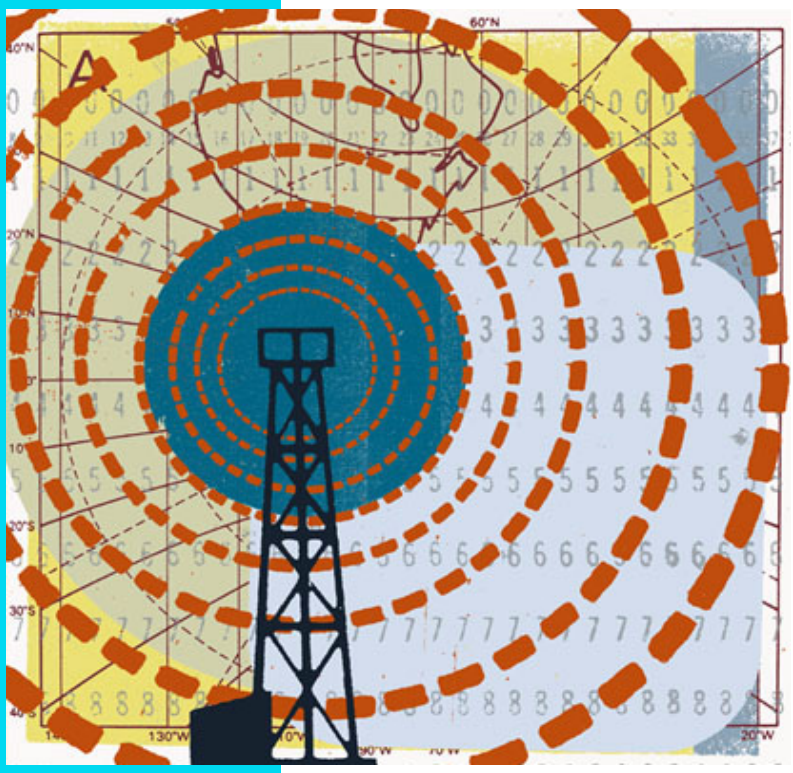
SecureMesh Connector Installation
CONN-1000



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About This Guide

This guide explains how to install and set up a Trilliant™ SecureMesh Connector™ to provide wireless network access to users of a Trilliant wireless mesh network. It assumes administrator-level knowledge of IP networks and a familiarity with configuring wireless devices.

Chapter Highlights

- Audience and purpose
- How this guide is organized
- Conventions used in this guide

Audience and Purpose

This guide provides directions for installing and setting up a Trilliant SecureMesh Connector device that can provide access to users of a Trilliant wireless mesh network.

This guide assumes administrator-level knowledge of IP networks and a familiarity with configuring wireless devices.

How This Guide Is Organized

This guide is organized as follows:

- Chapter 1, “Introduction,” provides an overview of the Trilliant solution, describes the Trilliant devices, and then illustrates how they combine to form a mesh network.
- Chapter 2, “Your SecureMesh Connector Kit,” provides the information you need before you begin your installation.
- Chapter 3, “Installing a SecureMesh Connector,” provides instructions for the physical installation of the SecureMesh Connector as well as background information about configuration and references to associated procedures.
- Appendix A, “Grounding Guidelines,” provides direction on protecting your Trilliant device with proper grounding and surge protection.
- Appendix B, “FCC Statements,” provides the FCC radio frequency interference statements for the SecureMesh Connector

Conventions Used in This Guide

This section describes the text and syntax conventions used throughout this guide.

Text Conventions

This guide uses the following text conventions:

- *Italic* is used to introduce new terms.
- **Bold** is used to indicate what you click or type in a graphical user interface (for example, commands names or text being entered). In examples showing user interaction with the command-line interface, bold is used to indicate user input as opposed to command output.
- A `monospace` font is used for code elements (variable names, data values, function names, and so forth), command lines, scripts, and source code listings.
- *`Italic-monospace`* is used for replaceable elements and placeholders within code listings.

