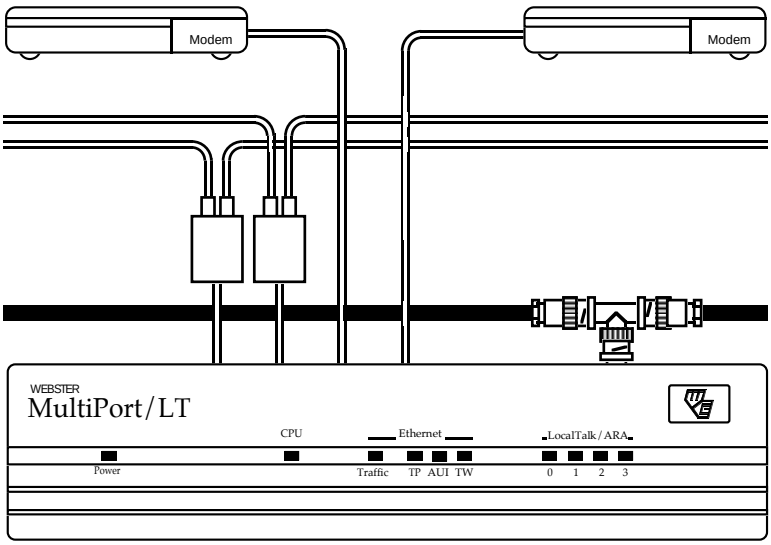
WEBSTER

MultiPort/LT

ARA Server, Dial-Out Server
AppleTalk, IP
and DECnet Router



User Reference Manual

WEBSTER COMPUTER CORPORATION

WEBSTER

MultiPort/LT

USER REFERENCE MANUAL

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ABOUT THIS MANUAL .....

This manual provides useful reference material for the MultiPort/LT user and network administrator.

Chapter 1 provides an introduction to Network Addressing.

Chapter 2 describes MultiPort/LT operation and the MultiPort/LT monitor commands.

Chapter 3 describes the MultiPort/LT Gateway code commands.

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CHAPTER 1 Introduction to Network Addressing

This Chapter provides an introduction to network addressing.

AppleTalk, Ethernet and IP addresses are discussed, as well as the relevant network protocols and interfaces.

1.1. Interface Requirements

For successful communication, all devices and networks must be represented by unique addresses. These addresses enable datagrams to arrive at their correct destination.

A device can have more than one address. For each network interface on a device, so there exists an address for each protocol the interface uses.

Figure 1-1 shows a device with two unique addresses, one for each protocol the device uses, even though only one network cable physically connects to it

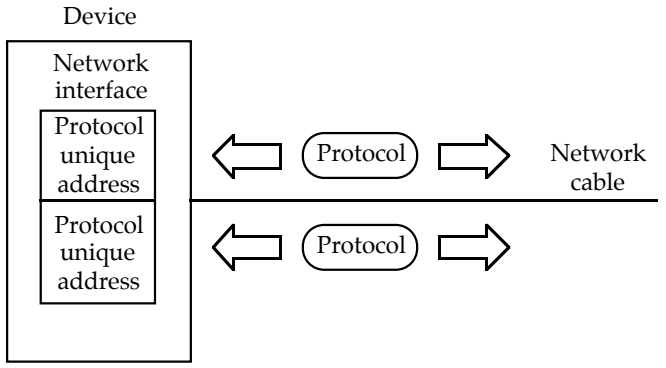


Figure 1-1. Protocol Addresses

1.2. Types of Addresses

Devices connected to an Ethernet, which handle Ethernet, IP and AppleTalk protocols, require three types of addresses:

- ❑ Ethernet addresses
- ❑ Internet Protocol (IP) addresses
- ❑ AppleTalk addresses

Every device connected to an Ethernet has an Ethernet interface and a corresponding Ethernet address used by the Ethernet protocol. A device which also uses IP and AppleTalk protocols, such as the MultiPort/LT, also has corresponding IP and AppleTalk addresses. Refer to Figure 1-2.

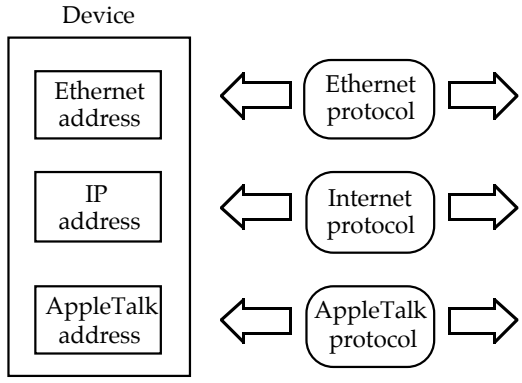


Figure 1-2. Types of Addresses

1.3. Multiple Interfaces

Devices with more than one network interface require additional addresses.

Figure 1-3 shows a device with a LocalTalk interface and an Ethernet interface. Each interface has addresses corresponding to the protocols used.

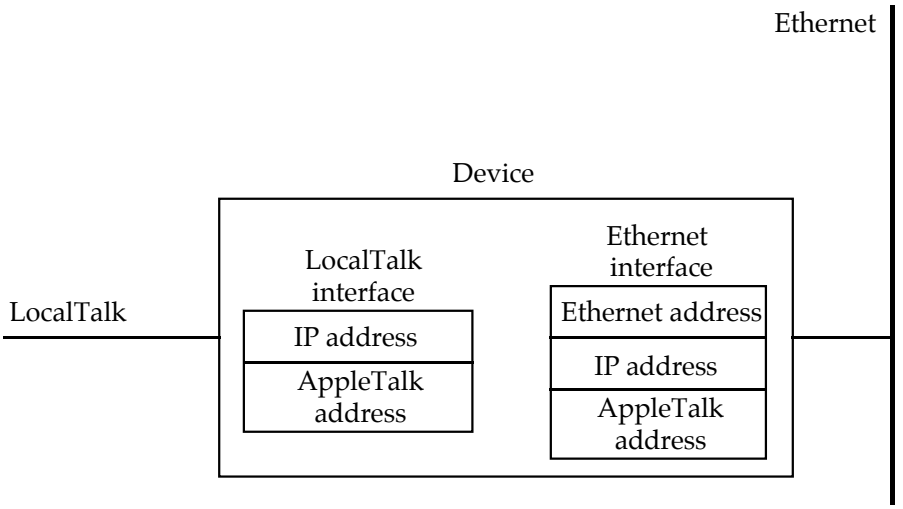


Figure 1-3. Multiple Interfaces

1.4. Ethernet Addresses

All device interfaces connected to an Ethernet, including the MultiPort/LT's, are required to have a unique 48 bit Ethernet address. The address is conventionally written as six pairs of hexadecimal digits and divided into two distinct parts.

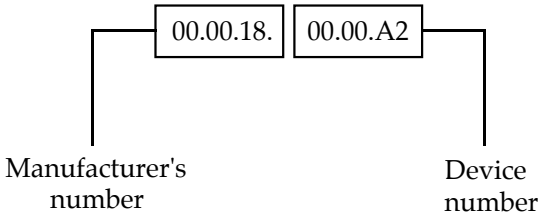


Figure 1-4. Ethernet Addresses

The manufacturer's number is assigned by a central Ethernet authority. A manufacturer could be assigned more than one manufacturer's number. All MultiPort/LTs are given the manufacturer's number of 00.00.18.

The device number is unique for each Ethernet interface the manufacturer produces. Each MultiPort/LT, with its one Ethernet interface, has one unique device number and therefore one unique Ethernet address.

For the MultiPort/LT, the Ethernet address is configured in memory at the manufacturing plant and recorded on a label attached to the rear panel of the case. The Ethernet address can also be checked using the command VERSION. Refer to Section 2.2.4.12. in this manual. There should be no requirement to change the address on-site.

1.4.1. Using Ethernet Addresses

To ensure correct transfer, all datagrams sent across an Ethernet include source and destination Ethernet addresses. Refer to Figure 1-5.

Please note that Ethernet addresses are only valid for the devices directly connected to a logical segment of Ethernet (a logical segment includes Ethernet segments interconnected by repeaters and bridges).

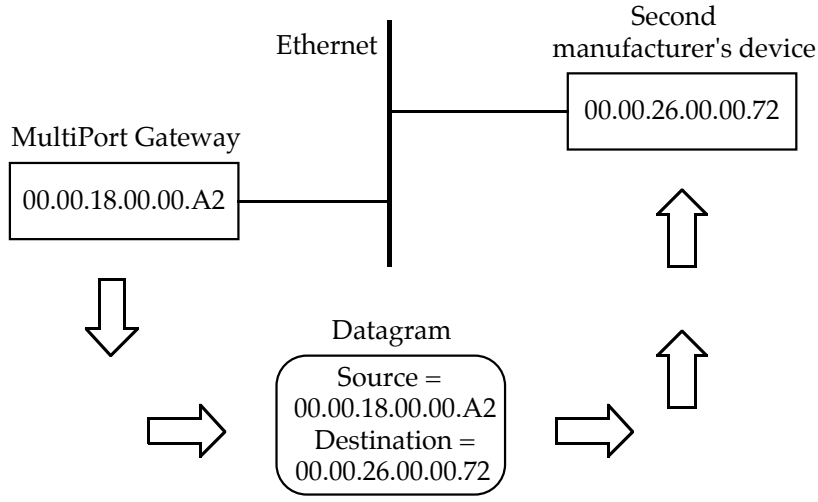


Figure 1-5. Using Ethernet Addresses

1.5. Internet Protocol (IP) Addresses

Each device interface which uses Internet Protocol is required to have a unique 32 bit IP address, conventionally written as four decimal numbers separated by periods. Each decimal number represents 8 bits.

- Example

  192.160.22.16

Each IP address is divided into two distinct parts, a network number and a host number.

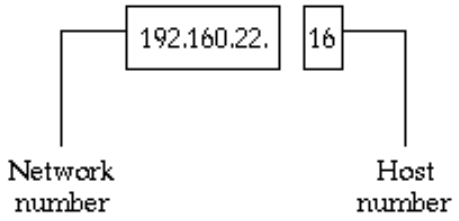


Figure 1-6. IP Addresses

A network is assigned a unique network number. The device interface connecting to that network is assigned a unique host number.

1.5.1. Using IP Addresses

All datagrams sent to and from a MultiPort/LT on the Ethernet include source and destination IP addresses to ensure correct routing across multiple networks. Refer to Figure 1-7.

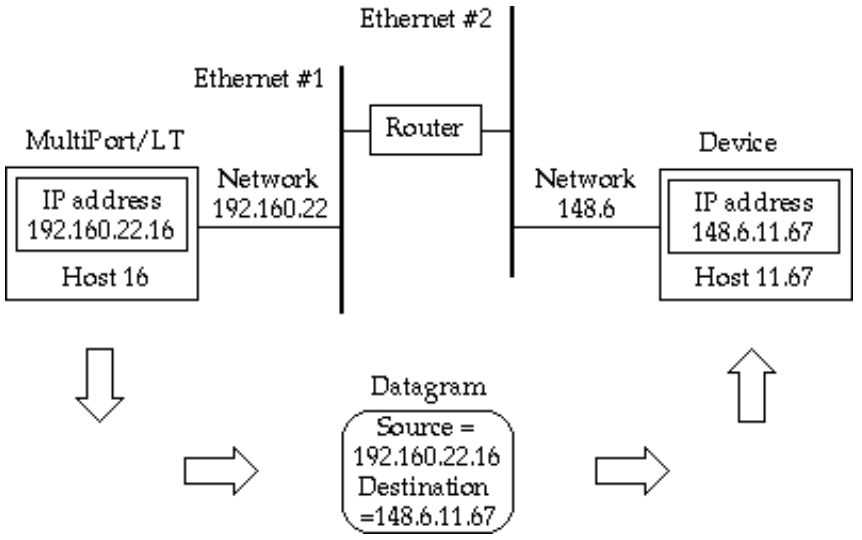


Figure 1-7. Using IP Addresses

Variation in network and host number lengths is permitted.

In Figure 1-7 note how Ethernet #1's network number of 192.160.22 is three decimal numbers long (24 bits), yet Ethernet #2's network number of 148.6 is only two decimal numbers long (16 bits). Similarly, the host numbers vary in length.

1.5.2. Subnetmask

To distinguish between network and host numbers, an IP address is used with a 32 bit subnetmask number, conventionally written as four decimal numbers separated by periods.

- Example

  255.255.255.0

Bits set in the mask indicate the address network number; bits not set indicate the address host number.

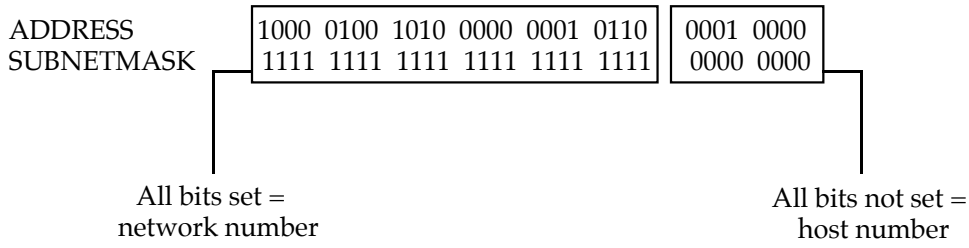
- Example 1

  ADDRESS 192.160.22.16
  SUBNETMASK 255.255.255.0

  For interpretation, both numbers are first changed into hexadecimal:

  ADDRESS 84.A0.16.10
  SUBNETMASK FF.FF.FF.00

  Then both numbers are changed into binary:



In example 1 the subnetmask decodes a host number of 0001 0000 (decimal 16).

- Example 2

ADDRESS 129.15.115.71
SUBNETMASK 255.255.255.224

ADDRESS 81.0F.73.47
SUBNETMASK FF.FF.FF.E0

ADDRESS 1000 0001 0000 1111 0111 0011 0100 0111
SUBNETMASK 1111 1111 1111 1111 1111 1111 1110 0000

In example 2 the subnetmask decodes a host number of 0 0111 (decimal 7). Note how the host number is decoded as only 5 bits long.

Host numbers and their corresponding subnetmask bits do **not** have to be multiples of 8 bits.

1.5.3. External and Internal Network Numbers

- Terminology

This manual uses the terms 'external network number' and 'internal network number' in preference to the alternative terms 'network number' and 'subnet number' respectively.

The network number itself is subdivided into two distinct parts, an external network number and an internal network number.

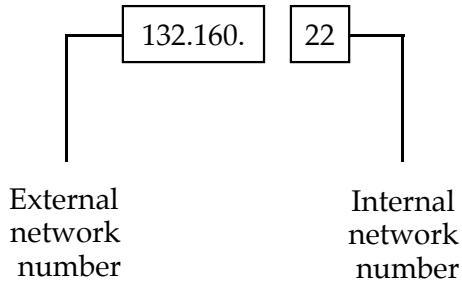


Figure 1-8. IP Network Numbers

External network numbers are assigned by the central network authority Network Information Center (NIC) at registrar@nic.ddn.mil.

Internal network numbers are assigned by a local network authority, possibly a customer's own organization.

Host numbers are assigned by the customer's local network administrator.

1.5.4. IP Address Classes

External network numbers, as assigned by ARPANET, belong to one of five classes. These classes give IP addresses a flexible numbering system, able to accommodate maximum networks with minimum hosts, or vice-versa.

Only the first three classes, classes A,B and C, are applicable to the MultiPort/LT's networking environment:

Class A

An address with the most significant binary bit set to 0; that is, an address beginning with 1 to 127 (decimal) inclusive.

- Example

  92.120.247.32

  With Class A addresses, the first 8 binary bits are **always** the external network number. The complete network number is a minimum 8 bits and maximum 31 bits, as decoded by the subnetmask.

Class B

An address with the first two most significant binary bits set to 10; that is, an address beginning with 128 to 191 (decimal) inclusive.

- Example

  132.160.22.16

  With Class B addresses, the first 16 binary bits are **always** the external network number. The complete network number is a minimum 16 bits and maximum 31 bits, as decoded by the subnetmask.

Class C

An address with the first three most significant binary bits set to 110; that is, an address beginning with 192 to 223 (decimal) inclusive.

- Example

  220.72.117.26

  With Class C addresses, the first 24 binary bits are **always** the external network number. The complete network number is a minimum 24 bits and maximum 31 bits, as decoded by the subnetmask.

1.5.5. Using Subnetmask

The address class determines the length of the external network number.

- ❑ Example

  ADDRESS 220.72.117.26

  This is a Class C address - and therefore the external network number is 220.72.117 (first 24 bits).

The subnetmask must **always** decode the external network number as belonging to the network number.

- ❑ Example

  ADDRESS 220.72.117.26
  SUBNETMASK 255.255.255.240

  This is a valid subnetmask for a Class C address.

The subnetmask must **never** decode (part of) the external network number as belonging to the host number.

- ❑ Example

  ADDRESS 220.72.117.26
  SUBNETMASK 255.255.240.0

  This is an illegal IP address and subnetmask combination. Part of the external network number is decoded as belonging to the host number.

1.5.6. Multiple Networks

Organizations having multiple internal networks use the external network number to give the appearance of a single network to the outside world.

Refer to Figure 1-9.

In this example, all datagrams with the external network number 132.160 are sent to the organization's gateway.

The different internal network numbers are used within the organization to distinguish the three networks.

These internal networks are called "subnets" of the organizations main IP network.

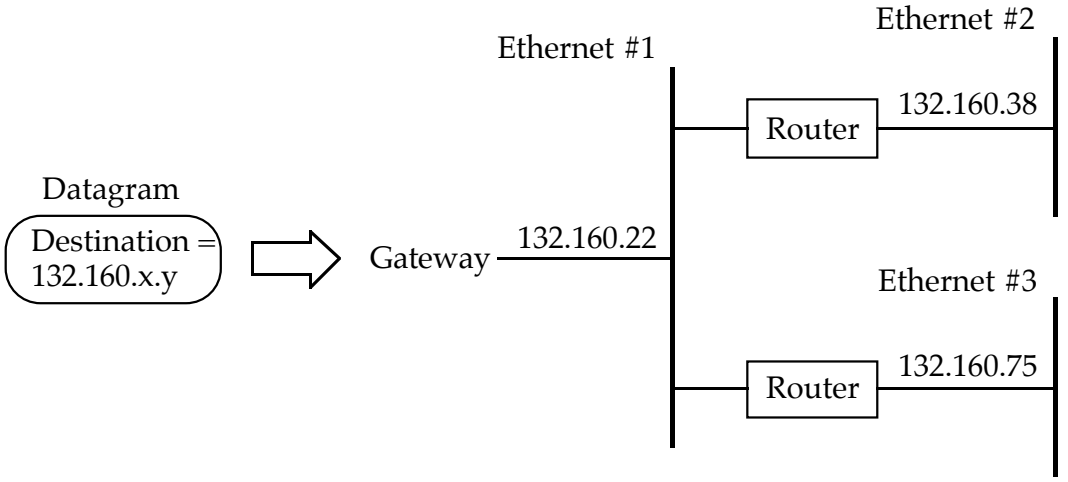


Figure 1-9. Multiple Networks

1.5.7. ARP

ARP stands for "Address Resolution Protocol". An ARP process runs on all IP hosts to facilitate the translation of IP addresses to their corresponding Ethernet Addresses.

