PhoneNET®

User's Guide

An AppleTalk Local Area Network

farallon
computing

Congratulations on your purchase of a PhoneNET PLUS connector - Farallon Computing's AppleTalk local area network (LAN) connector System.

We want you to read the manual but...

If you can't wait, here are instructions for constructing a PhoneNET daisy chain:

insert an RJ11-mounted terminating resistor

insert an RJ11-mounted terminating resistor
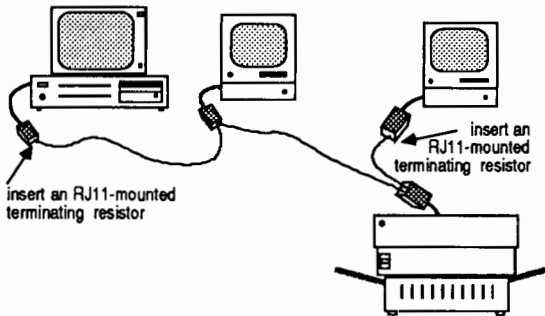
PhoneNET If-you-can't-wait Instructions

"If-you-can't-wait" Instructions

- You need a PhoneNET PLUS connector (Farallon PN208 or PN209) for each device (computer, printer, etc.) you wish to connect. See page 9 to determine the appropriate type of PhoneNET connector for your device.
- Plug a PhoneNET PLUS connector into the AppleTalk port of each device to be networked. Use the printer port on Macintosh computers.
- Link each PhoneNET PLUS connector to the next with and ordinary telephone extension cable. The RJ11 plugs on the connector are identical, so it does not matter which end you use. The sequence of devices does not affect their individual or network performance.
- Insert an RJ11 mounted terminating resistor (Farallon PN104) 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 devices together.
- Before using your network, make sure that you have installed it correctly. Follow the instructions in "Testing Your Installation," page 47, to confirm that your PhoneNET network is functioning.
- *If your installation does not work, please read the manual.*

PhoneNET User's Guide
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Introduction

Farallon Computing offers a comprehensive product line to facilitate the networking needs of businesses, universities, and individuals using AppleTalk local area networks. These products include connectors and wiring distribution systems, fault isolation and network control hardware, and intelligent network management and analysis software.

Farallon Computing is committed to providing its customers with full service and technical support in addition to that provided in the product literature and technical manuals. Please call or write us with any questions, concerns or suggestions.

The PhoneNET User's Guide is your personal assistant for designing and installing your PhoneNET System. This Guide begins with a general introduction to networks, and moves into a description of the PhoneNET System. Next are instructions for constructing an AppleTalk network with PhoneNET products. They begin with the most basic network installation (daisy chain) and progress to more complex installation that require knowledge of telephone wiring. You may wish to have a

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complex network installed by your dealer or a telephone equipment installer.

The PhoneNET User's Guide also contains a Troubleshooting section and a partial list of other products available for use in conjunction with the PhoneNET System.

Please call your local dealer or Farallon Computing at (415) 849-2331 If you have any questions regarding the installation of your PhoneNET System.

About Networks

A local area network (LAN) allows different devices such as computers, printers, and file servers to communicate with each other. This enables several users to share programs and information, and to access common resources such as printers and large storage devices.

Devices must follow rules of conversation, called protocols, in order to communicate with others on the network. There are many different network protocols being used today. For our purposes, we are concerned with Apple Computer's AppleTalk protocol.

The LAN communicates on a physical media layer, in this case, the PhoneNET System. The AppleTalk network functions much like a telephone party-line. With the AppleTalk protocols only one device may speak at a time, and all devices must wait their turn. Information is transmitted along the network in units called packets.

When one device wants to talk to another, it addresses packets to the receiving device(s) and then sends them out to the network through a connector. The packets are transmitted to all the connectors on the network, but packets are accepted only by those devices specifically

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addressed. Each device on a network has a unique address for accurate communications. The AppleTalk software is self-configuring; thus, all addresses are set automatically by each device each time it attaches to the network.
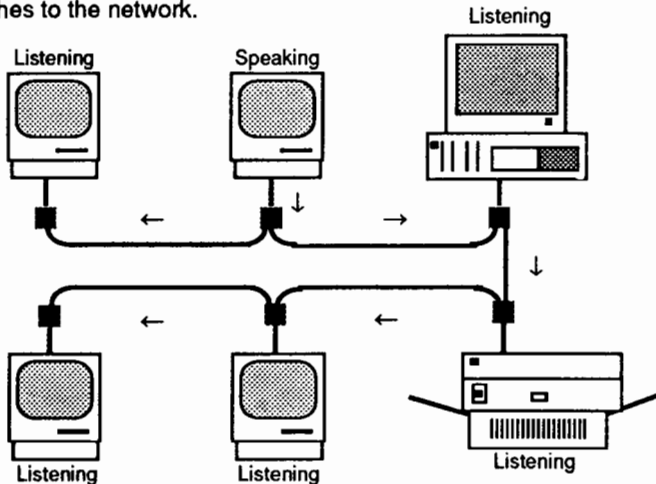
About The PhoneNET System

The PhoneNET System uses the AppleTalk network protocols to communicate over ordinary telephone cables.

The PhoneNET System offers increased reliability, low maintenance, cost effectiveness, extended network distances, and flexibility of network topologies.

A basic PhoneNET System is created by connecting AppleTalk compatible devices with PhoneNET connectors, standard telephone cabling and telephone accessories. One PhoneNET connector is required for each device you wish to attach to the network.

PhoneNET products are designed to simplify network installation, maintenance and management. The PhoneNET connectors and wiring can be installed by the user or by telephone equipment installers. PhoneNET adapts to AT&T telephone wiring schemes so that your network may also be run through the existing telephone wire in your

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building. Most telephone cables have four wires (color-coded black, yellow, green and red). Usually only two of the wires (green, red) are used for telehone communication. PhoneNET can use the other two wires (yellow, black).

In most cases, you should be able to connect to the network at any location where you have a telephone. Because PhoneNET connectors use a unique low-resistance floating-ground parallel circuit (patent pending), a PhoneNET System can run up to 4000 feet through standard telephone wire.

About Network Management and Administration

Generally a PhoneNET System is not difficult to install, maintain and manage. For networks consisting of several devices or multiple locations, we recommend that an individual in your organization serve as the network administrator. Network administration is not necessarily a full-time task unless your network is very extensive. However, centralized responsibility for the network system hardware and software should minimize problems and increase productivity as your network grows.

About PhoneNET PLUS Connectors

The PhoneNET PLUS connector is the basic hardware unit that attaches a computer or other device to the network wires. The connector provides the necessary signal link for communicating between devices, and each device must have one.

The PhoneNET PLUS connectors are 100% compatible with the original PhoneNET connectors which support the normal 230K Baud speed of an AppleTalk network. The PhoneNET PLUS connectors, PhoneNET StarController and PhoneNET Repeater are speed independent and can support network speeds in excess of 1M Baud. (Note: Cable distances and topologies are more restrictive at higher speeds.) This manual discusses the normal 230K Baud speed of AppleTalk.

PhoneNET and PhoneNET PLUS connectors are compatible with Apple Computer's AppleTalk connectors and all of them can be combined on the same network.

7-foot modular telephone extension cable (with RJ11 Plugs)

PhoneNET

PN208 or PN209

PhoneNET

120-ohm RJ11-mounted terminating resistor

120-ohm unmounted terminating resistor
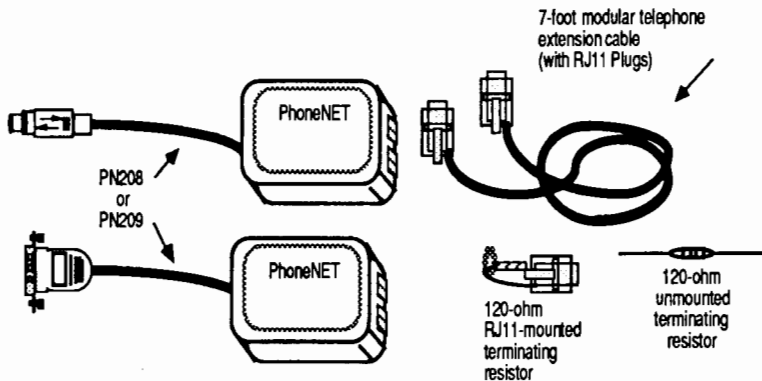
In Your PhoneNET Package

PhoneNET PLUS Connectors (continued)

PhoneNET PLUS connectors come in two models. One model has a mini DIN-8 plug, while the other has a DB-9 plug. The model you need depends on the device you wish to attach to the network.

