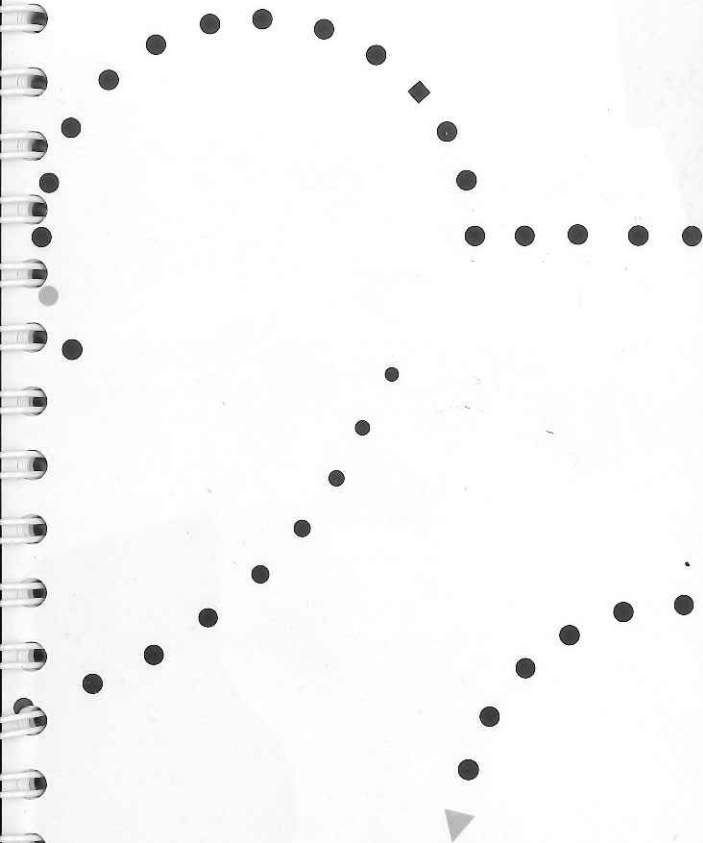


**Farallon™** PhoneNET®  
Connector  
User's Guide





# PhoneNET Connector User's Guide



Farallon Computing, Inc.  
Berkeley, California

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User manual written and formatted by Ron Schmidt. Edited by Barbara Tien. Illustrated by Jan Marti. Art direction by Lisa Cort. Special thanks to Brad Adams, Sam Roberts, Harold Webber and Zig Zichterman.

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## Introduction

The PhoneNET System is a network solution that includes a complete line of hardware and software products to help you build your networks, manage them, and use them to their full potential. PhoneNET Connectors are an important component of the PhoneNET System. Each AppleTalk-compatible device (computer, printer, and so on) on your network requires a PhoneNET Connector.

A basic network is created by interconnecting these PhoneNET Connectors with ordinary telephone cabling. A more complex network may include hundreds of PhoneNET Connectors, miles of telephone cabling, and additional network devices such as PhoneNET StarControllers and PhoneNET Repeaters.

PhoneNET System products are designed to simplify network installation, maintenance and management. The PhoneNET System offers high reliability and maximum flexibility. You can configure devices in a variety of network topologies, including daisy chain and star topologies. You may be able to use existing telephone wiring for your network.

Farallon Computing is committed to providing its customers with reliable products and excellent technical support. Please call Farallon at (415) 849-2331 or write us with any questions, concerns or suggestions.

## About this manual

The *PhoneNET Connector User's Guide* tells you how to design, install and test a network made of PhoneNET System components. This manual is divided into six chapters and includes a glossary and an index.

Chapter 1, "*About Networks*" describes some network terms and four network topologies. Read this chapter if you are new to networking or are designing a network for the first time.

Chapter 2, "*Designing a Network*" provides suggestions for planning a network and outlines some guidelines for each network configuration.

Chapter 3, "*Installing PhoneNET System Cabling*" provides step-by-step installation instructions for each network topology.

Chapter 4, "*Using Existing Wiring*" explains how to install PhoneNET System cabling using existing wiring.

