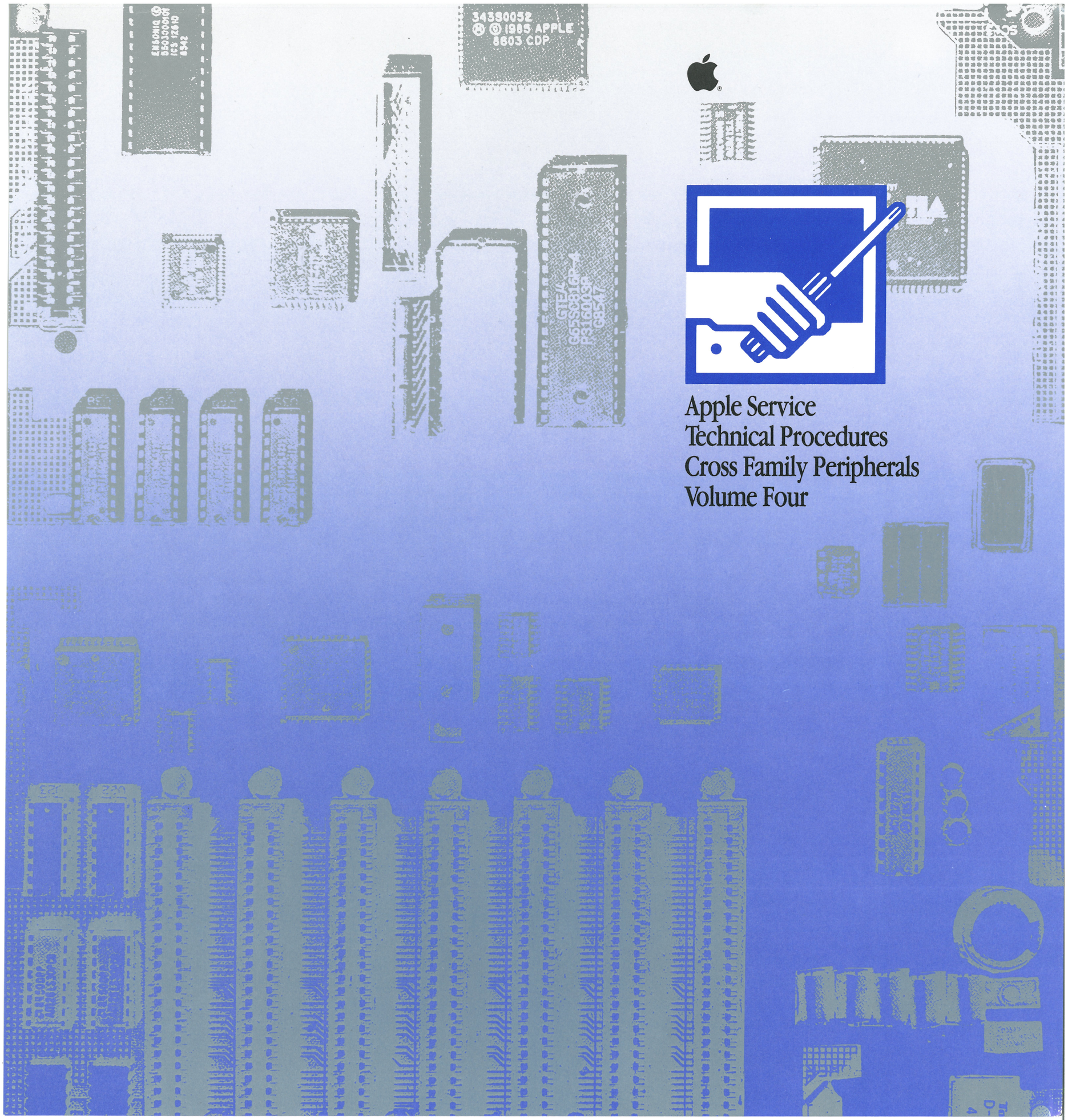

Apple Service Technical Procedures Cross Family Peripherals Volume Four

Quick Reference: Apple Module Symptom *Codes*

All Logic Boards

	Startup/Run Problems
150	Bad or no startup tone
151	No Mac face; screen bright
152	Sad Mac; self-test fails; startup error
153	System bombs or crashes
154	No power light indicator with good power supply
155	Restarts or shuts down randomly
156	Can't shut down
	Video/Sound Problems
160	Bad or no color on display
161	Distorted or no video; system boots OK
162	Distorted or no sound; system boots OK
	I/O Device Problems
170	Bad or no response (keyboard, mouse, trackball...)
171	Bad or no response from game paddle/joystick
172	Serial port failures
173	Printing or Appletalk problem
174	Communications or modem port problem
175	Bad expansion slot (Apple II, Direct, NuBus...)
	Disk I/O Errors
180	Can't boot/read internal floppy disk
181	Can't boot/read external floppy disk
182	Can't write/format internal floppy disk
183	Can't write/format external floppy disk
184	Can't boot/read internal SCSI drive
185	Can't boot/read external SCSI drive
186	Can't write/format internal SCSI drive
187	Can't write/format external SCSI drive
	Miscellaneous Problems
190	Control Panel settings don't work
191	Connector or jack problems
192	SIMM socket problems
193	Board is cracked, damaged
194	Bad battery

All Monitors - CRT & Analog Boards

250	Black screen
251	Vertical bright line
252	Horizontal bright line
253	Rolls vertically
254	Diagonal stripes
255	Dim or low intensity
256	Fuzzy screen, unclear characters
257	Unstable picture; logic board OK
258	Incorrect picture size or alignment
259	Lighted screen, no picture
260	Fan not spinning
261	Color not adjustable; no color
262	Distorted sound
263	No power; no raster

All Drives

350	Won't eject
351	Won't format
352	Disk does not spin
353	Too many bad blocks
354	Won't mount
355	Won't recognize disk formatted on other drive
356	Won't read/write data; disk spins
357	Won't write data
358	Excessive read/write errors
359	Won't boot; reads/writes okay
360	Excessive seeking
361	Icon doesn't appear on desktop; formats OK
362	Won't format; able to see drive in SC setup
363	Won't format; unable to see drive in SC setup
364	Unable to access drive; system folder present
365	Noisy; works OK

All Power Supplies

450	Clicking noises
451	Fuses keep blowing
452	Causes system failure
453	Noisy; works OK
454	No power
455	System randomly resets

Keyboards, Mice, Input Devices

550	No or bad response
551	Bad keyswitch or button
552	Foreign substance spilled on unit
553	Sticky or bouncing keys
554	No cursor response

All Printers

650	Improper print head movement
651	Paper won't feed
652	Self-test OK; won't print from host
653	Fails self-test
654	Won't select from front panel
655	Printer not seen in Chooser
656	Prints blank pages
657	Prints black pages
658	Print is distorted or uneven
659	Indicator lights suggest fault
660	No power light

Instructions

1. From the above lists locate the symptom that reflects the problem encountered on the module.
   Note the associated code.
2. Select the appropriate modifier #, and replace the with it. Choose the highest # modifier that applies. The modifier tells how or when the failure occurs.
3. Write the four digit code on the SRO form.

Modifier Codes

8	Inoperable upon first use
7	Noisy
6	Fails only with application software (pass diagnostic)
5	Depends on configuration (memory, peripherals,...)
4	Fails after warmup
3	Environmental; can't duplicate customer symptom
2	Intermittent problem
1	Continuous

Choose highest numbered modifier that applies.

Example

A Macintosh logic board is crashing after being on for an hour or more only when inserting a disk.

Choose 153, "System bombs or crashes." The board "fails after a while" and "depends" on what you did. 4 and 5 both apply, so choose the higher one: 5

Enter the code 1535 on the SRO form.

For more information refer to the *Apple Service Technical Procedures*, You Oughta Know, Section 5.

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Apple Technical Procedures

AppleTalk

Section 1 – Basics

❑ CONTENTS

❑ WHAT IS APPLETALK?

The AppleTalk® Network System is a type of local area network. A local area network provides a communication path between two or more devices and controls communication over that path (see Figure 1).

AppleTalk is the name of the protocol that defines how the AppleTalk Network System operates. The AppleTalk protocol is as important to AppleTalk product designers as the local building codes are to carpenters and plumbers. The protocol defines requirements for building products that operate successfully in an AppleTalk Network System.

This section describes the components of the AppleTalk Network System, how networks can be connected together to form internets, and how the AppleTalk protocol operates.

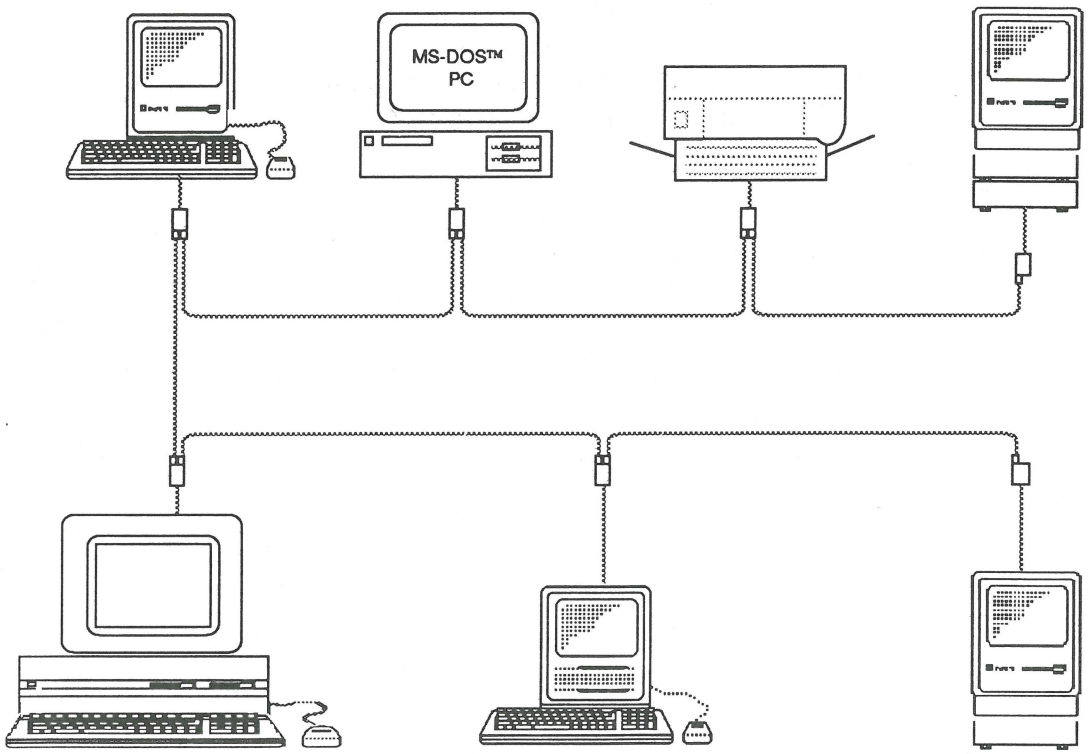


FIGURE 1

❑ APPLETALK OVERVIEW

The sole function of the AppleTalk Network System is to transfer data from one location to another. When you print a file, data is transferred between your computer and the printer. When you send a file to another user, it is transferred from your computer to another computer.

The AppleTalk Network System uses a single communications path (usually cable) to conduct all data transfers from one device to another. This single-path design reduces installation complexity, time, and costs.

The sole function of the AppleTalk protocol is to define how multiple data transfers take place over a single shared data path. To share this path and transfer data reliably, all users must follow a common set of rules that are similar to traffic laws. By following the AppleTalk protocol, product designers build a set of common rules into their products to minimize network traffic problems.

The implementation of the AppleTalk protocol results in specially designed hardware and control logic. The required hardware components are a communication path (usually cabling) and an interface from each device to the communication path. The control logic is the portion of hardware or software in each device that controls the data transfer.

❑ APPLETALK NODES

"Node" is another term for a device on a network. When we use the term node, we are referring to any device that contains the AppleTalk hardware and control logic needed to send and receive data.

Types of Nodes

The AppleTalk protocol allows as many as 32 nodes on each network. Depending on their use, these nodes may be classified as workstations or shared devices (see Figure 2). Most data transfers occur between one workstation and one shared device.

- A *workstation* is any computer that is used on a network by a single user.
- A *shared device* is any device that may be used regularly by more than one workstation on the network.

Types of shared devices include printers, print servers, disk servers, file servers, electronic mail servers, and communications servers.

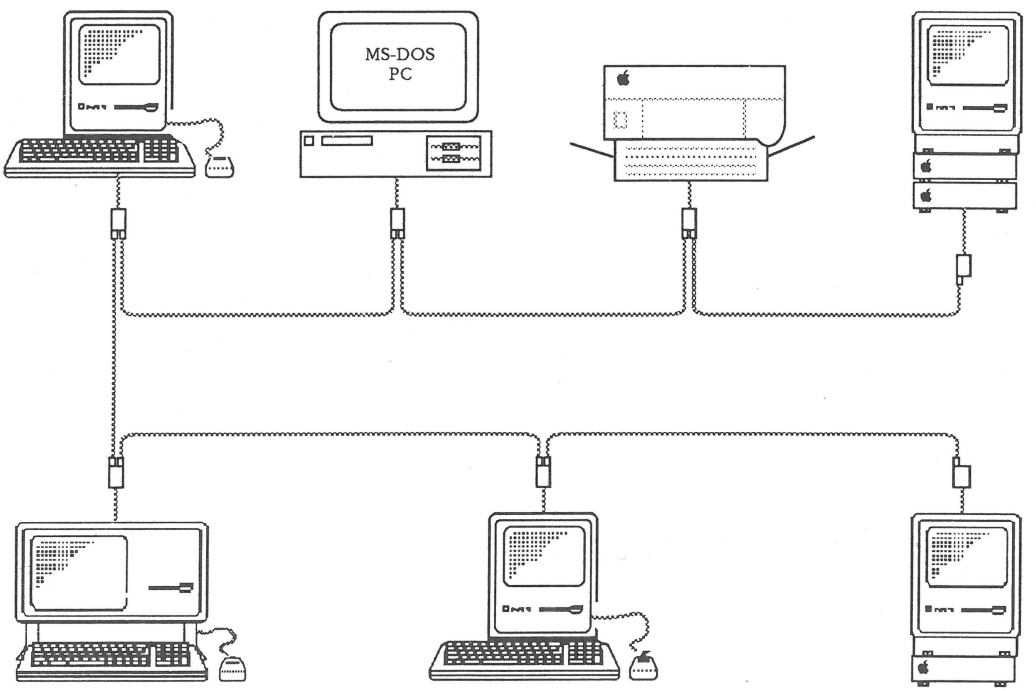


FIGURE 2

Workstations

The workstation is the network user's computer. This is where most data transfers are initiated.

Apple's Macintosh® family of computers and the Apple IIGS® computer are delivered with the required AppleTalk control logic and are ready to be used as workstations. The Apple II Workstation Card adds control logic to Apple IIe computers, and the AppleTalk PC Card adds the AppleTalk control logic to MS-DOS™ personal computers. All these products connect to the LocalTalk™ Cabling System for AppleTalk networks.

Printers

The AppleTalk printer is a shared device that can accept print jobs from any network workstation that has the appropriate printer driver installed.

Most of Apple's printers (in the LaserWriter® and ImageWriter® families) are delivered with the required AppleTalk control logic, but some printers may require the installation of an AppleTalk Option, which is available from Apple. All of Apple's AppleTalk-equipped printers connect to the LocalTalk Cabling System.

Print Servers

Print servers allow workstations to send print jobs to a printer at any time. After the job is sent, the workstation is available for other uses, even though printing may not be complete.

The print server operates as a temporary storage center for data to be printed. Since a printer can only print one job at a time, the print server collects the jobs and forwards them to the printer one at a time.

The AppleShare® Print Server program runs on a Macintosh and collects print jobs for up to five printers at one time. The print server supports all Apple LaserWriter and ImageWriter printers that are AppleTalk compatible. Special features include a status display and the ability to operate with one other server program on the same Macintosh at the same time.

Disk Servers

A disk server is a shared device that allows more than one workstation to share the hard disks that are connected to the server. The space on the hard disks is divided into fixed sections dedicated to individual users. For example, a disk server for a 20M hard disk might allow 10M for one user and 5M each for two others. Each user may add files until he uses up the disk space in his section of the disk.

File Servers

File servers are similar to disk servers in that they allow more than one workstation to share hard disks. The difference is that each disk is available to all users. Each user may add files until the entire disk is full.

The AppleShare File Server is a program that runs on a Macintosh. The program's features include file security and the ability to use the same Macintosh to run one other server program. Depending on the capabilities of the applications on the network, some applications and files may be used by more than one user at a time.

> ***Note:*** If your network includes Apple IIGS computers that will be using AppleShare, you will need to install the AppleShare IIGS Workstation Software at each AppleShare File Server.

Electronic Mail Server

An electronic mail server is a shared device that allows workstations to send messages and files to each other. Electronic mail servers require hard disk storage, and additional software must be used at each workstation to send and receive messages.

In a typical exchange, the electronic mail server acts as an intermediate storage device and control center. The sending workstation sends the message to the electronic mail server, and the server tries to contact the destination workstation. When contact is established, the message can be forwarded.

Communications Server

A communications server is a shared device that allows network users to communicate with non-AppleTalk systems. For example, a communications server may link AppleTalk users to another type of network, or it might allow AppleTalk users to share modems.

A communications server operates as an interpreter between AppleTalk and a non-AppleTalk system. Data transferred in either direction is accepted in the source format and protocol, translated to the destination format and protocol, and retransmitted.

To use a communications server, a user must have the proper software installed at the workstation. The cabling in the AppleTalk Network System provides the path to the server and eliminates the need to add an additional cable.

Inside Each Node

A cabling interface and AppleTalk control logic are required inside each node so that data can be transferred from one node to another (Figure 3).

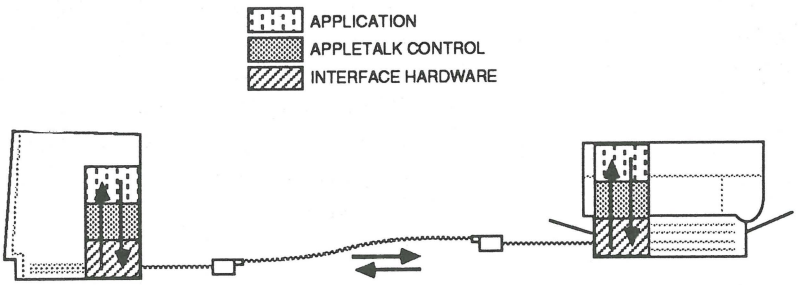


FIGURE 3

Cabling Interface Hardware

Figure 4 shows a block diagram of the cabling interface hardware provided in Macintosh computers. This hardware allows direct connection between the control logic in a node and the LocalTalk Cabling System.

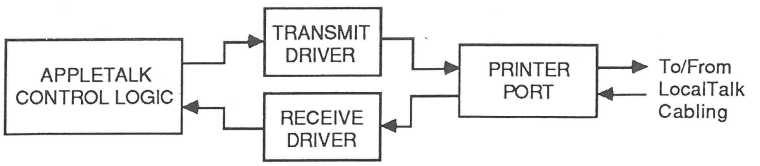


FIGURE 4

The EtherTalk™ Interface Card is another type of cabling interface hardware offered by Apple. The EtherTalk Interface Card provides a direct connection between the AppleTalk control logic in a Macintosh II and the EtherTalk cabling system.

AppleTalk Control Logic

The AppleTalk control logic in each node executes all AppleTalk data transfers.

During a typical data transfer, an application program such as a word processing program transfers data to the AppleTalk control logic, which transfers data through the cabling interface hardware to the cabling. At the destination device, the resident AppleTalk control logic receives the data from the cabling interface hardware and delivers the data to the destination application.

The control logic in each node may be stored in software, hardware, or both. In Macintosh computers, the control logic is split into a number of pieces. Some of the control logic is installed in the System file, and some in device-specific drivers such as LaserWriter and LaserWriter Prep.

To complete a data transfer, the appropriate AppleTalk control logic must be installed in the devices at each end of the data transfer. For specific hardware and software requirements, always refer to the product manuals. For a discussion on the operation of the AppleTalk control logic, see "AppleTalk Control Logic" later in this section.

❑ CABLING

Cabling is the link between all AppleTalk nodes. Apple builds products for two different cabling systems: LocalTalk and EtherTalk.

LocalTalk Cabling System

Figure 5 shows the LocalTalk cables and connectors available from Apple Computer. The following paragraphs describe the general features of LocalTalk. For more specific information, see *LocalTalk Cabling System Technical Procedures.*

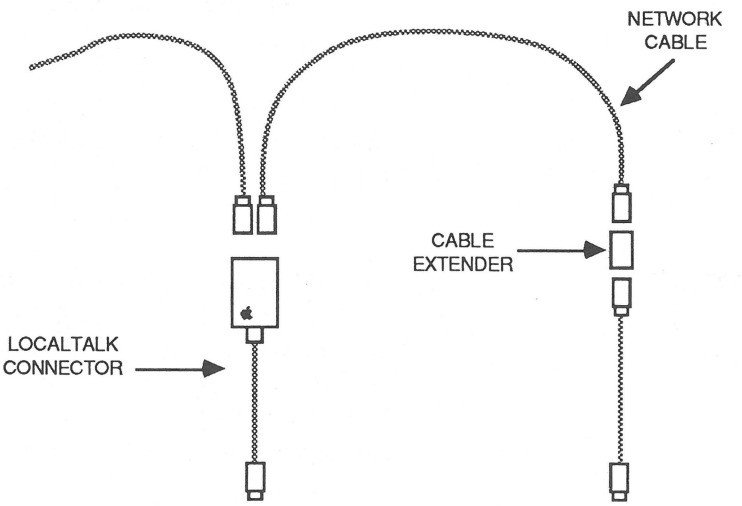


FIGURE 5

LocalTalk Connectors

A LocalTalk connector is required for every node on the network. The short cable on the connector plugs into the node, and two LocalTalk cables can be plugged into the connector box. This connector is made in several versions to accommodate the different plug connectors used by AppleTalk nodes.

LocalTalk Cables

LocalTalk cables provide the link between the connectors at each network device. The maximum length of the LocalTalk cabling system is 300 meters (about 1,000 feet).

LocalTalk cables are available in 2-, 10-, and 25-meter lengths and in a LocalTalk Custom Wiring Kit. The Custom Wiring Kit includes 100 meters of shielded LocalTalk cable, 4 LocalTalk Cable Extenders, 20 LocalTalk Cable connectors, and the hardware needed to assemble the cables.

Cable Extenders

LocalTalk cable extenders join two cables to create a longer cable.

EtherTalk Cabling System

The EtherTalk cabling system is a high-performance cabling system that uses coaxial cables, which are usually installed by professional cable installers. Apple does not provide cables for the EtherTalk cabling system, but these cables may be purchased from cable distributors or electronics stores.

Topology

"Topology" refers to the organization of network nodes and cabling. Apple's cabling systems use the bus topology. Other manufacturers produce cabling systems that use different topologies.

In bus networks (see Figure 6), all the nodes are connected in a line. The end nodes connect to just one cable, and all other nodes connect to two cables. Loop networks are not allowed.

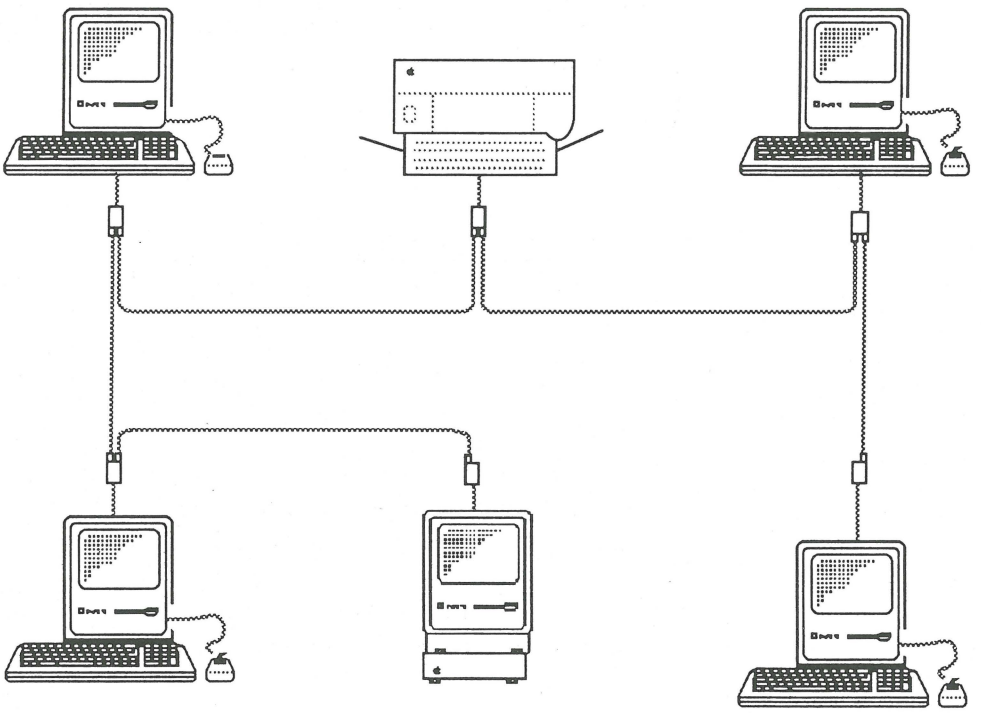


FIGURE 6

❑ INTERNETS

An internet is a collection of individual networks, joined by *bridges* and *gateways* (see Figure 7). Internets expand the communications path beyond the cabling and node limits of the individual network.

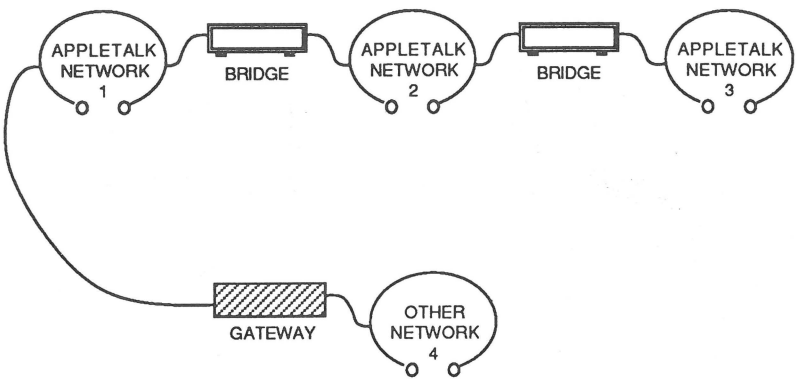


FIGURE 7

Bridges and gateways are additional types of nodes, and each device requires an application program and at least two network communication ports. For each AppleTalk port, there must be AppleTalk control logic and interface hardware, as shown in Figure 8.

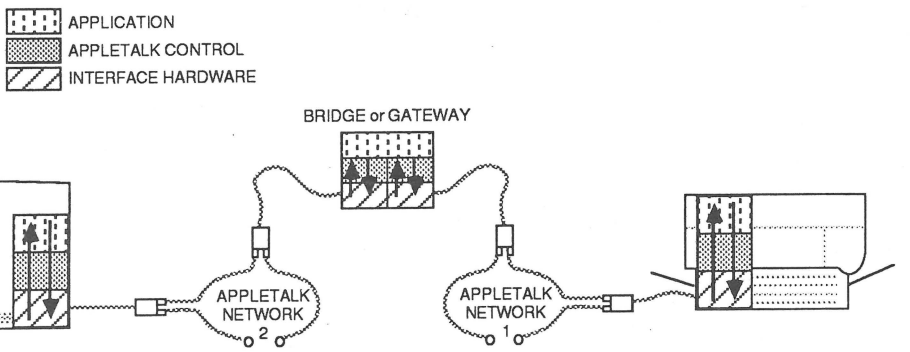


FIGURE 8

Bridges

AppleTalk bridges connect one AppleTalk network to another AppleTalk network. When workstations want to use a shared device in another network, the data path can travel through as many as 15 bridges to reach the shared device. If the shared device is 16 or more *hops* away (each hop is equal to one bridge on the data path), the two nodes cannot communicate.

There are basically two types of bridges: full bridges and half bridges. Bridges can be used to create different internet topologies. Bridges may also be used to divide an internet into management units called zones.

Full Bridges

A *full bridge* is a single device that connects two AppleTalk networks. This bridge counts as one of the 32 nodes allowed on each network.

Note: Full bridge is another name for the standard bridge. The term "full bridge" is only used when it is necessary to distinguish a bridge from a half bridge.

Half Bridges

Half bridges connect two networks when the networks are not close enough together to use a full bridge. Figure 9 shows how two half bridges function as a full bridge.

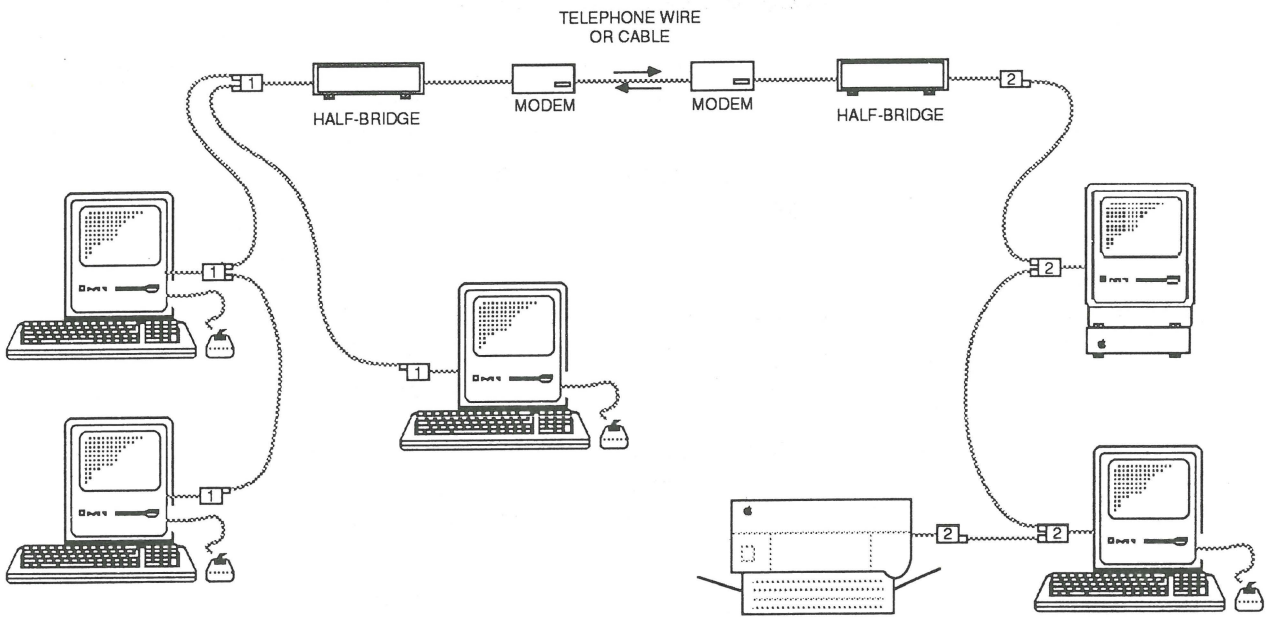


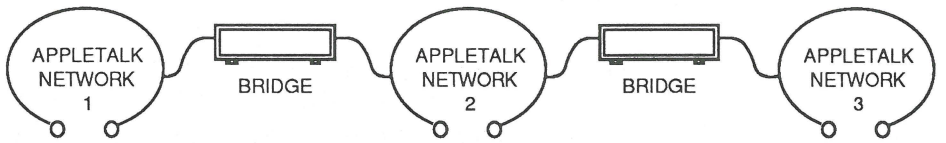
FIGURE 9

Half bridges must be used in pairs, and each half bridge counts as one node in the network to which it is connected. The path through two half bridges is one hop.

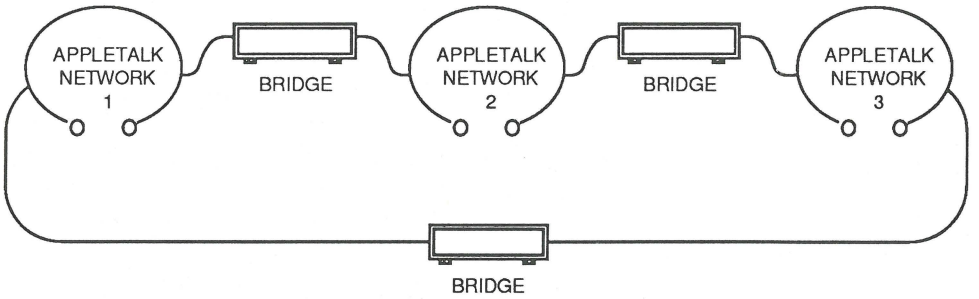
To connect a pair of half bridges locally, a cable can be used. For remote networks, the half bridges can connect to modems and use telephone lines, fiber optics, or even a satellite to complete the connection.

Internet Topologies

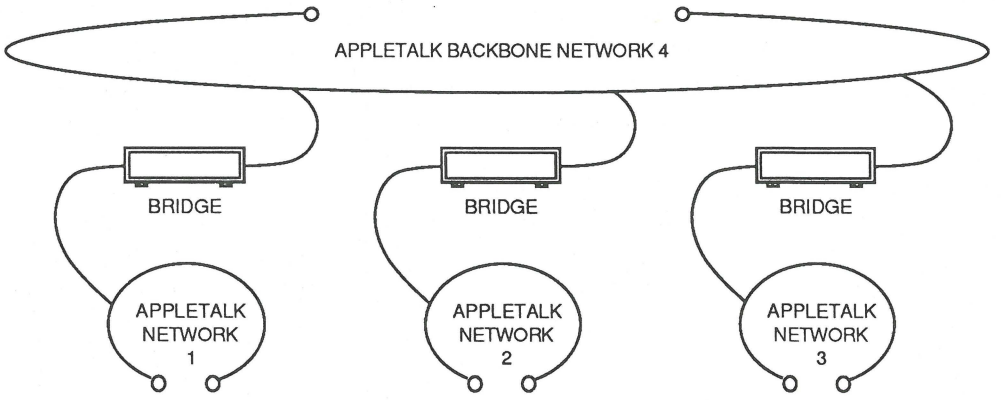
Bridges and networks can be connected to create several different types of internet topologies. Figure 10 illustrates the bus, loop, and backbone topologies.



BUS TOPOLOGY



LOOP TOPOLOGY



BACKBONE TOPOLOGY

FIGURE 10

The following descriptions indicate the benefits of each topology and the maximum number of networks that will receive full support. (By full support, we are referring to the number of networks that may be connected before two networks become separated by more than 15 hops.)

- The *bus* topology is the simplest and most economical to create. It requires the minimum number of bridges and connections. Bus topologies can fully support up to 16 networks.

- The *loop* topology requires one more bridge than the bus topology, but provides a secondary or backup path in the event of a bridge failure. Loop topologies can fully support up to 31 networks.

  Note: Loop internets should not be confused with loop networks. Loop internets are a group of bus networks linked by bridges. Each individual network must use the bus topology and may not be connected in a loop.

- The *backbone* topology also requires one more bridge than the bus topology. It can fully support up to 32 networks.

To fully support the maximum number of networks, use combinations of the above topologies.

For example, if you use 26 bridges to join 27 backbone networks in a loop (30 networks bridged to each backbone), then you can provide full support to 810 networks (up to 25,110 workstations and shared devices).

When creating internets, try to anticipate network usage. Each network hop adds to the time required to complete a data transfer. Internets much smaller than the above example will operate extremely slowly if all workstations in the internet frequently use shared devices in other networks. With careful planning, internets much larger than the above example can be used.

Zones

A zone is a network management feature of AppleTalk. Whenever bridges are used, AppleTalk allows the bridge installer to separate the internet into zones and to name each one. The entire internet can be a single zone, or it can be divided into as many zones as there are networks. Zones may include networks that are not connected together. (See Figure 11.)

Zones control access to their shared devices. Workstations can list and access shared devices in only one zone at a time. To use a shared device in a different zone, a user uses an application (the Chooser for Macintosh users) to change zones.

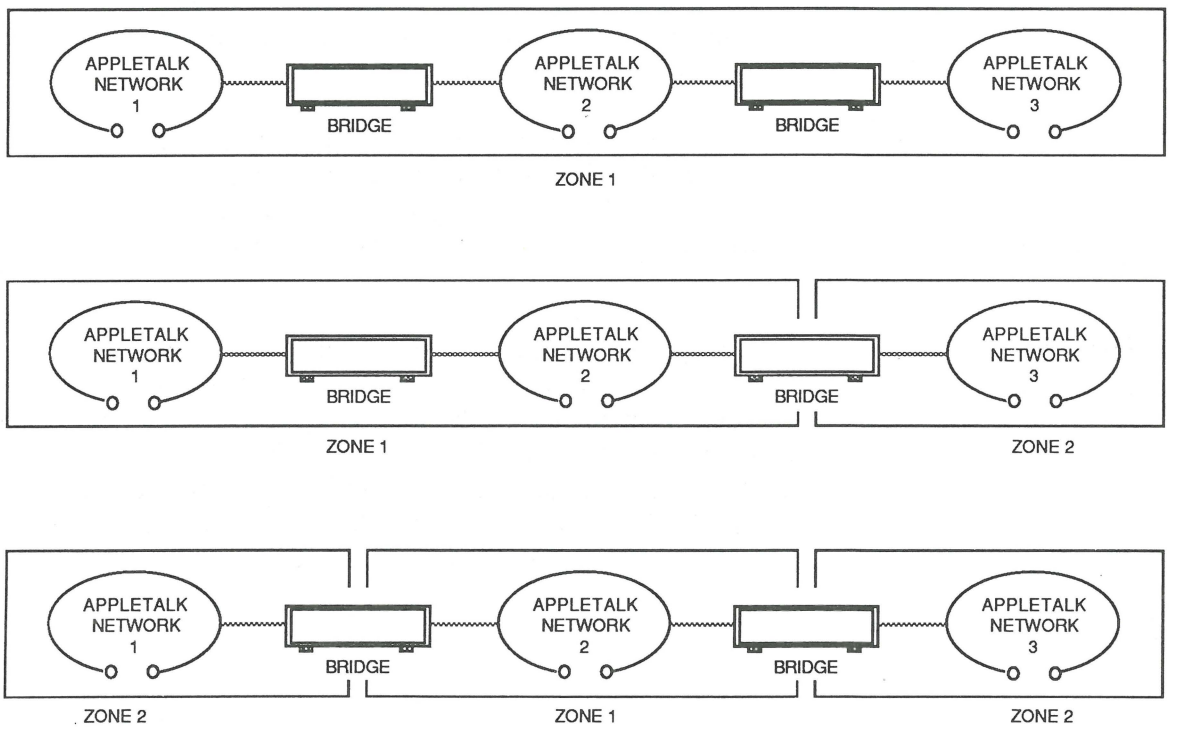


FIGURE 11

To understand how zones can be helpful, imagine that you have just created an internet with 810 networks. Also imagine that there are 810 LaserWriters in this internet.

If the entire internet is created as a single zone, you will have to select from 810 LaserWriters on Chooser. If the internet is divided into zones, you can only select from the LaserWriters within your zone. If you want to use LaserWriters in other zones, you can use Chooser to change zones.

Gateways

An AppleTalk gateway connects an AppleTalk network to another type of network. Since each type of network uses its own method of data coding and signal transmission, a gateway is needed to interpret between any two different types.

AppleTalk gateways are used for access to non-AppleTalk shared devices, and for access to non-AppleTalk backbone networks. Gateways may be used for both purposes in the same internet.

Non-AppleTalk Shared Devices

An AppleTalk gateway may be used to allow AppleTalk workstations to use a shared device on a non-AppleTalk network. The shared device could be similar to any of the shared devices available for AppleTalk, or it may be a mainframe computer. The workstation application, the non-AppleTalk shared device, or both must be designed for this purpose.

Non-AppleTalk Backbone Networks

An AppleTalk gateway can also be used to connect AppleTalk networks to a non-AppleTalk backbone (Figure 12). Each AppleTalk network uses the gateway and the backbone network to connect to other gateways, leading to other AppleTalk networks.

Depending on the type of network selected and the network use patterns, using gateways and a non-AppleTalk backbone may be better than using bridges and an AppleTalk backbone. This is because the 15-hop count also applies to gateways. If the non-AppleTalk network allows more than 32 nodes, more networks can be connected to the internet and the hop count (and time) between networks will be less.

