 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 CopperLink/L (local) located at one end of the LAN extension and a CopperLink/R (remote) at the other end, these units 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 CopperLink Ethernet Extenders. The CopperLink Ethernet Extenders automatically add and delete MAC addresses, only passing packets across the CopperLink link that are meant for the remote peered LAN.
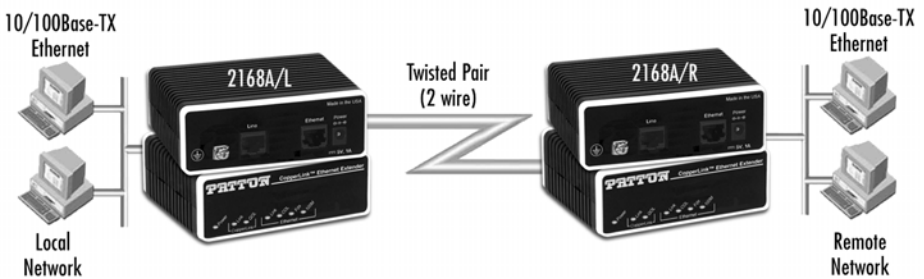

Figure 1. Typical application

The CopperLink/Lunit and CopperLink/R unit 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 Extender requires no configuration, it can be installed quickly.

> **Note** If asymmetric transmission or line rates other than 12.5 Mbps are required , refer to section 4.0, "Configuration" on page 16.

3.1 UNIT INSTALLATION

Do the following:

1. Make a ground connection for the unit (refer to section 3.2, "Grounding the CopperLink Ethernet Extender" on page 10).

2. Connect the line interface between the units (refer to section 3.3, "Connecting the Twisted-Pair Line Interface" on page 10)

   > **Note** See Figure 2 for the unit's rear panel arrangements.

3. Connect the Ethernet interface (refer to section 3.4, "Connecting the 10/100Base-T Ethernet Interface" on page 14).

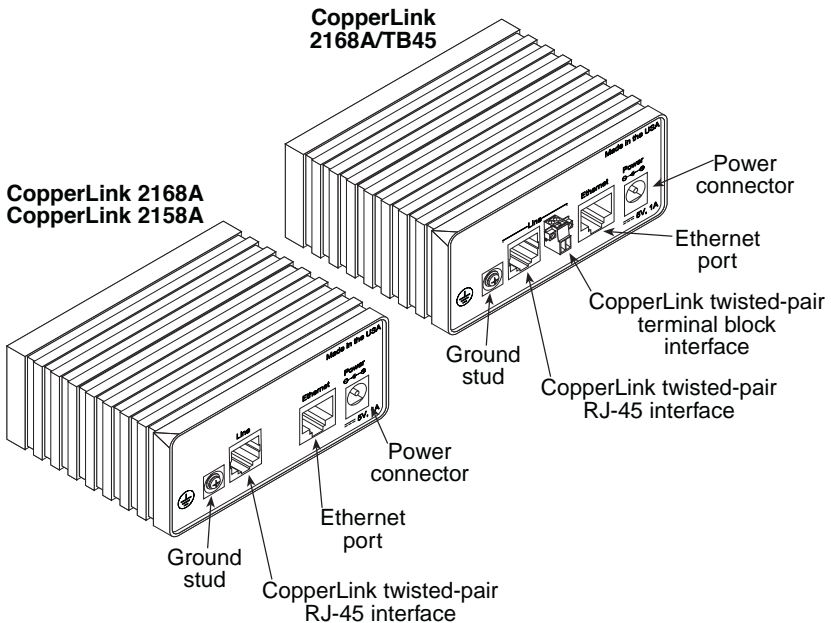4. Connect the power plug (refer to section 3.5, "Connecting Power" on page 15).

Figure 2. CopperLink Ethernet Extender rear panel

3.2 GROUNDING THE COPPERLINK ETHERNET EXTENDER

Before installing the CopperLink Ethernet Extender, it is important to establish a good grounding connection first.

1. Assemble a ground wire using #10 AWG wire with green-and-yellow-colored insulation and two ring terminals. Make the wire long enough to reach one of the following **earth** ground sources:

   — The building ground rod (generally located at the site's main service entrance)

   — A sprinkler system pipe

   — A metal cold-water pipe

   — Building structural steel

2. Install the grounding wire between the grounding stud (see Figure 2 on page 9) and the grounding source.

3.3 CONNECTING THE TWISTED-PAIR LINE INTERFACE

The CopperLink Ethernet Extender supports communication between two peer Ethernet LAN sites over a distance of up to 6,000 ft (1.83 km) over 24 AWG (0.5 mm) twisted-pair wire.