Use the PhoneNET PLUS **mini DIN-8 model** (Farallon PN208) with the following devices:
side view   end view
- Macintosh SE, Macintosh II
- Macintosh Plus
- Apple IIGS
- Apple IIe (with AppleTalk option)
- ImageWriter II printer (with AppleTalk option)
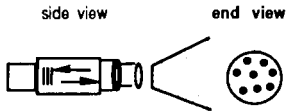
Use the PhoneNET PLUS **DB-9 model** (Farallon PN209) with the following devices:
side view   end view
- Macintosh 128K, 512K, 512Ke
- LaserWriter and LaserWriter Plus
- IBM PC, XT, AT, or compatibles (with AppleTalk interface card)
- Kinetics Interface cards
- Most third-party AppleTalk network devices

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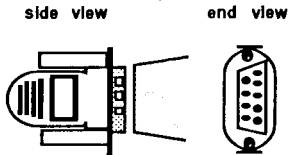
In addition to PhoneNET PLUS connectors, you may need other
PhoneNET components from the following list.

Other PhoneNET Products
- PhoneNET to AppleTalk Adaptor Cables (PN120)
- Adaptors and Construction Kits for connection to most types of
  wiring
- PhoneNET CheckNET and the Network Testing Disk (SW110)
- TrafficWatch network analysis software (SW100)
- PhoneNET StarController (PN207)
  with StarCommand network management software
- PhoneNET Repeater (PN200)

The cable construction kits include cable, connectors, instructions and
necessary tools. These kits and many of the modular telephone
components mentioned in this manual are available from Farallon
Computing or through your local dealer.

All Farallon Computing parts are designated with a PN part number.

Planning a PhoneNET System

If you want to connect more than five devices in your network, we suggest you develop an installation plan. This section contains a description of the various network configurations (called topologies), wiring guidelines and restrictions, plus a list of planning considerations. If you have questions or need assistance after reading this section, contact your dealer or Farallon Computing.

The PhoneNET System has been designed to minimize the cost of installing an AppleTalk LAN. It uses standard telephone components such as modular extension cables, wall boxes, modular cable extenders, and wall cable. In many buildings, existing telephone installations have unused wiring going to each station. The PhoneNET two-wire parallel circuit allows you to take advantage of this unused wiring to construct an AppleTalk LAN.

PhoneNET System Topologies

PhoneNET Systems can be configured in four basic network topologies: a daisy chain, a trunk or backbone, a passive star, an active star, or a combination of the above. The following wiring guidelines are conservative and should insure a functioning network. For more detailed wiring guidelines, consult the PhoneNET Technical Wiring Guidelines manual.

Network Topologies

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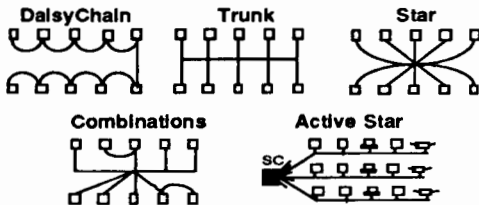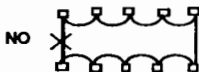
Daisy Chain Topology

A daisy chain network is suitable for small installations with all devices in the same room. A daisy chain can be quickly constructed using the modular telephone extension cables and RJ11-mounted terminating resistors supplied with each PhoneNET connector.

The telephone extension cable used to construct a daisy chain is usually 26-gauge wire, limiting the total network length to about 2000 feet. No more than 20 connectors should be used when daisy chaining. A trunk or star configuration is preferred for more devices.

Removing a connector from the middle of a daisy chain network splits the network into two separate networks that cannot communicate with each other. This does not happen when a connector is removed from a trunk or a star network. Thus, if a more permanent network is desired, we recommend using trunk or star topology.

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insert RJ11-mounted terminating resistors

insert RJ11-mounted terminating resistors
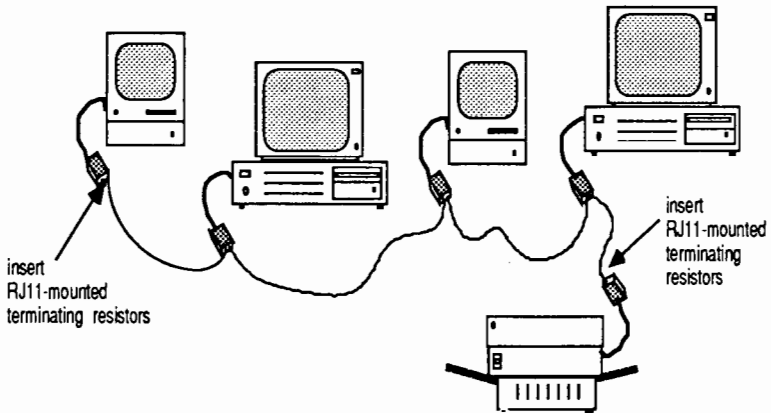
Daisy Chain Topology

Trunk Topology

A trunk topology is also called a backbone topology. A trunk consists of a single cable linking RJ11 modular wall boxes installed at each device location. A PhoneNET connector is attached to each device and then connected to the nearest wall box with an extension cable (also called a telephone modular extension cable).

The trunk topology is suitable where extended distance networks are desired and the cost of running new dedicated network cabling is not prohibitive. The trunk topology allows users to create large, reliable, multi-office networks without the complications of dealing with existing telephone wiring. Users can disconnect from the network without disturbing other users. Small daisy chains also can be connected as branches to a trunk without seriously degrading network performance.

The total length of a trunk network can be up to 4000 feet using 22 gauge solid copper unshielded wall cable (also known as telephone station cable) for the trunk. Each foot of extension cable branching off of the trunk counts as two feet in computing total network length. For more information about computing the effective total network length see the wiring tables in the section entitled "Passive Star Topology," page 18.

The type of cable used affects the distance signals will carry on a network. The following are some guidelines:

22 gauge copper wall cable - 4000 feet

24 gauge copper wall cable - 3000 feet

26 gauge copper extension cable - 2000 feet

Using shielded wire reduces the maximum distance by about 30%.

Install terminating resistor inside the wall box on the two extreme ends of the trunk cable
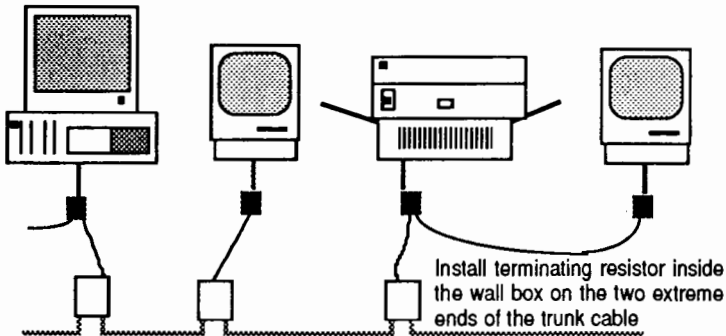
Trunk Topology

Passive Star Topology

A network wired in a passive star topology consists of up to six
branches (spokes) connected together at one central location (hub). A
branch can be a trunk with daisy chains branching from it.

A passive star topology is usually used to take advantage of existing
telephone wiring, or to allow for easy reconfiguration of the network as
office personnel are relocated. Trunks and daisy chains can be linked
into a passive star topology.

No more than six branches should be connected into a passive star. The
four longest branches must be terminated by installing a terminating
resistor inside the wall box furthest from the center of the star. Any
other branches should be less than 100 feet in length and left
unterminated. The total network length (the sum of the lengths of all
branches) cannot exceed 4000 feet.

When calculating the total length of a passive star, use the following
equivalents:

1 ft terminated wall cable, 22-gauge =1 ft of the total length
1 ft unterminated wall cable, 22-gauge = 2 ft of the total length
1 ft terminated extention cable, 26-gauge = 2 ft of the total length
1 ft unterminated extention cable, 26-gauge = 4 ft of the total length

These calculations should insure that a device with signal strength and sensitivity similar to that of a Macintosh can communicate with another such device anywhere else on the network.

Passive Star Topology

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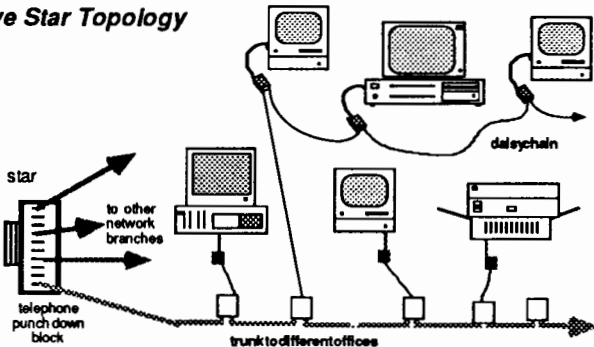
Active Star Topology

The active star topology is required if the number of branches or the total network length exceeds the limits of a passive star network. An active star topology consists of a group of trunks, daisy chains, and/or passive stars joined by a network controller called the PhoneNET StarController (Farallon PN207). The StarController has 12 ports, each capable of supporting 3000 feet of wiring conforming to the wiring guidelines in the Passive Star Topology section above.

For office buildings, the PhoneNET StarController can be used to connect 12 branches, each consisting of up to 3000 feet of wire, into one large network of 36,000 total feet of wire. Computers connected through a StarController communicate on the network as though they were directly wired together on the same physical network. However, since the StarController branches are isolated, much more total wire length can be supported more reliably with fewer errors.

