# RadioLAN

## BridgeLINK-Pro™ Wireless Ethernet Bridge

## Installation Guide

**RadioLAN**

## FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules . These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**FCC ID:**              MCI-397
**FCC Rule Part(s):**    15
**Frequency Range:**     5.725-5.875 GHz
**Equipment Class:**     Low Power Communication Device Transmitter
**Max. Output Power:**   50 mW (+17 dB)

This device has shown compliance with new rules adopted under Docket 87-389 and is not affected by Section 15.37, transition rule.  Each radio is marked with its operating frequency.

***All interface cables must be shielded.***

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

> *FCC regulations require that a person knowledgeable in electronics and trained in the correct installation of this device professionally install this device. Antennas used with this product shall be mounted in such a way so that there is at least 2m separation between all persons and the antenna, and at least 20 cm away from any other transmitting antenna.*

> *Professional installers have a responsibility to comply with FCC part 15 rules on antenna limits and amplification, and with RF exposure requirements in FCC rule section 1.1307 Unauthorized modifications to the device could void the End-user's authority to operate it.*

## Conventions

The following conventions are used in this manual to highlight important topics:

***Bold Italic Indented Block Text*** – Highlights an important notice

**Bold** – a field name

*Underline Italic* – The name of a referenced document

Blue Underline – A Hyperlink to a URL or E-Mail address

Notice Symbol – Please take special notice

Disclaimer

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## Table of Contents

## Introduction

The purpose of this guide is to help successfully complete the installation and setup of a BridgeLINK-Pro Wireless Ethernet Bridge. The BridgeLINK-Pro® (BL-Pro) is a module which connects or bridges two 10BaseT wired networks located in different buildings by using a 10BaseRadio™ wireless link. These buildings may be located up to 32 miles (50 km) apart. You need only install the components at each building, aim the antennas toward one another, and power the system on.

If you decide not to read this Guide completely, at least read the next section entitled "Quick Setup". It will help you understand the basic concepts of the installation and initial setup. Please see the *BridgeLINK-Pro Administration and Management Guide* located on the RMG website www.radiolan.com for information on configuring and managing the Bridge.

### The BridgeLINK-Pro™ System

The BridgeLINK-Pro system includes a Bridge Processor Unit (BPU) in a weatherproof NEMA-4 Enclosure, a power transformer, a Power-over-Ethernet (PoE) adapter, an Ethernet cable, an antenna, and an RF Cable. Also included are all the mounting hardware for the BPU and an articulation assembly for the Antenna. The BPU contains the Radio and all the digital electronics.

**BridgeLINK-Pro™ BPU**

A Typical BridgeLINK-Pro™ Application

The figure to the right shows a typical BridgeLINK-Pro application in which two buildings are connected. These buildings may be located up to 32 miles apart from each other, and may have either Local Area Networks (LANs) or simply have an Ethernet device. Notice that there are no solid obstructions between the two buildings and that each building's antenna points toward the other.
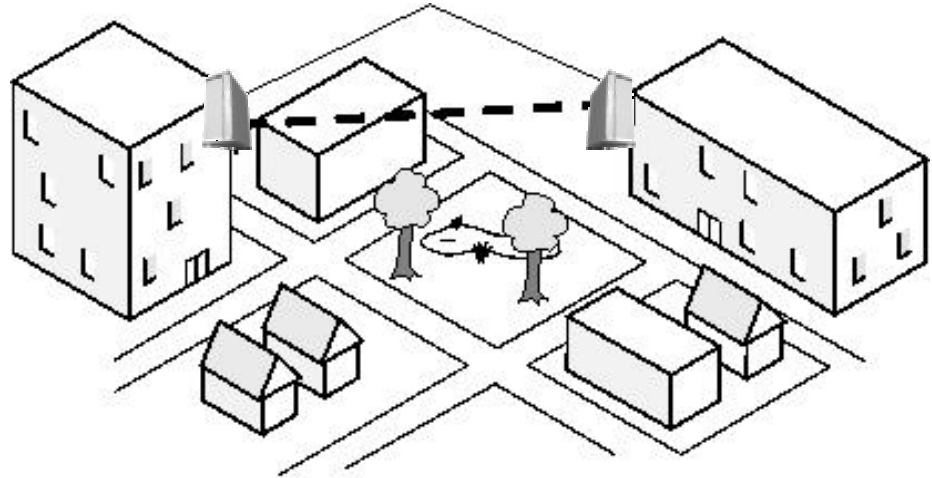


