HP 3000 Series 900 Computer Systems

HP 36923A LAN 3000/XL Link and Terminal LAN Link

Hardware Reference Manual

HEWLETT PACKARD

Hewlett-Packard Company
Roseville Networks Division
8000 Foothills Boulevard
Roseville, California 95678

Manual Part Number: 36923-90001
E1189
Printed in U.S.A.
November 1989

Printing History

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition or a new update is published. No information is incorporated into a reprinting unless it appears as a prior update; the edition does not change when an update is incorporated.

A software code may be printed before the date; this indicates the version level of the software product at the time the manual or update was issued. Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

Edition 1 . . . . . January 1988
Edition 2 . . . . . January 1989
Edition 3 . . . . . November 1989

Notice

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD COMPANY MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard Company.

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

Reader Comment Sheet

HP 36923A LAN 3000/XL Link and Terminal LAN Link

Hardware Reference Manual

36923-90001 November 1989

We welcome your evaluation of this manual. Your comments and suggestions help us to improve our publications. Please explain your answers under "Comments", below, and use additional pages if necessary.

Is this manual technically accurate? ____ Yes ____ No

Are the concepts and wording easy to understand? ____ Yes ____ No

Is the format of the manual convenient in size, arrangement, and readability? ____ Yes ____ No

Comments:

This form requires no postage if mailed in the U.S. For locations outside the U.S., your local company representative will ensure that your comments are forwarded.

FROM: **Date** _____

Name _____

Company _____

Address _____

_____

_____

Fold Fold

No Postage
Necessary
If Mailed
in the
United States

Business Reply Mail

First Class Permit No. 256 Roseville, California 95678

Postage will be paid by addressee.

Editor (R3NB)
Hewlett-Packard Company
Roseville Networks Division
8000 Foothills Boulevard
Roseville, California **95678-6598**

Fold Fold

Safety Considerations

General

This product and related documentation must be reviewed for familiarization with safety markings before operation.

Safety Symbols

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

Indicates earth (ground) terminal. This symbol is sometimes used in the manual to indicate circuit common connected to a grounded chassis.

Warning

The warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

Caution

The caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Static Sensitive Devices

Caution

When any two materials make contact, their surfaces are crushed on the atomic level and electrons pass back and forth between the objects. On separation, one surface comes away with excess electrons (negatively charged) while the other is electron deficient (positively charged). The level of charge that is developed depends on the type of material. Insulators can easily build up charges in excess of 20,000 volts. A person working at a bench or walking across a floor can build up a charge of many thousands of volts. The amount of static voltage developed depends on the rate of generation of the charge and the capacitance of the body holding the charge. If the discharge happens to go through a semiconductor device and the transient current pulse is not effectively diverted by protection circuitry, the resulting current flow through the device can raise the temperature of internal junctions to their melting points. MOS structures are also susceptible to dielectric damage due to high fields. *The resulting damage can range from complete destruction to latent degradation.*

The LANIC card is shipped in a opaque padded shielding bag. The card should be kept in this bag at all times until it is installed in the system. Save this bag for storing or transporting the card. When installing the card in the system, do not touch any components. Hold the card by its edges.

Warning

SAFETY EARTH GROUND – The computer in which this product is installed is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety ground must be provided from the main source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, or before the power cord is removed from the wall receptacle, the interface cable connector must be removed from the computer system and insulated from exposed conductive surfaces.

Warning

At infrequent intervals, exposed metal surfaces of the interface cables may be subject to transient hazardous voltages due to strong electrical disturbances (such as lightning or disturbances in the electrical utilities power grid) in the area surrounding the network to which this product is connected. These surfaces should be handled with caution, especially when the interface cables are not connected to a properly grounded computer system.

Servicing

Warning **Any servicing, adjustment, maintenance, or repair of assemblies or subassemblies of the computer system must be performed only by qualified personnel.**

Warning **This product is not designed for attachment to a network serving an area which contains multiple unconnected power system safety grounds. Before installing this product, verify that all of the power system safety grounds are securely interconnected in the area served by this local network. Special caution should be taken for cable systems run between buildings or exposed to weather environments.**

Warning **Do not connect this product to an ungrounded "thick" network coaxial cable defined by this manual.**

FCC Notice

For U.S.A. Only

The Federal Communications Commission (in 47 CFR 15.838) has specified that the following notice be brought to the attention of the users of this product.

FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFACE STATEMENT

Warning: This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Sub-part J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: re-orient the receiving antenna; relocate the computer with respect to the receiver; move the computer away from the receiver; plug the computer into a different branch circuit. If necessary, the user should consult the dealer or authorized field service representative for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

Note

User modification or fabrication of device connection cables, or connection to other than HP supplied MAU may invalidate RFI certification on the user's system.

Preface

This manual is the hardware reference manual for the LAN Interface Controller (LANIC) card and card connector cable used with either:

- **The HP 36923A LAN 3000/XL Link**
  This link provides the connection for an HP 3000 computer to a local area network for system-to-system communication. The complete link product consists of the LANIC card and cable, a Medium Attachment Unit (MAU), software, this manual and the appropriate software manuals. HP 36923A product options (described in chapter 1 of this manual) allow you to order different hardware combinations, for connection to the various network cabling now available. Note that the HP 36920A Network Service product provides the necessary network software for the use with the LAN 3000/XL Link.

- **The Terminal LAN Link**
  This link provides the connection for an HP 3000 computer to a local area network for system-to-workstation communication. This link is automatically provided with your HP 3000 Series 900 computer and therefore has no product number. The link includes the LANIC card and cable, and a ThinMAU and ThickMAU.

This manual is organized as follows:

Chapter 1 – General Information
Chapter 2 – Site Preparation
Chapter 3 – Installation/Configuration
Chapter 4 – Functional Description
Chapter 5 – Removal and Replacement
Chapter 6 – Troubleshooting
Chapter 7 – Replaceable Parts
Chapter 8 – Reference
Appendix A – HP 28641A ThinMAU
Appendix B – HP 30241A Thick MAU
Appendix C – HP 28664A Twisted-pair MAU
Index – Cross-reference Index

Contents

Chapter 1 General Information

Product Overview 1-1
- Connection to the Host 1-1
- Connection to a LAN 1-1
- Software 1-1

Link-Level (Node) Address 1-2
Identification 1-2
- The Product 1-2
- Interface Card 1-3
- Manuals 1-3

Specifications 1-4
- Features 1-4
- Physical Characteristics 1-4
- Environmental 1-4
- Power Requirements 1-4

Support Strategy 1-5
Test Equipment and Special Tools 1-5
Equipment Supplied 1-6
- LAN 3000/XL Link 1-6
- Terminal LAN Link 1-7

Chapter 2 Site Preparation

Chapter 3 Installation / Configuration

Inspection 3-2
- Observe Anti-Static Precautions 3-2
- Repacking 3-2
- Storage 3-2

Power Requirements 3-3
Determining the Link-Level Address 3-3
SQE Jumper Setting 3-5
Installation 3-6
- Installing the LANIC Card 3-6
- LAN Node Connection 3-7
- Installing the Cables 3-8

Start-up and Verification 3-8

Chapter 4 Functional Description

Microprocessor 4-2
System Interface 4-2
Memory Registers 4-2
Network Interface 4-3
Bus Arbiter 4-3

Chapter 5 Removal and Replacement

LANIC Card and Connector Cable 5-1
- Removing the Card Connector Cable 5-1
- Removing the LANIC Card 5-2
- Replacing the LANIC Card 5-2
- Replacing the Card Connector Cable 5-2

Replacing Components on the LANIC Card 5-3
- The Fuse 5-3
- NOVRAM or EPROM 5-3

Chapter 6 Troubleshooting

Safety Considerations 6-1
Troubleshooting Strategy 6-1
Maintenance 6-2
- Preventive Maintenance 6-2
- Maintenance Aids 6-2

Local Area Network Device Adapter Diagnostic 6-3
- LANDAD Capabilities 6-3
- Minimum Configuration 6-3
  - Hardware 6-3
  - Software 6-3
- LANDAD Operational Modes 6-4
- Description of LANDAD Sections 6-5
  - Section 2 – Reset 6-6
  - Section 3 – Identify 6-6
  - Section 4 – Local Loopback 6-6
  - Section 5 – Self-test 6-7
  - Section 6 – Status 6-7
  - Section 7 – Link Statistics 6-7
  - Section 8 – External Loopback 6-8
  - Section 9 – Remote Node Test 6-9
  - Section 10 – Remote XID Test 6-9
  - Section 11 – AUI Cable Fault Isolation 6-10
  - Section 12 – Offline MAU Test 6-11

Running LANDAD 6-12
- Example of a Diagnostic Session 6-15

Chapter 7 Replaceable Parts
Ordering Information 7-1
Field Replaceable Units 7-1
Exchange Assemblies 7-2
New Assemblies 7-3
Component Parts 7-3

Chapter 8 Reference
Technical Manual Reference 8-1
Glossary of Terms 8-2

Appendix A HP 28641A ThinMAU
IEEE 802.3 Type 10BASE2 . . . . . A-2
Connecting the AUI Cable A-3
"D" Connectors A-3
Diagnostic Setup A-4

Appendix B HP 30241A ThickMAU
IEEE 802.3 Type 10BASE5 . . . . . B-2
Connecting the AUI Cable B-3
"D" Connectors B-3
Diagnostic Setup B-4

Appendix C Twisted-pair MAU
General Overview C-2
Connecting the AUI Cable C-3
"D" Connectors C-3
Diagnostic Setup C-4

1 General Information

This manual presents installation and reference information for the Local Area Network Interface Controller (LANIC) printed circuit assembly (PCA, also referred to as card) and card connector cable used with HP 3000 Series 900 computers. The LANIC card will be referred to throughout this manual as the LANIC card, the LANIC, the LAN card, or the card. This chapter provides a general overview of the LANIC.

Product Overview

The LANIC connects an HP 3000 Series 900 host computer to a Local Area Network (LAN). With appropriate network software, the host becomes a node on the LAN, and can access and communicate with other nodes.

The LANIC operates with 10 megabit-per-second *baseband* networks using a *Carrier Sense Multiple Access with Collision Detect* (CSMA/CD) protocol for network access. Baseband implies that a single channel uses the entire bandwidth available and is shared by all the nodes on the network. CSMA/CD implies that the nodes gain access to the common channel through a contention process whenever the channel is free of traffic, all without the use of a master node.

Connection to the Host

The LANIC card is an input/output (I/O) card that plugs into the Channel I/O Bus (CIB) of the HP 3000 Series 900 host computer. An 80-pin connector (J1), located on the LANIC card, mates with connector pins on the CIB when the card is inserted into the CIB card cage.

Connection to a LAN

The LANIC is an implementation of the Institute of Electrical and Electronic Engineers (IEEE) LAN standards 802.2 Type 1 and 802.3. These standards define baseband, CSMA/CD LANs which feature burst transfer rates of 10 Mbits per second.

Refer the the appropriate appendix for specific information about your Medium Attachment Unit (MAU).

Software

The LANIC is supported under MPE-XL on HP 3000 Series 900 Computer Systems.

Link-Level (Node) Address

The link-level address, also referred to as the station address, is a 12-digit hexadecimal number that uniquely identifies each node. This address is associated with the Data Link Layer (level 2) of the International Standards Organization (ISO) Open Systems Interconnection (OSI) model, and should not be confused with "internet" or other addresses associated with higher layers. During normal node operation, the destination address of a received packet is matched with this address to determine whether or not the packet is accepted for processing. In addition, the node's station address is inserted in transmitted packets for source node identification.

The station address is assigned at the factory and stored in the card's NOVRAM (non-volatile, static RAM). It is globally administered, that is, it is a unique node address regardless of manufacturer. Refer to chapter 3 to determine the address of your LANIC card.