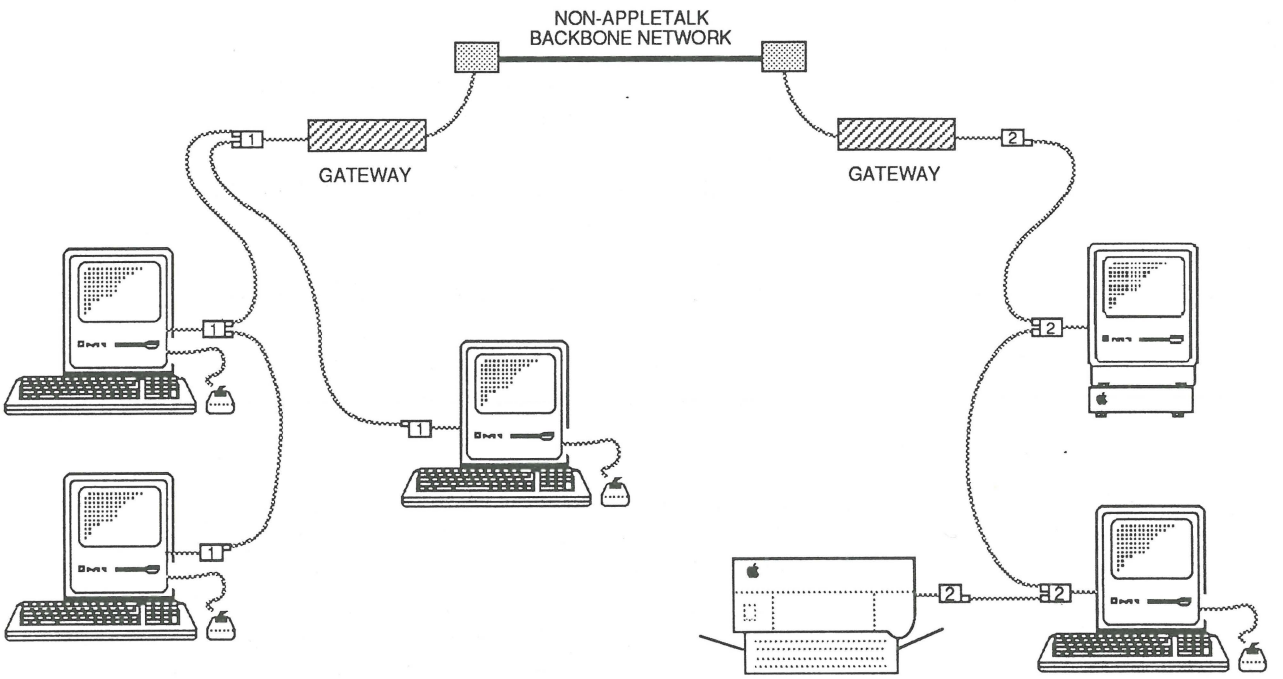


FIGURE 12

❑ APPLETALK CONTROL LOGIC

The AppleTalk control logic is the connection between the application and the cabling interface hardware in a node. The AppleTalk control logic controls data transfers so that

- The cabling is used for just one data transfer at a time
- Many data transfers can *appear* to happen at the same time to any one user
- Nodes can locate shared devices on a network or internet
- Data is delivered to the correct node on a network or internet
- Data transfers take the route with the least number of hops on a loop internet
- Data transfers are checked for errors

These control logic tasks can be divided into network configuration and data packaging tasks.

AppleTalk Configuration

AppleTalk configuration is the process of assigning addresses to all appropriate network devices. AppleTalk uses these addresses to specify what device is sending a message and what device should receive it. Without addresses, the nodes on the cable (the shared data path) would not know when to receive a message and when to ignore it.

Figure 13 lists the addresses used on an internet. These addresses are stored in a names directory on each network and in routing tables in each bridge or gateway. The following paragraphs describe the addresses required, the names directory, and the routing table.

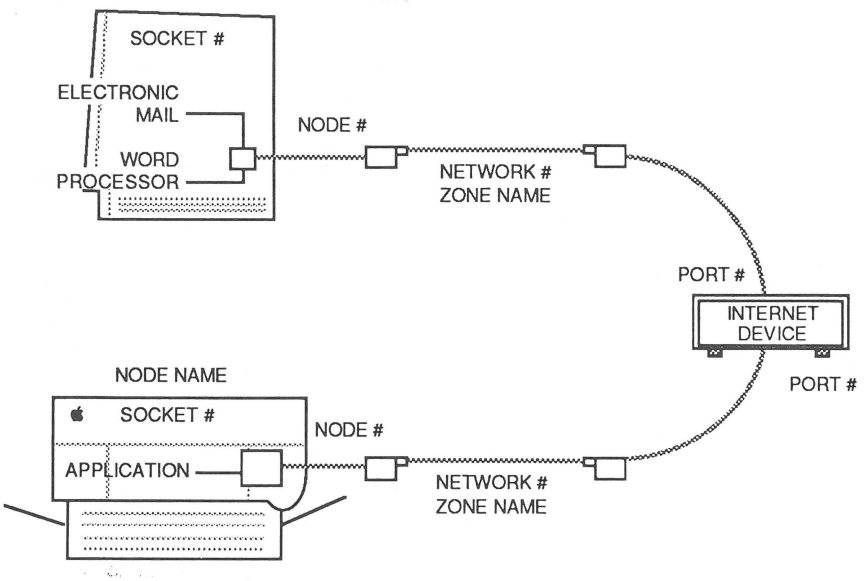


FIGURE 13

Socket Addresses

Socket addresses identify the sockets at each end of a data transfer. A socket is a data path between the AppleTalk control logic and an application program in a node.

Sockets are opened and closed by an application program. Some applications may open a single socket, while others will open separate sockets for data in and data out. Still other applications (such as file servers) may open one or more sockets for each user.

Node Addresses

Node addresses are used to identify the source and destination nodes used in a data transfer. Within a network, these addresses must be unique so that there is no confusion during data transfers.

To assure a unique address, the control logic in each node picks a random address number each time power is applied and AppleTalk is started. AppleTalk then tries to send a message to that address. If there is no response, the number is kept. If there is a response, the process is repeated until a unique address is found.

Node addresses must be a number between 1 and 254. Node numbers 1–127 are usually assigned to workstations, and numbers 128–254 to shared devices, but there are situations where a device uses a number from the opposite set. The special address 255 is reserved for messages that are broadcast to all nodes (for example, a search for shared devices).

Node Names

Node names allow users to identify a node by name instead of by a series of numbers. To assist in locating devices, node names are linked to node types and zones.

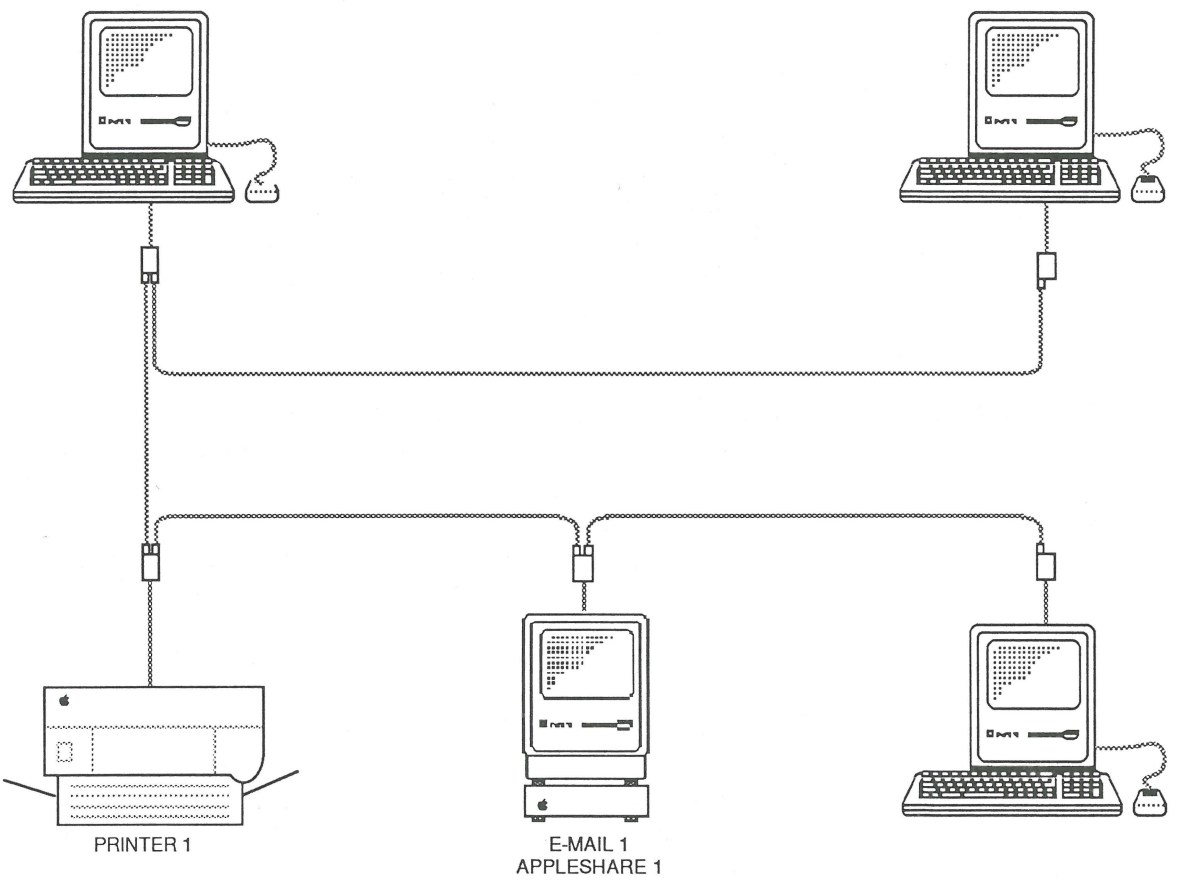
A node is named by an application that runs in that node. The application links the name to the current socket, node, and network addresses for that device. If more than one application is running in the node (for example, AppleShare File Server and AppleShare Print Server), the node may have more than one name.

The application that names the node also specifies a node type and zone for that node. The node type is a name such as LaserWriter that identifies what that node is. The zone name applies to internets and is assigned by an internet device such as a bridge. The node type and zone allow a user to search for the names of all devices of a specified type in a specified zone.

When the node-naming process is complete, the node name, type, address, and zone are added to a names table in the control logic.

Names Directory

The names directory is the control logic service that provides access to the names table in each node on an internet (see Figure 14). At the request of an application, the control logic can broadcast a lookup request to find all the registered names in a selected zone. The lookup request can specify the name of a device to verify an earlier request, or it can specify a type of device to limit the responses.



NAMES DIRECTORY

NAMES TABLE		
Zone Name		
Node #		
Name	Type	Socket
Printer 1	xxx	#

NAMES TABLE		
Zone Name		
Node #		
Name	Type	Socket
E-Mail 1	xxx	#
AppleShare 1	xxx	#

FIGURE 14

The response to a lookup request is a list of the names table entries that meet the specifications of the request. These entries include all address information required to transfer data to or from the application(s) in the responding node.

If you have used the Macintosh Chooser, you have used an application that makes use of a names directory. When you select the **LaserWriter** icon in Chooser, you are asking the control logic to list the names of all the nodes that are LaserWriters. When you select a LaserWriter name, Chooser remembers it and looks up the LaserWriter's address each time you want to print.

Network Addresses

Since node addresses may be duplicated in other networks, the network address is used with the node address to specify the network location of each node. The network address is assigned by the installer of an internet device. If the network is not on an internet, the network number is 0, indicating no network number and no zone.

Zone Names

The zone name is assigned by the installer or the administrator of an internet device. If the network is not on an internet, there is no zone name. For more information on zones, refer to the "Internets" section above.

Internet Device Addresses

Internet device addresses are used by the internet devices to build the routing table. The internet device address is assigned by the installer of an internet device. The installer must also assign a port number for each port that connects to an AppleTalk network.

Routing Tables

The routing table is the control logic feature in each internet device that maps the connection to the other networks. When a data transfer message is received by an internet device, it compares the destination network number of the message to a network number in the routing table. The internet device forwards the message based on the information in the routing table.

Figure 15 shows two examples of routing tables in a loop internet. The routing table in each internet device lists the network addresses on the internet. Stored with each address is a port number, next bridge number, hop count, and status.

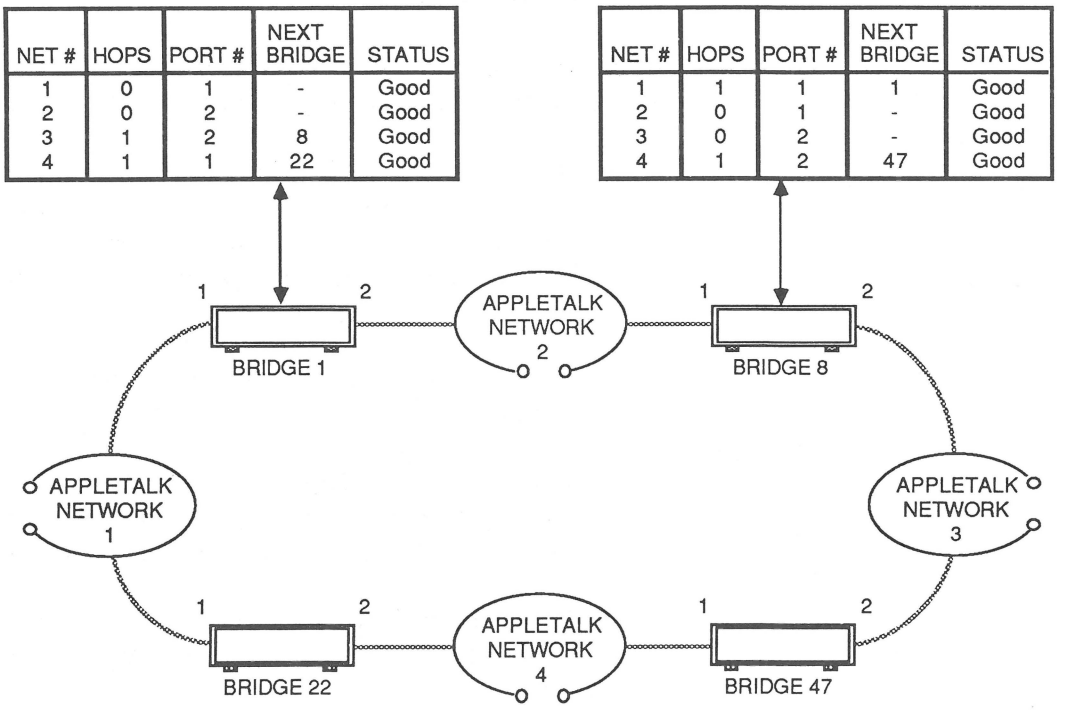


FIGURE 15

The port number identifies the device port that leads to the destination network. If there are additional bridges leading to that network, the address of the next bridge is included. The hop count is used to measure the distance to the destination network.

The status is a measure of how long ago the table entry for that network was updated. Each routing table must be updated regularly. If it is not updated within a set period of time, the status changes from good to suspect. If the entry is not updated after an additional period of time, the entry status changes from suspect to bad and that table entry is discarded.

The control logic in each internet device creates its own routing table when it is installed and operating. The first entries are for the networks directly connected to the device. Then the device forwards its routing table to any other internet devices on the adjoining networks. This forwarded routing table is called a *routing tuple.*

When any internet device receives a routing tuple, it compares the network entries with its own.

- If the tuple reveals a new network number with a hop count less than 15, the internet device adds one to the hop count (to cover the hop to the sending bridge) and adds the network entry in its own routing table.
- If a network entry has a hop count of 15, it is ignored.
- If the same network has different entries in the routing tuple and in the receiving bridge, the entry with the lowest hop count is recorded.
- If a network entry in the tuple is an exact duplicate, the status for that entry is listed as good.

Data Packaging

Data packaging is the control logic feature that allows multiple data transfers to appear to happen at the same time. Instead of transferring all the data at once, the control logic transfers a portion of the data, waits, and transfers another portion.

The portion of the data that is transferred is packaged in a network message called a packet. As shown in Figure 16, each packet contains address and control information, the data to be transferred, and error-checking data.

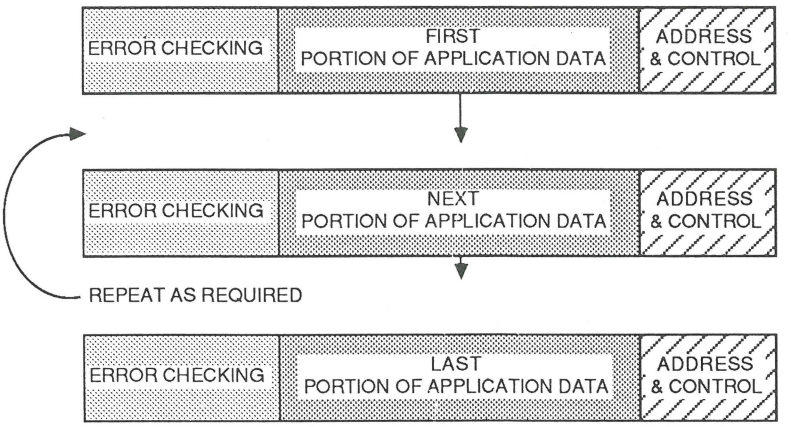


FIGURE 16

The address information is the socket, node, and network addresses of the applications at each end of the data transfer. The control information is provided so that the control logic at each end of the transfer can provide transfer status to the other. This is discussed in more detail below.

The error-checking data is generated by applying a formula to the preceding information in the packet. When the packet is received at the destination, the same formula is applied and compared to the error-checking data received. A match indicates an error-free transfer, a mismatch signals an error. Packets with errors are discarded and must be retransmitted.

Figure 17 shows how multiple data transfers appear to take place at the same time. After the control logic sends a packet, it must wait before it can send another. While it is waiting, any other nodes are free to send data packets.

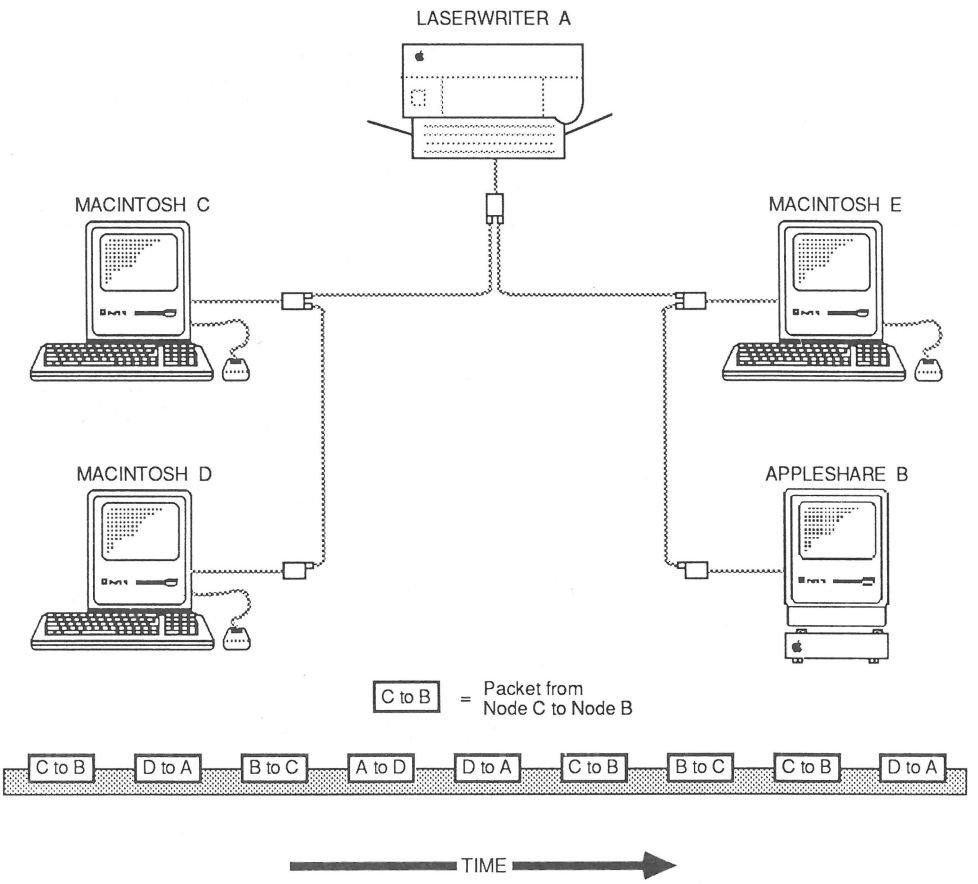


FIGURE 17

Before the control logic sends a data packet, it "listens" to the network to see if any data is being transmitted. If the network is quiet, it waits again and then listens again. If the network is still quiet, the data transfer begins.

The data transfer begins with an exchange of packets between the applications at each end of the transfer. This exchange is called *handshaking* and is used by the control logic at the source node to find out if the destination application is available for a transfer.

As shown in Figure 18, handshaking begins when the source node sends a request-to-send (RTS) packet to the destination. If the destination responds with a clear-to-send (CTS) packet, the source node transmits a data packet. Handshaking is repeated for every data packet until all data is transferred.

To identify and track packets, the control logic enters transfer status information in the control section of each packet. Transfer status information might indicate an RTS or a CTS packet, or a data packet with a packet order number. As shown in Figure 18, there is also a confirmation packet. These controls allow the control logic to retransmit lost packets instead of transferring the entire message again.

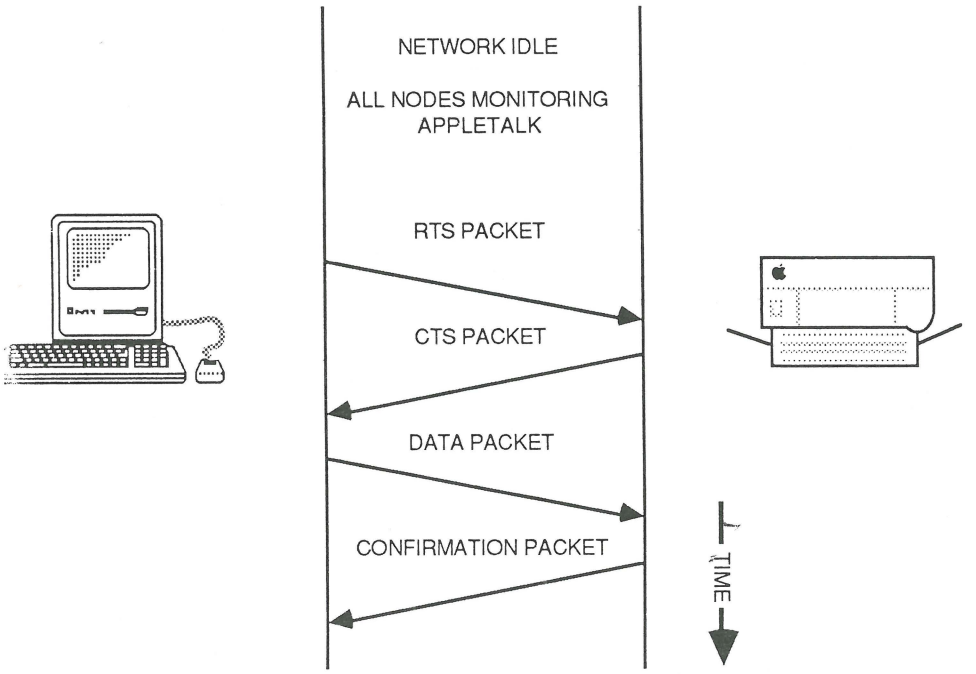


FIGURE 18

Apple Technical Procedures

AppleTalk

Section 2 – Troubleshooting

❑ CONTENTS

❑ BEFORE YOU BEGIN

This section provides a logical approach for troubleshooting AppleTalk networks. A step-by-step procedure for all network troubleshooting is not practical because AppleTalk networks vary in size, types of nodes and cabling used, and topology.

Before you begin troubleshooting, take some time to learn the AppleTalk network, its components, and its application programs. Then read this section completely.

AppleTalk Documentation

Refer to Section 1, Basics, for an overview of AppleTalk components, operation, and network terminology. The *LocalTalk Cabling System Technical Procedures* and the *EtherTalk Interface Card Technical Procedures* describe Apple's cabling system products.

For more information on specific hardware or software products, refer to the appropriate product manuals.

Goals

The goal of AppleTalk troubleshooting is to locate and correct problems quickly, with the least disturbance to network users. In some cases, meeting this goal requires an on-site repair. In other cases, you may have to remove hardware and return it to the network later. Any decision should be based on the customer's best interest.

Sometimes you will have to present customers with difficult choices. They may have to decide whether

- To close down the network so that you can work quickly, without interruption, or
- To keep the network running, which may require more of your time to find the problem, or
- To have you come back later even though it means tolerating the problem a while longer

It will be your responsibility to explain the pros and cons of each choice.

What Is a Network Problem?

A network problem may affect one or many users. And those affected may be on one network or on different networks in an internet. Regardless of the complexity of the network, the basic problem is always the same: one or more devices cannot transfer data to other devices.

Figure 1 shows the three principal areas where problems occur in the network. For a single network, the problem is always in the workstation, the cabling, the shared device, or some combination of the three. Internet problems are always between a workstation and a shared device, but there are additional devices and cabling between them. Internet problems are discussed in the Internets section below.

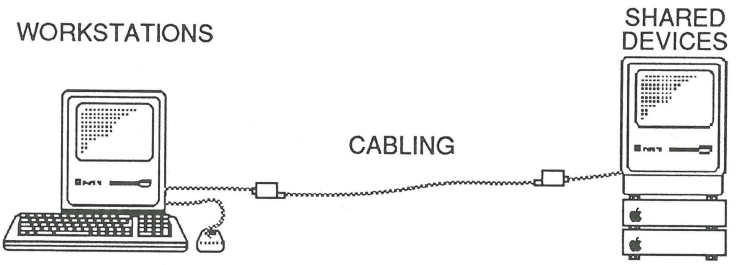


FIGURE 1

What Is Not a Network Problem?

It is important to know what a customer is trying to do when the problem occurs. If a data transfer is not taking place when a problem occurs, the problem is not a network problem. Some users are so mystified by how AppleTalk operates that they may be tempted to blame AppleTalk for any problem they do not understand.

❑ NETWORKS

This section applies to single networks or to internet situations where the symptoms are confined to a single network. If the customer's problem involves workstations and shared devices on different networks of an internet, see Internets below.

The ideal troubleshooting situation occurs when the customer calls in and you help him or her solve the problem over the phone. In this situation, you save traveling time, the customer saves money, and the customer learns more about network troubleshooting. The customer may then become less dependant on you for support and may be more likely to buy additional equipment.

Network Troubleshooting Form

A reduced version of the Network Troubleshooting Form is shown in Figure 2. At the back of this section is a full-size version that you can use as a duplication master.

The Network Troubleshooting Form is a guide for collecting information on network problems. It may be useful as a questionnaire or a check-off list. Since the types of customers vary from novices to experts, you may want to vary the way you use this form.

Customer Data

The customer data and date at the top of the form are for your information. Always try to get a contact name, and then use it during your discussion. A name will help to ease the tension a customer often feels when he or she has tried to solve a problem, has given up, and has called for help.

The Network Problem

The bottom portion of the Network Troubleshooting Form is for defining the customer network and the problem. Since the customer may not be familiar with network terminology, you may need to define network terms as you ask questions.

NETWORK TROUBLESHOOTING FORM

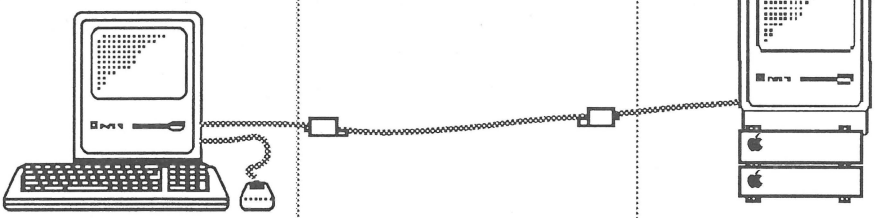
Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

Network

Only ☐
Source ☐
Destination ☐



WORKSTATIONS

SHARED DEVICES

How many nodes have symptoms?

One ☐
Two or more ☐

Device types: _____

Applications: _____

System/ Finder Versions: _____

Printer Driver Versions: _____

CABLING

LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____

Total LocalTalk cabling length ≤ 300 meters? _____

One ☐
Two or more ☐

Are problem(s) intermittent? Yes ☐ No ☐

Total nodes (workstations + shared devices must be ≤ 32): _____

Is there a network log? _____

Any recent changes? _____ What changed? _____

Is there a network map? _____

Do problems appear in one physical area? _____

What has been done already? _____

Notes: _____

FIGURE 2

The first thing you need to know is whether the customer is using a single network or an internet (multiple networks). If he or she has only one network, or if the symptoms seem to be in just one network, check the **Only** box under the Network heading. The **Source** and **Destination** headings are for use when troubleshooting internets.

The next question asks how many workstations and shared devices are affected. As you will see in the following Troubleshooting Chart section, the number of affected workstations and shared devices indicates where the problem is most likely to be.

You need to know the types of workstations, cabling, and shared devices the customer is using, as well as the applications he or she is using. For example, the customer may be using LocalTalk cabling, *MacWrite* at a Macintosh as the workstation, and a Macintosh with an AppleShare File Server as the shared device. If the customer mentions other types of devices and applications that are not affected by the problem, you might want to write them down too, and circle the devices and applications that are affected by the problem.

It is also important to know whether the problems are intermittent or steady. As you will see in the following Troubleshooting Chart section, the presence of intermittent problems indicates that the problem is most likely in the cabling.

The questions on the total length of the cabling and the number of nodes on a network are reminders of the limits of a single LocalTalk network. When networks start small and build slowly, it is easy to accidentally creep over the limits.

Network Log

The customer may or may not have a network log, but it never hurts to ask. The network log is a valuable tool, and if you ask about it often enough, the customer might even create one.

A network log is a list of the equipment on the network, the software on the network, the versions of all network products, and the dates and nature of all network changes.

> ***Note:*** You can use Apple's Inter•Poll™ program to find out what versions of System, Finder, and LaserWriter drivers are being used at each network computer. For more information on troubleshooting with Inter•Poll, see the *Inter•Poll Network Administrator's Guide.*

Even if the customers do not have a log, they should have some idea (no guarantees) of whether there have been any recent changes to the network. Changes—such as software additions, and node additions or deletions—indicate areas where user errors or compatibility problems may have occurred.

Any Recent Changes?

If a network was working well, then was changed, and now is not working well, there is a good chance that the change caused the problem. If the changes were recent, examine the equipment that changed. This simple checkup can reduce troubleshooting time considerably.

Network Map

As in the case of the network log, the customer may or may not have a network map that locates all the nodes on the network. The network map is one of the most important cabling troubleshooting tools. If there is no existing map, try to find someone at the site who knows the layout of the network so that you can create your own map.

The most important information on the network map is the order of the nodes on the network bus. The second most important item is the length of the cables between each node. When problems belong to a continuous group of nodes, the cause is likely to be in the cabling.

Problems in One Continuous Section?

Problems that appear in one continuous section of the network are likely to be cabling problems. For information on LocalTalk cabling troubleshooting, refer to *LocalTalk Cabling System Technical Procedures,* Section 3.

What Has Been Done Already?

The final items on the page are for your own notes. Find out what troubleshooting the customer has done already and see if it makes sense to you.

Troubleshooting Chart

Figure 3 is the troubleshooting chart for a single network. This chart uses the information from the Network Troubleshooting Form to predict where the problem is most likely to be.

NETWORK TROUBLESHOOTING CHART		
WORKSTATIONS WITH SYMPTOMS	**SHARED DEVICES WITH SYMPTOMS**	
	One	**Two or More**
One	Workstation **Cable*** Shared Device	Workstation **Cable*‡** Shared Device
Two or More	Shared Device **Cable*‡** Workstation	Cable Shared Device Workstation

*** If problem is intermittent, check cabling first.**
‡ If problems are in one physical area, check cabling first.

FIGURE 3

To use this chart:

1. Determine if the symptoms appear in one workstation or if two or more workstations have the same symptoms.

2. Determine if the symptoms appear in one shared device or if two or more shared devices have the same symptoms.

3. Check to see if the problem is intermittent and if it is confined to one physical area.

4. Use the data from Steps 1–3 to select the section of the troubleshooting chart that applies to your situation.

5. Troubleshoot the workstations, shared devices, and cabling in the order listed in the section of the chart you selected. If the problem seems to be in the workstation or shared device, look for troubleshooting instructions in the Nodes section of this procedure. If the problem seems to be in the LocalTalk cabling, see *LocalTalk Cabling System Technical Procedures.*

For example, suppose a customer reports that two or more workstations are having problems communicating with a single shared device. This is a good indication that the problem is with either the shared device or the cabling. To decide where to start troubleshooting, ask if the problem is intermittent and if it is confined to one physical area.

If the problem is not intermittent or confined in one area, check the shared device first, the cabling second, and the workstations last.

If the problem is intermittent, confined to a single area, or both, check the cabling first, the shared device second, and the workstations last.

❑ NODES

This section describes how to troubleshoot workstations, shared devices, and internet devices in general terms. The information in this section is not specific. For specific troubleshooting information on a product, refer to the product manuals and the *Apple Technical Procedures* for that product.

Causes of Problems

When network problems develop in workstations, shared devices, or internet devices, the possible causes are:

- User errors
- Software failures
- Hardware failures
- Incompatible software or hardware

User Errors

User errors are one of the most common network problems. Because AppleTalk is easy to install and use, users are less intimidated and more likely to experiment. Some user errors will affect only themselves; others can affect the entire network.

For example, users can:

- Install nodes incorrectly
- Install applications incorrectly
- Forget to turn on a node
- Operate an AppleTalk application incorrectly
- Forget to check for application compatibility

To effectively troubleshoot user errors, learn as much as you can about the user's equipment and applications. If the customer is using non-Apple products and you do not have an opportunity to learn about them, try to study the installation and operation of any comparable Apple products.

When you find that the problem was caused by user error, be sure that the customer understands why it happened and how to avoid it the next time. Consider the customer's feelings as you explain this; he or she may be embarrassed or defensive.

Software Failures

Once operating, software probably will not fail by itself, although users may accidentally erase required files or mishandle diskettes.

The best way to verify software failures is to use a known-good copy of software in place of the suspect copy (use a different disk in the same machine). If the known-good copy works, check to see what is different between the two copies. If the setup is identical and you cannot locate any user errors, the software is probably damaged.

If you find that damaged Apple software is the cause of a network problem, the customer may be entitled to new software as specified by the media exchange program in the *Service Programs* manual.

Hardware Failures

Once operating, hardware failures may occur because of misuse or age. The best way to verify hardware failures is to use a known-good piece of hardware in place of the suspect piece. If the known-good hardware works, verify that the two pieces are identical. If the version numbers and configurations of both pieces of hardware are the same, the suspect hardware is probably damaged.

Incompatible Software or Hardware

Incompatible software or hardware can cause network problems and is always the responsibility of the network user. The user is responsible for buying compatible products and following the installation and operation instructions.

The two most common types of compatibility problems are incompatible products and incompatible versions of products. The problem could be that two products were not designed to work together. If the products were designed to work together, the problem may be that one or both products require a specific version of the other product.

To avoid compatibility problems, network users should always use the same versions of all applications, especially the System, Finder, and printer software. If one user needs to update to a later version of software to use a product, all users should update. Otherwise, incompatibility problems may arise later as the other users begin to use the same product.

> ***Note:*** You can use Inter•Poll to find out what versions of System, Finder, and LaserWriter drivers are being used at each network computer. For more information on Inter•Poll, see the *Inter•Poll Network Administrator's Guide.*

The best way to prepare for troubleshooting compatibility problems is to be familiar with all the products on the network in question. Read the product manuals and take note of any warnings or claims regarding compatibility.

If you are working with a large AppleTalk network or if there seem to be a lot of changes in the network, ask the customer to maintain a network log. The log can be used to assess the status of the network and to spot incompatible products or product versions.

General Procedure

When you suspect problems in a node, refer to the manual and technical procedure for that product. If you cannot find any troubleshooting information on the product, try the following general procedure.

1. Check to see that the device power is on. This may seem obvious for workstation troubleshooting, but a shared device or internet device might be located at some distance from the workstation and may be turned off.

2. Verify that the LocalTalk connector:

   - Is plugged into the node.
   - Is plugged into the correct port.
   - Has at least one network cable plugged into the connector box.

3. Check the application program status and verify that:

   - The application is active.
   - Any error messages have been read.
   - Any status indicators have been checked.
   - You can list and select the shared device at the workstation (use Chooser at a Macintosh for example).
   - AppleTalk software is installed with the application.
   - AppleTalk is turned on.
   - All operating software packages are compatible.

4. Turn the device off, and then turn it back on. If other users are using the device, let them know what you want to do and give them a chance to finish what they are doing.

   Turning off the device clears the memory and the digital logic and may eliminate erratic operation. Turning off the device also forces the AppleTalk logic to validate the node address at startup, eliminating the possibility of a duplicate node address.

5. Replace the product with a known-good product.

   - Use known-good software in a device to see if the node hardware, cables, and connectors are functioning properly.

   - Use known-good hardware to replace a device and see if the software, cables, and connectors are functioning properly.

   - Sometimes it may be easier to replace the entire suspected device (hardware and software) to find out if the problem is in that device.

   - If you suspect that a node is interfering with network operation, and if you do not have duplicate hardware, unplug the node's connector or bypass it with a cable extender (see *LocalTalk Cabling System Technical Procedures,* Section 3).

❑ INTERNETS

Internet troubleshooting is an extension of network troubleshooting. The difference is that the cabling at the workstation may be separated from the cabling at the shared device by bridges (see Figure 4), gateways (see Figure 5), or bridges and gateways.

If the customer's problem is such that the workstation and shared device are within a single network on an internet, follow the Network Troubleshooting procedure. If you are concerned about the presence of bridges and gateways, ask the customer if you can disconnect them (unplug the cabling connectors, not the network cables) until that network has tested as good.

If the affected workstation and the shared device are in different networks, follow the procedure in this section to determine where the problem is most likely to be.

