# LANceGS

## Ethernet Card For Apple II Computers

## User's Manual

© Joachim Lange 7'2000 --- Revision Date: September 2000

**Thirty-day money back guarantee:**

If you are not satisfied with your purchase, you may return this product within thirty (30) days. You will get a refund on the value of the product only, not the shipping/ handling cost. This product cannot be returned for a refund if it is damaged in any way.

Support for the LANceGS card can be found in the Internet:

http://www.a2central.com/site/lancegs (not fully functional yet)

or by e-mail from the author:

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## Preface

The LANceGS Ethernet software consists of three or more test programs and the link layer driver for Marinetti. Marinetti, the Apple IIGS TCP/IP stack, is not part of the LANceGS package, so you cannot expect support for Marinetti in this document. You will find some hints on how to use Marinetti, but this cannot be a users's guide on how to use a TCP/IP stack or a network/Internet application. We ask you to keep this in mind if you do not feel satisfied with the descriptions about usage of the actual applications here, or if you have any problems with the upper-layer programs.

In other words: this is the user's manual for the LANceGS Ethernet card and its test programs, not for any user application, and not for the Marinetti TCP/IP stack. The LANceGS card is a standalone product containing a software package which is not affiliated with any other program.

I wish to express my thanks to the following folks (in no particular order) for their efforts and contributions to the Apple II community and/or for supporting the LANceGS card.

Richard Bennett   Shawn Behrens   Eric Shepherd   Ryan Suenaga   Geoff Weiss

## What you need to know when working in a network environment:

Please make a few notes about the numbers you need to know frequently:

- The IP addresses of the computers you want to communicate with.

- The IP address of your Apple II where your LANceGS card operates. Your LANceGS card has been set up in factory with a default address which may (almost for sure) require modification to work correctly in your LAN/subnet. Please use the test/setup program (LANCETST.SYSTEM) provided on the utilities disk to view and modify your address setup. Also see the section "Setting up your Apple II's IP address" for recommendations.

- For a low-level test, you might need to know the hardware address (also called MAC address, Media Access Controller) of the Ethernet card(s) of other computers present in the network. The MAC address of your Apple (exactly spoken, it's the

hardware address of the LANceGS card) can be found by using the test/setup program LANCETST.SYSTEM, menu item "I" (information).

## Before it's too late:

Please make a backup copy of the LANceGS utilities disk. If it's too late (the disk is bad, the disk has been lost, the disk has been toasted in any way, the disk has been reformatted to save your favorite download...) we can send you a disk image by e-mail.

## Slot selection:

The LANceGS Card can be used in any slot. Be sure the Control Panel setup is set to "Your Card" for the slot you have selected for the LANceGS Card. Well, as usual, slot 3 is not available for any card which requires I/O address space, you know.

## Connecting the LANceGS Card to a network:

The card has a standard 10Base-T interface for using inexpensive twisted pair Ethernet cable. You have two options connecting the card:

1) If you have only a second computer, you can use a **crossover** 10Base-T cable (similar to a nullmodem cable for the serial ports which also has crossed lines) to directly connect your Apple IIGS to the other computer. This could also be another Apple IIe/IIGS. Having this kind of configuration, you cannot use the Loopback Test provided in the test utility LANCETST.SYSTEM.

2) The more common way is to connect your Apple/LANceGS to a hub (or an Ethernet "switch") with 10Base-T connectors. In this case you would have to use a regular (non-crossed) 10Base-T cable.

## What are the LEDs for?

Four LEDs are implemented on the card to give you some valuable information about the current status.

Red LED (first, frontmost) - Card Access

indicates that the LANceGS Card is accessed from the Apple IIGS, i.e. the processor reads from or writes to the card.

Green LED (second) - Link OK

indicates that the LANceGS Card is connected properly to a hub or another computer, telling you that the Ethernet link is OK. For the link being OK it is also required that the hub or your other computer is powered up.

Yellow LED (third) - Data In

indicates that data comes from outside (from the hub or another computer you are connected to) to the LANceGS Card. There is no difference whether data is dedicated to your card or to any other computer participating on your Ethernet, i.e. any data currently on the Ethernet causes flashing this LED. It even flashes when the LANceGS is sending out data because the same data that gets sent out also gets received.

Red LED (fourth) - Data Out

indicates that data (Ethernet packets) is sent out from your card to the Ethernet.

## Installing the LANceGS card

Important notes first!