The node's station address is changed if the NOVRAM is physically replaced. If the address changes, software reconfiguration and documentation updates for your network may be necessary.

Identification

The Product

Up to five digits and a letter (36923A in the case of the LAN 3000/XL) are used to identify Hewlett-Packard products. The digits identify the product; the letter identifies the revision level of the product.

Interface Card

The card supplied with the product is identified by a part number printed on a white sticker affixed to the card. In addition to the part number, the card is further identified by a letter and a 4-digit date code (e.g., A-1234). This designation is placed below the product number. The letter identifies the version of the etched circuit on the card. The date code (the four digits following the letter) identifies the electrical characteristics of the card with components mounted. Thus, the complete part number on a card could be as follows:

5062-3313
A-1234

Note

Note that the date code on your card will be the current revision of the assembly, not the number in the above example.

Manuals

The hardware reference manual (this manual) supplied with the product is identified by name and part number. The name, part number, and publication date are printed on the title page of the manual. If the manual is revised, the publication date is changed.

Specifications

Features

Capacity:	Single half-duplex (transmit and receive) communication channel with up to 64 Kbytes of RAM for buffering both receive and transmit packets.
Transmission Mode:	CSMA/CD, bit serial, Manchester encoded, variable packet size from 64 to 1518 bytes.
Data Transfer Rate:	Transmitted in bursts of 10 Mbits per second. Throughput capacity is processor and process dependent.

Physical Characteristics

Size:	19.3 cm by 17.1 cm by 1.59 cm (7.6 in. by 6.75 in. by 0.75 in.)
Weight:	280 grams (10 ounces)
I/O Channel Interconnect:	One 80-pin female connector (J1) connects to the host computer's Channel I/O Bus (CIB).
Device Interconnect:	One 26-pin male connector (J2) connects to a card connector cable.

Environmental

Operating:	0° to +55° Celsius
Non-Operating:	-40° to +75° Celsius
Electromagnetic:	Conforms to VDE Level B, and FCC Level A for radiated and conducted interference.

Power Requirements

Voltage	Current (amps)	Power (watts)
+5V	3.00	15
+12V	0.50	6

The +12V is passed through the LANIC to the MAU. The LANIC does not use the +12 power itself.

Support Strategy

If the LANIC card, MAU, or cables fail, they must be replaced. A defective LANIC card can be returned to Hewlett-Packard for repair. (For instructions on returning a card for repair, refer to the section *Exchange Assemblies* in chapter 7.) The MAUs, coaxial tap, BNC "T" connector, and cables are not repairable, and must be replaced with new assemblies on failure.

Note

User modification or fabrication of device connection cables or connection to other than HP-supplied MAU may invalidate RFI certification on the user's system.

Test Equipment and Special Tools

The following items are available from Hewlett-Packard for testing the LAN node:

- HP 92257B MAU Test Fixture
- HP 92257Q ThinMAU Test Fixture
- HP 5061-4977 Twisted-pair MAU Loopback Connector

The above test fixtures can be obtained from the nearest Hewlett-Packard Sales and Support Office. In addition, the above items are available from the Hewlett-Packard Direct Marketing Division.

Equipment Supplied

The following lists equipment supplied with either the HP 36923A LAN 3000/XL Link or the Terminal LAN Link.

LAN 3000/XL Link

Standard equipment supplied with the HP 36923A LAN 3000/XL Link is operationally compatible with the IEEE 802.3 standard. Included are the following:

Part Number	Description
5062-3313	LANIC Card Assembly
36923-90001	This manual
27125-63009	LANIC Card Connector Cable (Stub Cable)
28641-60004	ThinMAU (Medium Attachment Unit)
28641-90001	ThinMAU Installation Manual
1250-0781	BNC "T" Connector
1252-1650	BNC "T" Connector cover

The HP 36923A LAN 3000/XL Link also includes the appropriate Link software manuals. For a listing of these manuals refer to the "Technical Manual Reference" section of chapter 8.

Option #142 – Deletes the ThinMAU and adds a Twisted-pair MAU

Option #200 – Right to use with HP 3000 Series 925

Option #242 – Deletes the ThinMAU and adds a ThickMAU

Option #300 – Right to use with HP 3000 Series 930

Option #330 – Right to use with HP 3000 Series 935

Option #340 – Right to use with HP 3000 Series 955

Option #400 – Right to use with HP 3000 Series 950

Terminal LAN Link

The Terminal LAN Link is automatically supplied with your HP 3000 Series 900 computer. Equipment supplied includes the following:

Part Number	Description
5062-3313	LANIC Card Assembly (installed)
27125-63009	LANIC Card Connector Cable (Stub Cable)
30241-60102	ThickMAU (Medium Attachment Unit)
92254A	6-meter AUI Cable
0362-0819	Coaxial Tap
28641-60004	ThinMAU
1251-0781	BNC "T" Connector
1252-1650	BNC "T" Connector Cover
36923-90001	This Manual
28641-90001	ThinMAU Installation Manual

2 Site Preparation

Because the 36923A is part of an HP 3000 Series 900 Computer System, this manual assumes that all computer-level site preparation procedures have been followed and that the appropriate cabling has been installed for your type of LAN network.

Furthermore, it is assumed that the HP LAN 3000/XL operating system and NS/3000 LAN software has been installed in the computer. For installation information, refer to your system manuals.

3 Installation / Configuration

This chapter contains the following information for the HP 36923A:

- Inspection
- Repacking
- Storage
- Voltage requirements
- Cabling information, including pinouts
- Installing the card and cables
- Start-up and verification

Caution

Some of the components used in the LANIC card are susceptible to damage by static discharge. Refer to the safety considerations information at the front of this manual before handling the card. The card is shipped in an opaque padded shielding bag. The card should be kept in this bag at all times until it is installed in the computer system. When handling the card outside of this bag, do not touch any components. Hold the card by its edges.

Note

The LANIC card used with the Terminal LAN Link will already be installed in the System Processor Unit (SPU) when your computer system arrives. It will not be necessary to install this LANIC card, but you will be required to install the cables.

Inspection

After unpacking the LANIC product, keep the shipping carton and packing materials. These items will be useful in case any item has to be returned to Hewlett-Packard at some future date. If you notice evidence of damage when you open the carton containing the LANIC product, inspect all items carefully. If any item appears to be damaged, notify the nearest Hewlett-Packard Sales and Support Office.

If any item does not meet specifications, or if the LANIC does not pass the start-up and verification procedures described later in this chapter, notify the nearest HP Sales and Support Office immediately. Retain the shipping carton and packing material for the carrier's inspection. The HP Sales and Support Office will arrange for repair or replacement of the defective item without waiting for any possible claims against the carrier to be settled.

Observe Anti-Static Precautions

Once you are satisfied there is no damage to the card or any of the other items, remove the card from the opaque padded shielding bag and place it on a clean, anti-static work surface. (The bag is acceptable for this purpose, if you do not have a special work area set aside.)

Use a grounding wrist strap to channel your own static charge safely to ground. Avoid working on a carpet. Reduce unnecessary movements. These precautions will help prevent static buildup that might damage your card.

Repacking

Caution Be sure to observe anti-static precautions.

If it ever becomes necessary to repack any item for reshipment, use the original carton and packing material, if available. If the original material is not available, good commercial packing material should be used. Commercial packing and shipping companies have the facilities to repack the items for shipment.

Storage

If the LANIC card is to be stored, it should be placed in the original padded shielding bag used for shipping. If the original bag is not available, use one of equivalent quality and size. It is also a good idea to enclose the card and bag in the original shipping carton (or a similar carton if the original one is not available). No special containers are required to store the cable(s) or the MAU.

Power Requirements

The LANIC draws its power from the host computer through the backplane. Power requirements for the LANIC are listed in the "Environmental" section of chapter 1, and summarized below:

+5V @ 3A; +12V @ 0.5A

Any power limitations imposed on the computer by the addition of a LANIC card is system dependent. Consult the I/O configuration guidelines for your particular system.

Determining the Link-Level Address

The link-level address is a unique node identifier used for selective address filtering of LAN data packets. This address is represented by a 12-digit hexadecimal number. From Hewlett-Packard, this address is globally administered; it is unique across manufacturers. The first six digits are:

$08\ 00\ 09_{HEX}$

The second six digits are marked on the LANIC card's NOVRAM (non-volatile static RAM) in the following form:

$hh\ hh\ hh_{HEX}$

Thus, the complete link-level address might be $08\ 00\ 09\ 00\ 3E\ E9_{HEX}$.

The NOVRAM is an integrated circuit (IC) mounted in a dual in-line package. Refer to figure 3-1 for approximate location.

It is recommended that the link-level address be entered in a network manager's *logbook*. This logbook should be maintained to promote orderly network changes and additions. All pertinent information should be included, including such items as a network map showing node connection locations, internet addresses, link-level addresses, node names, software directory files, etc.

Note that the link-level address is changed whenever the NOVRAM is physically replaced (should the need arise).

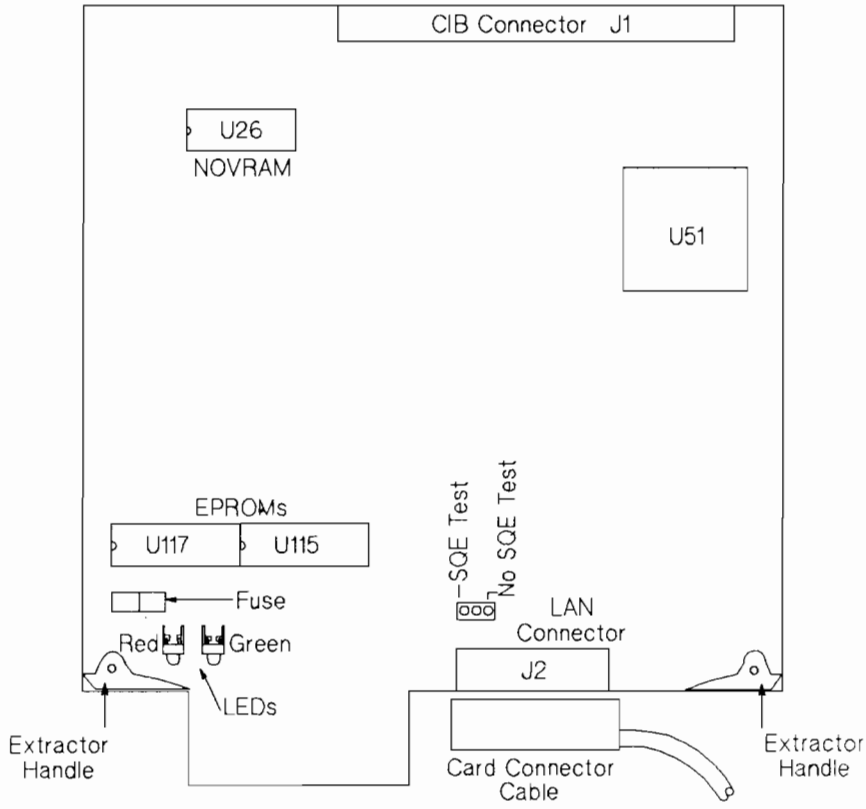

Figure 3-1. LANIC Card Key Component Locations

SQE Jumper Setting

The card contains a three-post SQE (Signal Quality Error) jumper located directly behind the LAN Connector (J2) as shown in figure 3-1. The placement of the shorting clip will determine if the SQE Test function is *enabled* or *disabled*. The SQE test function is an implementation of the IEEE 802.3 standard.

A jumper shorting clip is installed at the factory in the "SQE TEST" position which *enables* the SQE test signal. As you hold the card by the extractor handles, the shorting clip is positioned on the left side of the three-post jumper, figure 3-2. All IEEE 802.3 installations should have the jumper in this position.