> **Note** Actual distance and link performance may vary depending on the environment and type/gauge of wire used.

Follow the steps below to connect the CopperLink Ethernet Extenders interfaces.

> **Note** The CopperLink units work in pairs. One of the CopperLink units must be an L (local), and the other unit must be an R (remote). It does not matter which end is the L and which is the R. The link is always initiated by the R. As long as the L is powered on, the R can establish a link by being powered on or by having its power reset.

1. To function properly, the two CopperLink 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 CopperLink Ethernet Extenders are equipped with an interface jack that can be used on the CopperLink interface, an RJ-45 (2168A or 2158A), or a terminal block (2168A/TB45, which also has the RJ-45 interface). These CopperLink interfaces are a two-wire interface. Observe the signal/pin relationships on the CopperLink Ethernet Extender's CopperLink interface jacks.

The **RJ-45 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.
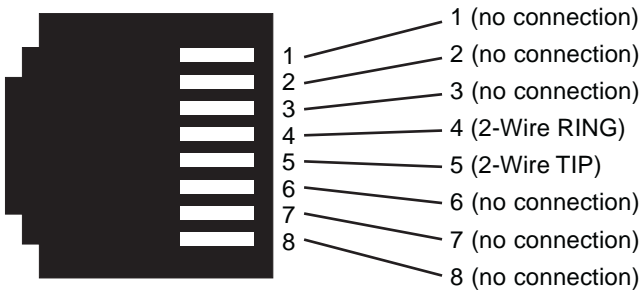

Figure 3. CopperLink Ethernet Extender (RJ-45) twisted pair line interface.

The **terminal block connector** on the CopperLink Ethernet Extender's twisted pair interface **is polarity insensitive** and is wired for a two-wire interface. The signal/pin relationships are shown in Figure 4.
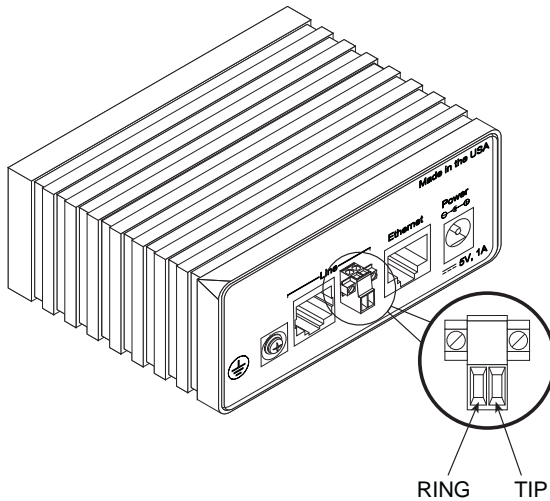
Figure 4. CopperLink2168A/TB45 Ethernet Extender twisted pair line interface.

Using a Ferrite Clamp to Connect the Line Interface

WARNING

- **The ferrite clamp that is shipped with the unit must be used as detailed in the following instructions in order to meet EMC requirements.**

Connecting the ferrite clamp to the RJ-45 port.

To connect the ferrite clamp to the RJ-45 port:

1. Place the RJ-45 cable inside the ferrite clamp, leaving about 1-2 inches of cable between the unit and clamp.

2. Wrap the cable tightly around the clamp two times and secure the wire firmly in the clamp channel.

3. Close the clamp and connect the cable to the line port on the unit (See Figure 2 on page 9).

Model 2168A
Model 2158A

Note: Be sure to leave 1-2 inches of cable between the unit and the ferrite clamp.

CopperLink twisted-pair RJ-45 interface

Ferrite clamp

Figure 5. Connecting the ferrite clamp for 2168A/2158A models

Connecting the ferrite clamp to the terminal block.