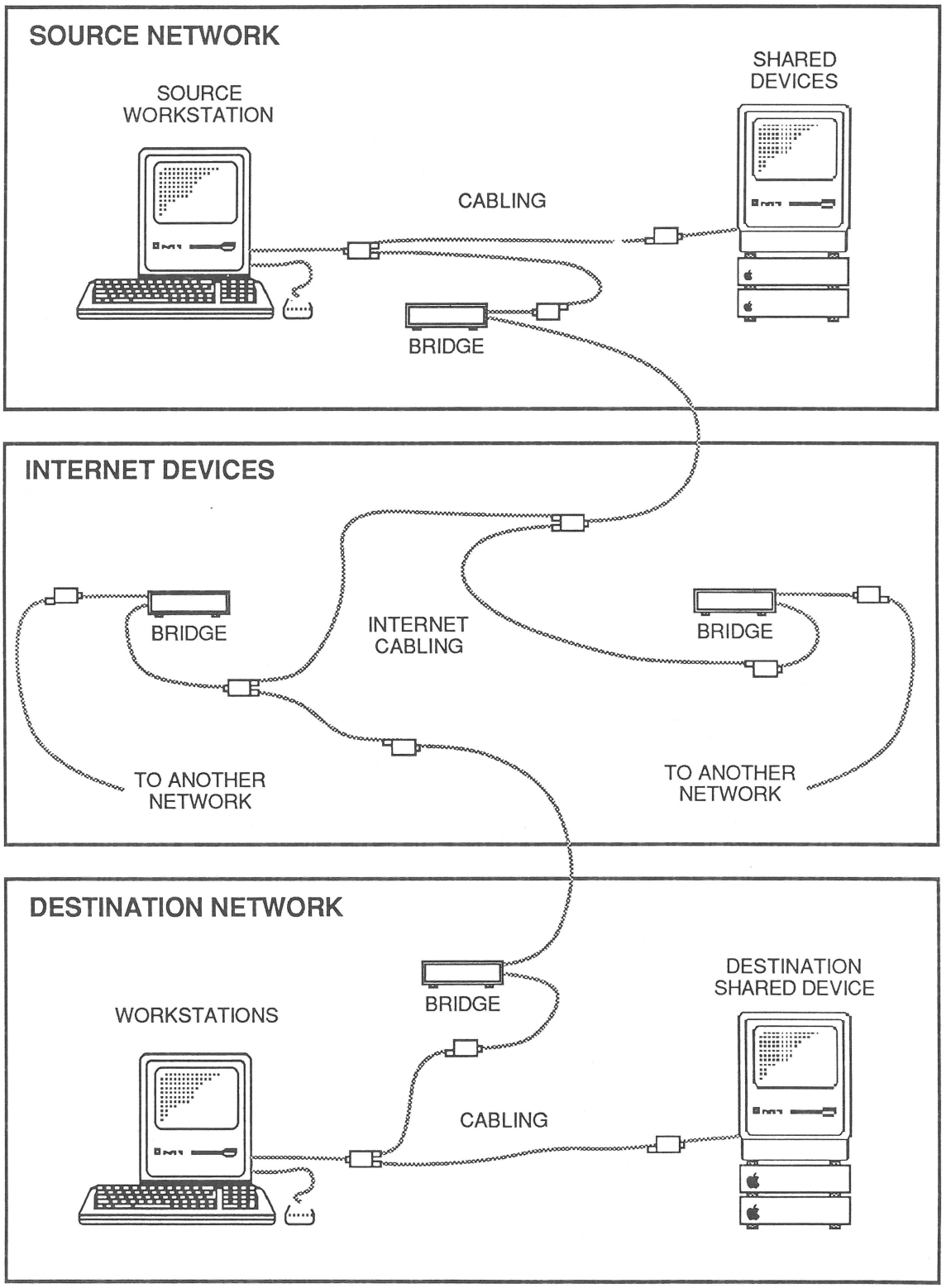

SOURCE NETWORK
SOURCE WORKSTATION
SHARED DEVICES
CABLING
BRIDGE
INTERNET DEVICES
BRIDGE
INTERNET CABLING
BRIDGE
TO ANOTHER NETWORK
TO ANOTHER NETWORK
DESTINATION NETWORK
BRIDGE
DESTINATION SHARED DEVICE
WORKSTATIONS
CABLING

FIGURE 4

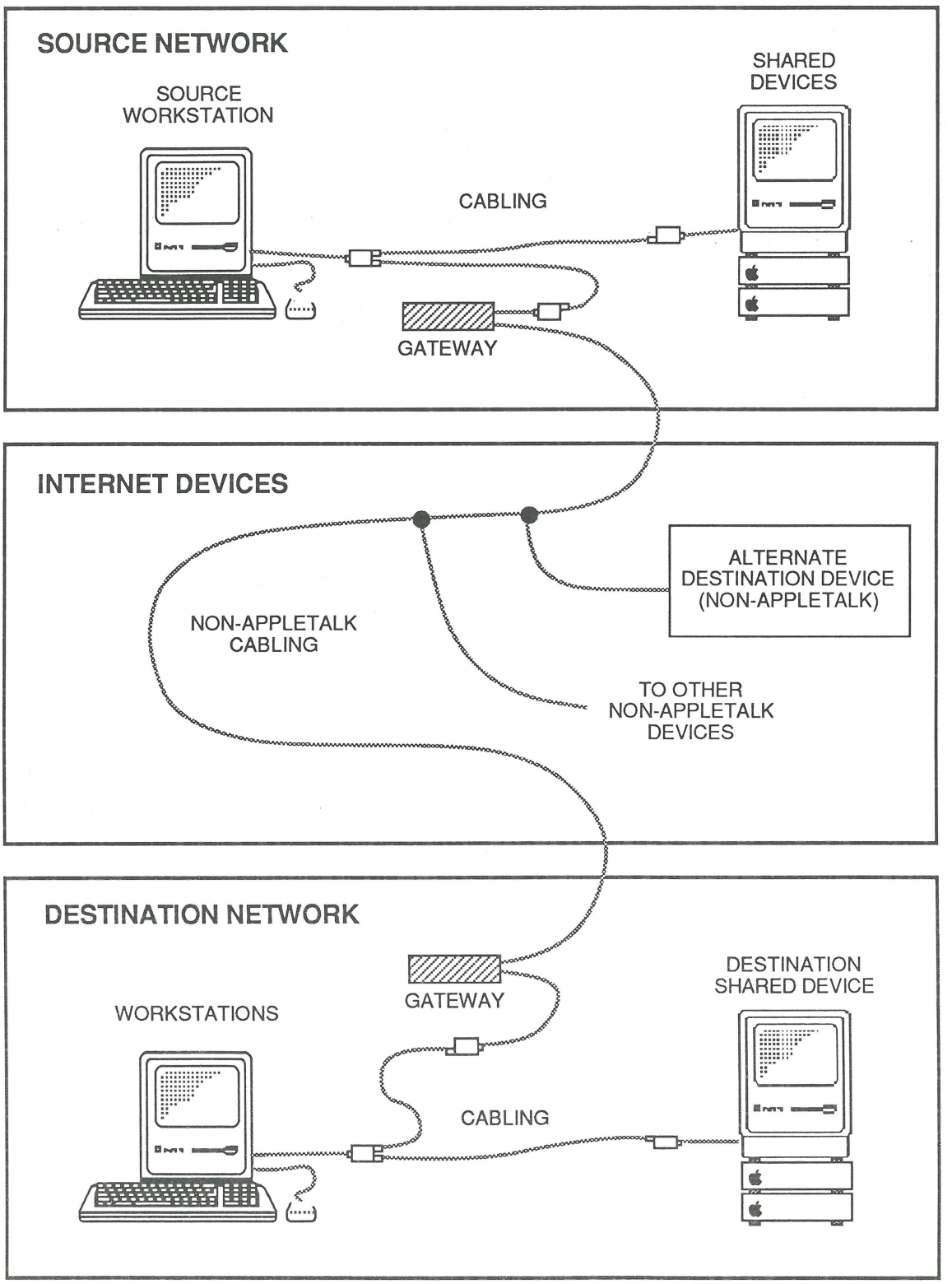

SOURCE NETWORK
SOURCE WORKSTATION
SHARED DEVICES
CABLING
GATEWAY
INTERNET DEVICES
ALTERNATE DESTINATION DEVICE (NON-APPLETALK)
NON-APPLETALK CABLING
TO OTHER NON-APPLETALK DEVICES
DESTINATION NETWORK
GATEWAY
DESTINATION SHARED DEVICE
WORKSTATIONS
CABLING

FIGURE 5

Internet Troubleshooting Form

A reduced version of the Internet Troubleshooting Form is shown in Figure 6. At the back of this section is a full-size version that you can use as a duplication master.

The Internet Troubleshooting Form is a guide for collecting information on internet problems. This form covers the internet devices and cabling between the workstation in one network (source network) and the shared device in another network (destination network).

The form is divided into a section for internets using bridges, and another section for internets using gateways. The form does not provide space for describing the source and destination networks. To collect this information, use two Network Troubleshooting Forms as described under "Networks" above.

Note: When you fill out the Network Troubleshooting Forms, be sure to check the appropriate box under the Network heading to specify whether the form describes the source or the destination network.

Networks With Symptoms

The "Networks With Symptoms" heading on the form asks for information on the source and destination networks. As with network troubleshooting, the number of source and destination networks that share the same symptoms is a significant clue. The Troubleshooting Chart section below will use this information to predict where the cause of the problem is most likely to be found.

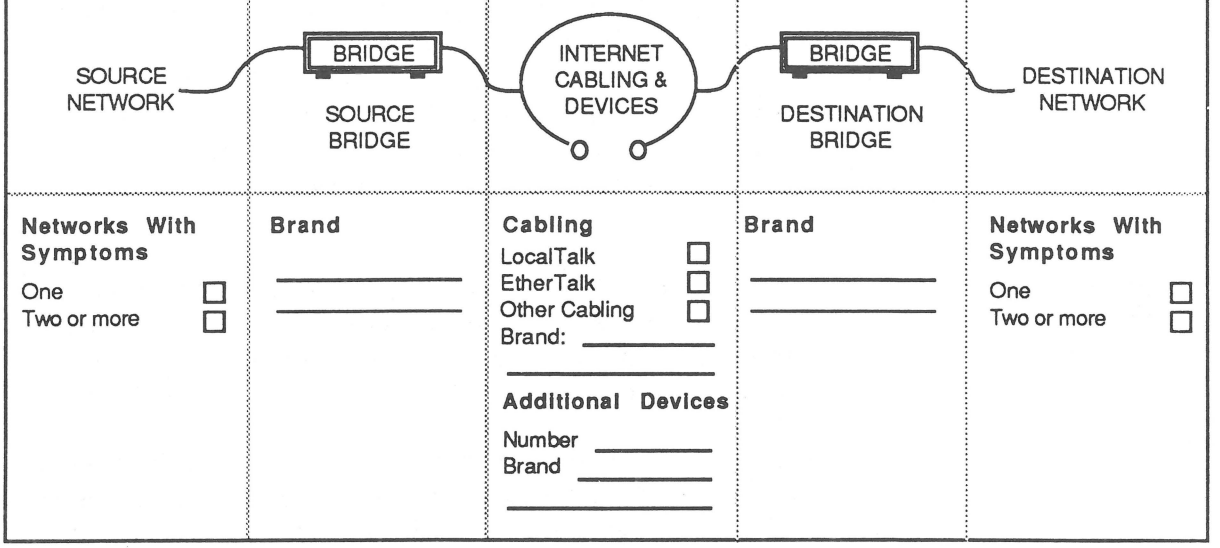
INTERNET TROUBLESHOOTING FORM

Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

BRIDGED APPLETALK NETWORKS



APPLETALK GATEWAYS TO OTHER NETWORKS OR DEVICES

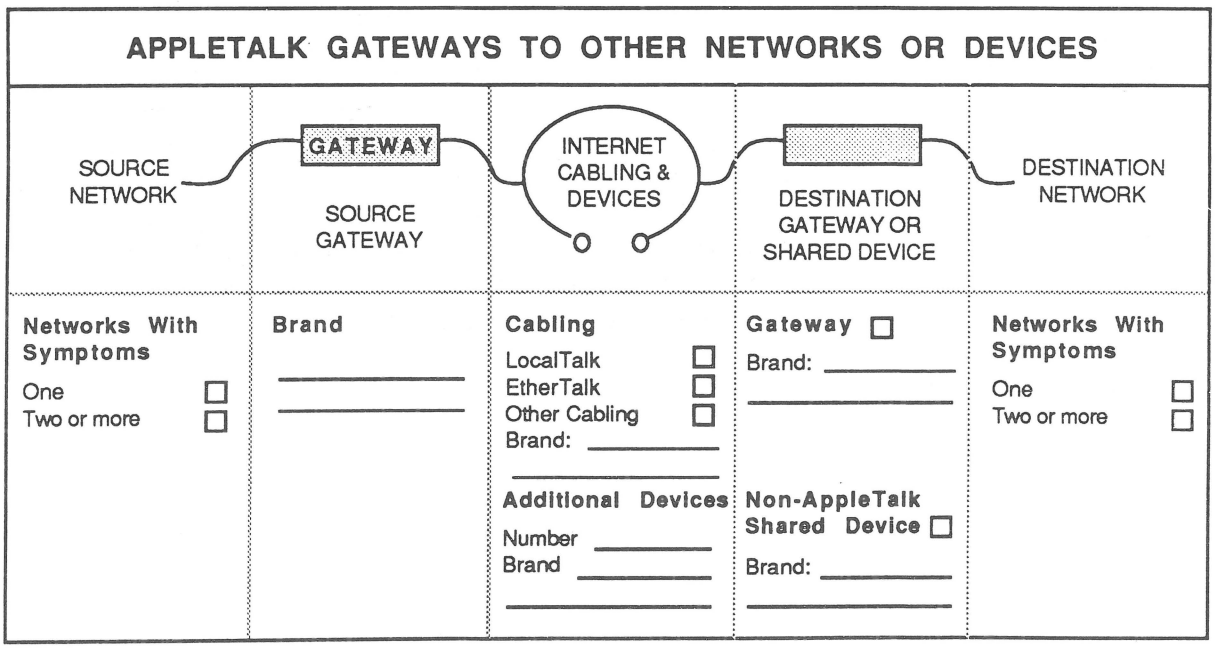


FIGURE 6

Bridges, Gateways, and Shared Devices

In both sections of the form, there are places to record the brand of source and destination bridges or gateways. If the internet in question uses only one bridge, cross out the internet cabling and destination bridge columns as a reminder that there is just one bridge.

If the internet in question uses a gateway to connect workstations to a non-AppleTalk shared device, there may not be a destination gateway. Instead, the internet cabling attached to the shared device is the destination network. In this case, you could cross off the Destination Network heading and check the Non-AppleTalk Shared Device box under the Destination Gateway or Shared Device heading. In the spaces provided, enter the brand of the devices used.

Internet Cabling and Devices

The Internet Cabling and Devices area in each section provides space to record the equipment used between the source network and the destination network or shared device.

If the internet uses bridges, the internet cabling might be LocalTalk, EtherTalk, or it might consist of modems and cables between two half bridges. There might also be additional bridges between the source and destination bridges. The number and brands of additional bridges should be recorded.

If the internet uses gateways, the internet cabling is non-Apple cabling. Record the cabling type and brand, and ask the customer if there are any other types of devices between the source network and the destination. There may be repeaters (signal boosters), or there could be additional gateways leading to yet another non-Apple cabling system.

Bridge and Gateway Combinations

The Internet Troubleshooting Form provides for the most common internet situations. If the customer builds an internet with bridges and gateways, and if this form cannot cover the situation, you may want to design a custom form for that customer. Troubleshooting will be even easier if you give a copy of the form to the customer so that both of you can refer to it when troubleshooting over the phone.

Troubleshooting Chart

Figure 7 is the troubleshooting chart for an internet. This chart uses the information from the Internet Troubleshooting Form and the Network Troubleshooting Forms to predict where the problem is most likely to be.

To use this chart:

1. Determine if the symptoms are present in one workstation or if two or more workstations have the same symptoms.

2. Determine if the symptoms are present in workstations in one network or if the same symptoms appear in workstations from two or more networks.

3. Determine if the symptoms are present in one shared device or if two or more shared devices have the same symptoms.

4. Determine if the symptoms are present in shared devices in one network or if the same symptoms appear in shared devices from two or more networks.

5. Use the answers from Steps 1–4 to select the area of the Internet Troubleshooting Chart that applies to your situation.

   For example, suppose a customer reports that two or more workstations are having problems communicating with two shared devices. After further questioning, you learn that the workstations

...Continued after Figure 7

INTERNET TROUBLESHOOTING CHART

WORKSTATIONS WITH SYMPTOMS	SHARED DEVICES WITH SYMPTOMS (Different Network From Workstation)		
	One Shared Device, One Network	**Two or More Shared Devices, One Network**	**Two or More Shared Devices, Two or More Networks**
One Workstation, One Network	→	Workstation Workstation Net* Shared Device Shared Device Net* Bridges/Gateways‡ Internet Cable‡	←
Two or More Workstations, One Network	Shared Device Shared Device Net* Workstation Net* Bridges/Gateways‡ Internet Cable‡ Workstation	Shared Device Net* Workstation Net* Bridges/Gateways‡ Internet Cable‡ Shared Device Workstation	Workstation Net* Bridges/Gateways‡ Internet Cable‡ Shared Device Net* Shared Device Workstation
Two or More Workstations, Multiple Networks	Shared Device Shared Device Net* Bridges/Gateways‡ Internet Cable‡ Workstation Net* Workstation	Shared Device Net* Bridges/Gateways‡ Internet Cable‡ Workstation Net* Shared Device Workstation	Bridges/Gateways‡ Internet Cable‡ Shared Device Net* Workstation Net* Shared Device Workstation

*** Check bridge or gateway first, then verify proper network operation.**
‡ Includes all devices between Workstation Network and Shared Device Network.

FIGURE 7

are in one network, and both shared devices are in another network. According to the Internet Troubleshooting Chart, the problem is most likely to be in the shared device network. The recommended order for troubleshooting is:

a) Shared device network (check the bridge first).

b) Workstation network (check the bridge first).

c) Bridges/gateways (between source and destination bridges).

d) Internet cable (between source and destination bridges).

e) Shared devices.

f) Workstations.

6. Troubleshoot the network areas in the order listed in the section of the chart you selected in Step 5. If the problem seems to be in the workstation, shared device, or internet device, look for troubleshooting instructions in the product manual or in the Nodes section of this procedure. If the problem seems to be in the cabling, see the *LocalTalk Cabling System Technical Procedures.*

   If the problem seems to be in the workstation or shared device network, use the network troubleshooting procedure to check the suspected network. Try using the suspect workstation or shared device with other devices in that network. If the network troubleshooting procedure does not identify the most likely area to check, check all areas individually.

❑ WHEN YOU GO ON-SITE

When getting ready to go on site, collect any tools, products, and information you may need. Consider bringing

- *Inter•Poll* program (see *LocalTalk Cabling System Technical Procedures* or the *Inter•Poll Network Administrator's Guide*)
- *NodeCheck* program (see *LocalTalk Cabling System Technical Procedures*)
- Known-good system software
- Known-good application software
- Known-good cabling components
- Known-good node hardware
- Any diagnostics designed for node hardware
- Product manuals
- Any *Apple Technical Procedures* binders that cover the equipment used
- Any tools required for assembly/disassembly of network hardware
- Spares kit for any suspect devices

When you arrive at the site, ask the customer to show you the problem. Compare what you see with the information you received over the phone. If the information compares directly, begin troubleshooting where you left off when you hung up the phone.

If the information seems different from what you heard on the phone, find out why. You may need to collect the information again to be sure that you are not troubleshooting under false assumptions.

NETWORK TROUBLESHOOTING FORM

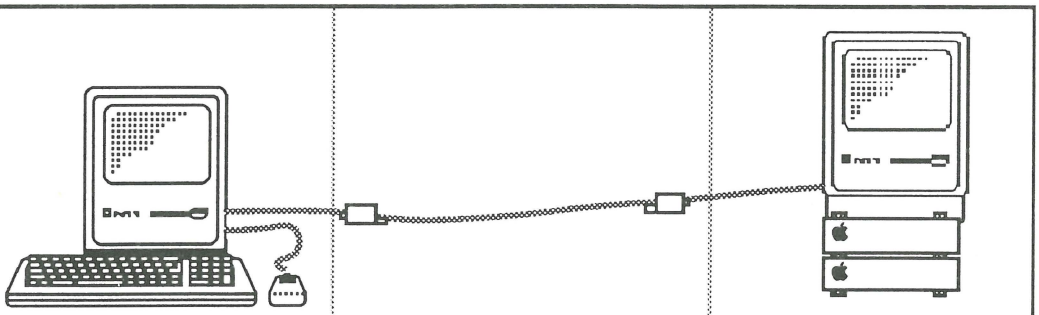
Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

Network

Only ☐
Source ☐
Destination ☐



WORKSTATIONS **SHARED DEVICES**

How many nodes have symptoms?

One ☐
Two or more ☐

Device types: _____

_____

_____

Applications: _____

System/ Finder Versions: _____

Printer Driver Versions: _____

CABLING

LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____

_____

_____

Total LocalTalk cabling length ≤ 300 meters?

_____

One ☐
Two or more ☐

_____

_____

_____

_____

_____

_____

Are problem(s) intermittent? Yes ☐ No ☐

Total nodes (workstations + shared devices must be ≤ 32): _____

Is there a network log? _____

Any recent changes? _____ What changed? _____

Is there a network map? _____

Do problems appear in one physical area? _____

What has been done already? _____

_____

_____

_____

Notes: _____

_____

_____

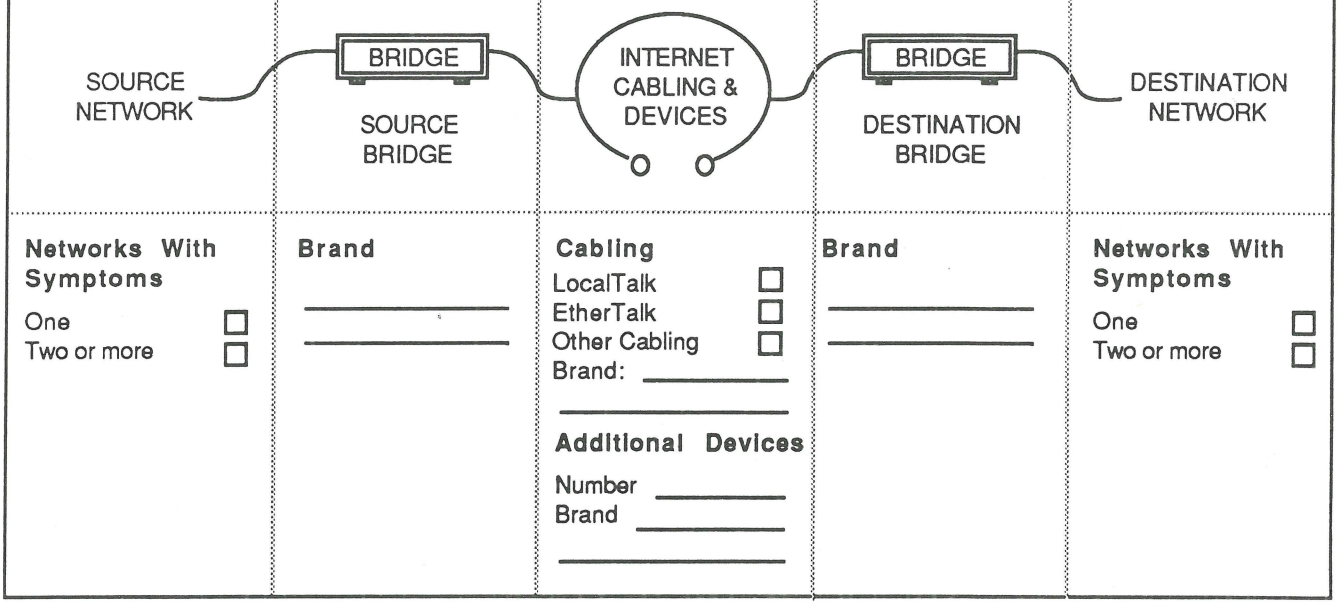
INTERNET TROUBLESHOOTING FORM

Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

BRIDGED APPLETALK NETWORKS



Networks With Symptoms
One ☐
Two or more ☐

Brand
_____
_____

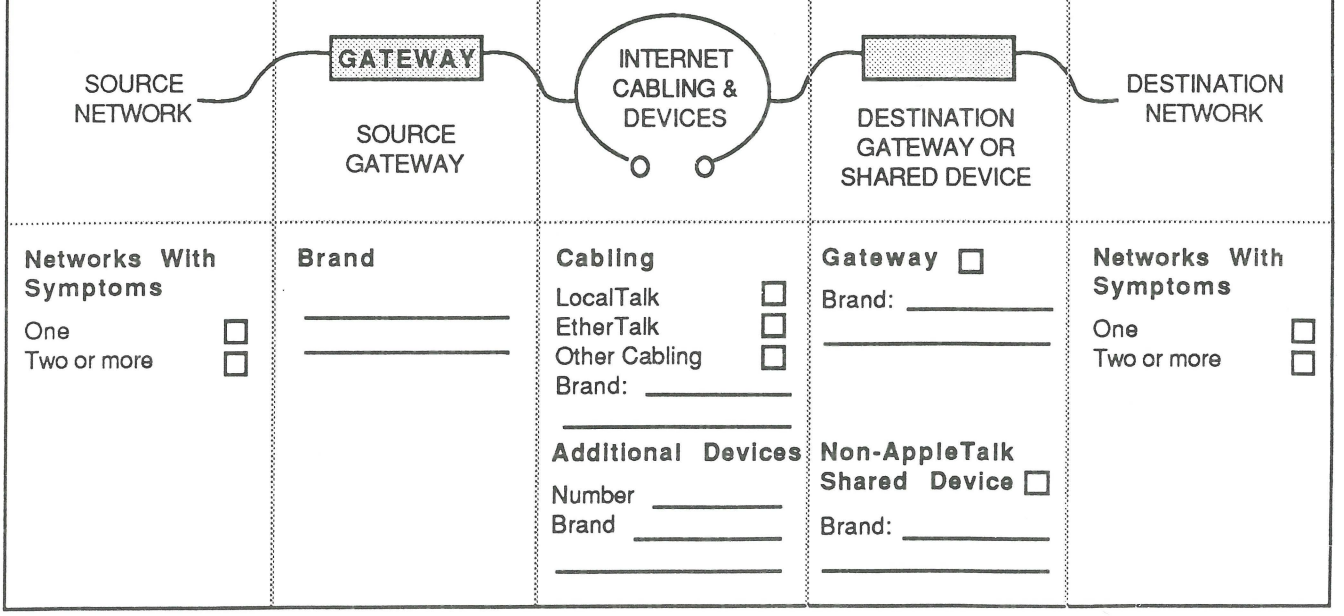
Cabling
LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____
_____

Additional Devices
Number _____
Brand _____
_____

Brand
_____
_____

Networks With Symptoms
One ☐
Two or more ☐

APPLETALK GATEWAYS TO OTHER NETWORKS OR DEVICES



Networks With Symptoms
One ☐
Two or more ☐

Brand
_____
_____

Cabling
LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____
_____

Additional Devices
Number _____
Brand _____
_____

Gateway ☐
Brand: _____
_____

Non-AppleTalk Shared Device ☐
Brand: _____
_____

Networks With Symptoms
One ☐
Two or more ☐

Apple Technical Procedures

LocalTalk Cabling System

Technical Procedures

❑ TABLE OF CONTENTS

Section 3 – Troubleshooting

Apple Technical Procedures

LocalTalk Cabling System

Section 1 – Basics

❑ CONTENTS

❑ INTRODUCTION

The LocalTalk™ Cabling System is Apple's low-cost cabling system for AppleTalk local area networks.

The LocalTalk Cabling System is designed as a radio-frequency transmission line for data transfer between devices on an AppleTalk network. The cabling system transmits data at 230,400 bits per second at a maximum distance of 300 meters (about 1,000 feet).

This section describes the cabling components, how they operate as a system, and what happens when common network problems occur. For more information on AppleTalk and on general network terminology, see *AppleTalk Technical Procedures*. For specific information on installing LocalTalk cabling, see the *LocalTalk Cable System Owner's Guide*.

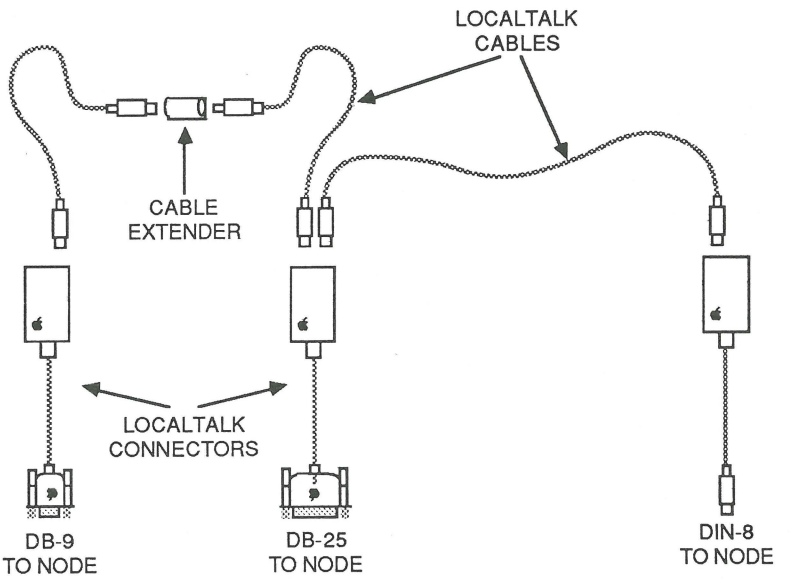


FIGURE 1

❑ LOCALTALK COMPONENTS

The LocalTalk Cabling System is made up of cables, connectors, and cable extenders (Figure 1). This cabling system works in a bus network topology (Figure 2), which means that all nodes are connected in a line from one end node to the other.

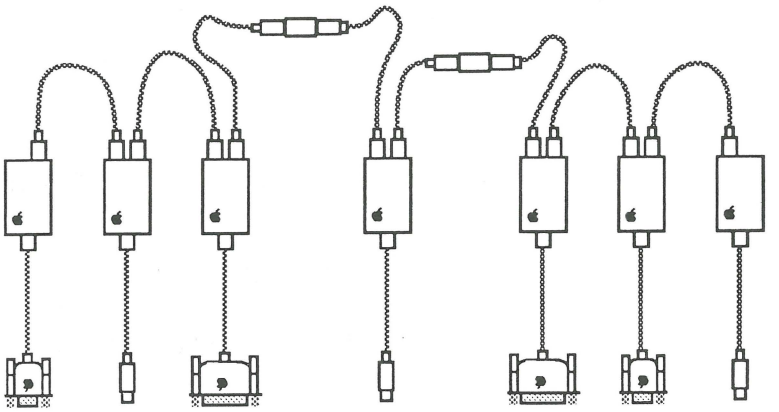


FIGURE 2

Cables

LocalTalk cables are available in 2-, 10-, and 25-meter lengths and in a LocalTalk Custom Wiring Kit. The Custom Wiring Kit includes 100 meters of shielded LocalTalk cable, 4 LocalTalk Cable Extenders, 20 LocalTalk Cable connectors, and the hardware needed to assemble the cables.

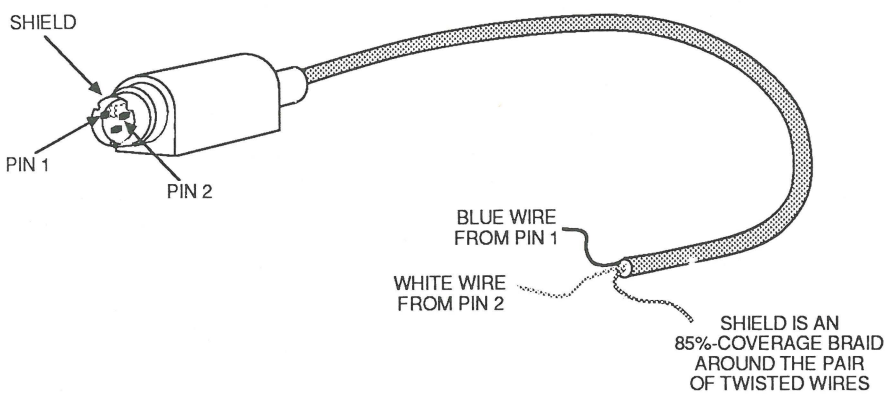


FIGURE 3

Figure 3 shows the construction of a LocalTalk cable. Two wires are twisted together inside a shield (the third wire in Figure 3 represents the shield conductor). The two wires carry the electrical signals and are color coded. The wires connect to Mini-DIN-3 male plugs that are keyed to plug into each connector or cable extender in just one way.

The twisted-pair construction of the cable and the use of a shield are important features of the cabling design. The twisted wires and their spacing define the impedance of the cable (78Ω). Impedance is a measure of the apparent opposition (resistance, capacitance, and inductance) to signal travel over a specified distance of cable. The type of data signalling used by LocalTalk (described later) requires that the impedance be the same in all network cables.

The construction of the cables helps to minimize the contamination of network data due to electrical noise radiated by other equipment. This construction also minimizes the electrical noise produced by LocalTalk cabling.

Cable Extenders

LocalTalk cable extenders allow two cables to be joined together to create a longer cable (Figure 4). The extender is constructed so that

- Pin 1 in one cable connects to pin 1 in the other.
- Pin 2 in one cable connects to pin 2 in the other.
- The shield in one cable connects to the shield in the other.

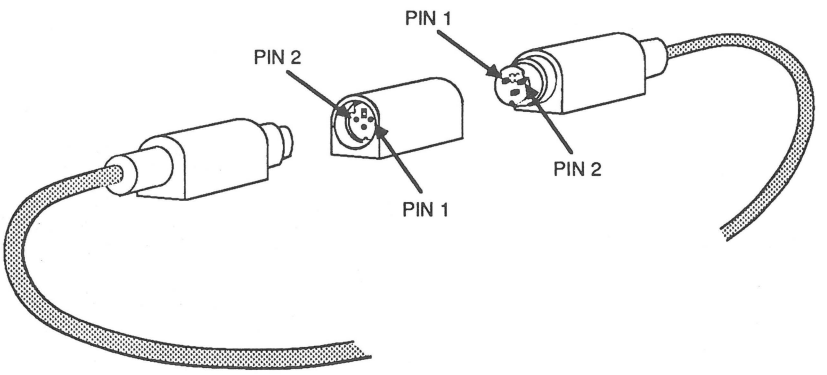


FIGURE 4

Connectors

A LocalTalk connector is required for every node on a LocalTalk network. The short cable on the connector plugs into the node, and two LocalTalk cables can be plugged into the connector box. This connector is made in several versions to accommodate the DB-9, DB-25, and Mini-DIN-8 plug connectors used by AppleTalk nodes.

Figure 5 is a schematic diagram of a LocalTalk connector. The circuits in the LocalTalk connector provide

- Continuity between two network cables
- Connection between node and cables
- Termination at network ends
- Grounding of cable and connector shield

The circuits of the connector are described in more detail later in this section.

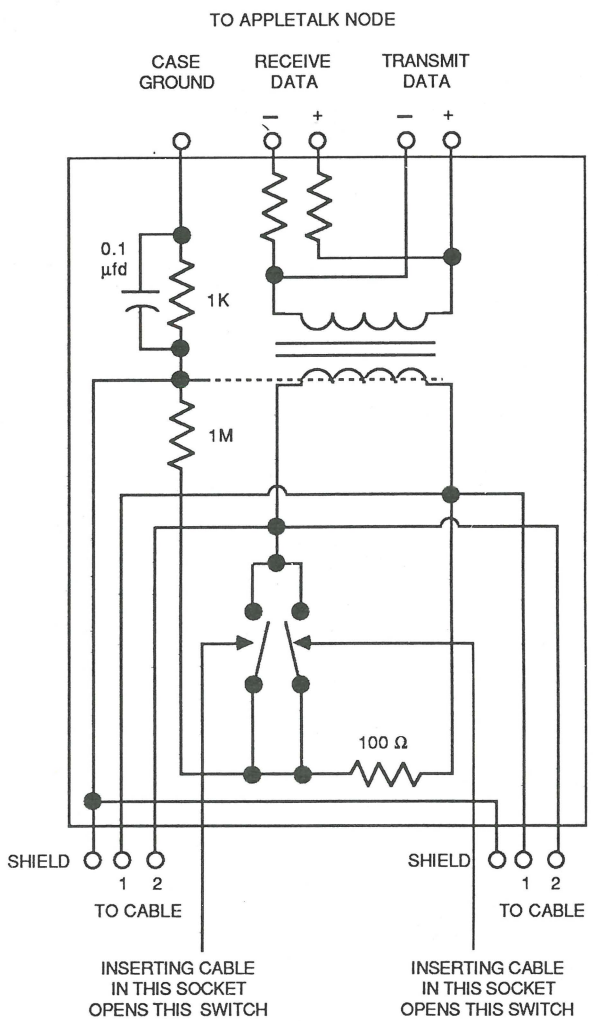


FIGURE 5

Connecting the Components

The *LocalTalk Cable System Owner's Guide* describes how to install LocalTalk cabling. The LocalTalk Cabling System is easy to install, but it must be installed correctly:

- All nodes must be connected in a line (no circles).
- Only one cable should be plugged into the connector at each end of a network.
- Two cables should be plugged into all connectors that are not end connectors.
- All network cable connections should be joined completely.

If the cabling is installed incorrectly, part or all of the network may not operate.

If a node must be disconnected from the network, there are two options:

- Disconnect the connector from the node and leave the connector attached to the network (Figure 6).

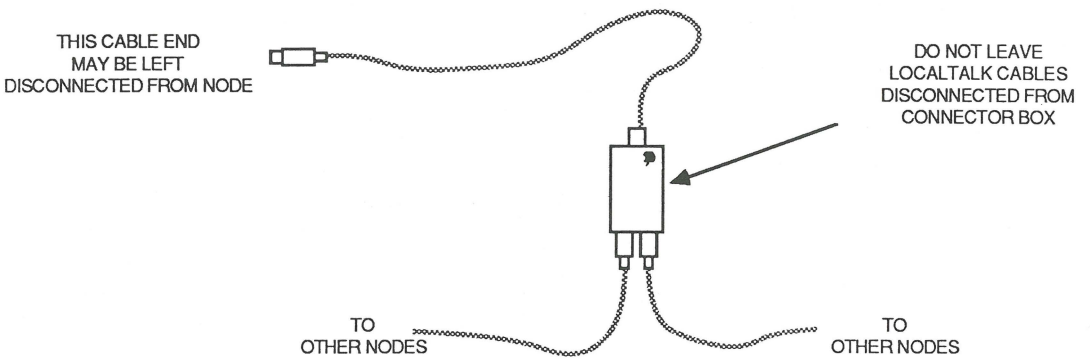


FIGURE 6

- Replace the connector with a cable extender so that there are no dangling cables (Figure 7).

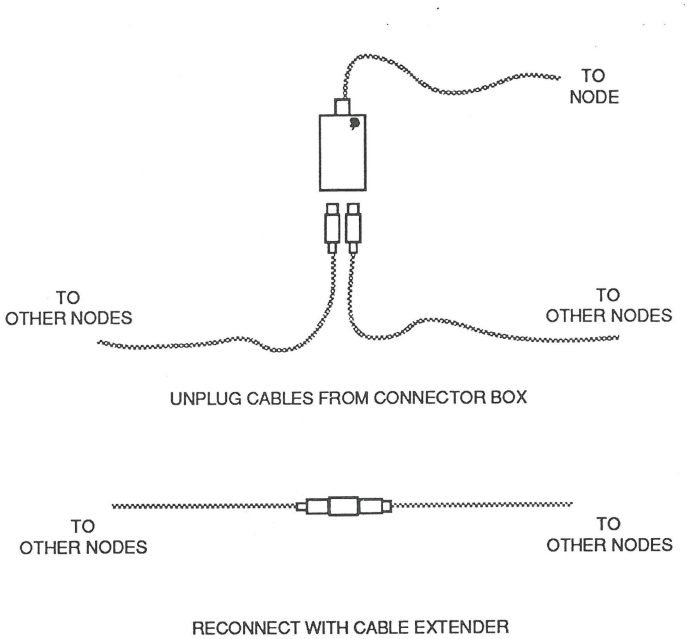


FIGURE 7

❑ LOCALTALK SYSTEM OVERVIEW

The LocalTalk Cabling System carries electrical data signals from any AppleTalk node to all other nodes on the same network (Figure 8).

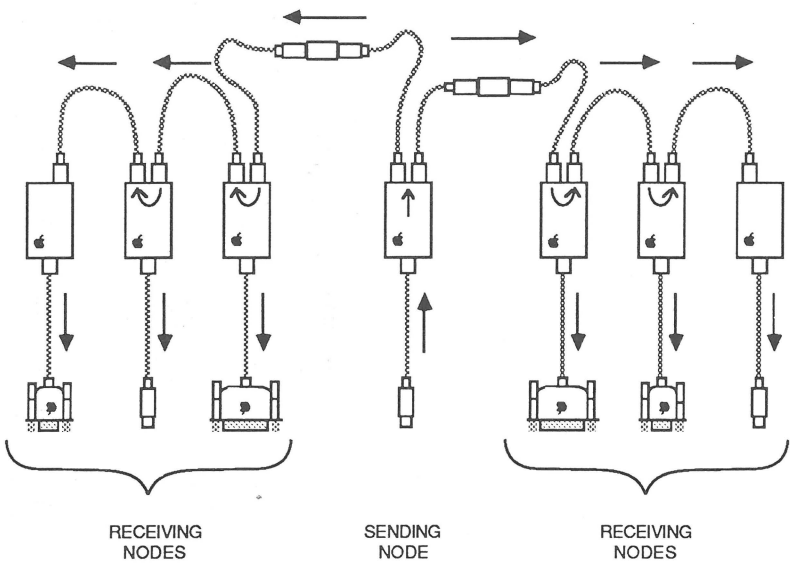
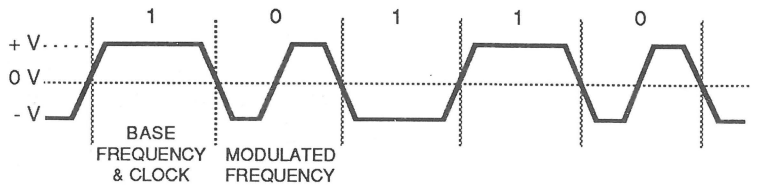


FIGURE 8

The transmitting node converts digital data into digitally coded signals (Figure 9). This coding technique is called Frequency Modulation = Zero (FM0). FM0 uses two frequencies to produce a clock pulse, the data 1s, and the data 0s. The base frequency (230.4K for LocalTalk) is the clock frequency and represents the data 1s. When a 0 is transmitted, the frequency is doubled.



FREQUENCY MODULATION = 0

FIGURE 9

To meet the LocalTalk frequency and distance specifications, the LocalTalk Cabling System is designed as a radio frequency transmission line. As shown in Figure 10, the transmission line is one continuous pair of wires that passes through all connectors from one end of the network to the other.

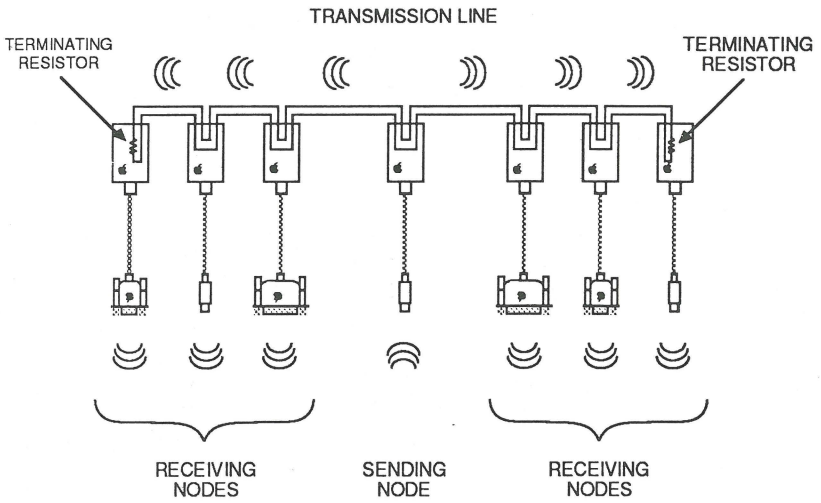


FIGURE 10

This transmission line can be compared to a radio antenna. When a node wants to transmit data, it broadcasts the data through its connector onto the transmission line. The data then travels along the transmission line in energy waves that are very similar to radio waves. As the waves pass each connector, the attached node is free to receive the data through its connector.