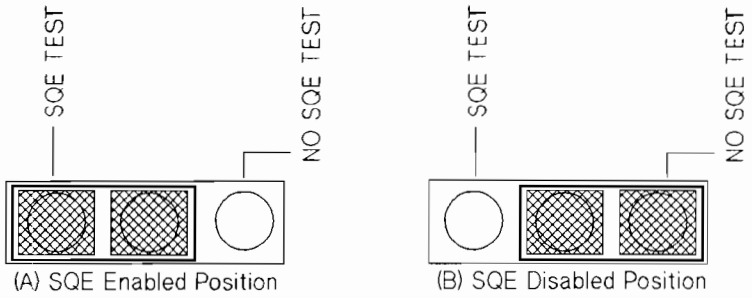

Figure 3-2. SQE Test Jumper Position

Installation

The general procedures for installing an interface card are described in your computer system installation manual. You should refer to your system manual before performing the steps below.

Installing the LANIC Card

Note

If you have an HP 3000 Series 900 computer, a LANIC card is already installed in your system. In this case, the LANIC is part of the Terminal LAN Link.

Caution

All system power must be off before attempting to install the LANIC card.

Perform the following steps to install the LANIC card:

1. If the system is in operation, log in at the system console and shut down the operating system. Refer to the *System Administrator's Quick Reference Guide*, furnished with your computer system, for information on shutting down the system).
2. Turn off power to the host computer system.
3. Install the LANIC card in the proper slot of the CIB card cage. Refer to the *Installation and Configuration Guide* furnished with your computer system.
4. Do not turn on computer power until the cables have been installed (see the following paragraphs). You should verify that all LAN connections for this node are correct.

LAN Node Connection

This manual assumes that the LAN cable and cable connectors have been installed for this LAN node. LAN cable and connector installation information for your type of LAN can be found in the following:

- *LAN Cable and Accessories Installation Manual* (coaxial cable LANs)
- *Twisted-pair Cabling Installation Guide* (unshielded twisted-pair LANs)

Warning

The MAU and cabling to the LANIC card must all conform to the IEEE 802.3 standard. Failure to comply will result in incompatible grounding and an electrical shock hazard.

Table 3-1. LANIC Card Connector Cable Pin Assignment

26-pin Card Connector Pin Number	Signal Name	15-pin Connector Pin Number
1A	Chassis Ground	1, 4
1B	Collision (–)	9
2A	Collision (+)	2
2B	Chassis Ground	1, 4
3A		
3B	Transmit (–)	10
4A	Transmit (+)	3
4B	Drain	
5A	Chassis Ground	1,4
5B		
6A		
6B	Receive (–)	12
7A	Receive (+)	5
7B		
8A	Chassis Ground	1, 4
8B	Power	13
9A	Power Return	6
9B		
10A		
10B		
11A		
11B		
12A		
12B		
13A		
13B		
Plate GND		
Contact GND		
Foil shield on each twisted pair.		

Installing the Cables

Use cable part number 27125-63009 (furnished with the standard HP 36923A product). Install this cable by connecting the 26-pin connector to the LANIC card. The cable pin assignment for this cable is shown in Table 3-1.

For AUI cable connection procedures, refer to the appropriate appendix for your MAU.

Start-up and Verification

Once you are sure that the card and all cables are installed correctly, start up the system by turning on computer power.

The LANIC card contains a self-test in EPROM. This self-test is initiated whenever the card is reset (for example, during the system power-up and booting process, or upon command from the LAN diagnostic).

While the self-test is running, a red LED on the LANIC card (see figure 3-1 for approximate location) will light for approximately two seconds, then go out if the card passes self-test. When the LANIC self-test passes this point successfully, the test continues by checking the cables using an External Loopback Test. If the External Loopback Test fails, meaning that the LANIC is OK but the cable or MAU attachment is defective, the red LED will blink on and off for 32 seconds at 320 millisecond intervals (approximately 50 on-off pairs).

After self-test, the green LED on the card will always be on to indicate that power is applied to the MAU.

If the red LED stays on or if the green LED does not come on, refer to chapter 6, "Troubleshooting".

4 Functional Description

The LANIC is an implementation of the IEEE 802.3 LAN standard and is used to allow HP 3000 Series 900 Computer Systems to communicate with other computer systems over a local area network (LAN). The IEEE 802.3 LAN standard defines a bus utilizing CSMA/CD (Carrier Sense Multiple Access/Collision Detect) as the access method.

The link consists of a LAN Interface Controller, interface cables, and Medium Attachment Unit (MAU). The MAU connects to a LAN cable for transmission and reception of signals on the LAN; the interface cables connect the MAU to the LANIC; and the LANIC provides the interface between the LAN and the computer system.

The LANIC is an intelligent DMA channel which communicates with the host system via the Channel I/O Bus (CIB). On the network end of the LANIC, the AUI cable carries bit-serial data and control information to and from the MAU, which attaches directly to the network LAN cable. A functional block diagram of the LANIC is shown in Figure 4-1.

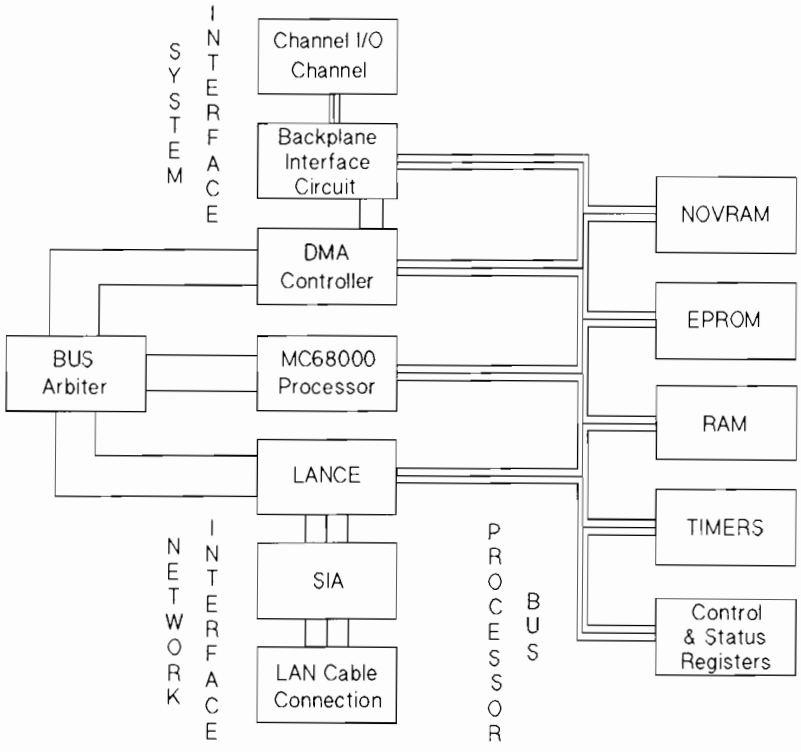

Figure 4-1. LANIC Functional Block Diagram

Microprocessor

A microprocessor provides the local intelligence for controlling the card's activities. Among other things, it executes the system channel I/O bus (CIB) protocol and controls the flow of data from the host computer through the system interface to memory, and through the network interface onto the network cable.

System Interface

The system interface portion of the card contains all the components that transport data between the CIB and card memory.

The primary components are the Direct Memory Access (DMA) Controller and the Backplane Interface Circuit (BIC) chip. The BIC is a custom gate array that provides all control signals needed for interfacing to the CIB. The DMA Controller is used to transfer data quickly between card memory and the CIB with minimal microprocessor control.

Memory Registers

Sixteen Kbytes of EPROM provide program storage of firmware for the microprocessor.

Thirty-two Kbytes of static RAM serve as the primary location for data interchange. The RAM stores incoming and outgoing data packets, provides the processor with stack and variable space, and provides processor communication paths with the DMA Controller and the LANCE (described below).

A 32-byte NOVRAM (nonvolatile static RAM) stores the link-level (node) address of the card and other configuration parameters that must be retained after power-down.

Two timers, using a 10-MHz crystal-controlled reference, are used. One timer generates an interrupt to the microprocessor every 10 milliseconds for timing various software functions. The other timer interrupts the microprocessor whenever the LANCE has been continuously transmitting for more than 4 milliseconds, which exceeds the time required to transmit a legal packet size.

A Control register is used to control the operation of the NOVRAM, the timers, and the self-test LED. A Status register stores information that indicates power available to the MAU and transmission error information.

Network Interface

The network interface consists of components that exchange data with memory, encode/decode data for transmission/reception, and transmit/receive data on the cable.

A Local Area Network Controller for Ethernet (LANCE) chip performs the link-level functions for an IEEE 802.3 or Ethernet node. For transmission, these include: deference, random back-off and retry, parallel-to-serial conversion, and CRC (cyclical redundancy check) generation. For reception, these include: address filtering, serial-to-parallel conversion, and CRC checking.

A Serial Interface Adapter (SIA) chip performs Manchester encoding and decoding of the serial data stream. It recovers a receive clock from the incoming data, and creates a transmit clock via a crystal oscillator (external to the chip). In addition, it interfaces TTL (transistor/transistor logic) signals of the LANCE and the differential signals of the attached cable.

Bus Arbiter

Since more than one device can assume control of the processor bus (e.g., DMA Controller, microprocessor, LANCE), the bus arbiter monitors bus requests and determines which device will gain bus access. The LANCE is given the highest priority to minimize the number of packets lost due to unavailable resources. If either the microprocessor or DMA Controller has the bus, and the LANCE requests it, the bus will be released after completing the current bus cycle.

5 Removal and Replacement

This chapter contains removal and replacement procedures for the LAN 3000/XL Link. These procedures are limited to the LANIC card, the LANIC card connector cable, and the fuse, NOVRAM, and EPROMs on the LANIC card. Refer to the appropriate MAU appendix for AUI and MAU removal and replacement information.

Caution Power must be off to the computer system before attempting to remove the LANIC from the system.

Caution Some of the components used on the LANIC card are susceptible to damage by static discharge. Refer to the safety considerations information at the front of this manual before handling the LANIC card. When handling the card, do not touch any components. Hold the card by its edges.

LANIC Card and Connector Cable

Removing the Card Connector Cable

Remove the card connector cable (stub cable) as follows:

1. Shut the operating system down and turn computer system power off.
2. Remove sheet metal covers from the card cage.
3. Disconnect the cable from connector J2 on the LANIC card.
4. Disconnect the 15-pin D connection between the card connector cable and the AUI cable.

Removing the LANIC Card

Remove LANIC card as follows:

1. Shut the operating system down and turn off power to the computer system.
2. Remove sheet metal covers from the card cage.
3. Disconnect the cable from connector J2 on the LANIC card.
4. Remove the card by grasping the extractor handles on each side of the card, and pulling the handles toward you. Once the card starts out of the card cage, pull it all the way out using the extractor handles.

Replacing the LANIC Card

Note

If you are replacing a defective card with an exchange assembly, be sure to remove the EPROMs from the defective card and install them on the exchange assembly before installing the new card. Be sure to observe anti-static precautions as described in chapter 3.

Replace the LANIC Card as follows:

1. Be sure the operating system is shut down and the power to the computer is off before installing the card.
2. Insert the LANIC card in the same slot in the CIB from which it was removed. Push on the handles on the outside edges of the card to lock the card in place.
3. Replace sheet metal card cage covers.

Replacing the Card Connector Cable

Replace the Card Connector cable stub cable) as follows:

1. Connect the 15-pin D connector end of the cable to the AUI cable connector. Be sure to slide the clip mechanism so that the connectors are locked together.
2. Connect the cable to connector J2 on the edge of the LANIC card.

Replacing Components on the LANIC Card

Replaceable components on the LANIC card are are limited to the MAU power fuse, NOVRAM, and EPROMs. These components fit into sockets; soldering is not required and may damage the components.

