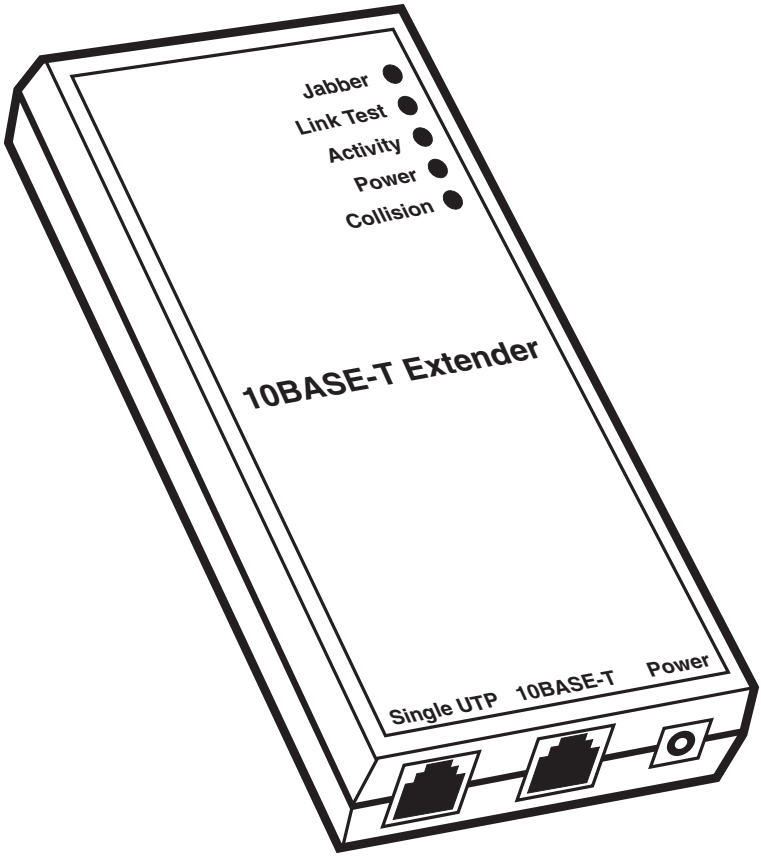
1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746

BLACK BOX®
NETWORK SERVICES

FEBRUARY 1999
LZ6000A-R4

10BASE-T Extender



CUSTOMER SUPPORT INFORMATION Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
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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 J 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.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

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

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

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

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

5. 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..

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

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

8. 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.

9. 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.

10. 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.

11. 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.

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

13. 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.

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

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

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

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

18. 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.

TRADEMARKS

The trademarks mentioned in this manual are the sole property of their owners.

CONTENTS

1. Specifications

Speed—10 Mbps

Standards—IEEE 802.3 Ethernet

Connectors—(1) RCA male, (2) RJ-45

Indicators—(5) LEDs: Power, Activity, Link Test, Jabber, Collision

Power—100-250 VAC, autosensing wallmount power supply, 47-63 Hz, 9 V at 1 Amp

Size—0.8"H x 2.7"W x 4.5"D (2 x 6.9 x 11.4 cm)

Weight—4 oz. (0.1 kg)

2. Introduction

2.1 Overview

The 10BASE-T Extender is a high-performance Ethernet repeater that operates over a spare pair of telephone wires already in the walls or buried in the ground. It works with any IEEE 802.3 compatible Ethernet system.

2.2 What's Included in the Package

Check to make sure that your LZ6000A-R4 kit contains the following items. If anything is missing or damaged, please call Black Box at 724-746-5500.

- (1) 10BASE-T Extender (part number LZ6000A-R3)
- (1) surge protector (part number SP512A-R2)
- (1) Velcro® strip for wall mounting
- (1) AC power supply, 100-250 VAC autosensing
- (1) North American power cord

2.3 Equipment Protection

You must be extremely careful to ensure the safety of persons and equipment whenever using wires that run between buildings. Both underground cable runs that are near the surface and overhead runs are at risk of damage from lightning strikes and must be suitably protected. This protection must be in place or there will be risk of serious injury or death. The service entrance at each end of the wires should be protected in strict accordance with local safety codes. In addition, to further reduce the risk of injury and/or damage to equipment due to lightning strikes or accidental connection to hazardous AC line voltages, secondary circuit protection, included with this product, must be installed.