On an IP network, hosts communicate by means of IP addresses. However, the IP protocol on Ethernet relies on the Ethernet protocol to convey packets across Ethernet. This requires that an IP host sending data to another IP host know the Ethernet address of the host it is sending to (as well as its IP Address).

As an example consider that host "George" with IP address a.b.c.d. and Ethernet address 00:00:18:00:00:10 wishes to send data to host "Fred" with IP address a.b.c.e. and Ethernet address 00:00:18:00:00:12.

To facilitate this, the host "George" sends an ARP packet that requests the host with IP address a.b.c.e reply to "George" with its Ethernet number. The diagram below shows the hosts "George" and "Fred".

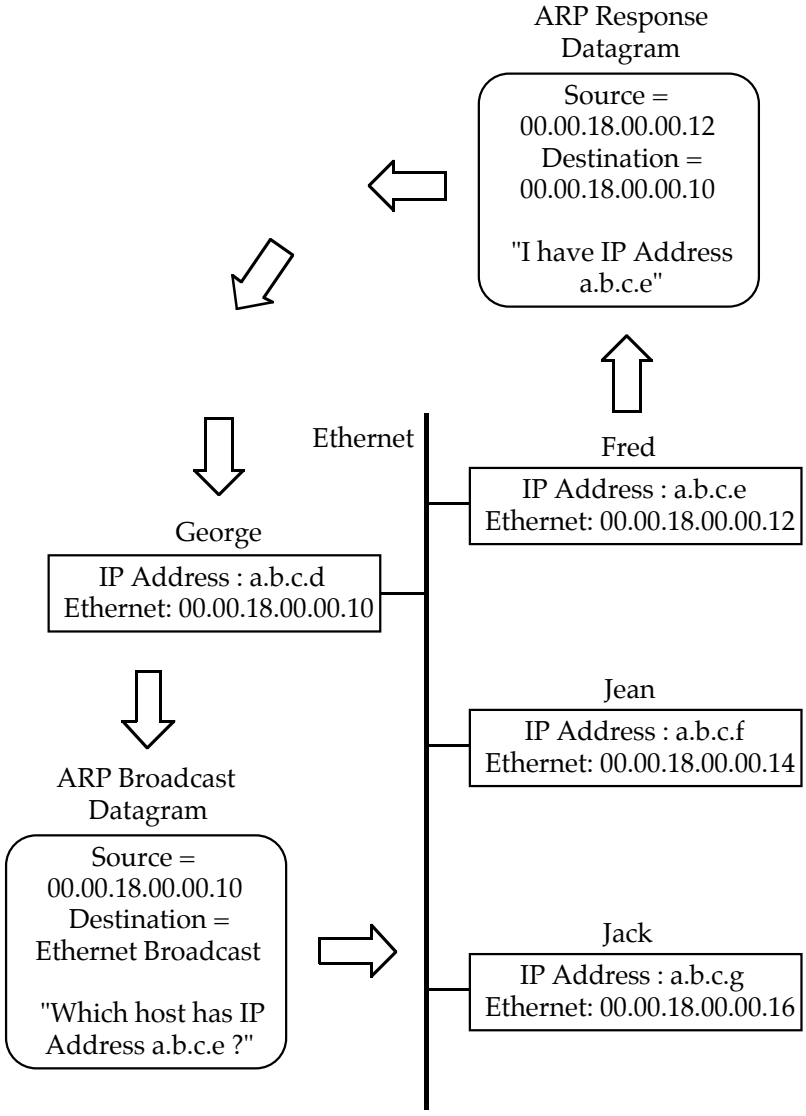


Figure 1-10. Address Resolution Protocol

The ARP process on "Fred" responds to "George" with a packet saying that to reach IP host a.b.c.e, the packet should be sent to the Ethernet address 00:00:18:00:00:12. Since "George's" request contained "George's" Ethernet number, "Fred" can send the reply packet to the Ethernet address 00:00:18:00:00:10.

At this point, "George" would record that to reach IP address a.b.c.e in future, the packets should be sent to the Ethernet address 00:00:18:00:00:12.

Likewise, "Fred" would record that to reach IP address a.b.c.d in future, the packets should be sent to the Ethernet address 00:00:18:00:00:10.

1.6. AppleTalk Addresses

AppleTalk addresses comprise two distinct numbers, a 16 bit AppleTalk network number and an 8 bit AppleTalk node (device) number.

1.6.1. AppleTalk Network Numbers

Each network which uses AppleTalk protocol is required to have a unique AppleTalk network number, sometimes written as two decimal numbers separated by periods.

- Example

  24330 or 95.10

AppleTalk network numbers are assigned by the local network administrator. Care must be taken to ensure a new network number does not conflict with any existing local network number.

Figure 1-11 shows a device with two network interfaces, both using AppleTalk protocol. Each network has a unique network number.

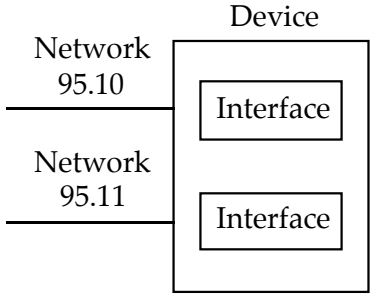


Figure 1-11. AppleTalk Network Numbers

1.6.2. AppleTalk Node Numbers

Each device interface, which uses AppleTalk protocol, is required to have a unique AppleTalk node number on that network, conventionally written in decimal.

- Example

  194

Node numbers are separated into two ranges (on LocalTalk only):

- Node numbers 1 to 127

  This range identifies 'user' nodes. These are nodes which are frequently switched on and off (for example, Macintosh computers).

- Node numbers 128 to 254

  This range identifies 'server' nodes. These are nodes normally engaged in time consuming tasks and are seldom switched off (for example, a gateway).

Configuration of node numbers is optional. If **not** configured, a node number is dynamically assigned by the node itself when switched on. If a node number **is** configured and, in error, a number is selected which is already assigned to another node on the same network, then the node will dynamically re-assign itself another number.

Figure 1-12 shows two device interfaces which use AppleTalk protocol. Each device interface has a unique node number.

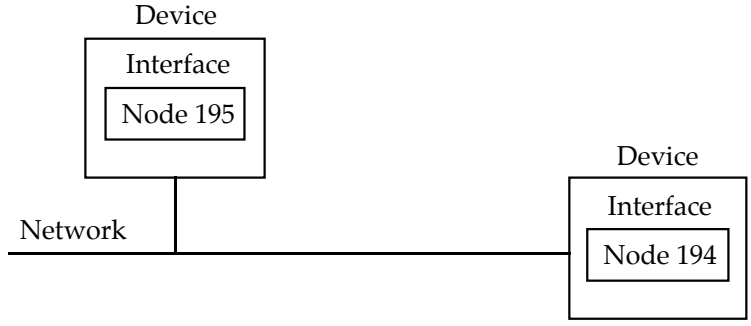


Figure 1-12. AppleTalk Node Numbers

1.6.3. AppleTalk Zone Names - Phase 1

A zone describes a group of networks which use AppleTalk protocol. A particular network can only reside in one zone.

AppleTalk protocol uses zones to group networks together. Each zone has a discrete zone name which can then be used (for example) to broadcast datagrams to all devices within the zone.

The MultiPort/LT can be configured with the zone name of each network it connects with which uses AppleTalk protocol.

Zone names are a maximum 32 characters long. The choice of name is completely arbitrary. However, it is recommended a zone name should reflect (for example) the purpose of the network or a specific organization. For example, the zone name "webcomrad" might represent WEBster COMputer's Research And Design centre.

1.6.4. AppleTalk Zone Names - Phase 2

A zone describes a group of networks which use AppleTalk protocol. With the advent of AppleTalk Phase 2, a particular network can reside in more than one zone. This only applies to EtherTalk Phase 2 networks, where a range of network numbers is allowable, and a zone list is available.

Please see Chapter 6 in the Installation Manual.

AppleTalk protocol uses zones to group networks together. Each zone has a discrete zone name which can then be used (for example) to broadcast datagrams to all devices within the zone.

The MultiPort/LT can be configured with the zone name of each network it connects with which uses AppleTalk protocol.

Zone names are a maximum 32 characters long. The choice of name is completely arbitrary. However, it is recommended a zone name should reflect (for example) the purpose of the network or a specific organization.

For example, the zone name "webcomrad" might represent WEBster COMputer's Research And Design centre.

1.6.5. Seed Gateways

A seed gateway is one which is configured with, and permanently knows, its own AppleTalk network number and is able to inform other (non-seed) gateways on its network of that known network number.

Network numbers are unique for each interface on a device. Therefore, it is possible for a gateway to be a seed gateway for some of the networks it connects with and not others.

A non-seed gateway is one which is not configured with the network number. Instead, the non-seed gateway will obtain the network number from a seed gateway on that network.

A seed gateway can also inform other gateways of zone names. If a gateway is a seed gateway for a network number then it must also be made the seed gateway for that network's zone name.

CHAPTER 2 Inside MultiPort/LT and Monitor Commands

This Chapter describes how the MultiPort/LT operates, and the MultiPort/LT monitor commands.

2.1. MultiPort/LT Operation

When first powered on, the MultiPort/LT executes an Eprom resident program called the "monitor". The main function of the monitor in normal operation is to load the MultiPort/LT software called "LT_Code" from Flash Eprom (or a network host if the Flash copy is corrupted), and then to transfer control of the MultiPort/LT operation to the gateway code. Once the MultiPort/LT's gateway code is running, the MultiPort/LT can operate as an ARA server, AppleTalk Router and IP and DECnet Gateway.

2.1.1 Console Port

The console port min-din 8 connector is located on the rear panel of the case, and is used for direct terminal connection. The pinout is shown below:

Pin	Name	Direction
6/3	Transmit Data (TD) +/-	Out
5/8	Receive Data (RD) +/-	In
4	Request to Send (RTS)	Out
2	Clear to Send (CTS)	In
4	Signal Ground	-
7	Data Carrier Detect (DCD)	In
1	Data Terminal Ready (DTR)	Out

Table 2-1. Console Port Pin Assignments

2.1.1.1. Port Requirements

For successful communication, the following configuration is required:

- ❑ The MultiPort/LT detects when a terminal is connected by monitoring the level of the receive data signal.

2.1.2 Minidin-8 Connectors

The Minidin-8 connectors on the MultiPort/LT may be used for either LocalTalk or modem connections.

When a modem is connected, the pinout is as shown in Table 2-2.

Pin	Name	Direction
6	Transmit Data (TD)	Out
5/8	Receive Data (RD)	In
4	Request to Send (RTS)	Out
2	Clear to Send (CTS)	In
4	Signal Ground	-
7	Data Carrier Detect (DCD)	In
1	Data Terminal Ready (DTR)	Out

Table 2-2. Minidin-8 Pin Assignments - Modem Connection

When a channel is used for LocalTalk, the pin assignments shown in Table 2-3 apply.

Pin	Name	Direction
6/3	Transmit Data (TD) +/-	Out
5/8	Receive Data (RD) +/-	In
4	Signal Ground	-

Table 2-3. Minidin-8 Pin Assignments - LocalTalk Connection

2.1.2.1. Modem Cable

The pinout for a hardware handshake modem cable is shown below. A hardware handshake cable is needed if high speed (>9600) modems are connected to the MultiPort/LT.

Minidin-8 Pin	DB-25 Pin	Function	Direction
5	3	Receive Data	In
3	2	Transmit Data	Out
4 & 8	7	Ground	-
2	5	Clear to Send	In
1	4 & 20	RTS & DTR	Out
7	8	CD (Not used)	In

Table 2-4. Macintosh Hardware Handshake Modem Cable

2.1.3 Monitor and Gateway Code Functions

The Monitor and Gateway Code have the following characteristics, functions and responsibilities:

Item	Monitor	Gateway Code
Resides:	Permanently in the MultiPort/LT (in Eprom).	In Flash EPROM, and optionally on on a Mac or UNIX host.
Loaded:	When Gateway Code is not running.	By the Monitor.
Started:	At Power-up or from Gateway Code.	By the Monitor.
Prompt:	LT >	None.
Communication:	Console, Telnet Server.	Commands - Console, mgcmd Config - MultiPort Manager mgccc (from a UNIX host) Statistics - MultiPort Manager
Other:	Boots LT Code from Flash Eprom, Mac or UNIX hosts. Power-up self-tests. Configuration entry.	LocalTalk to LocalTalk to EtherTalk to IPTalk router. ARA server IPTalk gateway IPGATEWAY services for NCSA Telnet and others

Table 2-5. Monitor and Gateway Code Functions

Console is the Console Serial port on the back of the MultiPort/LT. MultiPort Manager is used to enter the MultiPort/LT's configuration. mgcmd is a Unix program.

While the main function of the monitor is to provide a means for the gateway code to load and to start, the monitor also provides alternative access to some of the MultiPort/LT's configuration parameters.

2.1.4 MultiPort/LT Program Control

Control of the MultiPort/LT can be passed between the monitor and gateway code by using the following commands:

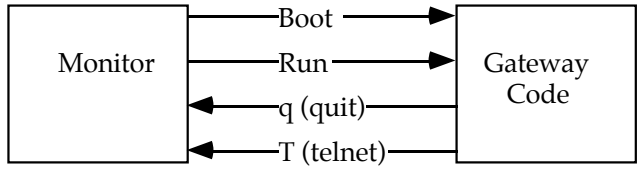


Figure 2-1. Monitor and Gateway Code Program Control

The monitor commands are detailed in the second part of this chapter; gateway code commands are described in Chapter 3.

2.1.5 MultiPort/LT Power-On Sequence

The MultiPort/LT Power On Sequence is as follows:

1. Power on.
2. Self Tests.
3. If a terminal or Macintosh running terminal software is connected, goto step 25.
4. Attempt Flash Boot. If successful, goto 24.
5. If the MultiPort/LT's IP address is configured, goto step 12.
6. If RARP is enabled, RARP for the IP address. If successful, goto 12.
7. If BOOTP is enabled, BOOTP for the IP address.
8. Goto 12.
9. If the MultiPort/LT's IP address is configured, goto step 12.
10. If RARP is enabled, RARP for the IP address. If successful, goto 12.
11. If BOOTP is enabled, BOOTP for the IP address.
12. If TCPBOOT is enabled, attempt a TCP/IP boot. If successful, goto 24.
13. If APPLETALKBOOT is not enabled, goto 19.
14. Attempt an EtherTalk Ph 1 Boot. If successful, goto 24.
15. Attempt an EtherTalk Ph 2 Boot. If successful, goto 24.
16. Attempt an Apple Boot over LocalTalk I/F 0. If successful, goto 24.

17. Attempt an Apple Boot over LocalTalk I/F 1. If successful, goto 24.
18. Attempt an Apple Boot over LocalTalk I/F 2. If successful, goto 24.
19. Attempt an Apple Boot over LocalTalk I/F 3. If successful, goto 24.
20. If MOPboot is not enabled, goto 22.
21. Attempt MOPboot. If successful, goto 24.
22 If a serial cable is connected, and a ^C or DEL character has been received, goto 25.
23. Goto 9.
24. Run the loaded gateway code. If a "q" command is received, goto 25.
25. Display the "LT>" prompt. Wait for commands.

For a Factory-Configured MultiPort/LT, the IP address is not configured. As a consequence of the above sequence, if the MultiPort/LT has been powered-on without a "live" serial cable attached ("live" meaning with MGTalk), then it will not display the "LT>" prompt when a cable is connected unless it receives ^C (Control-C) or DEL (delete-key - not backspace).

2.1.6 MultiPort/LT IPTalk Operation

2.1.6.1. Definition of IPTalk

Under Apple's terminology "XxxxTalk" means that the AppleTalk data packets are being "Transported" over or delivered by an "Xxxx" network. For example:

Protocol	AppleTalk packets are transported over:
LocalTalk	Apple's LocalTalk network wiring
EtherTalk	Ethernet
TokenTalk	Token Ring
IPTalk	An IP-protocol-based Network

IPTalk is the odd one out here. The other three are transporting AppleTalk packets directly over a "raw" network. With IPTalk, AppleTalk packets are being encapsulated inside another networking protocol - IP (which is the lower-level part of TCP/IP).

This means that AppleTalk packets can travel over almost any existing IP network, no matter what underlying transport hardware is used to guarantee delivery of the IP packets.

2.1.6.2. Uses for IPTalk

There are two applications for IPTalk, both of which allow AppleTalk packets to go where EtherTalk packets usually can't. Firstly, IPTalk allows delivery over established IP networks that don't transport other AppleTalk protocols. For an example of this see Figure 2-2 in the example presented later in this section.

Secondly, IPTalk allows communication between AppleTalk-based devices and those that can only communicate using IP, such as most Unix-based computers. IPTalk allows a pathway for delivery of AppleTalk packets to applications running in these computers, notably the CAP-library-based applications aufs and lwsrv.

As as example of IPTalk being used for AppleTalk packet delivery over established IP networks, consider the Macintosh below printing a document on the LaserWriter shown.

Normally one would not expect to print on such a remote LaserWriter - this is just a simple example to show how the MultiPort/LT and IPTalk are involved.

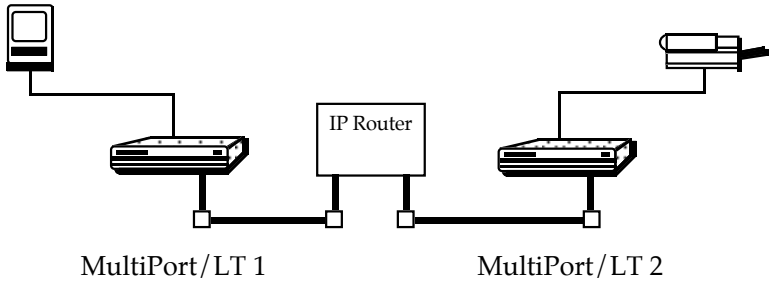


Figure 2-2. IPTalk Operation

1. Macintosh sends AppleTalk packet to MultiPort/LT 1.
2. MultiPort/LT knows from atalkad that to reach destination it must send packet to MultiPort/LT 2, and to get there it must go through the IP router.
3. MultiPort/LT 1 encapsulates AppleTalk packet within an IP packet, and sends it to IP Router.
4. IP Router forwards the IP packet to second MultiPort/LT.
5. MultiPort/LT 2 strips off IP packet to reveal AppleTalk packet.
6. MultiPort/LT 2 forwards AppleTalk packet to the LaserWriter.