To connect the ferrite clamp to the terminal block:

1. Place the cable inside the ferrite clamp, leaving about 1-2 inches of cable between the unit and clamp.

2. Wrap the cable tightly around the clamp two times and secure the wire firmly in the clamp channel.

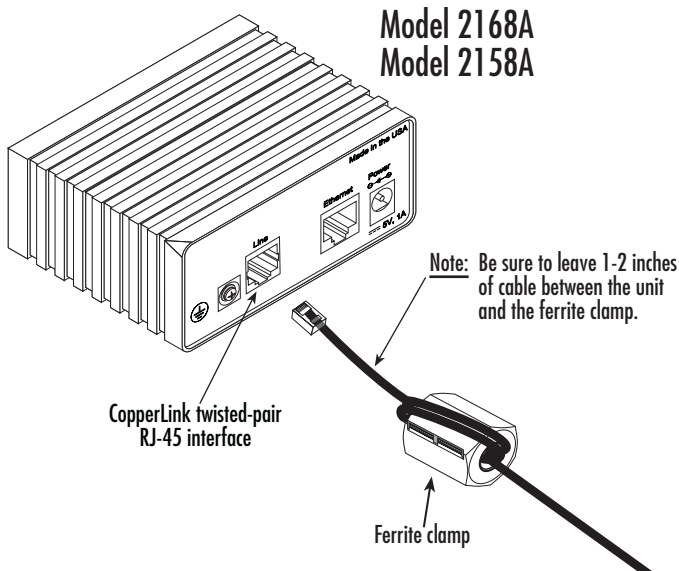3. Close the clamp and connect the cable to the line port on the unit (See Figure 2 on page 9).
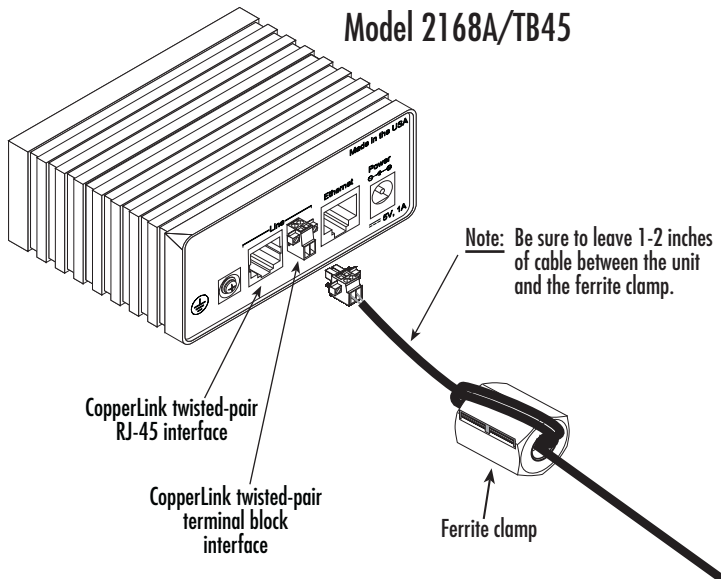
Figure 6. Connecting the ferrite clamp for 2168A/TB45 models

3.4 CONNECTING THE 10/100BASE-T ETHERNET INTERFACE

The RJ-45 port labeled *Ethernet* is the Auto-MDIX10/100Base-T interface. This port is designed to connect directly to a 10/100Base-T network. Figure 7 shows the signal/pin relationships on this interface. You may connect this port to a hub or PC using a straight through or crossover cable that is up to 328 ft long.

1 TX+/RX+ (data output from CopperLink)
2 TX-/RX- (data output from Copperlink)
3 RX+/TX+ (data input to CopperLink)
4 (no connection)
5 (no connection)
6 RX-/TX-(data input to CopperLink)
7 (no connection)
8 (no connection)
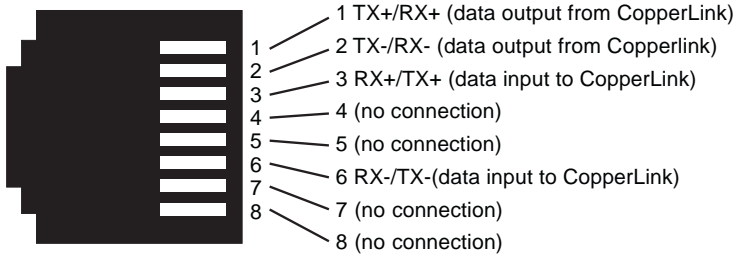
Figure 7. CopperLink Ethernet Extender 10/100Base-T RJ-45 Connector Pinout.

3.5 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 CopperLink Ethernet Extender. No configuration is necessary for the power supply (See Appendix B for domestic and international power supply and cord options).

DC power (supplied via the power supply jack to the CopperLink Ethernet Extender) must meet the following requirements; DC power supplied must be regulated +5VDC ±5%, 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.

The CopperLink Ethernet Extender does not have a power switch, so it powers up as soon as it is plugged in.