Outdoor cabling installed by the phone company is typically installed with gas-discharge protection devices, carbon blocks, or no protection devices at all. If cabling has protection, DO NOT BYPASS these devices—they will help protect both your equipment and all those who work with it.

WARNING

If the cable run you will be using is not protected, DO NOT continue with the installation. STOP.

Install suitable protection devices before proceeding and be sure that the instruction are followed fully (including connecting the ground strap)!

NOTE

Many carbon-block protection devices add a significant load to the line and will not work with the 10BASE-T Extender. These must be removed and replaced with suitable protection devices.

Figure 2-1 shows a 10BASE-T Extender installed with surge protection.

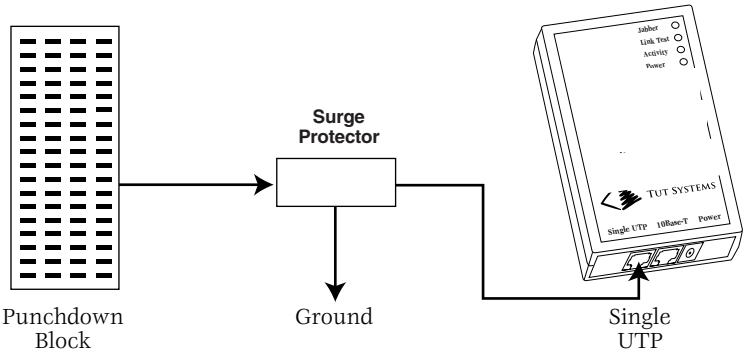


Figure 2-1. Lightning protection.

3. Installation

Figures 3-1 and **3-2** show typical installations of the 10BASE-T Extender.