Syntax Conventions

This guide uses the following conventions when showing syntax:

- Angle brackets, "<"and ">", enclose mandatory elements. You must enter these elements. For example:
  `ping <IP-address>`
- Square brackets, "["and "]", enclose optional elements. You can omit these elements. For example:
  `show filter [filter-table-number]`
  Square brackets are also used to show the current value of parameters in the output of some commands.
- A vertical bar, "|", separates choices. For example:
  `show bridge [cache | port]`

1

Introduction

This chapter provides an overview of the Trilliant solution, describes the Trilliant devices, and then illustrates how they combine to form a mesh network.

Chapter Highlights

- Solution overview
- Mesh network
- SecureMesh Gateway
- SecureMesh Extender devices
- SecureMesh Connector

Solution Overview

Trilliant delivers a wireless, end-to-end broadband solution that seamlessly supports high-capacity, high-coverage mesh networks. Designed for managed-access networks and service providers, the Trilliant network takes broadband wireless the “last mile” with a cost-effective, robust infrastructure solution.

Based on a high-performance architecture that deploys intelligent antenna arrays, the Trilliant network delivers a dynamic broadband solution with significant advantages for business and home users.

Trilliant wireless devices are simple to install and easily fit into any type of wireless environment—metropolitan, business, or home.

The auto-discovery and rapid provisioning features of a Trilliant wireless mesh network can greatly reduce deployment and maintenance costs. Multiple topology options and network scalability create intriguing options for rapidly expanding a metro Wi-Fi customer base.

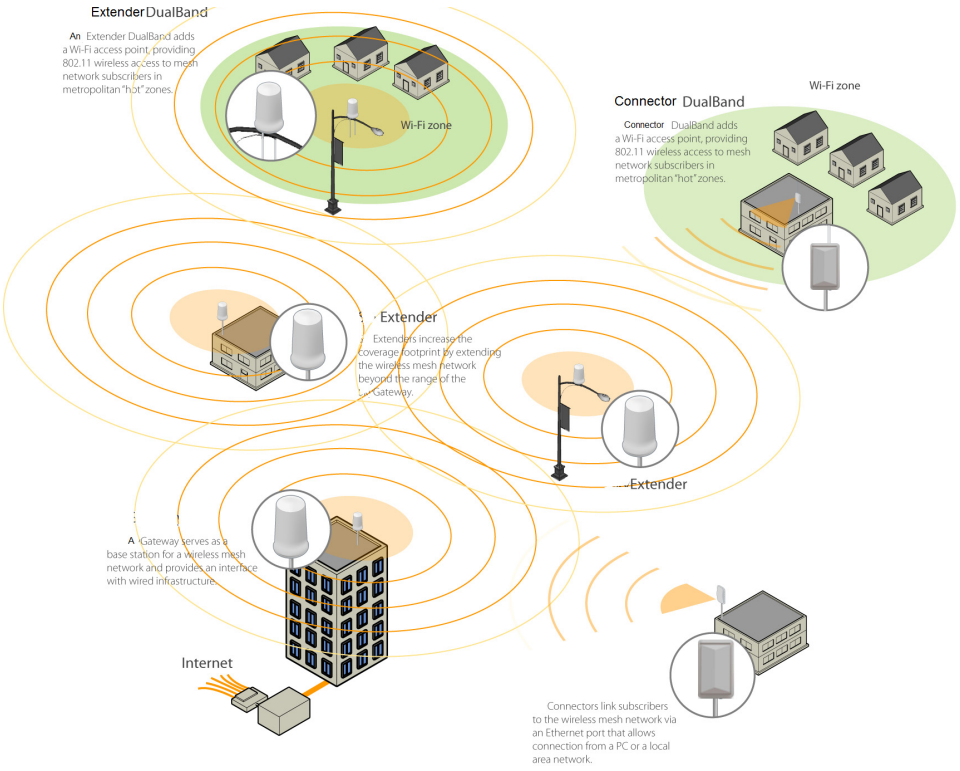
Trilliant devices’ multiple antenna configurations work within mixed-use environments of municipal applications and broadband Internet access, supporting public-private partnerships such as public safety services.