The PhoneNET StarController greatly simplifies the installation,

troubleshooting, and long-term management of large AppleTalk networks. It is easily incorporated into an existing passive star topology. The optimum arrangement for easy network configuration and management is to link all devices in an office room, and connect that office room as a branch to a StarController port. For very large networks, multiple StarControllers can be connected in a backbone or a hierarchical way to build very large networks.

Active Star Topology

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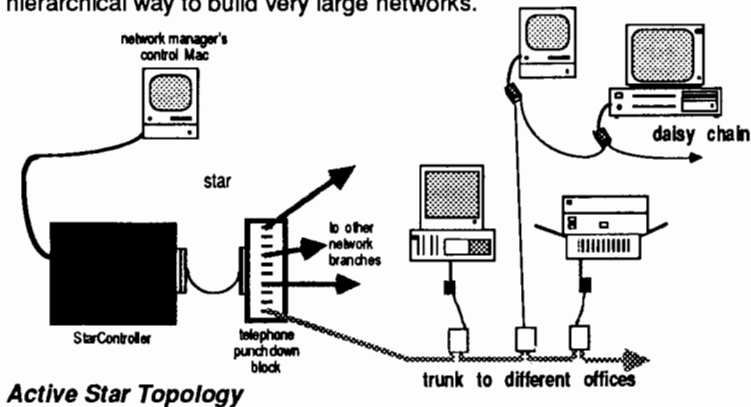
Active Star (continued)

The PhoneNET StarController has many unique and simple-to-use features for troubleshooting and managing very large networks. Through the StarCommand software you can attach or detach each port on the network, test a branch for proper termination, and automatically isolate network jamming problems.

The PhoneNET active star system can be managed remotely from the network administrator's location. A separate management bus communicates with PhoneNET StarControllers and is accessed by the StarController StarCommand network management software. The local StarController management bus can be accessed directly or from a distant location through a modem link. The StarController is a stand alone device; the StarCommand software runs on a Macintosh and is used only when you want to reconfigure, test, or monitor your network. A dedicated Machintosh is not required.

If your network requirements include linked remote locations and/or separate buildings, be sure to read about "Very Large Networks" on page 73. For more detailed PhoneNET StarController installation recommendations, see the StarController Installation Guide and the Field Service Guide.

PhoneNET Planning and Implementation Guidelines

Now that you have read about network topologies and wiring guidelines, you are ready to plan your network installation. The following suggestions and questions will help you with your network planning and implementation

- Think through the entire network layout before purchasing anything.
- Start with a floor plan for each location to be included in the network.
- Consider alternative topologies to determine the most cost-effective plan and most flexible plan.
- Make a list of everything you will need to purchase for each topology alternative.
- How many locations are involved?
- What is the proximity of the branch locations to one another?
- What kind of wire will be used?
- How much wire is needed?
- How many different PhoneNET PLUS connectors are needed?
- How many PhoneNET Repeaters are required? (see page 67)
- Do you need PhoneNET StarControllers? (see page 19)
- Are Bridges necessary?
- Consider current and future expansion needs. (see page 65)

PhoneNET Planning and Implementation Guidlines
(continued)

- How many wall boxes are needed?
- How many wall jacks are needed?
- How many 50-pin line taps are needed? (see page 43)
- How many modular one-to-five plug adaptors are needed? (see page 31)
- Do you need a punch down block? (see page 38)
- Who will supply the boxes, connectors and adaptors?
- Do you need TrafficWatch? (see page 57)

In addition to the hardware and software considerations, you should develop an implementation schedule for a turnkey operation. This schedule should include considerations for:

- Delivery lead time on products.
- Scheduling the telephone installer or network specialist.
- Planning and conducting any training necessary for the users.

Installing a PhoneNET System
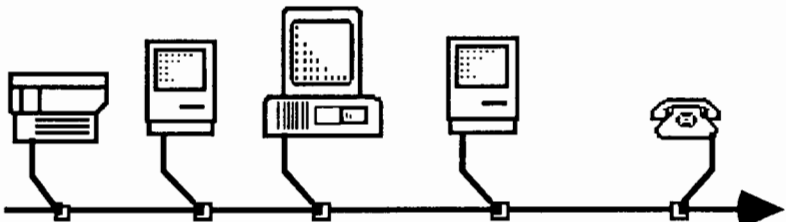
Installing a Daisy Chain Topology

You need a PhoneNET PLUS connector (Farallon PN208 or PN209) for each device (computer, printer, etc.) you wish to attach to the network. See page 9 to determine the appropriate type of PhoneNET connector for your device.

- Plug a PhoneNET PLUS connector into the AppleTalk port of each device to be attached to the network. Use the printer port on Macintosh computers.

- Link each PhoneNET PLUS connector to the next with the telephone extension cables supplied with each PhoneNET connector. The RJ11 ports on the connector are identical, so it does not matter which one you use. The sequence of devices does not generally affect their individual or network performance.

If you need longer cables or custom lengths, use the PhoneNET modular cable construciton kit (Farallon TE140) with which you can construct modular cables of any length.

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- Insert an RJ11-mounted terminating resistor (Farallon PN104) into the unused socket on the first and last PhoneNET connectors at each end of the daisy chain. Do NOT create a circle by linking the first and last devices together.

- Before using your network, make sure that you have installed it correctly. Follow the instructions in "Testing Your Installation," page 47, to confirm that your network functions.
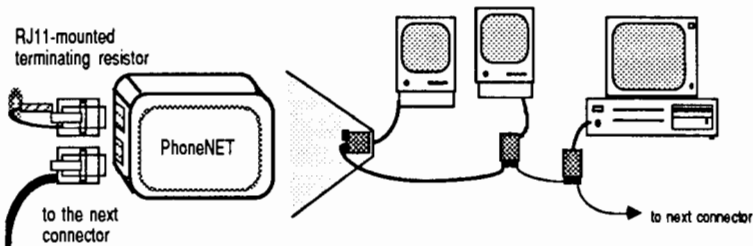
RJ11-mounted Terminating Resistor

Installing a Trunk Topology

As with the daisy chain topology you need a PhoneNET PLUS connector for each device on the network. We recommend that you follow these steps to install the trunk:

• First mount a telephone wall box (Farallon TE152) about 1 foot (30 cm) from the floor at each potential device location.

• Beginning at one end of the proposed network, connect the wall boxes with standard 22-gauge solid copper unshielded wall cable, (Farallon TE145).

The PhoneNET wall cable construction kit (Farallon TE240) contains the cable, wall boxes and tools necessary to construct a trunk network. Whenever possible, avoid cutting the telephone wall cable. If the cable must be cut, solder the spliced ends together. The preferred method of attaching trunk cable to the wall boxes is to tap into the cable as follows:

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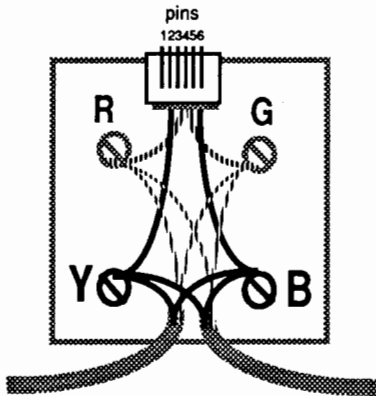
Telephone Wall Box

Installing A Trunk Topology (continued)

- Use a razor blade to cut the outer cable insulation without cutting the wires inside.

- Expose a section about 2 inches (4cm) long by pulling apart the cable insulaton at the cut. You will see four wires colored yellow, black, red and green.

- Strip about 1 inch (2cm) of the insulation from each of the yellow and black wires without cutting the wire itself.

- Wrap the exposed yellow wire around the post labeled "Y" inside the wall box. Attach the yellow wire from the RJ11 jack to the "Y" post and tighten the screw.

- Wrap a loop of the exposed black wire around the post labeled "B" inside the wall box. Attach the black wire from the RJ11 jack and tighten the screw.

- Repeat the above steps for each wall box to be installed in the network.

- Before continuing further, "Testing Your Wiring," page 47.

- Install a 120-ohm resistor inside the wall box on the two extreme ends of the trunk cable so that it connects the yellow and black posts.

- Before using your network, make sure that you have installed it correctly. See the instructions in "Testing Your Installation," page 47.
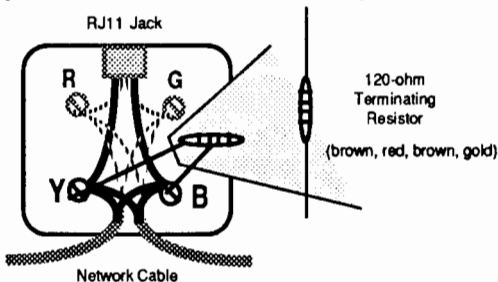
Installing an Unmounted Terminating Resistor

Installing a Passive Star Topology

A passive star network consists of up to six branches in the trunk and/or daisy chain configuration joined at a central location. The instructions in this section deal only with connecting the branches together and terminating them properly. The individual branches should be constructed according to the installation instructions in the preceeding sections (Daisy Chain or Trunk). A modular one- to-five-plug adaptor (Farallon TE154) may be used at the center of a passive star consisting of only daisy chained branches. A PhoneNET Passive Star Wiring Kit (Farallon TE340) is recomended for use at the center of a larger passive star that includes trunk branches.

