BLACK BOX®
NETWORK SERVICES

High Speed Ethernet Extender

Extend 10/100Base-TX Ethernet up to 10,000 feet (3 km)
Over a single twisted-pair, Cat 5e/6/7, or even coaxial cable

Black Box Ethernet Extenders

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RADIO FREQUENCY INTERFERENCE STATEMENTS

FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate 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 communication. It 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 against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

INSTRUCCIONES DE SEGURIDAD

(Normas Oficiales Mexicanas Electrical Safety Statement)

5. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

6. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

7. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

8. Todas las instrucciones de operación y uso deben ser seguidas.

9. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

10. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

11. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

12. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

13. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

14. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

15. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

16. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

17. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

18. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

19. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

20. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

21. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

22. Servicio por personal calificado deberá ser provisto cuando:

   A. El cable de poder o el contacto ha sido dañado; u

   B. Objectos han caído o líquido ha sido derramado dentro del aparato; o

   C. El aparato ha sido expuesto a la lluvia; o

   D. El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

   E. El aparato ha sido tirado o su cubierta ha sido dañada.

SAFETY WHEN WORKING WITH ELECTRICITY

WARNING

• This device contains no user serviceable parts. This device can only be repaired by qualified service personnel.

• Do not open the device when the power cord is connected. For systems without a power switch and without an external power adapter, line voltages are present within the device when the power cord is connected.

• For devices with an external power adapter, the power adapter shall be a listed Limited Power Source. The mains outlet that is utilized to power the device shall be within 10 feet (3 meters) of the device, shall be easily accessible, and protected by a circuit breaker in compliance with local regulatory requirements.

• For AC powered devices, ensure that the power cable used meets all applicable standards for the country in which it is to be installed.

• For AC powered devices which have 3 conductor power plugs (L1, L2 & GND or Hot, Neutral & Safety/Protective Ground), the wall outlet (or socket) must have an earth ground.

• For DC powered devices, ensure that the interconnecting cables are rated for proper voltage, current, anticipated temperature, flammability, and mechanical serviceability.

• WAN, LAN & PSTN ports (connections) may have hazardous voltages present regardless of whether the device is powered ON or OFF. PSTN relates to interfaces such as telephone lines, FXS, FXO, DSL, xDSL, T1, E1, ISDN, Voice, etc. These are known as "hazardous network voltages" and to avoid electric shock use caution when working near these ports. When disconnecting cables for these ports, detach the far end connection first.

• Do not work on the device 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 contains no user serviceable parts. This device can only be repaired by qualified service personnel.

WARNING

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

Electrostatic Discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic printed circuit cards are improperly handled and can result in complete or intermittent failures. Do the following to prevent ESD:

• Always follow ESD prevention procedures when removing and replacing cards.

WARNING

• Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground.

• To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

1. GENERAL INFORMATION

Thank you for your purchase of this Black Box 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 Black Box Technical Support at +1 (301) 975-1007.

1.1 FEATURES

- Variable rate extender - Easy to configure

- Auto-MDIX Ethernet

- Configurable 10/100, Full/Half, and Auto-Negotiating Ethernet

- Extends up to 4x 10/100Base-TX Ethernet beyond 328-foot (100-meter) limitation over a single twisted-pair, Cat 5e/6/7, or coaxial cable

- Symmetric or asymmetric settings via DIP switch

- Transparent operation

- LED indicators for Power, DSL Link, Ethernet Link/Activity, Remote and Local

1.2 DESCRIPTION

The Black Box 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, one Ethernet Extender is configured as the (L) Local unit located at one end of the LAN extension and the other Ethernet Extender is configured as the (R) Remote unit at the other end. The Ethernet Extender is configured as a L or R via the switch on the bottom of the unit. These units can automatically forward LAN broadcasts, multicasts, and frames across a 2-wire voice-grade twisted-pair or BNC link. The data is passed transparently (unmodified) through the Ethernet Extenders. The Ethernet Extenders automatically add and delete MAC addresses, only passing packets across the line link that are meant for the remote peered LAN.
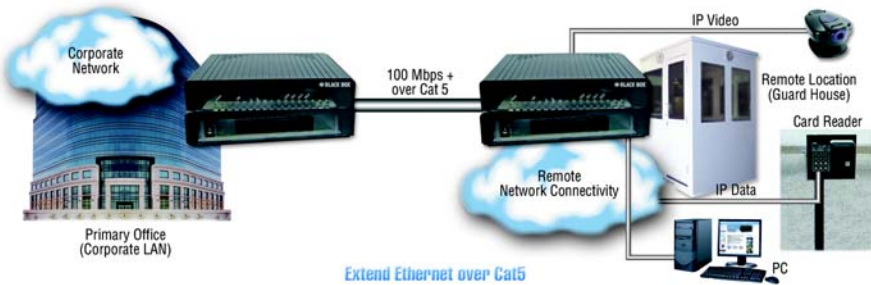
Figure 1. Typical application

The pair of Ethernet Extender models work together to create a transparent extension between two peered Ethernet LANs using twisted pair (2-wire), Cat5+, or 75-ohm BNC. Figure 1. shows a typical point-to-point application.