Mesh Network

The typical configuration for a Trilliant network is a mesh topology, which uses SecureMesh Extenders to extend range and add network flexibility. In a mesh configuration, subscribers can either connect directly to the SecureMesh Gateway or connect indirectly via SecureMesh Extenders (see Figure 1-1). In addition to adding range, a mesh network allows connections from locations where obstructions prevent line-of-sight access to a SecureMesh Gateway hub.

Mesh networks are ideal for dense subscriber environments, for filling in coverage “holes,” and for reaching subscribers in areas where RF communication is obstructed by hills, trees, buildings, or other obstacles.

Figure 1-1. Trilliant wireless mesh network



SecureMesh Gateway

The SecureMesh Gateway operates as a base station for a wireless mesh network. It provides an interface between wired infrastructure and a wireless network of subscribers who enjoy secure, high-speed access to the Internet or to wide area networks.

A Trilliant wireless network requires at least one SecureMesh Gateway for operation. If necessary, you can add additional SecureMesh Gateways to increase network capacity or provide redundancy.

The SecureMesh Gateway typically resides at a location with easy access to wired infrastructure—usually a POP (point of presence) or data center.

For optimal performance, install the SecureMesh Gateway on an elevated site such as a cell tower or the top of a tall building.

SecureMesh Extender Devices

SecureMesh Extenders, SecureMesh Extender DualBand provide a cost-effective way to add capacity and balance network loads by operating as “repeaters” to extend the wireless range of a SecureMesh Gateway (see Figure 1-1). You can add any SecureMesh Extender device to your network to expand your coverage footprint and provide redundancy through Trilliant’s mesh networking features. SecureMesh Extender devices (except DualBands) can provide subscribers with a direct connection to the wireless network via the device’s Ethernet port.

SecureMesh Extender DualBand is a dual-radio solution that combines Trilliant’s long-range, high-capacity 5 GHz mesh backhaul with a high-powered 2.4 GHz 802.11b/g access point that allows service providers and municipalities to offer standard Wi-Fi services over great distances—for targeted hot zones or dense, ubiquitous coverage patterns.

For optimal performance, install the SecureMesh Extender in an elevated location such as a roof, tower, or utility pole.

SecureMesh Connector and SecureMesh Connector DualBand

SecureMesh Connectors link your subscribers to the Trilliant wireless network. An Ethernet port on the device allows a connection to a subscriber's computer, or to a local area network (LAN) via a data switch or router. Designed for installation by the service provider, the SecureMesh Connector attaches to an external structure such as an eave, roof, or pole.

The SecureMesh Connector DualBand offers the same features as a SecureMesh Connector, plus a Wi-Fi access point that enables service providers and municipalities to provide standard 802.11 wireless access over great distances, for targeted hot zones, or for dense coverage patterns.

2

Your SecureMesh Connector Kit

Your Trilliant SecureMesh Connector installation kit provides the basic equipment you need to install the device and configure it for operation on a Trilliant wireless mesh network. This chapter describes that equipment and lists additional items you should have on hand before starting installation.