Caution

Removal and installation of card components should be performed at a static-free work station.

The Fuse

Order the 125V, 5A fuse from Hewlett-Packard under part number 2110-0520.

With the component side of the LANIC card up, locate the fuse. Figure 3-1 in chapter 3 shows the approximate fuse location.

Remove the fuse from its socket by gently pulling it free.

Caution

Excessive prying or pressure can damage the fuseholder or the card.

Test the fuse for a broken element using an ohmmeter or continuity tester. The fuse should be replaced if an "open" circuit is indicated. You should always check the fuse first when the green LED is not on and the computer is supplying the LANIC with power.

Installation of a known good fuse simply requires inserting it into the empty fuse socket.

NOVRAM or EPROM

At some point, it may be necessary to replace the NOVRAM or EPROM. For example, NOVRAM or EPROM faults may revealed by card self-test, or EPROM firmware may require updating.

Note that a replacement NOVRAM will contain a new unique link-level address assigned by the factory. When using Hewlett-Packard LAN software, it may be necessary to reconfigure the node onto the network when a new NOVRAM is installed. The node or network logbook must be updated with the new address.

With the component side of the LANIC card up, locate the NOVRAM or EPROM. Refer to figure 3-1 in chapter 3 for approximate location. Part numbers and associated socket locations will be as follows:

Component	1818-4372	1818-4373	27125-81001
Type	EPROM	EPROM	NOVRAM
Location	U115	U117	U26

Remove the component from its socket, without damaging the socket. An IC removal tool reduces any chance of ruining the chip, socket, or board.

Caution

Excessive prying and pressure can damage the socket and component; use great care during removal.

When installing the replacement component, note the half-circle notch located on one end. The notch shows the orientation of the IC, and must be matched with a similar notch on the empty socket. Ensure that the IC pins are aligned with the socket receptacles. It may be necessary to adjust the pins (bow them inward or outward) for proper alignment. Gently press the IC into place to properly seat the pins. If pressure is not applied uniformly, the pins on one side or the other may fold and collapse without properly mating in their sockets. (Note: If this happens, remove the IC, straighten the pins, and try again. If extensive damage occurred, you may need a new chip.)

6 Troubleshooting

All major components of the link are field replaceable units (FRUs) and a troubleshooting procedure is used to identify a defective FRU. Link FRUs include the LAN interface controller (LANIC) card, the LAN card connector cable, and various subassemblies associated with the Medium Attachment Unit.

This chapter summarizes the diagnostic used to identify problems on the link in order to isolate a defective FRU.

Safety Considerations

Warning

Before attempting to remove or replace any card or cable in the system, follow the power down instructions in the system manual. Failure to turn off the power creates an electrical shock hazard, may damage the card or the computer.

Caution

Some of the components used on the LANIC card are susceptible to damage by static discharge. Refer to the safety considerations at the front of this manual before handling the LANIC card. When handling the card, do not touch any components. Hold the card by its extractors or by its edges.

Troubleshooting Strategy

Any malfunction on the LANIC card is remedied on a card exchange basis. To exchange the LANIC card, remove it from the system as explained in chapter 5, and prepare it for reshipment to Hewlett-Packard in accordance with the instructions contained in the paragraph *Exchange LANICs* in chapter 7. Hewlett-Packard Company will neither repair nor exchange cables or MAUs.

Maintenance

Preventive Maintenance

There are no specific preventive measures for the LANIC. When the host computer scheduled maintenance is done, it is a good idea to:

- Check the card connector cable (stub cable) for visible damage and wear
- Check the MAU and the AUI cable for damage and wear.
- Check that the LANIC is properly seated in the card cage.

Maintenance Aids

To test and troubleshoot the LAN 3000/XL Link and Terminal LAN Link, you will need one of the following:

- HP 92257Q ThinMAU Test Fixture (used with the HP 28641A ThinMAU)
- HP 92257B ThickMAU Test Fixture (used with the HP 30241A MAU)
- HP 5061-4977 Loopback Connector (used with the HP 28664A Twisted-pair MAU)

It is helpful to have a set of known good spares to exchange for suspected faulty parts.

Local Area Network Device Adapter Diagnostic

The Local Area Network Device Adapter Diagnostic (LANDAD) is a part of the Online Diagnostic subsystem and is capable of detecting a failure in one or more of the LANIC FRUs.

LANDAD Capabilities

LANDAD can:

- Identify the product type and node address of the LANIC
- Report the status of the LANIC
- Report the link statistics of the LANIC
- Reset the LANIC
- Perform self-test on the LANIC
- Execute a local or external loopback
- Send TEST or XID (exchange identification) packets to a remote node and interpret the results
- Perform AUI cable and MAU fault tests

Minimum Configuration

Hardware

The hardware required to run LANDAD consists of an HP 3000 Series 900 computer, a LANIC, LANIC card connector cable, AUI cable, and a MAU attached to a network (or a terminated loopback hood). Refer to the appropriate appendix for information that applies to your particular MAU.

Software

Required software includes an MPE-XL operating system and the Online Diagnostic subsystem (of which LANDAD is a part).

LANDAD Operational Modes

Before you run LANDAD, make sure the LAN is set up for the test sections you will run. Many sections can be run without affecting the rest of the network, but some go out onto the medium and read or write either to the card you are testing or to other nodes. LANDAD has two different modes as described below:

- **Normal Mode** – LANDAD tests which use this mode will not destroy data on the LANIC, other Network Nodes on the LAN, or other devices on the system. An example of a normal mode test is a request for link level statistics. The sections that run in normal mode are: 1, 3, 4, 6, 7, 9, and 10.

- **Destructive Mode** – Tests using this mode will destroy data on the LANIC and affect other users on the system. If you plan to run tests in this mode, be sure that you are the only system user before you begin. An example of a destructive mode test is self-test, which will bring the LANIC off-line and destroy any data transfer in process. Sections which run in destructive mode are: 2, 5, 8, 11, and 12.

Note

To run a destructive test in LANDAD, you must use the system console or a terminal attached to a different LANIC from the one you want to test.

Description of LANDAD Sections

LANDAD's sections and steps are summarized below, and are briefly described in the following paragraphs. For detailed descriptions of LANDAD sections, refer to the *On-Line Diagnostic Subsystem Manual, Volume 1.*

Table 6-1. LANDAD Section Description

In Default Set?	Destructive or Normal	Section Number	Diagnostic Function
N	D	2	Reset
Y	N	3	Identify
Y	N	4	Local Loopback (to LANIC and back)
N	D	5	Self-test
Y	N	6	Status
N	N	7	Link Statistics Step 71 – Read and decode link statistics Step 72 – Reset link statistics
N	D	8	External Loopback
N	N	9	Remote Node Test
N	N	10	Remote XID Test
N	D	11	AUI Cable Fault Isolation Test
N	D	12	Offline MAU Test Step 121 – Normal Test Step 122 – Error Test

Section 2 — Reset

Reset causes a reset of the LANIC to its "power on" state. All pertinent data needed by the LANIC to operate properly will then be downloaded to the LANIC. If, after a reset of a LANIC that is offline due to bad hardware, the LANIC indicates that it passed its self-test, the LANIC will be put into the online state.

Note

It is better to do a self-test command (section 5) to bring the LANIC back online because it checks status of the LANIC card and displays what has failed if the LANIC is really broken.

If section 2 completes successfully, it will put the LANIC into the online state, even if it is in the offline state when section 2 is called.

Section 3 — Identify

Identify causes a Status command to be issued to the LANIC. This command then decodes the information obtained and displays it in a manner that is informative to the user. This section can be used to determine what the LANIC hardware and firmware date codes are. It is also useful in that if it executes successfully, the path from the diagnostic to the LANIC is at least partially functional.

Section 4 — Local Loopback

Local Loopback transmits a frame addressed to itself. The LANIC will loop this frame on the card and send it back to the diagnostic. This test will test the data path from the diagnostic to the card and back. The data in the frame will be known and a byte-for-byte comparison of the data will be made to be certain that the data was not corrupted. Since the LANIC only loops back the frame if the transmission onto the network medium is successful, this test also checks all components from the network medium to the driver. If the transmission is not successful, LANDAD prints out what it thinks the problem was with the transmission.

Section 5 — Self-test

Self-test tells the LANIC to perform a hardware self-test. If the returned self-test status is abnormal, messages indicating the problem are displayed. Since self-test brings the card offline and aborts all current information transfers, it should only be done when absolutely necessary. Therefore, you will be prompted with a message and asked if the diagnostic should really perform the operation. If you answer yes, the self-test is performed and the results analyzed. If self-test passes, it will put the LANIC into the online state. If message LANDADWARN 6005 is ever displayed, self-test should be run to first determine if the LANIC is functional, and if it is to put the card back online.

Note

If this section completes successfully, it will put the LANIC into the online state, even if it is in the offline state when the section is called.

Section 6 — Status

Status is used to obtain information about the current state of the LANIC.

Section 7 — Link Statistics

Link Statistics allows you to read and display link statistics that the LANIC keeps. It also allows you to reset these link statistics.

This function has two steps: Step 71 is the default step. It reads link statistics from the LANIC and decodes them. To invoke this step, enter:

```
DUI > run landad pdev=X.Y section=7 <RETURN>
```

Where "X" is the system dependent channel address, and "Y" is the slot number. For more details, refer to you *System Administrator's Manual.*

The second function is the reset statistics function, step 72. This function is disruptive since it modifies data on the LANIC. Since step 72 is not a default step, you must enter the following:

```
DUI > run landad pdev=X.Y section=7[72] <RETURN>
```

Step 71 — Read and Display Link Statistics

This step requests link level statistics from the LANIC and displays the statistics.

Step 72 — Reset Link Statistics

This section resets the link statistics on the LANIC.

Section 8 — External Loopback

External Loopback first takes the card offline and then tells the LANIC to perform an external loopback test. This test transmits and receives a frame off the network cable. If this test passes, the following things have a high probability of being functional:

1. This Network Cable Segment

Note

ThickMAUs (30241-60102) and ThinMAUs (28641-60004) with date code A-2735 are unable to detect network cable shorts. To determine if the cable is connected properly, it may be tested with an ohmmeter/TDR.

2. Both 50 ohm terminators
3. The MAU Tap at this node
4. The MAU at this node
5. The AUI cable(s) at this node
6. The card connector cable at this node
7. The LANIC at this node

Note

If this section completes successfully, it will put the LANIC into the online state, even if it is in the offline state when the section is called.

Section 9 — Remote Node Test

A Remote Node test indicates the ability of this node to bounce a packet off another node connected to the network. This is useful for two reasons: First, it illustrates that the node can communicate with a remote node. Second, it can point to upper level software problems. If a frame can be bounced off another node using the diagnostic, but normal NS communications do not work, the problem is not the hardware, it's the upper level software.

1. This section sends an IEEE 802.2 test frame, and you are asked for the length of the test frame. This can be any length from 60 bytes to 1514 bytes. The default is 500 bytes. When a test response frame is received from the remote station, its length is checked for being either a minimum size frame or for being the specified length -0/+1. If the response frame is not a minimum size frame, then the data is compared with the data sent. If the comparison fails, then the test frame part of the test fails.

This section will allow communication only to individual network addresses. If you input a broadcast or multicast address as a response to the Remote Node Address prompt, an error message will be issued and you will be prompted again for a valid remote node address.

Note

The remote node MUST be in the proper state and capable of responding to IEEE 802.2 test frames. For example, some remote systems must have the LANIC device driver installed and operating before test frames will be answered.

Note

This test can be used to check the receive threshold of the MAUs for the two nodes involved in the test. The worst case occurs when the two nodes are the maximum 185 meters apart for ThinLAN (500 meters for ThickLAN).