2.1.7 MultiPort/LT MacIP Operation

In order for a Macintosh to communicate with a Non-AppleTalk host it is necessary for the Macintosh to use the same protocol that the host is using. For TCP/IP-based hosts, this means the Mac must use TCP/IP. For a Mac connected directly to an Ethernet, this is easy as it can (with appropriate software such as NCSA Telnet or MacTCP-based products) directly receive and transmit TCP/IP/Ethernet packets. For a Macintosh connected to a LocalTalk (or EtherTalk-only) network, this is not possible.

The MacIP protocol allows IP packets to be transported over AppleTalk networks. Note this is almost the **reverse** of IPTalk, which allows AppleTalk packets to be transported over IP networks. The name MacIP is appropriate because it performs the functions of the IP protocol, but over AppleTalk networks.

Even with a protocol that allows IP packets to be transported over an AppleTalk network, there is another simple requirement. In order for a Macintosh (or any device) to communicate using IP, it has to first have an IP address. Allocation of a fixed IP address to a large, fixed computer is not a problem. Allocation of a fixed IP address to a small and mobile Macintosh does cause problems, as it may be removed from the network on which its IP address is appropriate and connected to one on which it isn't. For this reason, MacIP includes the concept of Dynamically Allocated Addresses. For those applications that do require fixed addresses, MacIP provides Static Addresses.

NCSA Telnet uses MacIP. The following example shows how NCSA Telnet using MacTCP starts a communication session.

2.1.7.1. NCSA Telnet Operation

The sequence proceeds as follows:

1. The MultiPort/LT registers itself as an IPGATEWAY service on NBP.
2. NCSA Telnet is launched on a Mac.
3. NCSA opens MacTCP, and it looks for an IPGATEWAY and finds the MultiPort/LT.
4. NCSA asks the MultiPort/LT to allocate an IP address for the Mac.
5. MultiPort/LT gives the Mac a Dynamic IP Address from its allowed range.
6. The User selects an IP Host by name or IP address and opens a session.
7. NCSA Telnet sends an IP packet to MacTCP.

8. MacTCP sends an AppleTalk-encapsulated IP packet to the MultiPort/LT.
9. MultiPort/LT forwards the IP packet to the appropriate host/gateway.
10. Session continues with the Mac and the IP host exchanging packets.

2.1.8 MultiPort/LT and RTMP

An RTMP report can be requested from the console or via mgcmd. On AppleTalk networks that contain more than one MultiPort/LT (i.e. two MultiPort/LTs on EtherTalk or two MultiPort/LTs interconnected using LocalTalk) it is possible that some of the AppleTalk networks will have a status of "SUSPECT" when an RTMP report is displayed. The "SUSPECT" state usually only lasts a few seconds.

This is caused by the interaction between two independent MultiPort/LT timers:

- ❏ Any MultiPort/LT LocalTalk interface that is either "seed" for a network, or has been "seeded" by another router on that network, transmits an RTMP packet every 10 seconds. The other MultiPort/LTs receive this and set all networks that they are told about in that packet to "GOOD".

- ❏ In all MultiPort/LTs there is a 20 second timer which controls the RTMP table ageing. Every 20 seconds all entries in the table drop one step in the list "GOOD" --> "SUSPECT" --> "BAD" (this obeys the specification for RTMP which is to age them out in 40 seconds). An entry will age from "GOOD" to "SUSPECT" irrespective of the RTMP packets that came in in the previous 10 seconds, i.e. there is no "memory" of when the last RTMP packet came in.

This means that for up to 10 seconds after the RTMP table has aged, "SUSPECT" entries will appear when an RTMP report is requested.

The MultiPort/LT treats "GOOD" and "SUSPECT" entries the same, with the only difference that "GOOD" ages to "SUSPECT" and "SUSPECT" ages to "BAD". "BAD" entries get removed.

2.1.9 MultiPort/LT AppleTalk Interfaces

There are **eight** AppleTalk software interfaces associated with the MultiPort/LT.

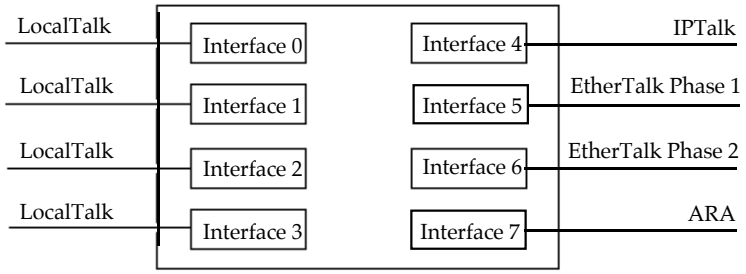


Figure 2-3. AppleTalk Software Interfaces

The eight software interfaces are:

- AppleTalk Interfaces 0,1,2 and 3

  These four identical software interfaces service the four standard (230.4 Kbps) LocalTalk networks connected to the MultiPort/LT (as long as they are not being used for ARA)

- AppleTalk Interface 4

  AppleTalk interface 4 is also referred to as the IPTalk interface. This software interface is used when any one of the four standard LocalTalk networks communicate with any reachable IP host connected to the ethernet. Refer to Figure 2-4. AppleTalk interface 4 encapsulates AppleTalk DDP (Datagram Delivery Protocol) packets into UDP/IP packets.

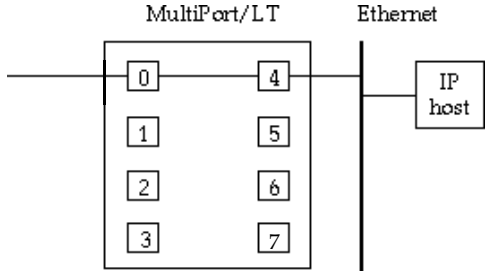


Figure 2-4. AppleTalk Interface 4

❑ AppleTalk Interface 5

This software interface is used when any one of the four standard LocalTalk networks communicate, using EtherTalk Phase 1 protocol, with any device connected directly to the local Ethernet.

Refer to Figure 2-5.

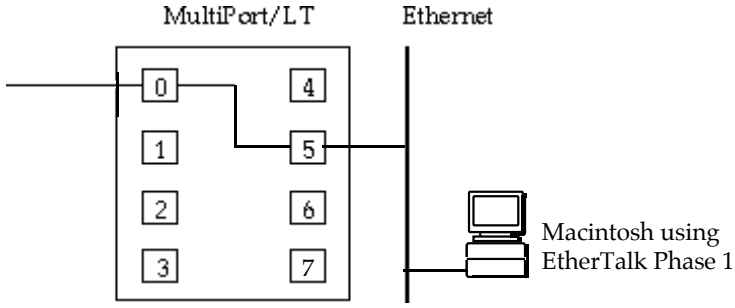


Figure 2-5. AppleTalk Interface 5

❑ AppleTalk Interface 6

This software interface is used when any one of the four standard LocalTalk networks communicate, using EtherTalk Phase 2 protocol, with any device connected directly to the local Ethernet. Refer to Figure 2-6.

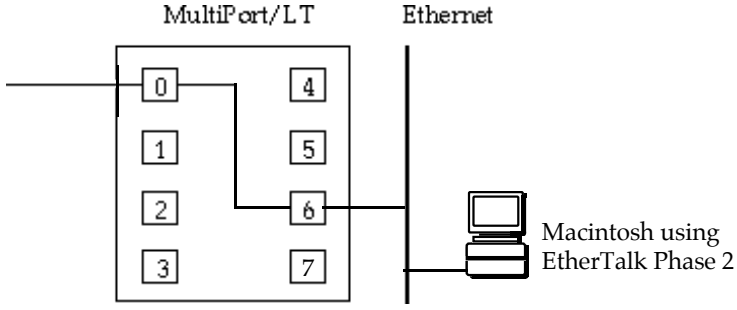


Figure 2-6. AppleTalk Interface 6

- ❑ AppleTalk Interface 7

  This software interface is used when any channels are configured for ARA. In the example below, an ARA user is communicating with a device on EtherTalk Phase 2.

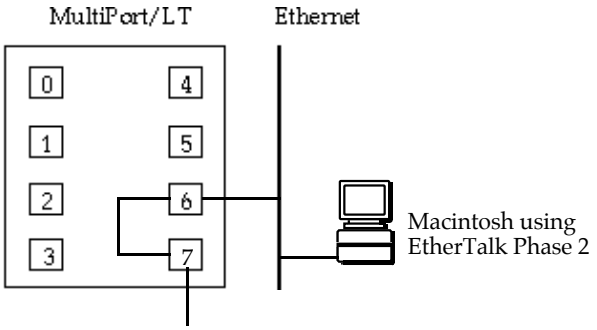


Figure 2-7. ARA Interface

2.2. MultiPort/LT Monitor

The following sections describe how to connect to the monitor, and the monitor commands. Storage of configuration data is discussed initially.

Please note that the information in these sections is not required for normal operation of the MultiPort/LT. It is only provided for debugging purposes. Also, note that the monitor commands can not access the ARA data storage area - this can only be done via MultiPort Manager and Mgccc. Also, note that saving a configuration using the monitor commands will erase any ARA configuration that was previously saved.

2.2.1 MultiPort/LT Configuration Data Storage

Four types of memory are associated with configuration data:

- ❑ Master Configuration
- ❑ Working Configuration
- ❑ Hardware Flash Eprom
- ❑ Factory Configuration

To understand the display and storage of configuration data, it is necessary to explain the function of each copy.

2.2.1.1. Master and Working Configuration

The configuration data stored in the "Master Configuration" is used for the MultiPort/LT's real-time gateway operation. Refer to Figure 2-8.

The command CONFIGURE DISPLAY MASTER displays the contents of the "master EEPROM". Refer to section 2.2.5.2.11.

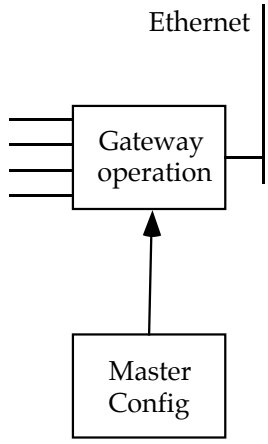


Figure 2-8. Master Configuration

The "working configuration" stores the configuration data currently being entered into MultiPort/LT using the monitor commands. Refer to Figure 2-9.

The command CONFIGURE DISPLAY WORKING displays the contents of the "working EEPROM". Refer to section 2.2.5.2.11.

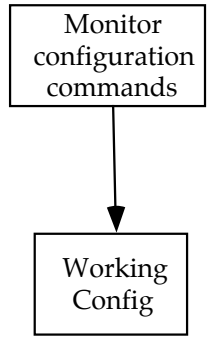


Figure 2-9. Working Configuration

2.2.1.2. Using Data

New configuration data, stored in "working configuration", cannot be used for the MultiPort/LT's real-time gateway operation until transferred to "master configuration".

The command CONFIGURE USE copies the contents of the "working configuration" to the "master configuration". Refer to Figure 2-10.

Once configuration is complete, the CONFIGURE USE command **must** be used before the new data affects gateway operation.

The relationship between "master" and "working configurations" minimizes the possibility of configuration errors affecting the MultiPort/LT's real-time gateway operation.

All data can be displayed and checked for accuracy before transferred to the "master configuration".

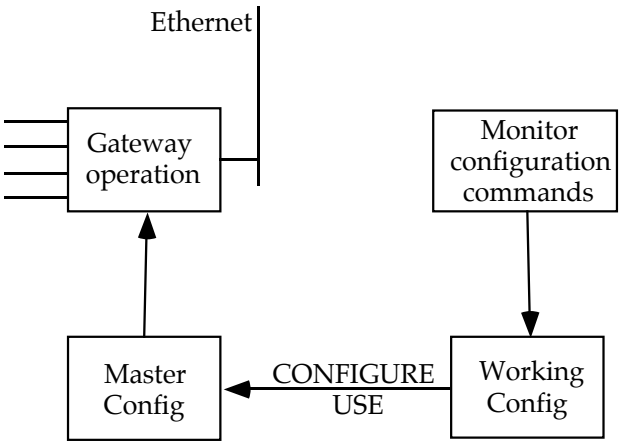


Figure 2-10. Using Data

2.2.1.3. Saving Data

The Config Flash EPROM is used to permanently save configuration data.

The contents of the "master configuration" are lost during a MultiPort/LT power off/on or reset cycle. However, during such cycles, the contents of the "hardware Flash EPROM" are retained and copied to the "master configuration".

The command CONFIGURE SAVE copies the contents of the "working configuration" to the "hardware Flash EPROM". Following configuration changes the command CONFIGURE SAVE **must** be used.

This procedure ensures that, after a power off/on or reset cycle, current configuration data is **always** copied back to the "master configuration" for operational use. Refer to Figure 2-11.

The command CONFIGURE DISPLAY EEPROM displays the contents of the "hardware Flash EPROM". Refer to Section 2.2.5.2.11.

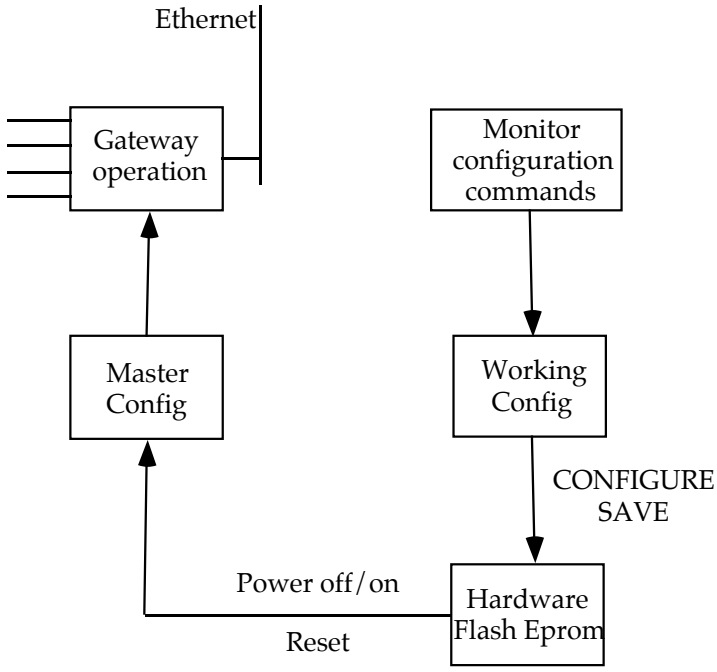


Figure 2-11. Saving Data

2.2.1.4. Factory Configuration

A fourth type of memory, named the "Factory Configuration", holds the data configured at the manufacturing plant. The command CONFIGURE FACTORY copies the contents of the "factory Configuration" to the "working Configuration". Refer to Figure 2-12.

Additional commands for controlling the copying of configuration data are described in Sections 2.2.5.2.14 and 2.2.5.2.15.

Figure 2-12. Factory Configuration

2.2.1.5. Gateway Requirements

Each "configuration" is divided into two storage areas - an area which stores the motherboard configuration data and an area which stores the daughterboard configuration data (the daughterboard is imaginary in the case of the MultiPort/LT - it refers to the AppleTalk interfaces !). Refer to Figure 2-13.

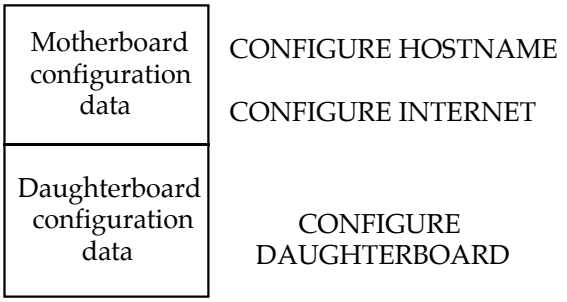


Figure 2-13. Configuration Storage Areas

The motherboard gateway configuration is achieved using the commands CONFIGURE HOSTNAME and CONFIGURE INTERNET. The data configured includes the MultiPort/LT's Principal IP Address.

The daughterboard configuration is achieved using the command CONFIGURE DAUGHTERBOARD (this is an imaginary separation of the AppleTalk interfaces at the software level). The data configured includes the addresses of the MultiPort/LT's AppleTalk interfaces.

The MultiPort/LT also requires its ethernet address to be configured. This is done at the manufacturing plant with the address stored in Flash EPROM and recorded on a label attached to the rear panel of the case.

2.2.2 Making A Monitor Connection

Two direct methods are available for making a monitor connection:

- ❏ Using a Macintosh
- ❏ Using a terminal

Both of these methods are described below. A third method, using a Telnet session for remote login, is also available. This is described in section 2.2.2.3

2.2.2.1. Using a Macintosh

This procedure uses MGTalk, a terminal emulation application that runs on any Macintosh. MGTalk is located on the disk labelled "MultiPort/LT Utilities". MGTalk is used to access the MultiPort/LT's monitor using the special MultiPort/LT - Macintosh serial cable provided.

To access the MultiPort/LT's monitor, perform the following steps:

- ❏ Connect the MultiPort/LT - Macintosh serial cable between the MultiPort/LT's console port and the Macintosh computer's modem port. Refer to Figure 2-14.

- ❏ Insert the MultiPort/LT Utilities disk.
  Drag MGTalk to a spare folder on your hard disk, and launch it.

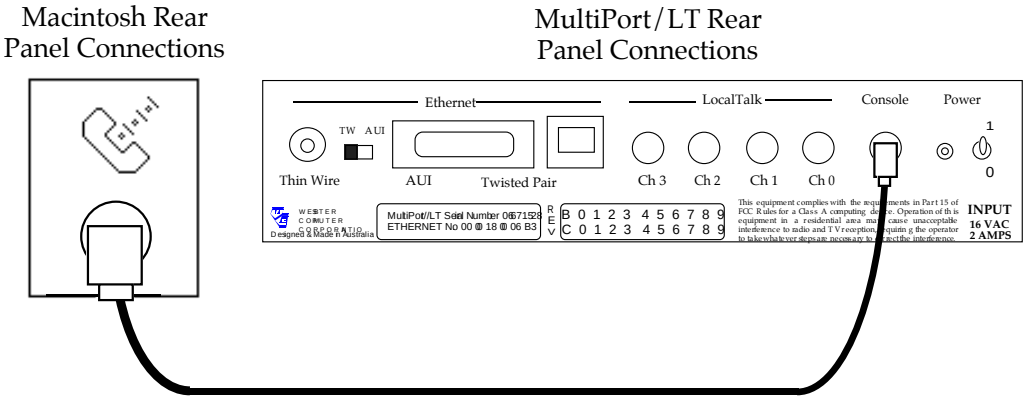


Figure 2-14. MultiPort/LT - Macintosh Connection

- ❏ With the MultiPort Talk window displayed, select Line from the Terminal menu. Ensure the following parameters are selected:

Baud Rate	Parity	Stop Bits	Data Bits
9600	None	One	Eight

  If necessary, use the mouse to select the above parameters. Once the parameters are correct, click OK to return to the MultiPort Talk window.