The connection between each node and the transmission line is a transformer in the LocalTalk connector. Transformers use electromagnetic induction to transfer signals from one circuit to another. The transformer electrically isolates the circuitry in each node from the transmission line, but allows the signal waves to pass through.

Electrical isolation allows the transmission line and the node to operate independently. The node can be turned off or disconnected from the transmission line without affecting the other network traffic. If electrical damage occurs in a node, there is no electrical connection to connect the damage to the transmission line.

The resistor shown on each end connector in Figure 10 is a terminating resistor (100Ω). The terminating resistor absorbs the signal waves when they reach the end of the network. If the terminating resistor is not present, the waves will reflect and travel toward the opposite end of the network. The problems caused by reflected waves are described below in LocalTalk System Problems.

A terminating resistor and a pair of switches are built into each connector. One of the switches is opened when a cable is plugged into one of the network cable positions on the connector. If two cables are plugged in, two switches are opened and the terminating resistor is not connected. If one cable is plugged in, only one switch is open and the terminating resistor is connected.

❑ LOCALTALK SYSTEM PROBLEMS

The most common cabling problems generally fall into one of the following categories:

- Poor connection or disconnect
- Loop network
- Network too long
- Noise

Poor Connection or Disconnect

The most common cabling problems are poor connections and disconnected cables. The network transmission line must be continuous from end to end, and terminated at each end. Any poor connection or disconnection may interfere with network operation.

Poor connections or disconnects may occur during network installation or during network use. Common causes include:

- Loosened cable, which may or may not be separated from the extender or connector. This loosening is often caused by
  - Users' bumping or tripping on the cable.
  - Cables that are stretched too tightly.
- Dirt or foreign material in the cable connections.
- Cables disconnected from the connector, instead of the connector disconnected from the node (to move equipment).
- Improper modification of network, or use of improper cable types.
- Damaged or defective cable, extender, or connector.
- Cold or dirty solder joints in custom cables.

Poor cable connections and disconnected cables produce similar symptoms. Such cabling problems can cause intermittent or steady data transfer errors between a seemingly random selection of nodes. These errors may:

- Prevent workstations from "seeing" shared devices.
- Cause a failure after the data transfer is started.
- Increase the data transfer time.

The difference between a poor cable connection and a disconnected cable is that a disconnected cable between two nodes produces two separate networks and disables communication between the two. If a disconnected cable is at the end of a network (unterminated network), the possible symptoms are the same as for a poor connection.

Figure 11 shows how a disconnected cable creates network problems. In this case, the network cable is broken and therefore unterminated, but any impedance mismatch might produce the same problems. Impedance mismatches may be caused by poor cable connections and by using improper cables (non-LocalTalk cables or mixing incompatible cabling systems).

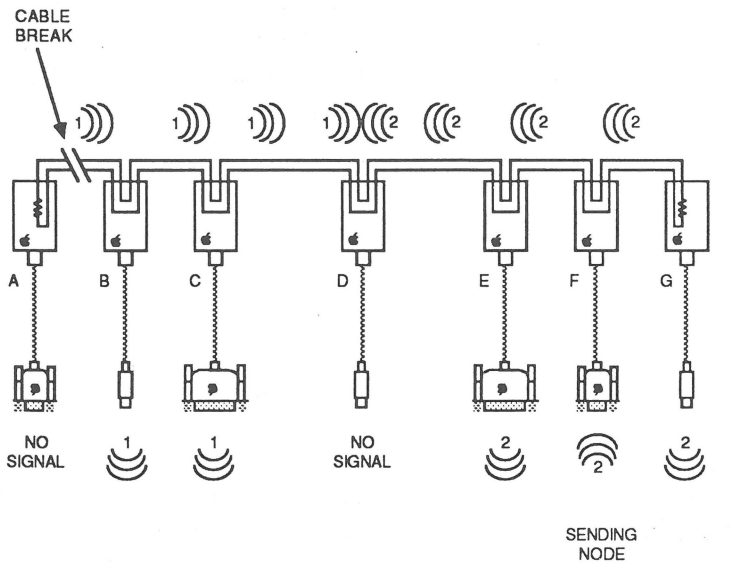


FIGURE 11

In the figure, the number 1 signal waves represent the first broadcast signal that is reflected from the cable break (which means there is no resistor to absorb the wave energy). The number 2 waves are from a later signal, and they collide with the number 1 waves. This collision prevents node D from receiving signal 2 or the reflected signal 1. Node A receives no signal because the cable break has interrupted the signal path.

In this example, nodes A and D are having problems communicating. If node F is trying to communicate with either node A or node D, it might appear that node F is having problems. The cable break between nodes A and B is the problem, but the symptoms may appear in several places.

The symptoms of this problem can be intermittent because they change each time a different node starts transmitting. The occurrence of the wave collisions is based on the wave frequency and the length of the cable. Each time a different node begins transmitting and another node starts responding, the collision points move or increase in number.

The solution to the disconnected cable problem is to test the network methodically until the node or nodes that can never communicate are located (node A in this example).

If the problem was a poor connection at the same location, node A might sometimes work and make it impossible to find a node that never works. The solution to this type of problem is to split the network into two properly terminated networks and test again. This is called a split-halves search and is described further in Section 3, Troubleshooting.

Loop Networks

Loop networks display symptoms that are very similar to those produced by poor connections and disconnects. Because there is no termination in loop networks (two cables are plugged into every connector), signal waves rotate around the network and collide into themselves or other signals (Figure 12). If many users try to use the network, the symptoms may appear everywhere.

The best way to detect loop networks is to check the end connectors whenever you suspect intermittent cable problems. Only one network cable should be plugged into each end connector. Check this first because it takes very little time and immediately rules out one possible problem.

Cable Too Long

The recommended maximum length for a LocalTalk cabling system is 300 meters (about 1,000 feet). Beyond 300 meters, network operation may suffer because the impedance of the cabling absorbs energy and reduces the strength of the signal.

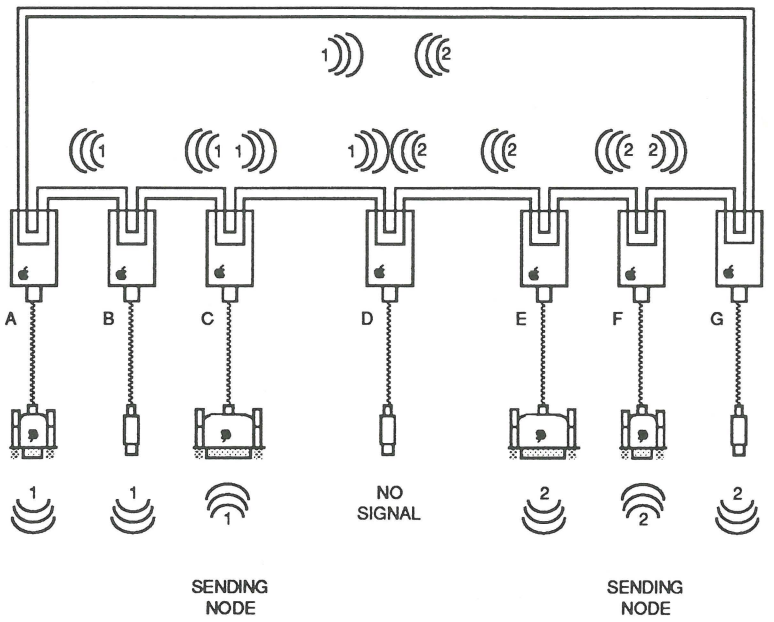


FIGURE 12

The best way to avoid this problem is to know how much cable is connected to the network. When you suspect the cable length may be the problem, check the end nodes to be sure someone else has not extended the network. If the network needs to travel more than 300 meters, consider adding a bridge (see *AppleTalk Technical Procedures).*

Noise

Network noise from electromagnetic interference (EMI) and radio frequency interference (RFI) can collide with network signals and create intermittent problems. Noise should not be a problem with LocalTalk cables and connectors, but it can be a problem if non-Apple cables and connectors are used.

If you suspect network noise problems with non-Apple equipment, consult the manufacturer of that equipment to find out if it was designed to protect against EMI and RFI.

Apple Technical Procedures

LocalTalk Cabling System

Section 2 – Troubleshooting Tools

❑ CONTENTS

❑ INTRODUCTION

Apple provides two troubleshooting tools for AppleTalk troubleshooting: Inter•Poll™ and NodeCheck™. Inter•Poll is an enhanced replacement for NodeCheck and should be used whenever you can use a Macintosh Plus, a Macintosh SE, or a Macintosh II for network testing. If your Macintosh has 512K of memory or less, you cannot run Inter•Poll and you should use NodeCheck.

Inter•Poll and NodeCheck are "roll call" tests for the AppleTalk network. They can be used to test a network when the network is first set up, to track down a problem when two or more devices (Macintoshes and LaserWriters, for example) aren't communicating, or to check whether LaserWriter printers, file servers, gateways, etc. are connected.

❑ INTER•POLL

Inter•Poll looks for workstations, shared devices, and internet devices in an AppleTalk network system and displays a table of devices with device names and addresses. The program allows you to rearrange the columns in the Inter•Poll window and sort the device listings to suit your preferences.

Inter•Poll also provides a message-sending function for testing individual devices and a workstation feature for examining workstations. By accessing software in workstation computers, Inter•Poll can determine

- the type of computer (Macintosh Plus, Macintosh II, Apple II, or MS DOS PC, for example),
- the version level of the System, Finder, and LaserWriter drivers,
- the number of hops or bridges to other network devices.

For more information on troubleshooting with Inter•Poll, please refer to the *Inter•Poll Network Administrator's Guide.*

❑ NODECHECK

NodeCheck looks for workstations and shared devices in a single AppleTalk network and displays a table of devices with device names and addresses. NodeCheck also allows you to send a messages between two computers that are running NodeCheck.

The *NodeCheck* diskette can be used on the Macintosh family of computers, and on the Lisa/Macintosh XL running MacWorks® (version 3.0 or later). If you have not used the Macintosh or MacWorks, see the owner's guides to get more help.

Starting Up NodeCheck

1. Insert the *NodeCheck* diskette and power up the system.

2. Select and open the *NodeCheck* disk icon.

3. Select and open the *NodeCheck* icon. After a few moments, the AppleTalk Network Status window will appear.

   Note: If you see the message "AppleTalk isn't installed properly on system disk," check to see that the LocalTalk connector is connected properly.

❑ USING NODECHECK

Naming Your Computer

Each time one of the network's computers or shared devices is turned on, a node number or "device number" is assigned to it. The device number can be different every time the device is turned on. **The** NodeCheck **program can list all of the devices on the network by their assigned device numbers, but NodeCheck can only "talk" to the ones that are given a name.** LaserWriters and other shared devices have names (and types) "built in," but Macintoshes and other computers do not. To name the computers on your network, you must start up *NodeCheck* on each terminal and assign each a name.

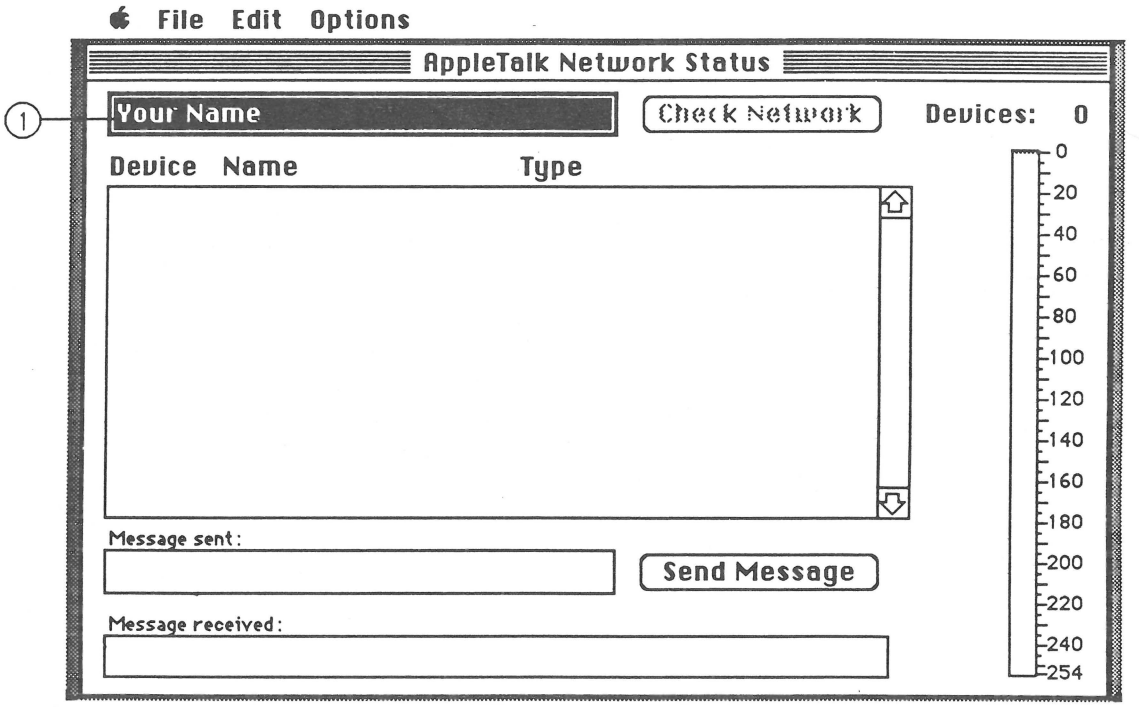


FIGURE 1

The **Your Name** field in the **AppleTalk Network Status** window (Figure 1, #1) is activated as soon as you enter the program. Enter a name (up to 32 characters) for the computer you are working on. You can use the real name of the person who uses that computer, or a letter code like A, B, or C. It is helpful to enter the name that is listed on the network cabling diagram, which was drawn when the system was set up (see Figure 2).

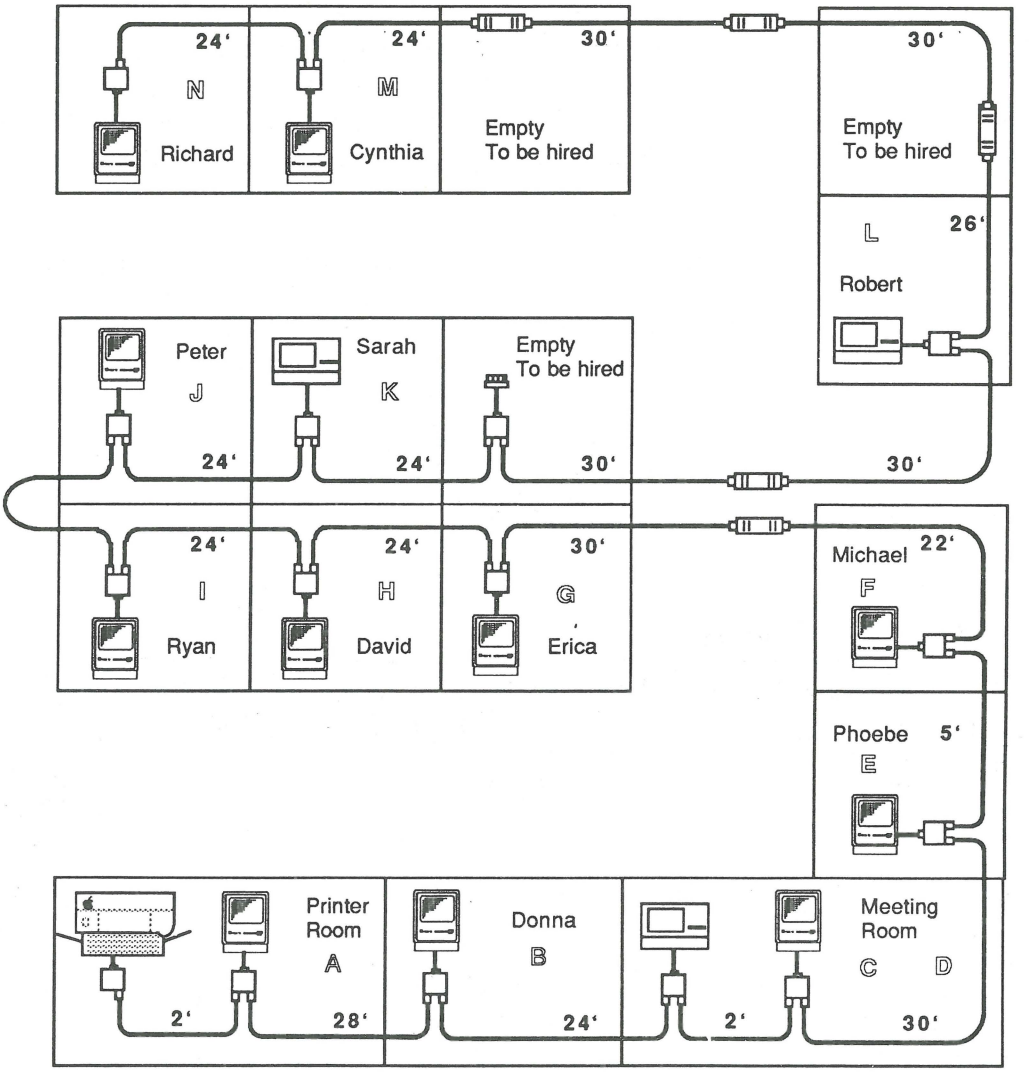


FIGURE 2

Checking the Network

After you have made an entry for **Your Name** (Figure 3, #1), press <Return> or click on **Check Network** (Figure 3, #2). *NodeCheck* registers the new name on the network and starts "looking" to see if there are any other devices on the network.

After the name you have entered is registered on the network, *NodeCheck* in effect broadcasts to the network, "I am looking for devices. Please respond." When *NodeCheck* receives a response from a device, a line appears at its device number on the scale (Figure 3, #3). This process is actively demonstrated by the hand icon, which moves down the left side of the scale, highlighting each device number as that device is "heard."

The scale (with the numbers 0–254) illustrates all the device numbers that can be assigned to the devices on the network. The numbers 0–127 are reserved for computers, and numbers 128–254 are reserved for LaserWriters and other shared devices. However, it is possible and acceptable for workstations to have shared device addresses and for shared devices to have workstation addresses.

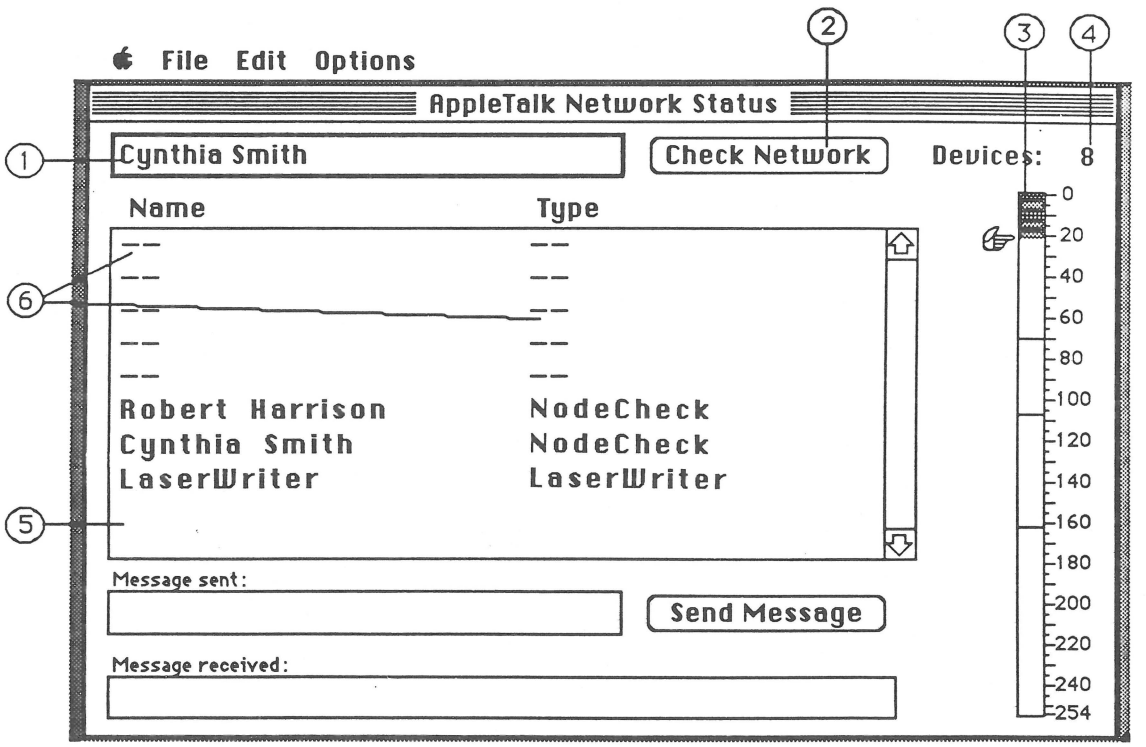


FIGURE 3

Devices (Figure 3, #4) will show you how many named devices *NodeCheck* finds on the network, **or** the total of all devices. The **Options** menu allows you to choose whether *NodeCheck* displays **Named Devices Only** (the default) or **All Devices**. (For a listing of available menu items, see "NodeCheck Appendix," below.)

Named devices, as they respond, are listed in the *NodeCheck* window (Figure 3, #5) by Name and Type. If you have chosen **All Devices** from the **Options** menu, the unnamed devices will also be displayed, but they will be represented only by dashes (Figure 3, #6).

You can list the devices by their numbers as well as by their names (Figure 4, #1) by choosing **Show Device Numbers** from the **Options** menu. (If all devices are being displayed, unnamed devices will be represented by numbers and dashes on the screen.) If there are more devices on the network than can fit on the screen, use the scroll arrows in the list box to display the remaining devices (Figure 4, #2).

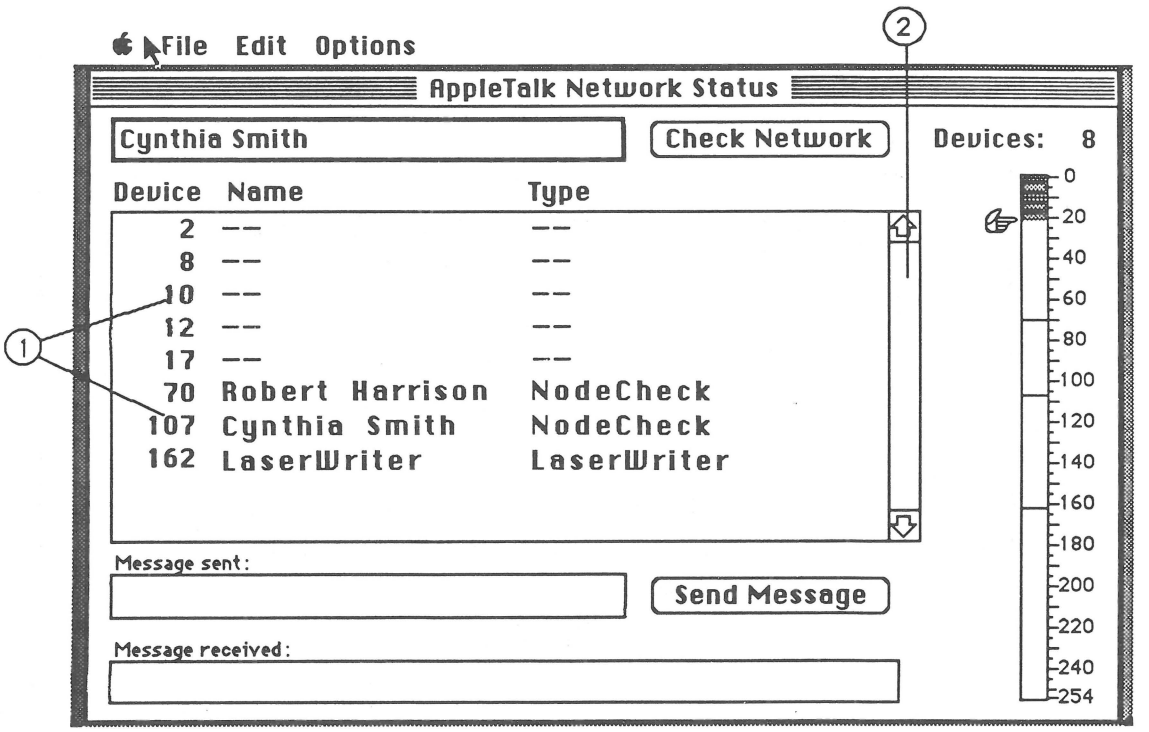


FIGURE 4

Printing Device Information

You may print out part or all of the information in the *NodeCheck* window. To print device information for all devices, choose **Print All Devices** from the **File** menu. If the option **Show Device Numbers** was selected from the **Options** menu, the device information printed will also contain the device numbers, as well as names and types. Figure 5 shows a printout from an **AppleTalk Network Status** display listing all devices and their numbers.

AppleTalk Network Status

Device	Name	Type
2	Kathi Venz	NodeCheck
8	--	--
10	--	--
12	--	--
17	--	--
24	--	--
33	--	--
41	--	--
59	--	--
70	Robert Harrison	NodeCheck
82	--	--
90	--	--
94	--	--
95	--	--
107	Cynthia Smith	NodeCheck
115	--	--
162	Laserwriter	LaserWriter

FIGURE 5

To print information about a specific device or devices, first highlight the device(s) in the *NodeCheck* window list by clicking on the device name. (For multiple device selection, hold down the <Shift> key and click on each selection.) Then choose **Print Selected Devices** from the **File** menu. Figure 6 shows the printout for a single selected device.

AppleTalk Network Status

Device	Name	Type
107	Cynthia Smith	NodeCheck

FIGURE 6

Note: The *NodeCheck* diskette must be in the disk drive of the computer from which you give the print command. And in order to print, you must have previously set up and configured a printer for the network (see "NodeCheck Appendix").

Sending Messages

You can use the **Message Sent** box (Figure 7, #1) to enter any message you wish to send to other devices on the network:

1. Highlight the **Message Sent** box by clicking on it or by pressing the <Tab> key. Then enter a message (up to 50 characters long) such as, "Are you connected?"

2. When you have finished typing your message, click on **Send Message** (Figure 7, #2). (If the **Message Sent** box is highlighted, pressing <Return> will also send the message.)

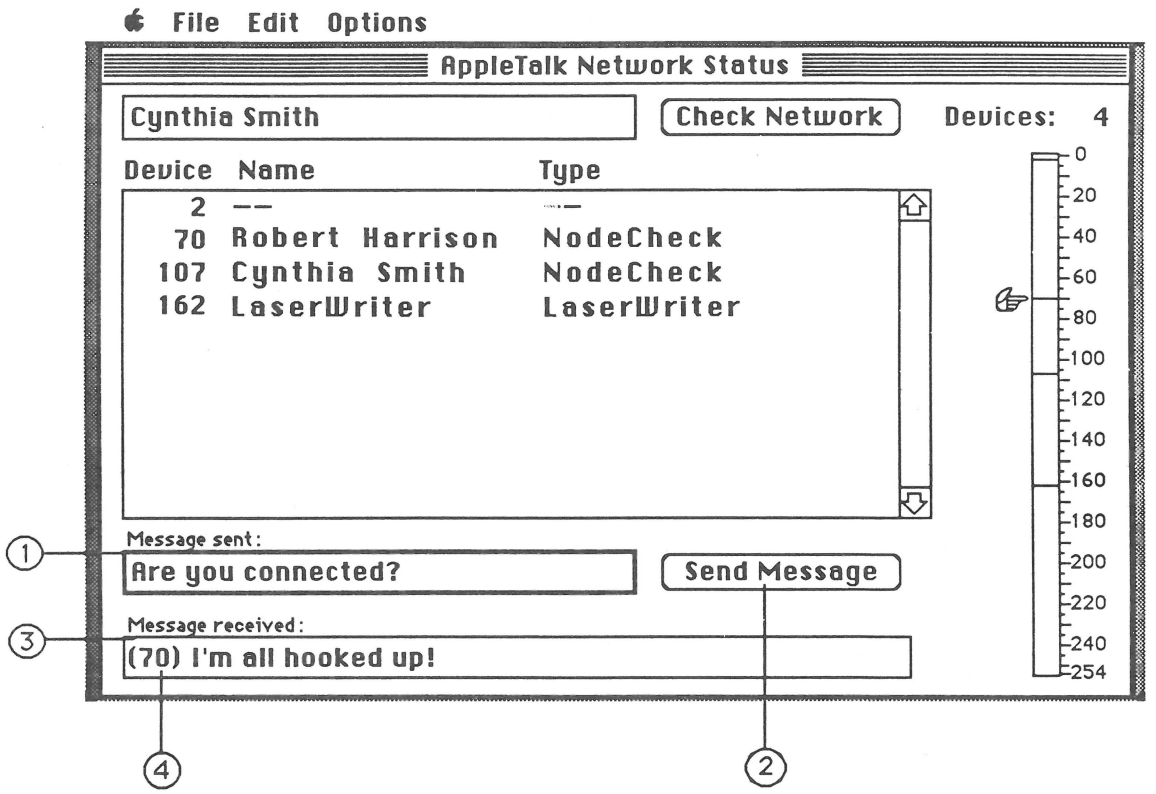


FIGURE 7

Your message will be broadcast to all devices on the network.

To send a message to a specific device, choose **Send Message To...** from the **Options** menu and click on **Selected Devices**. Then, in the display that appears on the screen (Figure 8, #1), enter the desired device number in the box (Figure 8, #2) and click on **OK**.

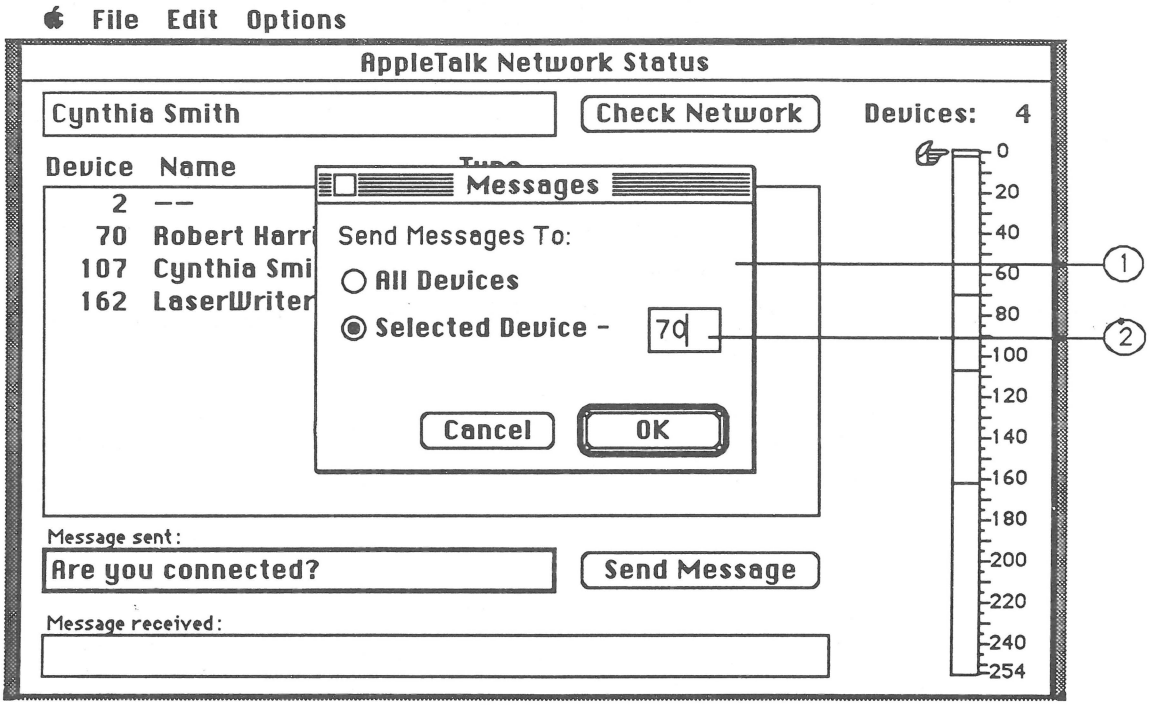


FIGURE 8

You can also identify the selected device by clicking on its name in the *NodeCheck* window display list. Then choose **Send Message To...** from the **Options** menu, click on **Selected Devices**, and click on **OK**.

Receiving Messages

Messages are received in the **Message Received** box (Figure 7, #3). Each message is preceded by the device number of the sender (Figure 7, #4).

Messages from more than one device may be received, but only the last message received from each device will be shown. If more than one message is in the "queue," small scroll arrows will appear and allow the different messages to be scrolled into the **Message Received** box.

You can clear the **Message Received** box by choosing **Check Network** or by turning off the computer.

❑ USING NODECHECK DURING NETWORK INSTALLATION

As you set up, it is a good idea to use *NodeCheck* to ensure that all of the devices are correctly connected to the network. To do this:

1. Draw a network map and assign each computer a name (Figure 9).

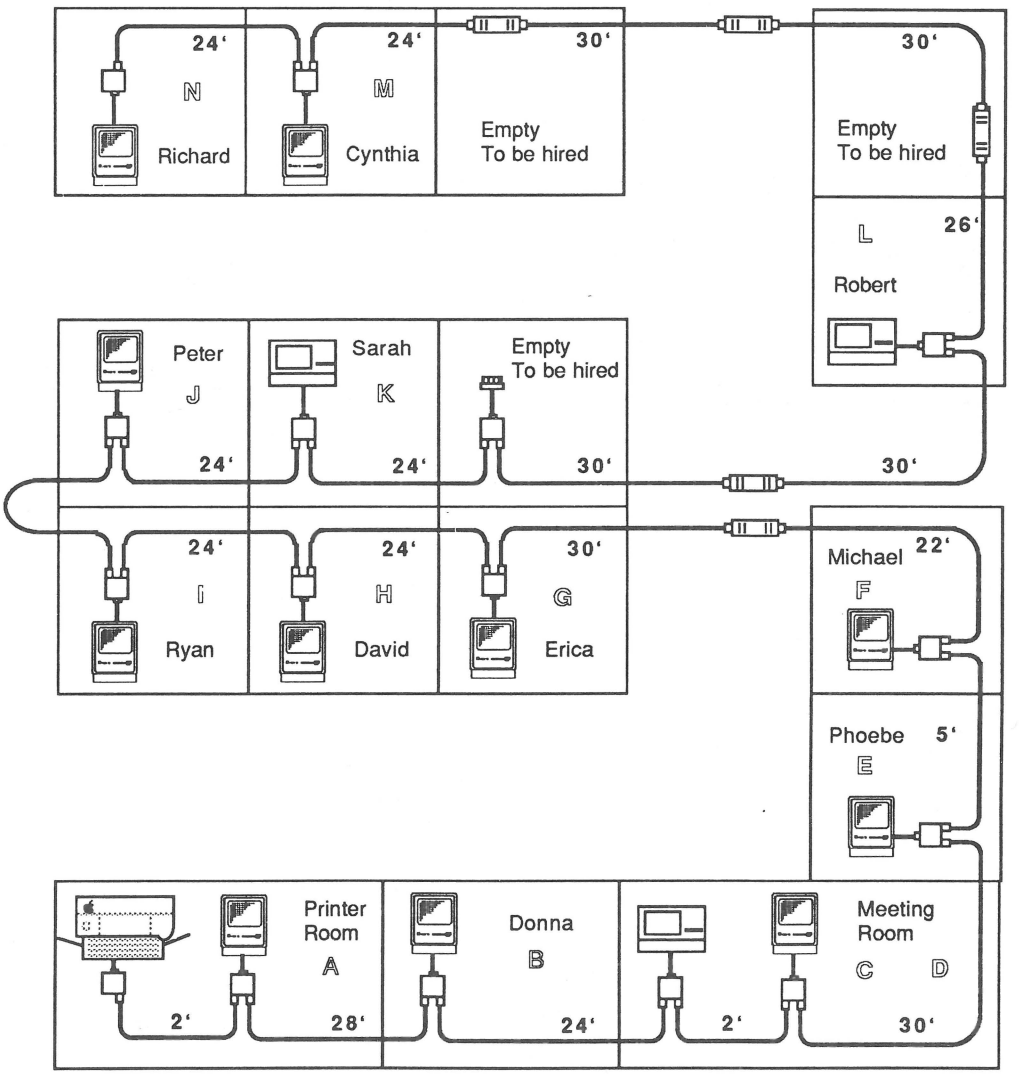


FIGURE 9

2. Run *NodeCheck* on each computer as it is connected to the network: start up *NodeCheck* on the computer, enter the computer's assigned name, and click on **Check Network**. All computers and shared devices that are connected to this computer should be displayed on the screen.

   Note: You can start up *NodeCheck* on all the devices using the same *NodeCheck* diskette. Once the program is started up, simply select **Eject** from the **File** menu and take the diskette to the next device. The diskette is necessary only for starting up the program, for using desk accessories, and for printing.

3. When you have hooked up the last device and run *NodeCheck* on it, all of the assigned names should be listed on the **AppleTalk Network Status** display. If they are all listed, the network is functioning.

If you are setting up a network in several different rooms or floors of a building, the **Send Message** option can save you a lot of time and footwork.

You can broadcast a message on the network, and an assistant can acknowledge your message by sending you a return message using the same method. All you have to do is wait for a response in the **Message Received** window.

If you know the device number of your helper's computer, you can send the message to that specific device instead of to **All Devices**, and your helper can send a message to your specific device also.

❑ NODECHECK APPENDIX

Special NodeCheck Options

The **Apple** (), **File**, and **Edit** menu options function as they do in other applications. The **Apple** menu contains help screens that describe *NodeCheck's* uses. Unusual menu options are described below.

File Menu

The **File** menu has the following special options:

- **Print All Devices** prints a copy of the full *NodeCheck* device list.
- **Print Selected Devices** allows you to print device information about devices you have selected from the *NodeCheck* window list.
- **Quit** allows you to exit the program. If you have changed program options, you will be asked if you want to save your changes before you quit. (The term "program options" refers to any options you have chosen from the **Options** menu.) If you choose **Yes**, the options you have selected during this session will be in effect the next time you start up *NodeCheck*. If you select **No**, the options will revert to those that were in effect before this session. If you select **Cancel**, you will be returned to the program without quitting.
- **Eject** allows you to eject the diskette from the drive.

Options Menu

The **Options** menu has the following special items:

- **Show Device Numbers/Don't Show Device Numbers** allows you the option of displaying the devices' address numbers.
- **Named Devices Only/All Devices** allows you to display only those devices that have names (devices running *NodeCheck* or shared devices), or to display all of the devices on the network.

- **Send Message To...** gives you the choice of sending a message to one selected device or to all of the devices on the network.

- **Sound**, when checked, makes *NodeCheck* audibly "beep" whenever a message is received and whenever a device changes its name or logs on or off the system.

Putting NodeCheck on a Hard Disk

You can install *NodeCheck* on the hard disks of network computers so that you can check the network at any time without using a *NodeCheck* diskette. To install NodeCheck:

1. Insert the *NodeCheck* diskette into the drive.

2. Select and open the *NodeCheck* diskette icon.

3. Select the *NodeCheck* icon and drag it to the hard disk icon.

The program will be copied from the diskette to the hard disk.

AppleTalk and Printer Configuration

If you wish to print out *NodeCheck's* device information, you must configure the computer(s) to print with an attached or shared printer.

- With 128K systems, the printer configuration must be set up before you open the *NodeCheck* icon, and you must not open the **Chooser** after beginning the *NodeCheck* program.

- With 512K and larger systems, the **Chooser** may be accessed at any time during the running of *NodeCheck.*

To configure the computer for printing:

1. If you are using a NodeCheck diskette, make sure the NodeCheck diskette is in the internal disk drive.

2. Select **Chooser** from the **Apple** menu.

3. Choose the appropriate printer and the proper (modem or printer) port.

4. Close the Chooser window.

   Note: If the desk accessory **Chooser** is not available from the **Apple** menu, copy the *NodeCheck* icon to a diskette containing the **Chooser** desk accessory.

Apple Technical Procedures

LocalTalk Cabling System

Section 3 – Troubleshooting

❑ CONTENTS

❑ BEFORE YOU BEGIN

This section provides a logical approach for troubleshooting AppleTalk network problems caused by the LocalTalk Cabling System. A step-by-step procedure for LocalTalk troubleshooting is not practical because LocalTalk Cabling Systems vary in size and layout.

Before you begin, take some time to learn the AppleTalk network and its components, and any application programs being used. The *AppleTalk Technical Procedures* describe network operation and troubleshooting and can help you determine if the problem is in the LocalTalk cabling or in other AppleTalk components.

❑ NETWORK TROUBLESHOOTING FORM

The first step in troubleshooting is to complete the Network Troubleshooting Form (Figure 1) as described in the *AppleTalk Technical Procedures*.

The Network Troubleshooting Form asks the following questions:

- How many nodes have symptoms?
- Are problems intermittent?
- Device types?
- Total cabling ≤ 300 meters?
- Any recent changes?
- Is there a network map?
- Are problems in one continuous section?

The answers to these questions can help you identify the problem quickly, without having to work through the entire troubleshooting procedure.