Section 10 — Remote XID Test

Remote XID Test allows you to send IEEE 802.2 XID command frames to a specified remote node and receive the response frame from the remote node. This section also decodes the response and displays what types of IEEE 802.3 services are available at the remote node.

You are prompted for both the 6-byte remote node address and the 1-byte DSAP of the service on the remote system to which the XID frame should be sent. The addresses that you give must be individual addresses, i.e., they cannot be broadcast or multicast. Should you input one of these illegal addresses, an error message will be issued and you will be prompted again for a valid address.

Section 11 — AUI Cable Fault Isolation

AUI Cable Fault Isolation isolates a broken cable in the AUI cable segment. This is done by repeatedly sending external loopback frames and checking to see if the frame loopback was successful.

To run this section connect a terminated loopback fixture to the end of the stub cable and start the test. Next disconnect the loopback hood at the stub cable, reconnect the stub cable to the AUI cable, and connect the loopback fixture to the other end of the AUI cable. If there are multiple AUI cables, continue doing this until all the AUI cable segments are tested.

If the AUI cable segment passed the test, a "P" is printed. If it did not pass, one of the following fail codes will appear on the screen.

Fail Code	Description
L	Loss of carrier error possible broken AUI cable
R	Retry fault possible bad loopback hood
I	Infinite deferral possible bad loopback hood

Note

As you disconnect and reconnect the loopback test fixture to the different AUI segments, the Loss of Carrier error code (L) will print to the screen when the cable is disconnected.

Note

The last thing that this section does is reset the LANIC. If the reset is successful, the LANIC is put into the online state, even if it is in the offline state when the section is called.

Section 12 — Offline MAU Test

Offline MAU Test provides a way to verify that a MAU is operating properly. In order to run this test, the MAU should be taken off the network cable and the terminated loopback test fixture for your MAU should be attached to it. (See the "Test Equipment and Special Tool" section in chapter 1 for test fixture part numbers.) You then run the first step of the test (Step 121).

1. **Step 121 — Normal Test**
   Follow the instructions issued. The test sends out a group of eight external loopback frames to the MAU. The frames should be transmitted and received successfully.

2. **Step 122 — Error Test**
   Alter the test fixture as per the issued instructions. The test sends eight external loopback frames to the MAU. These should all fail, indicating that Retry Errors have occurred. This step uses the same activity indicators as the AUI Fault Isolation Section.

For detailed instruction to run this test, refer to the *Online Diagnostic Subsystem Manual Volume 1.*

Note

The last thing that this section does is reset the LANIC. If the reset is successful, the LANIC is put into the online state, even if it is in the offline state when the section is called. A subtle side effect also occurs after this test is run. Since the last external loopback frame sent out when running this test fails due to retry faults when using a healthy MAU, any additional status requests (sections 3, 4, 6, 7, 9, 10) will indicate that a retry fault occurred. After you verify that the MAU is functional, you should connect the MAU to a working network and then run section 2, RESET, to reset the retry fault condition.

Running LANDAD

LANDAD is accessed via the Online Diagnostic Subsystem. To bring up the Online Diagnostic Subsystem enter the following command to the MPE-XL prompt:

```
SYSDIAG <RETURN>
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI>
```

To run the diagnostic, enter:

```
DUI> RUN LANDAD pdev=X.Y  <RETURN>
```

Note

pdev is the physical device specifier and represents the physical path of the LANIC card. The pdev entries are system dependent.

If an error (such as no LANIC at the specified device) is detected, the Online Diagnostic subsystem prints an error message. (The LANDAD diagnostic will not output an error message, and will terminate.) The diagnostic now determines if you are at a terminal that is connected to the computer via a Distributed Terminal Controller (DTC) port that uses the LANIC that is to be diagnosed. If the terminal is not connected via such a port, the diagnostic proceeds normally. If you are at a port of this type, the diagnostic checks to see if any destructive sections are specified. If not, the diagnostic proceeds normally. If there are, the following message is displayed:

```
*** WARNING -- DESTRUCTIVE SECTIONS CANNOT BE RUN FROM YOUR TERMINAL.
*** DESTRUCTIVE SECTIONS MAY ONLY BE RUN FROM A TERMINAL THAT IS NOT CONNECTED
*** THROUGH THE LANIC TO BE DIAGNOSED.  THE FOLLOWING SECTIONS CAN
*** BE PERFORMED FROM YOUR TERMINAL: 1,3,4,6,7,9,10.  NO OTHER
*** SECTIONS CAN BE SPECIFIED. (LANDADWARN 6000)
```

This action is taken because all terminal traffic can become deadlocked if the diagnostic were to prompt for information to a DTC-connected terminal. This is because the Online Diagnostic subsystem locks the device whenever a destructive test is specified. Since any prompt for information would not be sent because the LANIC was locked, and thus you would not be able to answer the prompt, the LANIC gets hung. Whenever this message is issued, the diagnostic terminates. In addition, no destructive tests may be performed over a virtual terminal connection (i.e., DSLINE).

At this point, the sections and steps specified by you will be executed and the results output. If you did not specify sections and steps to be run, the default sections and steps will be executed (Sections 3, 4, and 6). If at any time the number of errors generated reaches the limit specified by you in the ERRCOUNT parameter, the following message will be output:

```
*** THE MAXIMUM NUMBER OF ERROR MESSAGES HAS BEEN EXCEEDED (LANDADERR 99)
```

The diagnostic will then terminate. If the ERRPAUSE parameter of the run command was assigned to "on", the diagnostic will stop after each error is generated and ask if the test should be continued:

```
Do you wish to continue ([Y]/N)?
```

If the response is "Y", the test will resume (if possible); if the response is "N", the diagnostic will terminate. If the sections and steps specified by you were executed the number of times specified in the LOOP parameter of the run command without the number of errors exceeding the ERRCOUNT value, the diagnostic will terminate normally.

At any time that the diagnostic is prompting for information, you may enter "exit" to terminate the diagnostic. Either the entire word or only the first letter of the word "exit" need be entered, in either upper or lower case. If you exit in this manner, the following message is displayed:

```
Exiting LANDAD per user request...
```

Any time that the diagnostic is not prompting for information, you may enter an interrupt character (Control Y). When the diagnostic detects the interrupt, one of two actions will occur. If the diagnostic has not bound to the driver, it will print the following message and return control to the Online Diagnostic subsystem.

```
LANDAD suspended per user request...
```

You may then resume the diagnostic. If the diagnostic has started execution, the following message will be printed:

```
Unable to suspend in current state, Aborting LANDAD...
```

At this point, LANDAD will be aborted and control will be returned to the Online Diagnostic subsystem.

Caution

You should never do an "ABORTJOB" on a session running LANDAD when sections 3, 4, 9, or 10 are specified (you may, however, enter Control Y). This can cause the diagnostic to lose functionality the next time the diagnostic is run. For this reason, LANDAD should never be run in background with steps 3, 4, 9, or 10 specified.

Upon termination of the diagnostic, control will return to the Online Diagnostic subsystem.

Example of a Diagnostic Session

The following illustrates running sections 2, 3, 4, and 7 of the diagnostic. User input is shown in this typeface.

```
:SYSDIAG <RETURN>

************************************************************************
******                                                            ******
******                ONLINE DIAGNOSTIC SUBSYSTEM                 ******
******                                                            ******
******             (c)  Hewlett-Packard Co.    198X               ******
******                  All Rights Reserved.                      ******
******                     Version X.XX.XX                        ******
******                                                            ******
************************************************************************


DUI > run landad pdev=X.Y section=2,3,4,7 <RETURN>

************************************************************************
******                                                            ******
******           LANDAD LAN Device Adapter Diagnostic             ******
******                                                            ******
******           (c)  Hewlett-Packard Co.  198X                   ******
******                  All Rights Reserved.                      ******
******                     Version X.XX.X.XX                      ******
******                                                            ******
************************************************************************


Welcome,  Today is Wed Nov 04 11:01:19 198X

A destructive section has been selected.
Do you wish to continue (Y/N) [N]? Y
```

```
Section2  Reset

Endof Section2  Reset

Section3  Identify

    CIO card ID byte = $06 (LANIC)
    Hardware Revcode = 4
    Hardware Datecode = 2512
    Firmware Datecode  = 2620
    CIO Firmware ID = 1
    NOVRAM (Permanent) station address =       $08-00-09-00-3E-E9
    RAM (Currently Active) station address =   $08-00-09-00-3E-E9
    DAM Revcodeec = $A0407001

Endof Section3  Identify

Section4  LocalLoopback

    Binding to DAM...
    Sending data to LANIC...
    Receiving data from LANIC...
    A frame has been successfully transmitted onto the Network Media
    Path to LANIC is functional.

End of Section4  LocalLoopback
```

Note LANDAD will return the hardware date and revision codes and the firmware date code currently valid on your board.

```
Section 7  Link Statistics

    Step 71  Read and Display Link Statistics
    Link level statistics have been read successfully.

    Transmit Statistics
      TOTAL frames transmitted without error . . . . . 1
         Deferred transmits . . . . . 0
         One collision transmits . . . . . 0
         More than one collision transmits . . . . . 0
      TOTAL frames NOT transmitted . . . . . 0
         Retry error . . . . . 0
         Late collision . . . . . 0
         Loss of carrier during transmit . . . . . 0
      No heartbeat detected after transmission . . . . . 0
      No free transmit buffers . . . . . 0
      TDR of last retry error . . . . . 0
      LANCE restarts . . . . . 0
    Receive Statistics
      TOTAL frames received without error . . . . . 1
      Frames rejected by address filter . . . . . 0
      Frames rejected due to CRC errors . . . . . 0
      Frames rejected due to alignment errors . . . . . 0
      Frames rejected due to oversize length . . . . . 0
      LANCE indicated one or more frames lost . . . . . 0
      No free receive buffers . . . . . 0
    End of Step 71  Read and Display Link Statistics

End of Section 7  Link Statistics

LANDAD Exiting...
LANDAD (PIN 34) has just terminated.
DUI > E <RETURN>
```

7 Replaceable Parts

This chapter contains information on replaceable parts for the HP 36923A. The following information is included:

- How to order parts for the 36923A
- Field Replaceable Units (FRUs) for the 36923A
- Information for exchanging the LANIC card
- Information for exchanging the MAU

Note Customer repair of the LANIC card is not recommended. Customers who perform unauthorized component level replacement will invalidate the 90-day warranty and render the card ineligible for exchange.

Ordering Information

Some of the replaceable parts (also known as field replaceable units, or FRUs) qualify for the HP exchange program, that is, the units can be exchanged for refurbished assemblies. Those FRUs that cannot be exchanged, can be ordered as new parts.

To order replacement or exchange FRUs, consult your HP Support Representative.

Field Replaceable Units

The HP 36923A FRUs consist of the LAN interface controller (LANIC) card, the LANIC card connector cable, the attachment unit interface (AUI) cable, the medium attachment unit (MAU), the ThinMAU BNC "T" connector or the ThickMAU coaxial tap.

Exchange Assemblies

Table 7-1 provides a list of exchange assembly part numbers.

Table 7-1. Exchange Assembly Part Numbers

HP Part Number	Exchange Assembly Part Number	Description
5062-3313	5062-3331	CIO LANIC Card

If the LANIC PCA (printed circuit assembly, or card) is to be returned to Hewlett-Packard for service or repair, remove the firmware EPROMs (U115 and U117), attach a tag to the card identifying the owner and indicating the type of service or repair to be accomplished. Include the part number and date code of the card.

Note

The firmware EPROMs (U115 and U117) must be removed from the LANIC card before it is returned for service or repair. The EPROMs are *not* included with the exchange assembly.

Refer to the "Repacking" section in chapter 3 for repacking instructions.