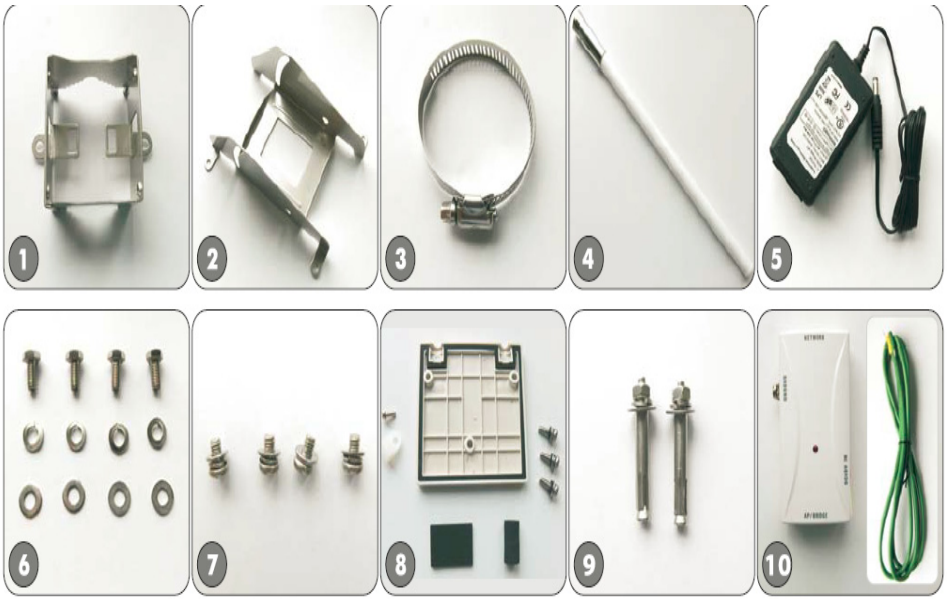
Chapter Highlights

- Kit contents
- What else you need

Kit Contents

Figure 2-1 shows the contents of the SecureMesh Connector installation kit.

Figure 2-1. Trilliant installation kit



Trilliant separately offers accessories for different types of installation, including a surge suppressor and a tilt mount kit. For more information, visit the Trilliant website at www.Trilliant.com/support/.

What Else You Need

Before starting installation, you also need the following:

- For basic mounting:
  - Phillips screwdriver
- For pole mounting:
  - Magnetic level
  - Steel pole between 1 1/8” (2.87 cm) and 1 3/8” (3.48 cm) in diameter

- For network cabling:
  - Spool of CAT-5 network cable (shielded cable is recommended)

    IMPORTANT Ethernet cabling must comply with NEC/CEC requirements for CAT-5 cables. The cabling's outer jacket must be clearly marked as CAT-5e per ANSI/TIA/EIA-568-B.2.

  - Crossover cable (for connecting to a an access point, switch, or router)
  - RJ-45 connectors (connectors without a protective "boot" are recommended)
  - RJ-45 crimping tool
- For configuration:
  - Computer with a serial port, a terminal emulation program, a network interface card, and a Web browser (laptop recommended for convenience)

3

Installing a SecureMesh Connector

This chapter provides instructions for planning and performing the physical installation of a SecureMesh Connector.

Chapter Highlights

- Planning your installation
- Cabling
- Powering up the SecureMesh Connector
- Optimizing location
- Monitoring SecureMesh Connector status
- Mounting
- Configuring the SecureMesh Connector
- Accessing the command-line interface
- Troubleshooting

Planning Your Installation

In a typical wide area wireless mesh network, you'll install a SecureMesh Connector on a utility pole or the roof of a building. The effective range of a SecureMesh Connector is usually proportional to the height of the installation.

When choosing a site for a SecureMesh Connector, consider the radio frequency (RF) environment and the physical layout of the area.

Trees, buildings, and hills can attenuate or block a wireless signal. When assessing a site, examine the overall topology of the wireless path for possible obstructions—both existing and planned—as well as seasonal changes of foliage and tree growth. The RF environment is dynamic, and can deteriorate over time as structures appear or are relocated.

Plan to use test signals to determine the suitability of the link topology for target applications. Interference on your desired frequency results in overlapping signals, causing outages or intermittent drops in throughput.

Once you've identified a potential site, use a topographic map or path profile software to ensure that terrain or obstacles will not interfere with the links.

Your site survey should include an RF scan to identify available frequencies. You should also check your preferred frequency at all locations. A frequency that's clear at one location may be crowded at another. Frequency planning is a critical factor in planning and implementing a wireless network. (For device operating frequencies, see Appendix C, "Specifications.")

The site survey process should be ongoing. To verify that a site is relatively free of interference, make site audits every six to twelve months, scheduling regular maintenance visits to coincide with the site audits.

