Chapter 5 – Testing a Network

This chapter describes how to test a network. Included are procedures for testing installed cabling and testing to see that a network functions properly.

Testing installed cabling

It is important to test the network wiring for shorts and to see that terminators are properly installed. When testing branch cables, use a digital ohm meter since most analog ohm meters cannot accurately display small resistances.

### Setting a digital ohm meter to measure resistance

This section tells you how to set up a digital ohm meter to measure resistance. If you already know how to use an ohm meter, refer to the next section.

1. Turn on the ohm meter.

2. Insert the probes into the ohm meter. Insert one of the probes into the socket labeled Ground, GND or Common. Insert the other probe into the socket labeled ohms, resistance or Ω.

3. Rotate the measurement selection knob to the selection labeled ohms or Ω.

4. Test to see that the ohm meter is properly set to measure resistance.

    Hold both probes so they are not touching each other. The display should read all nines (99999), infinity (∞) or 1.

Touch the probes together. The display should show all zeros (00000). If the display does not indicate zero when the probes are touching, try another selection knob setting.

5. Wrap a 120-ohm resistor around the ends of the probes as shown below to see that the settings are correct.
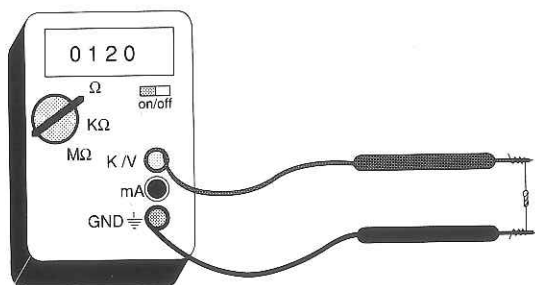
*A 120-ohm resistor wrapped around probe ends.*

The value on the meter should be 120 ohms. If the reading on your ohm meter includes a decimal point (1.20 or .120), move the selection knob to a different Ω setting until the reading is 120 ohms.

Testing a branch of a star

After installing a terminating resistor in the wall jack at the end of each branch cable, test the cables to confirm that the wall jacks are wired correctly. Before you test the cables, make sure that no PhoneNET Connectors are connected to any of the wall jacks.

Use a digital ohm meter and a PhoneNET Connector to test each network branch cable from the telephone clóset.

1. Attach the ohm meter to a network branch cable in
    the telephone closet.

2. Measure the resistance. The resistance should
    be 120 ohms, plus approximately 30 to 50 ohms
    more for every 1,000 feet of cable.
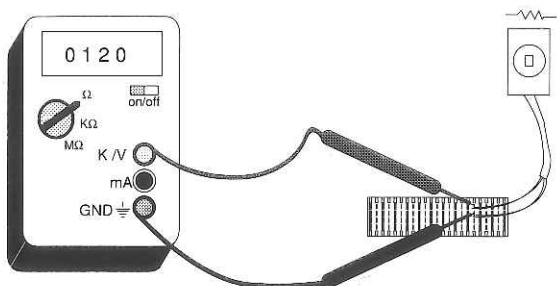
Measuring the resistance in a network branch.

If the resistance is infinite, then the cable is cut,
damaged or not terminated. Inspect the cable
carefully. Check the wall jack at the end of the
cable to make sure that a terminating resistor is
correctly installed.

If the resistance is close to zero or approximately
30 to 50 ohms for every 1,000 feet of cable,
either the cable has a short or a PhoneNET
Connector is plugged into a wall jack along the
cable. Check the cable for snapped wires or wires
that are crimped together.

3. Measure the DC voltage. There should be no DC
    voltage. If there is DC voltage, the network branch
    cable is probably connected to a pair of wires
    used by a live telephone line. Locate the
    telephone circuit and disconnect it from the
    network wires or choose another pair of wires for
    the network.

4. Measure the AC voltage. There should be no AC
    voltage. If there is AC voltage, the network branch
    cable is probably connected to a wire pair used by
    a non-network device. Locate the AC voltage
    source and disconnect it from the network, or
    choose another wire pair for the network.

5. Plug a PhoneNET Connector into the wall jack at
    the end of a network branch cable.

6. Attach the ohm meter to the corresponding
    network branch cable in the telephone closet and
    measure the resistance. The resistance should
    be between 0 and 100 ohms.

    If the resistance is greater than 100 ohms, you
    may have a bad connection or you may have
    exceeded the recommended cable length.

    If the resistance is the same as it was before you
    plugged in the PhoneNET Connector, either you
    have connected the 120-ohm terminating resistor
    to the wrong pair of wires inside the RJ11 wall
    jack, or you are measuring the wrong network
    branch cable.