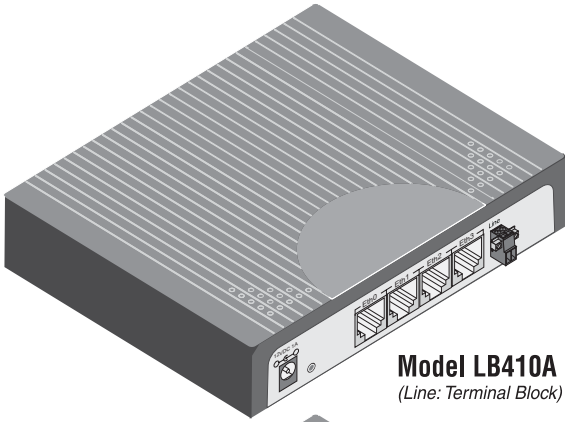## 2. INSTALLATION

CAUTION

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

To install the Ethernet Extender, do the following:

1. Connect the line interface between the units (refer to section 2.1, "Connecting the Line Interface" on page 11)

NOTE: See Figure 2. for the Ethernet Extender's rear panel arrangements.
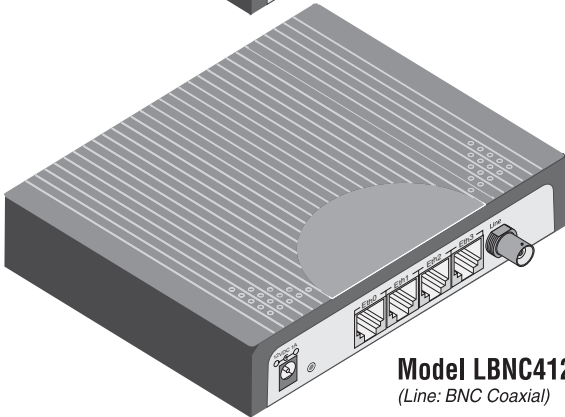
2. Connect the Ethernet interface (refer to section 2.2, "Connecting the 10/100Base-T Ethernet Interface" on page 12).

3. Connect the power plug (refer to section 2.3, "Connecting Power" on page 13).

Model LB410A
(Line: Terminal Block)
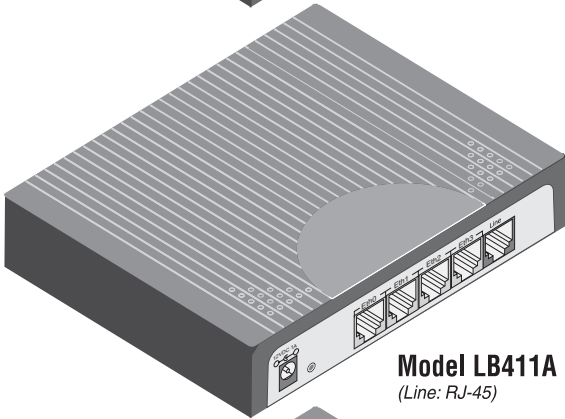
Model LB411A
(Line: RJ-45)

Model LBNC412A
(Line: BNC Coaxial)

Figure 2. Ethernet Extender rear panel options

2.1 CONNECTING THE LINE INTERFACE

⚠ **CAUTION**

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

The Ethernet Extender supports communication between two peer Ethernet LAN sites over a distance of up to 10,000 ft (3 km) over 24 AWG (0.5 mm) twisted-pair wire, Cat5+, or 75-ohm BNC.

NOTE: Actual distance and link performance may vary depending on the environment and type/gauge of wire used.

NOTE: The Ethernet Extender units work in pairs. One of the units must be configured as a (L) Local unit, and the other unit must be configured as a (R) Remote unit.

Connecting the Line Interface for LB411A or LB410A

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.

The Ethernet Extender is equipped with an RJ-45 interface jack (Figure 3.) or terminal block (Figure 4.) that can be used on the line interface. The line interface is a two-wire interface. Observe the signal/pin relationships on the Ethernet Extender's line interface jack.