*Because the system uses radio frequency to establish the connection between the two buildings, it is important to avoid blocking the radio link with any objects, such as a trees, buildings, walls, or items that are attached to the building walls, such as stairwells, fire escapes, or other antenna equipment.*

## Quick Setup Guide[1]

1.  For a fast, successful installation, make sure you have:

    A non-switched electrical outlet to power.

    Access to the Ethernet backbone - devices local to the electrical outlet.

    Installation locations that have an unobstructed view of the associated BL-Pro.

    Two (2) lengths of Category-5 jumper cables to connect the PoE adapter to your Ethernet.

    Proper tools to complete the installation, including a 9/16ths inch wrench, a medium Phillips head screwdriver, a large flat-head screwdriver, and cable tie-downs.

2.  Assign an IP Address using the IPAssign utility.  Setup a Subnet ID and Port Name to both BL-Pros using the HTTP Browser interface.

3.  Assemble the Mounting Assembly and attach to the BridgeLINK-Pro

4.  Assemble the articulator assembly and attach to the antenna.

5.  Mount the Antenna Assembly in the selected location.  Make sure the assembly is securely mounted for the windiest conditions expected.

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[1] **FCC regulations require that this device be professionally installed by a person knowledgeable in electronics and trained in the correct installation of this device.**

6. Mount the BL-Pro BPU close to the antenna assembly so that the RF cable can freely attach the two. Fasten the BPU using the provided mounting hardware.

7. Attach the Antenna Assembly to the BPU using the provided RF Cable. Tie down the slack cable to the mounting structure.

8. Attach the CAT-5 cables to the BL-Pro BPUs and draw the slack cable to the associated Ethernet Equipment.

9. Install the Power Adapter and connect the PoE adapter to the Ethernet port of a hub, switch, router or PC with an RJ-45 Jumper cable. Make sure that the total length of Ethernet Cable from the BPU to the Ethernet Equipment port is less than 295 feet.

10. Configure the other side of the link according to steps 1 – 9 above.

11. Test the link by pinging one IP address you previously assigned from a PC on the other side of the link.

FCC regulations require different antenna types to be qualified for this product. The regulations distinguish between point to point operation and point to multi-point operation. The following antennas are qualified for use with this product:

9 dBi Omni        Point to multipoint and point to point operation
18 dBi Panel      Point to point operation only
23.5 dBi panel    Point to point operation only

# Installation Guide

<u>Unpacking the BridgeLINK-Pro units</u>

The BridgeLINK Units come ready to use.  To complete the installation, you will need two CAT-5 jumper cables to connect your network equipment to the PoE Injectors on the BL-Pro units.  The following components are included in the BL-Pro system:

### BridgeLINK-Pro™ Processor Unit (BPU)

The BPU is the heart of the BridgeLINK-Pro system.  It contains the digital electronics and the transceiver system, all in one small, power-efficient unit.  The BL-Pro operates in the license-free, 5 GHz U-NII band, specifically at 5.775 GHz.  The BPU has a removable cover that allows the Professional Installer access to internal connections and indicators.

The BPU features three sets of LED indicators.  An external bi-color LED shows activity on the RF port. Two internal green LEDs indicate activity on the Ethernet port.  A third set of three indicators show activity on the digital electronics

There are three ports.  We will look at these ports from left to right.  To access these ports, remove the face cover from the BPU by unscrewing the hex-head screws from each of the four corners.