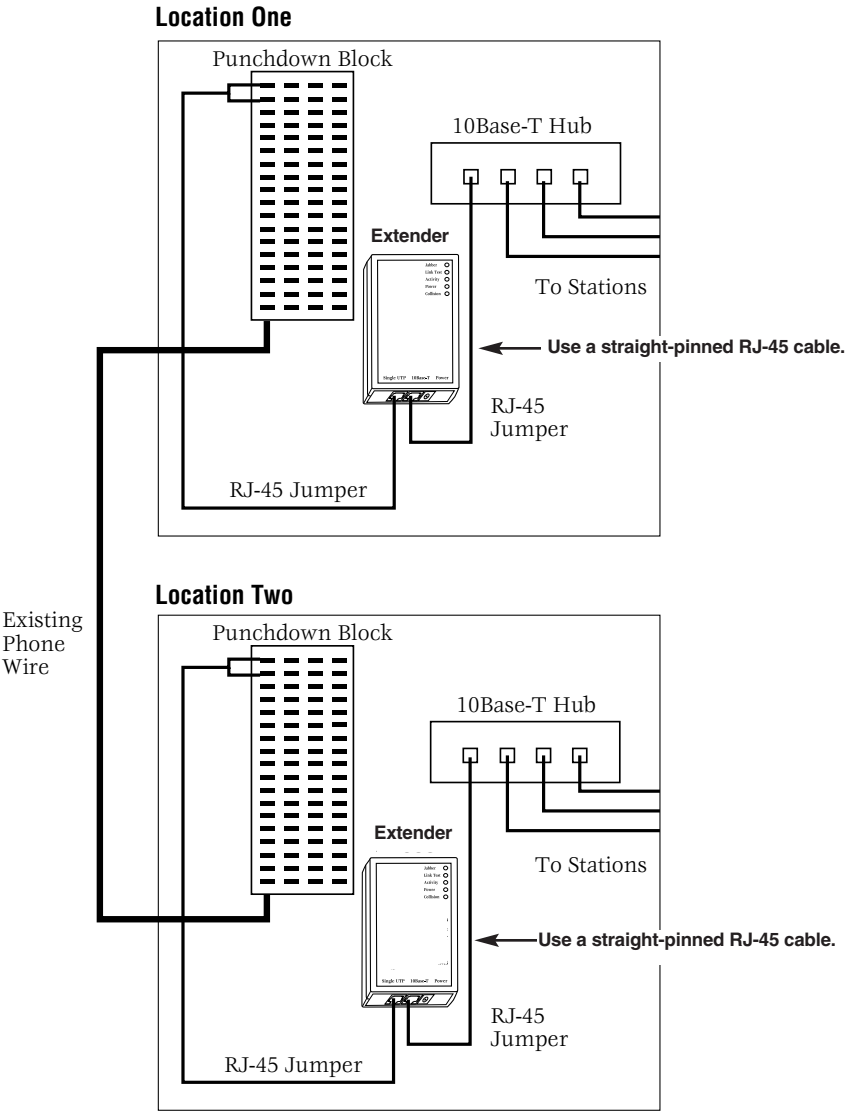


Figure 3-1. Complete hub-to-hub connection.

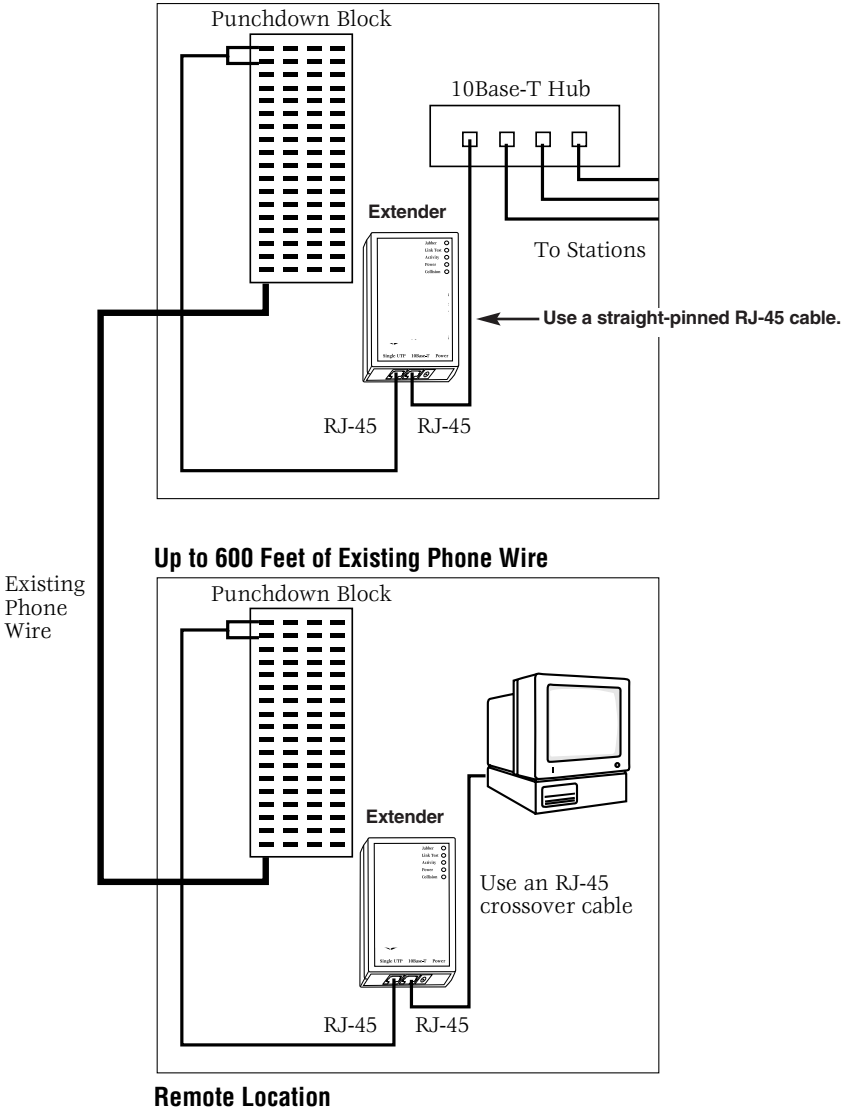


Figure 3-2. Complete hub-to-node connection.