4.0 CONFIGURATION

The CopperLink Models 2168A and 2168A/TB45 have an eight-position DIP switch for configuring the unit for a wide variety of applications. This section describes switch locations and explains the different configurations. The Model 2158A does not include dip switches.

4.1 CONFIGURING THE HARDWARE DIP SWITCHES

Using a small flat-tip screwdriver, remove the protective cover located on the underside of the CopperLink Ethernet Extender (see Figure 8).
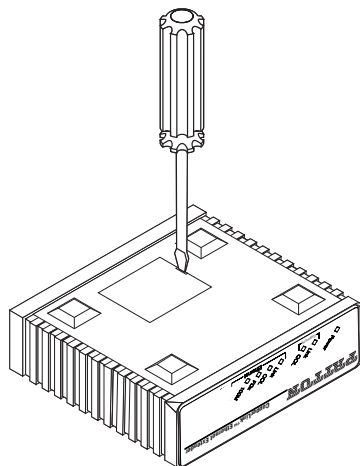

Figure 8. Removing protective cover

Figure 9 on page 16 shows the orientation of the DIP switches in the On and Off positions.
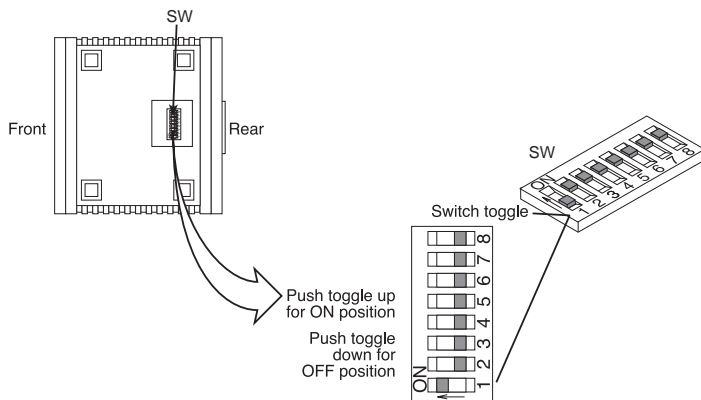
Figure 9. Models 2168A and 2168A/TB45 DIP switch orientation

4.2 CONFIGURING DIP SWITCH SW

DIP switch SW is where you configure the CopperLink line rate, and if the rate is symmetric or asymmetric.

Switches SW-2 and SW-4: Data Rate

Use switches SW-2 and SW-4 to configure the CopperLink line rates.

Table 1: Symmetric CopperLink Line Rates Selection Chart

SW-2	SW-3	SW-4	Symmetric Line Rate
ON	ON	ON	6.25 Mbps
ON	ON	OFF	9.38 Mbps
ON	OFF	OFF	12.5 Mbps (Factory Default)[*]
ON	OFF	ON	16.67 Mbps

> *. Model 2158A only has one symmetric line rate setting, which is 12.5 Mbps.

Note   Table 2 only applies to Models 2168A and 2168A/TB45.

Table 2: Model 2168A and 2168A/TB45 Asymmetric CopperLink Line Rates Selection Chart

SW-2	SW-3	SW-4	Asymmetric Line Rates DS/US[*]
OFF	OFF	ON	4.17 Mbps/1.56 Mbps
OFF	ON	ON	9.38 Mbps/1.56 Mbps
OFF	ON	OFF	16.67 Mbps/2.34 Mbps

> *. DS = downstream from L unit to R unit
> US = upstream from R unit to L unit

Switches SW-1 and SW-5 through SW-8: Reserved

Table 3: Reserved for future use

SW-1	SW-5	SW-6	SW-7	SW-8	Reserved for future use
OFF	OFF	OFF	OFF	OFF	Reserved (Factory Default)

5.0 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.

5.1 POWER UP

Before applying power to the CopperLink Ethernet Extender, please review section 3.5, "Connecting Power" on page 15 to verify that the unit is connected to the appropriate power source.