Chapter 5, "*Testing a Network*" tells you how to test network wiring using an ohm meter.

Chapter 6, "*Reference*" includes troubleshooting hints, technical specifications and a recommended reading list.

*Note:* Boldface terms in this manual appear in the glossary.



## Devices compatible with the PhoneNET System

Like Apple's LocalTalk Cable System, the PhoneNET System lets you connect many different AppleTalk-compatible devices. This includes devices that have built-in AppleTalk capability, such as Macintoshes and LaserWriters. This also includes IBM PCs, IBM PC-compatibles, Apple IIs and other types of devices equipped with an AppleTalk interface. Check with Farallon Computing or your dealer for information about connecting UNIX, Q-Bus and Multibus devices to a PhoneNET System.

PhoneNET Connectors are compatible with LocalTalk connector boxes. Both types of connectors can be used together on the same network.

### If you want to get started immediately

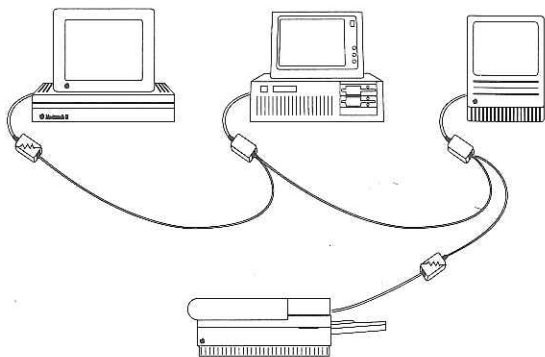
If you are an experienced computer user and would like to set up your network immediately, follow these steps to create a simple daisy chain.

1. Purchase a PhoneNET Connector for each network device. PhoneNET Connectors come in three models, and all three are identical except they contain different plugs. The model you need depends on the device you wish to attach to the network. See "*PhoneNET Connectors*" in Chapter 1 if you don't know which model to purchase.
2. Plug a PhoneNET Connector into the AppleTalk port of each network device. Use the printer port on Macintosh computers.

Link each PhoneNET Connector to the next with modular extension cable. Each PhoneNET Connector comes with a 7-foot modular extension cable.

The RJ11 sockets on the PhoneNET Connector are identical, so it does not matter which socket you use.

4. Insert an RJ11-mounted terminating resistor into the unused socket on the first and last PhoneNET Connectors of the daisy chain. Do *not* create a circle by linking the first and last PhoneNET Connectors together.



*Creating a simple daisy chain.*

5. Power on all the equipment and test your installation by printing a one-page document from each device. If your network includes Macintoshes and one or more LaserWriters, follow these steps from each Macintosh:

- a. Start up from a disk containing the latest System, Finder, LaserWriter and LaserPrep files.
- b. Choose the Chooser desk accessory from the Apple menu.
- c. Select a zone, click on the LaserWriter icon, and select a LaserWriter.
- d. Click on the close box to quit the Chooser and return to the Finder.
- e. Select Print Directory from the File menu in the Finder.

If you have trouble with the network, see "*Installing a daisy chain*" in Chapter 3 for complete installation instructions.

## Chapter 1 – About Networks

This chapter discusses network terms, describes PhoneNET System network topologies, and explains why terminating your network is important.

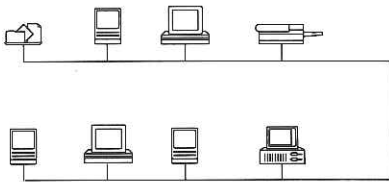
### Network terms

It is important to understand some key network terms before you design and install your network. Refer back to these concepts as you go through the manual.

**Protocols** refer to a set of rules for communicating between devices. Protocols specify how information is addressed, sent, received and read over the network. The **AppleTalk network system** is a set of hardware and software specifications that allow Macintosh computers to communicate with printers, file servers, and other devices over a variety of cabling schemes. PhoneNET System cabling supports AppleTalk protocols at transmission speeds of 230.4 kilobits per second (kbps). PhoneNET System cabling will also support higher speeds of up to 1 Mbps.

Information is sent over a network in organized chunks called **packets**. A packet contains data, the sending address, the receiving address, and other information.