---> **Turn off your computer before inserting the card <---**

---> **Never apply any pressure to the surface mounted components. Only touch the card at the edges to pull it out or to push it in. This is delicate hardware, and misuse of this kind of hardware is not covered by our warranty. <---**

You have installed several cards in your Apple over the years, so there is not much more to say; only that the 10-pin header connector must point to the rear panel. The adaptor cable has to go to the rear panel, not to the front of your computer. Connect the 10Base-T adaptor and your 10Base-T cable from the network or you will get warning messages when running the test programs.

(you also may find a very nice and detailed description how to install the card on A2Central.com)

Choose any free slot for the LANceGS card, but do not use slot 3. In the Control Panel setup of your Apple IIGS set the slot where your LANceGS card is in to "Your Card". In future revisions of the LANceGS software it may be possible to use the card without setting the slot to "Your Card", so perhaps you can save a slot for other cards. Slot 4 would be a good candidate for the LANceGS being installed "behind" the Mouse slot.

## Verifying your network setup

At the beginning, you may not be sure whether your new network card is working correctly. Especially, with a network equipment, one or more partner computers (which could be misbehaving) are involved in processing data. So please follow these few steps to decide whether you should blame the application software or the LANceGS software/hardware if anything doesn't work as expected.

1) Install the LANceGS card in your computer (LANceGS slot: Control Panel setup to "Your Card")

2) Establish the network connection (plug in the cables) (LANceGS --> Adaptor Board --> 10Base-T cable --> hub or switch or other computer)

3) Make sure your network environment (hub, switch, other computers) is powered up and running.

4) Turn on your Apple. If the Apple hangs (does not boot), turn it off immediately and check if the card has been pushed in into the slot completely. When the Apple is powered up, the green LED turns on and tells you that the network connection is OK. If the greed LED is not on, check the network cabling, including the plugs from the LANceGS card to the 10Base-T adaptor (plugging in the 10-pin header plugs in the wrong way is _not_ harmful for your hardware, so you can try it in the reverse direction).

5) Run the LANCETST.SYSTEM program. You don't need to launch GS/OS to run the test programs. You may find it convenient to use a ProDOS 8 program launcher to switch between the various test programs.

6) Choose menu item "S", Selftest. Let the selftest run for a few passes. If nothing bad happens, the test runs "forever". If an error occurs, the test stops with an appropriate error message. This should not occur, however due to extensive noise on the power lines a.selftest error could happen <u>sometimes</u>. You can stop the selftest with a keypress.

7) Choose menu item "L", Loopback test. In order to let this test run without error message, you need to assure that no Ethernet traffic is on the line. If any other packets get sent on the lines, the loopback test fails because in loopback mode the LANceGS chip cannot distinguish "foreign" packets from its own. Again, if nothing bad happens, or you don't press any key, the test runs "forever".

8) Good progress so far, if you successfully have reached this point with no errors. No errors means that the LANceGS hardware is OK, there is no reason to assume any defects on the card.

9) Now it's a good time for setting the IP address for your Apple. Choose menu item "P" from the main menu to get into the sub-menu of the test program. You can also setup your favorite destination IP address (of the computer you want to communicate with over the Ethernet) to store it in nonvolatile memory for the following tests. After setting up the IP addresses, choose menu item "S" to save your setup in nonvolatile memory, otherwise the IP numbers will be lost.

Note 1: Your "own IP address" is the address which makes your Apple known in your network environment.

Note 2: Please also have a look a the section "Setting Up IP Addresses" which gives you some information on how to correctly assign IP addresses and related topics.

Note 3: The "destination IP address" entered here is only required for the low-level tests. You will be prompted for the real destination address when running Marinetti or the application which calls Marinetti.

Note 4: At this time only the item "own IP address" is required for setting up the LANceGS correctly. The items "destination IP address", "subnet mask" and "default Gateway" have been implemented but do not yet take effect for any Marinetti-related application.

10) If you are curious about the working of the LANceGS, you can try to send out a test packet on the network and try to receive it on another computer. This can be done with the "X" or the "T" menu option. On your destination computer, you will need a utility which is able to receive and display raw Ethernet frames on the low level, otherwise "nothing" happens - the operating system (the network part) will simply ignore these unknown frames coming along. Please find a more detailed description about these test features in the program descriptions section.