The Passive Star Wiring Kit includes a punch down block with a prewired 50-pin connector. It minimizes the cost of installing a StarController later if your network grows to exceed the limits of the passive star topology. A StarController can connect directly into the passive star punch down block. Detailed instructions are packaged with the kit and are not included in this guide.

After constructing each branch of the passive star according to the

instructions in the preceeding sections, join the branches together at a central location as follows:

- Connect the yellow wires from each branch together.

- Connect the black wires from each branch together.

- Before continuing further, follow the instructions in "Testing Your Wiring," page 47.

- Install a 120-ohm resistor at the extreme ends of the four longest branches according to the instructions for installing trunk or daisy chain networks (pages 26 or 30).

- Attach a PhoneNET connector to each device on the network.

- Link each connector to a wall box with a telephone extension cable.

- Before using your network, make sure that you have installed it correctly. See the section entitled "Testing Your Installation," page 47, to confirm that your network functions.

Installing an Active Star Topology

A Passive Star Wiring Kit (Farallon TE340) will allow easy connection to a StarController. For more information on the PhoneNET StarController see the StarController Installation Guide.
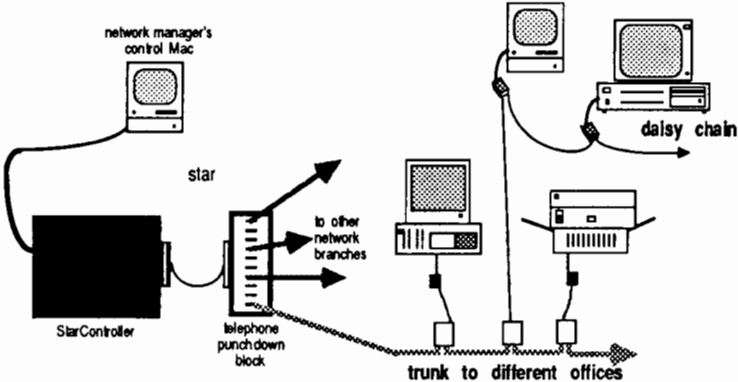
Active Star Topology

PhoneNET Systems and Existing Telephone Wiring

Most single-line telephone systems are installed using 4-wire cable. Single-line telephones use only two of these wires (typically, red and green). PhoneNET is specifically designed to use the other two wires (yellow and black) in the cable. Multi-line telephone systems may be installed using 4, 6, 8, or even 50 wire cables. As a rule these systems have at least one pair of unused wires which can be used for PhoneNET.

Occasionally, a telephone system uses all of the wire pairs going to a station. If this is the case, new wiring must be installed for the network. PhoneNET requires one free pair of wires going to each station.

When using existing telephone wires, a qualified telephone installer should be consulted to insure correct installation.

Telephone cables run from each telephone extension to a central location in the building (either a terminal block or a punch down block) where they connect to the telephone company service lines going to the telephone company central location. This wiring layout is a star topology having the same characteristics and limitations as active and passive stars.

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The PhoneNET Circuit

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Connecting the Branches

Instructions for connecting branches into an active star are covered in the StarController Installation Guide. Passive stars are joined at either a terminal block (single-line telephone systems) or at a punch down block (multi-line telephone systems). For the following instructions assume that the unused pair are the yellow and black wires.

To install an AppleTalk network using existing wiring, you will connect the unused pairs from each extension at a terminal block or punch down block.

At a Terminal Block (Center of the Star):

The terminal block is usually located inside an office and outside a house.

- Check to make sure neither the yellow or black wire is connected to any telephone service wires (the wires coming into the building) or to the ground line.

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Connecting the Branches (continued)

- If they are not connected, twist all of the yellow wires together.

- Now connect all of the black wires together.

- Test your network wiring using the suggestions in "Testing Your Wiring," page 47.

- Install a 120-ohm terminating resistor at the ends of the four longest branches as described on pages 26 and 30.

Terminal Block Connection

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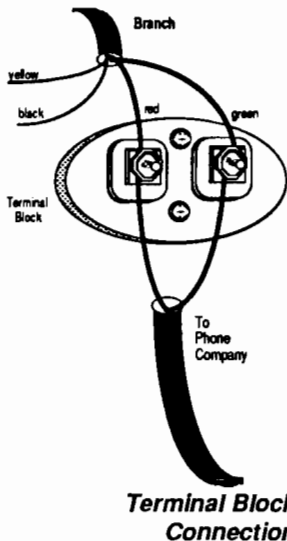
At a Punch Down Block:

The punch down block is usually located in a telephone closet in your building. Go to the closet and select several feet of unused 22-guage copper wire. Cut two 18-inch lengths to be used as jumper wires.

The punch down block has paired pins. Notice that each yellow or black wire comes from your office's modular wall mounts into a pin on the block.

- Attach one jumper cable wire to the first pin with a yellow wire, then sequentially link each of the other yellow wires coming from office rooms to be attached to the network.

- Repeat for the black wires.

- Test your network wiring using the suggestions in the section entitled "Testing Your Wiring," page 47.

- Install a 120-ohm terminating resistor at the end of the four longest branches, pages 26 and 30.

Connecting the Branches (continued)
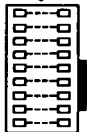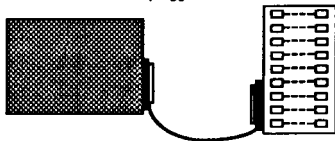
Telephone Punch Down Block Connections
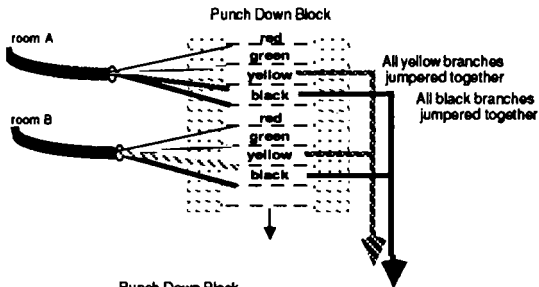
Providing the Proper RJ11 Connection

PhoneNET connectors are designed to use the outer two pins of a four-pin RJ11 telephone wall box (pins 2 & 5 corresponding to the yellow & black posts). See diagram page 42. If the telephone uses only the red and green wires, the only modification necessary at a wall box is the possible installation of a terminating resistor. The PhoneNET connection and the telephone can operate from the same wall box. The telephone and/or modem can be plugged into the unused socket of the PhoneNET connector. If the telephone already uses the outer two pins of the RJ11 wall box, an additional wall box should be installed for the PhoneNET with its yellow and black wires connected to the free pair in the cable. (See diagram on page 42.)

Various standard telephone accessories are available to install an additional network jack. Single flush-mounted RJ11 wall jacks can be replaced with dual flush-mounted RJ11 wall jacks (Farallon TE155). A telephone wall box (Farallon TE152) can be mounted on the wall next to an existing wall jack. The telephone Y-adaptors commonly used when installing telephone answering machines don't provide a reliable connection and are not recommended for use with the PhoneNET System.

Installing New Wall Boxes

• Mount a new wall box next to the existing wall box containing the unused pair of wires.

• Attach the unused pair from the old wall box to the yellow and black the posts in the new wall box. Refer to the section entitled

TelephonePair
(Red-Green)

TelephonePair
(Red-Green)
(pins 3,4)

PhoneNET Pair
(Yellow-Black)
(pins 2,5)

1 2 3 4 5 6

RJ 11
Modular Telephone Plug
(on ends of flat modular
extension cables-
6 position/4 conductor)
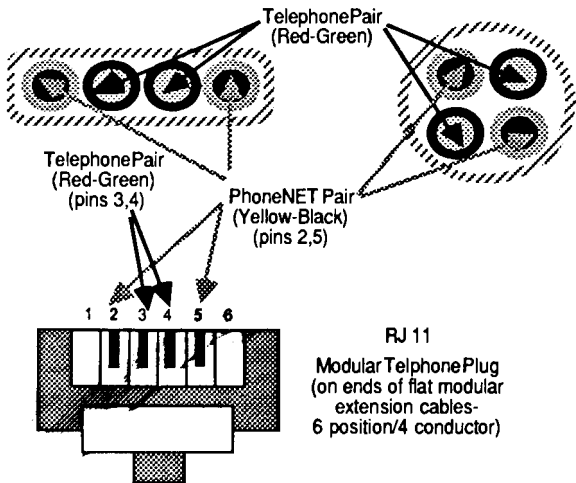
4-pin RJ11 Modular Connector

42

Installing a 50-pin Line Tap

Some office buildings use 25-pair (50-wire) cables which do not attach to wall boxes or use RJ11 plugs. A PhoneNET 50-pin line tap (Farallon TE153) can be used to tap into the cable enabling you to attach a PhoneNET connector to any pair of wires in the cable. A telephone extension cable is used to attach a PhoneNET connector to the RJ11 socket on the line tap. Multi-line telephones typically use wire pairs 1-20; pairs 23-25 are often used for intercom lines. Pairs 21 and 22 are rarely used by the telephone and are thus recommended for the PhoneNET connection. The 50-pin line tap is preconfigured for pair 21; it can be reassembled to tap into any pair. (see diagram, page 45)

- Identify the unused pair to be used for the network.