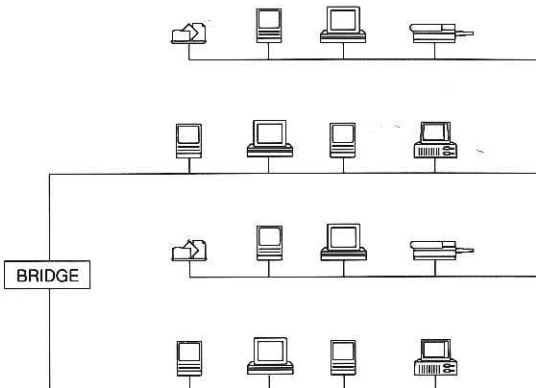
A **network** is a group of interconnected devices that share the same network number. A network often contains all of the devices in a work group, including **network services** (file servers, electronic mail servers and printer servers).



*A network*

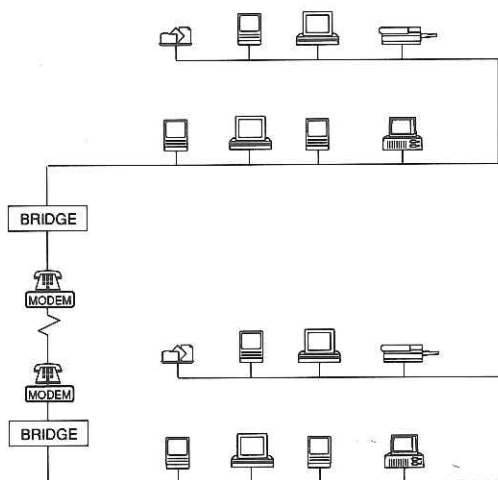
A **bridge** is a device that connects two networks. Bridges can be used to divide an internet into separate, interconnected networks. Bridges are often referred to as routers.

A **local bridge** connects two networks located in close proximity. Local bridges are often used to connect networks on different floors or areas of the same building.



*A local bridge*

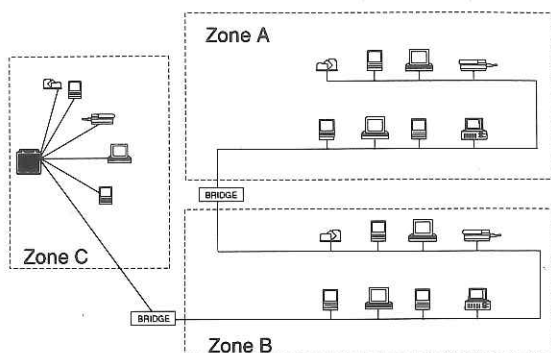
A **remote bridge** connects two networks that are in different geographic areas by modem or satellite link. Because modem throughput speeds (usually 1,200 to 19,200 bps) generally provide a slower throughput rate than on a local area network, a remote bridge with modem links may significantly slow down network signals.



*A remote bridge*

The **internet** refers to a collection of interconnected networks divided by gateways or bridges.

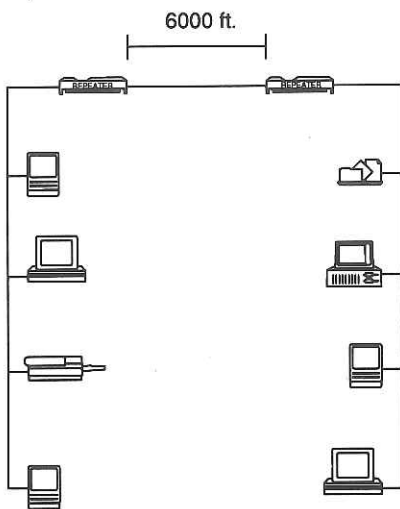
A **zone** is a selected group of networks. Zones help you organize users into logical work groups.



*An internet divided into three zones.*

Zones are defined by bridges and gateways, and can contain a single network or an entire internet. Networks on either side of a bridge can be part of the same zone, or in different zones. Since bridges and gateways are used to isolate traffic, zones typically are used to group together users with shared network services. Users can still access the shared network services of other groups by selecting another zone with the Chooser.