The next step assumes the MultiPort/LT is **not** running as an operational gateway. If the MultiPort/LT **is** running as a gateway (and the monitor is being accessed to make changes to the configuration), do not switch the MultiPort/LT off. Instead, halt the gateway code by using the "q" command. Refer to Section 3.3.1.1. in this manual. The LT> prompt will then be displayed.

- ❏ Ensure the MultiPort/LT is switched off.

  Switch on the MultiPort/LT. After a few moments the Macintosh will access the MultiPort/LT's monitor and the following type of message will be displayed:

```
MultiPort/LT self tests...
RAM bank decode: OK
Size DRAM: two banks of 256k SIMs, parity enabled
Test DRAM 0x400000 to 0x500000: OK
Device addressing: OK
LANCE: OK
ISCC:  OK

MultiPort/LT Monitor 1.01 -- Financial Services [0]
1024 kilobytes of parity memory installed
Last reset: External


MultiPort/LT Command Processor 1.01
LT>
```

Note the exact information displayed will vary depending on the current MultiPort/LT configuration. The important feature is for the message to end with the monitor prompt LT>. Commands can now be entered. Once a Macintosh running MGTalk (or another terminal emulation program) has been

connected to the MultiPort/LT, any of the Monitor commands described in section 2.2.3 can be used.

2.2.2.2. Using a Terminal

For communication to be established, both the MultiPort/LT's monitor and the terminal must agree on the communication mode. The console port is configured with the following values:

9600 Baud, 8 Data Bits, No Parity, 1 Stop Bit

2.2.2.3. Using a Telnet Session

It is possible to connect to the MultiPort/LT's Monitor from a UNIX host with a Telnet session. This can be achieved in four ways:

- ❏ The "server" command can be issued via the MultiPort/LT's console port (see section 2.2.5.8), and then a Telnet connection made to the MultiPort/LT.

- ❏ A Telnet session to a MultiPort/LT can be started at switch-on, but it is necessary to "commit" the Telnet command on the host between 10 and 20 seconds after switch-on. Note that this won't work if there is a serial cable connected to the console port that causes the Monitor to go to the "LT>" prompt.

- ❏ If the gateway code is already running, the program mgcmd can be used to communicate with it. Issuing the "T" command causes the gateway code to return to the Monitor, which then waits for a Telnet connection. Note that you must initiate the Telnet session on the host between 10 and 60 seconds after giving the "T" command via mgcmd. After one minute has elapsed, the MultiPort will re-boot using the normal methods.

- ❏ The Mgccc "-T" command.

Once a Telnet session to the MultiPort/LT has been established, any of the Monitor commands described in the next section can be used.

2.2.3 MultiPort/LT Monitor Commands

The following sections describe how to use the MultiPort/LT monitor commands.

Firstly, the structure of monitor commands is described, followed by details on all the monitor commands.

2.2.3.1. Command Name-levels

All monitor commands are defined using a command name.

- Example
  LT> configure

Some commands are further defined using sub-names.

- Example 1
  LT> configure internet

- Example 2
  LT> configure daughterboard

Once the correct name-level is reached, the command parameter is defined followed by the data.

- Example
  LT> configure internet address 132.160.22.16

Note each entry is separated from the next by a space.

2.2.3.2. Command Execution

Each command is executed with a carriage return (cr). Successful execution is recognized by the LT> prompt displayed waiting for the next command.

- Example
  LT> configure internet address 132.160.22.16(cr)
  LT>

Illegal commands, which cannot be executed, are signalled with an error message.

- Example
  LT> configure internet address 132.160.22.16(cr)
  Unknown internet address slot "address 132.160.22.16"
  LT>

The remaining examples in this section do **not** show the required carriage return (cr) entry at the end of each line.

2.2.3.3. Name-level Prompts

Name-level prompts can be changed to the next lowest level.

- Example
  LT> configure
  Conf> internet
  IP-Conf>

Each parameter with data, applicable to the current name-level, can be entered.

- Example
  IP-Conf> address 132.160.22.16

- Example
  IP-Conf> subnetmask 255.255.255.0

2.2.3.4. Abbreviations

All command names and parameters have a minimum abbreviation shown by capital letters on the displayed menus.

- Example
  CONfigure
  Internet
  ADDRess

The capital letters are for information only and not required for entry.

- Example
  LT> con
  Conf> i
  IP-Conf> addr 132.160.22.16

The remaining examples in this section do **not** use abbreviations.

2.2.3.5. Answering Questions

The execution of some commands prompts a question from the monitor.

- Example
  LT> configure
  Conf> hostname
  New Hostname [ ]: Admin
  Verify 'Admin' OK? y

Questions must be answered with a "y" for "yes" or any other character for "no".

After answering a question do **not** enter carriage return.

If a carriage return is entered in error the monitor will treat it as an answer to the next line.

2.2.3.6. Use Of Brackets

Square brackets are used to indicate optional parameters. The contents of the brackets show the current default data for that parameter.

If no new entry is made the current default data will be used.

- Example
  Conf> hostname
  New Hostname [Admin]:

Entering carriage return will keep the name "Admin".

Parentheses (round brackets) are used to enclose comments.

- Example
  USE (now: copy to master config)

2.2.3.7. Entering Hexadecimal Numbers

Numerical data can be entered in hexadecimal using a leading 0x. This is particularly helpful when entering subnetmasks.

- Example
  IP-Conf> subnetmask 0xffffffc0

2.2.3.8. Asking For Help

A "?" is used to ask for available options.

- Example
  IP-Conf> ?
  Available ip address slots:
  ADDRess
  SUBNETmask
  etc.

2.2.3.9. Editing

When typing a line:

- A backspace will erase the last entered character (not delete !).
- A "delete" (or control-X) will terminate the whole line. The monitor responds with a series of X's and waits for the line to be re-entered.

- Example
  IP-Conf> addr 132.160.2@XXX
  (cr)
  IP-Conf>

To delete a character that has just been typed, use backspace.

2.2.3.10. Exiting From A Name-level

The command Quit causes the monitor to exit from the current name-level and return to the previous level.

- Example
  IP-Conf> quit
  Conf> quit
  LT>

2.2.4 Monitor Sign-on

With a Macintosh or terminal connected, applying power to the MultiPort/LT displays the following type of sign-on message:

MultiPort/LT self tests...
RAM bank decode: OK
Size DRAM: two banks of 256k SIMs, parity enabled
Test DRAM 0x400000 to 0x500000: OK

```
Device addressing: OK
LANCE: OK
ISCC:  OK

MultiPort/LT Monitor 1.01 -- Financial Services [0]
1024 kilobytes of parity memory installed
Last reset: External


MultiPort/LT Command Processor 1.01
LT>
```

The exact message displayed will vary depending on how the MultiPort/LT is currently configured. For example, self tests can be bypassed using the command CONfigure Option TRUSTworthy.

2.2.5 Monitor Main Menu

The main menu displays all available commands:

```
LT> ?
MultiPort/LT monitor commands (min abbrev in capitals) :-
Boot [ Tcp | Atalk | Flash | Console ]
CONfigure [ lots-of-stuff ]
FTp [ hostname | address ]
Help (this message)
INItialize
Load [ Tcp | Atalk | Serial | Console ]
FLash [ Save | Erase ]
Run [ address ]
SERVEr (of incoming telnet)
SHow [ Date | Version | EEprom ]
TAlk [ end-ch ]
Test [ hardware ]
user debugging escape
Version [ Daughterboard | EEprom | Ethernet | Internet ]
```

2.2.5.1. Boot Command

The Boot command connects the MultiPort/LT to a boot server, loads the gateway code (or any other application code) and then executes it.

The Boot command has the formats:

```
    Boot
or: Boot Flash
or: Boot Tcp [file] [host]
or: Boot Appletalk [file] [server]
or: Boot Decnet/MOP
or: Boot At[n] (0..6) [file] [server]
or: Boot Phase2 [file] [server]
or: Boot Serial
or: Boot Console
```

"Boot" without any parameters will attempt a Flash boot, followed by a TCP boot, followed by AppleTalk boot attempts on all LocalTalk interfaces and the EtherTalk interfaces, followed by a DECnet boot attempt.

If the second parameter is included it can be:

a	All LocalTalk and Ether Talk interfaces are tried
abn or atn	n = 0, 1, 2 or 3 - LocalTalk port "n"
at4 or ab4 or e	EtherTalk Phase 1 Boot
at5 or ab5 or e	EtherTalk Phase 1 Boot
at6 or ab6	EtherTalk Phase 2 Boot
f	Flash EPROM Boot
t	TCP Boot using FTP from a Unix host

The third parameter is the File name to boot from. If omitted or a comma (a comma serves as a "place holder" when the default is required), the default Hostname is used as the file name.

Note that a comma-entry must have spaces on both sides of it, such as "b a , @zone".

The fourth parameter in Boot TCP is the Host name or IP address.

If a name is given, the MultiPort/LT will attempt to resolve it by using the configured Nameserver address to do an IEN116 Nameserver lookup.

If the fourth parameter (server) is present in Boot AppleTalk, it is interpreted as:

|server|:type|@zone|

|item|	Means that this item is optional
server	Specific server. This equates to the User Name in the Mac's chooser. This allows booting from a particular Mac.
:	Separator between the Server and Type fields.
type	The type of service. It had better be MGBOOT.
@	Separator between Type and Zone fields.
Zone	The zone to look in for the Boot Mac, if on another MultiPort/LT. This is usually used for booting over EtherTalk through other MultiPort Gateways.

The default AppleTalk boot is from "=:MGBOOT@*" where:

=	Any answering device accepted (usually Mac running MGBoot cdev).
:	Separator between items
MGBOOT	MGBOOT Servers only
@	Separator
*	This Zone

Some examples of the different types of boot commands will now be given.

- Flash Boot

  This command causes the MultiPort/LT to boot from its Flash EPROM.

- AppleTalk Boot

  ```
  LT> boot appletalk webgate @zone1
  ```

  In this example "webgate" is the name of the gateway code file to be booted and "zone1" is the name of the zone in which the Macintosh resides. Note if the optional parameter [file] is omitted it must be replaced using a comma, like this:

  ```
  LT> boot appletalk , @zone1
  ```

❑ TCP Boot

This command causes the MultiPort/LT to boot from an IP host. The optional parameter [file] specifies the name of the gateway code file, resident in the host, to be booted. The optional parameter [host] specifies the IP address (or name) of the IP host.

```
LT> boot tcp LT_Code solaris
```

In the above example, "LT_Code" is the name of the gateway code file and "solaris" is the name of the host. Note if the optional parameter [file] is omitted it must be replaced using a comma.

```
LT> boot tcp , solaris
```

The following type of message is displayed for a TCP boot:

```
LT> boot tcp
Connection to 132.160.22.10 established
220 solaris FTP server (Version 4.15 Sat Nov 7 15:44:57 PST
1987)
ready.
> user anonymous
331 Guest login ok, send ident as password.
> pass etherboot
230 Guest login ok, access restrictions apply.
> type i
200 Type set to I.
> cwd Boot 200 CWD command okay.
> retr LT_Code
150 Opening data connection for LT_Code (132.160.22.16,
 63812)
(55657 bytes).
Magic 407: text A0C4, data 6CB8, bss 4F5A4, entry 1000000
File loaded at 100000 - execute at 100400
> quit 221 Goodbye

Executing ... from 0x100400

MULTIPORT/LT: Webgate running
```

The exact message displayed will vary depending on how the MultiPort/LT is currently configured. For example, Webgate and

Solaris (the names assigned to this MultiPort/LT and host) will be different, as will their IP addresses.

2.2.5.1.1. Booting from a Telnet Session

It is possible to connect to a MultiPort/LT's Monitor from a UNIX host with a Telnet session (it is recommended that FTP directories NOT be requested from a Telnet session though).

Please refer to section 2.2.2.3 for details on how to establish a Telnet connection with the MultiPort/LT and section 2.2.5.1. above for the boot command details. Also, please see section 2.3 to see how the MultiPort/LT can be reconfigured once a Telnet session has been established. .

2.2.5.2. Configure Command and Menu

The CONfigure command is used for changing configuration data.

```
LT> configure
Conf>

To display available configuration sub-commands:
Conf> ?

Available configuration commands:
Hostname [name]
Bootname [name]
Bootzone [name]
Bootpath [name]
Bootuser [name]
Bootpass [name]
Options [ option [ = ON/OFF ] ]
Internet [ slot [ = addr ] ]
DAughterboard [ type [ config ] ]
Display [ Flash EPROM-image ]
SAVE (in Flash EPROM)
USE (now: copy to master config)
REStore (master config to working area)
FETch (from config Flash to working area)
Quit
```

2.2.5.2.1. Configure Hostname Command

To change MultiPort/LT's hostname:

```
Conf> hostname
New Hostname [ ]: Webgate
Verify: 'Webgate' ... ok ? y
Conf>
```

2.2.5.2.2. Configure Bootname Command

The file name on the boot host that the MultiPort/LT is to boot or load from is specified by the "bootname" parameter. This applies to both booting from a Macintosh and to booting from an FTP host.

To change MultiPort/LT's bootname:

configure bootname *bootname*

or

```
Conf> bootname
New Bootname [ GWCode]: LT_Code_1.1
Verify: 'LT_Code_1.1' ... ok ? y
Conf>
```

If the "bootname" parameter isn't configured the bootname will default to "LT_Code".

2.2.5.2.3. Configure Bootzone Command

This applies to Macintosh Booting only. When the MultiPort/LT Monitor goes "looking" for a Mac running MGBoot, it has to search in specific Zones. The default is to search in the six AppleTalk Zones that the MultiPort/LT directly connects to.

In the Figure 2-15, this corresponds to the four LocalTalk networks and the EtherTalk Phase 1 and Phase 2 networks for each MultiPort/LT. If the EtherTalk network and LocalTalk network 1 on MultiPort/LT 2 are in the same Zone, then MultiPort/LT 1 will be able to boot from the Mac with the default configuration.

Note that this case does not apply if one of MultiPort/LT 1's LocalTalk networks is in the same Zone the Mac as in, as at this stage the MultiPort/LT has not "seeded" any of its connected networks.

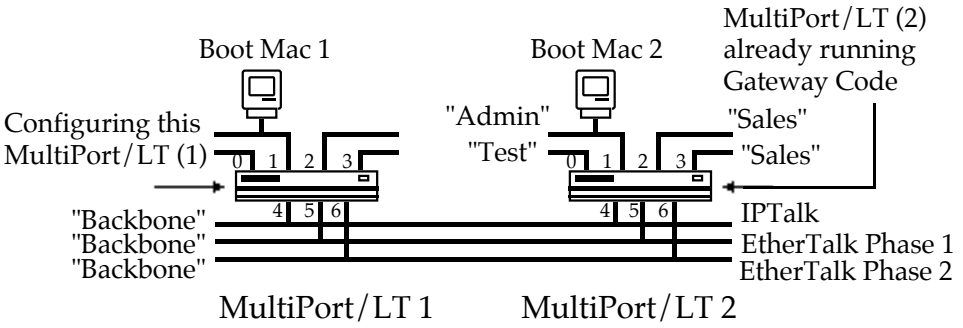


Figure 2-15. MultiPort/LT Boot Zone

In order for MultiPort/LT 1 to boot from the Macintosh connected to MultiPort/LT 2, MultiPort/LT 1 must have its "BootZone" set to the Zone the Mac is in. MultiPort/LT 2, being directly connected to the Mac does not need this, although it will work OK if it is.

The Monitor command to set and change this parameter is:

configure bootzone *zonename*

or

```
Conf> bootzone
New Bootzone [ ]: Freddy
Verify: 'Freddy' ... ok ? y
Conf>
```

If the "bootzone" parameter isn't entered the MultiPort/LT will only attempt to boot from the Zones that it is directly connected to. If a "bootzone" is configured, it will only use that Zone if the port it is attempting to boot from (it cycles through the four LocalTalk ports and the EtherTalk one) has another Router (such as another MultiPort/LT) on it.

If it fails to boot from "bootzone" on an interface, it retries with the default Zone (designated "*").

2.2.5.2.4. Configure Bootpath Command

The FTP User Name, Password and Directory Path apply to FTP Booting only. The default booting method for the MultiPort/LT is by "Anonymous ftp". This involves initiating an FTP session and logging on as user "anonymous" or "ftp". This is a "special case" restricted login.

Refer to the ftpd pages in section 8C (maintenance commands) in your Unix documentation for more details.

The default login sequence for the MultiPort/LT is:

user anonymous	Anonymous Login
pass etherboot	Password not used
type i	Switch to "Binary" mode
cwd Boot	Change to a subdirectory called "Boot"
retr *bootfile*	Retrieve the Gateway Code file

For certain ftp implementations (such as those that don't support "Anonymous FTP", configuring a "real" account with the above user name and password may cause a problem. For other ftp implementations (such as some for VAX VMS) the "cwd Boot" command can cause problems.

To change the MultiPort/LT's Bootpath:

```
Conf> bootpath
New bootpath [ ]: Boot
Verify: 'Boot' ... ok ? y
Conf>
```

2.2.5.2.5. Configure Bootuser Command

See section 2.2.5.2.4 for details.

To change the MultiPort/LT's Bootuser:

```
Conf> bootuser
New Bootuser [ ]: MultiBoot
Verify: 'MultiBoot' ... ok ? y
Conf>
```

2.2.5.2.6. Configure Bootpass Command

See section 2.2.5.2.4 for details.