⚠ **WARNING** **There are no user-serviceable parts in the CopperLink Ethernet Extender. Fuse replacement should only be performed by qualified service personnel. Contact Patton Electronics Technical support at (301) 975-1007 for more information.**

5.2 FRONT PANEL LED STATUS MONITORS

The CopperLink Ethernet Extender features seven front panel LEDs (five on the rack card) that monitor power, the Ethernet signals, and the CopperLink connection. Figure 10 shows the front panel LEDs. Table 4 on page 19 describes the LED functions for the model.
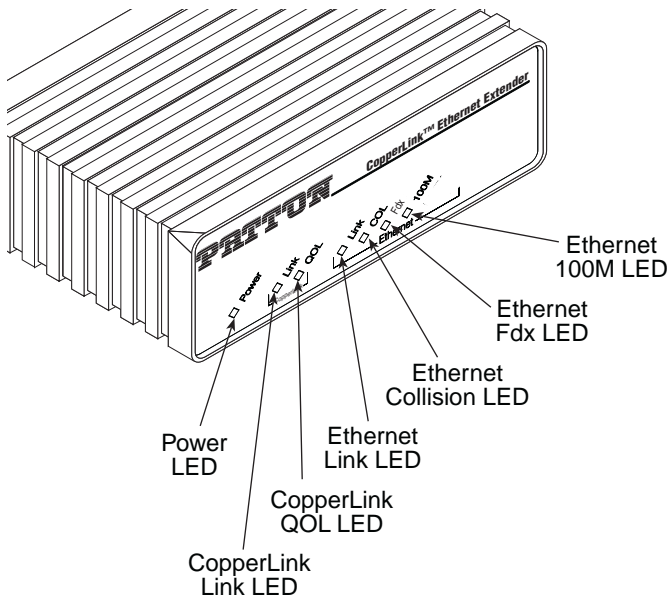

Figure 10. CopperLink Ethernet Extender unit front panel

Table 4: Front panel LED description for the 2168A

LED	Description
Power	**On (green)** when power is applied to the unit. **Off** when no power is applied to the unit.
CopperLink - Link	**On (green)** when the end-to-end CopperLink link between the units is established. **Off** when the link has not been established or when the link fails
CopperLink - QOL	**Flashes yellow** at different rates to indicate the amount of error correction taking place on data passing over the CopperLink link. This is a normal operating condition and all data is passing correctly over the link even if the link is **solidly yellow.** However, if the LED is **solid yellow** and the **CopperLink Link LED is Off**, then there is too much noise on the line for an active link.
Ethernet - Link	**On (green)** when the 10/100Base-T Ethernet link has been established. **Off** when the 10/100Base-T Ethernet link has not been established or when the link fails. Flashes when there is Ethernet activity.
Ethernet - COL (Collision)	**Flashes yellow** to indicate Ethernet collisions are occurring.
Ethernet - FDX (Duplex)	**On (yellow)** when in full-duplex Ethernet mode. **Off** when when operating in half-duplex Ethernet mode.
Ethernet - 100M	**On (yellow)** when the link has not been established or when operating in 100-Mbps Ethernet mode. **Off** when operating in 10-Mbps Ethernet mode.

APPENDIX A
SPECIFICATIONS

A.1 LAN CONNECTION
- Unshielded RJ-45, 10/100Base-T, IEEE 802.3 Ethernet
- CopperLink Connection:
    - 2168A/TB45: RJ-45 and Terminal Block
    - 2168A/2158A: RJ-45 only

A.2 TRANSMISSION LINE
Two-wire unconditioned twisted pair.

A.3 COPPERLINK LINE RATE
16.67 Mbps (Model 2168A and Model 2168A/TB45) and 12.55 Mbps (Model 2158A) symmetric upstream/downstream. Additional symmetric and asymmetric rates are available via DIP switch settings:

- Model 2158A - Symmetric Line Rate: 12.5 Mbps
- Model 2168A and Model 2168A/TB45 - Symmetric Line Rates: 6.25 Mbps, 9.38 Mbps, 12.5 Mbps, 16.67 Mbps
- Model 2168A and Model 2168A/TB45 - Asymmetric Line Rates: 4.17 Mbps/1.56 Mbps, 9.38 Mbps/1.56 Mbps, 16.67 Mbps/2.34 Mbps

A.4 COPPERLINK DISTANCE
6,000 ft (1.83 km) at 1.56 Mbps upstream/4.17 Mbps downstream

> **Note** Distances depend on selected line rate.

A.5 COPPERLINK SURGE SUPPRESSOR
Transient peak surge maximum current: 200A (8/20 ms).

A.6 LED STATUS INDICATORS
- Power (Green)
- CopperLink: Link (Green) & QOL (Yellow)
- Ethernet: Link (Green), Collision (Yellow), Duplex (Yellow), 10/100M (Yellow)

A.7 POWER SUPPLY

Input power: 5 VDC, 1A

Power consumption: 560 mA at 5 VDC (typical)

External AC and DC options:

• AC: 120 VAC, 220 VAC, and UI (120–240 VAC)

• DC: 12 VDC, 24 VDC and 48 VDC

Internal 36-72VDC (nominal 48V) Terminal Block Plug (1x3, 3.81mm, with screws) Pin Header Socket Connector

A.8 TEMPERATURE RANGE

32–122°F (0–50°C)

A.9 HUMIDITY

Up to 90% non-condensing.