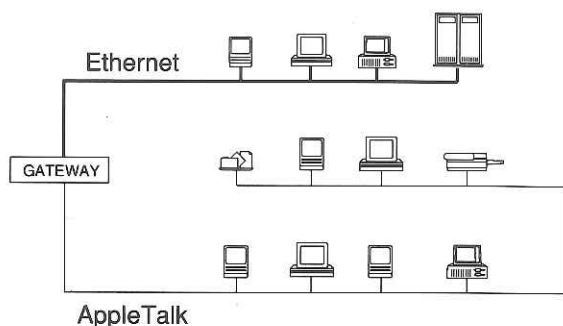
A **repeater** is a device that amplifies a network signal, allowing it to travel through several thousand feet of cable. Network segments on both sides of a repeater share the same network number and zone name. Repeaters have little effect on the speed of the network signal. The **PhoneNET Repeater** amplifies and reclocks a network signal. You can install multiple PhoneNET Repeaters to extend the length of the network to several miles.



*A network with two PhoneNET Repeaters*

A **gateway** connects two or more networks that use different protocols. The Kinetics FastPath, for example, is a gateway that can connect an AppleTalk network with an Ethernet network. Gateways provide the necessary translation between the two network protocols.





*A gateway connecting an Ethernet network to an AppleTalk network.*

## About network addressing

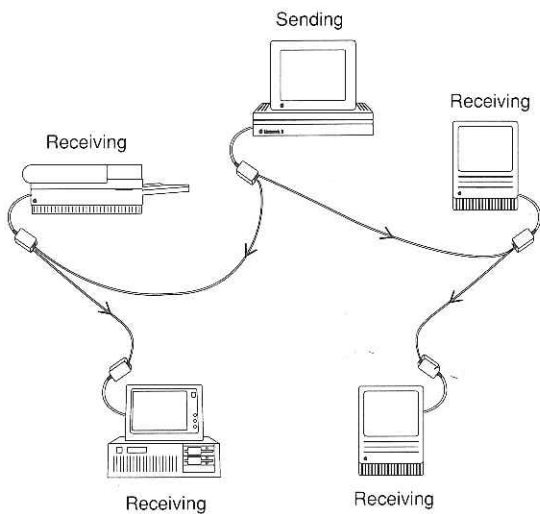
Each network on an internet has a unique **network number**. Some bridges and gateways set unique network numbers automatically, others must be assigned network numbers.

A **node** refers to an addressable device on the network. A node can be a computer, printer, or other device. Every node is automatically assigned a unique **node number** when the device first accesses the AppleTalk network.

A **socket number** is an address within a node. Socket numbers are assigned when a specific network task within a device is initiated. Multiple socket numbers are assigned to the same device if the device performs more than one network task.

Every packet sent on the network includes a detailed network address. Addressing information includes the network number, node number and socket number of the sending and receiving devices. Bridges and gateways keep track of network numbers and route packets to their destination.

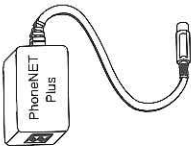
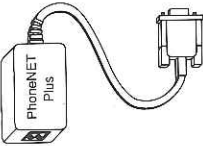
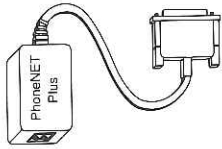
Only one device can send packets at a time. Other devices receive packets and wait until a short interval of no activity lapses before sending packets.






*Only one device can send packets at a time.*

## PhoneNET Connectors

The PhoneNET Connector is the basic hardware unit that attaches a device to the network. PhoneNET Connectors come in three models, and all three are identical except they have different plugs. The model you need depends on the device you wish to attach to the network.