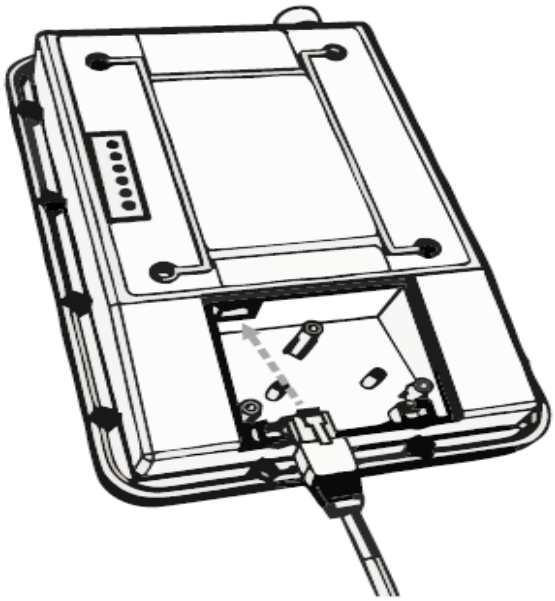
IMPORTANT Plan to configure the SecureMesh Connector before mounting it. Some steps, such as those requiring serial console access, are easier if the device is more accessible. For information about configuration, see "Configuring the SecureMesh Connector" on page 20.

Cabling

Ethernet cabling provides power and data connectivity for the SecureMesh Connector. This section provides instructions for attaching CAT5 cable to the device.

To install CAT-5 cabling:

Figure 3-1. Connecting CAT-5 cable to the SecureMesh Connector

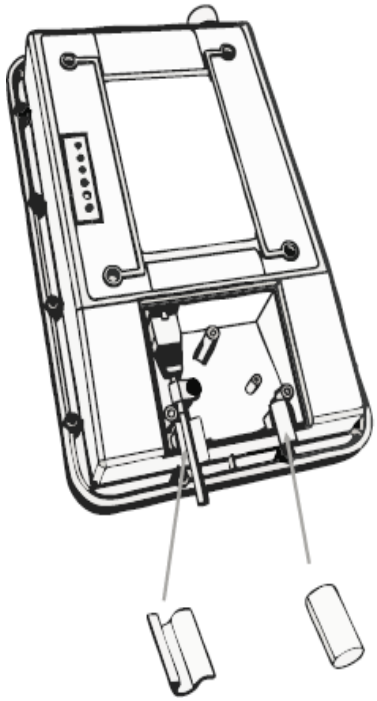


1 Terminate the appropriate grade and length of CAT-5 cable with an RJ-45 connector, and plug it into the RJ-45 port on the back of the SecureMesh Connector.

2 Make sure the fit is snug

Securing cable placement

Figure 3-2. Securing the CAT-5 cable to the SecureMesh Connector



1 Fit the CAT-5 cable in between the guide posts to fit in place

2 Use a screw to tighten the cable guide to secure the CAT-5 cable in place

Figure 3-3. Attaching weather gasket and metal cover

1 Tighten the cover with three screws

Powering Up the SecureMesh Connector

Before mounting the SecureMesh Connector, first power on the unit so you can use the status LEDs to determine optimal location placement.

To power on the SecureMesh Connector:

1 Attach the power supply.

   a Connect the AC power cord to the AC adapter, and plug it into an AC outlet.

   b Connect the Ethernet cable to the port labeled “CPE” on the power injector.

IMPORTANT Be careful not to plug the Ethernet cable connected to the SecureMesh Connector into the port labeled "Computer."