Testing a backbone

1. Create a test cable from a short piece (1-3 feet) of modular extension cable. Put an RJ11 plug on one end, and strip about 1 inch of insulation from the yellow and black wires at the other end. Attach the leads of the ohm meter to the yellow and black wires.

2. Insert the test cable's RJ11 plug into any wall socket on the backbone.

3. Measure the resistance. The resistance should be 60 ohms, plus approximately 30 to 50 ohms for every 1,000 feet of cable.
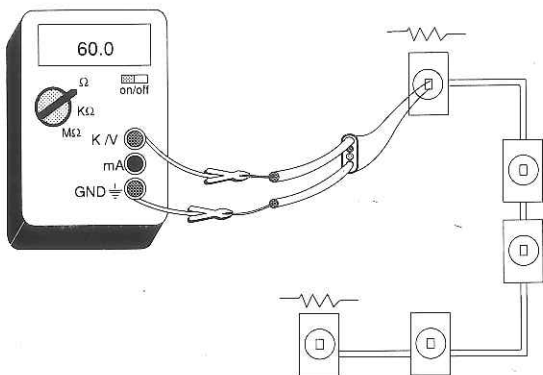
Measuring the resistance in a backbone.

If the resistance is infinite, then the cable is cut, damaged or not terminated. Inspect the cable carefully. Check the wall jack at the end of the cable to make sure that a terminating resistor is correctly installed.

If the resistance is close to zero or approximately
30 to 50 ohms for every 1,000 feet of cable,
either the cable has a short or a PhoneNET
Connector is plugged into a wall jack along the
cable. Check the cable for snapped or crimped
wires.

Testing to see that the network functions properly

Once you've testing the wiring, it is a good idea to print
a test document from each network device. A more
thorough way to test your network is to run a diagnostic
software such as PhoneNET CheckNET. CheckNET
displays the name, address, and type of every device
on the network. CheckNET can search for particular
devices (even across multiple bridges and zones) and
can sort by name, address, or device type.

The following steps describe how to set up a
Macintosh to print a test document to a LaserWriter.

1.   Check to see that all devices are properly
     connected to the network.

2.   Power on the LaserWriter.

3.   Power on a Macintosh.

4. Start up a Macintosh with a disk containing the
    latest System, Finder, LaserWriter and LaserPrep
    files.

** File Edit View Special**
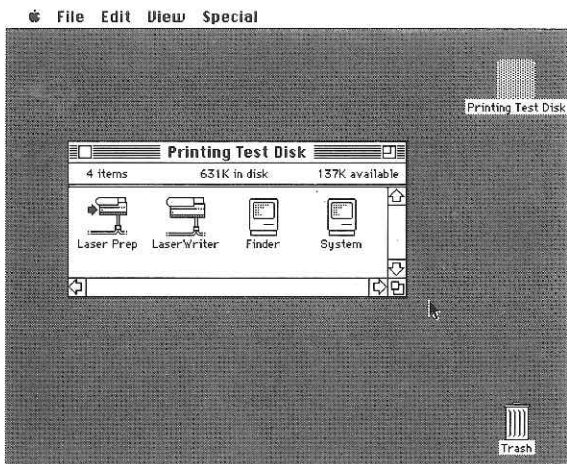
5. Choose the Chooser desk accessory from the
    Apple menu.

6. Check to see that the AppleTalk Active box is
    selected. If necessary, click to make AppleTalk
    active.

7. Select a zone, click on the LaserWriter icon, and
    select a LaserWriter.
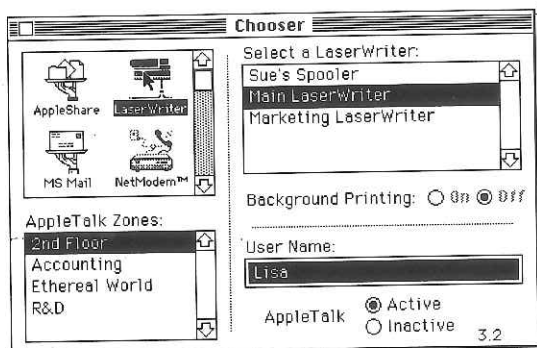
Selecting a network printer using the Chooser desk accessory

8. Close the Chooser to return to the Finder.

9. Choose Print Directory from the File menu. A one-page document should print.

10. Repeat steps 3 to 9 for each Macintosh.

Chapter 6 – Reference

Troubleshooting Tips

This section provides information to help you solve
network problems. This section only provides general
troubleshooting tips. If you are unable to solve a
problem yourself, call Farallon customer service at
(415) 849-2331.

Wiring tips

* Make sure that the terminating resistors are
  installed properly. Terminating resistors should be
  placed at each end of a daisy chain or backbone,
  and the end of each branch of a star.