	DIN-8 plug
	DB9 plug
	DB25 plug

*Three models of PhoneNET Connectors*

Device	AppleTalk port socket
Macintosh Plus, SE, II Apple IIGS Apple IIe* ImageWriter II*, LQ* LaserWriter II NT, II NTX Other third-party AppleTalk devices	 DIN-8
Macintosh 128K, 512K, 512Ke LaserWriter, LaserWriter Plus IBM PC, XT, AT, and compatibles* Kinetics FastPath Hayes InterBridge Other third-party AppleTalk devices	 DB9
Lisa/Macintosh XL	 DB25
* with AppleTalk card	

*Select the appropriate PhoneNET Connector for each device.*

## PhoneNET System topologies

PhoneNET Systems can be configured in four basic network topologies: daisy chain, backbone, passive star and active star. A description of each topology along with a sample network diagram follows.

## Important terms

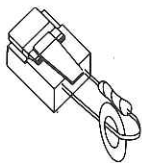
**terminating resistor:** A small electrical component used to properly balance the electrical signal by adding resistance at the end of a length of cable. A terminating resistor is included with each PhoneNET Connector.



*Terminating resistor*

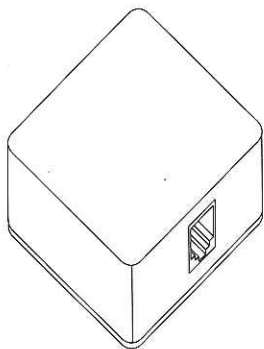
*Note:* You can identify any 120-ohm resistor by its four bands: brown, red, brown and gold.

**RJ11-mounted terminating resistor:** A terminating resistor mounted on an RJ11 plug. An RJ11-mounted terminating resistor is included with each PhoneNET Connector.



*RJ11-mounted terminating resistor*

**wall jack:** A small hardware component used to tap into telephone wall cable. Inside a wall jack are screw terminals for the four telephone wall cable wires. These screw terminals are connected to a female RJ11 socket on the outside of the wall jack.



*Wall jack*

**telephone wall cable:** Ordinary 4-wire, 22- or 24-gauge solid copper wire cable. Telephone wall cable is sometimes called telephone station cable or twisted-pair cable.



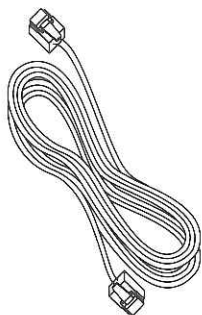
*Telephone wall cable*

**modular extension cable:** Ordinary 4-wire, 26-gauge stranded cable.



*Modular extension cable*

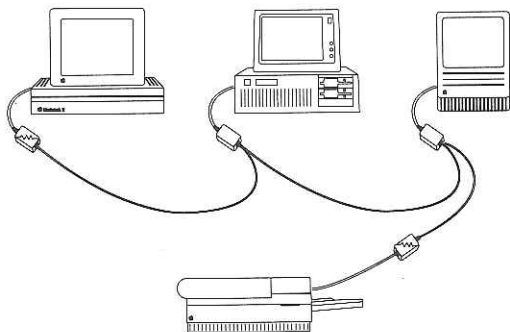
Each PhoneNET Connector comes with a 7-foot modular extension cable with an RJ11 plug mounted at each end.



*7-foot modular extension cable*

### Daisy chain topology

A **daisy chain** is a network topology where multiple devices are linked one to another. In a daisy chain, each device has a PhoneNET Connector and is directly linked to the next with modular extension cable.



*Daisy chain topology*

A daisy chain can be constructed quickly and easily, and is a good choice if you want to connect a few devices that are in the same room. A daisy chain is also useful for temporary installations.

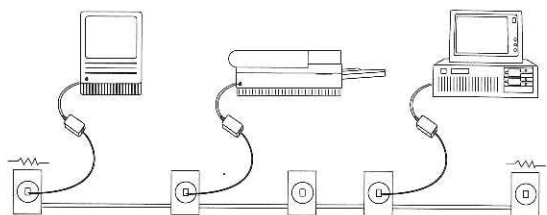
There are a few important limitations to keep in mind when constructing a daisy chain. Modular extension cable isn't twisted and contains relatively thin, stranded wire. A daisy chain contains a separate length of wire and two contact points between each PhoneNET Connector. As a result, a daisy chain should contain no more than 24 PhoneNET Connectors and should be limited to 1800 feet of modular extension cable.