To change the MultiPort/LT's Bootpass:

```
Conf> bootpass
New Bootpass [ ]: Pass123
Verify: 'Pass123' ... ok ? y
Conf>
```

2.2.5.2.7. Configure Options Command / Menu

To display available options:

```
Opt-Conf> ?
```

The available options with this command are:

```
FORCEboot
TCPboot
MOPboot
APPLetalkboot
FLASHboot
NS116
MONSave
RARP
BOOTP
RAMEEprom
RAMSave
TRUSTworthy
ERRDiags
DIAGNosticmode
Display
Quit
```

To change some options:

```
Opt-Conf> forceboot
Option: FORCEboot; Attempt boot on power up/reset if console off;
    alter? y
Will always attempt power on boot
Opt-Conf>

Opt-Conf> tcpboot
Option: TCPboot; Attempt to boot using ftp/tcp/ip (ethernet);
alter? y
Won't attempt ftp/tcp/ip ethernet boot

Opt-Conf> appletalkboot
Option:APPLetalkboot; Attempt boot via appletalk;
alter? y
Won't attempt appletalk boot
```

```
Opt-Conf> ns116
Option: NS116; Don't use IEN116 style IP nameserver lookup;
alter? y
Will use IEN116 style IP nameserver lookup;

Opt-Conf> rarp
Option: RARP; Use the RARP protocol to discover IP address;
alter? y
Won't use RARP (if needed) to locate IP address

Opt-Conf> bootp
Option: BOOTP; Use the BOOTP protocol to discover IP address;
alter? y
Won't use BOOTP (if needed) to locate IP address

Opt-Conf> rameeprom
Option: RAMEE; Ignore master copy of eeprom if valid on power up;
alter? y
Will use, if valid master eeprom copy;

Opt-Conf> ramsave
Option: RAMSave; Trash ram contents in power on selftest;
alter? y
Will attempt to save ram contents at start up/reset;

Opt-Conf> trustworthy
Option: TRUSTworthy;Run power up hardware selftest;
alter? y
Will assume hardware is O.K. at startup;

Opt-Conf> errdiags
Option: ERRdiags; Enter diagnostic mode if startup self test fails;
alter? y
Won't enter diagnostics on self test failure;

Opt-Conf> diagnosticmode
Option: DIAGNosticmode; Startup normally;
alter? y
Diagnostics monitor enabled;

Opt-Conf> quit
Conf>
```

2.2.5.2.8. Configure Internet Command

To display the available Internet parameters:

```
Conf> internet?
Usage: config INternet [ slot [ = value ] ]
Slots are...
ADDRess
SUBNETmask
BROADcastaddr
NAMEserver
GATEway
BOOTaddress
CONFighost
DEFault
Display
```

To display current internet data:

```
Conf> internet
IP-Conf> display
IP addr:132.160.22.16   broad:132.160.22.255   mask: 255.255.255.0
boot:   132.160.22.10   conf: 0.0.0.0          debug: 0.0.0.0
name: 132.160.22.10          gate:        132.160.22.10
```

To change internet data:

```
IP-Conf> address
IP address [132.160.22.16]:132.160.22.25
IP-Conf>quit
```

2.2.5.2.9. Configure Daughterboard Command

To display the available "daughterboard" options:

```
Conf> daughterboard ?
Usage: config Daughterboard type [ options ]
Where 'type' is one of ...
Unknown
Appletalk
DEFault
Display
```

To display current daughterboard data:

```
Conf> daughterboard display
```

```
Daughter board type 0x01 (appletalk) -- 4 channel
at0: net 95.10, node 194,  Zone "webcomrad" (9)
IP addr 132.160.22.65, mask 255.255.255.224 (FFFFFFE0);
Base H#  *1 (29)

at1: net 95.11, node 194,  Zone "webcomrad" (9)
IP addr 132.160.22.97, mask 255.255.255.244 (FFFFFFE0);
Base H# 1 (29)

at2: net 95.12, node 194,  Zone "webcomrad" (9)
IP addr 132.160.22.129, mask 255.255.255.244 (FFFFFFE0);
Base H# 1 (29)

at3: net 95.13, node 194,  Zone "webcomrad" (9)
IP addr 132.160.22.161, mask 255.255.255.224 (FFFFFFE0);
Base H# 1 (29)

at4: net 95.6, node 16,  Zone "webcomrad" (9)
IP addr 132.160.22.16, mask 255.255.255.0 (FFFFFF00)

at5: net 95.18, node 194,  Zone  unconfig'd
IP addr 132.160.22.193, mask 255.255.255.224 (FFFFFFE0)
Base H# 1 (29)

at6: net unconfig'd, node 0,  Zone  unconfig'd
```

* The term '1 (29)' means BASEHOSTOFFSET = 1 and HOSTNUMBERS = 29.

To change daughterboard data:

```
Conf> daughterboard
Current config'd daughterboard type: 0x00: none
*   Installed daughterboard is type 0x01 (appletalk)
Enter Daughterboard type:
DB-Type> a
Changing daughterboard config from 0 x 00 (none) to appletalk
OK? y
Select an appletalk unit:
A-Unit> ?
```

Available appletalk unit name/numbers:

```
0
1
2
3
IPTalk
Ethertalk 1
EtherTalk 2
Current
Quit

A-Unit> 0
Configure appletalk channel 0:
A-conf> ?
```

Available appletalk configuration options:

```
Net
Node  *(suggested)
Zone
IPaddr
SUBNetmask
Basehostoffset  * *
Hostnumbers     * *
Display
Quit

A-conf> net
Appletalk network number [95.10]: 95.20
A-conf> quit
A-unit> quit
DB Type> quit
Conf>
```

* The term "suggested" is used because if the node number configured already exists on the network, then MultiPort/LT will dynamically re-assign another node number.

* * The terms static and dynamic are used in MultiPort Manager. The terms are related as shown:

```
Number of static IP addresses      =   Basehostoffset -1
Number of dynamic IP addresses     =   Hostnumbers
```

2.2.5.2.10. Configure Display Command

There are four types of memory associated with configuration data. Refer to Section 2.2.1. This command displays the contents of the Flash EPROM, "master" and "working" configuration areas. To display the options available:

```
Conf> display
Config (EE) image viewer
EEDisp> ?

Available config images:
Flash
Master
Working
Quit
```

To display the current contents of a selected memory:

```
Conf> display flash
Configuration version 3 (current 3), mods 5
Configuration History:
  Date: Wed Jun 16 09:59:10 1993; Wed, Jun 16, 1993
   From: A_Hostname:(A_Working_Directory)CDC Wren III:MultiPort Ma

Name: "Main_Router";  Address: 000018-000080
DECnet enabled - Megan will use Ethernet Address: aa:00:04:00:0A:04
MPG Password: "(none)"
Boot File: "LT_Code";  Boot Path: "Boot" (default)
Boot User: "anonymous" (default);  Boot Password: "etherboot" (default)
Boot Zone: "*" (default)
Options: TCPBOOT APPLETALKBOOT NS116 RARP BOOTP
         TRUSTWORTHY RAMEEPROM ERRDIAGS FLASHBOOT
Flags:   0x0
RAM base 0x100000 (size 512Kb)

IP addr: 131.161.200.10  broad: 131.161.200.255   mask: 255.255.255.0
   boot: 131.161.200.2   conf: 131.161.200.1  debug: 131.161.200.0
   name: 131.161.200.1   gate: 131.161.200.1

Daughter board type: 0x0001  Appletalk.
at0: net 10.0 (2560), node 210,  Zone "WCP" (3)
  Interface Enabled and Seed, Phase 2, RIP Enabled
  IP addr 131.161.210.1, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
at1: net 10.1 (2561), node 210,  Zone "WCS" (3)
  Interface Enabled and Seed, Phase 2, RIP Enabled
```

```
  IP addr 131.161.210.17, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
at2: net 10.2 (2562), node 210,  Zone "R+D" (3)
  Interface Enabled and Seed, Phase 2, RIP Enabled
  IP addr 131.161.210.33, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
at3: net 10.3 (2563), node 210,  Zone "R+D" (3)
  Interface Enabled and Seed, Phase 2, RIP Enabled
  IP addr 131.161.210.49, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
at4: (iptalk) net 1, node 10,  Zone "Ether-Servers" (13)
  Interface Enabled and Seed, Phase 1, RIP Enabled  UDP Port 768
at5: (etalk 1) net 2, node 210,  Zone "Ether-Phase 1" (13)
  Interface Enabled and Seed, Phase 1, RIP Enabled
  IP addr 131.161.210.65, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
at6: (etalk 2) net 3, node 210,  Zone "Ether-Phase 2" (13)
  net range 3..3
  Interface Enabled and Seed, Phase 2, RIP Enabled
  IP addr 131.161.210.129, mask 255.255.255.240 (FFFFFFF0);  Stat: 1, Dyn: 12
EtherTalk Phase 2 Zone List:
  Default: "Ether-Phase 2" (13)

Filter Settings:
   Policy style is 'Hide'
   Filter string is () [0]
Interfaces       Laser       Mac
   at0:          Off         Off
   at1:          Off         Off
   at2:          Off         Off
   at3:          Off         Off
   at4: (iptalk) Off         Off
   at5: (etalk 1) Off        Off
   at6: (etalk 2) Off        Off

DECnet Configuration:
   Address:     1.10
   Router Timer: 60 Seconds
   Hello Timer:  20 Seconds
   Priority:    1

SNMP Configuration:
   sys_contact:  ""
   sys_name:     ""
   sys_location: ""
   Community 0:  "public", , Write
```

2.2.5.2.11. Configure Save Command

This command copies the contents of the working configuration to the Flash Eprom.

```
Conf> save
Config Flash updated
```

2.2.5.2.12. Configure Use Command

This command copies the contents of the working configuration to the master configuration.

```
Conf> use
```

2.2.5.2.13. Configure Restore Command

This command copies the contents of the master configuration to the working configuration.

```
Conf> restore
```

2.2.5.2.14. Configure Fetch Command

This command copies the contents of the config Flash Eprom to the working configuration.

```
Conf> fetch
```

2.2.5.3. FTP Command

This command transfers programs from an Ethernet host to the MultiPort/LT memory. This allows loading of different boot programs and the loading of diagnostics.

To display available options:

```
LT> ftp ?
Usage: Ftp [ hostname | address ]
```

To transfer programs:

```
LT> ftp
Connection to 132.160.22.10 established
220 muri FTP server (Version 4.7 Sun Sep 14 12:44:57 PDT 1986) ready
> [your favourite FTP commands]
> quit
221 Goodbye.
```

2.2.5.4. Initialize Command

This command re-initializes MultiPort/LT:

```
LT> initialize
LT>
```

2.2.5.5. Load Command

The Load command connects the MultiPort/LT to a boot server and then loads the gateway code (or any other application code). The Load command, unlike the Boot command, will not automatically execute the loaded code.

```
LT> load ?
Remote Cmd>
```

After the code has been loaded, it can be run or saved to Flash Eprom (recommended).

2.2.5.6. Flash Commands

The Flash EPROM used to store the Gateway Code can be accessed via the Flash commands, which are shown below:

```
LT> Flash
Flash Memory Functions
Flash> ?

Available commands:
Save
Erase
Display
TestVPP
SELFlash
Quit
```

```
LT> flash save
FLASH chip 0 size: 262144 bytes, type: AMD 28F020 2Mbit
FLASH chip 1 not installed
Zeroing chip 0
Erasing chip 0
Writing headers
Writing Code
   to chip 0
Save to flash passed

Configuration FLASH chip is Intel 28F256P2 256Kbit, 19 uses.
Wanda FLASH chip 0 is AMD 28F020 2Mbit, 6 uses.
LT>


LT> flash erase
Are you SURE you want to erase the code FLASH chips?y
FLASH chip 0 size: 262144 bytes, type: AMD 28F020 2Mbit
FLASH chip 1 not installed
Zeroing chip 0
Erasing chip 0
Flash chips erased OK
LT>


LT> flash display
Configuration FLASH chip is Intel 28F256P2 256Kbit, 19 uses.
Wanda FLASH chip 0 is AMD 28F020 2Mbit, 1 use.
LT>


LT> flash TestVPP     (Webster Test Command only)
VPP Power-up time = 55 microseconds, OK
VPP Power-down time = 50 microseconds, OK
Turning FLASH programming supply OFF
LT>


LT> flash SELFlash   (Webster Test Command only)
Wanda FLASH chips now addressable at 0x200000 for debugging
LT>
```

2.2.5.7. Run Command

The Run command executes the gateway code (or any other application code) loaded into the MultiPort/LT.

```
LT> run
Nothing loaded to run
```

2.2.5.8. Server Command

The server command enables the MultiPort/LT as a telnet server, allowing an incoming telnet connection to be initiated by a host.

```
LT> server
```

Once established, control-C or the delete key will abort the telnet connection.

2.2.5.9. Test Command and Menu

```
LT> test ?
Usage: Test [ what ]

Current tests available...
Ram [ Long | Cdiag | Diagnostic ]
Addressing (of device chips)
LAnce [RW | DMA | Intr | Xmit | Rcv | Loop]
LEds
ISCC
ALL

LT> test
MultiPort/LT Diagnostic Monitor ...
Diag> lance
Lance diagnostic monitor
LanceD> ?
Available lance diagnostics:
RWtest
Addressing
Dma
INTerrupt [ level ]
Transmit
Loopback
ALL
Quit
LanceD> quit
```

```
Diag> daughterboard
MultiPort/LT appletalk daughterboard diagnotsics...

DB-Diag>  ISCC
ISCC  Diagnotics
ISCC  Diag>
Available scc tests:
Basic [chan]
Loop outchan [inchan]
Quit

ISCC-Diag>  quit
Diag> quit
LT>
```

2.2.5.10. Version Command

To display the Monitor version:

```
LT> version
MultiPort/LT monitor version 1.03: webgate
LT >
```

2.3. Remote MultiPort Configuration Across The IP Network

A MultiPort/LT connected to an IP network can be configured using mgccc, a UNIX application that allows for the transfer of configuration files to and from a MultiPort/LT, and other functions such as restart, reboot etc.

There is an mgccc folder on the MultiPort/LT Utilities disk, which contains the mgccc.doc file and a StuffIt archive containing the mgccc source files.

CHAPTER 3 MultiPort/LT Gateway Code Commands

This Chapter describes the commands that the MultiPort/LT gateway code will respond to. Access to the MultiPort/LT gateway code is via a terminal connected to the serial port, or from a UNIX host running the program mgcmd.

3.1. Introduction

When the MultiPort/LT is operating as an ARA Server, AppleTalk Router and IP and DECnet Gateway, it is running a program called "MultiPort/LT Code". This file is stored in Flash Eprom, and is run when the MultiPort/LT starts up.

3.2. MultiPort/LT Gateway Code Startup

When the MultiPort/LT gateway code starts running, it prints the message:

```
Wanda (v.r): Hostname running
```

on the Console port, where "v" and "r" are the version and revision numbers of the MultiPort code, and "Hostname" is the router name configured in the flash Eprom. Note that this message will only be seen if a terminal or equivalent (such as MGTalk on a Macintosh) is connected (Wanda is an internal project name used for the MultiPort/LT's gateway code).

Part way through its initialisation, the MultiPort/LT attempts to register its router name on the network as "Hostname:MultiPort/LT". This is a required part of AppleTalk's Name Binding Protocol - see "Inside AppleTalk" for details. If it finds that another gateway has already registered that name, it will retry with Hostname-1, -2..-9,-A..-Z until it finds one. If that doesn't work, it tries Hostname-00, -0A..-0Z..-10..-1Z..-Z0..-ZZ, for a total of 1331 different names. It reports this with:

```
Hostname "Hostname" in use, picking another... "Hostname-1"
```

for as many times as it is necessary to find a unique Hostname. If the Hostname is unconfigured, then the MultiPort/LT will substitute "MultiPort/LT S/N XXXX".

3.3. MultiPort/LT Gateway Code Commands

The MultiPort/LT gateway code supports a command interface which is accessible from the Console port on the rear panel of the MultiPort/LT.

The commands it accepts fall into six categories:

- ❑ Control Commands
- ❑ Informational Commands
- ❑ Statistics Commands
- ❑ Internal Table Commands

- ❑ DECnet Commands
- ❑ Debugging Control Commands

These commands are detailed below. Note that the case of the command is important.

NOTE. Responding to these commands below is a time-consuming operation for the MultiPort/LT, and may affect network activity. The packet forwarding rate of the MultiPort/LT will be affected by lengthy table and statistics printing commands.

3.3.1. Control Commands

3.3.1.1. q - Quit

The quit command causes the MultiPort/LT gateway code to return control to the Monitor. The MultiPort/LT will respond with the Monitor Prompt:

```
LT>
```

The "run" command will return control to the MultiPort/LT gateway code.

3.3.1.2. Q - Reboot

The reboot command is equivalent to the "quit" command followed by a monitor "boot" command. The MultiPort/LT will attempt a flash EPROM boot if this is enabled. Then it will attempt to boot from an IP host if one is available; if not it will try the 6 AppleTalk ports if enabled. Note that the EtherTalk interfaces (Phase 1 and Phase 2 on Ethernet) count as two of these.

If all the boot attempts fail, it will retry all boot attempts unless interrupted with a <del> or ^C character, at which point it returns to the Monitor prompt.

3.3.1.3. T - Telnet

This command is equivalent to "quit" followed by "server" which enables the MultiPort/LT as a telnet server, allowing an incoming telnet connection to be initiated by a host.

3.3.1.4. ? - Help command

The help command prints out the commands available in the following format:

```
hw:    a/b/c/d chan; E err/stat; X z8530
info:  e ee config; u uptime; v vers; = debug; # list debug; ^ traceback
       $ last panic regs; . stack space; , process times; ^C console focus
iface: 0/1/2/3 localtalk, 4 iptalk, 5/6 etalk (phase 1/2), 7 remote access
table: A arp; I ifs; N nbp; n ip assgn; R rtmp; r IProute; U RTMP+Zones
       W watch log; Z Zip; ^Z Zone hashing; * IPcache;
       w who (ARAP Users and Zone Groups); F filter; S SNMP;
stats: B bufs; g gateway; i icmp; l lance; M nbp; m local; p arp;
       s ab; t rip; x rtmp; z zip; % route; f filter;
DEC:   DN Node list; DR Routers; DC Circuits; DG Gateway
ctl:   q quit; Q quit & reboot; T exit to telnet server; @ clear stats
       K print ctl; j operator jotting
```

The MultiPort/LT will respond to other commands not listed here. They are mainly for Hardware Debugging and may have unexpected effects.

3.3.1.5. @ - Clear Statistics

This clears all the statistics in the MultiPort/LT to zero, with the exception of the SNMP related counters.

3.3.1.6. K - Print Control

The "K" command was used during development of the interrupt controlled console display output. The command acts as a toggle to turn interrupts off and on.

3.3.1.7. j - Operator Jotting

This command causes "jotting entries" to enter the log, which may be useful to test that logging is working correctly.

A "jotting" entry is shown below:

```
Operator jotting at 3958 seconds
```

In the log, this entry looks like:

```
12/9/94  7:58 AM  Operator jotting at 3958 seconds
```

The time shown is the number of seconds since the last restart.