11) You can also snoop around in your Ethernet and try to receive frames coming from other computers by choosing menu item "R" or "G". The first menu item would pick up any Ethernet frame that gets sent out on the network, whereas the "G" option would require that another computer knows about the presence of your Apple II with a LANceGS card (it needs to know your LANceGS' MAC address).
Your Apple will display a "*" on the screen for incoming packet events, but not for every single packet. If the memory is full or if you press any key, the receive process stops. If the status display shows a number of received frames different from 0, you can use menu item "V" to display the Ethernet frames which have been collected in memory.

This is all you need to verify that your LANceGS card will work successfully in your network. This is not a confirmation that the upper-layer software (which is not part of the LANceGS package) will work correctly.

To use a real application with your LANceGS, currently there is no other choice than using the Marinetti TCP/IP protocol stack and a user application which uses Marinetti as the protocol handler. So we'll describe Marinetti's usage in a few words in the following section.

## Using Marinetti with the LANceGS

Before doing anything further related to the LANceGS card, you should proceed with the installation of Marinetti if not already done (please see the Marinetti documentation).

After Marinetti has been installed, you will find a folder named TCPIP inside your SYSTEM folder on the boot disk. This is the location where you can find the so-called link layer modules. Link layer modules can be considered as the "driver" part of Marinetti - the low-level communication code which allows Marinetti to talk to the hardware installed in your computer.

To make Marinetti work with the LANceGS card it is only required to add a suitable "driver" (a link layer module) to the list of modules known by Marinetti. The LANceGS card comes with a link layer module for Marinetti. The driver is located in the MARINETTI folder on the LANceGS utilities disk. Just use the Finder to copy the driver to the

/your.boot.volume/SYSTEM/TCPIP folder

and reboot your system. A reboot is required because Marinetti creates a driver list at boot time, and anything you change inside the TCPIP folder after boot time is "unknown" to Marinetti (so if you delete a link layer module from the TCPIP folder and want to use its function, you will get an error message from Marinetti). Needless to say that if you do a shift-boot, no desk accessories will be loaded, and hence no Marinetti TCP/IP CDEV will be present and no LANceGS can be used for any Internet/Ethernet application.

Assuming you have installed the LANceGS link layer module and you have rebooted your system, you can use the LANceGS card with Marinetti. Open the TCP/IP CDEV in the Control panel, open it and select "Setup Connection...". You will be presented with the setup dialog, where you can select the type of connection in the lower left corner. In the pulldown list you should be able to find "LANceGS Ethernet". If this item is not listed, the LANceGS link layer driver is not installed properly. Also, different versions of Marinetti will require different versions of the link layer drivers, non-matching versions will not be recognized and will not be found in the pulldown list. The current version of Marinetti is v2.01, which is covered by the LANceGS link layer module provided.

For the LANceGS type of connection, there is nothing else to configure, so pressing the configure button will not do anything (in fact, you cannot dial-in into an Ethernet network, so there aren't any parameters to set up for dial-in). After confirming with the OK button, Marinetti is ready to use the LANceGS card for its work (for a correct network functionality it is important that you have set up your own IP address according to your local area network requirements. You should have already set up your IP address using the LANceGS test program as described above).

Now here is the tricky part of the story. There is a problem unsolved in Marinetti or inside the link layer module. If you press the Connect button in the TCP/IP CDEV dialog, Marinetti starts calling the link layer. If no action comes from the upper level to Marinetti (application calls), Marinetti looks for incoming data and calls the link layer driver periodically two or three times per second. This can be observed by looking at the LEDs of the LANceGS card. The frontmost LED (red, "access") should flash periodically, showing that the driver gets polled correctly. If you don't get the "flashing" message you have bad luck, and there are chances that your network application will not work. If the access LED does not flash, the Marinetti code is not called and thus the link layer is not accessed at all. In this situation, a request coming from the network cannot be replied to. We have found that different memory configurations give different results (different configurations can be achieved by rearranging the

order of drivers, not only link layer modules, and desk accessories and inits in the System folders). Also, enabling or disabling drivers, inits and desk accessories will cause modified memory configurations.

The problem described before may or may not arise in your system. The flashing access LED can only be observed when the Finder Desktop is running idle. If any other application gains control, the behavior of the polling is not predictable and depends on the specific software implementation. However it is a good sign if the access LED is on all the time, meaning that Marinetti (and the LANceGS link layer driver) gets polled by the application in very short intervals.

At this time the author, Richard Bennett knows about the problem, however it is not clear where it is located. There is still the (more unlikely) possibility that the link layer causes a misbehavior in the Marinetti code. BTW, when Marinetti is running it doesn't give us any hints whether the situation described above is currently present or not, the only symptoms are that you cannot establish a working Ethernet communication, i.e. you cannot transfer files and other data over the LAN (FTP will not allow to login) or you cannot control any other computer over the LAN (Telnet will not establish a connection).