A daisy chain can be broken easily. Removing a PhoneNET Connector from the middle of a daisy chain splits the network into two separate networks. If you would like to create a larger or more permanent network, consider a backbone or star topology.

### **Backbone topology**

A backbone consists of an unbroken length of cable with multiple network connection points. In a backbone many wall jacks are connected to a length of telephone wall cable. Each device has a PhoneNET Connector which is connected to a wall jack with modular extension cable.





*Backbone topology*

A backbone has many advantages over a daisy chain. You can create large, permanent, reliable networks of up to 4500 feet using telephone wall cable. You can plug or unplug a PhoneNET Connector from any wall jack on a backbone without affecting other devices.

You may need to pull new telephone wall cable and wire new wall jacks to install a backbone. A backbone is a good alternative if you plan to run new cabling and don't need the benefits of a star.

### **About star topologies**

A star is a network topology where many network branches are connected at a central location. A star provides the most flexible network topology because the network can easily be reconfigured from a central location. The PhoneNET System supports two similar star topologies: passive star and active star. Each is described in the sections below.

*Note:* Telephones are usually installed in a star. Passive and active stars can often be incorporated into existing telephone wiring. See Chapter 4, "Using Existing Wiring" for more information.

## Important terms

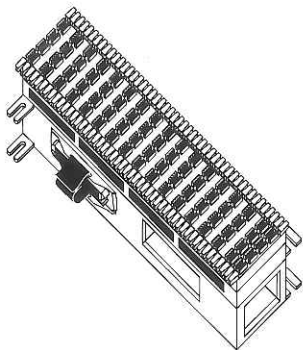
**PhoneNET StarController:** A hardware device that lets you connect large amounts of cabling into one AppleTalk network. A StarController provides branch isolation, error rate reduction, continuous anti-jamming monitoring, and fault isolation.



*PhoneNET StarController*

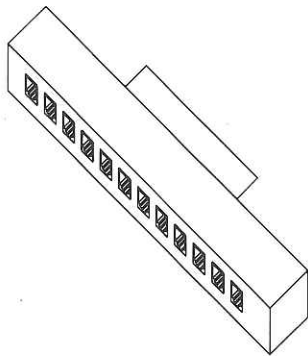
**telephone closet:** A central location where all the telephone wiring is connected. Telephone lines in a telephone closet branch out to individual extensions. The center of a star is usually located in the telephone closet.

**punchdown block:** A wall-mounted telephone wiring distribution block used to connect many pairs of wires. A punchdown block is often used at the center of a star to connect the branches together.

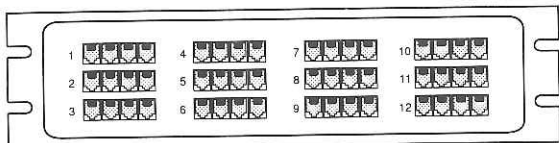


*Punchdown block*

**harmonica block:** A wiring distribution block with 12 RJ11 sockets on it. A harmonica block is used to connect a PhoneNET StarController to 12 network branches that use modular extension cable.

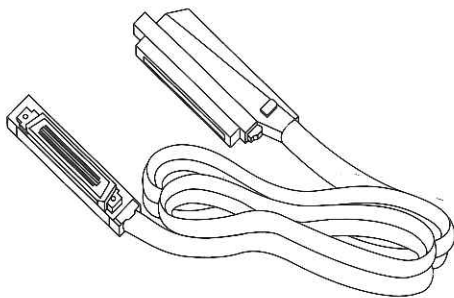


**patch panel:** A wiring distribution block with 12 sets of four RJ11 sockets. A patch panel is used to connect branches that use modular extension cable to a StarController.