* Make sure that all PhoneNET Connectors are
  plugged into the *printer ports* of Macintoshes and
  the AppleTalk port of other devices.

* Test the network for shorts, proper termination, and
  to see that the network is functioning properly. See
  Chapter 5, "*Testing a Network.*"

* Be sure you haven't exceeded the maximum
  recommended cable distances, number of
  branches, or number of devices. See "*Wiring
  guidelines for PhoneNET System cabling*" in
  Chapter 2.

Software tips

* Make sure that all Macintoshes start up from a
  disk containing the same version of the System,
  Finder, LaserWriter and LaserPrep files.

- Be sure that AppleTalk is active in the Chooser desk accessory. Also be sure the appropriate network service icon (AppleShare, LaserWriter and so on) is selected in the Chooser.

Traffic tips

- Analyze network traffic patterns to locate high traffic areas and evaluate error rates. TrafficWatch collects traffic data and includes utilities to analyze the data, providing the necessary information to optimize network performance.

- Consider adding a bridge to split a network into two separate but interconnected networks. If you already have two or more bridges, consider configuring your bridges to create an AppleTalk backbone.

- Consider adding gateways to create an Ethernet backbone.

- Consider purchasing a separate computer (preferably a Macintosh II) for each network service, instead of running all network services on the same computer.

Network management software from Farallon

PhoneNET CheckNET displays the name, address, and type of every device on the network. CheckNET can search for particular devices (even across multiple bridges and zones) and can sort by name, address, or device type. PhoneNET CheckNET is a powerful tool for network troubleshooting.

TrafficWatch is a network analysis package that displays network traffic in real time. TrafficWatch tracks packets sent between devices. An Excel macro lets you plot the data as graphs or charts.

Timbuktu is a collaborative software package that lets you share screens and operate Macintosh computers across an AppleTalk network for conferencing, network management, training, and on-line network support.

Technical specifications

Topology: parallel bus, low-resistance transformer isolated, floating ground

Signaling standard: EIA modified RS-422, balanced voltage

Signaling speed: 230,400 bits per second

Network signal rates: Speed independent. Speeds in excess of 1M Baud

Signal encoding: FMO (bi-phase) space

Frame format: SDLC (Synchronous Data Link Control)

Maximum distance between devices: ~4500 feet

Maximum number of nodes per network: Limited by traffic.

Node Identification: AppleTalk logical address is self-configuring, no user action required

RFI and Noise immunity: No RFI passive taps, noise immunity greater than 600 Volts

FCC Class: Verified to comply within FCC class A limits

Cabling: 22- 24-gauge telephone wall cable

ordinary 4-conductor flat telephone extension cable

Connectors: modular RJ11 four-pin connectors

AppleTalk compatibility: 100%

Recommended reading

Installing Your Own Telephones by Master Publishing, Inc. This book contains step-by-step installation instructions for replacing or adding telephones.

Technical Introduction to the Macintosh Family by Apple Computer, Inc. This book contains an overview of the technical features of the Macintosh family of computers. Published by Addison Wesley Publishing Company, Inc.

Inside AppleTalk by Apple Computer, Inc. This book discusses the technical and theoretical aspects of AppleTalk.

The Well-Connected Macintosh by Tony Bove and Cheryl Rhodes. This book provides a general overview of desktop communications. Published by Harcourt Brace Jovanovich Publishers.

Designing and Implementing Ethernet Networks by Bill Hancock. This books cover the theory and steps to install an Ethernet network. Published by QED Publishing.

Connections Magazine. A quarterly magazine reviewing recent topics in AppleTalk networking. Published by D.R. Kosiur, PO Box 5894 Fullerton, CA 92635.

Glossary

50-pin line tap: A device that taps into pair 21 of ordinary 50-wire (25 pair) office telephone cable. A 50-pin line tap can be reconfigured to tap into any wire pair.

active star: A network topology where the center of the star is a PhoneNET StarController with network branch cables radiating outwards.

Amphenol: A telephone industry 50-wire connector type. An Amphenol cable is used to connect a PhoneNET StarController to a wiring distribution block.

AppleTalk network system: 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.

AppleTalk port: A serial port on a Macintosh or AppleTalk-compatible device used for network communications. The AppleTalk port on a Macintosh is the printer port.

backbone: A network topology consisting 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.

branch: A length of cable in a star network that goes from the center of the star to one or more wall jacks.

bridge: A device that connects two AppleTalk networks. Bridges are often used to divide a network into separate, interconnected networks. *See also* **local bridge** and **remote bridge.**

CheckNET: *See* **PhoneNET CheckNET**

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

Ethernet: A high-speed network protocol.

gateway: A device which connects two or more networks that use different protocols. Gateways provide the necessary translation between the two network protocols.