New Assemblies

Those FRUs that cannot be exchanged can be ordered as new parts. Table 7-2 provides a list of new assembly part numbers.

Table 7-2. New Assembly Part Numbers

HP Part Number	Description
28641-60004	ThinMAU Assembly (without BNC "T")
28664-60001	Twisted-pair MAU Assembly
30241-60201	ThickMAU Assembly (without tap)
92254E	6-meter Thick AUI Cable *
92254J	5-meter Thin AUI Cable
0362-0818	ThickMAU Coaxial Tap
1250-0781	ThinMAU BNC "T" Connector
5061-4977	Loopback Connector
* Other lengths are available. Consult your HP Support Representative.	

Component Parts

There are only a few LANIC card components which qualify as field replaceable units. These parts are available through any Hewlett-Packard Sales and Support Office. Table 7-3 lists the components along with all the necessary information to order these parts.

Table 7-3. Replaceable Component Parts

Reference Designation	HP Part Number	Description
F1	2110-0520	Fuse
U26	27125-81001	NOVRAM*
U115	1818-4372	EPROM
U117	1818-4373	EPROM
*Note: A new NOVRAM will have a new Station Address.		

8 Reference

This chapter contains a list of other technical manuals and related documents which will be of assistance to you, and a glossary of terms.

Technical Manual Reference

Other technical manuals which might be required are listed below:

09740-64013	*Online Diagnostic Subsystem Manual, Volume 1*
28641-90001	*ThinMAU Installation Manual*
28664-90001	*Twisted-pair MAU Installation Guide*
32650-60004	*System Startup and Shutdown Manual*
36920-61004	*NS Cross-System Network Manager's Manual*
36922-61000	*NS3000/XL Local Area Network Configuration Guide*
36922-61002	*NS3000/XL Configuration Planning and Design Guide*
36922-61003	*NS3000/XL Screens Reference Manual*
36920-61005	*NetIPC 3000/XL Programmer's Reference Manual*
36923-61000	*NS3000/XL Error Messages Reference Manual*
36923-61001	*Getting Started with NS3000/XL*
5959-2208	*HP SiteWire Twisted-pair Cabling Installation Guide*
5959-2258	*HP StarLAN 10 Hardware Troubleshooting Guide*
5955-7680	*Cable and Accessories Installation Manual*

Glossary of Terms

The following terms are defined as they are used in Hewlett-Packard computer networking products manuals. The glossary is an all-inclusive list of terms used in a broad range of technical manuals and, therefore, some of the terms defined might not be used in this manual.

ASCII American Standard Code for Information Interchange, a data communications code set defining letters, characters and machine or control commands (such as end of line, or line feed). ASCII uses seven bits to define these characters, and duplicate them (as for a second font) or as a parity check bit.

AUI Attachment Unit Interface. The cable that connects the card (and card connector cable) to the MAU.

Baud Unit of signaling speed expressed as the number of signal event changes (as phase, frequency or amplitude) per second. As a function of both the modulation scheme and the transmission carrier frequency, it is rarely the same as "bits per second". When two bits are combined to form a signal unit, the baud rate is half the bps (the signal unit is call a "digit"), and has four levels, or states.

bps Bits per second, the speed of data transmission over a communications channel.

Broadcast A communication method of sending a message to all devices on a link simultaneously.

Card The Printed Circuit Assembly (see PCA).

CCITT *Comite Consultatif International Telephonique et Telegra Telephique*, International Telegraphy and Telephoney Consultative Committee. A part of the International Telecommunications Union of the United Nations. Responsible for establishing protocols for the Post, Telegraph and Telephone (PTT) ministries in most countries except the U.S.A. and Canada. (See also EIA.)

CIB Channel I/O Bus, a Hewlett-Packard proprietary input/output bus adapted to HP Precision Architecture computers.

CRC Cyclic Redundancy Check. A method of using a polynomial to perform error checking. The polynomial is an algebraic function used to generate a constant from the message bit pattern. This constant, derived and accumulated in both the transmitter and receiver, is used to divide the binary numeric value of the character. The quotient is discarded and the remainder added to the next character, which is again divided. This continues until the last character, when the remainder is transmitted to the receiver for comparison with the receiver's remainder. When the remainders are equal, the system can safely assume there were no errors in the transmission of the data.

CSMA/CD Carrier Sense Multiple Access with Collision Detect. A protocol for Local Area Network access. Each node monitors, or "listens", to the transmission line before a transmission. If it hears another station transmitting, it delays any packet it would have sent out. If two nodes transmit simultaneously, both stations recognize this as an error condition ("collision"), and after a random delay, will attempt to retransmit the packets involved.

Cyclic Redundancy Check See CRC.

DIP Dual In-line Package. A type of integrated circuit package with two parallel rows of contact pins.

Distributed System See DS.

DMA Direct Memory Access. The transfer of data directly to or from memory of the host computer. DMA capability vastly increases the speed of data transmittals to the host from the peripheral.

Download The process of transferring a block of information from one computer system to another, or from a computer to a microprocessor on a card which is a part of the computer.

Driver In a hardware sense, a driver refers to a circuit which is capable of supplying specific current and voltage requirements. In a software sense, a driver is a program that is capable of controlling a specific input/output device.

DS Distributed System. A term used to refer to networks using Hewlett-Packard Distributed Systems hardware and software products.

EPROM Erasable, Programmable, Read-Only Memory. A semiconductor device which cannot be altered by the user. Access to memory addresses which hold the programmed code by the CPU is completely random. It is available instantly on power-up, since it is not power dependent (that is, it is nonvolatile). An EPROM can be erased, usually by exposure to ultraviolet light.

Firmware Software code packaged in read-only memory (EPROM/ROM).

FCS Frame Checking Sequence. In IEEE 802.3 applications, a 32-bit CRC sequence. The sequence is appended to each frame and used to verify data transmission.

Host The computer which houses and controls the PCA.

IEEE Institute of Electrical and Electronic Engineers. IEEE investigates a wide variety of electronic and communications areas, and makes recommendations based on their findings. These recommendations often become standards (as IEEE 802.3) for users and vendors in the fields involved.

Interface A device providing electrical and mechanical compatibility between two communicating devices.

ISO International Standardization Organization.

Jitter In data communications, the variation of the signal from the reference timing position. This variation can include amplitude, time, frequency, or phase distortion.

LAN Local Area Network. A set of computers (or similar devices) communicating over a limited distance of between 10 and 10,000 meters. The transmission medium may be twisted pair cable, coaxial cable, radio broadcast, or fiber optics. LAN is recognized as a cost-effective approach to office automation. Ideally, a user should not be aware of the mechanics of the LAN, i.e., it should be "transparent".

LANIC Local Area Network Interface Controller.

Link The hardware (modems, wires, etc.) and the logical path used to transmit data between two (or more) points in a communications network.

MAU Medium Attachment Unit. A MAU is a transceiver which allows a network node to access the physical medium of the network. A ThinMAU is used for ThinLAN cable networks. A ThickMAU provides the same attachment for ThickLAN systems and a Twisted-pair MAU provides the same attachment for Twisted-pair LAN systems.

Node A device, such as a computer, that is physically and logically connected to a network.

NS Network Services. A system of hardware and software that allows users of one node to access the data and programs on any other node in the system. NS is a stream system, allowing several outstanding operations to occur before requiring a reply to any of them.

Octet A sequence of eight bits, i.e., a byte.

PCA Printed Circuit Assembly. Circuit cards are commonly referred to as PCAs. The term is ambiguous because it can refer to either the substrate material with the conducting traces in place, or to the card with all of its electronic components mounted. In this manual, it refers to the latter.

Polynomial Checking See CRC.

SAP Service Access Point. A SAP is an IEEE 802.2 Logical Link Control address field. SAP addresses (destination and source) are used to provide the logical connections between Network Layer processes for the ISO Open Systems Interconnect (OSI) model.

Tap The device which allows a MAU (defined earlier) to physically access the transmission cable in a local area network.

XID Exchange Identification. An IEEE 802.2 link level control command used to exchange indications of the types of services supported between SAPs (see above).

A HP 28641A ThinMAU

The ThinMAU is specifically designed for connection to the 10 Mbps IEEE 802.3 Type 10BASE2 "ThinLAN" coaxial cable. The ThinMAU includes a ThinMAU with an integrated 1-meter Attachment Unit Interface (AUI) cable, a BNC "T" Connector, a "T"-connector Cover and the ThinMAU Installation Manual.

The following information is included in this appendix:

- Description of IEEE 802.3 Type 10BASE2 (referred to as "ThinLAN").
- Instructions for connecting the AUI cable.
- Diagnostic setup information.

For detailed ThinMAU installation and removal procedures, refer to the *ThinMAU Installation Manual* supplied with the ThinMAU.

IEEE 802.3 Type 10BASE2

This LAN category uses an RG58 A/U or C/U coaxial cable medium that is approximately 0.19 inch (4.9 mm) in diameter. This cable is referred to as ThinLAN cable in this manual. ThinLAN allows connection of up to 30 nodes on a coaxial cable length of up to 185 meters long.

Figure A-1 illustrates a typical IEEE 802.3 Type 10BASE2 LAN connecting HP 3000 Series 900 computers. A node's physical connection and electrical access to a ThinLAN cable is provided by the ThinMAU. ThinMAUs transmit and receive data on the ThinLAN cable, exchanging data and control signals with the LANIC card. A BNC "T" connector connects the ThinMAU to the ThinLAN cable. Next a 1-meter AUI cable (which is built into the ThinMAU) connects to the card connector cable or "stub" cable which attaches directly to the LANIC card.

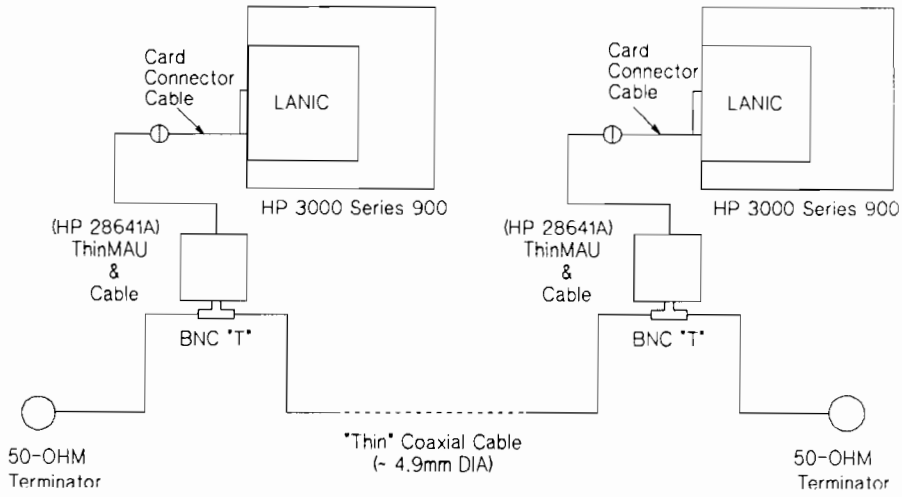

Figure A-1. Typical IEEE 802.3 Type 10BASE2 LAN

Connecting the AUI Cable

Once the card connector (stub) cable has been installed, connect the 15-pin connector of that cable to the AUI cable of the ThinMAU. (Refer to Figure A-1.) Be sure to push the slide latch mechanism so that the connectors lock together.

"D" Connectors

When connecting the 15-pin "D" connectors, be certain that the connector hold-down hardware is secure. The hold-down hardware is a sliding clip mechanism that captures the slotted studs on the opposing connector.

a. Slide the hold-down clip to the "open" position (see Figure A-2(A)).

b. Align the plug and socket, then connect them firmly.

c. Slide the hold-down clip to the "locked" position (see Figure A-2(B)). This hold-down clip prevents accidental cable disconnection during operation.