3.1 Tools and Parts Needed

Installing the 10BASE-T Extender is fast and simple, but does require tools you may not normally have around the office. Before you begin installation, be sure you have everything on this list:

- A site plan for your office showing the locations of all the wiring closets (a rough sketch will do)
- A punchdown tool (sometimes called an impact tool)
- An RJ-45 crimping tool
- An ohm meter

Call Black Box Technical Support at 724-746-5500 to find out how to obtain these tools.

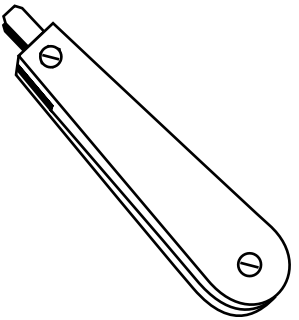


Figure 3-3. Punchdown tool.

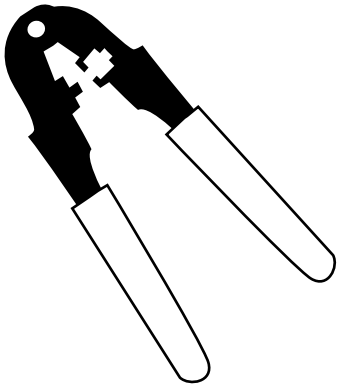


Figure 3-4. RJ-45 crimping tool.

3.2 About the Wiring Closet

A 10BASE-T Extender is typically installed in a wiring closet, making it possible to connect the phone wires carrying network traffic to the repeater using short patch cables.

3.3 UTP Phone Wire

The 10BASE-T Extender is intended for use with 100Ω unshielded twisted pair telephone wire (UTP) already installed in and between buildings. Buildings, individual floors and wings of a building are often interconnected with 25-pair, 50-pair, or 100-pair level 2 UTP cables. At least one pair in these cables is usually available for long distance LAN connections.

3.4 Patch Cables

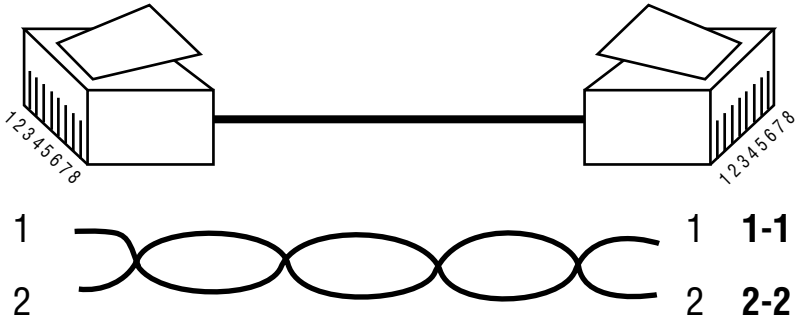
A patch cable connects each phone-wire pair to a 10BASE-T Extender port. Each patch cable extends from the Extender port to the phone punchdown block or patch panel containing the phone-wire connection. You must make your own patch cables for an installation. They are not included with your Extender. Call Technical Support for more information about patch cables. When making patch cables to connect patch panels to repeaters, use pins 3 and 6 of the RJ-45 connectors by joining one wire to pin 3 on both plugs and the other to pin 6 on both plugs with a crimping tool (see straight-through cabling in **Figure 3-5**). If making patch cords for connecting the repeaters directly to the punchdown blocks, make sure that the wire used is compatible with the punchdown block.

Most blocks do not work properly with stranded wires. These cables will typically have a connector on only one end, with the other end connected directly to the punchdown block.

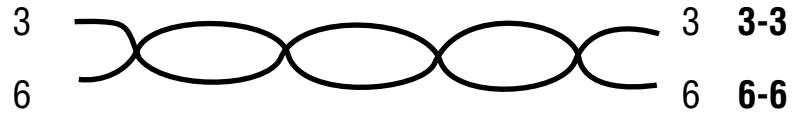
NOTE

Because standard telephone patch cords contain a crossover in their wiring, they will not function in a network. Flat "Silver Satin" telephone patch cords are not made of twisted-pair wires and should also not be used for Extender wiring.