- Configure the 50-pin line tap to connect to the unused pair; pair 21 is recommended.

- Insert the 50-pin line tap into the cable at any junction point.

- Test your network wiring using the suggestions in "Testing Your Wiring," page 47.

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- Attach PhoneNET connectors with modular cable. Multiple connectors can be daisy chained from one 50-pin line tap.

- Check the PhoneNET system for proper termination.

Before using your network, make sure that you have installed it correctly. See the section entitled "Testing Your Installation," page 47, to confirm that your network is functioning.

RJ11 Plug

50-pin line tap to Standard Multiline Telephone
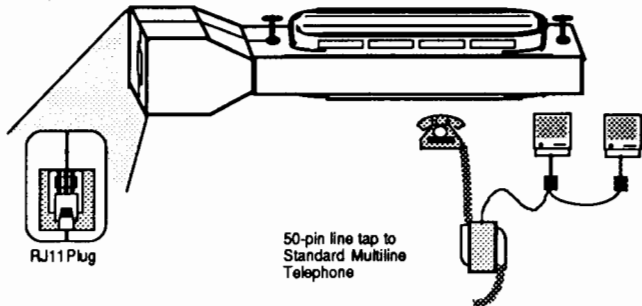
50-pin Line Tap

Installing a 50-pin Line Tap (continued)

Pairs 1-20 (Telephone Lines)

Pair 21 PhoneNET

Pair 22 (unused)

Pairs 23-25 (Intercom Lines)
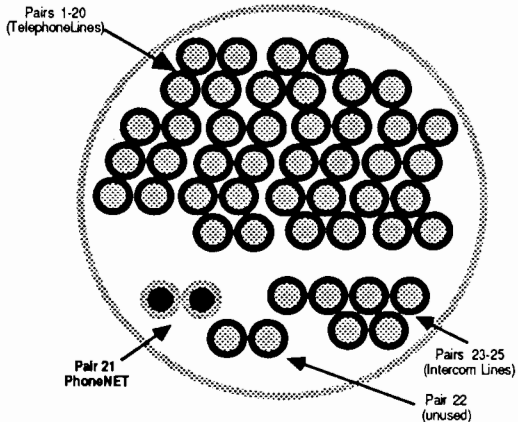
If you have questions about connecting a system in a manner not described on the previous pages, please call your dealer or Farallon Computing Technical Support at (415) 849-2331.

Installing An AppleTalk Network Using Other Wiring

Other Star Wiring
Many offices have existing unused computer wiring such as RS-232 terminal wiring, DEC Connect Cabling, and various IBM Cabling Systems. Farallon supplies adaptors that allow you to construct an AppleTalk network using these other types of wire. IBM Cabling System Line Taps (Farallon TE300) and DEC Connect Adapter Cables are available from Farallon to use your existing wiring.

Testing Your Installation

Testing Your Wiring

Before installing terminating resistors in the appropriate network wall boxes or attaching PhoneNET connectors, confirm that all wall boxes are wired together correctly. Use a voltage ohm meter and one telephone extension cable for the wiring tests. To construct a PhoneNET test kit:

- Cut the telephone extension cable in half to create two test cables.

- Create a test cable by connecting the voltage ohm meter to the yellow and black wires of one length of the extension cable.

- Create a continuity tester with the other length of the cut telephone extension cable by connecting (twisting) the yellow and black wires together.

Telephone installers use a signal toner to locate and test telephone wire. The signal toner is excellent for locating wire pairs in the telephone closet, but it should not be used as a substitute for a voltage ohm meter in the following tests.

Perform the following tests at each wall box on the network.

- Insert the tester cable into the network RJ11 socket and measure the resistance between the yellow and black wires. Each network wall box should have infinite (∞) ohm resistance. If the resistance is any value less than infinite, your network wires are connected (or shorted) to each other at some location. This short must be eliminated.

- While at each wall box, measure the DC voltage. Each wall box should have no DC voltage. If you measure any DC voltage, the wires you selected for your network are probably connected to a pair of wires being used by a live telephone line. Locate and detach the telephone circuit from the network wires or choose another pair of wires for the network.

- While at each wall box, measure the AC voltage. Each wall box should have no AC voltage. If you measure any AC voltage, your network devices are connected to wires being used by some non-network device. Locate and detach the AC voltage source from the network or choose another pair of wires for the network.

When each wall box has infinite resistance and no DC or AC voltage, proceed with the following tests:

- Plug the continuity test cable into any network wall box. This will directly connect the two network wires.

- Go to each wall box and again measure the resistance between the yellow and black wires with the voltage ohm meter. Each network wall box should have a resistance of less than 300 ohms. If the resistance is less than 300 ohms, that wall box is properly wired to the wall box with the continuity test cable. If the resistance is greater than 300 ohms, make sure that all network wires are securely connected together. If the resistance is infinite, your network wires are probably not correctly connected to the wall box or the network wires running between each wall box are not correctly connected. Begin at the first installation and recheck each connection.

- When all wall boxes test OK, proceed with the installation instructions. (Install terminating resistors and connectors.)

The PhoneNET StarController (Farallon PN207) has extensive wire testing, troubleshooting, fault identification and isolation capabilities built in. Tests can be performed at installation time and on a continuing basis to insure reliable network performance. The StarController also performs continuous monitoring of the network and fault isolation and identification, if a problem arises. For more information, see the StarController Installation Guide.

Note: Whenever physically attaching to the network, do so with the device turned off.

- Attach each network device (computers, printers, etc.) to the network with a PhoneNET connector.

- After attaching the connector, turn the device on and boot up.

- Turn on one network printer.

- Start each computer with a disk containing the latest System, Finder, the appropriate printer driver software and/or networking software. If you use an Imagewriter II, be sure the Appletalk ImageWriter printer driver is in the System Folder. If you use a LaserWriter, be sure the LaserWriter driver and the Laser Prep icon are in the System Folder. Put all three items in the System Folder if you will be using both printers.

```
┌─────────────────────────────────────────────────────┐
│ □▤══════════════ System Folder ═══════════════▤▫ │
├─────────────────────────────────────────────────────┤
│ 5 items          12321K in disk        9210K available │
├─────────────────────────────────────────────────────┤
│                                                       │
│                          🖨                            │
│                    AppleTalk ImageWriter              │
│                                                       │
│        🖥        🖥      - - - - - - - - - - -         │
│                                                       │
│      System    Finder       💾        💾              │
│                          Laser Prep & LaserWriter     │
└─────────────────────────────────────────────────────┘
```
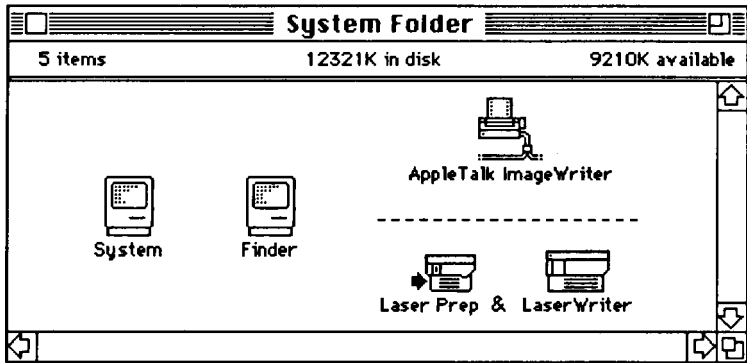
System Folder should contain Laser Prep and Laserwriter or AppleTalk ImageWriter.

System Folder

At each computer:
- Select the Chooser desk accessory under the Apple menu and click on (select) "AppleTalk Active" if it's not darkened. With software earlier than System 3.3 and Finder 5.4, use the Control Panel to connect the computer to an AppleTalk network.

- Next select the printer icon; the name of the printer that is ON should appear in the window. Select (click on) the name of the printer. (It should be highlighted dark.) Close the Chooser.

- Print a test file. We suggest selecting Print Catalog from the File menu while in the Finder.