NETWORK TROUBLESHOOTING FORM

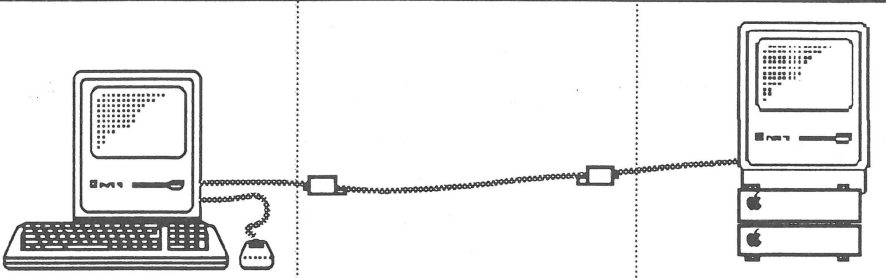
Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

Network

Only ☐
Source ☐
Destination ☐



WORKSTATIONS

SHARED DEVICES

How many nodes have symptoms?

One ☐
Two or more ☐

Device types: _____

Applications: _____

System/ Finder Versions: _____

Printer Driver Versions: _____

CABLING

LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____

Total LocalTalk cabling length ≤ 300 meters? _____

One ☐
Two or more ☐

Are problem(s) intermittent? Yes ☐ No ☐

Total nodes (workstations + shared devices must be ≤ 32): _____

Is there a network log? _____

Any recent changes? _____ What changed? _____

Is there a network map? _____

Do problems appear in one physical area? _____

What has been done already? _____

Notes: _____

FIGURE 1

How Many Nodes Have Symptoms?

The number of nodes that have symptoms can be a clue to the nature of a cabling problem. If only one workstation has the problem, the source could be a faulty connector at that workstation. If two or more workstations have problems communicating with just one shared device, the problem could be the connector at the shared device, or it could be somewhere else in the cabling.

Are Problems Intermittent?

When problem symptoms are intermittent, there is a good chance that the problem is an unterminated network or a loop network. Section 1, Basics, explains how unterminated networks and loop networks create problems.

When you suspect an unterminated or a loop network, locate and examine the end connectors on the network. If there is just one cable in each connector, there can be no network loop, and the termination is *probably* good at each end (although the connectors could be bad).

Device Types?

Since there are alternative AppleTalk cabling systems on the market, you need to ask which cabling system is being used. The procedure in this section covers the LocalTalk Cabling System.

If the customer is using a non-AppleTalk cabling system, refer to the manuals for that system to troubleshoot it. If the customer is mixing cabling systems, you may need to disconnect them and test them separately.

Total Cabling ≤ 300 Meters?

The recommended maximum length of a LocalTalk Cabling System is 300 meters (1000 feet), so be sure to check the total cabling length. The problem caused by an extended network is described in Section 1, Basics.

Although the 300-meter limit is recommended, the limit is not absolute. The specific combination of cables, connectors, and extenders determines the absolute limit of each network. A LocalTalk Cabling System can work above 300 meters, but the only way to identify the absolute limit is to exceed it and create problems. Problems may appear immediately or may be hidden until a change in network traffic occurs.

If you discover that a customer has exceeded the 300-meter limit, ask a few more questions:

- Are the problem devices at opposite ends of the network?
- How long has the extended network been working?
- Did the problem occur after a recent network change?

If you discover that the problem devices are at opposite ends of the network, the cabling is probably too long. If the devices cannot be moved closer together (to reduce cabling length), perhaps the customer can add a bridge to create an internet consisting of two LocalTalk Cabling Systems. This solution increases the total capacity to 600 meters and may be necessary if more additions are planned.

If the problem nodes are close together, the network has been working well for some time, and there have not been any recent changes, the cabling length may not be the problem. Look at the rest of the information you have gathered and see if there is a more likely cause.

Any Recent Changes?

If a network was working well, then was changed, and now is not working well, there is a good chance that the change caused the problem. If the changes were recent, examine the equipment that changed. This simple checkup can reduce troubleshooting time considerably.

Is There a Network Map?

A network map is the most important troubleshooting tool for cabling problems. The ideal network map shows:

- The location of each node.
- The type of node at each location.
- The length of cable between each pair of nodes.
- The order of the nodes from one end of the network to the other.

A reduced version of the AppleTalk Network Map form is shown in Figure 2. At the back of this section is a full-size version that you can use as a duplication master.

The blank lines above or below each box are for recording the location, name, or user's name of each node. The boxes, and the codes in the upper right corner of the map, are for recording the types of nodes. The blank lines attached to each cable (the lines between nodes) are for recording the length of each cable.

The network map helps to identify problem areas in a network. If all the problems are between two specific areas, the suspect cabling would also be there.

The best network map would show the physical layout of the network. If the customer has such a map, it will quickly acquaint you with the network.

If the customer does not have a network map, you may need to create one to speed up troubleshooting. If you do not have the time to create a map with a physical layout, use a copy of the AppleTalk Network Map form. When the map is complete, give one copy to the customer and keep another copy for your records. It may be useful later.

APPLETALK NETWORK MAP

M = Macintosh
P = Printer
S = Server, File or Other
L = Link, Bridge or Gateway

Cable lengths in _____

AppleTalk Network # ___

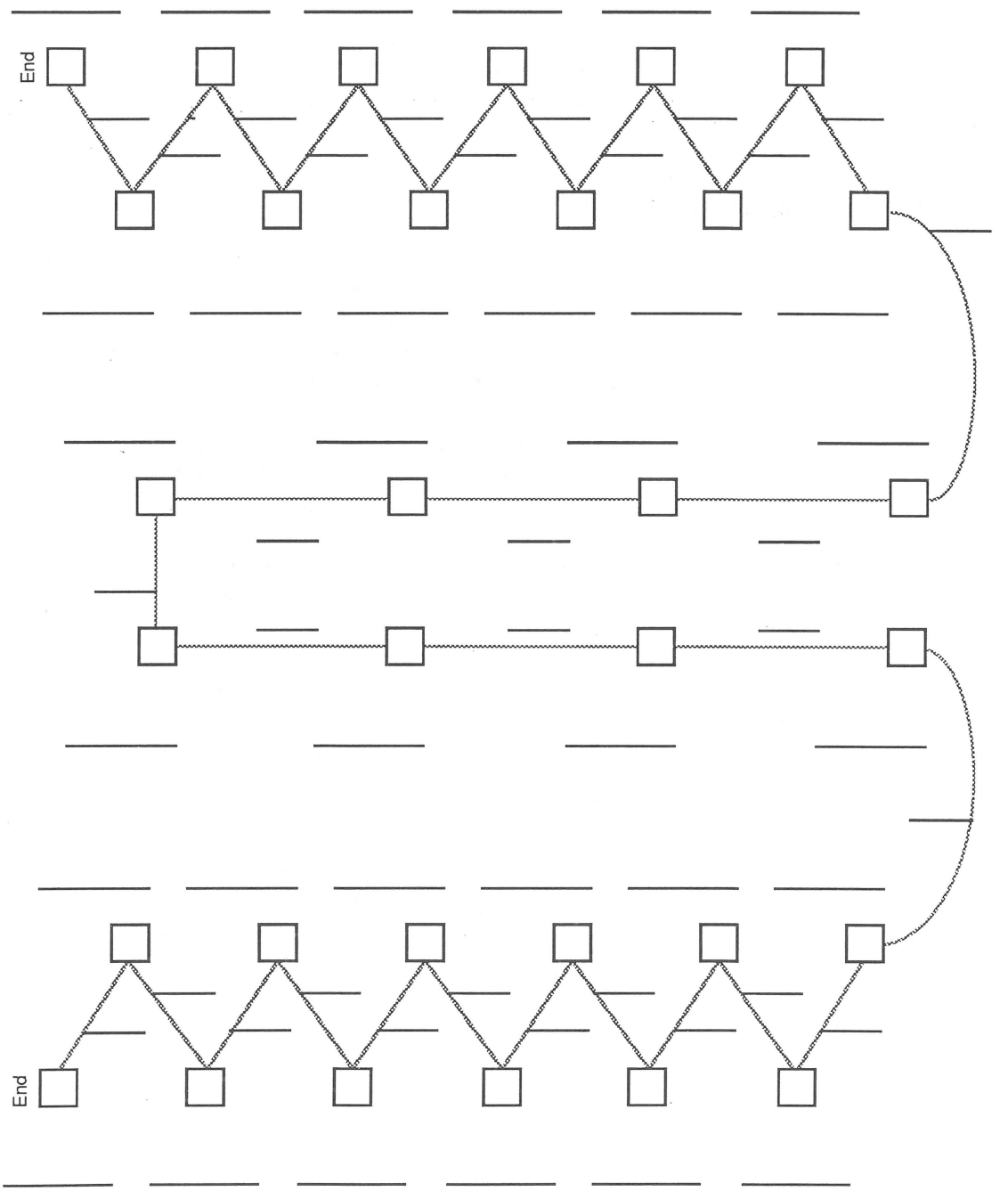


FIGURE 2

Problems in One Continuous Section?

Problems that appear in one continuous section of the network are likely to be cabling problems. The cabling should be checked first at the boundaries of the area, and then throughout the network. The rest of the network may need to be checked because signal reflections from an unterminated cable (see Section 1, *Basics)* can cause problems in other network areas.

❑ TROUBLESHOOTING

Follow the troubleshooting procedure below when there are no clues about the location of the problem. As you become more familiar with this procedure, you may want to omit some steps.

1. Gather all troubleshooting information. If the network is longer than 300 meters, follow the directions in the preceding section.

2. If you are at the customer's site, have the customer execute the network operation that is having the problems. Ask yourself:

   - Does this network operation make sense?

   - Are the problem symptoms the same as those reported?

   If the operation does not make sense, the problem may be user error and not cabling. If the symptoms are different from those reported, update your notes and troubleshooting approach to reflect the true symptoms.

3. Check the LocalTalk connectors at each end of the network. Only one cable should be plugged into each connector.

4. For small networks (2–8 nodes), check all network cabling connections:

   - Two cables should be plugged into each connector box that is not an end connector.
   - For each node that uses AppleTalk, a LocalTalk connector should be plugged into the node.
   - All cables and connectors should be joined completely so that no connections are loose.

5. For larger networks (9 or more), use a split-halves search (described below) to isolate the problem to a cable, cable extender, or connector module.

6. Replace or bypass (described below) the suspect component, and retest.

Split-Halves Search

A split-halves search is a troubleshooting method for isolating faulty cabling components. To use the split-halves search:

1. Remove the center cable in the network (see Figure 3).

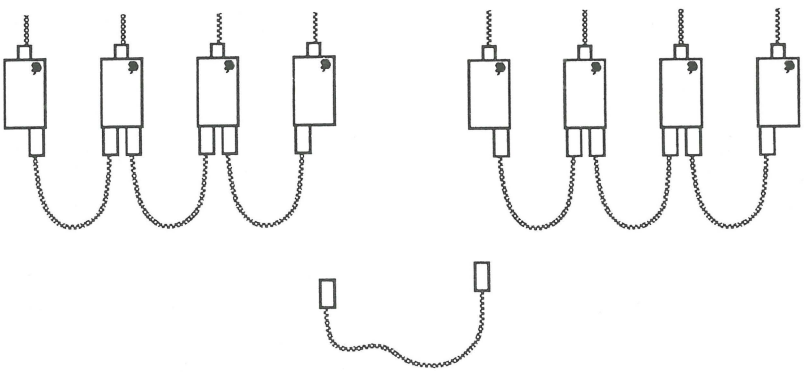


FIGURE 3

2. Test each network half separately (see below).

3. Remove the cable in the center of the faulty portion of the network (see Figure 4).

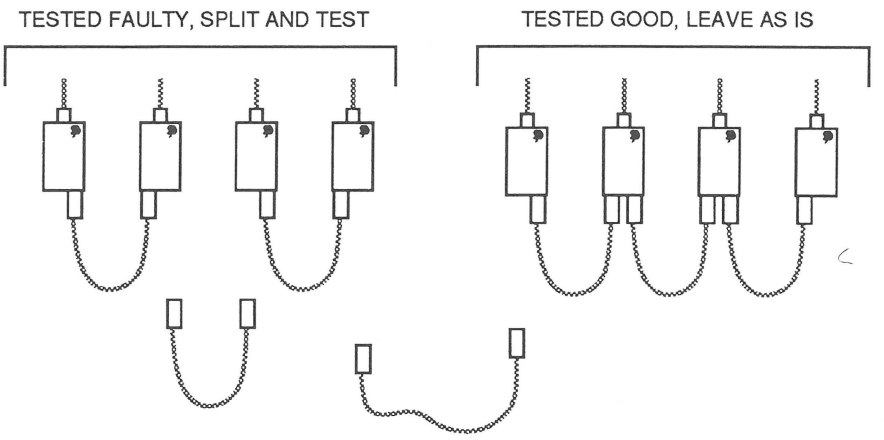


FIGURE 4

4. Test each of the new network halves.

5. Repeat steps 3 and 4 until the network cannot be split again.

   Note: As you continue to split the network, you may want to reconnect any "good" portions to any other adjacent "good" portions. This will allow users on the good portions to keep using the network.

Testing

Each time the network is split, both halves must be tested. Since you are searching for a cabling problem, your test must verify that all nodes in each portion of the split network can communicate with each other.

To test a separated portion of a network, use the Macintosh Chooser (see your *Macintosh* manual), Inter•Poll, or NodeCheck (see Section 2, Troubleshooting Tools). The Chooser can "see" (list) *only* shared devices; Inter•Poll and NodeCheck can see *any* device.

Note: All devices must have their power on, have AppleTalk active in the Chooser, and be connected to LocalTalk before Chooser, Inter•Poll, or NodeCheck can see them. If you are using Inter•Poll, you should either search for all devices (which is not the default condition), or you should make sure that the Responder software is installed at each Macintosh workstation.

Use Chooser, Inter•Poll, or NodeCheck to look from one end of the network to the other (see Figure 5). If you can see from one end to the other, or from a point in the center to both ends, the network path is complete.

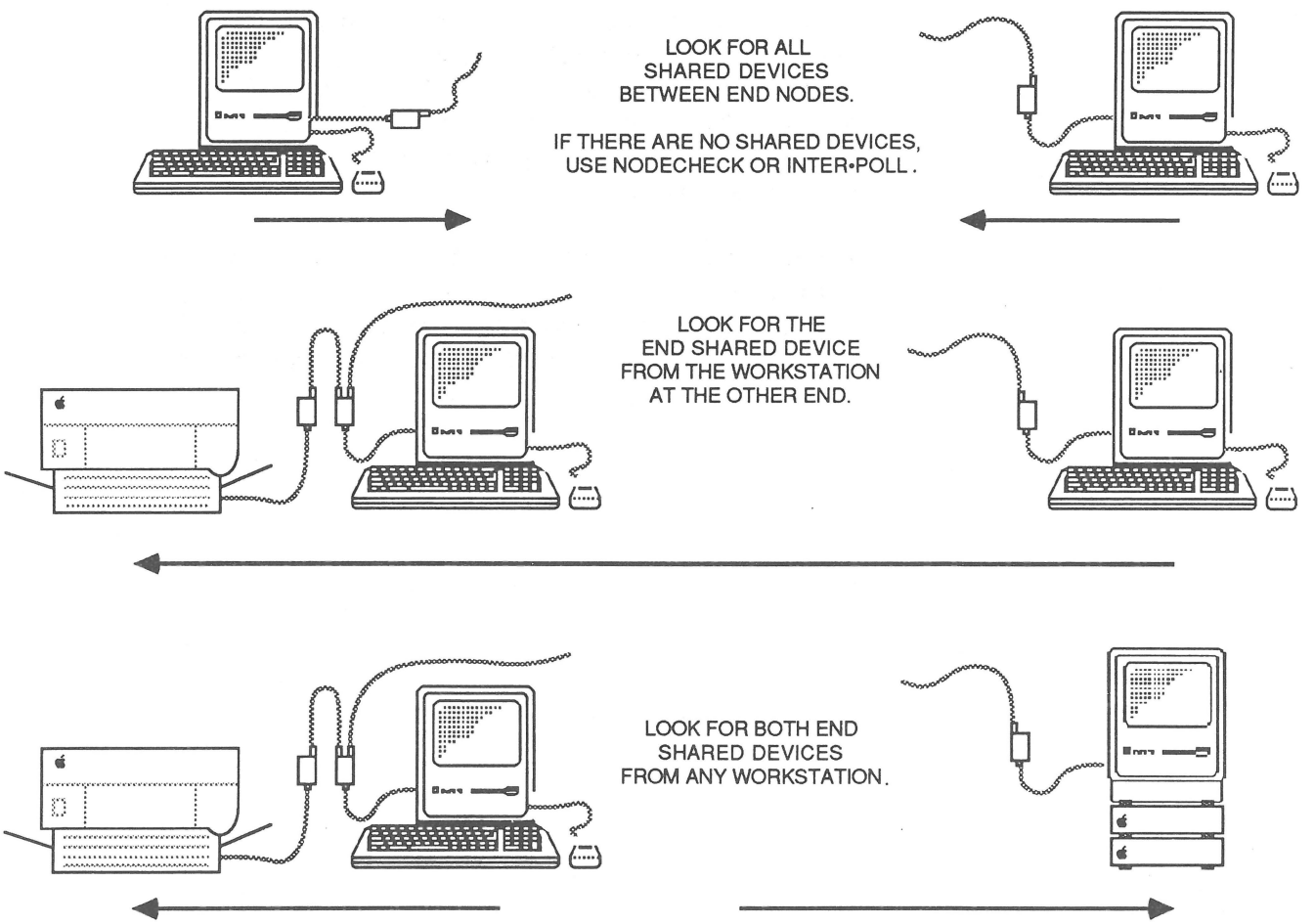


FIGURE 5

Now use Chooser, Inter•Poll, or NodeCheck at each workstation to verify that all workstations can see all shared devices. If they can, there are probably no loose connections (intermittent problems can disappear during testing).

> ***Note:*** You cannot use Chooser to see a shared device if the software for that device is not installed at the workstation.

The Macintosh Chooser is usually the preferred testing method because it is a desk accessory and requires the least interruption of the workstation user. But Chooser can only see shared devices, so Inter•Poll or NodeCheck must be used when there is no shared device on the network portion under test.

As you split the network and test each portion, keep an eye out for obvious cable problems (loose cables or connections). If you reach a point where both halves of a split network are good, replace the cable you removed with a known-good cable and retest the combined network.

If you reach the point where the bad portion of the network is made up of two nodes, two connectors, and one cable (or extended cable), replace the cable first and retest. If the network is still bad, replace the connectors one at a time and retest.

Bypassing Components

While troubleshooting, you may want to bypass a node or cable, and then test the network to see if the bypassed device was the cause of the problem.

To bypass a cable (see Figure 6), remove the cable ends from the connector and replace them with the ends of a known-good cable. If the suspect cable runs through walls or attics, consider running the known-good cable down a hallway or up stairs. Try to avoid replacing a cable until you know that it is bad.

> ***Note:*** When bypassing a cable with a longer cable, do not forget the 300-meter limit.

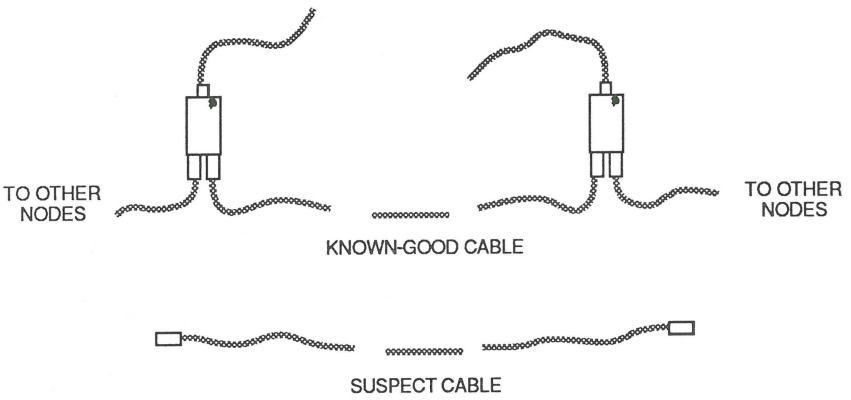
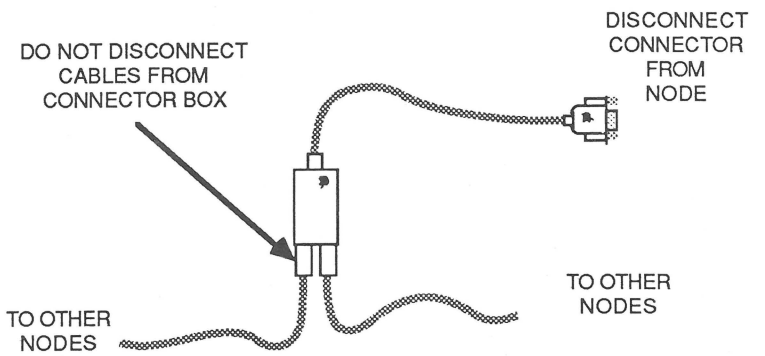
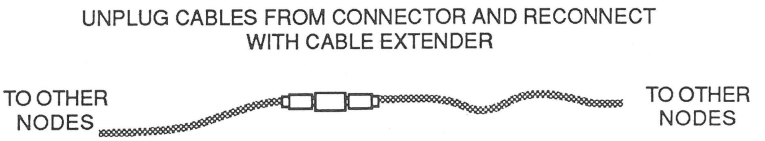


FIGURE 6

You may want to bypass a node if you suspect that it, and not the cabling, is the cause of the problem. As shown in Figure 7, there are two ways to bypass or remove a node from a network.



OPTION 1



OPTION 2

FIGURE 7

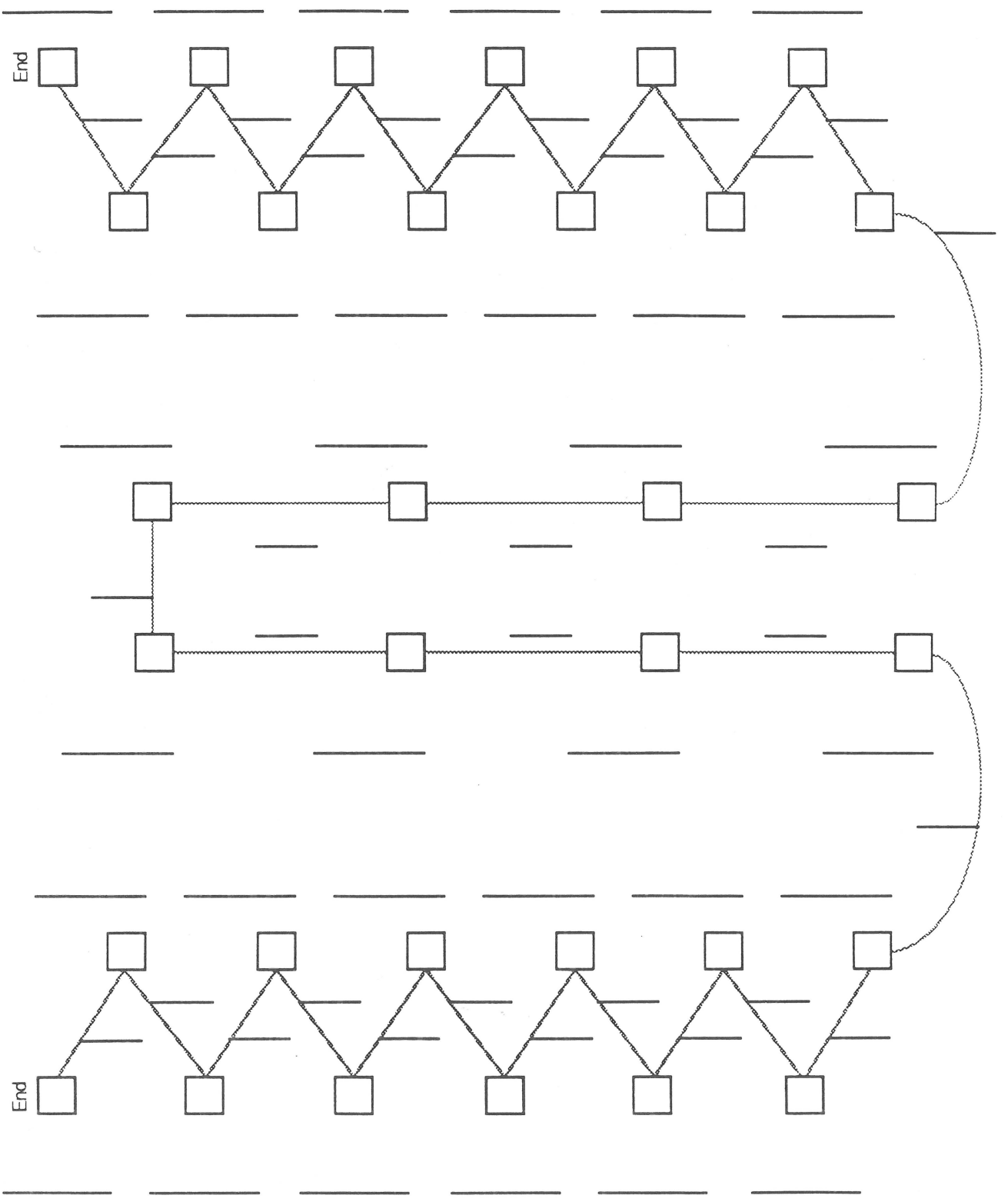
If you suspect a node problem, bypass the suspect node and test the cabling. If the problem has disappeared, reconnect the network halves and test. If the reassembled network is working and there are no problem symptoms, you have isolated the problem to that node. Examine the node and correct the problem before reconnecting it to the network.

APPLETALK NETWORK MAP

M = Macintosh
P = Printer
S = Server, File or Other
L = Link, Bridge or Gateway

Cable lengths in _____

AppleTalk Network # ___



NETWORK TROUBLESHOOTING FORM

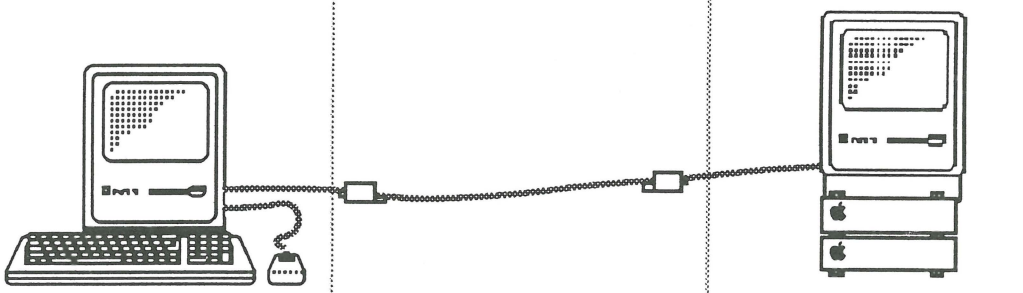
Date: _____

Business Name: _____ Phone: _____

Contact Name: _____ Phone: _____

Network

Only ☐
Source ☐
Destination ☐



WORKSTATIONS **SHARED DEVICES**

How many nodes have symptoms?

One ☐
Two or more ☐

Device types: _____

Applications: _____

System/ Finder Versions: _____

Printer Driver Versions: _____

CABLING

LocalTalk ☐
EtherTalk ☐
Other Cabling ☐
Brand: _____

Total LocalTalk cabling length ≤ 300 meters? _____

One ☐
Two or more ☐

Are problem(s) intermittent? Yes ☐ No ☐

Total nodes (workstations + shared devices must be ≤ 32): _____

Is there a network log? _____

Any recent changes? _____ What changed? _____

Is there a network map? _____

Do problems appear in one physical area? _____

What has been done already? _____

Notes: _____

Apple Technical Procedures

LocalTalk PC Card

Technical Procedures

❑ TABLE OF CONTENTS

Apple Technical Procedures

LocalTalk PC Card

Section 1 – Basics

❑ CONTENTS

❑ PRODUCT DESCRIPTION

Overview

The LocalTalk™ PC Card allows you to connect IBM PCs and PC-compatible computers to an AppleTalk network system utilizing the LocalTalk cabling system, and to use any LaserWriter® printers attached to that network. You can print files on the LaserWriter that were created with PC applications.

The Card

The card is a half-size board that fits into any of the empty slots in a PC. A connector on the board attaches to a LocalTalk connector box, which links the PC to the LaserWriter through the AppleTalk network.

The Software

Two MS-DOS-compatible 5.25-inch diskettes are shipped with the card. The diskettes contain programs that support the printing of documents from popular applications including WordStar, MultiMate, Lotus 1-2-3, and Microsoft Word. Text files in ASCII format or files prepared for printing on a Diablo 630 printer can also be printed on the LaserWriter.

What's in the Box

The LocalTalk PC Card box contains the following items:

- LocalTalk PC Card
- Startup and Applications diskettes
- *LocalTalk PC Card User's Manual*

Installation Instructions

Detailed instructions for installation of the LocalTalk PC Card can be found in the user's manual, which accompanies the product.

❑ THEORY OF OPERATION

The LocalTalk PC Card can be viewed as a single-board computer with two interfaces: a PC-compatible interface for communication with the host computer, and a LocalTalk network interface for communication with the LocalTalk cabling system. A short description of the functions of the major integrated circuits follows.

A **65C02A microprocessor** (U4A) provides for the processing of commands and control signals from the PC, receiving/transmitting and buffering of packets from and to the network, and handling of ATP (AppleTalk Transaction Protocol) transactions.

A **6264 8K x 8-bit static RAM** (U1A) provides working storage for the on-board 65C02A microprocessor.

A **2764 8K x 8-bit EPROM/ROM** (U3A) contains the operating firmware for the card, including AppleTalk protocol support. To ensure compatibility with third-party software, the EPROM/ROM should be revision C (P/N 342-0007-C) or higher (see "ROM Upgrade").

An **8530 Serial Communications Controller** (U6A) converts data from serial to parallel and vice-versa and handles all control functions associated with the AppleTalk network.

A **26LS30 RS-422 Line Driver** (U8B) converts TTL-level signals to an RS-422 differential signal.

A **26LS32 RS-422 Line Receiver** (U7B) converts the RS-422 differential signal to a TTL-level signal.

Data Transfer

The transfer of data between the PC and the LocalTalk Card is done through one of the DMA (Direct Memory Access) channels of the computer. The card has option switches so that one of two channels may be used. Refer to the following section, "Option Switches," for further information.

Control Signals

The LocalTalk PC Card uses eight I/O ports to pass DMA and interrupt control information back and forth between itself and the PC. The starting address of these I/O ports can be changed using one of the option switches on the card. Refer to the following section, "Option Switches," for further information.

❑ OPTIONS SWITCHES

The LocalTalk PC Card has an eight-position DIP switch (SW1) for defining how the card will communicate with the PC. The interrupt request level, DMA channel, and I/O port addresses are selected using these switches, as shown in the following table:

TABLE 1

Switch	Function
1	Interrupt Request - Level 4
2	Interrupt Request - Level 3
3	Interrupt Request - Level 2
4	DMA Request - Channel 3
5	DMA Request - Channel 1
6	DMA Acknowledge - Channel 3
7	DMA Acknowledge - Channel 1
8	I/O Port Addresses $24X (switch ON) I/O Port Addresses $22X (switch OFF)

Switches 1, 2, and 3 determine the priority level at which the card will interrupt the processor to indicate that the card requires servicing. Only one interrupt request level should be selected. A "level 2" interrupt is the highest priority; "level 4" is the lowest.

Switches 4 through 7 determine which DMA channel the card will use. Only one DMA channel should be selected. Also, the DMA Request and DMA Acknowledge channels **must match**.

Switch 8 selects the range of I/O port addresses to be used. Setting the switch ON selects ports $240 through $247. Setting the switch OFF selects ports $220 through $227.

Standard Setup

The LocalTalk PC Card is shipped from the factory with SW1 set to use interrupt request level 3, DMA channel 1, and I/O port addresses $240 through $247.

The switches should be set as follows:

Switches 2, 5, 7, and 8	ON
Switches 1, 3, 4, and 6	OFF

These switch settings should not need to be changed unless another card is installed that uses the DMA channel, I/O port addresses, or interrupt request level listed above. In that case, you will have to change the setup of one of the cards.

❑ ROM UPGRADE

Introduction

To provide compatibility between the LocalTalk PC Card and third-party software, the LocalTalk PC Card ROM has been revised. The new ROM has a new part number (342-0007-C).

If a crash occurs, check the part number of the ROM in column 3. Replace the ROM if it is not revision C or higher.

Materials Required

IC extractor

Installation

1. Locate in column 3 on the LocalTalk PC Card the ROM with part number 342-0007-A or -B (Figure 1, #1).

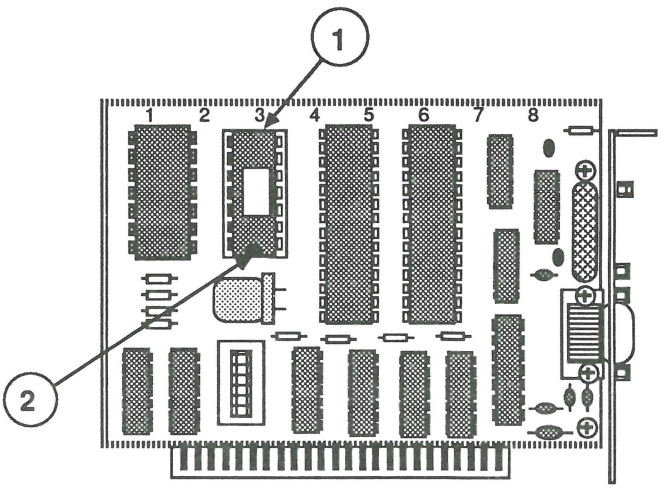


FIGURE 1

2. Remove the ROM with IC extractors. If it is difficult to remove, gently pry both ends up with a jeweler's screwdriver.

3. Position the new ROM with part number 342-0007-C (or higher) on the socket. Be sure that the notch (Figure 1, #2) on the ROM is facing toward the center of the card. Press the ROM firmly into the socket.

Apple Technical Procedures

LocalTalk PC Card

Section 2 – Troubleshooting

❑ CONTENTS

❑ INTRODUCTION

General Information

Most failures of the LocalTalk PC Card are quickly and easily solved by exchanging the defective card for a new one. Do not attempt to repair circuitry on the card. You may, however, upgrade the ROM (see "ROM Upgrade").

However, do keep in mind that many "failures" can be attributed to nonhardware faults. So before exchanging the card, look for things like incorrect DIP switch setup, conflicting cards, and software problems. Be especially concerned with these kinds of failures if you are troubleshooting during the installation process.

Before You Start

Read the "Things to Remember" section before you begin troubleshooting. There are a number of tips and suggestions that will aid you in quickly and accurately diagnosing the failure and implementing the remedy.

❑ THINGS TO REMEMBER

Safety Precautions

1. Follow the basic ESD precautions when troubleshooting. Refer to the *You Oughta Know* tab in the *Apple Service Technical Procedures* manuals for more information.

2. Be sure the power is off before installing or removing the card.

3. Refer to the manuals that came with the computer you are working with for any additional safety information.

Helpful Hints

1. The card may be installed in any slot with the exception of slot 8 of an IBM PC/XT or PC/XT-compatible.

2. The card uses COM2 to communicate with DOS. You will need to change one card or the other if any other cards installed in the system also use COM2.

   Note: You will need to refer to the documentation that comes with the other cards to determine if they use COM2 to talk to DOS. If they do, the documentation will also tell how to change the other card's setting from COM2.

3. If you are installing the card in an IBM PC/AT or PC/AT compatible, interrupt level 2 **cannot** be used.

4. If the system displays problems after installation of the LocalTalk PC Card—for example, the system "hangs" while loading DOS, or a serial port that did work doesn't work anymore—the cause may be incompatibility between two cards. Remove all the cards but those that are absolutely necessary (such as the display adapter, floppy/hard disk controllers, and the LocalTalk PC Card) and try the system again.

...Continued on next page

Then install the other cards, one at a time, trying the system after each. When you install a card that causes the system to "misbehave," check the setup of that card to answer these questions:

- Does it use the same I/O port addresses as the LocalTalk PC Card?
- Does it use the same DMA channel?
- Does it use the same interrupt lines?
- Does it use COM2?

If you answer yes to any of these questions, you will need to modify the setup of either the LocalTalk PC Card or the other card. Refer to Section 1, Basics, for further information on changing the standard setup of the LocalTalk PC Card.

❑ SYMPTOM/CORRECTIVE ACTION CHART

How to Use the Symptom Chart

The symptom chart has two columns. The left column lists a symptom; the right column lists corrective actions. For each symptom, perform the corrective actions in the order listed. If a corrrective action does not fix the problem, proceed to the next step.

In addition to the symptoms presented here, additional troubleshooting information is available in the *AppleTalk* section of the *Apple Service Technical Procedures.*

Network Problems	Solutions
• *No zones or LaserWriters found*	1. Check LocalTalk connection. 2. Verify option switch settings. 3. Check for duplicate I/O addresses, interrupt levels, or DMA channels. 4. Exchange card.
• *System hangs when accessing network*	1. Verify option switch settings. 2. Exchange card.

Compatibility Problems	Solutions
• *System hangs while booting from the hard disk*	1. Change option switches to DMA channel 1. 2. Exchange card.
• *Cards that worked before don't work now*	1. Check for duplicate I/O addresses, interrupt levels, or DMA channels. 2. Exchange card.
• *Card does not work with third-party software*	1. Check and replace the ROM if it is not revision C or higher. 2. Exchange card.

Apple Technical Procedures

AppleShare

Technical Procedures

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Apple Technical Procedures

AppleShare

Section 1 – File Server General Information

❑ CONTENTS

❑ INTRODUCTION

Technical Procedures for the AppleShare® File Server 2.0 consists of technical information, troubleshooting hints and tips, a list of available references, and other information that may be of value to the service provider. This information is intended to supplement that available in the manuals provided with AppleShare.

Differences Between Versions 1.1 and 2.0

AppleShare File Server version 2.0 is an upgrade to version 1.1. Changes that the technician should be aware of are discussed below.

- **Large volumes start faster**
  The time AppleShare requires at startup has been reduced.

- **Automatic "repair" at startup**
  In version 1.1, if errors were detected on startup, the administrator was required to run the *AppleShare Administrator* application to repair file server information on the affected volume. Version 2.0 automatically repairs the damaged information.

- **Support for read-only devices, like CD-ROM drives**
  Version 2.0 supports the use of storage devices that contain "fixed" or "recorded" information. This information cannot be changed or deleted. The AppleCD SC™ drive is an example of a read-only storage device.

- **Administration of the server while it's still operating**
  The AppleShare administration application can now be run without shutting down the server. Administration tasks can now be performed anytime without affecting users.

- **Apple IIe and IIGS® support**
  AppleShare now supports the Apple IIe and IIGS computers under the ProDOS® 8 and ProDOS 16 operating systems.

Hardware Requirements

Server:

Macintosh® Plus, SE, II, or IIx
- 1MB of RAM minimum
- Hard disk drive

Workstations:

Macintosh 512K, 512KE, Plus, SE, II, or IIx
- 512K of RAM minimum

Apple IIGS
- 768K of RAM minimum

IBM PC®, XT®, AT®, PS/2™ 25 & 30, & compatibles
- 384K of RAM minimum
- 2 floppy drives *or* 1 floppy and 1 hard disk

Number of Users Supported

AppleShare can support a maximum of 50 users per server. The actual number varies, depending on the type of computer (Macintosh Plus, SE, or II/IIx) and the amount of memory used in the server. The table below shows the various combinations.

Server Computer	*AppleShare Version*	*Number of Users*
Macintosh Plus, SE, II, or IIx	1.0	25
Macintosh Plus or SE	1.1/2.0	25 (1MB RAM) 50 (>1MB RAM)
Macintosh Plus or SE with a 68020 coprocessor card	1.1/2.0	50
Macintosh II	1.1/2.0	50

Macintosh

The tips that follow are for users who are running Appleshare on a Macintosh computer.

...Continued on next page

Desk Accessories

When users experience problems using AppleShare, the fault can sometimes be traced to a misbehaving desk accessory. If you have problems with a single workstation, try removing all non-Apple desk accessories. If the difficulties go away, add the desk accessories one at a time, testing the system after each addition, until the problem reappears. You will then have identified the problem desk accessory.

Software Versions

You should consult AppleLink® for the latest recommended versions of Macintosh system software.

Apple Technical Procedures

EtherTalk Cards

Technical Procedures

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Apple Technical Procedures

EtherTalk Cards

Section 1 – Basics

❑ CONTENTS

❑ INTRODUCTION

The EtherTalk™ Interface Card and EtherTalk NB allow you to connect a Macintosh® II family computer to an Ethernet® local-area network using the 802.3 IEEE standard. The cards support both thick and thin Ethernet (coaxial) cabling. Using thin Ethernet cable eliminates the need for the external transceiver required when using thick Ethernet cable.

When the EtherTalk Interface Card or EtherTalk NB is installed and connected to the Ethernet cable, you can send and receive files over the Ethernet network using the A/UX® or Macintosh operating systems. AppleTalk Phase 1 and 2 are supported when using either operating system. TCP/IP and the Network File System (NFS) are supported when using A/UX. TCP/IP and NFS can also be used when operating under the Macintosh OS using optional MacTCP™ software available from Apple Software Licensing.