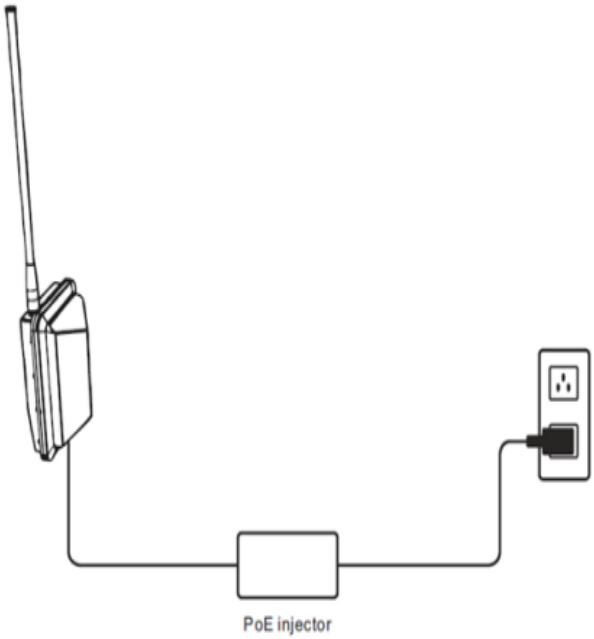
c Plug the AC adapter into the power injector.

d Ground the PoE injector

2 Check the LEDs on the SecureMesh Connector.

If the connections are correct, the SecureMesh Connector's power LED (labeled "PWR") should illuminate and the WAN activity LED (labeled "WAN Act") should blink on and off. (For details about the LED status lights, see Table 3-1 on page 18.)

Figure 3-4. Checking the SecureMesh Connector LEDs



Optimizing Location

After powering up the SecureMesh Connector, use the device's LEDs to identify the optimal location for mounting. (For details about the LED status lights, see Table 3-1 on page 18.)

To optimize a SecureMesh Connector's location:

1 Confirm signal acquisition.

a Position the SecureMesh Connector near the intended mounting location and watch the "WAN Act" LED for activity. The LED starts blinking when it acquires a signal from the network and is attempting to make a connection.

If the LED doesn't start blinking within 30 seconds, try changing the orientation of the SecureMesh Connector or walk to a new location. Repeat the process until the LED starts blinking.

b When the LED starts blinking, make minor adjustments to find the location where the signal is strongest. (The faster the LED blinks, the stronger the signal.)

When the LED blinks steadily at a high rate, you have an optimal signal.

2 Verify network connection.

Watch the "WLAN Link" LED for activity. Within 90 seconds of locating a signal, the LED should start to blink—first slowly, then more quickly, and finally it should remain steadily lit.

When the "WAN Link" LED is steadily lit and the "WAN Act" LED is blinking, SecureMesh Connector has established an authorized connection to the network, indicating that the current location is suitable for mounting.

If both the "WAN Link" LED and the "WAN Act" LED continue blinking, a signal is available but isn't strong enough for reliable service. Keep trying different locations until you can confirm a network connection.

NOTE To optimize your SecureMesh Connector installation, ask your network administrator (at the Network Operations Center) to measure signal strength on the node to which SecureMesh Connector has established a link.

Monitoring SecureMesh Connector Status

Table 3-1 provides detailed descriptions of SecureMesh Connector states indicated by the LED lights. When both LED lights are lit and steady, the SecureMesh Connector is successfully connected to the wireless network.

Table 3-1. SecureMesh Connector LED Status Lights

LED	LED state	Device state
LAN Link	Steady illumination	SecureMesh Connector is connected to another device via its Ethernet port.
LAN Act	Blinking	SecureMesh Connector is transmitting or receiving data via its Ethernet port.
PWR	Steady illumination	SecureMesh Connector is powered up.
WAN Link	Blinking (fast blink when SecureMesh Connector is in standby mode)	SecureMesh Connector is attempting to establish an authorized connection on the wireless network. If both WAN Link and WAN Act continue blinking, either the signal isn't strong enough to support reliable service or there's a provisioning problem that's preventing SecureMesh Connector from coming online. Contact your network administrator for assistance.
	Steady illumination	SecureMesh Connector is connected to the wireless network.
WAN Act	None	Device cannot detect a wireless network.
	Blinking	Device is within the coverage area of a wireless network. Blink rate communicates signal strength: • Fast (8x/second) = excellent • Medium (4x/second) = good • Slow (<1x/second) = poor • None = no reception

Mounting

After determining an optimal location for your SecureMesh Connector, you can mount the device and run the appropriate cables.