3.5 Straight-Through Cabling



Optional for XL links
Required for 10Base-T connections



Required for 10Base-T and XL connections

Figure 3-5. Straight-through cabling.

3.6 Preparing the Site Plan

1. Find or create a site plan. It must show the location of one or more phone closets where the Extender units will be installed.

2. Locate and identify each pair of wires that you will use for the long distance interconnection. The wire pairs must only run between the two points to be connected. The link will not connect if there is a bridge tap anywhere on the link (see **Figure 3-6**).

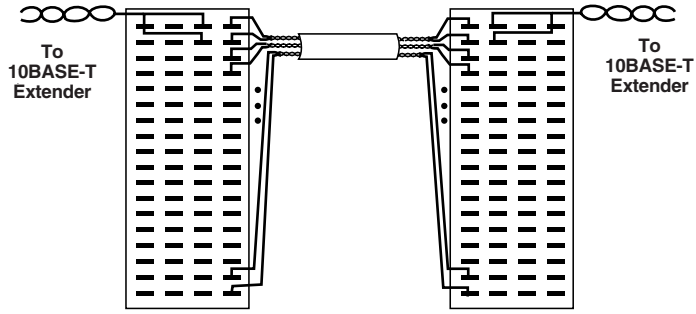


Figure 3-6. Long-distance links and bridge taps—correct connection.

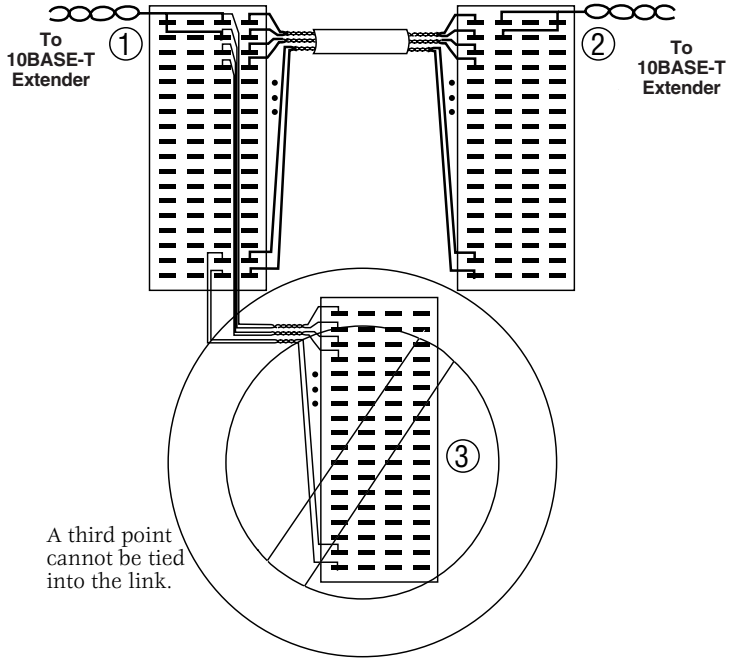


Figure 3-7. Long-distance links and bridge taps—incorrect connection.

3.7 Measuring Phone Wire

1. Use a cable scanner or an ohmmeter to measure the lengths of phone wire that will connect the Extenders. When using an ohmmeter, short-circuit one end of the phone wire and measure the resistance between the two wires at the other end (see **Figure 3-8**).