So please have a look at the LANceGS access LED from time to time when having done a CONNECT in the Marinetti CDEV or after having started any Marinetti-related application.

Most applications which require Marinetti as a protocol handler will automatically detect its presence. Also, such applications will start up (connect) the link you have selected in the pulldown list, so in most cases you will not need to do an explicit CONNECT in the control panel. Starting up the LANceGS connection manually only may help to see whether things are OK.

(The following section gives us some insight in selecting a suitable IP address. This part of the manual has been "donated" by our network professional, Shawn Behrens, living in Munich, Bavaria. Please note that currently (as of Marinetti v2.01) only your own IP address is required to be set up.)

## Setting up your Apple II's IP address

There are a couple scenarios here you might encounter. I will try to give some guidance as to how to handle each of them.

You have an administrator at hand who gives you all the values you need. Terrific. Input IP address, subnet mask and default gateway, and away you go. You need the IP address, and you need a subnet mask. The Apple II will not calculate the subnet mask for you. If no default gateway is given to you, that is fine, it just means you cannot get "out" of your local network. (Or, of course, you _are_ the administrator. What are you doing reading this?)

Your entire network gets IP addresses automatically from a central server. Terrific for your network. The Apple II cannot, however, at this point, get settings automatically. Again, bug your administrator to give you a "static IP" and the subnet mask used in the network, and a default gateway if necessary.

You are setting up a small network, in which a maximum of 254 machines talk to each other. Like, your home network, or your school network. May I suggest the following setup in this case:

Use the network 192.168.1.0. This means, for your settings:

- IP address: Choose freely between 192.168.1.1 to 192.168.1.254. No two devices in your network may share the same IP address. Of course. What did you think?

- Subnet mask: Let's keep this simple. It is a "Class C" network, and the subnet mask is 255.255.255.0

- Default gateway. Well ... none. Leave empty, or set to 0.0.0.0. If you have a way to get out of your local network, then input the local IP of the device that lets you get out. But then, if you set such a gateway up, you know that anyway.

Why 192.168.1.0? Well, it is a network that will not conflict with anyone "out there" on the Internet. 192.168.x.x, to be precise, are designated as Class C network addresses that can freely be used in LANs without having to fear that you'll conflict with addresses on the Internet once the LAN is connected to "The World".

You are setting up a large network. Congratulations, you must be a network admin. What are you doing reading this? ;-))

You want OUT. Out of the confines of your network. Into the wide world awaiting you just beyond that wall socket that denotes your connection to your Internet service provider. Well ... umm. Doable, over Ethernet, of course. One machine will be your "gateway", or more properly, "router", to the outside world. That machine will have to be something other than an Apple II, currently. And it will have to do NAT, or Network Address Translation, unless you have official Internet IP addresses. Any kind of proxy will currently not work with the Apple II. If all this means so much gibberish to you, well, er,

there is a reason network admins get paid large salaries. That reason being that we hide what we do behind technical gobble-de-gook. No, seriously, though, this topic, while not really difficult, is quite a bit beyond the boundaries of this guide. There have been books written about it. And, of course, there are web pages explaining it. And there is, probably, some poor nerd nearby who will happily set it up for you for a meal and the warmth of human companionship. (Relax. Just a bit of friendly ribbing. Not meant personally, for any nerds I might have offended :o))

--- End of "donation" from Shawn Behrens ---

# Using the main test program LANCETST.SYSTEM

**Purpose:** Testing the LANceGS hardware thoroughly and setting up various addresses, getting information about the card.

**What you need to know:** An "Own IP Address" for your Apple that matches your local network.

**Special requirements:** at least one second computer on your local network sending/receiving raw Ethernet packets (only applies to the specific tests) and its MAC address.

The test program features regarding sending and receiving test frames have nothing to do with a TCP/IP protocol. The addresses mentioned here are hardware-level (MAC) addresses, not IP addresses.

R: Receive All Ethernet Frames

All frames that are sent out on your local Ethernet will be captured in memory until the buffer is full. If there is plenty of traffic on your network, the buffer will be filled up quickly because there is only about 30K memory available for this ProDOS 8 application. "All frames" means that broadcast, multicast and dedicated addressed frames will be captured.