### Radio Port

The Radio Port allows the CPU module to connect to the transceiver module itself. This connection allows for modularity, assuring a smooth upgrade path for future radio or processor enhancements. Normally, you will not have to touch this port, since the Radio comes connected from the factory.
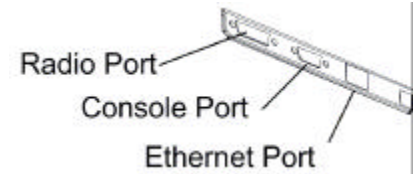
### Console Port

The console port is a female DB9 connector and allows for a serial connection between a local terminal or terminal emulator and the BridgeLINK-Pro, using a standard straight-through, male-to-female serial cable. A local terminal connection may be used to configure the CPU, although IPAssign is a more convenient way to connect to the BPU. Although the BridgeLINK-II is browser manageable, troubleshooting is often most easily done using the *Console Port*. There is very little clearance to attach a commercial DB9 connector, so use it only when absolutely necessary.

### Ethernet Port

The 10BaseT Ethernet port RJ-45 jack, located inside the BPU unit, accepts a standard shielded RJ-45 plug from the PoE Adapter module. The 10BaseT interface is set to automatically detect MDI/MDI-X, and you may hear a clicking sound during this detection process. A crossover cable is therefore not necessary to connect the PoE Injector to a laptop, simplifying field configurations.

**10BaseT LEDs**

On the upper left and right corners of the RJ-45 jack, inside the BPU, are green LEDs, which indicate transmit and receive status from the network.

When the CAR (for Carrier) LED illuminates, this indicates that the Ethernet carrier is active.  This LED should be illuminated when the BridgeLINK-Pro is operating normally.

When the ACT (for Activity) LED illuminates, this indicates Ethernet activity on the network. This LED flickers when there is communication taking place on the Ethernet network.

**Power Port**

The Power port is not used in the BridgeLINK-Pro, and nothing should be connected to this port.

**Radio LED**

The LED on the bottom of the BPU is a bi-color LED.  It will illuminate *green* when the 10BaseRadio chip detects packets in the air.  If there is no other BPU to talk to, this LED will flash *orange* about once a second, as it sends 'hello' packets to discover an associated unit.

Since 10BaseRadio sends and receives keep-alive packets about once a second, this LED should flash *green* that often on a quiet link, and more often on an active link.  It will flash *orange* when the BPU is sending traffic to the other BPU.  When sending long packets, this LED will appear to be solid orange, and when idle, will flash a very short orange about once a second.

### AC Power Adapter

The supplied power adapter provides an easy connection to standard AC electrical outlets. The adapter plugs into the PoE Adapter's power jack. RMG recommends using a non-switched electrical outlet to power the BPU.

The output from the BridgeLINK-Pro power adapter is 10VAC to 18VAC, depending on the length of the Ethernet Cable between the PoE Module and the BPU.  You may use older AC or DC power transformers from the original BridgeLINK or BridgeLINK-II to power the BridgeLINK-Pro, as the unit will run on DC power.  However, we recommend that you use only the AC Power transformer supplied with the BridgeLINK-Pro unit, or contact RMG for a suitable replacement power adapter.

### PoE Adapter

The PoE adapter module has three connectors: one for power, one for a connection to the BPU, and one for connection to the Ethernet Equipment.  It is very important to properly connect the PoE adapter.  The Input ports are labeled *Net* and  *Power*, and the output to the BPU is labeled *ODU*.  The PoE adapter is designed for easy mounting on the wall.

*Caution:  The BPU port carries AC power and may damage Ethernet equipment erroneously plugged into it.  Make sure that only the BPU is connected to this port.  Failure to do so will void the warranty.  RadioLAN assumes no liability for damage to any equipment due to failure to follow these instructions.*



**PoE Injector Module**

Planning the Installation

Proper selection of the installation points is critical for the success of the installation. In this topic we will look at the factors that go into a proper site selection.

### Determining the Distance Between Buildings

It is important to verify that you do not exceed the distance capabilities of the BridgeLINK-Pro. If you are unsure of the distance between the two points, you can use a measuring device such as range finders. You can also look at the architect's site plan or contact a local surveying service for assistance.

### Choosing a Location for the BL-Pro

Typically, there are a number of suitable locations on which to mount the BPU, such as a wall, a tower, or a rooftop.   What is essential is a clear line-of-sight to the other BPU with which it will be communicating. You must locate the BPU at a distance from the PoE adapter that is no farther than the specification will allow. The maximum cable length for Category 5 Ethernet is 295 feet, and you must consider all bends in the cable when determining distance. To avoid the risk of vandalism, consider placing the BPU in a location where it is out of reach of the general public.