*Patch panel*

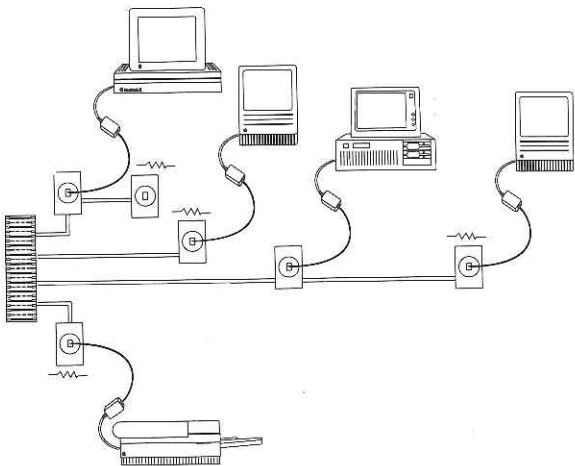
**50-wire Amphenol cable:** A 50-wire cable with Amphenol connectors used to connect a PhoneNET StarController to a punchdown block, harmonica block or patch panel.



*50-wire Amphenol cable*

### **Passive star topology**

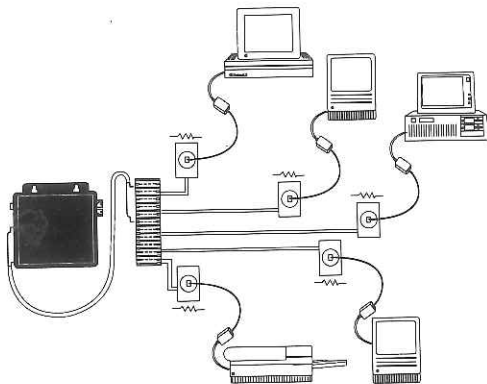
A passive star is a network topology where up to four network branches are connected at one central location. In a passive star each network branch usually contains one or more devices, and all the network branches are connected to a wiring distribution block such as a punchdown block.



*Passive star topology*

### **Active star topology**

An active star consists of multiple network branches connected to a PhoneNET StarController. Often an active star consists of a StarController connected to a punchdown block with network branches radiating to telephone wall jacks.

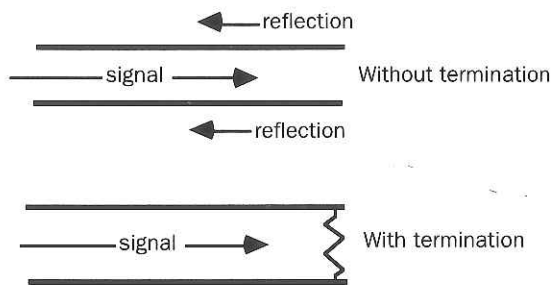


### *Active star topology*


A StarController amplifies the signals between network branches, increases network reliability and increases cabling distances. Each of a StarController's 12 ports can support up to 3000 feet of cabling and up to four network branches. A StarController also comes with software to manage, test and troubleshoot the network.

## About terminating a network

In order to understand why it is important to terminate a network, you first need to understand how data travels across network wires. The data in each packet travels across network wires on electrical impulses. When an electrical impulse reaches the end of a length of cable, the signal can either be absorbed or reflected. A reflected signal can cause errors. Errors make a network appear to be slow, or cause devices to occasionally disappear from the network. A resistor of the correct value placed at the end of a length of cable will absorb the signal and reduce reflections. Because resistors absorb network signals, however, placing too many resistors on a network reduces total network cabling lengths.



*Terminating a network reduces reflections*

Installing a 120-ohm resistor at the end of a length of cable to reduce reflections is called **terminating a network**. A properly terminated network will operate reliably. For convenience, each PhoneNET Connector includes two easily installed 120-ohm terminating resistors. Many of the diagrams in this manual include a resistor symbol (——) to indicate the proper location of terminating resistors on a network. The following table tells you where you need to install terminating resistors.

Topology	Instructions for Terminating the Network
daisy chain	Install an RJ11-mounted terminating resistor in the PhoneNET Connector at each end of the daisy chain.
backbone	Install a terminating resistor inside the wall box at each end of the backbone.
passive and active star	Install a terminating resistor inside the wall box at the end of each network branch.

*Note:* Placing terminating resistors in wall jacks ensures that they are not accidentally removed even if the PhoneNET Connector in the wall box is removed. See "Installing a terminating resistor in a wall jack" in Chapter 3 for details.