To mount the SecureMesh Connector:

1. Disconnect the CAT-5 cable from the power injector.

2. Power down the SecureMesh Connector.

3. Attach a magnetic level to the 1 1/8" (2.87 cm) and 1 3/8" (3.48 cm) diameter steel mounting pole to verify that the pole is plumb (straight).

   IMPORTANT It is the installer's responsibility to verify that the support pole and its installation method are of sufficient strength to withstand onsite weather conditions. (The supplied mounting bracket and screws are certified to withstand a 125 mph wind force.)

4. Use the provided clamps and screws (provided in the accessory kit) to attach the SecureMesh Connector to the mounting pole (see Figure 3-5).

   Before clamping down the bracket, check that the mounting pole is still plumb and that the SecureMesh Connector is level.

   NOTE If the device is not level, performance may be degraded.

Figure 3-5. Attaching the SecureMesh Connector

5 Reconnect the CAT-5 cable to the port labeled “CPE” on the SecureMesh Connector power injector.

Configuring the SecureMesh Connector

To operate on the wireless mesh network, the SecureMesh Gateway requires a network configuration.

A SecureMesh Connector will not transmit a wireless signal until it’s configured, and it will not be able to connect to other network devices without a configuration.

Trilliant offers two modes for provisioning devices with a configuration:

- **Automatic**—Requires the use of Trilliant EMS software to create configurations that an unattended central server can distribute to devices on the wireless mesh network. Although automatic provisioning requires more setup time than manual provisioning, it greatly simplifies the administration of a growing network.
- **Manual**—Usually performed in the field, manual provisioning permits the configuration of a single device at a time, creating the minimum settings required for a wireless link and storing them in the device’s flash (nonvolatile)

memory. Manual provisioning is a logical choice if you're installing a test network or rolling out a small-scale installation that isn't expected to expand.

For more information about provisioning modes and procedures, refer to *Getting Started with the SecureMesh Network* and *SecureMesh Network Administration*, available from the Trilliant website at www.Trilliant.com/support/.

Accessing the Command-Line Interface

Trilliant devices include a command-line interface which you can use for manual provisioning and troubleshooting.

You can connect to a device and access its command-line interface through Telnet over an Ethernet connection or via a terminal session from a console connected to the device's RJ-45 serial port. After logging in (by supplying a password), you can enter commands at the command prompt.

For detailed cabling and access instructions for the command-line interface, refer to the *SecureMesh Command-Line Interface Reference*.

Troubleshooting

After making an Ethernet or serial connection to the SecureMesh Connector, you can manage and troubleshoot the device using a wide range of commands available through the command-line interface.

For detailed troubleshooting procedures, refer to the "Troubleshooting" section in *SecureMesh Network Administration*. There you'll find troubleshooting procedures for:

- Power-on problems
- Ethernet connectivity problems
- IP connectivity problems
- SecureMesh Gateway transmission problems
- Link failure problems

A

Grounding Guidelines

This appendix provides some guidelines for properly grounding the Trilliant Connector.

Proper grounding protects both your Trilliant device and equipment connected to it. For the surge protection circuitry built into the Trilliant equipment to be effective, proper grounding of the unit is necessary. This is especially true if you're installing devices on tall structures, or in areas subject to lightning.

NOTE The techniques described in this appendix are intended as general guidelines only and do not constitute a comprehensive guide covering all installation scenarios. For maximum protection, contact a qualified installation specialist who is familiar with your operating environments. If lightning is a threat in your area, consider a consultation with a lightning and transient protection specialist.