### Co-Channel issues

If you are installing two BL-Pro units at the same location, that is less than 50 feet apart from each other, be sure to set a unique Subnet ID on each pair of bridges to minimize co-channel interference.  Please read the RadioLAN White Paper on *Co-channel Interference*.

**Locating the PoE Adapter**

Choose a location for the PoE adapter where there is access to local network cabling and electricity.  The PoE Adapter may be attached directly to a wall, and connects to an Ethernet hub port, Router port, switch port, or Ethernet jack of any network-enabled device. It may also be attached to a physical Ethernet jack somewhere on the Ethernet plant.

Before selecting an electrical outlet for use in powering the PoE Adapter, verify that the electrical outlet is non-switched (for example, it is not attached to a wall switch).

Setting up the BL-Pro

**Initial IP Address Setup**

Before using the TCP/IP management services of a BridgeLINK-Pro, a valid network IP Address must be assigned. There are two ways to do this:

1.  The IPASSIGN utility provided by RMG (ftp://ftp.radiolan.com/IPAssignInstaller.zip).

2.  A VT-100 terminal connection to the BPU console port.

**IPAssign method**



**IPAssign Utility**

To use the IPASSIGN Utility, connect the BridgeLINK-Pro PoE injector to a PC with a 10BaseT Card, either directly, or through the local area network (LAN).
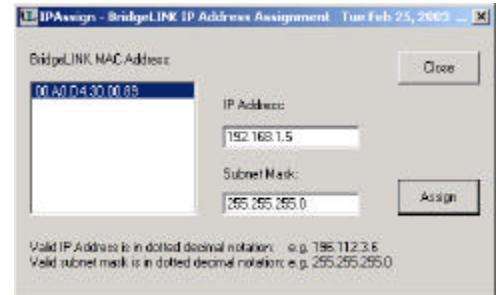
To run the IPASSIGN Utility on a PC with a 10BaseT Network Interface Card, connect a 10BaseT cable between the BPU and the PC's Network Interface Card.  Connect the power adapter to the power jack on the PoE Adapter, and plug the power adapter into an electrical outlet.  Make sure the green external LED illuminates.

### Using the IPASSIGN Utility to assign the BPU's IP Address

RMG's IPASSIGN utility allows you to assign an IP Address to the BPU quickly. The PC's Network Interface Card must have an IP Address on the same IP Subnet.

From either the supplied floppy disk or RadioLAN's FTP Site, ftp://ftp.radiolan.com, download the IPASSIGN utility.  This utility automatically connects to the BPU, discovers its internal MAC address, and allows you to enter an IP address for use on the TCP/IP network.

1. Download the IPASSIGN.EXE program, and install and run it.  Once the utility starts, it automatically searches the network for any new BPUs.  It finds the BPU that is connected, then lists the BPU's MAC Address in the New BLINK unit field.

2. Type in the appropriate IP address and Subnet Mask address into the fields on the screen, and then click the **Assign** button.

3. The utility assigns a temporary IP address, and displays a message asking if you want to further configure the BPU. Note the temporary IP address and make the following choices:

**Yes** This launches your web browser and connects you to the BL Home Page, allowing you to assign a permanent IP address and to further configure the BPU. You must also disable DHCP to set a permanent IP address and save the settings.

**No** This quits the utility. You will need to assign a permanent IP address, disable DHCP and save the settings from a PC running a web browser before powering off the BPU.

For information on how to use the console port to configure the BridgeLINK-Pro, see *Managing the BridgeLINK Locally* in the *BridgeLINK-Pro Administration and Management Guide* on the RadioLAN website for more information.

Installing the first physical BL-Pro unit

To maintain a very high quality link, it is important to have a line-of-sight between the BLs, and make sure they are within the specified range. Check to make sure that there will not be any objects such as buildings or trees blocking the line-of-sight between the two BLs.

### A Brief Word About Safety

If you chose to mount the antenna high up on a wall, make sure to use the appropriate type of ladder. Follow ladder safety tips provided by the manufacturer. RMG recommends that you have a partner available to secure the ladder and to offer assistance. RMG recommends that you not mount the unit during stormy weather, on windy days, or anywhere near electrical cables.