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.

internet: A collection of interconnected networks.

line tap: A hardware connector that lets you access a pair of wires in a cable. *See also* **50-pin line tap**.

local bridge: A hardware device that connects two networks located in close proximity. Local bridges are often used to connect networks on different floors of the same building.

LocalTalk connector box: Apple Computer's connector for adding a device to an AppleTalk network.

modem: A hardware device that converts digital computer data into analog tones that can be transmitted over dial-up telephone circuits. Modem throughput speeds typically range from 1,200 bps to 19,200 bps.

modular extension cable: Ordinary 4-wire 26-gauge stranded cable. Modular extension cable is sometimes called modular flat cable. RJ11 plugs can be easily crimped onto the ends of modular extension cable.

network: A group of interconnected devices that share the same network number. A network often contains a file server, printer and individual workstations.

network manager: A person who coordinates the design, installation and management of a network. A network manager is also responsible for adding new users to the network, and troubleshooting problems.

network service: A network device that provides services such as file serving, electronic mail or print spooling to other devices on a network.

network topology: The physical layout of network devices. Network topologies include daisy chain, backbone, and star.

node: An addressable device on a network. A node can be a computer, printer or other device.

node number: A number that identifies a node. A node is automatically assigned a unique node number when the device first accesses the AppleTalk network.

ohm meter: A device that measures the resistance of electrical current flowing through a wire.

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

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.

PhoneNET Connector: The basic hardware unit that attaches a device to the network. The connector provides the necessary signal link for communicating between devices.

PhoneNET CheckNET: Diagnostic software available from Farallon for setting up and testing a network.

PhoneNET Repeater: A device which amplifies and reclocks a network signal. You can install multiple PhoneNET Repeaters to extend the length of a network to several miles.

PhoneNET to LocalTalk Adapter Cable: A cable which connects a PhoneNET Connector to a LocalTalk connector box. This adapter has an RJ11 plug at one end, and a DIN-3 at the other.

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 System: 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.

punchdown block: A wall-mounted telephone wiring distribution block used to connect many pairs of wires.

punchdown tool: A tool used by telephone installers to attach wires to a punchdown block.

remote bridge: A hardware device that connects two networks that are in different geographic areas by modem or satellite link.

repeater: A device that reamplifies 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 affect on the speed of the network signal.

RJ11: A telephone industry connector type.

RJ11 plug: A clip that is crimped onto the end of a piece modular extension cable.

RJ11-mounted terminating resistor: A terminating resistor mounted on an RJ11 plug. *See also* **terminating resistor**.

server: A network device that provides services such as file serving or print spooling to multiple workstations on a network.

socket number: 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.

star: A network topology where several network branch cables are connected at one central location. *See also* **passive star, active star**.

StarController: *See* **PhoneNET StarController**

telephone tone tester: A device used to determine which wires in a wall jack are connected to which wires in a telephone closet. Includes a tone generator and tone receiver.

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.

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.

terminal block: A wiring distribution block often used in residential telephone installations.

terminating a network: Installing a 120-ohm resistor at the end of a length of cable to reduce reflections and increase network reliability.

terminating resistor: A small electrical component used to properly balance the electrical signal by adding resistance to the end of a length of cable.

Timbuktu: A collaborative software package that lets you share screens and operate Macintosh computers across an AppleTalk network for conferencing, network management, training, and on-line network support.

TrafficWatch: A network analysis package that displays network traffic in real time. TrafficWatch tracks packets sent between devices. An Excel macro lets you plot the data as graphs or charts.

trunk: *See* **Backbone.**

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.

wiring distribution block: Hardware used to interconnect many pairs of wires. *See also* **punchdown block, harmonica block, patch panel** and **terminal block.**

zone: A selected group of networks defined by bridges and gateways. A zone can contain a single network or the entire internet. Zones are typically used to group users together with shared network services.

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Limited Warranty and Disclaimer

Farallon Computing, Inc. warrants the PhoneNET Connector and cabling against defects in materials and workmanship for five years 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, along with satisfactory proof of purchase. This warranty is exclusive of all others, whether written, expressed or implied and Farallon hereby expressly disclaims all implied warranties including the warranties of merchantability and fitness for a particular purpose. Farallon is not responsible for special, incidental or consequential damages resulting from the use of this product, including, but not limited to, lost profits, down time, loss of goodwill, damage to equipment or property, or any costs of recovering, reprogramming, or reproducing any program or data. 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 improper installation of a PhoneNET System product. 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 the PhoneNET System.