A.10 DIMENSIONS

1.58H x 4.16W x 3.75D in. (10.6H x 4.1W x 8.8D cm)

APPENDIX B

MODEL 2168A AND 2158A SERIES FACTORY
REPLACEMENT PARTS AND ACCESSORIES

Patton Model #	Description
Base Models	
2158A/E-2PK	CopperLink 12.5 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit); No power supply
2158A/EUI-2PK	CopperLink 12.5 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit); 100-240VAC
2158A/L/E	12.5 Mbps CopperLink Ethernet Extender (Local); RJ45 line; No Power Supply
2158A/L/EUI	12.5 Mbps CopperLink Ethernet Extender (Local); RJ45 line; 100-240VAC
2158A/R/E	12.5 Mbps CopperLink Ethernet Extender (Remote); RJ45 line; No Power Supply
2158A/R/EUI	12.5 Mbps CopperLink Ethernet Extender (Remote); RJ45 line; No Power Supply
2168A/E-2PK	CopperLink Multi Rate 16 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit); No power supply
2168A/EUI-2PK	CopperLink Multi Rate 16 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit);RJ45 Connectors only; 100-240VAC
2168A/L/E	16 Mbps Ethernet Extender Kit (Local); RJ45 line; No Power Supply
2168A/L/EUI	16 Mbps Ethernet Extender Kit (Local); RJ45 line; 100-240VAC
2168A/L/TB45/E	16 Mbps Ethernet Extender Kit (Local); Terminal Block and RJ45 line; No Power Supply
2168A/L/TB45/EUI	16 Mbps Ethernet Extender Kit (Local); Terminal Block and RJ45 line; 100-240VAC
2168A/R/E	16 Mbps Ethernet Extender Kit (Remote); RJ45 line; No Power Supply
2168A/R/EUI	16 Mbps Ethernet Extender Kit (Remote); RJ45 line; 100-240VAC
2168A/R/TB45/E	16 Mbps Ethernet Extender Kit (Remote); Terminal Block and RJ45 line; No Power Supply
2168A/R/TB45/EUI	16 Mbps Ethernet Extender Kit (Remote); Terminal Block and RJ45 line; 100-240VAC
2168A/TB45/E-2PK	CopperLink Multi Rate 16 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit); Terminal Block Line side; No power supply
2168A/TB45/EUI-2PK	CopperLink Multi Rate 16 Mbps Ethernet Extender Kit (1 Local Unit and 1 Remote Unit); Terminal Block Line side; 100-240VAC
07M2168A-UM	User Manual

Patton Model #	Description
Power Supplies	
08055DCUI 08055-120-5-1	100-240VAC (+5V reg. DC/2A) Universal Input Adapter. 120 VAC (+5V reg. DC/1A) Input Adapter
12V-PSM	12 VDC Input Adapter
24V-PSM	24 VDC Input Adapter
48V-PSM	48 VDC Input Adapter
Power Cords (Only required with optional UI power supply (08055DCUI)	
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

COPPERLINK SERIES INTERFACE PIN ASSIGNMENT

C.1 10/100BASE-T INTERFACE

RJ-45

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

C.2 COPPERLINK INTERFACE

RJ-45

- Pin 4: RING
- Pin 5: TIP
- Pins 1, 2, 3, 6, 7, 8: no connection

Terminal Block

APPENDIX D
DISTANCE CHART, BASED ON 24 AWG (0.5 MM)

Symm Line Rate	Distance in feet (km)
6.25 Mbps	4,500 (1.37)
9.38 Mbps	4,150 (1.26)
*12.5 Mbps	4,000 (1.22)
16.67 Mbps	3,300 (1.00)

*. This is the only option available for Model
2158A.

Asymm Line Rate (DS/US)	Distance in feet (km)
4.17 Mbps/1.56 Mbps (Mode 0)	6,000 (1.83)
9.38 Mbps/1.56 Mbps	5,500 (1.68)
16.67 Mbps/2.34 Mbps	5,000 (1.52)

Note   DS = downstream from L unit to R unit
US = upstream from R unit to L unit

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

NOTES

NOTES

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____