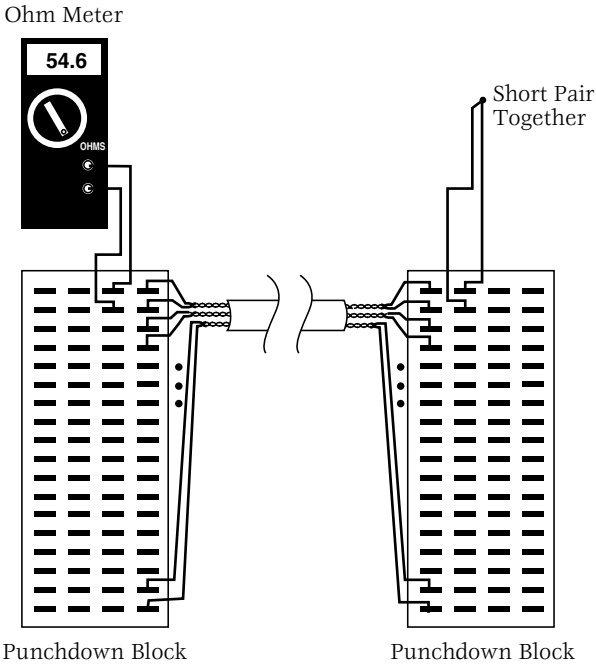


Figure 3-8. Using an ohmmeter to measure the length of phone wire.

2. Multiply the resistance by 20 to find the length of the wire in feet. For example, 26.4 ohms would indicate a cable length of about 525 feet: 26.4 x 20 @ 525 (+/-). This formula works for 24-gauge phone wire. For a maximum of 600 feet of wire the resistance must measure 30 ohms or less. Refer to **Table 3-1** for maximum acceptable resistance values of other wire gauges.

Table 3-1. Maximum resistance values of other wire gauges.

Gauge	Maximum Resistance (for 600 ft. [272 m])
24GA	30 Ω
22	19
20	12
18	7.5

NOTE

Wire smaller than 24 gauge is not recommended, and any wire used must be 100-ohm impedance, unshielded twisted pair.

Telephone wire connected between two Extender units may span up to 600 feet (272 m) in length.

3.8 Install 10BASE-T Extenders

Follow these steps to set up the Extenders:

1. Install the Extender in the wiring closet near the punchdown block or patch panel. You can mount it with the Velcro® strip provided.
2. Plug the power supply into the wall and attach it to the Extender.
3. Observe the LEDs on the Extender.

- The green power LED will be on.
- The LZ6000A-R3 is shipped with the Link Integrity Test set to ON (enabled). When power is connected, the Link Test indicator should not light, showing that the link is not yet established. After connecting to a 10BASE-T line, the indicator will light amber, indicating a "good link." Check the manual that came with the 10BASE-T device that you are connecting to. If it requires Link Integrity Test to be OFF, move the jumper so it covers only one pin (see **Figure 3-9**). This will set the Link Integrity to OFF and the indicator on the face of the unit will not be lit.

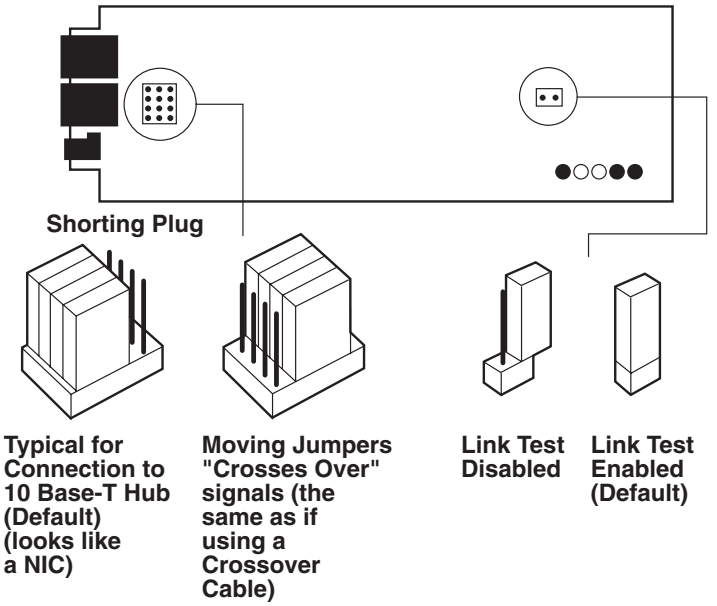


Figure 3-9. Jumper Settings.