- All computers should be able to print to the printer. If not, proceed with more extensive network communications testing using the PhoneNET CheckNet desk accessory and PhoneNET TrafficWatch network analysis software.
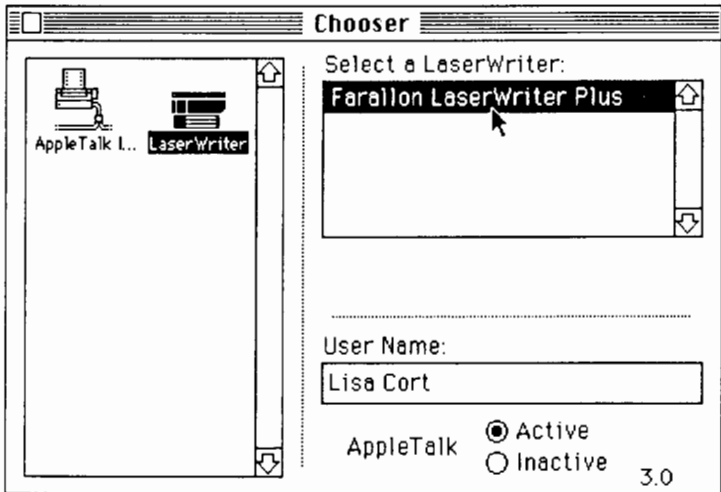
"Chooser" Desk Accessory

PhoneNET CheckNet Desk Accessory

The PhoneNET CheckNet Desk Accessory (DA) allows you to see which devices are attached to the network, and search for particular devices or device types. You can see bridges and devices in other network zones.

As a desk accessory you can use PhoneNET CheckNet while in any program. PhoneNET CheckNet is available on the PhoneNET Network Tesing Disk (Farallon SW110).

	PhoneNET CheckNET™					
		Searching....	11	1		
Name	Type	Net #	Node	Socket	Enum	
Kee's Banana Jr.	CheckNet		57	234	1	
Herkamer Ezakiel	ChooserName	1065	60	127	1	
AppleTalk Bridge	InterBridge	1065	29	128	1	
Colleen Alcarz	CheckNet	252	127	234	1	
NoName	ChooserName	252	1	127	1	
2nd Floor LaserWriter	LaserWriter	240	151	186	1	
Mac2 w/Whiteners	ChooserName	240	4	127	1	
Ben D'Bumper	Chooser	
Saul Wright	Chooser	
Becky Ning	Chooser	
1st Floor LaserWriter	LaserWr	
Lizzy Boredom	Chooser	
Ty M. Togo	Chooser	
Flora N. Fauna	Chooser	

CheckNet menu:
About...
Search options...
Sort options...
Save...
Close

Dialog: Enter search template for name lookup:

Name: [*]
Type: [LaserWriter]
Zone: [*]

* is a wild card for NAME and TYPE
* indicates lookup for local ZONE

Network Retry Interval: [2]
Network Retry Count: [2]
Desk Acc. Periodic Delay: [300]

[OK]   [Cancel]

CheckNET Desk Accessory

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TrafficWatch Network Analysis Software

The PhoneNET TrafficWatch network analysis software (Farallon SW100) monitors and displays who is talking to whom on the network and how much. Transmission error rates and types, as well as total traffic load are also monitored. TrafficWatch performs look-ups of users and devices registered on the network, and can also work with the StarController to perform physical user location look-ups. This information is stored and saved into Excel™ files for further analysis of network or user activity.

TrafficWatch is an important tool for setting up, managing, reconfiguring, and troubleshooting an AppleTalk network regardless of the topology. TrafficWatch requires at least a 512Ke Macintosh to run.

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TrafficWatch network analysis utility software

The PhoneNET StarController and StarCommand Management Software

The PhoneNET StarController is an intelligent hardware device that manages a large PhoneNET System. The StarController provides branch isolation, error rate reduction, continuous anti-jamming monitoring, and fault isolation.

The PhoneNET StarController can be controlled with the easy-to-use StarCommand network management software which tells the network administrator the location and character of problems. StarCommand can be used to attach or detach devices and perform detailed electrical tests on the network wiring. StarCommand does not require a dedicated Macintosh to run.

Detailed information can be found in the StarController Installation Guide.

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The StarCommand software displays a map of your network (drawn in MacPaint or MacDraw). The map has buttons on the picture that correspond to branches, StarControllers and physical locations in your building(s). The network can be reconfigured, problems can be identified, and wire tests can be performed all by simply clicking on the buttons.
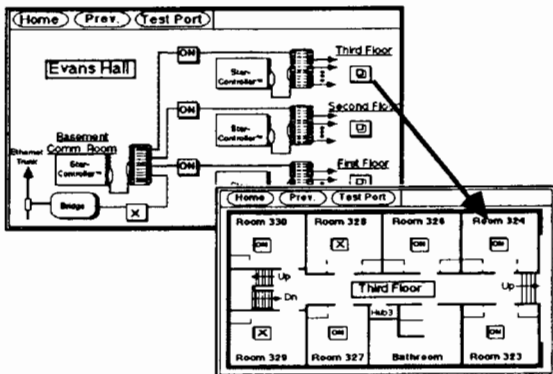
Special Installation Situation

PhoneNET and AppleTalk Connectors

PhoneNET connectors and AppleTalk connectors can be mixed on the same network. You simply add PhoneNET connectors to your existing AppleTalk network with the PhoneNET to AppleTalk Adaptor Cable (Farallon PN120).

It is best to avoid using more than one PhoneNET to AppleTalk adapter cable on the same physical network. With multiple AppleTalk connectors on a network, the overall maximum distance is limited to Apple's cabling limit of 1000 feet.

Apple's AppleTalk connectors do not have adequate surge protection to attach directly to unshielded telephone wiring. A PhoneNET connector should be attached between the AppleTalk connector and the telephone wiring.

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PhoneNET RJ11 Plug

AppleTalk Mini DIN-3 Plug

PhoneNET Connectors

AppleTalk Connectors
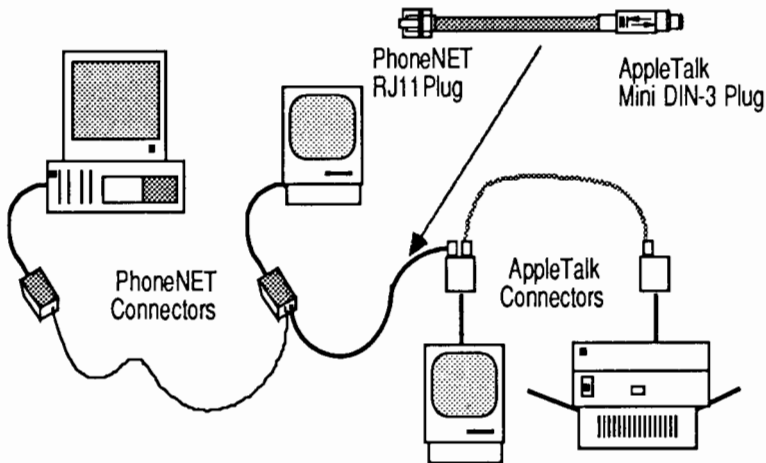
PhoneNET to AppleTalk Adaptor Cable

PhoneNET and AppleTalk Connectors (continued)

Follow these steps to install a PhoneNET to AppleTalk Adaptor Cable:

- Attach the mini DIN-3 plug on one end of an adaptor cable to an AppleTalk connector.

- Attach the RJ11 plug on the other end of the adaptor cable to the PhoneNET connector.

- For a daisy chain topology, install an RJ11 mounted-terminating resistor into the last PhoneNET connector. For a trunk or star topology, attach the PhoneNET connector directly into a terminated wall box.

- Do not plug the RJ11 end of the PhoneNET AppleTalk adaptor cable directly into a telephone wall box. Apple connectors do not have sufficient surge protection to be directly connected to telephone cabling.

WARNING: There should always be a PhoneNET connector between the telephone wall cabling and the first AppleTalk connector.

AppleTalk connectors allow a maximum network length of 1000 feet. If the overall length of the network is greater than 1000 feet, we recommend that you use only PhoneNET connectors because their lower-resistance, floating-ground circuit is better suited for longer distances.

PhoneNET
RJ11 Plug

AppleTalk
Mini DIN-3 Plug

PhoneNET to AppleTalk Adaptor Cable

Other Computers on PhoneNET

Macintoshes, IBM PCs, IBM PC-compatibles as well as other computers can share files and LaserWriters on the same network with PhoneNET connector, AppleTalk interface cards and appropriate software.

As of March 1987, three companies market PhoneNET compatible IBM PC-to-AppleTalk boards: Centram Systems West, Tangent Technologies, and Apple Computer. All include software allowing PCs to share files with Macintoshs and print to a LaserWriter.

Check with Farallon Computing or your dealer for information regarding connections for UNIX machines, Q-Bus and Multibus machines.