3.3.2. Informational Commands

3.3.2.1. u - UpTime

This prints the Version, the Uptime (in seconds only, and hours, minutes and seconds) and the number of restarts:

```
Wanda version 1.00: up 497768 seconds 5 days, 18:16:08 (0 restarts)
```

3.3.2.2. v - Version

The version command shows the following configuration information in addition to the the MultiPort/LT gateway code Version, Hostname and IP address (if configured):

```
Wanda version 3.0 Grass @ [131.161.200.13](using UDP port 768)
Configuration Information:
Date: 12/12/93, 10:01 AM
From: MultiPort Manager 1.0, by "Michael"
```

3.3.2.3. e - Flash EPROM Configuration

This prints out the configured IP address, the Subnetmask and the Broadcast, Confighost, Gateway and Nameserver addresses:

```
EE IP address configuration data...
IP address 131.161.200.13;  Mask 255.255.255.0 (0xFFFFFF00)
Broad 131.161.200.255;  AA (conf) 131.161.200.2;  Gate 131.161.200.1
Name 131.161.200.1;  Boot 131.161.200.2  Debug 131.161.200.2
```

3.3.3. Statistics Commands

3.3.3.1. B Buffer Statistics

Memory resources are allocated dynamically by the MultiPort/LT, rather than having preallocated fixed limits. The statistics kept are:

refusals: The count of the number of times a buffer request was refused due to a lack of buffers.

The current buffer usage is shown as:

free:	Free
ltalk:	Reserved waiting for incoming LocalTalk
ether:	Reserved waiting for incoming Ethernet
arp:	Address Resolution Protocol
data:	General Data
ip:	Internet Protocol
ddp:	AppleTalk DDP
rtmp:	Routing Table Management
zip:	Diagnostic Message
msg:	Message
time:	Timeout Queue
route:	Packets taken by RIP and Routing tables
decnt:	DECnet
flash:	Flash Eprom
arap:	ARA buffers
mnp:	Error Correction Protocol buffers

The ARAP Malloc counters are also shown.

A typical "B" report:

```
Memory configuration:
Two banks of 256 kilobyte SIMs installed
Wanda is using 1021 out of 1024 Kbytes of Parity-checked memory
Configuration FLASH chip is Intel 28F256P2 256Kbit, 7 uses.
Wanda FLASH chip 0 is Intel 28F010 1Mbit, 2 uses.
Wanda FLASH chip 1 is AMD 28F020 2Mbit
Wanda FLASH chip 2 is AMD 28F020 2Mbit

Buffer usages:  refusals: 1
free :  153  ltalk:    2  ether:   32  rtmp :    1
zip  :    2  msg  :    1  time :    1  route:    2
decnt:    1  mnp  :    2
ARAP Malloc Counters:
Free list contains 4 entries, 14520 bytes, min 32, max 13248.
Memory requested from system = 262144 bytes
Malloc calls = 732, bytes = 261352, refusals = 0
Free calls = 621, bytes = 154848
Malloc - Free calls = 111, bytes = 247608
```

3.3.3.2. a, b, c, d - Select Channel to Examine

Commands "a" to "d" select Interfaces 0 to 3 respectively.

3.3.3.3. s - Channel Statistics

The s command prints statistics for the interface selected by the previous "a", "b", "c" or "d" command.

3.3.3.3.1. LocalTalk Channel

The statistics are:

recvd	Bytes and Packets received
xmtqd	Bytes and Packets queued for transmission

recv errs: These are subdivided into:

crc	CRC or Framing error on received packet
overrun	SCC buffer overrun by incoming data
notend	No valid closing flag
oddbits	Packet not integral number of bytes
short	Packet shorter than 3 bytes
long	Packet longer than maximum allowed (586)
nobuf	No buffers available for received packet
badlap	LAP packet length or type wrong
strayrts	Data packet failed to arrive
missrts	Received data packet, but missed preceding RTS

xmt errs:

collsn	No response to our RTS
defers	Deferred transmitting due to packet on LocalTalk
idleto	Timed-out waiting for LocalTalk to become idle
aborts	Transmit failed to complete - aborted
xdefers	Excess Defers, packet dropped
xcollsn	Excess collisions, packet dropped
wrterrs	Failed to send packet (usually xcollsn)

dma errs:

DMA Controller error

Note that "collsn" and "defers" are not errors, and are to be expected on a LocalTalk network. A "defer" simply means that there was a packet detected on the LocalTalk when the MultiPort/LT tried to transmit a packet, and the transmission was deferred till later. A "collsn" is logged if an RTS packet wasn't acknowledged within 200uS. When sending a long stream of data packets to a slow Macintosh (Mac Plus and SE), it is normal for the Mac to still

be busy with processing packet "N" when the MultiPort/LT sends the RTS for packet "N+1", and the RTS goes unanswered. In this case, the collsn count can be as high as half of the xmtqd count. When the MultiPort/LT isn't ready to receive a packet from a Mac, this is counted as an "overrun".

A typical "s" report:

```
Chan A
daddylonglegs: s
ab0: recvd 5585580 bytes 157385 pkts, xmtqd 3819601 bytes 124223 pkts, resets 1
   rcv: overrun 2143, aborts 1,
   xmt: collsn 282, defers 118,
```

3.3.3.3.2. Serial Channel

When a channel is configured for serial operation, the statistics are different. A typical printout is shown below for a serial channel currently hosting an ARA session:

```
Chan C
mouse: s
Chan 2
Connected to ARA User "Michael", in Exclusion Zone Group "<All Zones>"
   Connected 01h51m20s out of Unlimited
   Dial-back on 9778050
Port Speed 19200, Line Speed 14400, Parity off, Data bits 8, Stop bits 1
Flow Control: Tx CTS en:on, Xoff dis:on, RX DTR dis:on, Xoff dis:on
Transmit                    Session        Total
    DDP  Pkts                   903        64845
         Bytes                195622      9136619
    ARAP Pkts                   1136        69907
         Bytes                190342      9065021
    SB   Bytes                184814      7680393
    V42b Bytes                 78460      3668804
    MNP  Frames                 1158        72583
         ReXmit                   38         1635
         Non-data               2405       163804
    Ser  Bytes                117764      6271661
         CTS Pause               24         1532
         CTS Jam                  0            0
    SB   Time                  2.14       489.21 sec
    V42b Time                 14.31       668.23 sec
Receive
    Ser  Bytes                 61244     13531415
         Parity Error             0            0
         Overrun Error            0            0
         Framing Error            0            7
```

```
        Break Received          0          2
        Buffer Overflow         0          0
    MNP Bytes               16700    9968266
        Good Frames          1023     151284
        Non-data             3000      88557
        Bad Frames              0         42
    V42b Bytes              29612   12055694
    SB  Bytes               34033   13344415
        Pkts                 1012     102292
    ARAP Bytes              21530   11515343
        Pkts                  333      90626
    SB  Time                 0.44     140.35 sec
    V42b Time                3.06    1928.19 sec
PortShare
        Write                   0          0
        Read                    0          0
        ReadStatus              0          0
        Status                  0          0
        Control                 0          0
        Others                  0          0
        Errors                  0          0

Buffers: Rcv cnt: 30, 0, 0 Xmt cnt: 0, 0
```

A channel configured for serial operation that is currently supporting a Dial-Out session will produce a printout like that shown below:

```
Chan B
Chan 1
PortShare Dial-Out User Michael Lawrence, Connected 01h30m50s out of Unlimited
    Data+Status mode off, DTR Hold on close off
Port Speed 19200, Line Speed 19200, Parity off, Data bits 8, Stop bits 1
Flow Control: Tx CTS en:on, Xoff dis:on, RX DTR en:on, Xoff dis:on
Transmit                    Session        Total
    DDP  Pkts                     0            0
         Bytes                    0            0
    ARAP Pkts                     0            0
         Bytes                    0            0
    SB   Bytes                    0            0
    V42b Bytes                    0            0
    MNP  Frames                   0            0
         ReXmit                   0            0
         Non-data                 0            0
    Ser  Bytes                48487        48487
         CTS Pause                0            0
         CTS Jam                  0            0
    SB   Time                  0.00         0.00 sec
```

```
    V42b Time                   0.00          0.00 sec
Receive
    Ser  Bytes                103852        103852
         Parity Error              0             0
         Overrun Error             0             0
         Framing Error             0             0
         Break Received            0             0
         Buffer Overflow           0             0
    MNP  Bytes                     0             0
         Good Frames               0             0
         Non-data                  0             0
         Bad Frames                0             0
    V42b Bytes                     0             0
    SB   Bytes                     0             0
         Pkts                      0             0
    ARAP Bytes                     0             0
         Pkts                      0             0
    SB   Time                   0.00          0.00 sec
    V42b Time                   0.00          0.00 sec
PortShare
         Write                  3058          3058
         Read                   4232          4232
         ReadStatus                0             0
         Status                    0             0
         Control                   5             5
         Others                    1             1
         Errors                    0             0

Buffers: Rcv cnt: 0, 0, 0 Xmt cnt: 0, 0
```

3.3.3.4. g - Gateway Statistics

This reports the number of data packets forwarded by the MultiPort/LT and the encapsulation method used. The statistics are:

recvd:	Packets received
route:	Packets routed to an IP or AppleTalk address Can count twice due to encapsulation
routefail:	Routing failed - packet dropped
encap:	Packets encapsulated in IP and DDP
decap:	Packets disencapsulated from IP and DDP
badencap:	Bogus encapsulated packets - junk mail

A typical report:

```
GW:   recvd: 908369 ethernet, 494261 localtalk;  0 error
       seen: 907185 ip, 494261 ddp
```

```
      encap: 505022 ip, 10659 ddp
      decap: 272195 ip, 4582 ddp
   badencap: 0 ip, 0 ddp
    dropped: 41447 en, 5 ab;  trailers rcvd 0

IP: xmt: 357696 local. 549490 routed:(538830 direct,10660 atalk) 0 w opt (0 opts)
IP: drop 0 - 0 noheader, 0 tooshort, 0 bad hl
       0 bad IP vers, 0 xsum err, 0 fwd broad
       0 ttl exceeded, 0 no route, 0 bad option
 Bounced(icmp) 0 (of 88), redirected 17 (of 17)
 Frags: needed 0, produced 0, drops 0

DDP: route 1113476 - 307303 fast, 479 ucast, 602473 direct atalk, 5974 indir
atalk
       0 kip, 505022 localnet, 0 distnet, 0 hnet
       0 rebroad, 0 async, 0 bcast async, 0 dflt
       811835 ddp route lookups, 811828 hash hits, 7 hash misses,
          7 no routes found
DDP: drop 7 - 0 short, 0 zero, 0 fwd broad, 0 hop count
       0 bad route, 0 encap fail, 7 no route
DDP hop counters:
    315633  797780  00036  00003  00000  00003  00000  00003
    00000  00003  00000  00003  00000  00003  00000  00003  00000
```

3.3.3.5. i - ICMP Statistics

This reports the number of Internet Control Maintenance Protocol packets received and transmitted. The reportable packet types are:

echo reply:	timestamp request:
dest unreachable:	timestamp reply:
source quench:	info request:
redirect:	info reply:
echo:	addr format request:
time exceeded:	addr format reply:
bad header:	others:

A typical report:

```
ICMP packet types...
   dest unreachable:  recv 12392  xmt 0
           redirect:  recv 0  xmt 17
addr format request:  recv 6  xmt 0
```

3.3.3.6. l - LANCE Statistics

The LANCE is the Local Area Network Controller - Ethernet, and is responsible for most of the Ethernet protocol handling. This command gives the statistics for this chip. Refer to AMD's data books for more details. The statistics are:

XMT BLOCK	Transmit currently blocked - no free buffers
babl	LANCE has been babbling
miss	LANCE ran out of receive buffers
merr	Bus error while LANCE bus master
recvd	Total count of received packets
good	Good packet count
sync	Start of Packet bit not set
long	Packet too long - longer than 1600 bytes
frame	Packet framing error
oflo	LANCE FIFO overflowed - excess bus contention
crc	CRC error on packet
buff	Lance buffer overflowed before next status read
nbuff	Buffer allocation failure - none available
xmtd	Total count of transmitted packets
collisions	Total collision packet count
multi	Multiple (>1) collisions
hard	Hard collisions - too many retries
lcol	Late Collisions - possibly cable too long
uflo	LANCE buffer underflowed - excess bus contention
buf	LANCE buffer error
defers	Packet deferred - Ethernet was busy

A typical "l" report:

```
babl 0, miss 0, merr 0
recvd 851796: good 851796, sync 0, long 0, frame 0,
          oflo 0, crc 0, buff 0, nbuff 0
xmtd  894829: collisions 105 (multi 50 hard 0)
          lcol 0, uflo 13, buf 0, defers 5164
```

Note that as with the "s" statistics, collisions and defers are to be expected, although an excess of either might indicate general networking problems. Excess crc errors could also mean network problems.

3.3.3.7. M - NBP Statistics

A typical printout from the NBP statistics is shown below:

```
NBP: 13503 pkts rcvd;
```

```
0 replies;
14 registrations; registered: 14, searches: 3,
13503 lookups; local object: 6877, replies sent: 6877, tuples sent: 6877,
13252 brrq, 0 fwdreq;
13320 nbp pkts sent; BrRq multicast: 13264, BrRq broadcast: 56,
```

3.3.3.8. m - MultiPort/LT-addressed Packets

This reports the statistics of packets addressed to (and processed by) the MultiPort/LT. Statistics are:

Local packets:	Counts of packets processed, broken up into:
ip	IP packets received
ddp	AppleTalk DDP packets received
stray	Something other than IP or DDP - shouldn't happen
udp	UDP protocol
unknown	To a port Wanda doesn't have
icmp	ICMP packets
unknown	Unknown ICMP type
unknownip	Unknown IP service request - usually TCP
nbp	AppleTalk Name Binding Protocol
rtmp	AppleTalk Routing Table Maintenance Protocol
zip	AppleTalk Zone Information Protocol
ddpecho	AppleTalk Echo Protocol
ddpip	AppleTalk KIP protocol for IP address assignment
bad	Bad ddpip packets
ipassign	IP address assignment
statsreq	Wanda status requests
debug	Wanda Debug requests
unknownddp	Stray UDP - usually broadcasts (RIP, RWHO)
AApkts	Packets from atalkad
reb pkts	Packets for rebroadcast - MultiPort/LT's address appears in an atalkatab "H" line

A typical report:

```
Local packets: 0 ip, 13797 ddp, 0 decnet, 0 stray
  0 udp (0 unknown), 0 icmp (0 unknown), 0 unknownip
  13708 nbp, 1 rtmp, 88 zip, 0 ddpecho, 0 ddpip (0 bad)
  0 ipassign, 0 udp discard, 0 statsreq (0 bad), 0 debug, 0 unknownddp
  0 atalk discard, 0 AApkts (+ 0 bad), 0 reb pkts (+ 0 bad)
  0 frags rcvd (0 discarded, 0 pkts built)
```

```
    0 bad IP options
  MacIP Gleaning off, pkts 0, bad 0, direct 0, cache hit 0
    complete 0, assign 0, addARP 0, encache 0
```

3.3.3.9. p - ARP Statistics

The Address Resolution Protocol handles the mapping of IP and Ethernet addressing. The AppleTalk Address Resolution Protocol handles the mapping of AppleTalk and Ethernet addressing. Each packet addressed to a logical address has to be sent by the Ethernet hardware to a physical Ethernet address. ARP and AARP handle this translation, and manage a buffer cache. The statistics are:

Resolver: requests	Times resolver called
broad	Times Broadcast address returned
cache: hit	Address found in ARP cache
miss	Address not in ARP cache
retry	Entry in cache re-fetched - no answer
Transmitted:	Packets sent via Ethernet, or via NBP for IP addresses allocated on AppleTalk
Deferred: xmt	Ethernet packets held waiting ARP resolution
nbp xmt	NBP packets held waiting ARP resolution
replaced	Held packets superseded by following ones
dropped	Dropped packets due to resolution failure
Received:	Incoming ARP packets
ignored:	Bad ARP requests
nbp	NBP requests
replies	Replies to Gateway Code's requests
requests	Requests for Gateway Code's address
xmtd	Replies sent for "requests"
Bad pkts: fraud	Request from machine with Gateway Code's IP addr.
from bad IP	From bad IP address
seek bad IP	Usually wrongly seeking broadcast address
Dropped:	Seeking IP address not known by Gateway Code
Cache: Completed	ethernet+nbp cache entries completed
updated	Updated by incoming ARP messages
old	Incoming ARP message replaced cache entry
new	Incoming ARP message created new entry
timed out	Entry unused for too long
vanished	Known IP address vanished
no reply	Timed out while invalid
replaced	Replaced to make room in cache
deleted	Deleted when IP address reallocated

A typical report printed for IP ARP is:

```
ARP stats:
Resolver:  685088 requests (122859 broad, cache: 562005 hit, 74 miss, 18 retry)
Transmitted: 173+10278 over ethernet, 14+8 via nbp
Deferred pkts: 66 xmt, 6 nbp xmt, 150 replaced, 2 dropped
Received: 18626 (ignored: 0 badlen, 0 bad proto, 0 echo) + 584 nbp
          10301 replies, 6384 requests; xmtd 6387 replies
Bad pkts: 0 fraud, 0 from bad ip addr, 3 seek bad ip addr
Dropped: 1302 (seeking unknown IP addr)
Cache: completed 66+6, updated 16561+494, old 16188 new 493
       timed out 509, vanished 26, no reply 2, replaced 0, deleted 4
```

3.3.3.10. t - RIP Statistics

This prints out the Routing Information Protocol statistics. The fields are:

RIP Interfaces	Count of Interfaces with IP addresses
Loops	Count of loops through RIP sending routine
Deaths	Count of interfaces considered dead - no response to RIP after 3 min.
Xmt	Count of transmitted RIP packets
Rcv, Req, Rsp	Count of received RIP packets

A typical report:

```
RIP Stats... (5 RIP interfaces, 82972 loops, 4 deaths)
Xmt: 23279 (16642 rsp, 6637 req, 64 build)
Rcv: 73060 (0 short, 0 badv, 0 oddv, 0 cmd, 0 port)
Req: 23 (23 all, 0 xtuple, 0 xbadafi, 0 xnoway)
Rsp: 73037 (0 echo, 0 foreign, 234971 tuples, 0 odd, 0 nonz,
           14 def, 0 badm, 0 bada, 53124 inf)
```

3.3.3.11. x - RTMP Statistics

The RTMP statistics show the number of RTMP packets processed and other relevant information.