The RJ-45 connector on the 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..
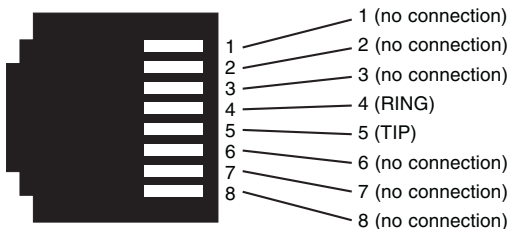

1 (no connection)
2 (no connection)
3 (no connection)
4 (RING)
5 (TIP)
6 (no connection)
7 (no connection)
8 (no connection)

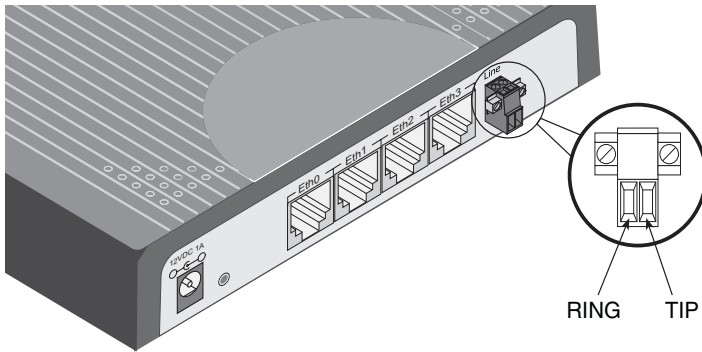**Figure 3.** Ethernet Extender (RJ-45) twisted pair line interfac.

Figure 4. Ethernet Extender (Terminal Block) twisted pair line interface

Connecting the Line Interface for LBNC412A

To connect the line interface of the Model LBNC412A, simply use a coaxial cable with a BNC connector at each end to connect the pair of Ethernet Extenders.

2.2 CONNECTING THE 10/100BASE-T ETHERNET INTERFACE

> ⚠ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability.**

The RJ-45 ports labeled *Ethernet* are the Auto-MDIX10/100Base-T interface. These ports are designed to connect directly to a 10/100Base-T device or network. Figure 5. 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.
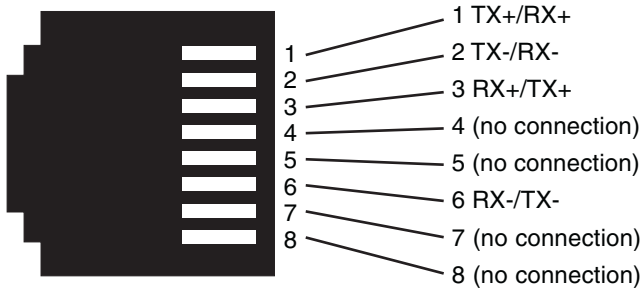
Figure 5. Ethernet Extender 10/100Base-T RJ-45 Connector Pinout.

2.3 CONNECTING POWER

⚠️ **CAUTION**

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

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

An external AC or DC power supply is available separately. This connection is made via the barrel jack on the rear panel of the 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 Ethernet Extender) must meet the following requirements; DC power supplied must be regulated 12VDC ±5%, 1.0A minimum. Center pin is +12V. The barrel type plug has a 2.5/5.5/10mm I.D./O.D./Shaft Length dimensions.

3. CONFIGURATION

The Ethernet Extender has eight DIP switches (S1) for configuring the unit for a wide variety of applications. This section describes switch locations and explains the different configurations.

3.1 CONFIGURING THE HARDWARE DIP SWITCHES

The DIP switches are externally accessible from the underside of the Ethernet Extender. Figure 6. on page 14 shows the orientation of the DIP switches in the On and Off positions.
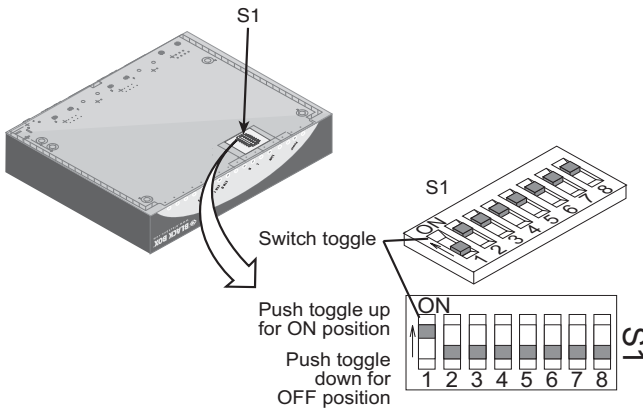
Figure 6. DIP switch orientation

3.2 CONFIGURING DIP SWITCH S1

DIP switch S1 is where you configure the line interface. The following tables describe the configuration for the Ethernet Extender.