IBM PC, XT or AT or compatible
with AppleTalk Card
and software

MacPlus or 512K

LaserWriter or
LaserWriter Plus
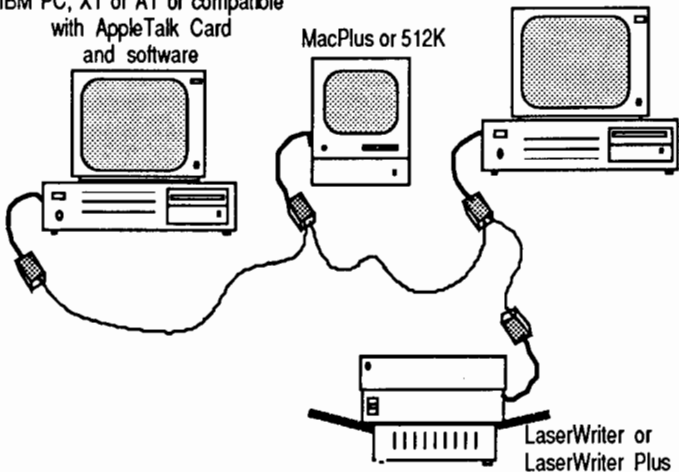
Adding IBM PCs to the network

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Very Long Cable Lengths

In most installations, PhoneNET connectors can operate through 4000 feet of ordinary telephone cable as described above. If you need to extend your network over longer distances, you can insert a PhoneNET Repeater approximately every 3000 feet to boost the signals traveling in either direction along the network.

For office buildings with large amounts of wire, the PhoneNET StarController can be used to connect 12 separate physical networks together into one large logical network. Each physical netowrk can have up to 3000 feet of wire. Thus a single StarController can accommodate a large volume of wiring (approximately 30,000-40,000 feet of wire). Devices connected on different ports of a StarController communicate on the network as though they were directly connected on the same physical network.

Bridging to Other Networks

Another solution for extending network lengths is an AppleTalk bridge, such as the Hayes InterBridge. A bridge separates one network into two logical networks, allowing 32 devices on each network. By using multiple bridges, thousands of devices can be networked together over virtually unlimited distances.

You can bridge from an AppleTalk network to other network types through a stand alone bridge that is connected both to AppleTalk and to another network (Ethernet, Token Ring, etc.). This bridge may be a device such as Kinetics' FastPath Ethernet bridge or another computer, such as an IBM PC, Mac II, or VAX, with links to AppleTalk and the other network.

AppleTalk networks in more than one location can be connected through high speed links (T1 circuits, broad bant, etc.)or a modem link. However, communication between the networks is limited by the speed of the link.

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Bridging to Other Networks (continued)
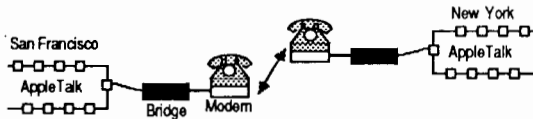
The Hayes Interbridge
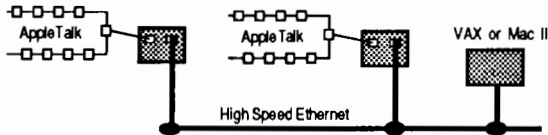
The Kinetics FastPath Ethernet Gateway
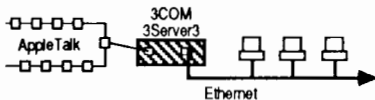
3Com 3Server3 File Server

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On most large communication networks, each separate communication link has reserve capacity to act as back-up in case other communication links fail. If you wish to transfer AppleTalk data through unused capacity in existing network links such as microwave, T1 circuits, broadband networks, fiber optics, or dedicated telephone lease lines, contact Farallon Computing.

If your network requires a bridge, consult the installation instructions for the bridging product you have chosen, or call your dealer or Farallon Technical Support for assistance in planning and installing a bridge system.

Other Useful AppleTalk Network Products

PhoneNET products are used to create and maintain the network highway (physical distribution system) used by other AppleTalk network hardware and software products. This partial list of AppleTalk network products is provided to give you an idea of the many applications available for use in conjunction with the PhoneNET System.

Attaching Other Computers
  TOPS for the PC & UNIX, Centram, (415) 549-5900
  Netway 1000A, IBM 3274 Gateway, Tri-Data, (415) 969-3700
  FastPath Q-Bus & MultiBus Cards, Kinetics, Inc., (415) 947-0998
  PC MacBridge, Tangent Technologies, Ltd., (404) 662-0366
  VAX VMS AlisaTalk, Alisa Systems, Inc., (818) 792-0474
  Apple IBM PC Card, Apple Computer, (408) 996-1010
  C-Server, Solana Electronics, (619) 566-1701
Electronic Mail Software
  InBox, Think Technologies, Inc., (617) 863-5590
  InterMail, Internet, (617) 965-5239
File Sharing Products
  TOPS, Centram, (415) 549-5900
  MacServe, Infosphere, (503) 226-3620
  EtherMac 3Server3, 3Com Corp., (415) 961-9602

File Sharing Products (continued)
    AppleShare, Apple Computer, (408) 996-1010
Multi-User Software
    Helix, Odesta, Inc., (312) 498-5615
    Omnis 3, Blyth Software. (415) 571-0222
    Flexware, Microfinancial, Corp., (818) 961-0237
    Appointment Diary, Imagine Software, (415) 769-4033
Network Bridges
    FastPath Ethernet AppleTalk Gateway,
        Kinetics, Inc., (415) 947-0998
    InterBridge, Hayes Microcomputer Products, (404) 441-1617
    R-Server, Solana Electronics, (619) 566-1701
Shared Devices
    LaserWriter, ImageWriter II w/AppleTalk,
        Apple Computer (408) 996-1010
    Linotronic, Allied Linotype, (312) 439-9800
    PS Jet, The Laser Connection, Inc. (800) 233-6687
    PS Laser Printer, QMS, Inc., (205) 633-4300
    LaserServer, DataSpace Corporation, (800) 387-0492
    MacBuffer LW, Ergotron, Inc., (612) 854-9116
    ComServe Modem Server, Infosphere, (503) 226-3620
    C-Server, Solana Electronics, (619) 566-1701

Very Large Networks

If you are planning to network a large facility, e.g., several floors in a large building or several buildings, you will find the following information helpful whether you do it yourself, have the wiring installed by a telephone installer, or work with a network specialist.

On an AppleTalk network utilizing the PhoneNET System, a device has both an AppleTalk determined logical node address and physical address. For example node 63 is in room 222.

The physical address of a device is determined by the user when the wiring is installed. The logical address of a device is configured by AppleTalk and can be independent of the device's physical location. Once the network wiring is correctly in place, the user need not be concerned with addresses or configurations. The network will be completely transparent to the user, which is one of the nicest features of AppleTalk.

A telephone number is a good analogy to a network address. It is also a combined logical and physical address system. The Area Code identifies a larger area; the prefix, a smaller area, last four digits are your personal number. The telephone number also has a physical address when the telephone number is installed. It is often possible to move your telephone to a different physical location within a town and keep the same telephone number.

Groups of devices connected together are on the same physical network. Each device is connected through the PhoneNET connector to the same set of wires and each hears the conversation between other devices.

Very large networks can be constructed by linking multiple physical networks. When a network has several physical branches with wire lengths greater than 3000 feet, branches may be electrically isolated by a PhoneNET StarController (30,000+ feet per StarController). A PhoneNET Repeater or StarController electrically isolates a branch of a physical network. Signals coming down one set of wires are detected and regenerated onto the other sets of wires (three physical networks of the Repeater, or 12 physical networks of the StarController).
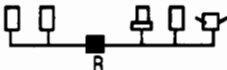
Very Large Networks (continued)

Each packet signal is regenerated Repeater or PhoneNET
StarController onto all the other sets of wires. Thus all devices are on
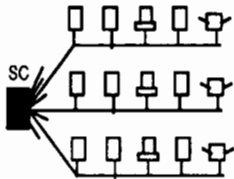the same logical network.

One logical and
physical network

A PhoneNET Repeater separating
one logical network into two physical networks

A PhoneNET StarController separating
one logical network into
multiple physical networks.

An AppleTalk bridge (e.g. a Hayes Interbridge) separating
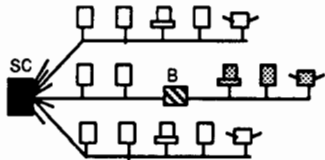two logical network and two physical networks

Devices on a PhoneNET System will have a physical address, with wall tap location, PhoneNET StarController branch number, StarController number, and StarController group number. A device will also have a logical address determined by AppleTalk and bridges.

Groups of physical networks, branches, or PhoneNET StarControllers can also be divided into separate logical networks with AppleTalk bridges connecting the different logical groups (usually work groups). Each logical network has a unique network number analogous to a telephone number prefix. Groups of logical networks can be divided into zones, analogous to a telephone area code. Thus a particular device on an AppleTalk network has a device name, a node address, a network number, and a zone name, as well as its physical address on the PhoneNET System.

A very large AppleTalk network can be constructed with multiple PhoneNET StarControllers and Bridges. See the StarController Installation Guide for more information.