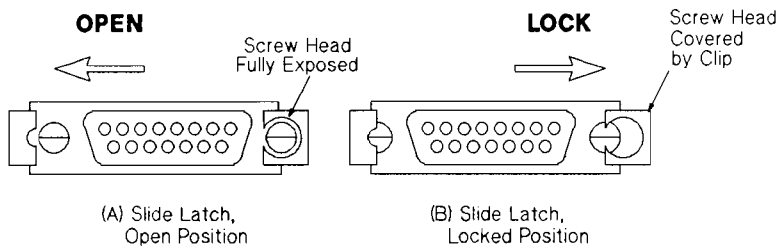

Figure A-2. Securing Cable Hold-Down Clips

Diagnostic Setup

To further isolate a LAN problem, it may be necessary to disconnect the ThinMAU from the LAN cable and attach it to a loopback text fixture (HP 92257Q) and re-run the appropriate diagnostic tests. Doing this will help determine if a problem is located in one of the Field Replaceable Units or somewhere else on the LAN. This type of diagnostic setup, including hardware and software components, is shown in Figure A-3.

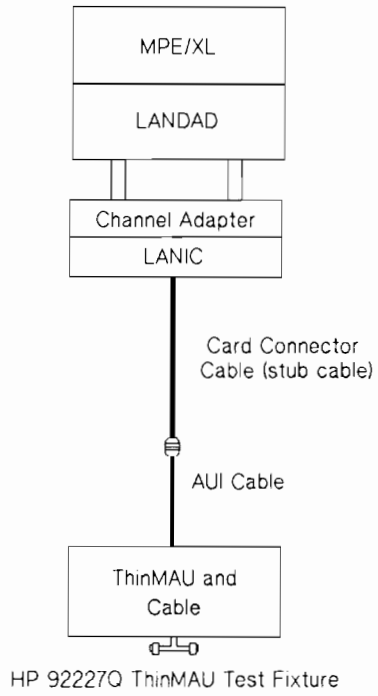

Figure A-3. ThinLAN Diagnostic Test Setup

B HP 30241A ThickMAU

The ThickMAU is specifically designed for connection to the 10 Mbps IEEE 802.3 Type 10BASE5 "thick" Local Area Network coaxial cable. The ThickMAU includes a 6-meter AUI cable, a ThickMAU, and a Coaxial Tap.

The following information is included in this appendix:

- Description of IEEE 802.3 Type 10BASE5 (referred to as "thick" cable).
- Instructions for connecting the AUI Cable.
- Diagnostic setup information

For detailed ThickMAU installation and removal procedures refer to the *Cable and Accessories Installation Manual,* available from HP Direct Marketing Division.

IEEE 802.3 Type 10BASE5

This LAN category refers to an IEEE 802.3 LAN that uses a 0.4 inch (approximately 10 mm) diameter coaxial cable bus, referred to as "thick" cable. Thick cable LANs feature 10 Mbits (megabits) per second transfer rates and connection of up to 100 nodes on a single 500-meter bus segment. Figure B-1 illustrates a typical IEEE 802.3 Type 10BASE5 LAN connecting HP 3000 Series 900 computers. The Medium Attachment Unit (MAU), serves as the node's access vehicle to the coaxial cable bus. The MAU transmits and receives data on the coaxial cable, and exchanges data and control signals with the LANIC card.

Included with the 30241A MAU is a fitting, or "tap", which pierces the coaxial cable and makes the electrical contact with the MAU. An AUI (Attachment Unit Interface) cable of the appropriate length connects the MAU to a 1-meter card connector ("stub") cable which connects to the LANIC card. A maximum distance of 50-meters is allowed between the LANIC card and the MAU; AUI cabling is available from Hewlett-Packard in a variety of lengths either pre-fitted with connectors or left with raw ends.

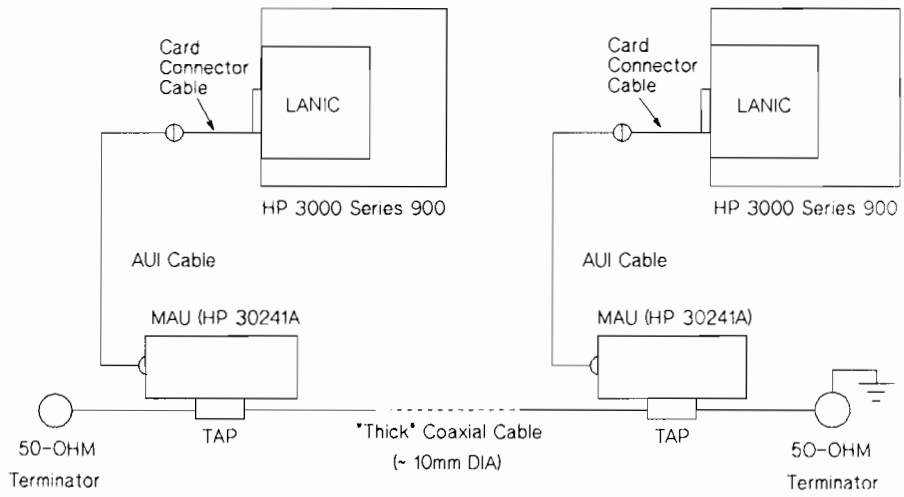

Figure B-1. Typical IEEE 802.3 Type 10BASE5 LAN

Connecting the AUI Cable

Once the card connector (stub) cable has been installed, connect the 15-pin connector of that cable to AUI cable or directly to the MAU. Be sure to push the sliding clip mechanism so that the connectors lock together.

"D" Connectors

When connecting the 15-pin "D" connectors, be certain that the connector hold-down hardware is secure. The hold-down hardware is a sliding clip mechanism that captures the slotted studs on the opposing connector.

a. Slide the hold-down clip to the "open" position (see Figure B-2(A)).

b. Align the plug and socket, then connect them firmly.

c. Slide the hold-down clip to the "locked" position (see Figure B-2(B)). This hold-down clip prevents accidental cable disconnection during operation.

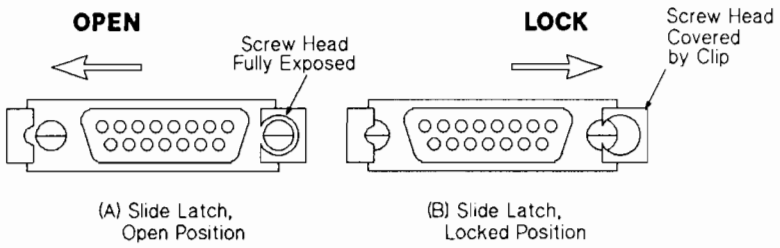

Figure B-2. Securing Cable Hold-Down Clips

Diagnostic Setup

To further isolate a LAN problem, it may be necessary to disconnect the ThickMAU from the LAN cable and attach it to a loopback text fixture (HP 92257B) and rerun the appropriate diagnostic tests. Doing this will help determine if a problem is located in one of the Field Replaceable Units or somewhere else on the LAN. This type of diagnostic setup, including hardware and software components, is shown in Figure B-3.

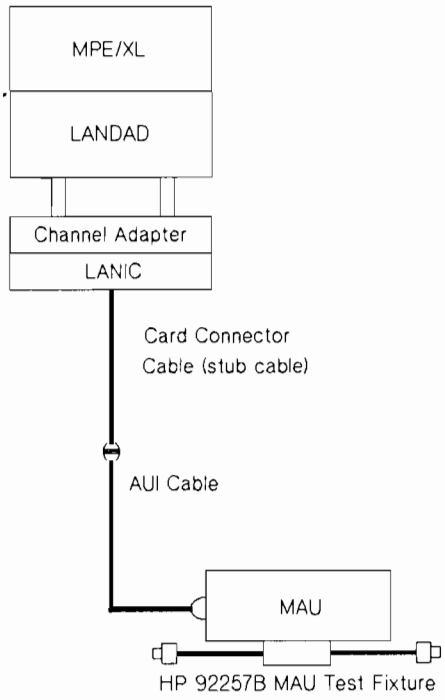

Figure B-3. Thick Cable LAN Diagnostic Test Setup

C HP 28664A Twisted-pair MAU

The Twisted-pair MAU is a Medium Attachment Unit capable of adapting 10 Mbps 802.3 Local Area Network Interface Controllers (LANICs) for use over unshielded twisted-pair cabling. The Twisted-pair MAU option includes the MAU with an integrated 1-meter Attachment Unit Interface (AUI) cable, a loopback connector, and the *Twisted-pair MAU Installation Guide.*

The following information is included in this appendix:

- General overview.
- Instructions for connecting the AUI cable.
- Diagnostic setup information.

For detailed Twisted-pairMAU installation and removal, refer to the *Twisted-pair MAU Installation Guide* supplied with the Twisted-pair MAU.

General Overview

In the LAN configuration, the LANIC card connects to the integrated AUI cable of the Twisted-pair MAU via the the Card Connector (stub) cable. The MAU then attaches to a StarLAN 10 hub or cross-connect block via a 4-pair unshielded twisted-pair cable. You can custom-build the cable yourself (according to the instructions in the *HP SiteWire Twisted-pair Cabling Installation Guide*), or purchase it pre-assembled, with an 8-pin modular connector at both ends, from Hewlett-Packard. The pre-assembled cables are:

HP 92268A (4 meters)
HP 92268B (8 meters)
HP 92268C (16 meters)
HP 92268D (32 meters)

The following shows a typical Twisted-pair MAU configuration.

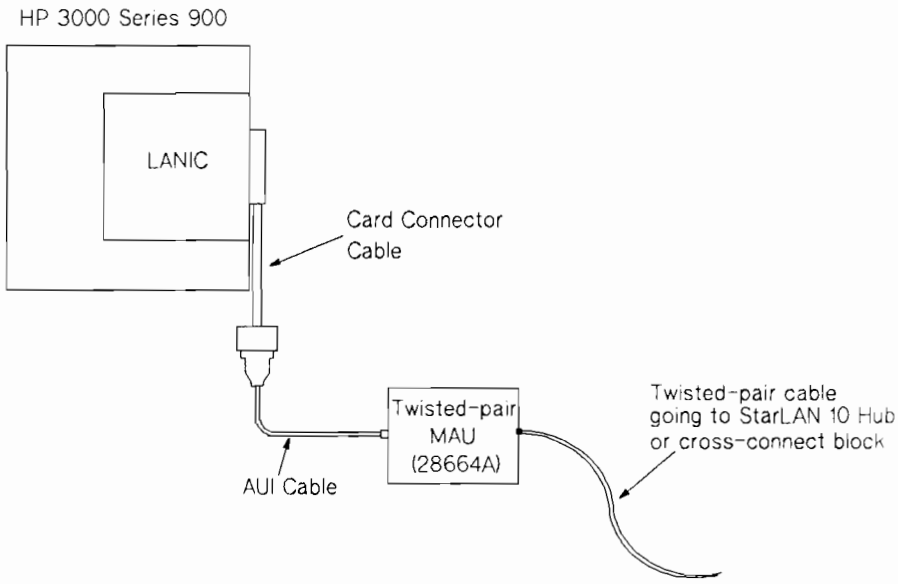

Figure C-1. Typical 802.3 LAN with a Twisted-pair MAU

Connecting the AUI Cable

Once the card connector (stub) cable has been installed, connect the 15-pin connector of that cable to the AUI cable of the Twisted-pair MAU. (Refer to Figure C-1.) Be sure to push the slide latch mechanism so that the connectors lock together.

"D" Connectors

When connecting the 15-pin "D" connectors, be certain that the connector hold-down hardware is secure. The hold-down hardware is a sliding clip mechanism that captures the slotted studs on the opposing connector.

a. Slide the hold-down clip to the "open" position (see Figure C-2(A)).

b. Align the plug and socket, then connect them firmly.

c. Slide the hold-down clip to the "locked" position (see Figure C-2(B)). This hold-down clip prevents accidental cable disconnection during operation.