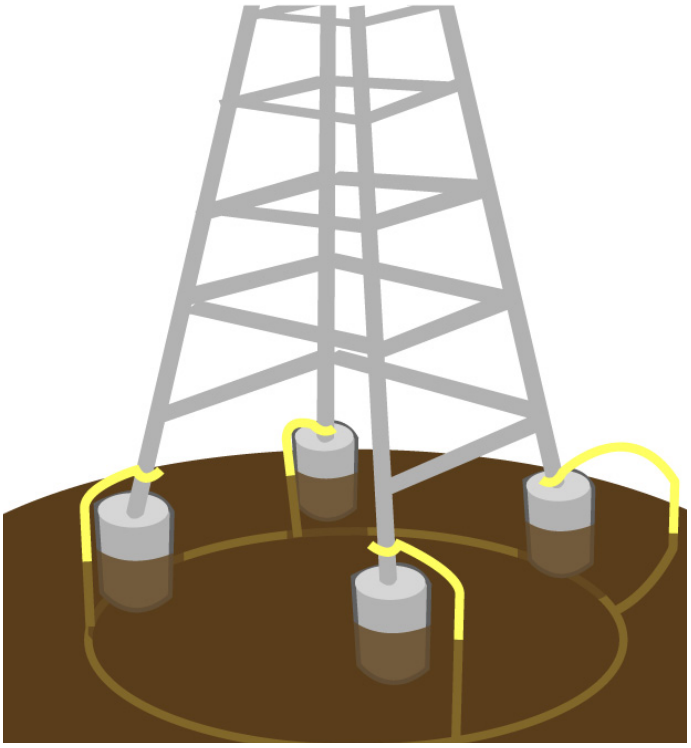
General Grounding Strategy

To ensure optimal reliability, properly ground the metal base of the Trilliant device. The most efficient way to ground the device is to use an 8 GA or larger wire to connect it to a ground point on the structure or tower.

The three most common ground points are:

- A cold-water pipe. Make sure it is well connected to earth.
- The primary grounding point of the AC electrical system of the building.
- A 10-foot or longer copper-clad ground rod driven into the earth. For a tower with multiple legs, you need one ground rod per leg and a ground wire loop connecting each of the rods; see Figure 12.

Figure 12. Ground wire loop



Making Connections "Gas-Tight"

Regardless of the grounding point you use, make sure the connections are "gas-tight"—capable of retaining low resistance and integrity over time and with exposure to the elements.

Use of an antioxide compound and proper sealing is essential. For protection against corrosion, wrap all connections with Scotch® 130C tape.

Checking Cold-Water Pipe Integrity

If you're using a cold-water pipe for grounding, verify the integrity of the ground. In some cases, sections of metal cold-water pipes may have been repaired or extended with PVC material. PVC material or a dielectric union will render a cold-water pipe ground unacceptable for grounding.

Measuring Resistance

Verify that there is no more than 5 ohms of resistance between any two ground points in the entire system. Also make sure that all ground points on a structure are tied together. For example, if you use a ground rod and a cold-water pipe as grounding points at different locations on the same structure, you must tie them together.

Adding Surge Protection

If you're installing a Trilliant device in an area that's subject to lightning storms, Trilliant recommends installing a surge protection device (SPD) at both ends of the Ethernet cable—one at the Trilliant device and one at the point of entry to a building or enclosure.

Trilliant offers SPDs with bracket and cabling designed for use with Trilliant equipment. For more information, visit Trilliant customer support at www.Trilliant.com/support/ to view accessory guides for Trilliant-branded surge protection solution. (You may also purchase SPDs from third-party vendors.)

Grounding Checklist

When grounding a Trilliant device, use the following checklist to confirm that your installation is adequately protected from power surges and lightning.

- Connect a ground wire from the Trilliant device to a ground system on the building or tower.
- Use shielded CAT5 cabling and connect the drain wire of the shield to ground at the Trilliant device. (Leave the other end of the drain wire unconnected.)
- Use the proper size down lead to connect a Trilliant device on a roof or tower to the ground system of indoor equipment.
- Verify that all points of the ground system are tied together with less than 5 ohms resistance between any two points.

- Run the CAT5 cable inside the tower structure, tying the cable to the tower leg at every 4 feet of length. For increased protection, run the CAT5 cable through metallic conduit installed on the tower.
- Bleed off any static charge by installing a streamer-delaying, static-dissipation array above the Trilliant device.
- Install all lightning and surge protection devices in accordance with UL 96A installation requirements for lightning protection systems and the NFPA 780 standard for lightning protection.