3.9 Connecting the Extender to the Phone Block

Attaching the cable wires to the phone block requires the use of a punchdown or impact tool. The wires must be "punched down" on forked pins corresponding to the phone wire pair used for each end of the long-distance span.

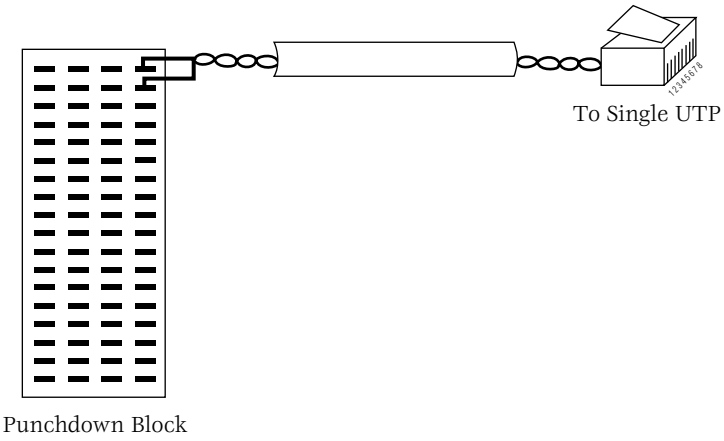


Figure 3-10. Connected patch cable.

1. Form a loop at the end of each patch cable wire and place the loop under the lip of a pin. Position the punchdown tool over the pin, with the cutting edge above the short end of the wire, and press down firmly. The tool forces the wire down between the halves of the forked pin and severs its short end (**Figure 3-11**).

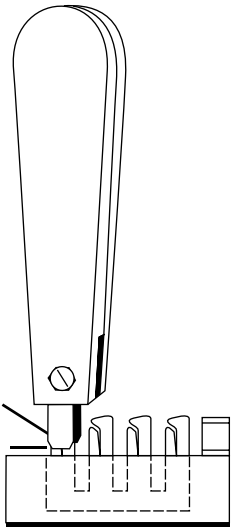


Figure 3-11. Punching wires onto a punchdown block.

An RJ-45 crimping tool is required for attaching the RJ-45 connector to the other end of the patch cable. Use pins 3 and 6 of the connector and make a straight-through patch cable. To be straight-through, pin 3 on one connector must connect to pin 3 on the connector at the other end of the long-distance span and pin 6 to 6.

3.10 Connecting the Extender to 10BASE-T

3.10.1 Connecting to a Hub

The Extender is shipped configured to connect to a 10BASE-T hub "downlink" port like a network interface card (NIC) with Link Integrity enabled. This means the Extender can be connected to a standard downlink port of a hub, using a straight-through 10BASE-T cable (see **Figure 3-5** on **page 13**).

The Extender is shipped with Link Integrity Test set to ON (enabled). When power is connected, the Link Test Indicator should not be lit, showing that link is not yet established. After connecting the 10BASE-T port to a powered-up 10BASE-T hub, the indicator will light green, indicating a "good link."

3.10.2 Connecting to a Node (NIC)

The Extender is shipped configured to connect in a manner similar to a network interface card (NIC) with Link Integrity enabled. To connect the Extender to a NIC use a crossed 10BASE-T cable. See **Figure 3-12**.

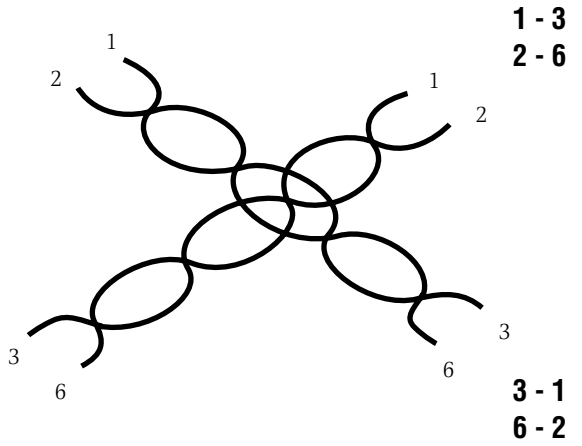


Figure 3-12. Crossed 10BASE-T cable.