Very Large Network (continued)

A PhoneNET StarController separating
multiple physical networks with one
branch also divided into separate
logical networks by a bridge

An AppleTalk bridge dividing
two PhoneNET StarControllers into
separate logical networks which
are in-turn divided into
multiple physical networks
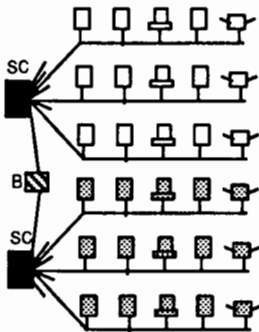
Prefered arrangement for a very large network:
Workgroups attached with a PhoneNET StarControllers to a FastPath Ethernet Bridge
then to an Ethernet backbone. Machines can communicate to other workgroups through
the backbone or to devices attached directly to the Ethernet Backbone such as VAXs,
MacIIs with EtherTalk Card, and Mac SEs with Kinetics Card.

PhoneNET StarController
attached to a FastPath
Ethernet to AppleTalk Bridge
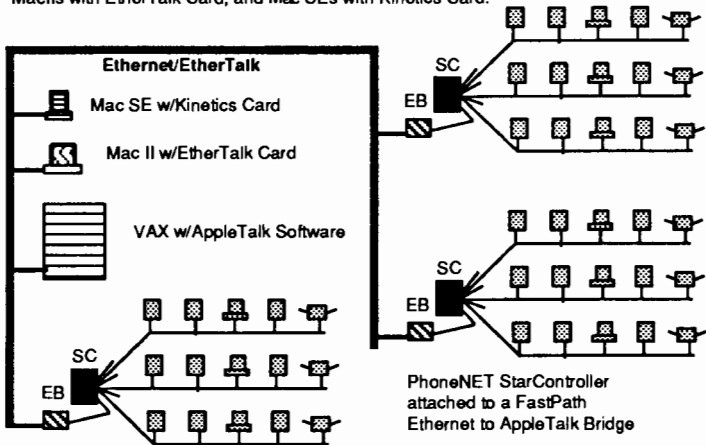
Troubleshooting

Basic Trouble Shooting

- Make sure that all PhoneNET connectors and any connectors are plugged into the printer ports of the Macintoshes and the AppleTalk ports of all printers and other Appletalk network devices.

- Make sure that terminating resistors are installed properly. No more than four terminating resistors should be installed on a single physical network.

- Make sure that AppleTalk is "Active" in the Chooser desk accessory. On software earlier than System 3.3 and Finder 5.4, use the Control Panel desk accessory to connect AppleTalk.

If your network is still not functioning properly, review the installation instructions for the type of network topology you have installed. If you still haven't located the trouble, move on to Advanced Troubleshooting in the following section.
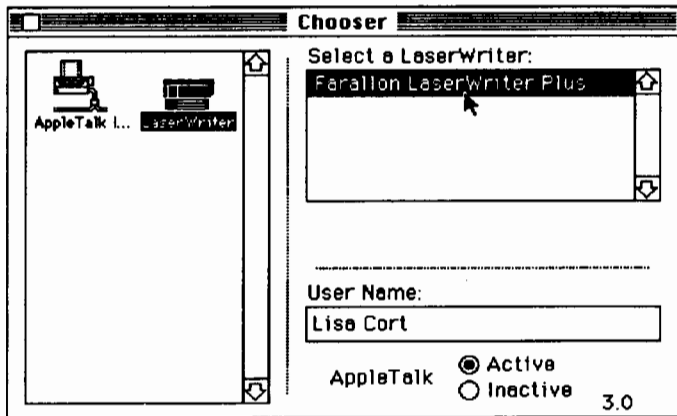
Trouble Shooting through Software

Troubleshooting (continued)
Advanced Troubleshooting

The following flow chart below may be used to identify network problems. Start at number 1 and read statments A and B. Choose the statement that best describes your situation, then follow the instructions to the right of that statement. Sometimes statement A will direct you to test something. If this test does not identify the problem, follow the instructions for statement B.

1. A. Network does not work at all   Go to 2
   B. Network works inconsistently   Go to 5

2 A. The network is a daisy chain topology   Go to 3
   B. The network is a star or trunk topology   Go to 4

3. A. Check for defective parts   Swap parts
(connectors, extension cables,   and retest
RJ11-mounted terminating resistors)

   B. If swapping components shows no effect   Call Tech
on network   Support

4. A. Testing wires indicates discontinuity or a   Repair wires
short (see section entitled
"Testing Your Wiring, page 47)

   B. Testing wires shows continuity and   Call Tech
no shorts   Support

5. A. All devices on network are visible to each
other but data or print files transfer slowly
or not at all   Go to 6

   B. Some devices are not visible on the network   Go to 9

6. A. Reduce the amount of traffic on the network   retest
   B. If excess traffic is not the problem   Go to 7

Advanced Trouble Shooting (continued)

7. A. Replace terminating resistors (remember, no more than four per network   retest
   B. If terminating resistors are not the problem   Go to 8

8. A. Replace printer drivers and/or networking software   retest
   B. If this does not solve the problem   Go to 13

9. A. Network is a trunk topology   Go to 10
   B. Network is a star topology   Go to 11

10. A. Total length of trunk line exceeds 4000ft   Reduce length of network or Go to 14
    B. Total length of trunk line less than 4000ft   Go to 7

11.	A. Sum length of all branches exceeds 4000ft	Reduce length of network or Go to 14
	B. Sum length of all branches less than 4000ft	Go to 12
12.	A. Star network has more than four branches over 100 ft in length	Reduce number long branches
	B. Star network has four or fewer branches over 100 ft in length	Go to 7
13.	A. Non-AppleTalk devices with weak signals being used on the network	Move devices near the center
	B. Moving weak signal devices does not solve the problem	Call Tech Support
14.	Add PhoneNET StarController, Repeater or Bridge	

PhoneNET Specifications and Circuit

Functional AppleTalk Compatibility: 100% Hardware and 100% Software

Topology: parallel bus, low-resistance transformer isolated, floating ground (Patents Pending)

Signaling Standard: EIA modified RS-422, balanced voltage

Signaling Speed: 230,400 bits per second (baud). The PhoneNET System is speed independent and can support network signal rates in excess of 1M Baud

Signal Encoding: FMO (bi-phase) space

Frame Format: SDLC (Synchronous Data Link Control)

Maximum Length: ~3000 feet between repeaters or bridges, or per branch on a StarController for Macintosh equivalent devices

Maximum Number of Connections: 32 recommended per logical network (254 address space)

Node Identification: AppleTalk logical address is self-configuring, no user action required. User may configure Physical Port Address with PhoneNET StarController

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- RFI and Noise immunity: No RFI passive taps, noise immunity greater than 600 Volts. The PhoneNET System including the PhoneNET StarController and the PhoneNET connectors have been verified not to exceed FCC class A RFI emission limits
- Cables: Ordinary 4-conductor flat telephone extension cable or 22 guage telephone wall cable
- Connectors: Modular RJ11 four-pin connectors
- PhoneNET to AppleTalk Adaptor cable (Farallon PN120): RJ11 to Mini DIN-3

Where to go for more Information

If you need more information on connecting telephone devices together see: Installing Your Own Telephones by Master Publishing, Dallas, Texas (available at Radio Shack). Most AppleTalk-compatible products discuss networking practices and principles in their accompanying user manuals. The technical manual "Inside AppleTalk", AppleTalk Network Administrators Guide and courses from Apple Computer discuss the technical and theoretical aspects of AppleTalk. For more technical information, see the Advanced Micro Devices manual on the AM26LS31/32 Quad Driver/Receiver chip set and the EIA RS422 bus standard. For general information on PhoneNET and AppleTalk network applications and products, see the Berkeley Macintosh Users Group newsletter, MacTutor, InfoWorld, ComputerWorld, MacWorld, LAN, and MacUser magazines.

Limited Warranty and Disclaimer

Farallon Computing warants the PhoneNET connector and cabling against defects in materials and workmanship for one year from the date of original purchase. If you discover a defect, Farallon will, at its option, repair, replace, or refund the purchase price provided you return the defective part within the warranty period. All implied warranties, including merchantability and fitness for a particular purpose, are limited in duration to one year from the date of original retail purchase of this product. Farallon Computing warranties are exclusive of all others written, expressed or implied. Farallon is not responsible for special, incidental, or consequential damages resulting from the use or mis-use of this product, including lost profits, downtime, goodwill, damage or replacement of equipment or property, and any costs of recovering, reprogramming, or reproducing any program or data used with this product. Farallon is not responsible for the safety, quality, or integrity of the cabling in your building, and will not be responsible for any result of an improper installation of a PhoneNET product or PhoneNET system. Farallon is not responsible for incidental damage caused to persons, data, or equipment resulting from extraordinary circumstances (e.g., lightning strikes) or improper installation of PhoneNET.

**farallon
computing**
2150 Kittredge
Berkeley, CA
USA 94704
(415) 849-2331