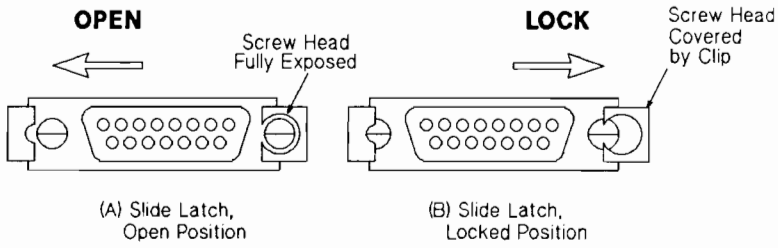

Figure C-2. Securing Cable Hold-Down Clips

Diagnostic Setup

When running most of the diagnostic tests, the Twisted-pair MAU will be connected to the network. When running the tests in this manner, the Loopback switch located on the Twisted-pair MAU will remain in the "NORMAL" position.

If it becomes necessary to isolate a LAN problem, you will need to disconnect the Twisted-pair MAU from the twisted-pair LAN cable, attach it to a loopback connector (HP 5061-4977) and re-run the appropriate diagnostic tests. Doing this will help determine if a problem is located in one of the Field Replaceable Units or somewhere else on the LAN.

Whenever you run the diagnostics using the loopback connector, the loopback switch located on the Twisted-pair MAU must be in the "TEST" position as shown in Figure C-3. If the loopback switch is not in this position, your test results will be inaccurate. This type of diagnostic setup, including hardware and software components is shown in Figure C-4.

Note

Be sure to change the Loopback switch back to the "NORMAL" mode once testing is complete.

For more details on Twisted-pair troubleshooting refer to the *HP StarLAN 10 Hardware Troubleshooting Guide*.

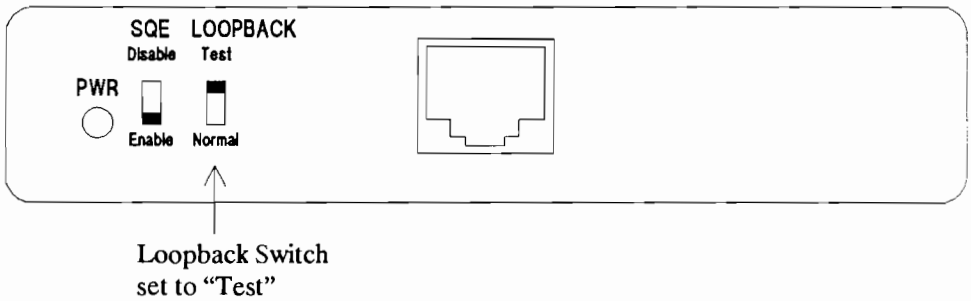

Figure C-3. Loopback Switch in Test Position

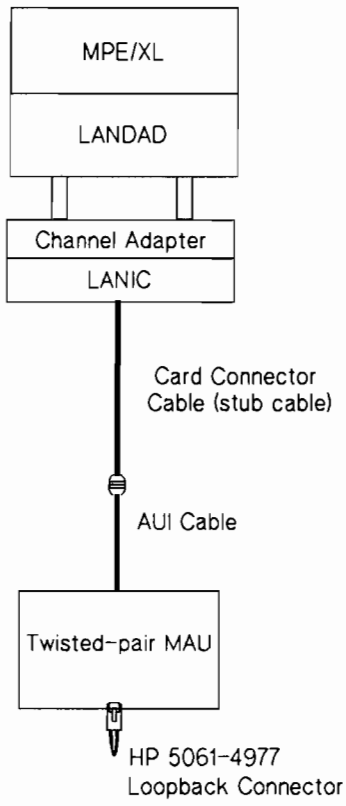

Figure C-4. Twisted-pair Diagnostic Test Setup

Index

A

address
- link-level ... 1-2, 3-3
- node ... 1-2
- station ... 1-2

AUI cable
- connecting ... B-3, C-3
- thickMAU ... B-2
- thickMAU connection ... B-3
- thinMAU ... A-2
- thinMAU connection ... A-3
- twisted-pair MAU connection ... C-3

AUI cable fault isolation ... 6-10

B

backplane interface circuit (BIC) ... 4-2
bus arbiter ... 4-3

C

cable
- AUI ... A-2–A-3, B-2–B-3, C-3
- card connector ... A-2, B-2
- card connector removal ... 5-1
- coaxial ... A-2, B-2
- connector cable replacement ... 5-2
- installation ... 3-8
- pre-assembled ... C-2
- site preparation ... 2-1
- stub ... 5-1–5-2, A-2, B-2
- thick ... B-2
- thinLAN ... A-2
- twisted-pair ... C-1
- unshielded twisted-pair ... C-1–C-2

component parts ... 7-3
connection
- applicable standards ... 1-1
- to a LAN ... 1-1
- to host ... 1-1

control register ... 4-2

D

"D" Connectors ... A-3, B-3, C-3
description
  functional ... 4-1
  LANIC ... 1-1
  product ... 1-1
diagnostic session example ... 6-15
diagnostic setup
  thickMAU ... B-4
  thinMAU ... A-4
  twisted-pair MAU ... C-4
direct memory access (DMA)
  controller ... 4-2

E

EPROM
  part numbers ... 5-4
  removal ... 5-4
  replacement ... 5-4
equipment
  LAN 3000/XL Link ... 1-6
  supplied ... 1-6
  terminal LAN link ... 1-7
  test ... 1-5
Ethernet controller ... 4-3
exchange assemblies ... 7-2
external loopback ... 6-8
external loopback test ... 3-8

F

field replaceable unit (FRU) ... 6-1, 7-1
FRU ... 6-1, 7-1
functional description ... 4-1

G

glossary ... 8-2

H

hardware
  site preparation ... 2-1

I

identification
  interface card ... 1-3
  LANIC ... 1-2
  product ... 1-2
identify ... 6-6
IEEE 802.3
  Type 10BASE2 ... A-1–A-2
  Type 10BASE5 ... B-1–B-2

I *(continued)*
information
ordering replaceable parts ... 7-1
other technical manuals ... 8-1
reference ... 8-1
inspection ... 3-2
installation
AUI cable ... A-3, B-3, C-3
cables ... 3-8
card ... 3-6
"D" connectors ... A-3, B-3, C-3
LAN cable ... 3-7
thickMAU ... B-1
thinMAU ... A-1
twisted-pair MAU ... C-1
interface
network ... 4-3

J jumper
SQE factory setting ... 3-5

L LANCE chip ... 4-3
LANDAD
capabilities ... 6-3
description ... 6-3
destructive mode ... 6-4
diagnostic session example ... 6-15
minimum configuration ... 6-3
necessary hardware ... 6-3
necessary software ... 6-3
normal mode ... 6-4
operational modes ... 6-4
running ... 6-12
Section 2 – Reset ... 6-6
Section 3 – Identify ... 6-6
Section 4 – Local Loopback ... 6-6
Section 5 – Self-test ... 6-7
Section 6 – Status ... 6-7
Section 7 – Link Statistics ... 6-7
Section 8 – External Loopback ... 6-8
Section 9 – Remote Node Test ... 6-9
Section 10 – Remote XID Test ... 6-9
Section 11 – AUI Cable Fault Isolation ... 6-10
Section 12 – Offline MAU Test ... 6-11
sections ... 6-5

L *(continued)*

LANIC
- card installation ... 3-6
- card removal procedure ... 5-2
- card replacement procedure ... 5-2
- card self-test ... 3-8
- component replacement ... 5-3
- description ... 1-1
- exchange assembly ... 7-2
- functional description ... 4-1
- identification ... 1-2
- link-level address ... 3-3
- power requirements ... 3-3
- repacking ... 3-2
- replaceable component parts ... 7-3
- reshipment ... 3-2
- returning a card to HP ... 7-2
- specifications ... 1-4
- storage ... 3-2
- support strategy ... 1-5
- twisted-pair MAU ... C-2

LED
- self-test green ... 3-8
- self-test red ... 3-8

link statistics ... 6-7
link-level address ... 3-3
local loopback ... 6-6
loopback test fixture
- thickMAU ... B-4
- thinMAU ... A-4
- twisted-pair MAU ... C-4

M

maintenance ... 6-2
- aids ... 6-2

MAU
- thickMAU ... B-1
- thinMAU ... A-1
- twisted-pair ... C-1

MAU power fuse
- replacement ... 5-3

memory registers ... 4-2
microprocessor ... 4-2

N

network interface ... 4-3
new assemblies ... 7-3
node
  address ... 1-2
  connection ... 3-7
  identifier ... 3-3
  station address ... 1-2
  thickMAU connection ... B-2
  thinLAN connection ... A-2
NOVRAM ... 4-2
  part number ... 5-4
  removal ... 5-4
  replacement ... 5-4

O

offline MAU test ... 6-11
operating voltages ... 3-3

P

parts
  ordering replacement ... 7-1
power consumption ... 3-3
procedure
  card connector cable removal ... 5-1
  card connector cable replacement ... 5-2
  card installation ... 3-6
  LANIC card removal ... 5-2
  LANIC card replacement ... 5-2
  SQE jumper setting ... 3-5
product
  overview ... 1-1

R

RAM ... 4-2
reference information ... 8-1
register
  control ... 4-2
  memory ... 4-2
  status ... 4-2
remote node test ... 6-9
remote XID test ... 6-9
removal
  card connector cable ... 5-1
  EPROM ... 5-4
  LANIC card ... 5-2
  NOVRAM ... 5-4
  stub cable ... 5-1
  thickMAU ... B-1
  thinMAU ... A-1
  twisted-pair MAU ... C-1

R *(continued)*
repacking ... 3-2
replacement
  card connector cable ... 5-2
  EPROMs ... 5-4
  LANIC card ... 5-2
  MAU power fuse ... 5-3
  NOVRAM ... 5-4
  ordering parts ... 7-1
  stub cable ... 5-2
reset ... 6-6

S
self-test ... 3-8, 6-7
serial interface adapter (SIA) ... 4-3
SIA chip ... 4-3
site preparation
  cable ... 2-1
  hardware ... 2-1
software
  network services ... 1-1
special tools ... 1-5
specifications ... 1-4
  environmental ... 1-4
  features ... 1-4
  physical characteristics ... 1-4
  power requirements ... 1-4
SQE
  factory setting ... 3-5
  jumper setting ... 3-5
  test function ... 3-5
standards
  connection between host computer and LAN ... 1-1
  IEEE standards 802.2 and 802.3 ... 1-1
status ... 6-7
status register ... 4-2
storage ... 3-2
strategy
  troubleshooting ... 6-1
support strategy ... 1-5

T
test equipment ... 1-5
thickMAU
  connecting "D" connectors ... B-3
  diagnostic setup ... B-4
  installation ... B-1
  loopback test fixture ... B-4
  removal ... B-1

T *(continued)*
thinMAU ... A-1
connecting "D" connectors ... A-3
diagnostic setup ... A-4
installation ... A-1
loopback test fixture ... A-4
removal ... A-1
tools ... 1-5
troubleshooting
strategy ... 6-1
twisted-pair MAU ... C-1
AUI cable connection ... C-3
connecting "D" connectors ... C-3
diagnostic setup ... C-4
installation ... C-1
loopback switch setting ... C-4
loopback test fixture ... C-4
removal ... C-1
typical configuration ... C-2

U unshielded twisted-pair cabling ... C-2

V voltage requirements ... 3-3

Manual Part Number: 36923-90001
Edition 3, E1189
Printed in U.S.A., November 1989

HEWLETT PACKARD