### What you will need

(2) RJ-45 Ethernet Jumper Cables
A mounting structure for each side.

### Mounting Structures

The BridgeLINK-Pro's BPU and its associated antenna may be mounted on the antenna mast just below the antenna, or on a standard 2"-3" water pipe found on the sides of buildings.  Visually inspect the building on which you are installing the BridgeLINK-Pro to see if a water pipe is available.  If not, we recommend using the *Wall Mount Arm* pictured here.  The Wall Mount arm is easily attached to the outer structure with lag bolts and provides a great degree of flexibility in installing the BPU.



**Wall Mount Arm**

Often, it is best to mount on a tower to maximize range and overcome obstructions.  Whether you choose a simple pole-stand held by cinderblocks to the roof or a hundred-foot tall radio tower, you will require a pole or bar that is 2"-4" in diameter.

### Choosing the Best Mounting Height

The appropriate mounting height for the BPU will depend on A) the cable distance needed between the PoE injector and the BPU, B) the level of accessibility for routing cable and mounting the BPU, and C), the existence of a line-of-sight to the other side.

Greater distances increase probability for line-of-sight blockages: As the distance between buildings increases, there is a greater likelihood of objects blocking the line-of-sight between BL sites. When planning applications with greater distances, avoid problems caused by new construction or tree growth by placing the antenna higher. This decreases the likelihood for line-of-sight blockages over time but increases the length of Ethernet cable required.

If the structure has an eave, RMG recommends that you not place the BPU so high into the eave that the roof blocks a line-of-sight view to the distant BridgeLINK-Pro™. Before securing the BPU to its mounting structure, verify that you can see the distant BPU and that the line-of-sight is clear of all obstructions.

### Cabling

The BL-Pro comes with 50 feet of pre-installed Ethernet Cabling. This cabling is connected to the PoE injector. Other lengths are available upon request.

### Grounding Considerations

RMG recommends proper grounding of the BridgeLINK-Pro as described in mounting hardware installation instructions and as required by local ordinance. Connect any metallic mounts supporting the BPU to a ground rod driven a minimum of 10 feet into the soil. Make sure the BPU is at least 6 feet below the top of the mast. For more information, follow Section 810 of the National Electrical Code. Use UL-listed ground clamps and lugs.

### Securing the Unit (Wind loading)

Wind can cause an antenna to come out of alignment and degrade the data link. This will show up as intermittent or degraded performance or even as no link at all. While the shape of the BPU will minimize wind load, it is important to securely install the BPU and fasten it tightly.

Installing the BPU

### Tools You Will Need

Crescent Wrench, Screwdriver, screws, pencil, and measuring tape.

For a Wall Mount:  Drill with drill bits, Screwdriver, screws, pencil, and measuring tape.

To align the antenna properly, you may wish to have:

Crescent wrench, a carpenter's square, and a helper.

If your application requires that the buildings are nearly one mile apart, it may be difficult to visually resolve the distant BL antenna.  In these cases you may need a compass, GPS, local maps, or other direction calibration equipment.

### Mounting the BPU

The BridgeLINK-Pro comes with mounting hardware to attach the BPU to the mounting pole. Begin by inserting the four bolts into the inner holes on the plate. With the bolts' long ends facing away from the board, lay the plate on top of the enclosure. Now, screw the screws into the four holes on the outer corners of the plate, locking the plate in place on the enclosure. Finally, slide the C-clamp onto the bolts around the pole, and screw the 51/4" nuts onto each bolt to secure the C-clamp to the pole.
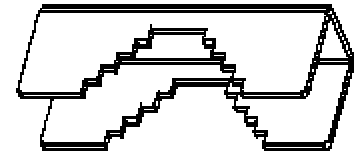


**C clamp**

<u>Installing the PoE Adapters</u>

***Important Overview:*** You should connect up the PoE Adapter in the following sequence in order to avoid any damage to your Ethernet Equipment.

1.  Attach the RJ-45 connector from the BPU

2.  Attach the Power Adapter

3.  Verify the BPU is powered by visually checking that the external LED is illuminated.

4.  Only after confirming step 3 above, attach the RJ-45 jumper cable between the PoE adapter and the Ethernet Equipment.