The Extender is shipped with Link Integrity Test set to ON (enabled). When the power is connected, the Link Test Indicator should not light, showing that the link is not yet established. After connecting the 10BASE-T port to a powered up NIC, the indicator will light green, indicating a "good link."

3.11 Start the Network

The Extenders are now fully installed and ready to transmit data. Power up the network (if it is not powered up already) and use it. If you encounter any problems, refer to **Chapter 4, Monitoring and Troubleshooting**..

4. Monitoring and Troubleshooting

If you find that the information in this section does not address a problem you are having with your network, call Black Box Technical Support at 724-746-5500. Besides software issues, the most common network problems are cable faults, which account for over 75% of all network hardware problems. Always suspect the cabling, and always suspect the connections to the cabling first—connectors unplugged, wires not making good contact in the connectors, faulty punchdown-block connections, etc.

4.1 Monitoring the 10BASE-T Extender LEDs

- Jabber—The amber indicator is on when the link is disabled due to a jabber condition.
- Link Test—The green indicator is on when the 10BASE-T link is good.
- Activity—The green indicator is on when data is passing through the Extender.
- Power—The green indicator is on when the unit is plugged in and power is on
- Collision—The amber indicator is on when there is a collision on the line. Two or more devices attempted to transmit at the same time. The Ethernet protocol takes care of this, and the units will retransmit.

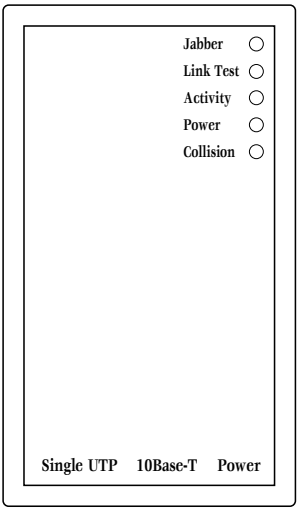


Figure 3-12. LEDs on the 10BASE-T Extender.

4.2 Troubleshooting

4.2.1 Solving Common Extender Problems

Make sure the Extender link is 600 feet (272 m) or less in length and that the cable is of unshielded twisted-pair construction. Do not use flat telephone cables for patch cables or any other Extender network connection for two reasons:

1. Some devices are quite sensitive to EMI and RFI noise. If you use flat untwisted wire—even short patch cables—you may experience very poor performance.

2. Flat telephone cables typically have their polarity reversed; any device on a leg with the wrong polarity will not communicate with the repeater.

4.2.2 Collision Indicator is Lit Continuously

Check that the Extender port:

- is connected
- does not have an open circuit
- does not have a crossed cable (instead of a straight-through cable) connected to it

Be sure that one pair in the cable has pins 3 and 6 in the same pair (see **Figure 3-5** on **page 13**). Do not split pairs.

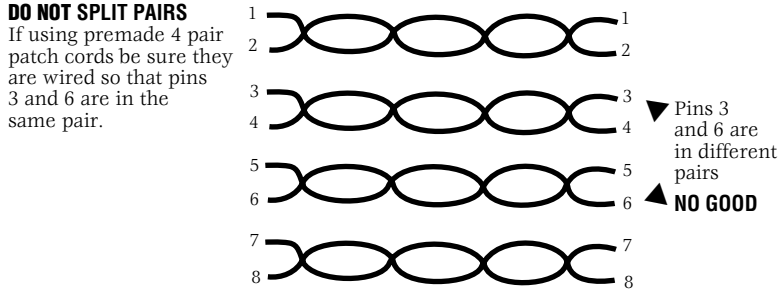


Figure 3-13. Incorrect cabling.

4.2.3 Link is Not Lit on the Extender

Make sure the 10BASE-T port on the Extender is connected:

1. to a functional, powered up 10BASE-T hub via a straight-through 10BASE-T cable, or

2. to a functional, powered up 10BASE-T NIC via a crossed 10BASE-T cable (1-3, 2-6; 3-1, 6-2).