Table 1: S1 Summary

Position	Description
S1-1	Local/Remote Configuration
S1-2	Line Rate/Symmetry
S1-3	Line Rate/Symmetry
S1-4	Reserved
S1-5	SNR Margin
S1-6	Reserved
S1-7	Reserved
S1-8	Reserved

Switch S1-1: Local/Remote Configuration

Use switch S1-1 to configure the unit as Remote or Local in the Ethernet Extender pair.

Table 2: Local/Remote Unit Configuration

S1-1	Setting
ON	CPE/Remote
OFF	CO/Local

Switches S1-2 and S1-3: Symmetric/Asymmetric Operation

Use switches S1-2 and S1-3 to configure the line rate type and operation.

Table 3: Symmetric/Asymmetric Selection Chart

S1-2	S1-3	Setting
OFF	OFF	High-Speed "Symmetric"
OFF	ON	High-Speed "Asymmetric"
ON	OFF	Long-Range "Symmetric"
ON	ON	Long-Range "Asymmetric"

NOTE: See Appendix D. on page 21 for line rate distances.

Switch S1-5: General Protection (Signal to Noise Ratio)

Use switch S1-5 to configure line noise protection.

Table 4: Signal to Noise Ratio

S1-5	Setting
ON	6dB
OFF	9dB

- **6dB:** Original line noise protection with 6dB SNR

- **9dB:** Better line noise protection with SNR up to 9dB

4. OPERATION

Once the Ethernet Extenders are properly installed, they should operate transparently. No user settings required. This section describes reading the LED status monitors. Before applying power to the Ethernet Extender, please review section 2.3, "Connecting Power" on page 13 to verify that the unit is connected to the appropriate power source.

4.1 FRONT PANEL LED STATUS MONITORS

The Ethernet Extender features six front panel LEDs that monitor power, the Ethernet signals, the line connection, and the remote/local setting. Figure 7. shows the front panel location of each LED. Table 5 on page 16 describes the LED functions.
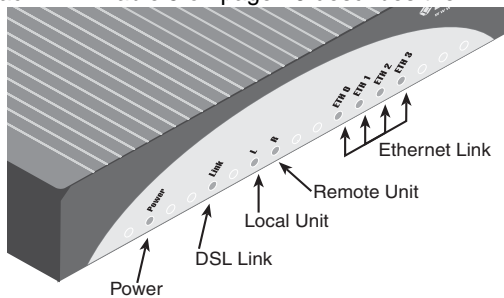

Figure 7. Ethernet Extender front panel

Table 5: Front panel LED description

LED	Status	Description
Power	Green	The device is powered on.
	Off	The device is powered off.
Line	Green	The port is connected.
	Blinking Green	Data transceiving.
	Off	No valid link on this port.
Ethernet	Green	The port is connected.
	*Blinking Green	Data transceiving.
Local	Green	The device acts in Local mode.
	Off	Local mode is off.
Remote	Green	The device acts in Remote mode.
	Off	Remote mode is off.

∗. Once the unit connects to a power source, the Link LED will blink as the Ethernet Extender automatically looks for the other unit in the pair.

A. SPECIFICATIONS

A.1 LAN CONNECTION
- Four RJ-45, 10/100Base-T, IEEE 802.3 Ethernet
- Line Connection: RJ-45

A.2 TRANSMISSION LINE
Two-wire unconditioned twisted pair or 75-ohm BNC

A.3 LINE RATE AND DISTANCE
- Line Rate: Up to 200 Mbps asymmetrical
- Distance: Up to 9,842 ft (3 km)

  Note Distances depend on line rate and line conditions.

A.4 LED STATUS INDICATORS
- Power (Green)
- Line: Link (Green)
- Local (Green)
- Remote (Green)
- Ethernet: Link (Green) & Activity (Flashing Green)

A.5 POWER SUPPLY
External AC and DC options:

- AC: 120 VAC, 220 VAC, and UI (120–240 VAC)
- DC: 12 VDC, 24 VDC and 48 VDC
- Power consumption: 400mA at 12VDC

A.6 TEMPERATURE RANGE
0–50°C

A.7 HUMIDITY

Up to 90% non-condensing.