A sample printout is shown below:

```
RTMP: sent 298350; direct: 30, extended: 49721, non-extended: 248599,
        tuples: 4212337, incl ranges: 49761, poison: 120,
5 interfaces went silent, 0 woke up again, 43 nets died
276693 rtmp packets received; requests: 30, net: 30,
276663 data packets; phase1: 106613, phase2: 170050, extended: 170050,
```

```
4212337 tuples processed; ranges: 170050,
4212345 route addition requests; hardway: 56886, new: 66, alter: 28, update:
666365, ignored: 3489074,
1 buffers grabbed;
```

3.3.3.12. z - ZIP Statistics

A typical printout from the ZIP statistics command is shown below:

```
ZIP:
0 queries sent;
109 ZIP pkts rcvd;
0 Replies;
0 GetNetInfo;
0 NetInfoReplies;
0 Queries;

109 ATP ZIP pkts received;
0 GetMyZone
109 GetZoneList answered: 109,
0 GetLocalZone
```

3.3.3.13. %-Routing Statistics

This prints out the routing statistics. The Routing Cache keeps a maximum of 23 of the last Routing Table lookups. If the Cache misses, the Table is searched linearly. The fields are:

Lookups	Number of Cache Lookups
Hits (OK, Fail)	Count of good and bad (hit on dead Routing Table entry) cache hits
Misses (OK, Fail)	Count of misses resulting in good and bad Table searches
New Routes	Count and source of new route entries
New Slots	Count of created Table entries
Bufs	Number of 1728 byte PBUF buffers used to hold Table
Deleted, Old	Count of routed deleted and those that aged out

A typical report:

```
IP routing:
528121 lookups - 528105 hits (528105:0) 16 misses (16:0)
234981 new routes (25 new, 0 icmp, 89833 same, 0 ign, 73035 priv,
                   0 upd rip, 72087 useless, 1 repl, 0 dflt)
25 new slots (1 bufs) 11 deleted (11 old)
```

```
12 timedout, 23 cache flushes 0 discarded routes
```

3.3.3.14. f - Filter Statistics

The filter statistics show the packets that have been processed, and the number that have been modified or dropped.

A typical report:

```
Filter Stats...: 4 pkts processed;
0 modified NBP packets;
```

3.3.4. Internal Table Printing Commands

3.3.4.1. 0,1,2,3,4,5,6,7 - Interface Information

This command prints out information associated with the selected MultiPort/LT interface. 0, 1, 2 and 3 are the LocalTalk interfaces; 4 is the IPTalk interface, 5 is the EtherTalk Phase 1 interface and 6 is the EtherTalk Phase 2 interface. Interface 7 is the ARA interface

Interface:	Name of interface Type of network Whether RTMP being received
RIP:	Whether RIP being received
IP:	IP Address and Mask and Broadcast address. Also MTU, RIP cost and timer
A'talk:	Node and Network Number
IP address assignment:	Static and Dynamic IP address range for this interface
Link level address:	Ethernet Number
ARP:	Protocol type

A typical report (when 0 is typed):

```
Interface: ab0:
    Phase 2 Appletalk net.
    Not receiving RTMP (no other active appletalk routers).
    RIP:  send routes, ignore received default
          Not receiving RIP (no other active IP routers).

IP: address 192.9.210.1 subnet mask 255.255.255.240 (0xFFFFFFF0)
```

```
    net 192.9.210.0 (subnet of 192.9.0.0), broadcast 192.9.210.15
    MTU 586,  RIP cost 3, RIP timer 10 (secs)

A'talk: Node 129(81) Net 15.232 (4072)
    IP address assignment:
        13 dynamic [192.9.210.2..192.9.210.14]

Link level address: 0FE881 (24 bits)
ARP: protocol 800, hardware 3
```

A typical report (when 4 is typed):

```
Interface: lc0:
    Phase 1 IP net.
    RIP:  send routes, ignore received default

IP: address 192.9.200.10 subnet mask 255.255.255.0 (0xFFFFFF00)
    net 192.9.200.0 (subnet of 192.9.0.0), broadcast 192.9.200.255
    MTU 1500,  RIP cost 1, RIP timer 5 (secs)

A'talk: Node 10(0A) Net 1 (1)

Link level address: 0000180003FA (48 bits)
ARP: protocol 800, hardware 1
```

A typical report (when 5 is typed):

```
Interface: et1:
    Phase 1 Appletalk net.
    RIP:  not sent, ignore received default

IP: address 192.9.210.65 subnet mask 255.255.255.240 (0xFFFFFFF0)
    net 192.9.210.64 (subnet of 192.9.0.0), broadcast 192.9.210.79
    MTU 586,  RIP cost 2, RIP timer 6 (secs)

A'talk: Node 250(FA) Net 2 (2)
    IP address assignment:
        13 dynamic [192.9.210.66..192.9.210.78]
    RTMP timer 110

Link level address: 0000180003FA (48 bits)
ARP: protocol 809B, hardware 1
```

A typical report (when 6 is typed):

```
Interface: et2:
    Phase 2 Appletalk net.  No IP.

A'talk: Node 129(81) Net 3 (3)
    RTMP timer 110

Link level address: 0000180003FA (48 bits) -- can multicast
ARP: protocol 809B, hardware 1
```

A typical report (when 7 is typed):

```
Interface: ar0:
    Appletalk net.  No IP broadcast.
    Not receiving RTMP (no other active appletalk routers).
    RIP:  not sent, ignore received default

IP: address 131.161.160.121 subnet mask 255.255.255.0 (0xFFFFFF00)
    net 131.161.160.0 (subnet of 131.161.0.0)
    MTU 586,  RIP cost 3, RIP timer 6 (secs)

A'talk: Node 1(0x01) Net 3.129 (897.)  |Remote Party|
    IP address assignment:
        2 static [131.161.160.122..131.161.160.123]
        17 dynamic [131.161.160.124..131.161.160.140]

Link level address: 0x038101 (24 bits)
ARP: protocol 0x800, hardware 0x3 (len 4)
```

3.3.4.2. A - ARP Table

This reports the current contents of the MultiPort/LT's Address Resolution Protocol tables for the IP interface.

The fields are:

1st Column:	I	In Use
	C	Completed
	P	Permanent
	*	Waiting till resolved or timed-out
2nd Column:	i	IP entry
	a	AppleTalk entry
	m	MacIP entry

Address	
(xxn)	Interface used to reach that IP address
confirmed	Time in Minutes since last validated
{nn nn ..}	Ethernet Address or "Incomplete"
age	Time in Minutes since last reference

A typical report:

```
ARP table:
IC   i 131.161.200.13 (lc0) confirmed 1 at {AA 00 04 00 0D 04} last used 16
IC   a 0:211 (0)      (et1) confirmed 2 at {00 00 18 00 00 70} last used 10
IC   a 0:213 (0)      (et1) confirmed 1 at {AA 00 04 00 0D 04} last used 16
IC   a 0:12 (0)       (et1) confirmed 2 at {AA 00 04 00 0C 04} last used 1
IC   i 131.161.200.1  (lc0) confirmed 1 at {08 00 20 00 CE 0E} last used 0
IC   m 131.161.210.37 (ab2) confirmed 1 at {0A 02 35 48 }     last used 0
IC   i 131.161.200.2  (lc0) confirmed 1 at {08 00 20 00 C8 CE} last used 0
I   *a 3:211 (3)      (et2) incomplete                        last used 0
IC   i 131.161.200.11 (lc0) confirmed 1 at {00 00 18 00 00 70} last used 48
```

3.3.4.3. I - Interfaces

This command prints out the data tables associated with the MultiPort/LT's seven interfaces. Initially this is the configuration loaded into the MultiPort/LT's EEPROM via the monitor or MGConfig. As the MultiPort/LT gateway code runs, this table can be updated by information obtained over the network.

A typical report:

```
Interfaces:
lc0: 192.9.200.10, mask FFFFFF00 net 192.9.200.0, bcst 192.9.200.255
  $  af 800, haf 1: 00 00 18 00 03 FA.  Atalk net 1 node 10.
et0: 192.9.200.64, mask FFFFFF0 net 192.9.200.64, bcst 192.9.200.79
  !  af 809B, haf 1: 00 00 18 00 03 FA.  Atalk net 2 node 10.
     Address range: (1,13) [192.9.200.65 ..  192.9.200.65 ..  192.9.200.77]
ab0: 192.9.210.1, mask FFFFFF0 net 192.9.210.0, bcst 192.9.210.15
  !  af 800, haf 3: 0F E8 81 48.  Atalk net 15.232 (4072) node 129.
     Address range: (1,13) [192.9.210.2 ..  192.9.210.2 ..  192.9.210.14]
ab1: 192.9.210.17, mask FFFFFF0 net 192.9.210.16, bcst 192.9.210.31
  !  af 800, haf 3: 0F E9 81 48.  Atalk net 15.233 (4073) node 129.
     Address range: (1,13) [192.9.210.18 ..  192.9.210.18 ..  192.9.210.30]
ab2: 192.9.210.33, mask FFFFFF0 net 192.9.210.32, bcst 192.9.210.47
  !  af 800, haf 3: 0F EA 81 48.  Atalk net 15.234 (4074) node 129.
     Address range: (1,13) [192.9.210.34 ..  192.9.210.34 ..  192.9.210.46]
ab3: 192.9.210.49, mask FFFFFF0 net 192.9.210.48, bcst 192.9.210.63
```

```
! af 800, haf 3: 0F EB 81 48.  Atalk net 15.235 (4075) node 129.
  Address range: (1,13) [192.9.210.50 ..  192.9.210.50 ..  192.9.210.62]
```

3.3.4.4. N - NBP registry

The Name Binding Protocol is the AppleTalk protocol for binding entity names to AppleTalk Net, Node and Socket addresses. This reports the MultiPort/LT's NBP registry, typically:

```
NBP Registry...
131.161.200.61:IPADDRESS@Ether-Servers    id 1, 1:61/72 (enum 0), state 0
131.161.161.109:IPADDRESS@Remote Users    id 2, 4.137:1/72 (enum 1), state 0
Mouse:MultiPort/LT@Ether-Phase 2          id 3, 3:128/43 (enum 0), state 0
Mouse:SNMP Agent@Ether-Phase 2            id 5, 3:128/8 (enum 0), state 0
Mouse:DECNET ROUTER, AREA #01@Ether-Phase 2  id 6, 3:128/100 (enum 0), state 0
Mouse:DECNET ROUTER, AREA #01@Remote Users  id 7, 4.137:1/100 (enum 1), state 0
131.161.200.61:IPGATEWAY@Ether-Servers    id 8, 1:61/72 (enum 2), state 0
131.161.161.109:IPGATEWAY@Remote Users    id 9, 4.137:1/72 (enum 3), state 0
=:IPADDRESS@=                             id A, 0:0/72 (enum 4), state 0
```

Note that the last ("=") entry is there to support proxy NBP ARP.

3.3.4.5. n - Assigned IP Addresses

This table maps IP addresses with the associated AppleTalk Net and Node numbers. Entries in the table are one of:

permanent	For this gateway
current(t)	Currently active with current timer value (mins)
replaceable	Hasn't been heard from in 5 minutes
dead	Hasn't been heard from in 50 hours

A typical report:

```
Assigned IP addresses:
192.9.210.49: 15.235/129; permanent
192.9.210.33: 15.234/129; permanent
192.9.210.17: 15.233/129; permanent
192.9.210.1: 15.232/129; permanent
192.9.200.10: 1/10; permanent
192.9.200.64: 2/10; permanent
192.9.221.49: 2/190; dead
192.9.221.33: 2/190; dead
192.9.221.17: 2/190; dead
```

```
192.9.221.1: 2/190; dead
192.9.200.21: 2/190; dead
192.9.210.2: 15.232/110; current (2)
192.9.210.3: 15.232/117; dead
192.9.210.4: 15.232/72; replaceable
192.9.210.5: 15.232/120; current (1)
```

3.3.4.6. R - RTMP Routing Table

The Routing Table Maintenance Protocol Table contains the information used by the MultiPort/LT to route packets to other networks. The table entries consist of:

net:	Destination AppleTalk network number
hops:	Hop count (number of intervening gateways)
Status:	one of Unused, Free, Down, Bad, Suspect or Good
to	Gateway identifier and length in bits (len n) if Hops > 0
via	Port used, one of ab0 to ab3, lc0 (IPTalk) or et0, et1 (EtherTalk) or ar0 (ARA)
Flag	This has the bit-values of:
x03	BMask - Broadcast Mask. Value of 0, 1, 2 or 3 postfix 255 bytes on a broadcast, but only if x40 flag is on.
x08	Entry received via AA
x10	Node is "core" gateway
x20	Node can rebroadcast on its local net
x40	Node is an IP net allowing directed broadcasts as allowed by BMask
x80	IP address of kbox
uses	Number of packets sent

A typical report:

```
RTMP tables:
net 15.235; hops 0 (Good) to  (len 0) via ab3 [Flags E0] 3923 uses
net 15.234; hops 0 (Good) to  (len 0) via ab2 [Flags E0] 56283 uses
net 15.233; hops 0 (Good) to  (len 0) via ab1 [Flags E0] 142059 uses
net 15.232; hops 0 (Good) to  (len 0) via ab0 [Flags E0] 156770 uses
net 1; hops 0 (Good) to  (len 0) via lc0 [Flags 40] 341361 uses
net 255.0..255.254; hops 0 (Good) to  (len 0) via et2 [Flags 1E0] 0 uses
net 3..3; hops 0 (Good) to  (len 0) via et2 [Flags E0] 90395 uses
net 2; hops 0 (Good) to  (len 0) via et1 [Flags E0] 1806 uses
net 13; hops 1 (Good) to 00000264 (len 32) via et1 [Flags 4E0] 1 uses
```

```
net 12; hops 1 (Good) to 00000264 (len 32) via et1 [Flags 4E0] 1 uses
net 11; hops 1 (Good) to 00000264 (len 32) via et1 [Flags 4E0] 1 uses
net 10; hops 1 (Good) to 00000264 (len 32) via et1 [Flags 4E0] 1 uses
net 80; hops 2 (Good) to 83A1C814 (len 32) via lc0 [Flags 498] 12 uses
net 81; hops 2 (Good) to 83A1C814 (len 32) via lc0 [Flags 488] 12 uses
net 82; hops 2 (Good) to 83A1C814 (len 32) via lc0 [Flags 488] 12 uses
net 83; hops 2 (Good) to 83A1C814 (len 32) via lc0 [Flags 488] 13 uses
```

Note that if the MultiPort/LT gateway code detects that there are NO OTHER ROUTERS on a particular interface (not receiving any RTMP packets) for five minutes, the MultiPort/LT gateway code reverts to sending virtually EMPTY RTMP packets, with NO tuples. If it gets an RTMP packet coming in, it reverts.

This feature can be disabled by clicking the "Full RTMP" button in MGConfig.

3.3.4.7. r - IP Routing Table

This prints out the internal IP Routing table. The fields are:

First :	F	Free Entry
	L	Local - describes a MultiPort/LT Interface
	P	Permanent - Installed by atalkad
	D	Dead - Timed out. Retained for 2 min.
	R	RIP - Learned from RIP packet. Valid for 3 min.
	M	MG - Learned from MultiPort/LT packet. Valid for 1.5 min.
	I	ICMP - Learned from ICMP packet. Valid for 30 seconds
Dest. IP		Destination IP Network
Mask		Network Mask used by this network. (nn) is the count of "1" bits in this mask
Via		Gateway IP address used to get to this network
Direct		Network is on this MultiPort/LT
Cost		Metric or hop-count
Timer		Expiry time for entry
Uses		Packets routed via this entry
[IP Range] (n)		IP address range for this IP network, and count. Only shown for LocalTalk and EtherTalk ports on this MultiPort/LT

A typical report:

```
IP routing table:
```

```
L: 192.9.200.64 mask FFFFFFF0 (28) direct (cost 1) Timer: 0 Uses: 0
      [192.9.200.65..192.9.200.79 (15)]
L: 192.9.210.16 mask FFFFFFF0 (28) direct (cost 1) Timer: 0 Uses: 5902
      [192.9.210.18..192.9.210.31 (14)]
L: 192.9.210.0 mask FFFFFFF0 (28) direct (cost 1) Timer: 0 Uses: 591
      [192.9.210.2..192.9.210.15 (14)]
L: 192.9.210.32 mask FFFFFFF0 (28) direct (cost 1) Timer: 0 Uses: 591
      [192.9.210.34..192.9.210.47 (14)]
L: 192.9.210.48 mask FFFFFFF0 (28) direct (cost 1) Timer: 0 Uses: 591
      [192.9.210.50..192.9.210.63 (14)]
L: 192.9.200.0 mask FFFFFF00 (24) direct (cost 1) Timer: 0 Uses: 55603
R: 192.9.210.0 mask FFFFFF00 (24) via 192.9.200.1 (cost 3) Timer: 170 Uses: 0
R: 192.9.221.0 mask FFFFFF00 (24) via 192.9.200.21 (cost 2) Timer: 160 Uses: 0
L: 0.0.0.0 mask 00000000 (0) via 192.9.200.1 (cost 1) Timer: 0 Uses: 288
```

3.3.4.8. U - Routing Table and Associated Zones

The "U" command lists the "Routing Table and Associated Zones", and the "Z" command lists the "Zone Table and Associated Routes". For an example of the information returned by the "Z" command, please see the next section.

In the list of the MultiPort/LT gateway code commands, U is listed as providing the "RTMP+Zones" information, where "RTMP" stands for "Routing Table Maintenance Protocol".

An EtherTalk Phase 2 connected device that can (or is) not explicitly configured with a zone name will register itself in the "default zone". This is relevant for devices such as ethernet connected LaserWriters that use EtherTalk Phase 2, as it is not possible to configure the EtherTalk Phase 2 zone they are to appear in.