G: Receive Dedicated Ethernet Frames

All frames that are sent out and addressed to your MAC address will be captured in memory until the buffer is full. "Dedicated frames" means that also broadcast frames will be captured, because broadcast frames are dedicated to "everyone".

Any repeated G or R command will cause the buffer to be cleared.

V: view captured Ethernet frames

Frames captured in memory will be displayed in a raw form. You can use the up/down arrows (OA increments by 10) or the +-keys to move between the frames. The command has no effect if no frames have been captured.

T: Transmit single test frame

Depending on the current setup, a raw Apple II test frame will be generated and sent out on the local network with the current destination address. The test frame can be addressed to a dedicated Ethernet address (single computer) or to all computers (broadcast) participating on the local network. See menu option D.

X: Transmit test frames continuous

Same as above, however the test frame gets sent out again and again until you press a key to abort.

For the T and X commands you want to use a frame analyzer to see that packets have been received by the destination computer(s). The test frames have no effect on the protocolized applications on your destination computer, they will simply be ignored (hmm, maybe a badly programmed TCP/IP stack may cause a crash).

D: Toggle Destination Address Mode (broadcast or dedicated)

If the destination address is broadcast, this means that the controller generates an address of FF-FF-FF-FF-FF-FF for the frames to be sent out.

If the destination address is dedicated, the LANceGS controller uses the address displayed on the menu line below the D menu item for generating outgoing frames.

A: Only for the transmit frames test, a location in nonvolatile memory is reserved to store the destination MAC address of your favorite computer. The default address gets loaded from nonvolatile memory at startup. You can modify this address and even save it in memory with the menu option S. This address will also be used in the Echo Test program.

O: Store destination address in nonvolatile memory

Not much to say. Again, this is a MAC address, not an IP address, and it is only used for sending out test frames.

S: Selftest

Does a comprehensive input/output test on the LANceGS hardware level. This verifies the basic bus communication functions to/from registers including transfers to/from nonvolatile memory. The test runs forever if no errors are found. Pressing any key will cause the test to stop after a full test cycle (pass) has been completed.

L: Loopback Test

The test requires your LANceGS card be connected to an Ethernet hub. At this time it is unknown whether the test can be performed with an Ethernet switch (no equipment for tests available). You need to assure that the hub is only connected to your LANceGS card, or by means of powering down all other participants to disable any "foreign" traffic on the local network.

The test continuously sends out a special Apple II test frame on the network and waits for getting it back on the receive channel. Receiving its own frames is possible because the Ethernet medium is common to all participants on the network, including our own computer. The frame received is compared to the frame sent out and an error message will be displayed if the frames are not equal. The test runs forever until an error occurs or it is stopped by a keypress.

If there are "foreign" frames on the local network, the test will immediately show up with an error message, because the comparison fails. In loopback mode there is no way to distinguish the own test frame addresses from other addresses.

I: Display hardware information

Various information stored in nonvolatile memory will be displayed, including your LANceGS' own hardware address, which sometimes in a test will be required for addressing from another computer.

P: Setup Default IP Addresses

A sub-menu will be presented where you can set up all addresses that may be required for full Ethernet and Internet access.

As already outlined before, currently only the item "own IP address" is required for setting up the LANceGS correctly. The items "destination IP address", "subnet mask" and "default gateway" have been implemented but do not take effect at this time. Later versions of Marinetti may take usage of the additional addresses.

Also, the destination IP address usually is set up by the user application which calls the Marinetti TCP/IP stack.

Q: Quit program

Do I need to explain this?

# Using the IPTools Program

**Purpose:** Testing low-level IP communication with another computer.

**What you need to know:** The IP addresses of your Apple II and your other computer(s).

**Special requirements:** at least one second computer on your local network with TCP/IP running.

If you have problems letting your Apple communicating with other computers, the first step would be to investigate the low-level part of IP, just at the point where communication between two nodes begins. This is where the IPTools program will help.

## What is ARP?

ARP means address resolution protocol, this is a protocol implementation (on most operating system implemented in the TCP/IP stack) to make the link layer know which MAC address it has to use for sending a certain IP packet with known IP address out on the network. In other words, this is a means of translation for IP addresses to physical addresses (protocol addressing to Ethernet addressing).

ARP also can be considered as a ping mechanism on the lower level: an ARP initiator sends out a request to all participants (by means of a broadcast message) on the network with the question: who has IP address aa.bb.cc.dd. The request will be received by all participants, but only the one which has the address aa.bb.cc.dd must respond, telling the requester that it has the MAC address uu-vv-ww-xx-yy-zz. Only after this reply the requester knows how to address IP packets on the Ethernet level (MAC destination address for the given IP address). Any further IP packets with the same IP address following now are known that they have to be sent to this MAC address, until the IP destination address changes.