Differences Between the Cards

The EtherTalk Interface Card and EtherTalk NB cards are functionally equivalent, with one exception. The EtherTalk Interface Card contains 16K of RAM to buffer data between the network and the interface card, whereas The EtherTalk NB contains 64K of buffer RAM.

❑ ETHERTALK INTERFACE CARD UPGRADE

A system containing a revision F (or lower) EtherTalk Interface Card should be upgraded by installing a revision G (or higher) card. The revision level is marked on the card at coordinates F-6, beside the large NuBus™ connector.

After the upgrade, you must reinstall the software by using version 1.1 (or higher) of the *EtherTalk Installer*.

Note: The upgrade applies only to the EtherTalk Interface Card, not the EtherTalk NB.

Apple Technical Procedures

EtherTalk Cards

Section 2 – Diagnostics

❑ CONTENTS

❑ INTRODUCTION

MacTest™ II/IIx and MacTest IIcx provide a one-card test and a two-card test for the EtherTalk Interface Card and EtherTalk NB. The two-card test uses a known-good card in addition to the suspect card, and tests communications between the two cards.

Both tests check the functional areas of the suspect card independently. The two-card test also checks to see if each of the functional areas works properly with the other functional areas.

If possible, always run the two-card test. **The one-card test cannot locate all problems**. If the customer reports that the card cannot transmit or receive data, and if the card passes the one-card test, you need to run the two-card test.

Note: Neither test checks the DB-15 connector (which is used for thick Ethernet cable) on the EtherTalk Interface Card.

The following conventions are used in these procedures (unless otherwise noted):

1. References to "EtherTalk cards" apply to both the EtherTalk Interface Card and EtherTalk NB.

2. Procedures are the same for both *MacTest II/IIx* and *MacTest IIcx* operating on any Macintosh II family computer.

❑ ONE-CARD TEST

Materials Required

MacTest II/IIx or *MacTest IIcx* disk
Macintosh II family computer
EtherTalk terminator kit

Procedure

1. If you are **not** using a known-good computer to test the EtherTalk card, start up *MacTest* and run the logic, drive, and monitor tests. (For MacTest operating instructions, see *Macintosh Family Technical Procedures*, "Diagnostics" for the Macintosh computer you are using.) Complete any needed repairs before you continue.

2. Turn the computer power off.

3. Put on your grounded wriststrap and set the EtherTalk card on the grounded workbench pad. Set the jumper on the EtherTalk card for thin cable, and install the card in the computer. (See "Setting the Jumper," later in this section.)

4. Assemble and install the loopback connector as follows:

   a) Select a T-connector and two terminators from the terminator kit (Figure 1). Connect the female end of each terminator to one of the male ends on the T-connector, and give the female connector barrel a twist to the right to secure the connection.

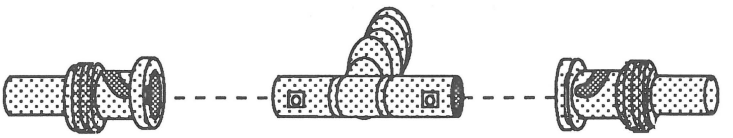


FIGURE 1

b) Locate the male connector on the EtherTalk card, and join the female connector on the T-connector to the connector on the card.

5. To start the diagnostic, insert the correct MacTest disk into drive one (right), and turn on the power.

6. If you do not know what expansion slot the EtherTalk card is in, pull down the Options menu and select **Configuration** (<Command>–K). Note the expansion slot number of the EtherTalk card for use in Step 7.

7. Pull down the Options menu and select **Test Selections** (<Command>–T). Click on the EtherTalk Interface Card check box until an X is displayed in the check box, and then enter the expansion slot number in the box to the right of the test name. (You may want to turn off all other tests to reduce testing time.) Then click **OK**.

8. Click **Start**.

   Note: If you did not install the loopback connector in Step 4, or if you did not install it properly, MacTest displays a window asking you to install the connector. Turn the power off (to reset the EtherTalk card), install the connector as described in Step 4, and continue this procedure at Step 5.

   MacTest runs until the test passes or until a failure is detected. If the test fails, MacTest displays a window with troubleshooting instructions. For additional information, see Section 3, Troubleshooting.

❑ TWO-CARD TEST

Materials Required

MacTest II/IIx or *MacTest IIcx* disk
Macintosh II family computer
Known-good EtherTalk Interface Card (Rev. G or higher) or EtherTalk NB
EtherTalk terminator kit
Thin net test cable

Procedure

1. If you are **not** using a known-good computer to test the EtherTalk card, start up MacTest and run the logic, drive, and monitor tests. (For MacTest operating instructions, see *Macintosh Family Technical Procedures*, "Diagnostics" for the Macintosh computer you are using.) Complete any needed repairs before you continue.

2. Turn the computer power off.

3. Put on your grounded wriststrap and set the EtherTalk card on the grounded workbench pad. Set the jumper on both EtherTalk cards for "thin cable" (BNC), and install the cards in the computer. (See "Setting the Jumper," later in this section.)

   Note: Record the slot numbers used by the card under test and by the known-good card (Rev. G or higher). The slot numbers are 1 (which is next to the power supply) through 6 (which is farthest from the power supply).

4. Assemble and install the loopback cable as follows:

   a) Select two T-connectors and two terminators from the terminator kit (Figure 2). For each T-connector, connect the female end of one terminator to one of the male ends on the T-connector.

   b) Connect each end of the thin net test cable to the remaining male end on each T-connector.

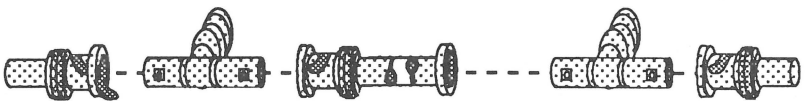


FIGURE 2

   c) Locate the male connector on each EtherTalk card. Join the remaining female connector on each T-connector to the connector on each card.

5. To start the diagnostic, insert the correct *MacTest* disk into drive one (right), and turn on the power.

6. Select the two-card test as follows:

   a) Pull down the Options menu and select **Test Selections**.

   b) Click **Communication test of EtherTalk Card** until an X is displayed in the check box. In the box to the right of the test name, enter the expansion slot number for the card under test.

   c) Click **known-good card** (Rev. G or higher) until an X is displayed in the check box. In the box to the right of the test name, enter the expansion slot number for the known-good card.

   d) Click **OK**. (You may want to turn off all other tests to reduce testing time.)

7. Click **Start**.

MacTest runs until the test passes, or until a failure is detected. If the test fails, MacTest displays a window with troubleshooting instructions. For additional information, see Section 3, Troubleshooting.

Note: If you did not install the loopback cable in Step 4, or if you did not install it properly, MacTest displays a window asking you to install the connector. Turn the power off (to reset the EtherTalk card), install the loopback cable as described in Step 4, and continue this procedure at Step 5.

Note: Test failure may indicate either a faulty board or a Rev. F (or lower) EtherTalk Interface Card (see EtherTalk Interface Card Upgrade in Section 1, Basics).

❑ SETTING THE JUMPER

1. Locate the jumper labeled P4 (Figure 3) and see if it is set for thick cable (DIX) or thin cable (BNC).

2. If the jumper is set for thick cable (DIX), remove the jumper, and install it in the position for thin cable (BNC). (Do not forget to reset the jumper before you return the card to the customer.)

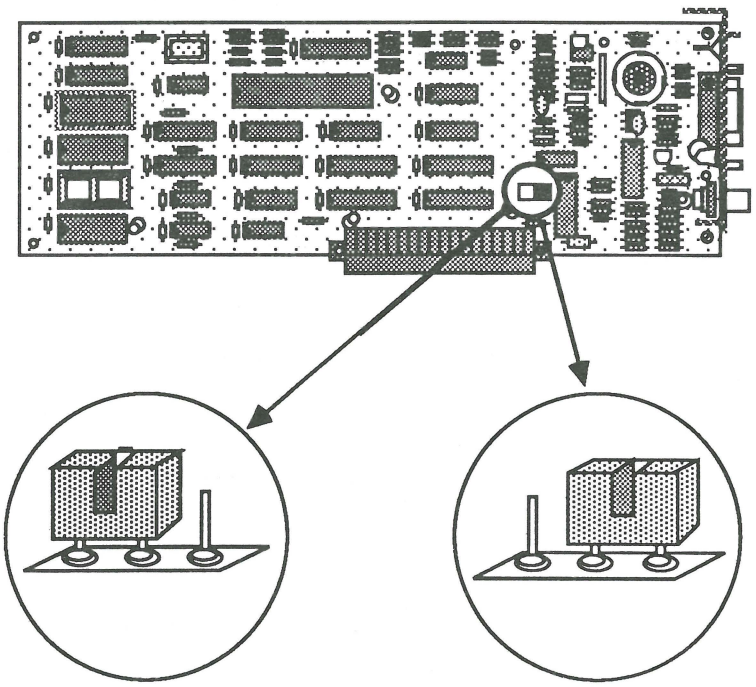


FIGURE 3

Apple Technical Procedures

EtherTalk Cards

Section 3 – Troubleshooting

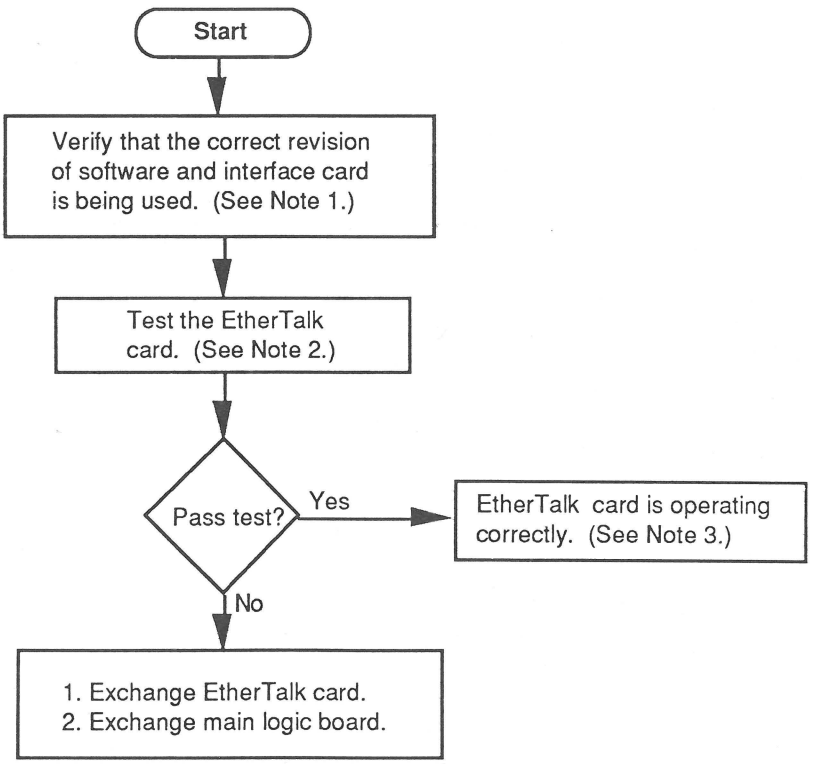
❑ CONTENTS

❑ USING THE FLOWCHART

Starting at the top of the flowchart, answer the questions and proceed down the chart. When you arrive at a rectangular box containing a list of actions, perform the actions in the sequence listed. Upon completion of each action, test again to see if the action corrects the problem. **If the problem remains, reinstall the original module before you go to the next action.**

The flowchart includes references that provide additional instructions or referrals to other procedures.

❑ TROUBLESHOOTING FLOWCHART



Notes

1. Refer to "Compatibility Chart."
2. Refer to Section 2, Diagnostics.
3. If you suspect intermittent problems, repeat the test several times.

❑ COMPATIBILITY CHART

Users sometimes experience problems using the EtherTalk Interface Card or EtherTalk NB. The problem can be due to incompatibility between the model of Macintosh computer and the revision level of the card and software being used. The chart below shows which revision of card and software to use.

CPU	Card	Software
Macintosh II/IIx	EtherTalk (Rev J or K) EtherTalk NB (Rev L or M)	EtherTalk 2.0.1 or greater
Macintosh IIcx	EtherTalk (Rev K) EtherTalk NB (Rev L or M)	EtherTalk 2.0.1 or greater
Macintosh IIci	EtherTalk NB (Rev L or M)	EtherTalk 2.0.3
Macintosh IIfx	EtherTalk NB (Rev L or M)	EtherTalk 2.0.2 or greater
Macintosh IIsi	EtherTalk NB (Rev L or M) requires adapter card	EtherTalk 2.0.3

Note: Determining the version of the driver software currently installed on the computer can be difficult. To bypass this problem, use the *Apple Network Product Installer* disk to reinstall your network software. There are two current versions of network software. Version 6.0.5 resides on 800K disks and will install EtherTalk 2.0.2. Version 6.0.7 is on 1.4MB disks and contains EtherTalk 2.0.3.

Apple Technical Procedures

EtherTalk Cards

Illustrated Parts List

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The figures and lists in this section include all piece parts that can be purchased separately from Apple for EtherTalk Cards, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

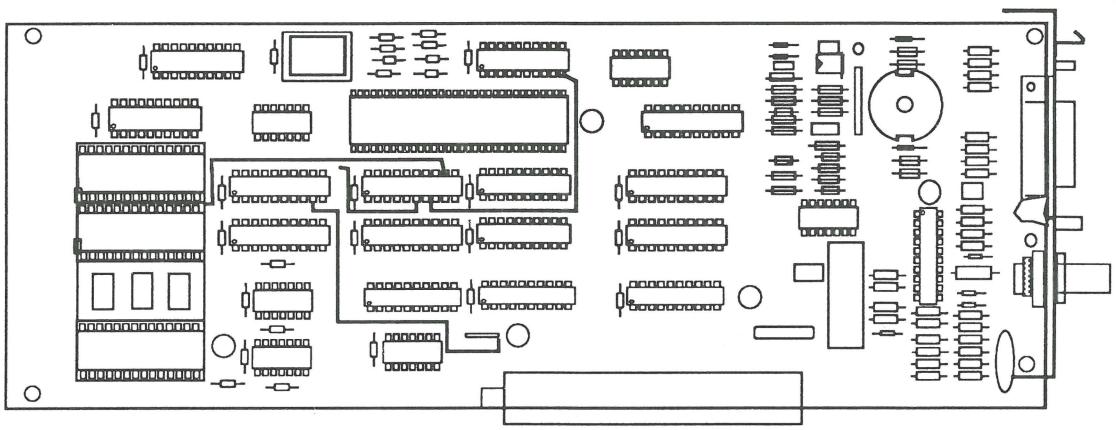

FIGURE 1

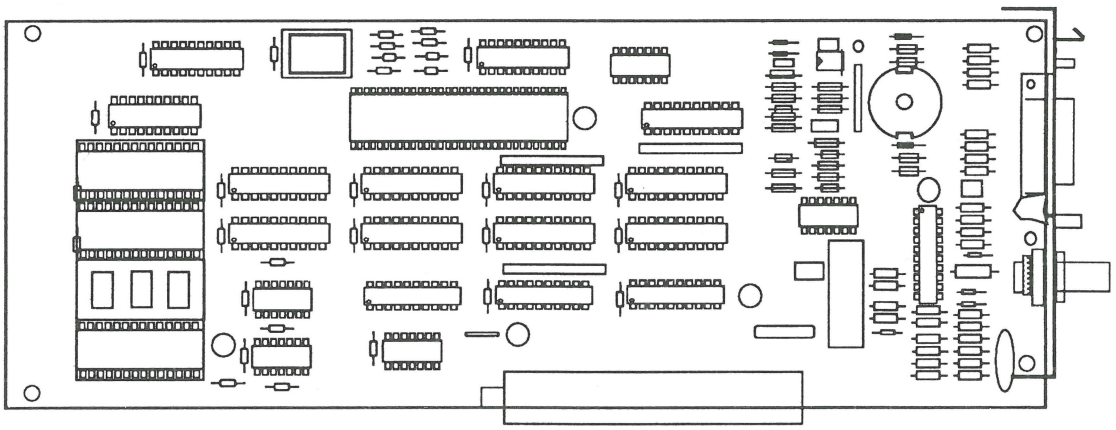

FIGURE 2

❑ ETHERTALK INTERFACE CARD (Figure 1)

Item	Part No.	Description
–	661-0414	EtherTalk Interface Card

❑ ETHERTALK NB CARD (Figure 2)

Item	Part No.	Description
–	661-0496	EtherTalk NB Card

Note: The distinguishing features between the EtherTalk Interface Card and the EtherTalk NB Card are:

- The EtherTalk Interface Card has jumper wires.
- The EtherTalk NB Card has resistor packs.

Apple Technical Procedures

Ethernet Networks

Technical Procedures

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Apple Technical Procedures

Ethernet Networks

Section 1 – Apple Ethernet LC Card

❑ CONTENTS

❑ BASICS

Product Description

The Apple Ethernet LC™ communications controller card allows you to connect a Macintosh® LC computer to an Ethernet local-area network using the IEEE 802.3 standard.

Transceivers

The Apple Ethernet LC card supports thick and thin coaxial cabling and twisted-pair cabling. The card requires a specific transceiver for each type of cabling.

Thin coaxial cable, also called thinnet, connects to the Apple Ethernet LC card via an Ethernet Thin Coax Transceiver. The transceiver connects directly into the Apple Ethernet LC card's Ethernet port on one end and to the main cable on the other end; thus the standard T-connector is unnecessary. The Ethernet Thin Coax Transceiver is also self-terminating. The transceiver automatically terminates the network whenever a cable is not connected. This feature eliminates the need for a terminator plug.

Connecting the Ethernet LC card onto a thick coaxial cable network, thicknet, requires an Ethernet AUI Adapter and a transceiver. A drop cable may be necessary if the thicknet cable is installed in the ceiling. One end of the adaptor plugs into the Ethernet port and the other end of the adaptor is an AUI connector, which connects to a transceiver or a drop cable. Also, the AUI power connector must be connected to a power outlet.

The Ethernet Twisted-Pair Transceiver connects twisted-pair cabling to the Apple Ethernet LC card. The transceiver connects to the Ethernet port and provides an RJ-45 input jack for attaching the twisted-pair cabling.

When the Apple Ethernet LC card is connected to the Ethernet cable and the EtherTalk software is installed, you can send and receive files over an Ethernet network using the Macintosh operating system. The Apple Ethernet LC card requires AppleTalk Phase 2.

The *Apple Ethernet LC User's Guide* contains additional information regarding the Apple Ethernet LC card, software installation, and setup.

What's in the Box

The following items are included in the Apple Ethernet LC package:

- Apple Ethernet LC card
- A pair of plastic standoffs
- *EtherTalk Installer Disk*
- *Apple Ethernet LC User's Guide*

❑ TROUBLESHOOTING

Helpful Information

1. The Apple Ethernet LC card requires Macintosh system software version 6.0.7 or later. If you use an earlier version, update the software before proceeding.

2. Use the *EtherTalk Installer* disk if you install other network software or system software after the initial EtherTalk software installation.

Diagnostic Information

The diagnostic for testing the Apple Ethernet LC card is currently not available.

Symptom/Cure Troubleshooting

Many common failures are related to startup disks. These failures may occur because of the wrong version of the system file, improperly installed EtherTalk software, or a current startup disk that doesn't contain the EtherTalk software. These problems may be solved by

1. Restarting the computer with a startup disk containing a correctly installed version of EtherTalk, or

2. Reinstalling EtherTalk on the problem disk

The following list describes these problems in detail.

- **EtherTalk icon missing from the Network extension in the Control Panel**
  1. Card is not seated properly; try reseating.
  2. EtherTalk software is not installed properly on current startup disk. Reinstall EtherTalk software.
  3. Card is not working properly; try a known-good card.

- **Two or more EtherTalk icons appear in the Network extension in the Control Panel**
  - Earlier versions of EtherTalk are on your startup disk. Remove the earlier versions.

- **EtherTalk icon missing on startup**
  1. Card is not seated properly; try reseating.
  2. EtherTalk software is not installed properly on current startup disk. Reinstall EtherTalk software.
  3. System software is damaged. Reinstall system software.
  4. Card is not working properly; try a known-good card.

- **Network service missing (file servers, printers, modem servers, and so on)**
  1. Check service zones.
  2. The versions of EtherTalk on your system and on the network don't match. The network and your personal system must both be using EtherTalk Phase II to work properly.
  3. Check cables and connections.

- **Can't change network connection**
  1. The current network is providing a service that your computer is using.
  2. Your computer is providing a service that the network is using (file server, router, etc.).

Ethernet Networks

Section 2 – Ethernet Thin Coax Transceiver

❑ CONTENTS

❑ BASICS

Product Description

The Apple Ethernet Thin Coax Transceiver™ is a self-terminating thin-wire coaxial cable transceiver. It is used to connect Ethernet-compatible devices to an Ethernet local-area network using the IEEE 802.3 standard. One end of the transceiver plugs into the computer's Ethernet port; the other end connects directly onto the main network cable, and thus eliminates the need for the standard T-connector.

The Apple Ethernet Thin Coax Transceiver is used for networks configured in a bus topology. In a bus topology, each end of the main cable terminates—the ends are never joined. This design contrasts with network topologies where the main cable is joined at the ends to form a ring.

Related Products

Three cables have been designed to accompany the Ethernet Thin Coax Transceiver. The *Ethernet 2-Meter Self-Terminating Cable* contains one 2-meter length of thin-wire coaxial cable and is designed to span short distances. If the cable is used inside walls or ceilings, the cable must run though metal conduit. Length is the only difference between the *Ethernet 5-Meter Self-Terminating Cable* and the 2-meter cable described above. The third cable is the *Ethernet 13-Meter Self-Terminating Plenum Cable.* This cable is teflon-shielded and requires no conduit for installation in ceilings or walls.

The *Apple Ethernet Thin Coax Transceiver User's Guide* contains additional information regarding the Apple Ethernet Thin Coax Transceiver, installation, and bus network topology.

What's in the Box

The following items are included in the Apple Ethernet Thin Coax Transceiver package:

- Apple Ethernet Thin Coax Transceiver
- A two-meter length of Apple Ethernet Cable
- *Apple Ethernet Thin Coax User's Guide*

❑ TROUBLESHOOTING

Troubleshooting Checklist

The following is a checklist of common problems:

- **Is EtherTalk selected in the Control Panel?**
- **Is the transceiver connected to the correct port?**
- **Are the cables secure—are any dangling?**
- **Is the device that you're trying to contact turned on and ready?**
- **Is the device that you're trying to contact connected to the same network?**
- **Is the EtherTalk communications card O.K.?**
  Use a known-good card to test the questionable card's status.
- **Is your terminator 50 ohms?**
  Even though 75-ohm terminators fit, 50 ohms is the correct terminator rating when using unterminated cables.
- **Is the network configuration correct?**
  It is very important that the ends of the Ethernet backbone cable are terminated when using thinnet.

  If the network is configured in an active-star topology, the computer must be connected to a hub to perform properly.
- **Could the trouble be specific to the application or the device that you're using?**
  What initially appears to be a network problem can be application or device specific. Check the appropriate application or device manuals.

Apple Technical Procedures

Ethernet Networks

Illustrated Parts List

❑ CONTENTS

The figures and lists in this section include all piece parts that can be purchased separately from Apple for EtherTalk Cards, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

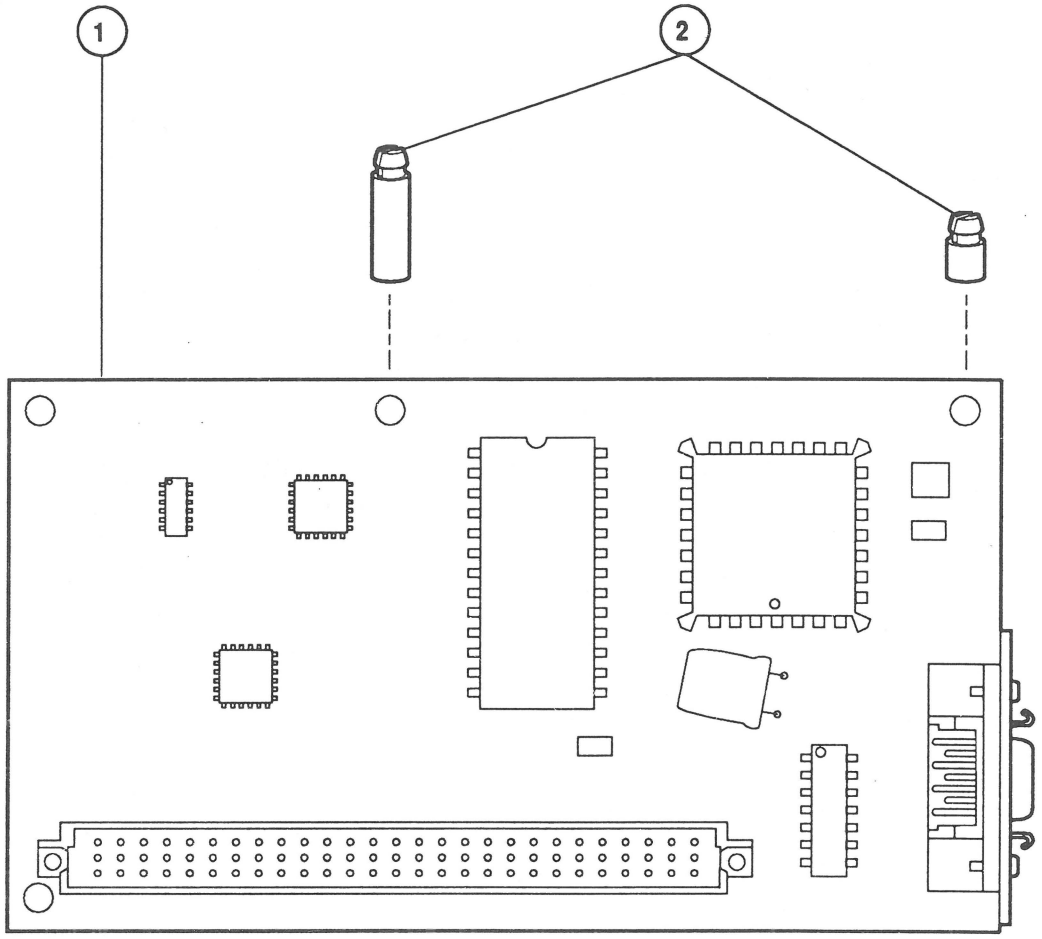


Figure 1 Apple Ethernet LC Card

❑ APPLE ETHERNET LC CARD (Figure 1)

Item	Part No.	Description
1	661-0621	Apple Ethernet LC Card
2	076-0543	Assembly, Ethernet LC Card, Standoffs, 10 sets

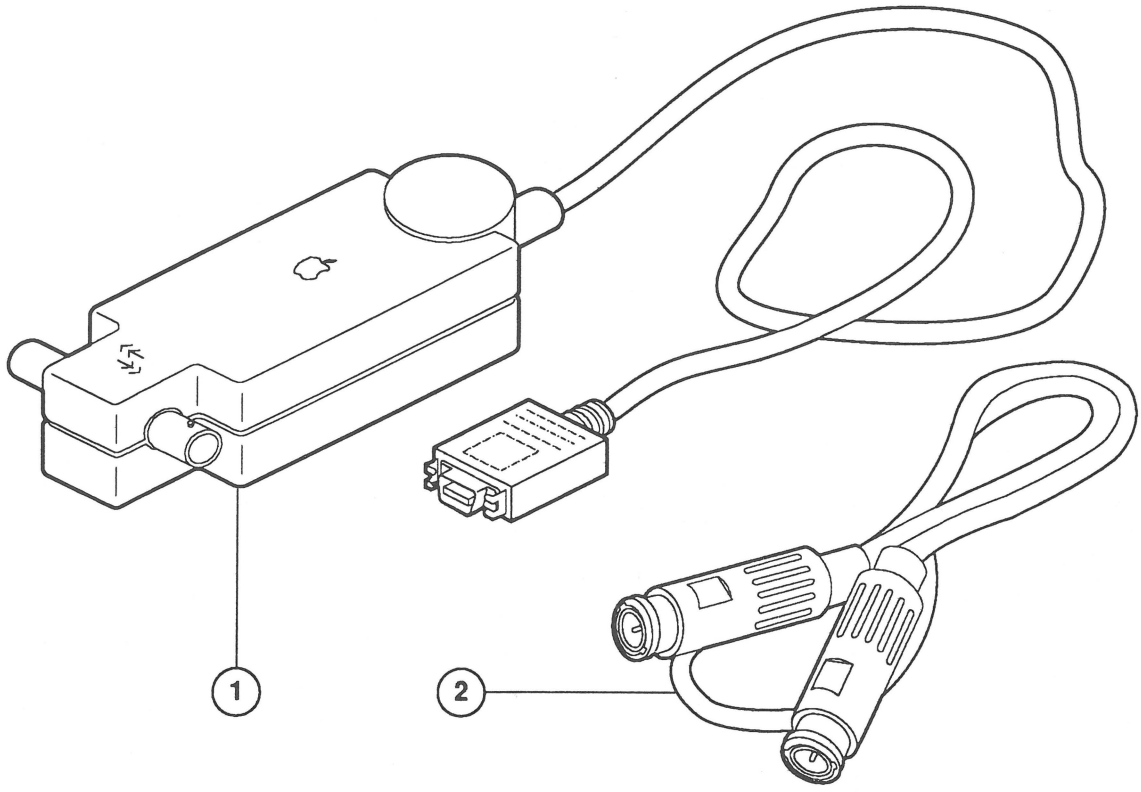


Figure 2 Apple Ethernet Thin Coax Transceiver

❑ APPLE ETHERNET THIN COAX TRANSCEIVER (Figure 2)

Item	Part No.	Description
1	630-8503	Apple Ethernet Thin Coax Transceiver
2	076-0540	Ethernet Self-Terminating Cable, 2-meter
	076-0541	Ethernet Self-Terminating Cable, 5-meter
	076-0542	Ethernet Self-Terminating Cable, Plenum, 13-meter

Apple Technical Procedures

Apple II Workstation Card

Section 1 – Diagnostics

❑ CONTENTS

❑ INTRODUCTION

Product Description

The Apple II Workstation Card allows you to connect an enhanced Apple IIe or IIGS computer to an AppleTalk Local Area Network.

Diagnostic Description

The *Apple II Workstation Card Diagnostic* is a series of tests for the card. The tests are contained on the *Apple II Series Diagnostic Diskettes* for the Apple IIe/IIc and IIGS (except the 5.25-inch version of the IIGS diagnostic). The diagnostic tests the major functions of the Apple II Workstation Card, including:

- RAM
- ROM
- Custom gate array
- Serial communications, both internal and external

The diagnostic allows you to select the tests you wish to run and the order in which you wish to run them. It also allows you to run a continuous test, which is valuable for pinpointing the causes of intermittent failures.

The diagnostic is only used if the card has passed its self-test.

Self-Test

During power-on or reset, the card performs an automatic self-test. This self-test will check the integrity of the ROM and RAM, the custom gate array, and the serial communications chip.

LED Patterns

When the self-test is finished, the results will be indicated on the red and green LEDs on the card.

If the green LED is on or flashing, the card has tested OK. To further test the card, run the diagnostic.

If neither LED is on, or if the red LED is on, or if both the red and green LEDs are on, then the self-test has failed and the card should be replaced.

❑ THINGS TO REMEMBER

Before You Begin

1. Note the results of the self-test. If the card fails the self-test, do not run the diagnostic: the card should be replaced.

2. If the diagnostic is to be run on an Apple IIe, an enhanced IIe must be used. Using an unenhanced IIe will yield unpredictable results.

   Note: The enhanced Apple IIe can be identified by the presence of a **65C02** microprocessor instead of a **6502**.

3. The diagnostic can test only one card at a time. **If more than one card is installed,** an error message will be displayed.

4. The card can be installed in any slot, except slot 3 of the IIe.

5. **If you are using a IIGS,** set the slot that contains the card to "Your Card" in the control panel. Refer to Getting Started for the procedure to do this.

6. If you are going to run the **Serial External Test** (or all the tests), the loopback cable must be installed.

Operation

1. To select a menu item, type the letter of the item or use the <Up Arrow> or <Down Arrow> keys until the item is highlighted; then press <Return>.

2. When a test is selected, a number (1, 2, 3, etc.) appears beside it. The numbers indicate the order in which the tests will be performed.

3. To deselect a test, type the letter of the test or use the arrow keys until the name of the test is highlighted; then press the <Delete> key. The test sequence numbers displayed will be corrected automatically. To deselect all tests, press <Open-Apple> and <Delete>.

4. Where input is required to continue to the next test, press <Space>.

5. Use <Escape> to abort the test in progress and return to the main menu.

❑ GETTING STARTED

Materials Required

Apple II Series Diagnostic Diskette
Known-good Apple IIGS or enhanced Apple IIe, with a video display and cable
Known-good 3.5-inch disk drive and controller (controller not required for the IIGS)
Apple II Workstation Card(s) to be tested
Apple II Junction Box
Loopback cable (required for serial external test)

Setting Up

1. Install the Workstation card in an open slot in the computer.

   Note: You must install the Workstation card in a lower-numbered slot than the disk controller. Slot 1, 2, or 4 is recommended. **Do not** use slot 3 of a IIe.

2. Install the Apple II Junction Box by attaching the two cables to the 10-pin molex connectors on the workstation card. Make sure the colored stripe is at the top of the card.

3. Attach the serial loopback cable to the two connectors on the Junction Box.

4. If you are using an Apple IIGS, set the slot containing the card to "Your Card":

   a) **If the computer is off,** hold down the <Option> key while you turn on the computer.

   If the computer is on, press the <Option>, <Control>, and <Escape> keys.

   b) When the control panel is displayed, press the <Down Arrow> key until the **Slots** option is highlighted, then press <Return>.

c) Use the <Up Arrow> and <Down Arrow> keys to highlight the slot you have installed the card in.

d) Use the <Right Arrow> and <Left Arrow> keys to set the slot to "Your Card."

e) Press the <Return> key.

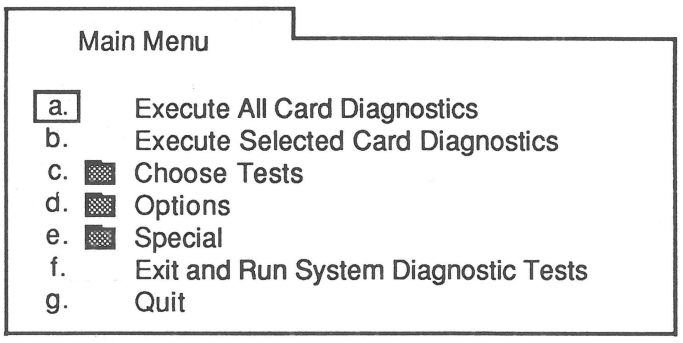
f) Highlight **Quit** and press <Return>.

5. Insert the appropriate *Apple II Series Diagnostic* diskette in the disk drive and turn on the computer.

6. Type the letter f or use the arrow keys to select **Exit & Run Workstation Card Diagnostic.** Then press <Return>. The screen will display the main menu of the Workstation Card Diagnostic.

❑ MAIN MENU SELECTIONS

The Workstation Card Diagnostic main menu is shown below.



Execute All Card Diagnostics

Runs all card tests.

Execute Selected Card Diagnostics

Runs the tests selected in **Choose Tests**.

Choose Tests

Contains all the tests that can be selected for the card. Used to select one or more tests for customized testing. The following list describes the tests available.

- RAM Tests – Performs a test of the 8K of on-board RAM. First, 0's are written to all RAM locations and verified. Next, 1's are written to all locations and verified. This test checks the integrity of each byte.

  Address circuitry is tested by writing a different bit pattern to each block of 256 bytes. The first 256 bytes has $00 stored in each location, the next 256 bytes is $01, then next is $02, and so on.

- ROM Test – Performs a checksum of the firmware ROM.

- Gate Array Test – Tests the custom gate array by writing to registers within the chip, reading the registers, and comparing the two.

- Serial Internal Test – Tests the serial communications chip by writing to registers within the chip, reading the registers, and comparing the two.

- Serial External Test – Checks that characters can be sent and received without error. A loopback cable is required.

Options

Contains the following options:

- Loop Tests Until Esc is Pressed
- Continue On Error Until Esc

If an option is selected, a check mark appears beside the item. To deselect an option, just select the same option again.

Special

Contains the following options:

- Display Error Log – Displays the names of the tests that failed since the last clearing of the error log (up to 255 names).
- Clear Error Log – Erases the log from RAM.
- Clear Testing Status Line – Clears the iterations and failure counts displayed.
- Display Current System Status – This option indicates the type of system, the ROM version, the amount of memory available (number of banks), and the memory card status.
- Load Selected Test Sequence from Disk – This option will load a previously saved test sequence. The sequence can then be executed.
- Save Selected Test Sequence to Disk – This option will save a test sequence you have selected to the test diskette.

Exit and Run System Diagnostic Tests

Terminates the Workstation card diagnostic and returns to the main menu of the system diagnostic.

Quit

Terminates the Workstation card diagnostic. The monitor screen displays the message "Insert System Diskette and Reboot."

❑ RUNNING THE DIAGNOSTIC

The diagnostic program can be configured in various ways. All the tests can be run in their automatic sequence, or selected tests can be looped or run in an order you specify.

The diagnostic also has the ability to execute a test selection sequence that has been saved to the test diskette.

Standard Test

1. Make sure the loopback cable is installed (see "Getting Started").

2. Type the letter a or use the arrows to select **Execute All Card Diagnostics**, and press <Return>.

   If an error is encountered, the testing will stop and an alert box will appear specifying which test failed. Replace the card.

3. If all tests passed, the message **Testing finished** will be displayed in the alert box.

Customized Test

1. If you are going to perform the Serial External test, be sure the loopback cable is connected.

2. Type the letter c or use the arrows to select **Choose Tests**, and press <Return>.

3. From this menu, select the tests desired and press <Return> to select them.

   If you wish to deselect a test, use the letters or arrows to select the test and press the <Delete> key.

Saving and Loading Test Sequences

4. To save your customized test sequence, return to the main menu, and select **Special**. Select **Save Selected Test Sequence to Disk** and press <Return>.

   You now have the selected test sequence saved to diskette. The sequence may be loaded using **Load Selected Test Sequence from Disk** at a later time when it is needed.

5. On completion, return to the main menu, select **Execute Selected Tests,** and press <Return>.

   If an error is encountered, the testing will stop, and an alert box will appear specifying which test failed. Replace the card.

6. On completion, the message **Testing finished** will be displayed in the alert box.

Continuous Test

A continuous (looping) test is possible with all tests. By following the instructions under "Customized Test" (see above), select the tests you wish to loop. Follow the steps below to run a continuous test.

1. After you have chosen the tests you want to run, return to the main menu, select **Options**, and press <Return>.

2. From the menu, select **Loop Tests Until Esc is Pressed** and press <Return>.

   A check mark will appear, indicating what has been selected.

3. Select **Continue On Error Until Esc** if you want to continue looping regardless of the error until <Escape> is pressed.

   If you do not select this option, the testing will halt when an error is encountered.

   Errors will be logged to RAM.

4. Return to the main menu, select **Execute Selected Card Diagnostics**, and press <Return>.

   The tests will run (depending on your selection in step 3) continuously until an error occurs or <Escape> is pressed. If <Escape> is pressed, the looping is canceled.

   If you press <Escape> to stop the testing, you can then check for errors by selecting **Special** and pressing <Return>, and then selecting **Display Error Log**.

5. If you are going to run the test again, be sure to clear the error log and the status line to reselect **Loop Tests Until Esc is Pressed** before returning to the main menu.

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Technical Procedures

❑ TABLE OF CONTENTS

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Section 1 – Diagnostics

❑ CONTENTS

❑ INTRODUCTION

Two levels of diagnostics exist for the Macintosh II family of intelligent communication cards—on-board self-tests and a more sophisticated, user-runnable application called ConnectTest™. ConnectTest presently supports the Apple TokenTalk™ NB and Apple Coax/Twinax™ cards. (Information on these cards can be found in Sections 2 and 3, respectively.) These procedures cover the setup and operation of ConnectTest.

Note: Some cards are also shipped with a confidence test that an end-user can run to verify proper installation of the card. This program only tests a portion of the card. ConnectTest provides a more extensive test of the board. Instructions for using the confidence test can be found in the owner's manual for that product.

Self-Tests

Each of the cards based on the Macintosh coprocessor platform contains self-test routines that are run whenever the Macintosh is switched on or restarted. These routines test the 68000 microprocessor, RAM, ROM, and NuBus™ circuitry. Unfortunately, except for the Coax/Twinax card, the cards have no way of indicating the results of the self-test to the user. For these cards, the only way to know their condition is to use ConnectTest.

ConnectTest

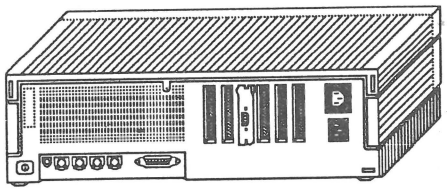
ConnectTest is a disk-based diagnostic that provides an enhanced level of thoroughness and usability above the built-in self-test routines contained on each card.