The "U" command presents information in the form shown below:

net:	Destination AppleTalk network number
hops:	Hop count (number of intervening gateways)
Status:	one of Unused, Free, Down, Bad, Suspect or Good
to	Gateway identifier and identifier length in bits (len n) if Hops > 0
via	Port used, one of ab0 to ab3, lc0 (IPTalk), et1 (EtherTalk Phase 1) or et2 (EtherTalk Phase 2)
Flag	This has the bit-values of:
x03	BMask - Broadcast Mask. Value of 0, 1, 2 or 3 postfix 255 bytes on a broadcast, but only if

	x40 flag is on.
x08	Entry received via AA
x10	Node is "core" gateway
x20	Node can rebroadcast on its local net
x40	Node is an IP net allowing directed broadcasts as allowed by BMask
x80	IP address of kbox
x100	No zones for these nets
x200	This route is to a phase 2 router
x400	The AA daemon knows this destination
x800	This rtmp entry is on a zone list
uses	Number of packets sent
*	Indicates this is the "default zone"
Zone:	Zone name the network is in

A typical report:

```
RTMP tables:
net 1; hops 0 (Good:21) to  (len 0) via lc0 [Flags 40] 12 uses
    Zones: *"Ether-Servers"(5388),
net 2; hops 0 (Good:7) to  (len 0) via et1 [Flags E0] 12 uses
    Zones: *"Ether-Phase 1"(4F6C),
net 15.235; hops 1 (Good:15) to 83A1C80A (len 32) via lc0 [Flags 80] 0 uses
    Zones: "R+D"(3C4),
net 15.233; hops 1 (Good:15) to 83A1C80A (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCS"(46A),
net 15.232; hops 1 (Good:15) to 83A1C80A (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCP"(464),
net 15.234; hops 1 (Good:15) to 83A1C80A (len 32) via lc0 [Flags 80] 0 uses
    Zones: "R+D"(3C4),
net 3..3; hops 0 (Good:7) to  (len 0) via et2 [Flags E0] 1 uses
    Zones: *"Ether-Phase 2"(4F6E),
net 15.215; hops 1 (Good:20) to 83A1C81E (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCS"(46A),
net 15.214; hops 1 (Good:20) to 83A1C81E (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCS"(46A),
net 15.213; hops 1 (Good:20) to 83A1C81E (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCS"(46A),
net 15.212; hops 1 (Good:20) to 83A1C81E (len 32) via lc0 [Flags 80] 0 uses
    Zones: "WCS"(46A),
net 10; hops 3 (Good:7) to 000002FA (len 32) via et1 [Flags E0] 0 uses
    Zones: "Async-Redback"(4D9C),
net 203; hops 1 (Good:10) to 83A1C80B (len 32) via lc0 [Flags 80] 0 uses
    Zones: "R+D"(3C4),
net 202; hops 1 (Good:10) to 83A1C80B (len 32) via lc0 [Flags 80] 0 uses
    Zones: "R+D"(3C4),
net 201; hops 1 (Good:10) to 83A1C80B (len 32) via lc0 [Flags 80] 0 uses
```

```
    Zones: "R+D"(3C4),
net 200; hops 1 (Good:10) to 83A1C80B (len 32) via lo0 [Flags 80] 0 uses
    Zones: "R+D"(3C4),
net 13; hops 1 (Good:7) to 000003BB (len 32) via et2 [Flags 2E0] 0 uses
    Zones: "Production"(7C02),
net 12; hops 1 (Good:7) to 000003BB (len 32) via et2 [Flags 2E0] 0 uses
    Zones: "Production"(7C02),
net 11; hops 1 (Good:7) to 000003BB (len 32) via et2 [Flags 2E0] 0 uses
    Zones: "R+D"(3C4),
net 4..4; hops 2 (Good:7) to 000003FA (len 32) via et2 [Flags 2E0] 0 uses
    Zones: "land rights for gay whales NOW!"(7553), "A Pig in a Poke"(D5A8),
net 84; hops 3 (Good:7) to 000002FA (len 32) via et1 [Flags E0] 0 uses
    Zones: "Production"(7C02),
net 124; hops 3 (Good:7) to 000002FA (len 32) via et1 [Flags E0] 0 uses
    Zones: "WCS"(46A),
net 255.0..255.254; hops 0 (Good:7) to  (len 0) via et2 [Flags 1E0] 0 uses
```

3.3.4.9. W - Watch Log

Log messages have been added to the Gateway Code to reflect the status of any channels configured to support ARA, and for general system log messages. There are various messages relating to the state of a connection, or to attempted connections.

For example, a channel that is configured for ARA but has no modem attached will cause the following message to be printed to the console every 45 seconds or so:

```
Channel 2: CCL Error -6019 at line ANSWER:JUMP:16: CCL: Modem not responding
```

Please note that the CPU LED on the front of the MultiPort/LT will flash red every five seconds if there is an alert level or higher message present in the Log. Displaying the log will stop the CPU LED from flashing red.
A typical log printout is shown below:

```
hypochilius: W

            EVENT LOG            Active 56620 seconds 15:43:40.40
6 entries logged.  Top message number is 11.  Trap level is DONT log
-------------------------------------------------------------------------
                                                 TIME   Priority Repeats
------------------------------------------- 00:00:00.00  info     0
Event logging started
------------------------------------------- 15:33:38.78  info     0
Channel 0, Michael: Connected, unlimited time
------------------------------------------- 15:34:24.82  info     0
```

```
Channel 0, ARAP session closed
------------------------------------------- 15:34:43.04  info     0
Channel 0, Michael: Connected, unlimited time
------------------------------------------- 15:35:22.70  info     1
 00:00:40
------------------------------------------- 15:39:51.13  info     0
 00:05:00
------------------------------------------- 15:39:59.96  info     1
```

3.3.4.10. Z - Zone Table and Associated Routes

"Z" command lists the "Zone Table and Associated Routes". In the list of the MultiPort/LT gateway code commands, Z is listed as providing the "Zip" information, where "Zip" stands for "Zone Information Protocol". The table entries consist of:

Zone name:	The zone name for this entry
(number):	The number of characters in the zone name
<LOCAL>:	If the zone is on a directly connected network, the <LOCAL> entry will be present.
Fl:	Internal flag byte
H:	Multicast hash code (Gateway Code internal value)
(Ref x):	"x" represents the number of networks in this zone
The zone for:	The network numbers (in the form a.b, where a and b are the two bytes of the network number in decimal form, separated by a period) of the networks in this zone.
One of the zones for:	EtherTalk Phase 2 network range associated with one of the EtherTalk Phase 2 zones.

A typical report:

```
Zones ...
Async-Redback (13)                              Fl:00 H:4D9C   (Ref 1)
    The zone for:  10
WCP (3)                                         Fl:00 H:0464   (Ref 1)
    The zone for:  15.232
WCS (3)                                         Fl:00 H:046A   (Ref 6)
    The zone for:  124  15.212  15.213  15.214  15.215  15.233
R+D (3)                                         Fl:00 H:03C4   (Ref 3)
    The zone for:  15.234  15.235  11
Production (10)                                 Fl:00 H:7C02   (Ref 7)
    The zone for:  84  80  81  82  83  12  13
aa (2)                                <LOCAL>   Fl:03 H:0186   (Ref 1)
```

```
    One of the zones for:  3..3
Ether-Phase 2 (13)                  <LOCAL>  Fl:03 H:4F6E   (Ref 1)
    One of the zones for:  3..3
Ether-Phase 1 (13)                  <LOCAL>  Fl:02 H:4F6C   (Ref 1)
    The zone for:  2
Ether-Servers (13)                  <LOCAL>  Fl:02 H:5388   (Ref 1)
    The zone for:  1
white zone (10)                     <LOCAL>  Fl:02 H:7E1C   (Ref 1)
    The zone for:  15.244
black zone (10)                     <LOCAL>  Fl:02 H:231C   (Ref 1)
    The zone for:  15.245
blue zone (9)                       <LOCAL>  Fl:02 H:199B   (Ref 1)
    The zone for:  15.246
red zone (8)                        <LOCAL>  Fl:02 H:935A   (Ref 1)
    The zone for:  15.247
```

3.3.4.11. ^Z - Zone Hashing Table

The zone hashing table stores the network addresses associated with the most recently accessed zones.

```
Zone Hash Table:
 0:  "Ether-Phase 2007"(16:7E20)
 2:  "Ether-Phase 2008"(16:7E22)
 4:  "Ether-Phase 2009"(16:7E24)
 8:  "Janet Court Study"(17:5728)
 B:  "Remote Party"(12:AB2B)
 C:  "Janet Court"(11:78EC)
12:  "Ether-Phase 2000"(16:7E12)
14:  "Ether-Phase 2001"(16:7E14)
16:  "Ether-Phase 2002"(16:7E16)
18:  "IPTalkin"(8:96F8)  "Ether-Phase 2003"(16:7E18)
1A:  "Ether-Phase 2004"(16:7E1A)
1C:  "Ether-Phase 2005"(16:7E1C)
1E:  "Ether-Phase 2006"(16:7E1E)
```

3.3.4.12. * - IP Routing Cache

This prints out the contents of the IP Routing Cache. The fields are:

IP address	Destination IP Host (not Network) Address
Route	Destination IP Network - corresponds to an entry in the IP Routing Table
Cost	Metric or Hop count
Via	Gateway IP address used to get to this network
Through	Interface used to get to Via

direct out	Network on this MultiPort/LT used to route packet

A typical report:

```
IP route cache:
192.9.200.20: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.200.21: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.210.15: route 192.9.210.0 (cost 1) direct out ab0 (local)
192.9.200.1: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.200.255: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.210.19: route 192.9.210.16 (cost 1) direct out ab1 (local)
192.9.231.49: route 0.0.0.0 (cost 1) via 192.9.200.1 through lc0 (local)
192.9.200.30: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.210.47: route 192.9.210.32 (cost 1) direct out ab2 (local)
192.9.241.49: route 0.0.0.0 (cost 1) via 192.9.200.1 through lc0 (local)
192.9.210.31: route 192.9.210.16 (cost 1) direct out ab1 (local)
192.9.200.40: route 192.9.200.0 (cost 1) direct out lc0 (local)
192.9.200.41: route 192.9.200.0 (cost 1) direct out lc0 (local)
```

3.3.4.13. w- who (users and Zone Groups)

This command shows which ARA users and Zone Groups are active. A typical printout is shown below:

```
attid: w
ARAP User and Zone-group list
User data:
    "Michael Lawrence", Zone Group: "Backbone"
        Dialback enabled on "245 8721"
        Connect Time is Global Maximum
    "Tom Evans", Zone Group: "<All Zones>"
        Connect Time is Global Maximum
Zone Groups (all groups include ARAP zone "ARAP")
    "Twilight", for ports 0 1 2 3  (0xF)
        Includes 1 zone
        "Twilight Zone"
    "<All Zones>", for ports 0 1 2 3  (0xF)
        Excludes 0 zones
    "<Multiport's Zone>", for ports 0 1 2 3  (0xF)
        Includes 0 zones
    "Backbone", for ports 0 1 2 3  (0xF)
        Includes 4 zones
        "Ether-Phase 1"
        "Ether-Phase 2"
        "Ether-Servers"
        "WCS"
```

```
"Accounting", for ports 0 1 2 3  (0xF)
    Excludes 3 zones
    "WCS"
    "WCP"
    "rocky road"
```

If any users are in their grace login period, the number of logins they have left is shown.

3.3.4.14. F - Filter Settings Table

The Filter Settings Table shows the filtering configuration currently being used by the MultiPort/LT gateway code. The table entries are of the form:

Policy style: Shows whether the LaserWriter notification message type (the possibilities are "hide", "substitute", "overwrite" or "prefix").

Filter string: The notification message that will be used by the MultiPort/LT gateway code when the LaserWriter name returned to the Chooser is modified as a result of filtering action.

[number]: The number of characters in the notification message.

Interfaces: The MultiPort/LT interface, where ab0-ab3 are the LocalTalk ports, lc0 if the IPTalk port, et1 is the EtherTalk Phase 1 port and et2 is the EtherTalk Phase 2 port.

Src (Laser): Shows which interfaces have the LaserWriter (or "LW") filter enabled.

Dst (Mac): Shows which interfaces have the "Mac" filter enabled.

A typical report:

```
Filter settings:
Policy style is 'Substitute'
Filter string is (LZR1260 is out to lunch) [23]
Interfaces  Src (Laser)  Dst (Mac)
```

```
ab0         Off         Off
ab1         Off         Off
ab2         Off         Off
ab3         On          Off
lo0         Off         Off
et1         Off         Off
et2         Off         Off
```

3.3.4.15. S - SNMP Table

The SNMP Table shows the number of variables and the configured contact, name and location variables. The statistics relating to the number of SNMP packets processed are also shown.

A typical printout is shown below:

```
SNMP
Number of SNMP variables 216
Size of one SNMP variable 40 bytes
Total size of SNMP table 8640 bytes
  sysContact: Michael Lawrence
     sysName: Agreeable
 sysLocation: Janet Court Study
 # Access     Community name(s)
 0  R  (0x2)  public
SNMP packets:  0 received, 0 sent
  IN:  0 GetRequests, 0 GetNexts, 0 SetRequests, 0 errors
  OUT: 0 Responses, 0 Traps sent, 0 errors
  0 retrieved, 0 changed
```

3.3.5. DECnet Related Commands

The following sections list the DECnet statistics and table printing commands in the MultiPort/LT gateway code.

If you are using mgcmd to connect to the MultiPort/LT gateway code, please note that mgcmd can only transmit one character at a time to the MultiPort/LT.

This means for two letter commands (such as those to obtain the DECnet statistics), that the first character must be typed (followed by RETURN) then the second character (followed by RETURN again).

3.3.5.1. DN - Node list

A typical report:

```
DECnet: Known Nodes:
Node: 42, Info: 255, Neighbour: 42, Timer: 0 (0), Hops: 0, Cost: 0,
     ATalk: 1:12:101,       Received: 0, Sent: 0, Returned: 0
Node: 100, Info: 2, Neighbour: 100, Timer: 20 (156), Hops: 1, Cost: 4,
           Received: 0, Sent: 0, Returned: 0
```

3.3.5.2. DR - Routers

A typical report:

```
DECnet: Known Routers (8):
Node: 100, State: 1, Info: 2, blksize: 1498, Priority: 2, Timer: 146 (20)
```

3.3.5.3. DC - Circuits

A typical report:

```
DECnet: Circuit Parameters
Ethernet:
    State: on, Service: enabled,
 Priority: 1
RTimer: 60, NTimer: 60, L1Timer: 20
```

3.3.5.4. DG - Gateway

A typical report:

```
DECnet: Gateway Parameters
State: 2, Address: 1.42, Nodes: 2, E: 42..100, A: 1023..0
Designated Router: 100, DTimer: 3
Router Timer: 48, Node Timer: 48, level1 timer: 8
Routed: 0, Errors: Ewrite: 0, Awrite: 0, Oversize: 0, Format: 0
Node out of range: 0, Node unreachable: 0, Aged packet: 0
```

3.3.6. Debugging Commands

3.3.6.1. Control P - Panic

The "Control P" command causes an "Operator Panic". In conjunction with Debug switch "d1000" it puts the gateway into the MultiPort/LT gateway code command mode from which its internal state can be examined. It will produce the message:

```
PANIC! operator
trapsp 000000 from 100CE6 sr 2700
abregs[00..] 00000000 00000025 00000000 00000000
abregs[04..] 00000000 00000000 00000076 00000050
abregs[08..] 0010ACDE 001448F8 00114184 0011419C
abregs[12..] 0004003E 0004003C 0011D0B4 0011D098
...cmd>
```

3.3.6.2. $ - Abort Save Registers

When the MultiPort/LT Panics, it saves the current 68010 D0 to D7 and A0 to A7 CPU registers in a structure referred to as the abregs. These are printed out with the Panic message, but can be printed out at any later time. This command is only useful in association with Debug switch "d1000". "Trapsp" is the value of the Stack pointer at the time of the trap, "from" is the program counter and "sr" the processor status register. The following is an "empty" printout - no panics having occurred:

```
trapsp 000000 from 000000 sr 0000
abregs[00..] 00000000 00000000 00000000 00000000
abregs[04..] 00000000 00000000 00000000 00000000
abregs[08..] 00000000 00000000 00000000 00000000
abregs[12..] 00000000 00000000 00000000 00000000
```

3.3.6.3. # - Print Debug Flags

There are currently 22 sets of debugging variables, each containing 16 flags.

The variables are identified as:

d	global process debugging
a	appletalk (localtalk)
l	lance (ethernet)
t	ethertalk
T	timer
R	rtmp

N	NBP debugging
Z	Zip debugging
A	ARP (IP) debugging
g	gateway debugging (routing, etc)
L	local processing debugging
r	route (IP routing)
i	RIP
I	IP
f	filter
D	DECnet
s	SNMP
F	Flash
S	serial
P	ARAP
m	MNP
c	CCL

A typical printout with no debugging flags set:

```
Debug Flags ...
d:dproc  00000 a:ab     00000 l:lance  00000 t:etalk  00000 T:timer  00000
R:rtmp   00000 N:nbp    00000 Z:zip    00000 A:arp    00000 g:gate   00000
L:local  00000 r:route  00000 i:rip    00000 I:ip     00000 f:filter 00000
D:DECnet 00000 s:snmp   00000 F:flash  00000 S:Serial 00000 P:ARAP   00000
m:MNP    00000 c:CCL    00000
```

Debug flag "0008" is the "DROP" flag in all debug variables. Setting this flag will cause the MultiPort/LT gateway code to print a message each time it drops a packet for any reason. This is the most useful flag for "casual" debugging.

3.3.6.4. =nXXXX? - Set Debug Flags

This command sets the debug flags in variable "n" as listed above to Hexadecimal "XXXX". This command is not echoed as typed, the trailing "?" causing it to have effect, and to display the new value. Typing in "=d1000?" will return:

```
dbg: d=1000
```

The values corresponding to the flags in the global debug variable are:

Value	Name	When Set

0x0010	PPHEAD	Controls p_printing in gw.c - obsolete
0x0020	PPALL	Likewise
0x0100	HIST	Enables history on Lance packets
0x1000	PANIC	Go to the MultiPort/LT gateway code command mode after panic, else restart.

Note that the only useful one here is the PANIC flag. The rest of the flags aren't listed here. Reference to the listing is required for their use.

3.4. MultiPort/LT Gateway Code Panics

A "PANIC!" is a condition from which the MultiPort/LT gateway code cannot recover cleanly. These are very infrequent but can be caused by severe misconfiguration, hardware failure or corruptions in the the MultiPort/LT gateway code program file. Other Panic messages are leftovers from the MultiPort/LT gateway code debugging - they were put there to catch illegal conditions.

After a PANIC, the MultiPort/LT gateway code will restart unless the "d1000" flag is set. A Panic message appears:

```
PANIC! <message describing reason for panic>
trapsp 000000 from 000000 sr 0000
abregs[00..] 00000000 00000000 00000000 00000000
abregs[04..] 00000000 00000000 00000000 00000000
abregs[08..] 00000000 00000000 00000000 00000000
abregs[12..] 00000000 00000000 00000000 00000000
```

The CPU light on the front panel flashes red once during a Panic. If the Debug Panic flag is set, the CPU light will flash green as an indication that the MultiPort/LT is waiting for operator intervention.

Some of the possible panic messages are:

operator
: Response to "P" command.

watchdog timer
: The MultiPort/LT gateway code failed to run the idle process for 100 seconds.

EEprom partial xsum error
: Hardware EEprom failed or corrupted.

need more pbufs in init_rr
Can occur after "Operator Panic" on busy network.

KIP appletalk net number not config'd
Bad configuration - Interface 4 must have an AppleTalk network number configured.

appletalk interface broken CA
Hardware failure, SCC or 3.6864MHz clock.

appletalk interface broken CF [nn]
Could be a problem with the ISCC.

This is absurd!
You have more than 1332 MultiPort/LTs on the network with the same Hostname. You will have to pick a different Hostname for some of them.

Corrupted MultiPort/LT Gateway Code Image
Probable non-binary upload the MultiPort/LT gateway code has detected that 0x0D == 0x0A This is usually caused by FTP'ing the the MultiPort/LT gateway code code in "ascii" instead of "binary" mode.

etalk addiproute()
There has been a clash between the EtherTalk IP address and some other address in the MultiPort/LT.

abus addiproute()
There has been a clash between one of the LocalTalk IP addresses and another network. Check for overlapping IP address ranges.

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