The mechanism described here can be verified by using the IPTOOLS program. It is a tool to verify that the TCP/IP implementation on your destination computer(s) react(s) to the activities coming from your Apple II computer equipped with a LANceGS card.

A: ARP request with default IP address

You know the IP address of the computer to communicate with. Enter this address by using menu item "D" to setup the default address in this program. After pressing "A" you will see a message which displays the important parameters of the ARP request message that has been sent out. The program waits for a while to receive an ARP reply and either shows an error message or displays the ARP data which it has received. The important part of this data block can be found in line 2, sender's MAC address. This is the MAC address of your destination computer which just has been detected.

B: ARP request with modified IP address

Same as above, however you will be prompted for input of a destination IP address.

R: ARP request scan using IP address range

Using this menu item you can scan your local network for Ethernet nodes being active and having TCP/IP running.

E: Send reply to echo requests coming in

This is the opposite side of an ARP request, an ARP reply. This menu item allows you to simulate a TCP/IP node running which can respond to ARP requests (but nothing else). The program waits "forever" for incoming packets an sends out a proper ARP reply if it has found an ARP request. For this test you would use Ping on your other computer:

If you already have had communication on the IP level, first clear the ARP table on your destination computer:

  ARP -D aa.bb.cc.dd    (example for Windows command shell)

  where aa.bb.cc.dd is the IP address of your Apple you have set up.

Then, use the Ping request on your other computer (which forces an ARP request by the TCP/IP stack):

  PING aa.bb.cc.dd       (example for Windows command shell)

You will not see a successful Ping execution, however the TCP/IP stack invisibly has generated the ARP request in the background. You can see it on the Apple screen if it has sent a reply.

P: Ping request

Basically does the same as a regular Ping application which has to use the TCP/IP stack implementation. We are doing this here without any TCP/IP presence. The program first performs an ARP request to find out the destination hardware (MAC) address, then generates the appropriate ICMP message "Echo Request" (Ping) on the IP packet level, sends it out and waits for an echo reply from the destination computer. This will be done five times with incrementing packet identifiers. The processing and the results will be displayed. You need to setup the IP address for your destination computer to call, or the Ping request will fail.

This is a very good test if you are not sure whether your TCP/IP application and Marinetti works correctly and whether your destination computer is capable for TCP/IP communication at all.

The remaining menu option should be trivial and self-explanatory.

Q: Quit program

Do I need to explain this?

## Using the Echo Test Program

**Purpose:** Testing Low-level communication on a raw Ethernet frame basis between two Apple II computers equipped with a LANceGS card.

**What you need to know:** The MAC (Media Access Controller) address, also known as "hardware address" of the destination computer's LANceGS card (see info menu item in LANCETST.SYSTEM)

**Special requirements:** at least one second Apple IIe or Apple IIGS computer on your local network equipped with a LANceGS card, echo test program running on this machine.

The initial purpose for the developer was to prove an error-free communication of the LANceGS card. This tool is provided with the card to give the LANceGS user certainty and the ability to verify correct working at any time. The only drawback is that you need two Apple II computers for performing this verification.

Two Apples will communicate with each other both running the Echo test program. One computer is a server, the other is a client. The server is considered as the responder ("destination" in this context), the client as the requester.

On the destination computer (the server), choose menu item

   R: reply to echo requests coming in

In this mode, the program just echoes incoming (special IIGS Ethernet) frames if they are addressed to its own MAC address.

On the requesting computer, use menu item "T" or "E" to generate an echo request. Before doing this, you need to setup the destination address correctly using menu item "D". Enter the MAC address of your other Apple computer (the server's LANceGS address).

Choosing menu item "E" lets the computer run an infinite loop with requesting and handshaking echoes with the destination computer. The special Apple IIGS frames do have unique frame identifiers and checksums which will be compared to the frames being echoed. Any compare error will stop the infinite loop.

If you try to stop the server computer sending out echoes for a short time (press the Space key for pause and continue, try it a couple of times), you can cause an error condition to see that the frames really are compared. After the short break the server still can respond with the current frame in memory, whereas the requesting computer already has incremented the frame identifier, awaiting an echo for _this_ frame. So the requester receives an echo frame with the wrong (older) frame identifier and comes up with a compare error.

--- End of LANceGS User's Manual ---