ConnectTest provides a **short test** and a **communications test** for each card. The short test performs a check of the MCP portion of the card—which includes the 68000 microprocessor, RAM, ROM, and NuBus circuitry. The communications test, in addition to performing the same tests as the short test, also performs a check of the communications circuitry of the card.

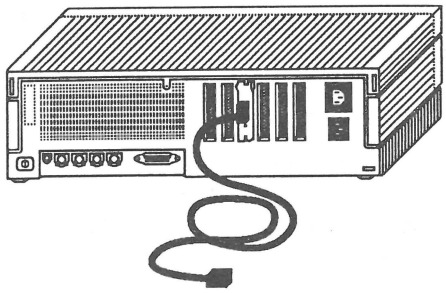
If possible, always run the communications test. **The short test cannot locate all problems.** If you test a suspect card and it passes the short test, you must run all of the available communications tests to completely verify operation of the card.

Figure 1 provides a summary of the tests available for each card and the advantages of each.

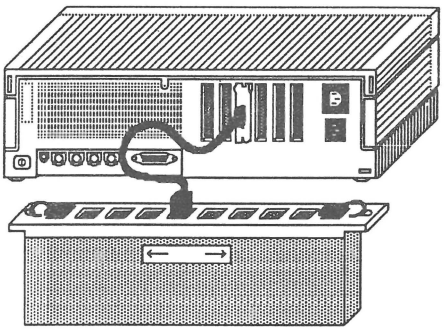
TokenTalk NB Card



Short Test
Only tests the MCP portion of the card
Communications circuitry is not test

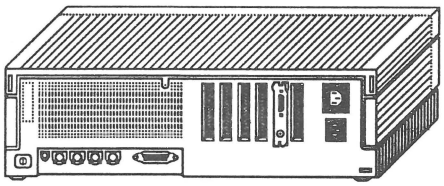


Communications Test
Cable connected to card only
Tests all card functions except circuitry used to open a token ring connection to the MAU

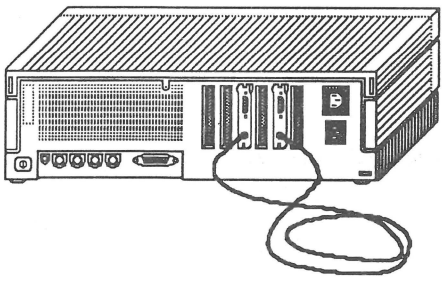


Communications Test
Cable connected to card and MAU
Tests all card functions. This is the most complete test of the card

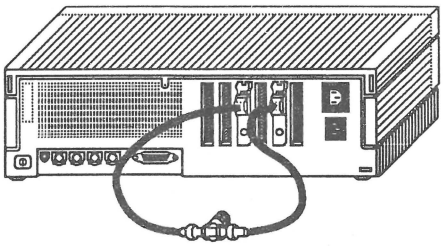
Apple Coax/Twinax Card



Short Test
Only test the MCP portion of the card
Communications circuitry is not test



Two-card communications Test
3270
Tests all card functions using 3270 protocol.



Two-card communications Test
5250
Tests all card functions using 5250 protocol

FIGURE 1
ConnectTest Test Summary

Multiple Cards

A feature of ConnectTest is the ability to test multiple cards in a single session, even if the cards are of different types. ConnectTest automatically checks to see which cards are installed and displays a list of them in the test selections window. You are then able to tell ConnectTest which cards are to be tested and which are the "known-good" cards to be used in the two-card communications tests.

❑ CONNECTTEST

Before using ConnectTest, make a copy of the original disk you receive from Apple. If this copy becomes damaged or unusable, you can make a new working copy from your stored original.

Materials Required

The materials you will need to run ConnectTest depend on the types of cards you have and the types of tests you would like to run on each card. Use the list below to find out what you'll need.

Test Station

The following items are needed for any cards or tests to be performed:

any Macintosh II family computer
video display, video card, and cable
mouse
single 800K or 1.4M floppy disk drive (hard disk optional)
ConnectTest diagnostic disk

TokenTalk NB Card

Short test
Suspect TokenTalk NB card

Communications tests
Suspect TokenTalk NB card
Token ring lobe cable
Multiple access unit (MAU) – optional

Coax/Twinax Card

Short test
Suspect Coax/Twinax card

Two-card communications test
Suspect and Known-good Coax/Twinax card
Coax loopback cable (required for 3270 loopback)
Twinax loopback cable (required for 5250 loopback)

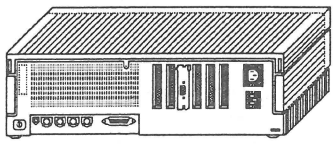
Equipment Setup

1. Set up the Macintosh computer, video display, video card, mouse, and cables.

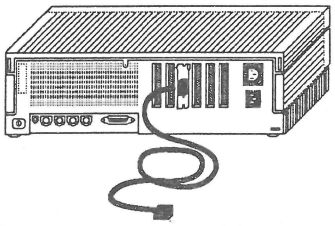
2. Install the cards to be tested and, if you'll be performing any two-card communications tests, the correct number of known-good cards in the computer. Any open slots can be used.

3. Using Figure 2, connect any loopback cables or external devices required for testing. The setup you use depends on the type of tests you wish to run.

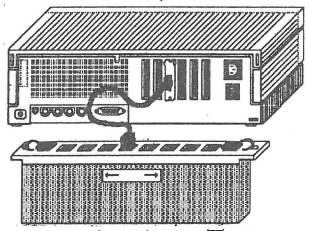
TokenTalk NB Card



Short Test

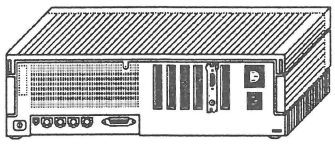


Communications Test
Cable connected to card only

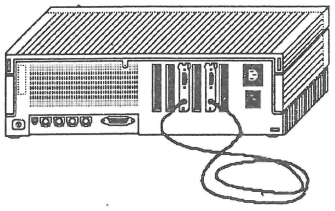


Communications Test
Cable connected to card and MAU

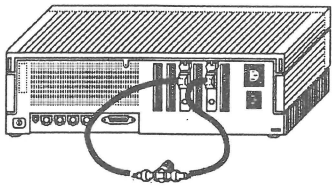
Apple Coax/Twinax Card



Short Test



Two-card communications Test
3270



Two-card communications Test
5250

FIGURE 2
Equipment Setup

Starting ConnectTest

1. Insert a **copy** of the *ConnectTest* disk into the floppy drive and turn on the computer. Since ConnectTest stores information back to the disk it is running from, make sure the disk is not locked.

2. When the desktop appears, open the *ConnectTest* disk by double-clicking the *ConnectTest* disk icon.

3. Before running ConnectTest, make sure the computer's RAM cache is turned off. Do this by selecting the Control Panel under the menu. When the Control Panel appears, click the **Off** radio button in the RAM Cache box (Figure 3).

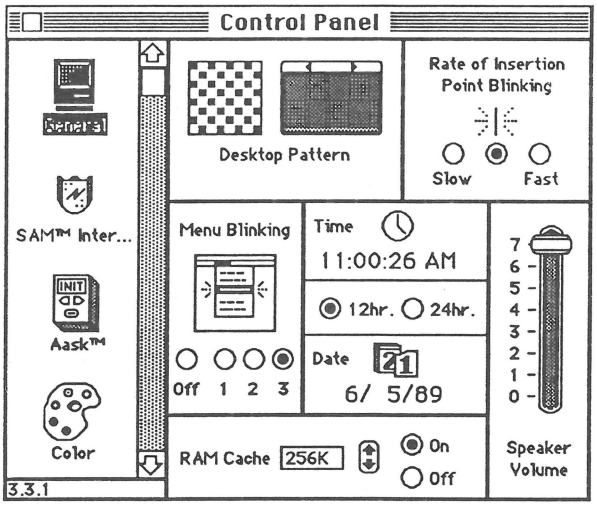


FIGURE 3
Control Panel RAM Cache

4. Start ConnectTest by double-clicking the *ConnectTest* application icon.

Test Selections

When you start *ConnectTest*, you will need to use the Test Selections option to indicate which cards you wish to test, whether they are suspect cards or known-good cards, and whether you want to run the short test or the communications test.

1. Select **Test Selections** (<Command>–T) under the **Options** menu. The main test selections window (Figure 4) will appear.

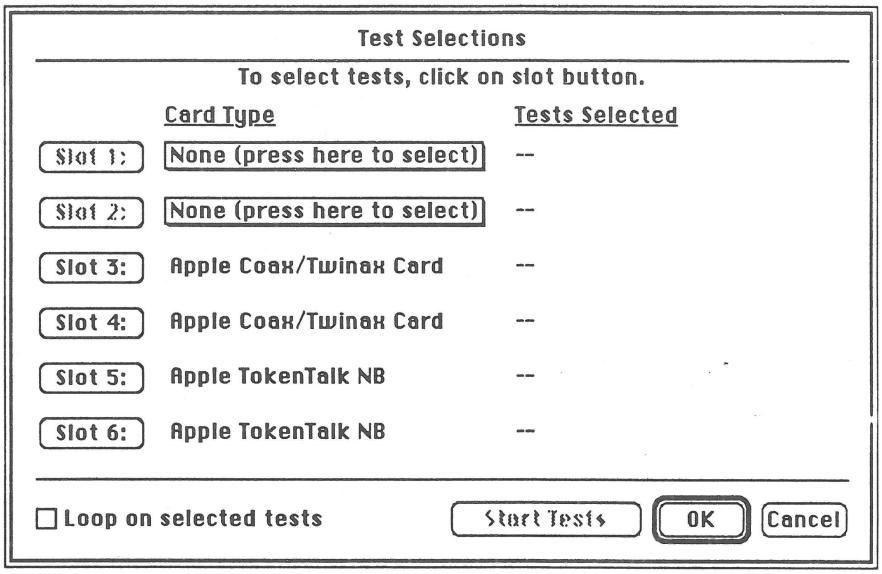


FIGURE 4
Test Selections

ConnectTest will scan the expansion slots and if any Macintosh coprocessor-based communications cards are detected, the name of the card will be displayed under **Card Type**, and the **slot number button** will be highlighted.

If any cards are installed but are not shown, refer to the procedures titled "Undetected Cards" later in this section.

2. You now need to select the types of tests you wish to perform on each card. Click the slot number to display the test parameters for the card in that slot.

   The tests available are different for each type of card. The tests are described below.

Coax/Twinax Card

The Coax/Twinax card has three types of tests available—a short test and two types of communications tests (Figure 5). Select the type of test by clicking the appropriate check box or radio button.

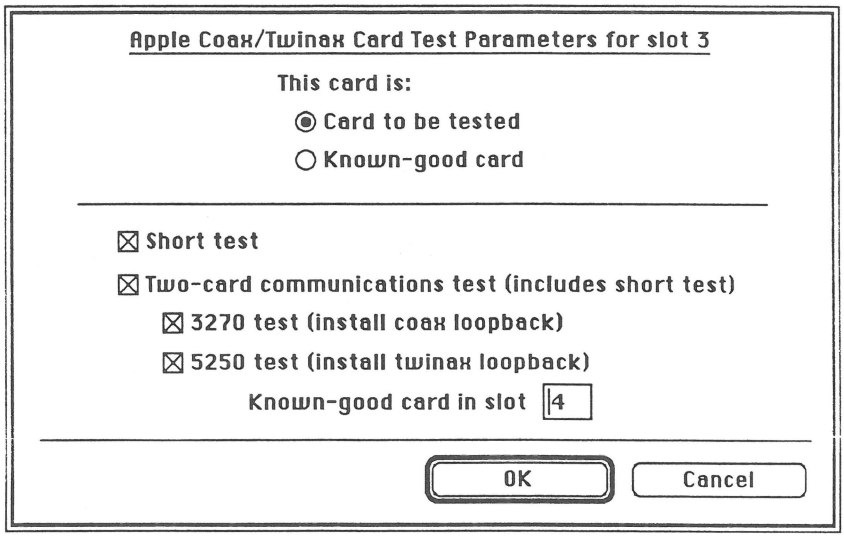


FIGURE 5
Coax/Twinax Card
Test Parameters

1. **Short test** – The short test verifies operation of the MCP portion of the card. No testing is performed on the communications interface side of the card. This test should only be used if you do not have either a coax or twinax cable, since only a portion of the card is tested.

   Click the Short test check box to select this test.

2. **Two-card communications test**

   If either communications test option is selected, the short test is automatically selected as well.

   a) **3270** – This test performs a transmit/receive test between a known-good card and the suspect card, in addition to the tests performed by the short test. The test information is sent using a 3270 protocol. This test requires a coax loopback cable connected between the two cards.

   Click the 3270 test check box to select this test.

b) **5250** – This test performs a transmit/receive test between a known-good card and the suspect card, in addition to the tests performed by the short test. The test information is sent using a 5250 protocol. This test requires a twinax loopback cable connected between the two cards.

Click the 5250 test check box to select this test.

TokenTalk NB Card

The TokenTalk NB card has three types of tests available—a short test and two types of communications tests (Figure 6). Select the type of test by clicking the appropriate check box or radio button.

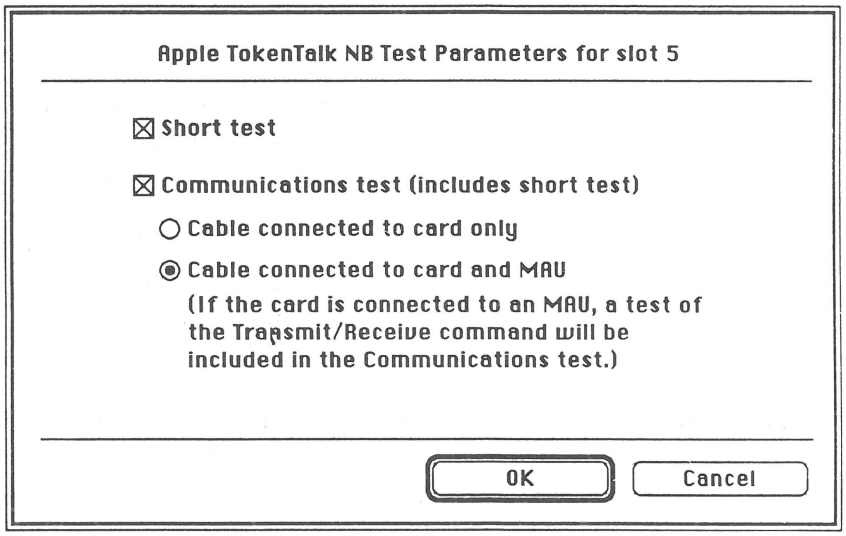


FIGURE 6
TokenTalk NB Card
Test Parameters

1. **Short test** – The short test verifies operation of the MCP portion of the card. No testing is performed on the interface side of the card. This test should only be used if you do not have a token ring adapter cable, a multiple access unit (MAU), or both.

   Click the Short test check box to select this test.

2. **Communications test**

   If either communications test option is selected, the short test is automatically selected.

   a) **Cable connected to card only** – This test performs a check of the transmit/receive circuitry on the card, in addition to the tests performed by the short test. This test requires a token ring adapter cable.

      Click the "**Cable connected to card only**" radio button to select this test, as well as the short test.

   b) **Cable connected to card and MAU** – Besides performing the two above-mentioned tests, this test will check the card's ability to establish communication with the MAU. This test requires a token ring adapter cable connected between the card and an MAU.

      Click the "**Cable connected to card and MAU**" radio button to select this test, as well as the short test.

Loop on Selected Tests

If you would like to run an extended test, click **Loop on Selected Tests**. Extended testing is useful for checking cards that are reported to fail only after being used for some time (intermittent failures).

If multiple cards are installed and you do not wish to run an extended test on all of them, do not select any tests for the cards you do not wish included.

When you're finished selecting the tests you wish to run, click **Start Testing** or press <Return> to start testing.

Test Results

If a card fails a test, ConnectTest will instruct you to shut down the Macintosh II and reseat or replace the card.

Note: Do not use the power switch to shut down: ConnectTest allows you to shut down automatically from within the test. Using the shutdown feature within ConnectTest will allow the program to "remember" its results.

When you restart the diagnostic, it will "remember" its results and will ask you whether you reseated or replaced the card. Select the appropriate answer and click OK to continue. ConnectTest will retest the card you have reseated or replaced, and will then go on to perform any other tests you had originally selected.

(You may also choose "Erase all results and restart this program from the beginning." In that case, all test selections and test results will be erased, and you will have to reselect tests before starting again.)

When all the tests you selected have been run and all repairs have been successfully completed, ConnectTest will display a window that summarizes the results for each slot, along with Repair Confirmation Codes (RCCs) for any failed cards.

❑ OTHER INFORMATION

Configuration

The **Configurations** menu item under **Options** is used to display the ROM version and RAM size of each card. For the TokenTalk NB card, the information displayed also includes the card serial number, node ID, and whether piggyback ROMs are installed.

Keyboard Equivalents

These are the keyboard equivalents that may be used to invoke menu selections.

Menu Item	Keyboard Equivalent
Stop Testing	<Command>-.
Save Test Selections	<Command>-S
Configuration	<Command>-K
Test Selections	<Command>-T
Quit	<Command>-Q

Installing ConnectTest on a Hard Disk

If you would like to run ConnectTest from a hard disk, you should check the following:

1. You **must** use System version 4.3 and Finder version 5.5 with ConnectTest. Later versions will yield unpredictable results.

2. ConnectTest is not compatible with MultiFinder™. Change to Finder™ using **Set Startup** under the **Special** menu selection.

3. Remove any non-Apple-supplied INITs or desk accessories from the System Folder. Failure to do so could cause unreliable results or crashes.

4. You must have Monaco 12 and Geneva 10 fonts installed for ConnectTest to display text correctly.

Undetected Cards

Occasionally, ConnectTest may be unable to detect that a TokenTalk NB or Coax/Twinax card is installed. This is usually due to improper seating of the card in the expansion connector or a failure on the card.

To determine the cause of the failure, quit from ConnectTest, turn off the computer, and reseat the card. Rerun ConnectTest and retest the card.

If the card is still undetected, you can instruct ConnectTest to try testing the card anyway. Select **Test Selections** (<Command>-T) from the **Options menu**. Click the **card type** button and select the card type. After selecting the card type, click **Start Testing** or press <Return>. If the card still fails, replace it.

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Section 2 – TokenTalk NB Card

❑ CONTENTS

❑ BASICS

Product Description

The Apple TokenTalk™ NB card is an intelligent communication interface card that permits any Macintosh II family computer to be connected to a token ring network. The TokenTalk NB card connects to the network through a shielded, twisted-pair cable called a lobe. The other end of the lobe is connected to a multistation access unit (MAU). The MAU functions as a wiring concentrator supporting the connection of 2 to 16 stations. Additional stations can be added to the network by daisy-chaining MAUs.

Additional information regarding the TokenTalk NB card, token ring networks, or TokenTalk software can be found in *Apple TokenTalk NB User's Guide.*

What's in the Box

The following items are included in the TokenTalk NB package:

- Apple TokenTalk NB card
- *TokenTalk Installer* disk
- *Confidence Test* disk
- Two *SMB File Transfer Utility* disks
- *Apple TokenTalk NB User's Guide*
- *Apple SMB File Transfer User's Guide*

❑ TROUBLESHOOTING

Introduction

Troubleshooting for the TokenTalk NB card is divided into two sections—a troubleshooting flowchart and a list of symptoms and possible solutions. Try using the symptom/cure list first to isolate the failure. If you are pointed to a possible card failure or the symptom isn't described, proceed to the troubleshooting flowchart (Figure 1).

Helpful Information

1. TokenTalk software requires Macintosh system software version 6.0.3 or greater. If an earlier version is being used, update the software before proceeding.

2. Use the TokenTalk installer application to install the TokenTalk software. Do not attempt to install the software by dragging (copying) the TokenTalk system files from the installer disk to the startup drive.

Using the Flowchart

The flowchart includes references to notes on this page. These notes provide additional instructions or referrals to other procedures.

If a step indicates that a module should be replaced, replace it and then test again to see if the action corrects the problem. **If the problem remains,** reinstall the original module before you go on to the next action.

Troubleshooting Flowchart Notes

1. Instructions for running ConnectTest are in Section 1, Diagnostics.

2. If you suspect intermittent problems, use the **Loop on Selected Test** option in ConnectTest. Refer to Section 1, Diagnostics, "Test Selections," for instructions.

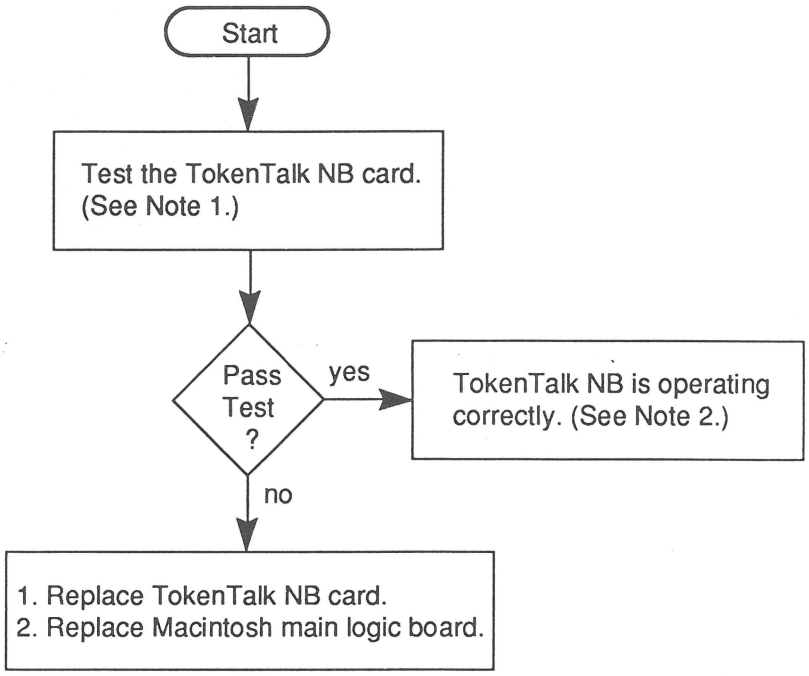


FIGURE 1
Troubleshooting Flowchart

Symptom/Cure Troubleshooting

The following is a list of common failures and error messages and their solutions:

- **TokenTalk icon missing from the Chooser**
  1. Card is not seated properly; try reseating.
  2. Run ConnectTest to verify proper operation of the card.

- **TokenTalk missing on Startup**
  1. Card is not seated properly; try reseating.
  2. Run ConnectTest to verify proper operation of the card.

- **Network service missing (file servers, printers, modem servers, and so on)**
  – Check cables and connections.

- **Computer hangs when the TokenTalk icon is selected in Chooser**
  1. A delay may be normal; it can sometimes take up to 30 seconds for the network to respond. Wait 30–40 seconds; if the computer still hangs, continue.
  2. Card is not seated properly; try reseating.
  3. Run ConnectTest to verify proper operation of the card.

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Section 3 – Apple Coax/Twinax Card

❑ CONTENTS

❑ BASICS

Product Description

The Apple Coax/Twinax card is an intelligent communication interface card providing connectivity for the Macintosh II to either an IBM System 370 through a 3x74-series controller using the 3270 coax type A protocol, or to a System 34/36/38 computer system using the local 5250 twinax protocol. The Macintosh, using software included with the card, can emulate the characteristics of an IBM 327x Information Display System.

Additional information regarding the Apple Coax/Twinax card, software installation, and setup can be found in *Apple Coax/Twinax Card User's Guide*.

What's In the Box

The following items are included in the Apple Coax/Twinax card package:

- Apple Coax/Twinax card
- *MacDFT* Software
- *MacDFT User's Guide*

❑ TROUBLESHOOTING

Helpful Information

Apple Coax/Twinax software requires Macintosh system software version 6.0.3 or greater, A/ROSE Prep software version 1.1.2 or greater, and MacDFT software version 1.1 or greater. Update the software before proceeding if earlier versions are present.

Using the Flowchart

The flowchart includes references to notes on this page. These notes provide additional instructions or referrals to other procedures.

If a step indicates that a module should be replaced, replace it and then test again to see if the action corrects the problem. **If the problem remains,** reinstall the original module before you go on to the next action.

Troubleshooting Flowchart Notes

1. Instructions for running ConnectTest are in Section 1, Diagnostics.

2. If you suspect intermittent problems, use the **Loop on Selected Test** option in ConnectTest. Refer to Section 1, Diagnostics, "Test Selections," for instructions.

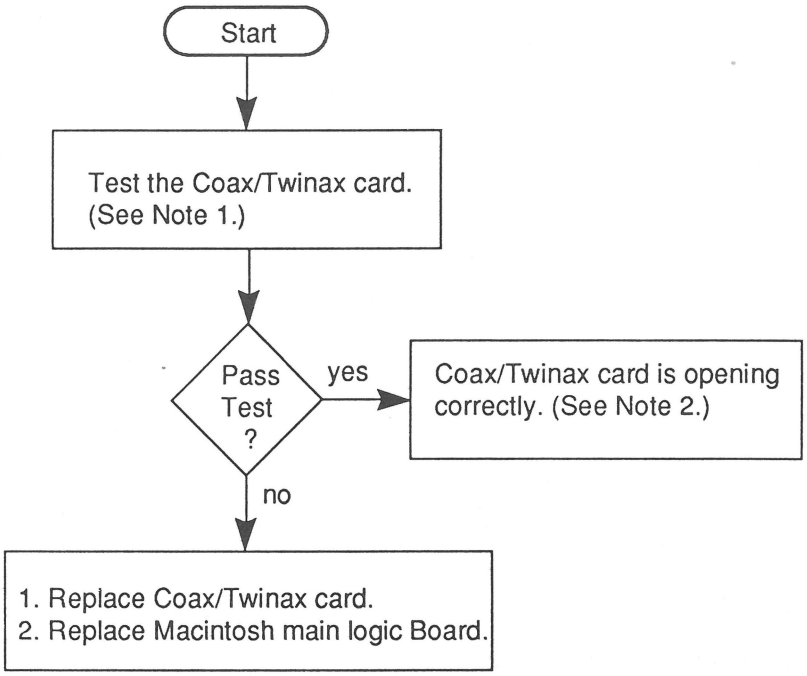


FIGURE 1
Troubleshooting Flowchart

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Section 4 – Serial NB

❑ CONTENTS

❑ BASICS

Product Description

The Apple Serial NB Card is an intelligent serial communications interface based on the Macintosh Coprocessor Platform™ for use with all Macintosh II family computers. Serial NB provides four serial ports using two Zilog serial communications controllers (SCC) that can be configured for use with the RS-232, RS-422, X.21, or V.35 communications standards. Two of the ports support direct memory access (DMA) and can be configured for communications of up to 64 kilobits per second (kbps). The other two ports support communications of up to 19.2 kbps.

The Serial NB card contains its own Motorola 68000 microprocessor operating at 10 MHz, 512K of RAM (expandable to 1 megabyte), 64K of ROM, and a multiprocessing operating system (MCP/OS and Apple IPC). Communication protocols are implemented by software running under this operating system.

Connecting to External Devices

A 62-pin D-connector on the card provides all external input/output signals for the Serial NB. To connect external devices to the card, Apple has two cables. The Hydra cable supports four RS-232 interfaces and uses male DB-25 connectors. The V.35 cable supports one V.35 and one RS-232 interface and also uses male DB-25 connectors.

What's in the Box

The following items are included in the Serial NB package:

- Apple Serial NB card
- *Apple Serial NB Installation Guide*

❑ TROUBLESHOOTING

Power-on Diagnostics

The Serial NB firmware contains self-test diagnostics that are executed at power-on. The results of the self-test are indicated on the red and green LEDs at the top of the card.

At power-up, both LEDs will light. Upon completion of the self-test, either the green or red LED will remain lit. If the card passes the self-test, the green LED will remain lit. If the card fails, the red LED will stay on and the card should be replaced.

Note: The LEDs indicate only the results of the self-test; card failures during operation are not indicated.

Symptom/Cure Troubleshooting

The following is a list of common failures and error messages and their solutions:

- **The self-test status LED stays red after power-up.**
  1. Switch off the computer and try reseating the card.
  2. Replace the Serial NB card.

- **MacDFT icon missing from the Control Panel.**
  1. Switch off the computer and try reseating the card.
  2. Replace the Serial NB card.

Apple Technical Procedures

Macintosh Family Intelligent Communication Cards

Illustrated Parts List

❑ CONTENTS

The figures and lists in this section include all piece parts that can be purchased separately from Apple for Macintosh II Family Intelligent Communication Cards, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

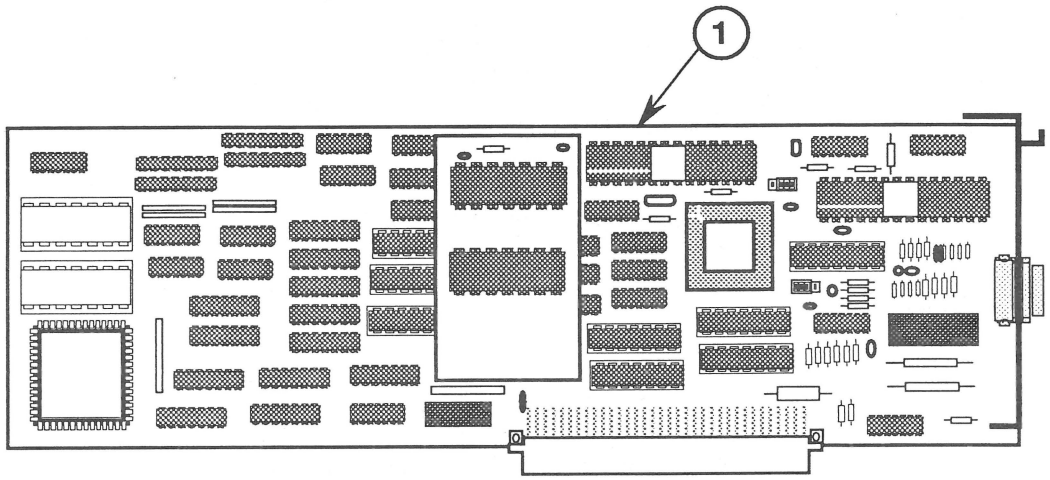


FIGURE 1

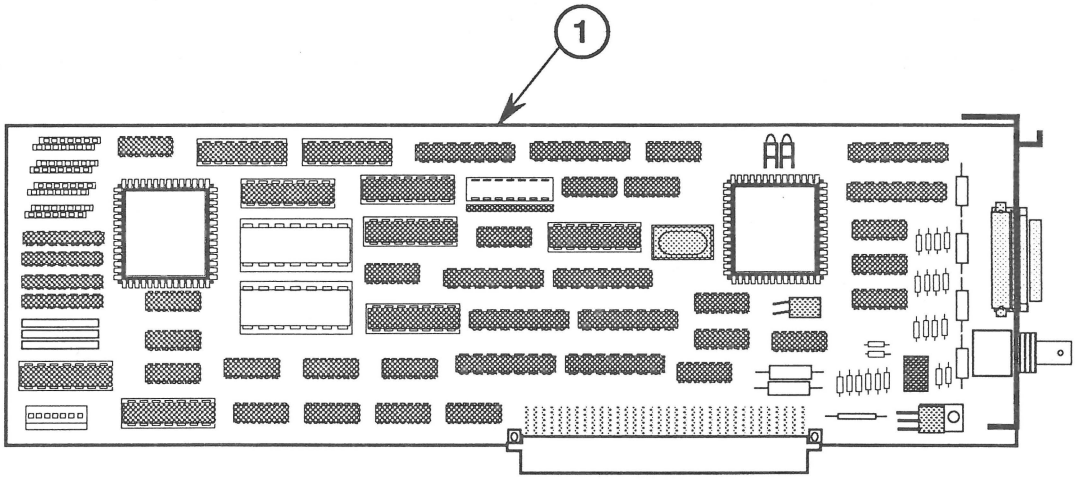


FIGURE 2

❑ APPLE TOKEN TALK NB CARD (Figure 1)

Item	Part No.	Description
1	661-0460	Apple Token Talk NB Card

❑ APPLE COAX/TWINAX CARD (Figure 2)

Item	Part No.	Description
1	661-0458	Apple Coax/Twinax Card

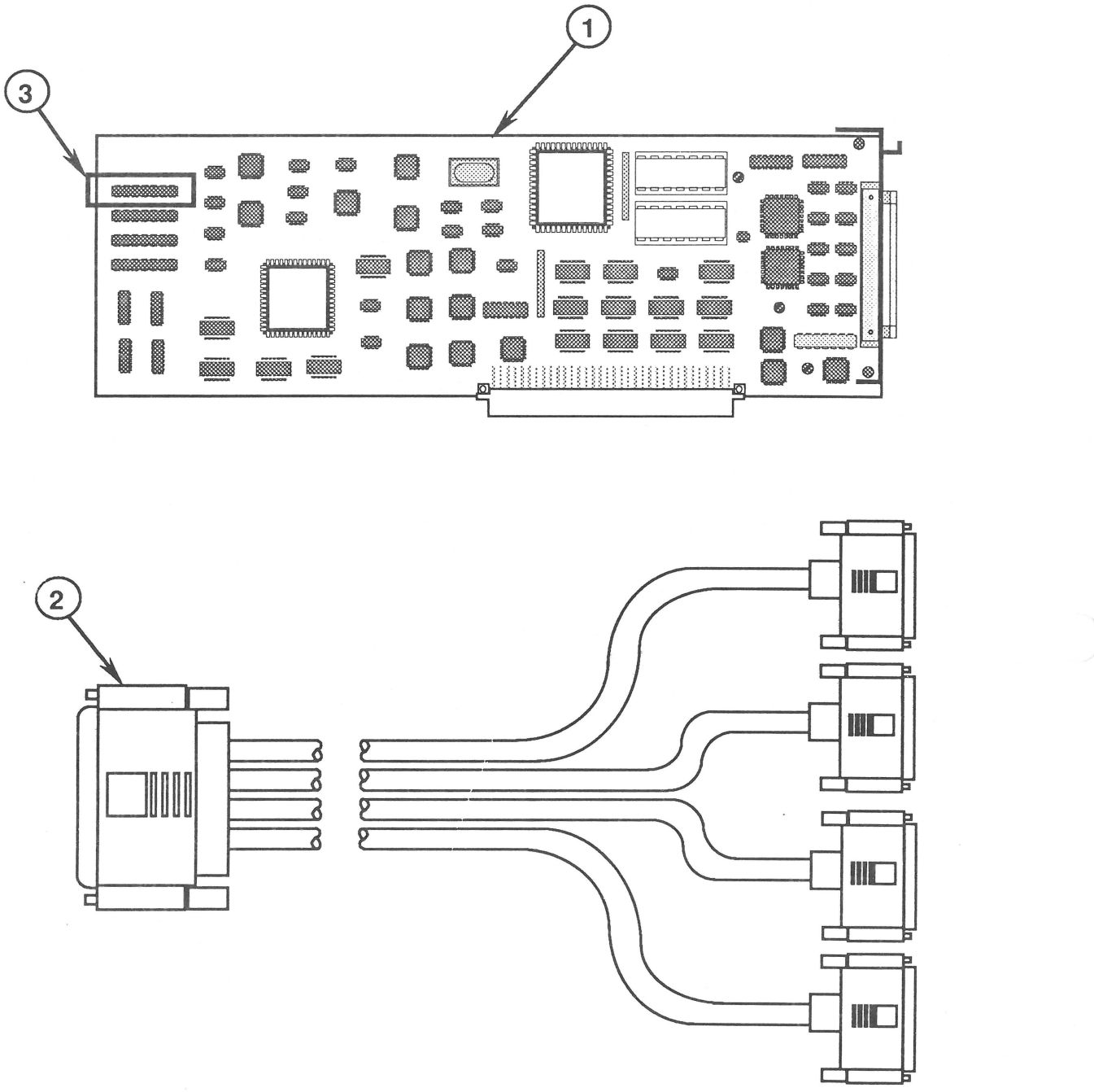


FIGURE 3

❑ APPLE SERIAL NB CARD (Figure 3)

Item	Part No.	Description
1	661-0517	Apple Serial NB Card
2	590-0690	Hydra Cable
3	334-4256	IC, 256K DRAM

Apple Technical Procedures

AppleLine

Technical Procedures

❑ TABLE OF CONTENTS

Apple Technical Procedures

AppleLine

Section 1 – Basics

❑ CONTENTS

❑ INTRODUCTION

The AppleLine™ is a communications product that links Apple® computers to the IBM® 327x Information Display System. Through the 327x system, an Apple computer can use applications on the system's mainframe computer (also referred to as a host computer). AppleLine also allows an Apple computer user to transfer data between files on the Apple computer and files on the mainframe.

❑ INSTALLATION

The AppleLine is a standalone device that connects by a cable to a 327x system device called a control unit (Figure 1). The control unit (often called a controller) regulates communication between the mainframe computer and a number of terminals and printers (different controller models support different numbers of devices).

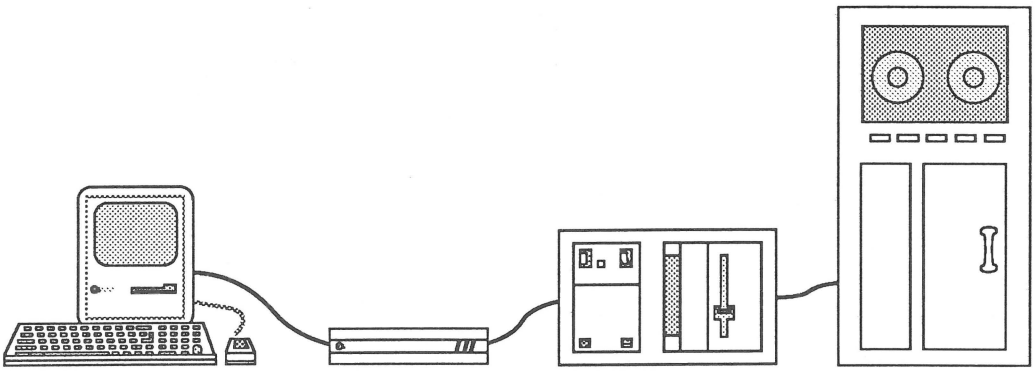


FIGURE 1

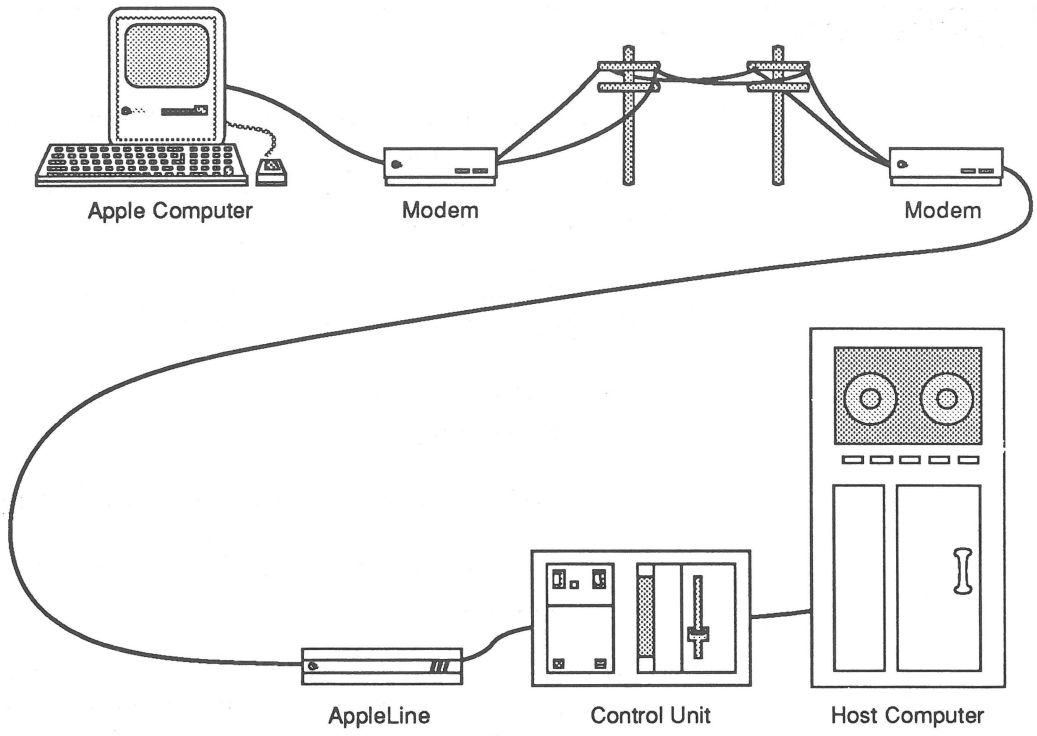


FIGURE 2

The connection between the AppleLine and the Apple computer can be a single cable (Figure 1) or a combination of cables and modems (Figure 2). If modems are used, the connection to the 327x system is only limited by the telephone lines.

For more specific installation information, refer to the *AppleLine User's Manual.*

❑ OPERATION

AppleLine operates with a terminal emulation program that runs on an Apple computer. Together, they convince the controller that it is communicating with an IBM 3278 Model 2 terminal.

The following terminal emulation programs may be used with AppleLine and Apple computers:

- MacTerminal™ can be used with all Macintosh family computers.
- LisaTerminal can be used with Lisa® computers.
- ACCESS 3270 can be used with Apple III computers.