Before selecting an electrical outlet for use in powering the BridgeLINK-Pro, verify that the electrical outlet is non-switched (for example, it is not attached to a wall switch).

### BPU Ethernet Port Jack

One 10BaseT port on the PoE Adapter allows a connection to the BPU. This port is labeled ***BPU Ethernet Port*** and ***MUST NOT BE CONNECTED TO ANY OTHER ETHERNET DEVICE***. The power that this port supplies drives the BPU but will damage customer Ethernet Equipment. Therefore, it is always recommended that the BPU Ethernet Port is connected first and that the BPU powered "on" before connecting to the Ethernet Equipment.

**Apply Power to the BPU**

Connect the Power Adapter to the PoE Adapter and the electrical wall outlet.  If the BPU is properly powered, the external LED will illuminate green, and the LED on the Ethernet jack will illuminate as well. Once the connection to the distant BL-PRO is made, the external LED will flash orange.

**10BaseT Ethernet Port Jack**

The 10BaseT port on the PoE Adapter interfaces the BridgeLINK-Pro to the Local Area Network (LAN). The 10BaseT port is RJ45-compatible, which allows an eight-wire connection to a network hub or other hard-wired external device.  You may use a straight-through or cross over cable – the BPU will automatically adjust to either type of cable.

**Attaching to the Network**

When connecting the PoE Adapter to the network hub or PC, use a RJ45-compatible modular cable. The cable is an eight-wire, twisted-pair cable and should not exceed the distance limits provided by the 802.3 standard.   After routing the cable, insert the modular connector into the port on the PoE Adapter.
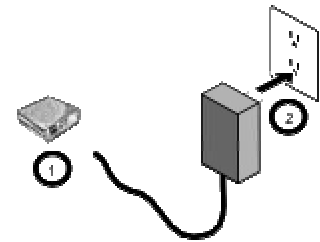


**Power Connection Sequence**

Install the second physical BL-Pro unit

After verifying that the first unit is powered, you should begin the installation of the second unit using the exact same steps listed above. Once complete, you should do a fine aiming to maximize the performance and minimize error rate on the new link.



### Fine Aiming

Use the System configuration - ANTENNA AIMING page to help you aim the antenna and maximize signal quality.  This page should be accessed via your web browser by entering the IP address of the BridgeLINK-Pro unit in the browser's *Address* bar.  See the *BridgeLINK-Pro Administration and Management Guide* on the RadioLAN website for more information.

**Antenna Aiming Page**

### Selecting the Distant BL-PRO's Address

The ANTENNA AIMING page allows you to select the remote BPU's Radio port name or explicit MAC address. If you place a check in the Explicit Address check box, the BPU Name drop-down list box changes to a field to enter a MAC address for the target BPU's radio port.  If you don't immediately see the distant BPU, or you are using the Serial port to run this program, use the Explicit Address.

<u>Test the link</u>

Select the desired frame size that you want to use for testing purposes. Similar to a PING, adjusting the frame size can vary test results. Enter your selection in the Frame Size field.

The Estimated Distance list allows you to choose the distance between links. Set this value on both sides of the link. Click a value in the list to make your selection, and save the entries on the page by clicking the Save Distance Parameter button. This change is stored immediately, and you do not have to save changes and reset. Using the console port, you must save changes on the Configuration Changes menu.

**Starting and Stopping the Test**

Begin and end the testing at any time by clicking on the Start or Stop button. Once you have started the test, the results are shown in the Successful % field. A good link should be 98% or better. The best and worst-case scenarios appear in the Best and Worst fields.

This page also features audio output of the Successful % field when you place a check mark in the Sound check box. With the Audio feature enabled, a Professional Installer can use two walkie-talkies or a cellular phone to adjust the antenna orientation without additional personnel.

### Test the Network

The final step is to ping a known address on one side of the bridge from a station on the other side using the Windows "Ping" utility. If the ping is done successfully, you have properly installed the BridgeLINK-Pro. It should provide you with years of trouble-free service.

### You're done!

Now that you have set up the BL-PRO, reference the user's manual for additional information on managing the system!

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