A.8 DIMENSIONS

6.22 W x 1.25 H x 4.75 D in. (157 W x 318 H x 120 D mm)

B. Factory Replacement Parts and Accessories

Black Box Model #	Description
Base Models	
LB411A-KIT	High Speed Ethernet Extender Kit (Local and Remote); RJ45 Line, 100-240VAC
LB410A-KIT	High Speed Ethernet Extender Kit (Local and Remote); Terminal Block Line, 100-240VAC
LBNC412A-KIT	High Speed Ethernet Extender Kit (Local and Remote); BNC Line, 100-240VAC
07MLB41x-UM	User Manual
Power Supplies	
PS-03671H1-002	100-240VAC (12V, DC/2A) Wall mount power adapter
Power Adapters	
12-130	European replacement plug
12-129	American replacement plug
12-131	United Kingdom plug
12-132	Australian/Chinese plug

C. Ethernet Extender 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 LINE INTERFACE

RJ-45

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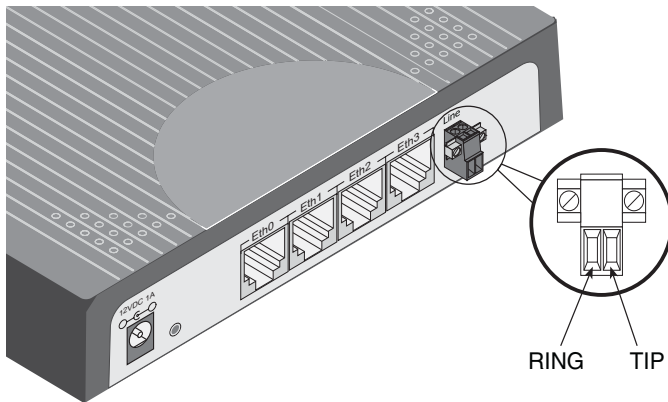- Pins 1, 2, 3, 6, 7, 8: no connection

Terminal Block

Figure 8. Ethernet Extender (Terminal Block) twisted pair line interface

D. Line Rate & Reach Chart, Based on 24 AWG (0.5 MM)

Table 6: Line Rate & Reach Chart Using Twisted-Pair (Long Range)

Mode (Long Range)	Distance in Feet		Mbps	
	ft	m/km	DS	US
Symmetric	250 ft	76 m	68	40
	1000 ft	305 m	62	44
	2,000 ft	610 m	50	16
	3,000 ft	914 m	33	4
	5,000 ft	1.5 km	16	2
	10,000 ft	3 km	2.5	1
Asymmetric	250 ft	76 m	67	16
	1000 ft	305 m	59	16
	2,000 ft	610 m	45	11
	3,000 ft	914 m	31	5
	5,000 ft	1.5 km	17	682 kbps
	10,000 ft	3 km	4	263 kbps

NOTE: The actual distance and link performance may vary depending on the environ-ment and type/gauge of wire used.

NOTE: DS = downstream, US = upstream

NOTE: This chart applies to Ethernet Extenders with a twisted-pair line interface: Model LB411A and LB410A. Contact Black Box for Model LBNC412A rates.

Table 7: Line Rate & Reach Chart Using Twisted-Pair (High Speed)

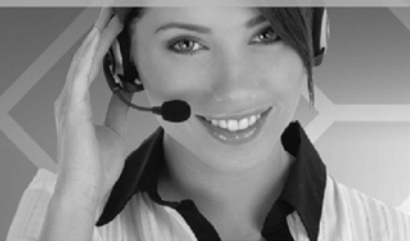| Mode (High Speed)	Distance in Feet		Mbps	
	ft	m/km	DS	US
Symmetric	250 ft	76 m	121	144
	1000 ft	305 m	73	103
	2,000 ft	610 m	45	37
	3,000 ft	914 m	46	10
	3,500 ft	1 km	30	4
Asymmetric	250 ft	76 m	168	95
	1000 ft	305 m	126	54
	2,000 ft	610 m	60	21
	3,000 ft	914 m	42	6
	3,500 ft	1 km	35	1

NOTE: The actual distance and link performance may vary depending on the environment and type/gauge of wire used.

NOTE: DS = downstream, US = upstream

NOTE: This chart applies to Ethernet Extenders with a twisted-pair line interface: Model LB411A and LB410A. Contact Black Box for Model LBNC412A rates.

NOTES

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About Black Box

Black Box provides an extensive range of networking and infrastructure products. You'll find everything from cabinets and racks and power and surge protection products to media converters and Ethernet switches all supported by free, live 24/7 Tech support available in 30 seconds or less.

LB410A, rev. 1