With AppleLine and a terminal emulation program, a single computer functions as both a computer and a terminal. When it operates as a terminal, the computer provides features that are not available on the 3278 Model 2 terminal. These features depend on the individual terminal emulation program and may include the following:

- The ability to add data to files on the mainframe from files on an Apple computer.
- The ability to add data to files on an Apple computer from files on the mainframe.
- The ability to print data from mainframe files on a printer connected to an Apple computer.
- With additional software, the ability to transfer complete files in both directions between an Apple computer and a mainframe.

For more specific operation information, refer to the *AppleLine User's Manual.*

❑ COMPUTER COMMUNICATIONS CABLES

The table below lists the cables required to directly connect (without modems) an AppleLine to an Apple Computer. **All cable configurations require the use of the AppleLine Gender Cable Assembly (590-0214).**

Computer	Port	Cable
Macintosh	Modem* or Printer	590-0169
Macintosh Plus, SE, II	Modem* or Printer	590-0169 with 590-0341 or 590-0553
Macintosh XL	B	590-0037 & 590-0029
Lisa	A* or B	590-0037 & 590-0029
Apple III	RS232C	590-0037 & 590-0029

*This is the preferred port. If you choose the other port, you may have to change the parameters in the terminal emulation software. For more information, see the *AppleLine* user's manual or the terminal emulation software.

Refer to the AppleLine user's manual for cable installation instructions.

Apple Technical Procedures

AppleLine

Section 2 – Take-Apart

❑ CONTENTS

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in the section.

❑ TOP COVER

Materials Required

#2 Phillips screwdriver

Remove

1. Turn off the AppleLine power.
2. Remove power cord and communications cables from the AppleLine.
3. Turn the AppleLine upside down on the grounded workbench pad, and put on your grounding wriststrap.
4. Remove the four Phillips screws (Figure 1, #1).
5. Hold the case together and turn the AppleLine over.
6. Lift the top cover from the case.

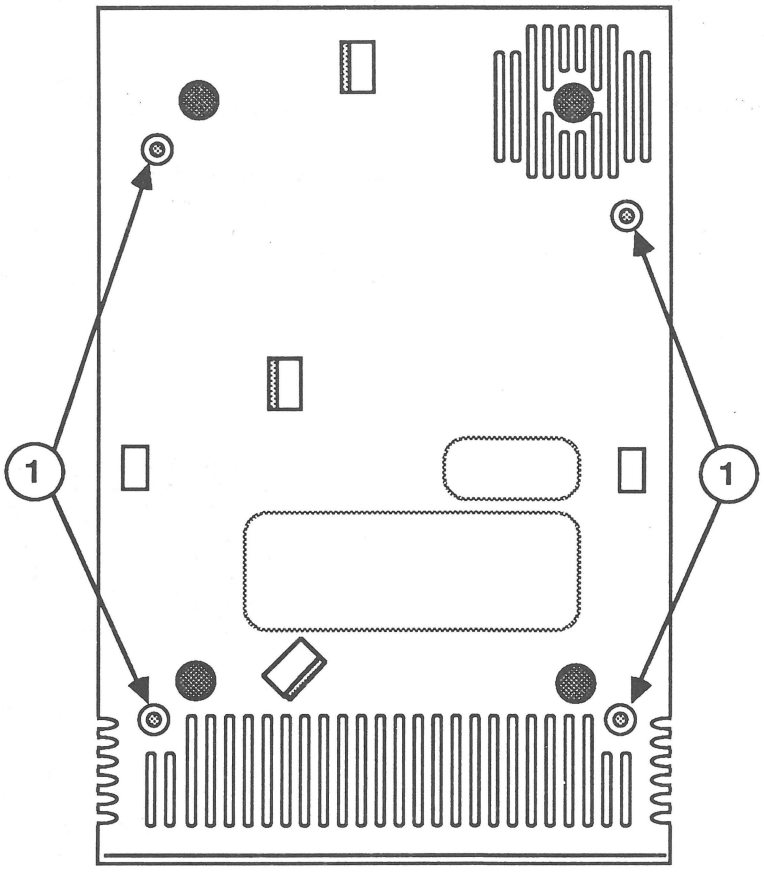


FIGURE 1

Replace

1. Position the AppleLine so that the back is facing you.

2. Position the top cover so that the front is facing away from you and you can see the holes on the inside of the front cover. Pull the top cover toward you so that the three LEDs on the logic board fit into the three holes on the left. When the LEDs are safely in the holes, lower the top cover into place.

3. Hold the case together and turn the AppleLine upside down.

4. Replace the four Phillips screws (Figure 1, #1).

❑ FAN

Remove

1. Remove the top cover.
2. Disconnect the fan cable from the logic board (Figure 2, #1).
3. Lift the fan from the case.

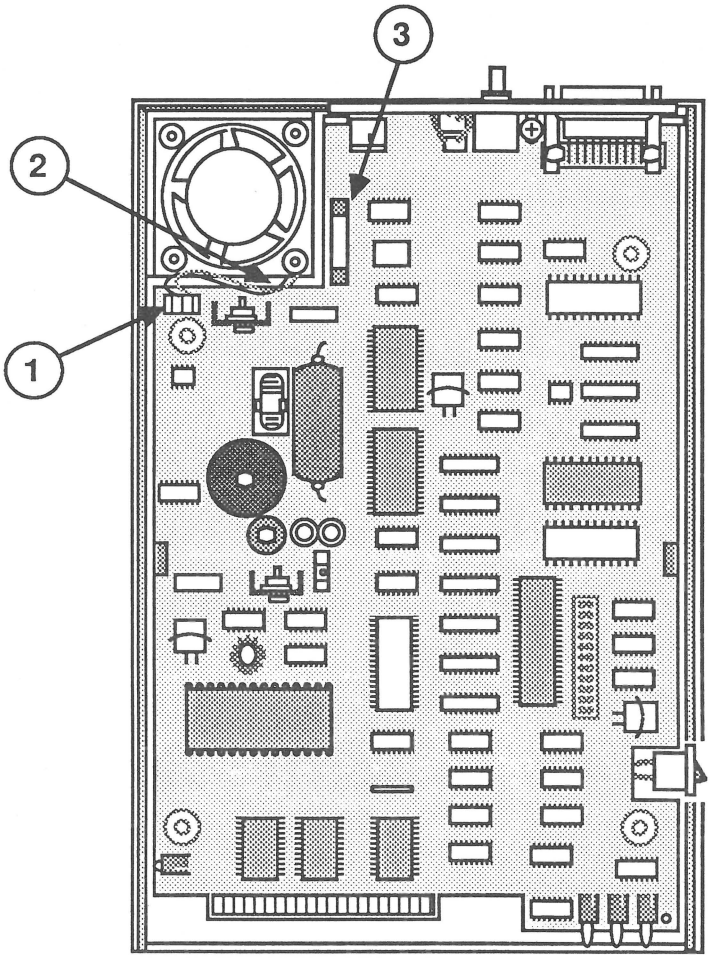


FIGURE 2

Replace

1. Locate the arrows on the fan housing. One arrow shows which direction the fan turns, and the other shows which way the air flows. Position the fan so that the air-flow arrow points toward the case bottom.

2. With the air-flow arrow pointing down, rotate the fan so that the fan cable exits the fan housing toward the front of the AppleLine (see Figure 2, #2). Lower the fan into the case bottom.

3. Connect the fan cable to the logic board (Figure 2, #1).

4. Replace the top cover.

❑ FUSE

Materials Required

Screwdriver (Phillips or flatblade)

Remove

1. Remove the top cover.

2. Use a screwdriver to slowly pry the fuse up and away from its mounting clamp (Figure 2, #3).

Replace

1. Place the new fuse above the mounting clamp so that the metal ends of the fuse align with the metal ends of the clamp (Figure 2, #3). Press down on the metal ends of the fuse until the fuse snaps into place.

2. Replace the top cover.

❑ LOGIC BOARD

Materials Required

#1 Phillips screwdriver
Flatblade screwdriver

Remove

1. Remove the top cover.
2. Remove the fan.
3. Disconnect the power switch cable from the logic board (Figure 3, #1).

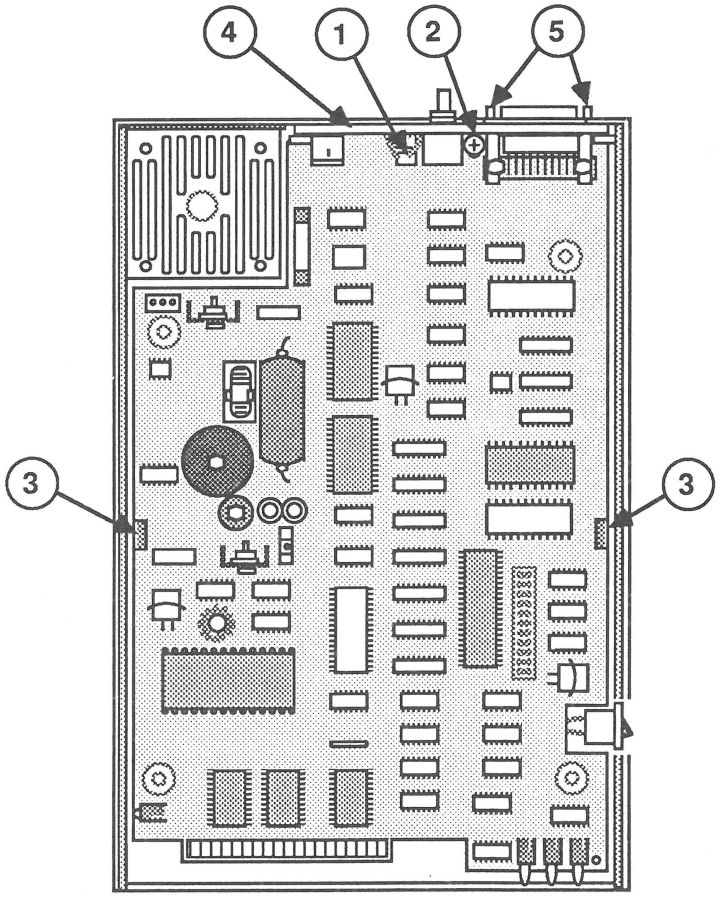


FIGURE 3

4. Remove the logic board retaining screw (Figure 3, #2).

5. While using your thumb to push one of the logic board retaining clamps (Figure 3, #3) away from the logic board, use a flatblade screwdriver to pry the board free from the clamp.

6. Lift the unclamped side of the board and slide it away from the clamped side. Feed the power switch cable through the notch in the logic board (Figure 3, #1) until the board is free of the AppleLine.

Replace

1. Position the logic board above the bottom cover and feed the power switch cable through the notch in the logic board (Figure 3, #1). Connect the cable connector to the logic board.

2. Align the metal panel on the logic board with its receiving slot in the bottom cover. Tilt and lower the logic board so that the clamp notch on one side slides under the retaining clamp (Figure 3, #3) for that side.

   Note: The logic boards and cases on the first AppleLine units were not designed for the metal rear panel (Figure 3, #4). If you are replacing an old logic board, use a wrench or nut driver to remove the two bolts (Figure 3, #5) that fasten the metal panel to the modem connector. Remove the metal panel and replace the two bolts before installing the new board.

3. Find the clamp notch on the unfastened side of the logic board (Figure 3, #3). Use a flatblade screwdriver to pry the logic board toward the clamped side and down, until the logic board snaps into place.

4. Replace the logic board retaining screw (Figure 3, #2).

5. Replace the fan.

6. Replace the top cover.

❑ POWER SWITCH

Materials Required

Flatblade screwdriver

Remove

1. Remove the top cover.
2. Remove the fan.
3. Remove the logic board.
4. Slide the power switch cable out through the open side of each of the cable retaining clips (Figure 4, #1). If the cable will not slide out from a clip, use a screwdriver to carefully pry the clip up while you slide the cable out.
5. Lift the power switch (Figure 4, #2) up and out of the case.

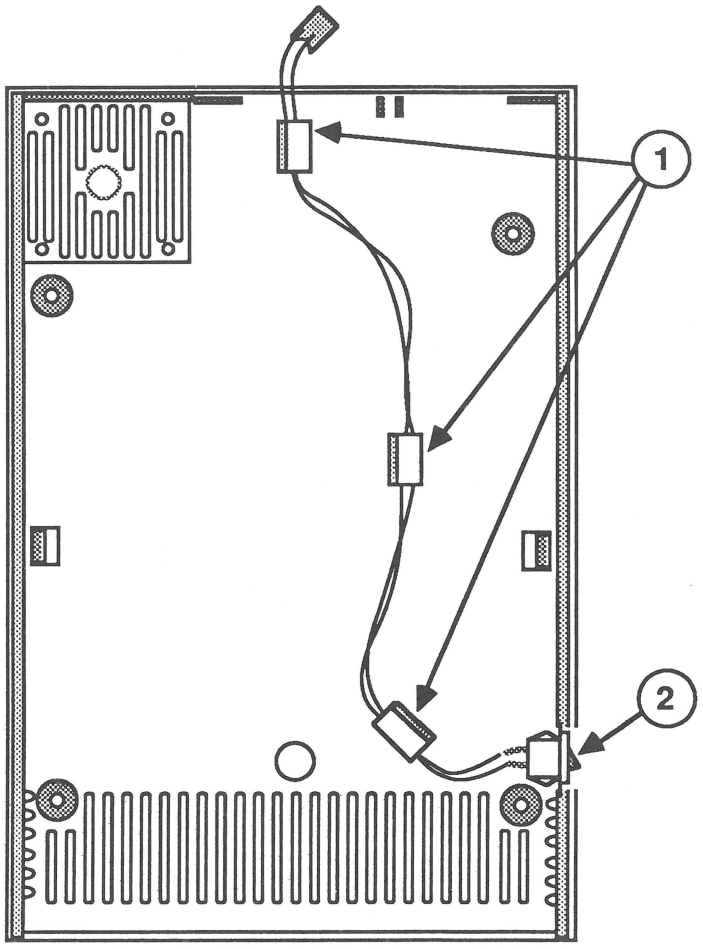


FIGURE 4

Replace

1. Position the power switch so that the **1** is on the left and the **0** is on the right. Insert the power switch into its slot in the case (Figure 4, #2).

2. Slide the power switch cable in through the open side of each of the cable-retaining clips (Figure 4, #1). If the cable will not slide into a clip, use a screwdriver to carefully pry the clip up while you slide the cable in.

3. Replace the logic board.

4. Replace the fan.

5. Replace the top cover.

Apple Technical Procedures

AppleLine

Section 3 – Diagnostics

❑ CONTENTS

❑ INTRODUCTION

This section describes four AppleLine tests:

- Power-On Test
- Loop-Back Test
- Terminal Communication Test
- Controller Communication Test

The Power-On and Loop-Back tests verify operation of the AppleLine itself, with no connections to other devices.

The Terminal Communication and Controller Communication tests verify operation of the AppleLine when it is connected to other equipment.

❑ POWER-ON TEST

1. Turn off the AppleLine power.

2. Disconnect the communication cables from the back of the AppleLine. (The power cord should remain in place.)

CAUTION: *To avoid creating communication problems at the controller, always turn off the AppleLine power before connecting or removing the controller cable.*

3. Turn on the AppleLine power and observe the LEDs. There are three LEDs on the front panel and a single green LED inside, which can be viewed through the ventilation slots at the left front of the AppleLine.

   The power-on test passes when the internal LED flashes continually and the front panel LEDs complete the following sequence:

   a) All three LEDs turn on for approximately 2 seconds and turn off.

   b) All three LEDs flash on and off, and then turn on.

   c) The red LED turns off, then the yellow, and then the green.

   d) The yellow and green LEDs alternately toggle on and off.

   The test is complete when the yellow and green LEDs begin to toggle on and off. The LEDs will continue to toggle until the AppleLine power is turned off.

❑ LOOP-BACK TEST

Materials Required

AppleLine
AppleLine loop-back connector

Testing

1. Turn off the AppleLine power.

2. Disconnect the communication cables from the back of the AppleLine. (The power cord should remain in place.)

CAUTION: *To avoid creating communication problems at the controller, always turn off the AppleLine power before connecting or removing the controller cable.*

3. Plug the AppleLine loop-back connector into the modem connector at the back of the AppleLine.

4. Turn on the AppleLine power and observe the LEDs on the front panel. The test passes when the LEDs complete the following sequence:

   a) All three LEDs turn on and then off.

   b) The yellow LED begins to blink slowly.

The test is complete when the yellow LED begins to blink slowly. The LED will continue to blink until the AppleLine power is turned off.

Note: Do not remove the loop-back connector while the AppleLine power is on. The passwords and communication parameters in the AppleLine Supervisor program will be reset to the default values if you disconnect the loop-back connector while power is on, wait 5 seconds or longer, and then turn off the power. (See the *AppleLine User's Manual.*)

If the passwords and communication parameters are reset, or if you return the AppleLine to the customer with a new logic board, tell the customer that the AppleLine passwords and communications parameters may need to be set again before operation. (See the *AppleLine User's Manual.*)

❑ TERMINAL COMMUNICATION TEST

The Terminal Communication Test tries to establish communication between the Apple computer and the AppleLine. If the computer communicates with the AppleLine successfully, the test passes.

The Terminal Communication Test may be run as a standalone test or as a system test.

- A standalone test is a test of the AppleLine with a direct cable connection (without modems) between the AppleLine and the Apple computer. The standalone test verifies the operation of the AppleLine, the cable, and the Apple computer.

- A system test is a test of the AppleLine with modems between the AppleLine and the Apple computer. The system test verifies the operation of the AppleLine, the cables, the modems, and the Apple computer.

The standalone test is the preferred test because there are fewer components to check if the test fails. However, if you are testing the AppleLine at a customer site and if all the Apple computers are separated from the AppleLine by modems, the system test may be the quickest and easiest way to find out if the AppleLine can communicate with Apple computers.

Materials Required

AppleLine and *AppleLine User's Manual*
Cable, or modem and cable connection between the AppleLine and the Apple computer
Macintosh, Lisa, or Apple III computer
Terminal emulation program and manual:

- MacTerminal for Macintosh computers
- LisaTerminal for Lisa computers
- ACCESS 3270 for Apple III computers

Standalone Test

1. Turn off the AppleLine power and disconnect the cable from the controller connector. The power cord should remain connected to the AppleLine.

CAUTION: *To avoid creating communication problems at the controller, always turn off the AppleLine power before connecting or removing the controller cable.*

2. Connect the computer communication cable between the modem connector on the back of the AppleLine and the appropriate port on the Apple computer. (AppleLine cables and the appropriate computer ports are identified under "Computer Communications Cable" in Section 5, Additional Procedures. The *AppleLine User's Manual* shows how to connect the cables.)

3. Start up the terminal emulation software in the Apple computer. (See the software user's manual or the *AppleLine User's Manual.*)

4. Turn on the AppleLine power and wait for AppleLine to complete the power-on test. The computer should display the following prompt:

   Press RETURN to begin logon sequence.

   Note: If the computer does not display the log-on prompt, the AppleLine may be waiting for a special key sequence called the Autobaud message, which lets AppleLine determine the computer's baud rate. Enter the Autobaud message for your terminal emulator program as follows:

   - For MacTerminal, press <Shift>-<Enter>, <Return>.
   - For LisaTerminal, press <Enter>, <Return>.
   - For ACCESS 3270, press <Open-Apple>-B, <Enter>.

5. When the log-on message is displayed, press <Return>. The test passes if the computer displays the prompt **Enter password**.

System Test

1. Verify that all cables and modems between the Apple computer and the AppleLine are connected properly, and are ready for use. (See the *AppleLine User's Manual* and the manuals for the modems.)

2. If you can easily reach the AppleLine, turn the power off, disconnect the controller cable, and turn the AppleLine power on.

CAUTION: *To avoid creating communication problems at the controller, always turn off the AppleLine power before connecting or removing the coaxial cable to the controller.*

   If you cannot easily reach the AppleLine, leave the power on, and try to complete this test. If the test fails, have someone at the remote location turn the AppleLine power off, disconnect the controller cable, and turn the power back on. Then, repeat this test.

3. Start up the terminal emulation software in the Apple computer. (See the software user's manual or the *AppleLine User's Manual.*)

   The computer may or may not display the following prompt:

   Press RETURN to begin logon sequence.

4. Press <Return>. The test passes if the computer displays the prompt **Enter password**.

   Note: If the computer does not display the **Enter password** prompt, the AppleLine may be waiting for a special key sequence called the Autobaud message, which lets AppleLine determine the computer's baud rate. Enter the Autobaud message for your terminal emulator program as follows:

   - For MacTerminal, press <Shift>-<Enter>, <Return>.
   - For LisaTerminal, press <Enter>, <Return>.
   - For ACCESS 3270, press <Open-Apple>-B, <Enter>.

❑ CONTROLLER COMMUNICATION TEST

The Controller Communication Test verifies communication between the Apple computer and the controller.

Materials Required

AppleLine and *AppleLine User's Manual*
Macintosh, Lisa, or Apple III computer
Cable, or modem and cable connection between the AppleLine and the Apple computer
Coaxial cable from the AppleLine to the controller
AppleLine password
Terminal emulation program and manual:

- MacTerminal for Macintosh computers
- LisaTerminal for Lisa computers
- ACCESS 3270 for Apple III computers

Testing

1. Verify that all cables and modems between the Apple computer and the AppleLine are connected properly, and are ready for use. (See "Computer Communications Cable" in Section 5, Additional Procedures, and the *AppleLine* user's manual.)

2. Verify that the coaxial cable is connected between the AppleLine and the controller.

3. Verify that the AppleLine power cable is in place, and that power is on.

4. Start up the terminal emulation software in the Apple computer. (See the user's manual for the software or for the AppleLine.)

   The computer may or may not display the following prompt:

   Press RETURN to begin logon sequence.

5. Press <Return>. The computer displays the prompt **Enter password.**

   Note: If the computer does not display the **Enter password** prompt, the AppleLine may be waiting for a special key sequence called the Autobaud message, which lets AppleLine determine the computer's baud rate. Enter the Autobaud message for your terminal emulator program as follows:

   - For MacTerminal, press <Shift>-<Enter>, <Return>.
   - For LisaTerminal, press <Enter>, <Return>.
   - For ACCESS 3270, press <Open-Apple>-B, <Enter>.

6. Enter the AppleLine user password. If this is a new installation, or if the logic board was just replaced, you can use the password APPLE1. If the AppleLine has been installed for some time, you will probably need to get the updated password from the customer.

   Note: Type carefully; the password is not displayed on the computer screen.

   The connection to the host system should be complete. At this point the Apple computer is operating as a terminal and should display the host system status line at the bottom of the display screen.

7. Reset the terminal by entering the appropriate command for the customer's terminal emulation program:

MacTerminal	Select **Reset** from Keypad menu
LisaTerminal	<Closed-Apple>-R
ACCESS 3270	<Shift>-9 (9 on numeric keypad)

8. Enter the controller test mode by entering the appropriate command for the customer's terminal emulation program:

MacTerminal	<Command>-T
LisaTerminal	<Closed-Apple>-T
ACCESS 3270	<Control>-G

This test passes if the word **TEST** is displayed on the left side of the host system status line.

9. Exit the controller test mode by entering the same command you entered in step 8.

Apple Technical Procedures

AppleLine

Section 4 – Troubleshooting

❑ CONTENTS

❑ INTRODUCTION

This section provides flowcharts for standalone troubleshooting and system troubleshooting. The Standalone Troubleshooting Flowchart verifies the proper operation of the AppleLine.

The System Troubleshooting Flowchart verifies the operation of the AppleLine with the equipment connected to it.

❑ USING THE FLOWCHARTS

The flowcharts include references to notes on the opposite page. These notes provide additional instructions or referrals to other procedures.

Starting at the top of each flowchart, answer the questions and proceed down the chart. When you arrive at a rectangular box containing a list of actions, perform the actions in the sequence listed. Upon completion of each action, test again to see if the action corrects the problem. **If the problem remains, reinstall the original module before you go to the next action.**

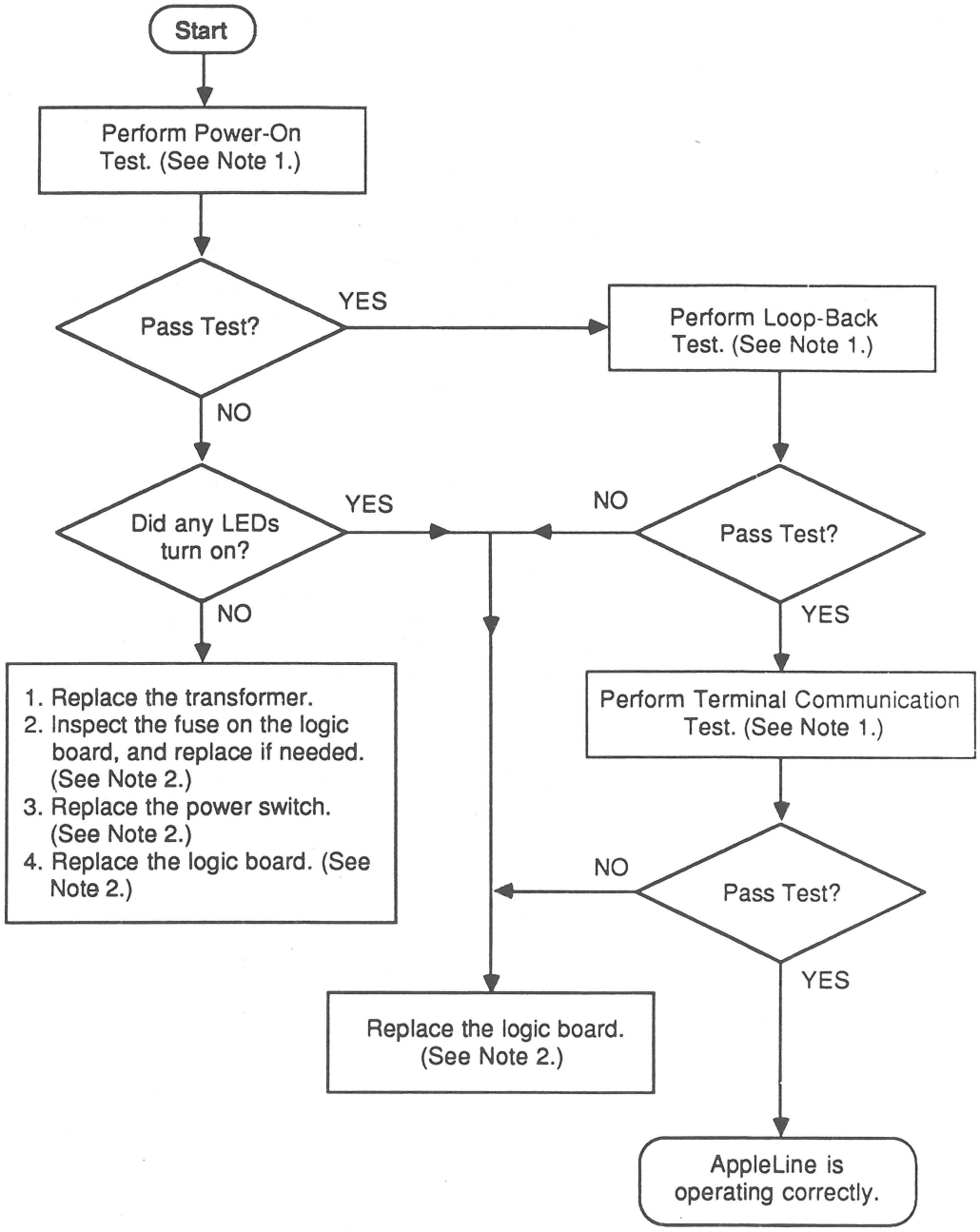
❑ STANDALONE TROUBLESHOOTING FLOWCHART

Notes

1. Refer to Section 3, Diagnostics.

2. Refer to Section 2, Take-Apart.

   Note: The passwords and communication parameters in the AppleLine Supervisor program are stored on the logic board. If you return the AppleLine to the customer with a new logic board, tell the customer that the AppleLine passwords and communication parameters have been reset to the default values and may need to be set again before operation. (See the *AppleLine User's Manual.*)


Start
Perform Power-On Test. (See Note 1.)
Pass Test?
YES
Perform Loop-Back Test. (See Note 1.)
NO
Did any LEDs turn on?
YES
NO
Pass Test?
NO
YES
1. Replace the transformer.
2. Inspect the fuse on the logic board, and replace if needed. (See Note 2.)
3. Replace the power switch. (See Note 2.)
4. Replace the logic board. (See Note 2.)
Perform Terminal Communication Test. (See Note 1.)
NO
Pass Test?
YES
Replace the logic board. (See Note 2.)
AppleLine is operating correctly.

❑ SYSTEM TROUBLESHOOTING FLOWCHART

Notes

1. Refer to Section 3, Diagnostics.

2. A coaxial cable should connect the AppleLine to the controller port. The controller port must be configured for an IBM 3278 Model 2 terminal.

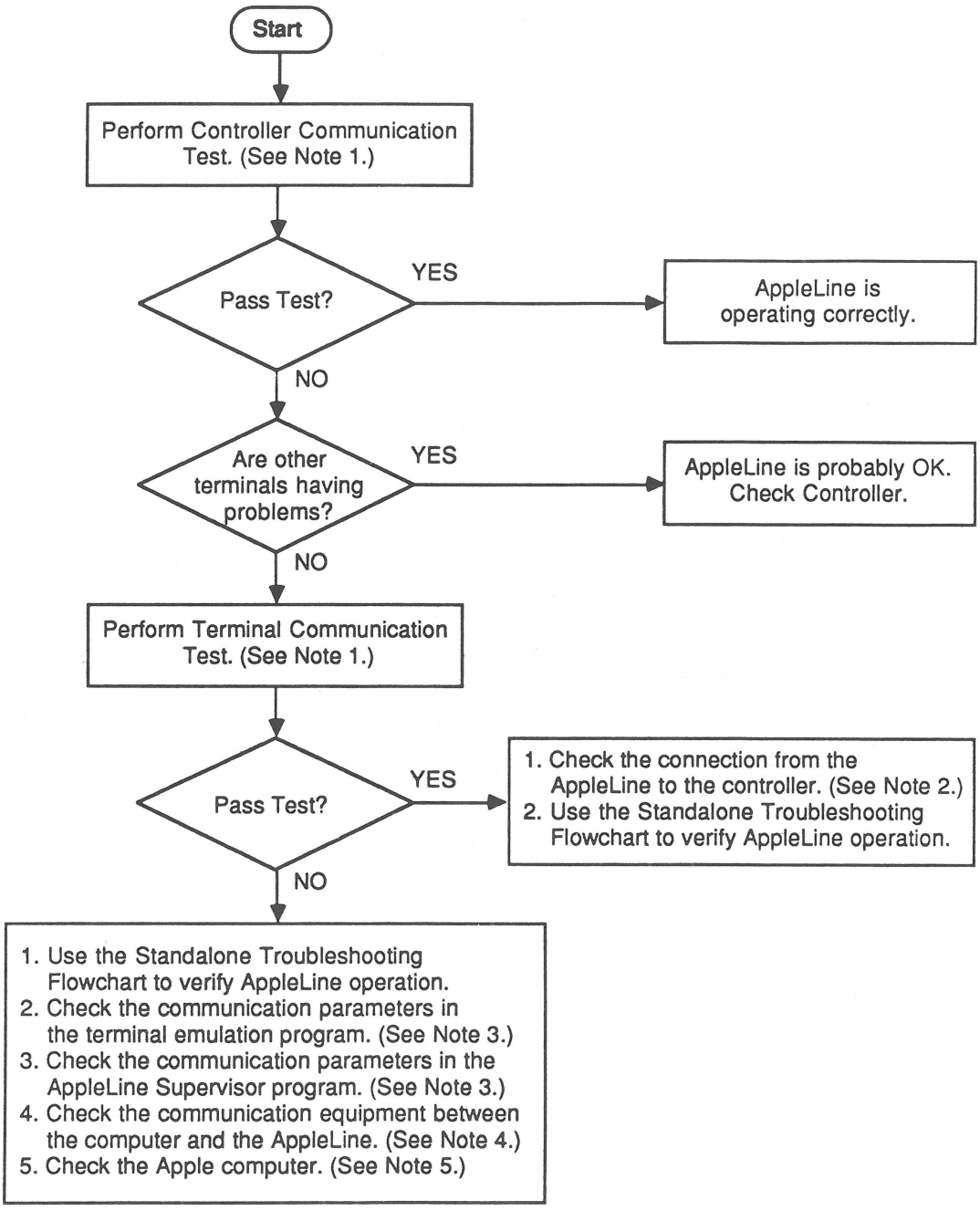
   To see if the controller port is the problem, turn the AppleLine power off, swap the controller end of the coaxial cable to a known-good port, turn the AppleLine power back on, and test again.

   To see if the cable is the problem, turn the AppleLine power off, swap both ends of the coaxial cable with a known-good cable, turn the AppleLine power back on, and test again.

3. Communication parameters in the terminal emulation program and in the AppleLine Supervisor program must be set so that the two can communicate. For more information, refer to the *AppleLine* user's manual and the manual for your terminal emulation program.

4. Any break in the communication path will disrupt AppleLine operation. If the problem appears to be in the communication path, systematically swap each cable for a known-good cable and test any modems in the path.

5. Refer to the *Technical Procedures* for the Apple computer you are testing.


Start
Perform Controller Communication Test. (See Note 1.)
Pass Test?
YES
AppleLine is operating correctly.
NO
Are other terminals having problems?
YES
AppleLine is probably OK. Check Controller.
NO
Perform Terminal Communication Test. (See Note 1.)
Pass Test?
YES
1. Check the connection from the AppleLine to the controller. (See Note 2.)
2. Use the Standalone Troubleshooting Flowchart to verify AppleLine operation.
NO
1. Use the Standalone Troubleshooting Flowchart to verify AppleLine operation.
2. Check the communication parameters in the terminal emulation program. (See Note 3.)
3. Check the communication parameters in the AppleLine Supervisor program. (See Note 3.)
4. Check the communication equipment between the computer and the AppleLine. (See Note 4.)
5. Check the Apple computer. (See Note 5.)

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Section 5 – Additional Procedures

❑ CONTENTS

Note: If a step in this section is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.

❑ PROM UPGRADE

AppleLine uses four socketed PROMs that may be replaced to upgrade AppleLine to the latest version. The latest ROM versions are:

IC	Part No.*	No. of Pins	Version No.
Z1	XXX29	24	3.35
Z6	XXX28	24	3.35
Z11	XXX27	24	3.35
Z46		28	2.2

*The last two digits identify the PROM. Ignore the first three digits.

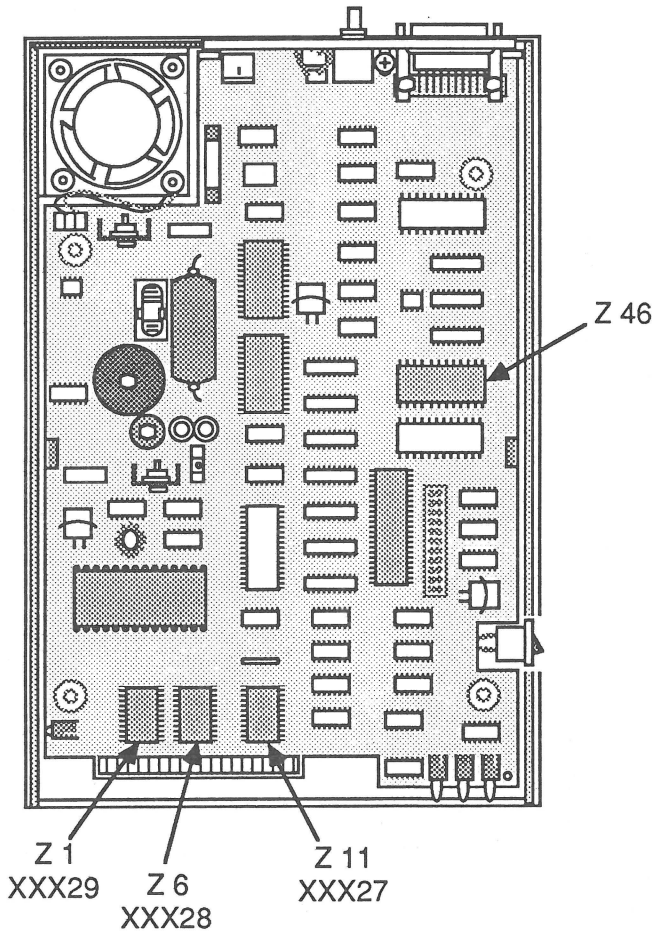

FIGURE 1

To replace the PROMs:

1. Remove the top cover.

2. Locate the PROMs on the logic board and note the version numbers (see Figure 1). Use an IC tool to remove any PROMs that need to be upgraded.

3. Replace the removed PROMs with the upgraded PROMs.

4. Replace the top cover.

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Illustrated Parts List

❑ CONTENTS

The figures and lists in this section include all piece parts that can be purchased separately from Apple for AppleLine, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

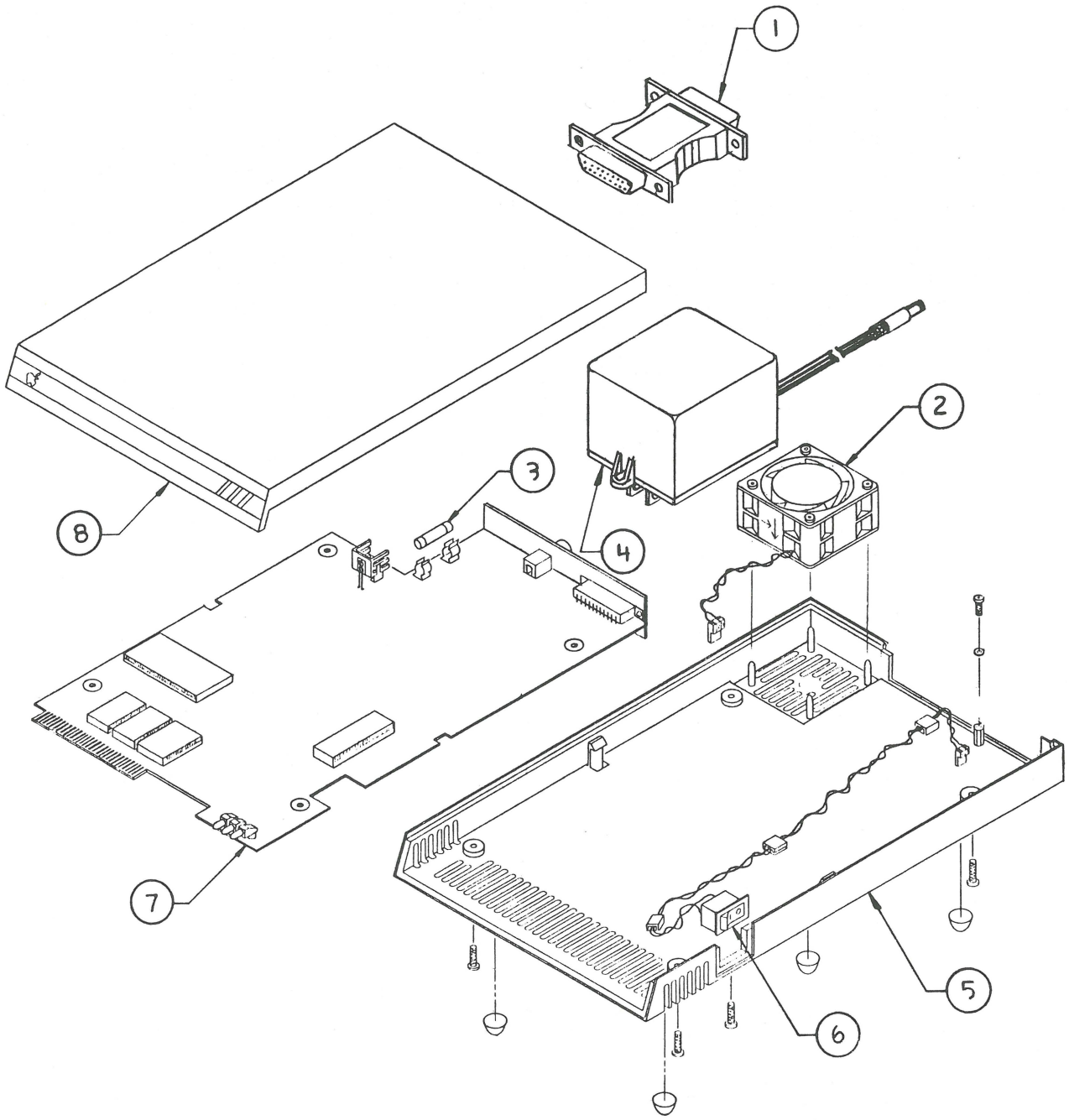

FIGURE 1

❑ APPLELINE (Figure 1)

Item	Part No.	Description
1	590-0214	Gender Cable Assembly
2	970-0883	Fan and Cable Assembly
3	740-0304	Fuse, 1A, 250V Quick Blow
4	076-8079	Transformer
5	970-0882	Bottom Cover
6	970-0884	Switch and Cable Assembly
7	661-75203	AppleLine PCB
8	970-0881	Top Cover